OBSTRUCTED LABOUR

REFERENCES

PART - III

THE WELLCOME TROPICAL INSTITUTE

REFERENCES PROVIDED WITH THE MODULE

A Driessen, F. Obstetric problems - a manual (1985)
Chapters: 5, 20, 42, 44, 45, 46, 48, 53, 54, 55.

B Philpott, R. H. Obstructed labour.
Clinics in Obstetrics and Gynaecology (1982) **9**, 625-640.

C Gebbie, D. A. M. Symphysiotomy.
Tropical Doctor (1974) **4**, 69-75.

D Heij, H.A.; Te Velde, E.R.; Cairns, J.M. Management of rupture of the gravid uterus.
Tropical Doctor (1985) **15**, 127-131.

E Lawson, J. Embryotomy for obstructed labour.
Tropical Doctor (1974) **4**, 188-191.

F Mphahlele, M; Van Der Meulen, A. J. Obstructed labour at the University Teaching Hospital, Lusaka, Zambia, April 1972-Dec 1973.
South African Medical Journal (1975) **49**, 1204-1206.

G Dutta, D. C. Destructive operations in obstructed labour.
Journal of the Indian Medical Association (1979) **72**, 204-206.

H Bullough, C. Postnatal care. [Influencing the outcome of future pregnancies].
Tropical Doctor (1988) **18**, 79-80.

I Lawson, J.B.; Steward, D.B. Obstetrics and gynaecology in the tropics.
pp. 189-192; 203-210.

J Harrison, K.A.; Rossiter, C.E. Child-bearing, health and social priorities: a survey of 22,774 consecutive hospital births in Zaria, northern Nigeria. 12. Maternal mortality.
British Journal of Obstetrics and Gynaecology (1985) **92,** Supplement 5, 100-115.

K Thornton, J.G. Should vesicovaginal fistula be treated only by specialists?
Tropical Doctor (1986) **16,** 78-79.

L Oronsaye, A.U.; Asuen, M.I. Obstructed labour - a four-year survey at the University of Benin Teaching Hospital, Benin City, Nigeria.
Tropical Doctor (1980) **10**, 113-116.

M Chiphangwi, J. Antenatal care in a district hospital.
Tropical Doctor (1987) **17**, 124-127.

N Chabot, H.T.J.; Eggens, K.H. Antenatal card for illiterate traditional birth attendants.
Tropical Doctor (1986) **16**, 75-78.

O Burgess, H.A. Use of the labor graph in Malawi.
Journal of Nurse-Midwifery (1986) **31**, 46-52.

P Philpott, R.H.; Castle, W.M. Cervicographs in the management of labour in primigravidae. I. The alert line for detecting abnormal labour.
Journal of Obstetrics and Gynaecology (1972) **79**, 592-598.

Q Philpott, R.H. The recognition of cephalopelvic disproportion.
Clinics in Obstetrics and Gynaecology (1982) **9**, 609-624.

R Lennox, C.E. The cervicograph in labour management in the Highland of Papua New Guinea.
Papua New Guinea Medical Journal (1981) **24**, 286-293.

S Naeye, R.L.; Dozor, A.; Tafari, N.; Ross, S.M. Epidemiological features of perinatal death due to obstructed labour in Addis Ababa.
British Journal of Obstetrics and Gynaecology (1977) **84**, 747-750.

T Adetoro, O.O. Maternal mortality - a twelve-year survey at the University of Ilorin Teaching Hospital (U.I.T.H.) Ilorin, Nigeria.
International Journal of Gynaecology and Obstetrics (1987) **25**, 93-98.

U Maternal mortality: helping women off the road to death.
WHO Chronicle (1986) **40**, 175-183.

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Chapter 5

PREGNANCY FOLLOWING CAESAREAN SECTION(S)

RISKS

- Rupture of the uterus:
  - usually during labour.
  - sometimes before labour (with a classical scar, inverted T incision).
- Repeat cephalopelvic disproportion and obstructed labour.

MANAGEMENT

IN EARLY AND MID PREGNANCY

- Encourage the patient to start antenatal clinic at ± four months.
- Check the haemoglobin and correct anaemia.
- Assess and record the fundal height accurately : this may help later to establish when the pregnancy is term.
- Arrange for review by gynaecologist, doctor or clinical officer at about 36 weeks.

AT 36 WEEKS

Patients with **two or more previous caesarean sections:**

- Estimate the gestational age.
- Admit into hospital unless the patient lives nearby and has transport easily available, in which case admission can be postponed until 37 – 38 weeks.
- Arrange for caesarean section to be done either electively or in very early labour [see below]

Patients with **only one previous caesarean section:**

- Make an **assessment:**
  - find out why the caesarean section was done
  - estimate the gestational age
  - check the presentation and size of the baby
  - assess the pelvis clinically and by x-ray if necessary [see Chapter 1]
- Make a **decision:**

Trial of scar is only allowed with:*

- a cephalic presentation
- a normal size baby
- an apparently normal pelvis
- a normal lower segment scar

* For the conduct of a trial of scar see chapter 31.

Caesarean section is indicated for:

- breech presentation or transverse lie (if persisting to term)
- borderline pelvis
- a large baby (estimated weight 3,500 gm or more)
- a classical scar or inverted T incision

THE PLACE OF ELECTIVE CAESAREAN SECTION

(Elective caesarean section is the operation before the onset of labour)

Elective caesarean section is a *must* if the patient is known to have a classical scar or an inverted T incision. It is best done between 36 and 38 weeks.

Elective caesarean section is *desirable* in all patients in whom a repeat operation is indicated, provided the gestational age is reasonably certain. It is then best done around 38 weeks.

However, if you have reason to believe that the patient does not want the operation, it may be better not to book her for an elective caesarean section. Such patients often give themselves a "trial of scar" at home and only come to hospital when labour has become obstructed!

It is better, although not ideal, to admit such a patient at 36 weeks, say that she will be allowed a short trial of scar and then do a caesarean section in early labour. Careful observation in the ward will still be necessary because these patients tend to retire to a quiet spot as soon as labour starts to make sure that they do not miss their "trial".

THE PLACE OF TUBAL LIGATION

Some patients will want to be sterilised at the time of a repeat caesarean section. Discuss this during the antenatal visits.

Tubal ligation can be done provided:

- both she and her husband agree to the operation and give written permission.
- they both understand that ligated tubes cannot be reopened
- they are both aware of the existence of other forms of contraception

The chance that tubal ligation will be necessary on medical grounds (extensive adhesions, weak scar) increases with the number of previous operations.

Tubal ligation is usually done with the fourth operation.

Chapter 20

THE LABOURGRAPH

Read this chapter with a real labourgraph in front of you.

BACKGROUND

During the first stage of labour the cervix effaces and dilates. If one plots the cervical dilatation in a graph, the progress of labour can be seen at a glance. Figure 20.1 shows the progress of an ideal labour. In the first part of the first stage the cervix dilates only slowly; this is called the *latent phase.* The latent phase ends when the cervix has become fully effaced and is 3 cm dilated. Between 3 cm and full dilatation the cervix dilates faster; this is called the *active phase* of labour.

Both the latent and active phases of labour can be prolonged. The labourgraph helps us to recognise this quickly, before serious trouble has developed. A prolonged active phase in particular is often the first warning of cephalopelvic disproportion.

The Malawi labourgraph spans 22 hours. The first eight hours on the chart are reserved for recordings during the latent phase. How recordings are made when the latent phase lasts longer than eight hours is discussed later in this chapter. The remaining part of the chart is for recordings made during the active phase. In it four lines have been drawn:

- **A** is the alert line. If the cervical dilation follows this line, the cervix dilates 1 cm per hour; this is the slowest rate of dilatation in the active phase which is still normal.
- **M** and **P** are the action lines for multiparae and primigravidae respectively. Action to correct a delay in the active phase should have been taken before these lines have been reached [see Chapter 22]
- The broken vertical line indicates the expected time of delivery [see Chapter 22]

RECORDING ON THE LABOURGRAPH

CERVICAL DILATATION

On admission

If the cervix is still less than 3 cm dilated, the dilatation is recorded at time 0 with an ×. Write date and clocktime underneath [see Figure 20.2]. If the cervix is 3 cm or more dilated, the dilatation is recorded on the alert line in the active phase [see Figures 20.3 and 20.4].

Later recordings

1. **In the latent phase** when the patient is examined again four hours after admission, there are two possibilities:
   - the cervical dilatation is still less than 3 cm. The dilatation is then recorded at time 4 hours [see Figure 20.2).
   - the cervix is 3 or more cm dilated. This dilatation is also recorded at time 4 hours, but the curve is then "transferred to the alert line" [see Figures 20.5 and 20.6].

   If the latent phase is prolonged, the cervical dilatation will still be less than 3 cm after eight hours. It can still be recorded at the appropriate times on the chart, but when the active phase is reached eventually, a new chart must be started [see Figure 20.6].

2. **In the active phase.** The cervical dilatation is plotted at the appropriate times [See Figure 20.3].
   If the cervix dilates normally the curve is on or to the left of the alert line. If the curve is on the right of the alert line, the active phase is becoming prolonged.

How often should vaginal examinations be done?

- Once labour is established vaginal examination is done four hourly in a nullipara and three hourly in a multipara
- It should *also* be done at expected time of delivery

  It should be done *earlier* if:
  - the membranes rupture
  - the patient wants to push
  - the cervix was 7 cm or more dilated at the last examination
  - signs of fetal distress develop.

DESCENT OF THE HEAD

The baby's head is, on examination, divided into five horizontal, equal parts and as labour progresses the number of parts (fifths) remaining *above the brim* is assessed and recorded on the labour-graph with a dot "•" or an "o" [see Figures 20.2 – 20.6]. The number of fifths still above the brim should be determined by abdominal palpation or better still by bimanual palpation at the time of a vaginal examination. The number of fingers that can be placed between the anterior shoulder and the symphysis indicates the number of fifths above the brim. Vaginal examination alone can be very misleading: due to moulding and caput formation the fetal scalp may be seen at the outlet while the largest part of the head is still above the brim.

CONTRACTIONS

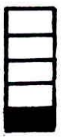
The duration of the contractions is recorded as follows:

 less than 20 seconds

 20 – 40 seconds

 more than 40 seconds

The number of contractions per ten minutes is recorded as follows:

 1/10 minutes

 3/10 minutes

 5/10 minutes

FETAL HEART RATE

The fetal heart rate is counted between the contractions, preferably with the patient lying on her side. If she lies on her back the supine hypotensive syndrome can cause slowing of the fetal heart.

The normal heart rate between contractions is 120 – 160 beats per minute. Changes during the contractions are best ignored. They are difficult to assess with the fetoscope and their significance is open to question.

MEMBRANES AND LIQUOR

The following symbols are used:

I = membranes intact
C = clear liquor draining
M = meconium stained liquor draining
R = membranes ruptured but no liquor draining at present

If the membranes rupture during labour, this should be recorded at the appropriate time [see Figure 20.5].

The following abbreviations are used:

SRM = spontaneous rupture of membranes
ARM = artificial rupture of membranes

MOULDING

This is graded as follows:

0 = bones normally separated
\+ = bones touching but not overlapping
++ = bones overlapping but easily separated
+++ = bones overlapping and cannot be separated

MATERNAL CONDITION

Pulse rate, blood pressure and temperature are recorded in their appropriate columns.

ADDITIONAL NOTES

Short comments can be written on the labourgraph. Longer notes should be written on a separate sheet of paper.

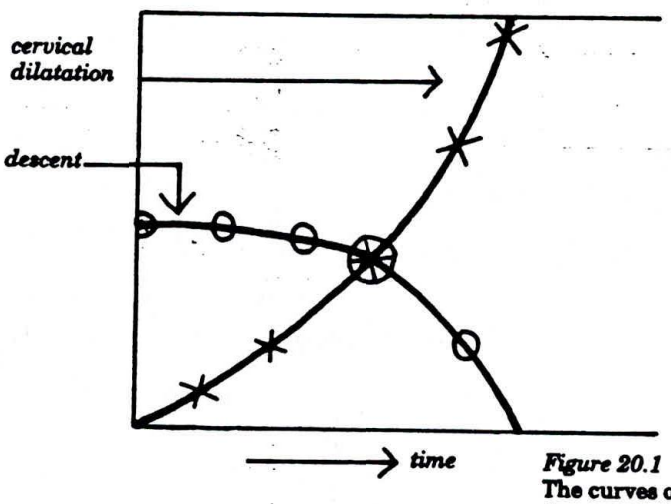


Figure 20.1
The curves of cerival dilatation and descent during a normal labour (not plotted on a labourgraph)

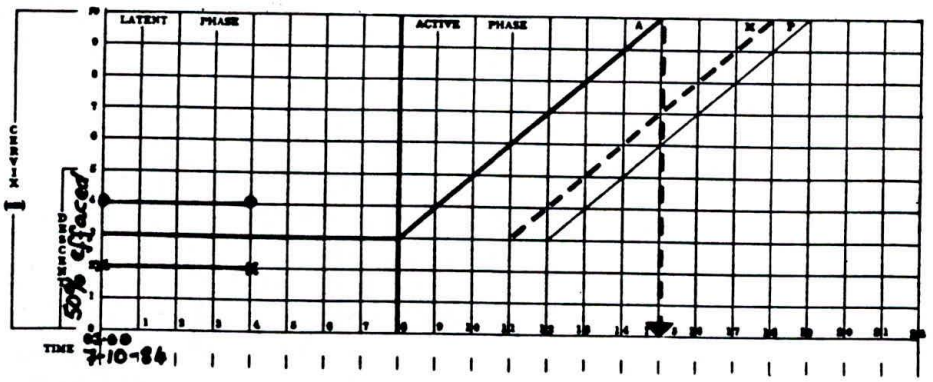


Figure 20.2
Labourgraph of a patient admitted in the latent phase at 02.00 on 7.10.84. Four hours later she was still in the latent phase.

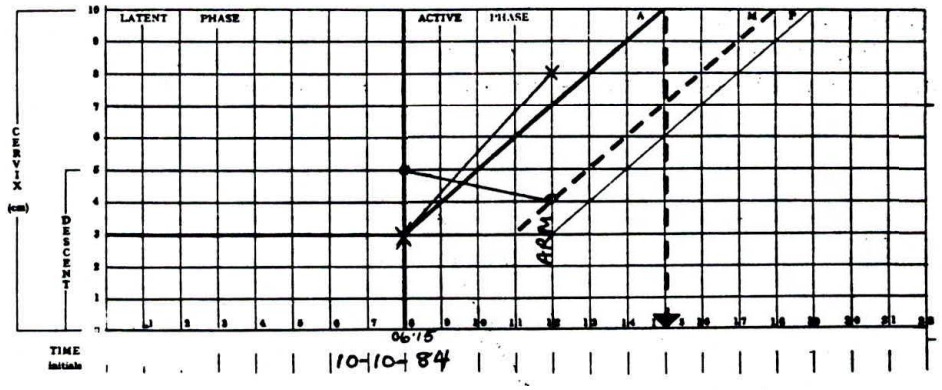


Figure 20.3
Labourgraph of a patient admitted at 06.15 on 10.10.84 with the cervix 100% effaced and 3 cm dilated. Good progress after four hours.

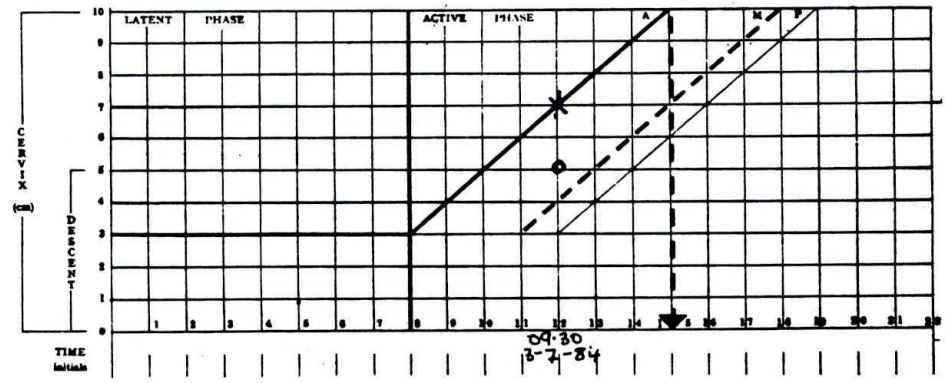


Figure 20.4
Labourgraph of a patient admitted at 09.30 on 3.7.84 at 7 cm dilatation.

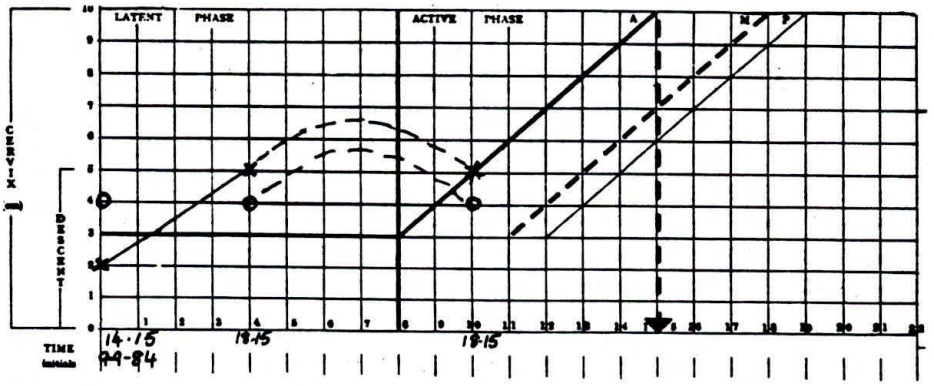


Figure 20.5
Labourgraph of a patient admitted at 14.15 on 9.9.84 with 2 cm dilatation. Four hours later the cervix was 5 cm dilated.

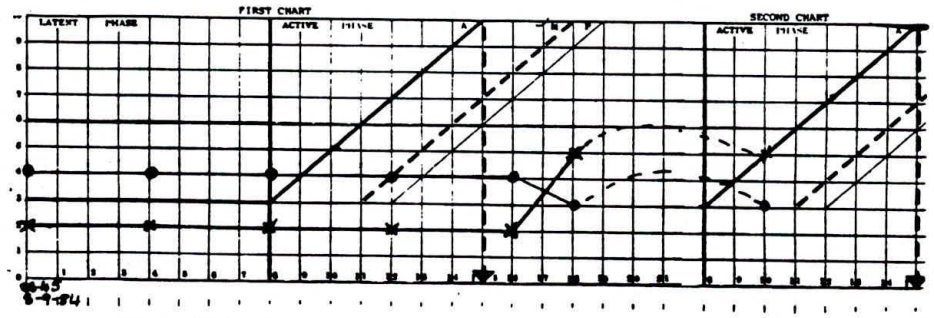


Figure 20.6
Labourgraph of a patient admitted at 03.45 on 2.9.84 who developed a prolonged latent phase. After 18 hours she was at last in the active phase.

Chapter 42

SYMPHYSIOTOMY

DEFINITION

Symphysiotomy is the division of the symphysis pubis in order to enlarge the pelvic diameters during delivery.

INDICATIONS

Symphysiotomy is indicated for moderate cephalopelvic disproportion which has resulted in one of the following problems:

1. OBSTRUCTED LABOUR WITH A LIVE BABY
   If the baby's head is deeply jammed into the pelvis and the caput is visible in the vulva, symphysiotomy is life-saving for the mother and therefore a "must"! The alternative, caesarean section, will be disastrous because of tears in the lower segment, bleeding and sepsis.

2. FAILED TRIAL OF VACUUM EXTRACTION
   Symphysiotomy can be done when a trial of vacuum extraction has failed by a small margin.
   It will not work, of course, if the cephalopelvic disproportion is gross and the indication for vacuum extraction was wrong in the first place.

3. DIFFICULT VACUUM EXTRACTION
   Sometimes vacuum extraction succeeds but only with difficulty after prolonged traction and at the expense of brain damage to the baby.
   Symphysiotomy will make the delivery much easier and helps to avoid injury to the baby.

4. PROLONGED SECOND STAGE
   If the criteria for symphysiotomy are met [see below] and vacuum extraction alone is unlikely to succeed, immediate symphysiotomy is better than trying a vacuum extraction first.

CONTRAINDICATIONS

- Severe cephalopelvic disproportion
- Malpresentation: breech, brow, face, transverse lie
- Dead fetus (craniotomy is preferable)

- Previous caesarean section
- Maternal deformity (spine, leg)

CRITERIA

- Live baby
- Cervix 8 cm or more dilated
- No overlap (the head should not bulge above the symphysis)
- The head is not more than 2/5 and not less than 1/5 palpable above the symphysis

If the head is too high, symphysiotomy will fail because of severe disproportion, if it is too low, a simple vacuum extraction will be sufficient.

PREPARATION

Ideally you need three helpers; two to hold the legs and one to keep the i.v. drip going, catch the baby, resuscitate it, etc.

- Explain the procedure to the patient
- Give antibiotics as for caesarean section
- Check that:
  - the vacuum extractor is in working order
  - the delivery trolley is ready
  - the resuscitaire for the baby has been prepared.
- If the contractions are weak and the patient is a nullipara, start a pitocin drip
- Put the patient in lithotomy position.
  Two helpers, *who do not do anything else*, support the legs; the thighs should be abducted at an angle of 80°.
  This position should be carefully maintained or the strain on the sacroiliac joints becomes too great; lithotomy poles are unsuitable.
- Disinfect the skin over the lower abdomen, symphysis and vulva; use iodine over the symphysis
- Infiltrate the skin and subcutis over the symphysis and the fibrocartilage with 1 or 2% lignocain; also infiltrate the perineum for the episiotomy
- Insert a plain catheter and leave this in
- Apply the cup of the vacuum extractor in the usual manner
- Pull once gently on the vacuum extractor (sometimes delivery is easier than expected and symphysiotomy is not necessary)

THE ACTUAL PROCEDURE

- Insert *one* finger between the fetal head and the symphysis, this automatically pushes the catheter and urethra out of the midline (if you use two fingers, the catheter will tend to stay in the midline)
- Using a scalpel (ideally with a fixed handle) make a vertical stab incision over the symphysis midway between its upper and lower border
- Keeping exactly to the midline, push the knife through the fibrocartilage [see Figure 42.1] until your finger in the vagina feels its point. If this is difficult, you are not in the midline; retreat and try again
- Guided by the finger in the vagina, the knife cuts the lower half of the fibrocartilage and the fibres of the arcuate ligament; stop there!
- Turn the knife 180° and cut the upper part of the fibrocartilage; the joint should now separate and one finger should fit the gap. If this is not the case, the division is incomplete and you must cut a few more fibres

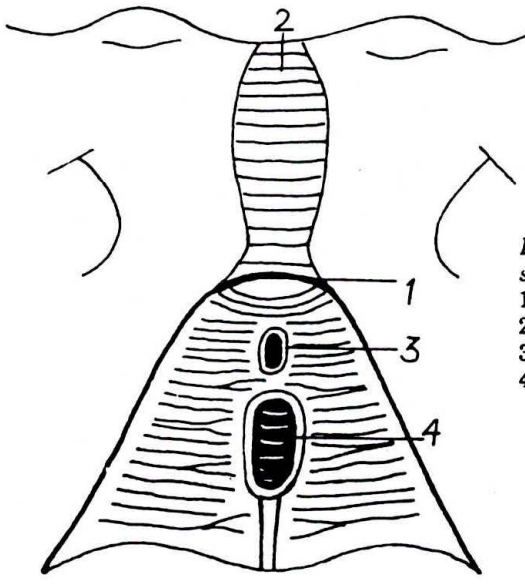


Figure 42.1 The anatomy of the symphysis pubis
1. arcuate ligament
2. fibrocartilage of symphysis pubis
3. urethra
4. vagina

DELIVERY

- Make a large episiotomy
- Pull on the vacuum extractor during a contraction; when the head descends, you will often feel the last fibres of the symphysis snap

- Deliver the head and the rest of the baby "away" from the symphysis to avoid more strain on the urethra
- After delivery of the placenta, check the cervix and vagina for tears
- Repair the skin incision over the symphysis, the episiotomy and whatever tears there are (usually none, fortunately!)
- Replace the plain catheter by a Foley's with an open drainage system
- Put the legs flat

AFTERCARE

- Keep the patient in bed for about three days, there is no need to strap the legs together
- After three days allow the patient to mobilise at the pace she finds comfortable; almost all patients walk well within ten days
- Leave the catheter in:
  - for two or three days if the operation was uncomplicated and the urine is clear
  - for one to three weeks if the urine is blood stained or if pressure necrosis due to obstructed labour is suspected
- Prescribe antibiotics as you would for caesarean section
- Give a simple analgesic like aspirin for a few days

PROBLEMS AND COMPLICATIONS

FAILURE

If you stick strictly to the criteria, failure should be rare. If it happens, caesarean section is the only alternative

BLEEDING

This stops after delivery of the baby. Before delivery it can be controlled by firm pressure

OSTEITIS PUBIS

This infection of the symphysis pubis is serious and may cripple the patient for life. However, it should not occur if reasonable aseptic precautions are taken

INJURY TO BLADDER OR URETHRA

Fistulae can result from faulty technique but are more commonly due to the obstructed labour which necessitated the symphysiotomy in the first place.

Incontinence of urine without a fistula is due to avulsion of the

urethra from the pubic bones. It is rare but serious as it is apparently difficult to treat.

PELVIC INSTABILITY

This is remarkably uncommon. Most patients walk well soon after the operation and have little or no pain. It is, of course, important to avoid too much abduction of the thighs during the procedure. If this does occur, a situation comparable to a fractured pelvis results with extensive soft tissue damage as well. So beware!!

Chapter 44

CAESAREAN SECTION

FOR CLINICAL OFFICERS AND DOCTORS

INTRODUCTION

This chapter is for those of you who have done some caesarean sections already and who are, therefore, familiar with the technique of the uncomplicated operation.

PREPARATION

ANTIBIOTICS

Caesarean section during labour

Clean cases

Before operation:

- x-penicillin 5 mega i.v. stat. + streptomycin 1 gm i.m. stat.

After operation:

- x-penicillin 2 mega i.v. or i.m., 6 and 12 hours after operation

Infected cases (temperature 38C° or more, offensive liquor or ruptured membranes of more than 12 hours)

Before operation

- x-penicillin 5 mega i.v. stat. + streptomycin 1 gm i.m. stat.

or

- chloramphenicol 1 gm i.v. stat

After operation:

- x-penicillin 2 mega i.v. or i.m. 6 hourly + streptomycin 1 gm i.m. daily for seven days

or

- chloramphenicol 0.5 gm i.v. or p.o. six hourly for seven days.

Elective caesarean section

No antibiotics!

BLOOD

- Check the haemoglobin
- x-match one pint of blood if possible

CATHETERISATION AND VAGINAL EXAMINATION

The doctor or clinical officer who will do the operation should catheterise the bladder in theatre.

If the patient is in labour do a vaginal examination at the same time in order not to miss unexpected progress and the possibility of a vaginal delivery.

TILT THE PATIENT TO THE LEFT
Tilt the patient approximately 15° to the left by placing a pillow or rolled up towel under the right buttock

ANAESTHESIA

GENERAL ANAESTHESIA

This is only safe if given by a trained anaesthetist who *intubates* the patient.

Never assume that the stomach will be empty because the patient has not taken food for a long time. Emptying of the stomach slows down during labour.

Aspiration of stomach contents will cause a most violent pneumonia which will probably kill your patient.

SPINAL ANAESTHESIA

This is a good technique provided:

- you know the technique and *its complications* in detail
- you put up an i.v. drip and run in 1 – 2 litres of fluid fast
- you tilt the patient to the left [see above]
- you observe the contraindications
  - severe antepartum haemorrhage
  - severe anaemia
  - severe hypertension or preeclampsia
  - serious heart disease

LOCAL INFILTRATION ANAESTHESIA

Safe for mother and baby.

Disadvantages are:

- uncomfortable for the mother
- unsuitable if extensive dissection is required (old scars)
- unsuitable for infected cases because packs cannot be placed by the side of the uterus and thorough cleaning of the abdominal cavity is difficult

Technique

- give diazepam 10 – 20 mg i.v. stat.
- prepare a ½% solution of lignocaine
- inject 10 – 20 ml under the skin in the line of the incision

- after a few minutes incise the skin and subcutis
- inject another 10 – 20 ml under the fascia
- after a few minutes incise fascia, muscles and peritoneum
- put a few ml of anaesthetic under the peritoneum of the uterus
- deflect the bladder peritoneum, incise the uterus and deliver the baby
- as soon as the baby is out, inject 50 mg of pethidine i.v., this may have to be repeated once or twice.
- complete the operation

INCISION OF THE UTERUS

There are four acceptable ways of making an incision in the uterus:
- a transverse incision in the lower segment
- a vertical incision in the lower segment
- a transverse incision in the upper segment
- a vertical incision in the upper segment

The techniques of making and closing these incisions are described here, the indications follow later in this chapter.

A fifth method of incising the uterus, the inverted T incision, is not described, as, with forethought, it can always be avoided. It heals poorly and should not be used.

TRANSVERSE INCISION IN THE LOWER SEGMENT

1. **Opening of the uterus**
   - Cut the peritoneum over the lower segment transversely and mobilise the peritoneum and bladder well down
   - Identify the midline of the uterus (it may have rotated to the right or the left)
   - Incise the lower segment transversely with the scalpel over a short distance
   - Enlarge the opening to the right and the left with scissors (this is safer than stretching the incision with your fingers which does not allow you good control over where the lower segment will tear)
2. **Repair of the incision**
   - Identify the lower edge of the incision by placing Green-Armytage forceps
   - Start at a point where the lower edge is easy to see
   - When you have placed the first clamp, lift it and a further stretch of the edge will come into view
   - Place another clamp and continue like this until you have identified the lower edge over its whole length.

A common mistake is to pick up a fold of the posterior wall of the uterus. If you use the above method, that mistake is almost impossible to make.

- Now repair the uterus with two layers of continuous chromic catgut No. 1 or No. 2

3. **Difficulties**

Heavy bleeding

Bleeding from the edges can be controlled by Green-Armytage clamps until the incision has been sutured.

A (partly) torn branch of a uterine vessel in one of the corners is sometimes easier clamped with an ordinary artery forceps. It may also need to be ligated separately.

Continued bleeding after the incision has been sutured in two layers needs extra figure-of-eight stitches. Do not pull these too tight or they will cut through and more bleeding will result.

Continued oozing is best controlled with a hot pack.

Vertical tears

These are often located in the corners and run downward behind the bladder. Very often there is heavy bleeding as well.

In order to repair these you must be able to see.

- If you are alone with a scrubnurse, ask for an extra assistant
- Identify the edges of the incision and the tear as described above
- Mobilise the bladder further downward if necessary
- Divide the round ligament if necessary : this often makes the lower end of the tear much easier to see
- In the area of the tear use interrupted sutures : these are easier to unpick if you catch the bladder or ureter by mistake
- After repairing the tear check that the ureter has not been caught in a stitch
- Remember that all bleeding can always, at least, temporarily, be controlled by pressure with a hot pack

THE VERTICAL INCISION IN THE LOWER SEGMENT (DE LEE INCISION)

1. **Opening of the uterus**
   - Incise the peritoneum transversely *high* on the lower segment
   - Mobilise the peritoneum and bladder well down
   - Identify the midline of the uterus

- Incise the lower segment vertically with the scalpel
- Enlarge the incision with the scalpel or scissors : often the upper segment has to be entered

2. **Repair of the incision**
   - Suture the incision with two layers of continuous chromic catgut No. 1 or No. 2
   - Make sure that you include the uterine fascia in the second layer or it will continue to bleed
   - Repair the peritoneum and pull it high up so that the top end of the incision is covered
   - If the upper segment was incised over a long distance, do tubal ligation

TRANSVERSE INCISION OF THE UPPER SEGMENT

1. **Opening of the uterus**
   - Check that the uterus is wide enough for an adequate incision
   - Incise the peritoneum over the lower part of the upper segment transversely with the scalpel
   - Mobilise the peritoneum away from the incision with scissors
   - Incise the uterus transversely in the midline
   - Enlarge the incision to the right and left by stretching it with your fingers (it is usually too thick to be cut with scissors)
   - Deliver the baby by breech extraction
2. **Repair of the incision**
   - Suture the incision in two layers with continuous chromic catgut No. 1 or No. 2
   - Do not catch the full thickness of the uterine wall in the first layer : it is often too thick
   - Repair the peritoneum over the incision, preferably with a locking stitch

THE VERTICAL (CLASSICAL) INCISION IN THE UPPER SEGMENT

This is a poor incision and should only be used as a last resort.
It has two dangers:
- it may rupture before labour in a future pregnancy
- infection can spread directly from the uterine into the peritoneal cavity

1. **Opening of the uterus**
   - Identify the midline of the uterus
   - Incise the uterus vertically with the scalpel
   - Enlarge the incision by stretching it with the fingers
   - Deliver the baby by breech extraction
2. **Repair of the incision**
   - Repair the uterus in three layers with a continuous chromic catgut No. 1 or No. 2 suture; each layer should catch about one third of the thickness of the uterine wall; the last layer should be a locking stitch.
   - always tie the tubes

CAESAREAN SECTION FOR SPECIFIC INDICATIONS

REPEAT CAESAREAN SECTION

Entry into the abdomen

This can be difficult but the following method is safe:

- Excise the skin scar
- Lift the fascia with two dissecting forceps as close to the umbilicus as possible and incise fascia, muscles and peritoneum to open the abdomen
- If entry into the abdomen at this site proves difficult, do not muddle on
- Extend the skin incision higher up the abdomen, round the umbilicus if necessary, and try again; by going higher it is always possible to find an area free of adhesions
- After the abdomen has been entered, lift the abdominal wall on two fingers and incise the layers one by one: fascia, muscle, peritoneum; in this way the bladder is easily recognised when it appears at the lower end of the incision

Separation of the adhesions

After a previous operation there can be dense adhesions between the uterus and abdomen wall

- Open the parietal peritoneum as far as possible
- Lift the parietal peritoneum with two dissecting or artery forceps to stretch the adhesions
- Cut the adhesions close to the uterus with curved scissors, keep the points of the scissors directed at the uterus
- If a plane of loose connective tissue is found, do the further separation with a finger or a swab; fibrous bands must be cut
- Stay close to the uterus to avoid the bladder
- If dissection of the adhesions proves difficult, give up and make an upper segment incision

Mobilisation of the bladder
After a previous operation the bladder is stuck to the lower segment and cannot be mobilised with the finger or a swab

- Incise the peritoneum on the uterus transversely about 2 cm above the bladder
- Lift the lower edge with two dissecting or artery forceps to stretch the adhesions between the bladder and the uterus
- Cut the adhesions close to the uterus with curved scissors keeping the points of the scissors directed at the uterus
- If this proves difficult, give up and make an incision higher in the uterus

The uterine incision
Usually a transverse incision in the lower segment is possible and with an elective caesarean section this should provide no further difficulty. If the section is done during labour, you may find the head tightly stuck under the old scar in the uterus. If you then make your incision just above the scar, the old scar will probably rupture during delivery of the head of the baby. It is safer to make a V-shaped transverse incision with the point of the V lying across the middle of the scar. This is thus divided and the tension removed. If any tearing occurs, it will be near the midline where it is relatively easy to see and repair

OBSTRUCTED LABOUR WITH A CEPHALIC PRESENTATION

- Enter the abdomen just under the umbilicus in order to avoid the bladder
- If catheterisation before the operation was impossible, empty the bladder now with a needle and syringe; a lot of its swelling will be oedema and this, of course, does not go away
- Mobilise the bladder of the lower segment in the usual manner
- If someone is going to push up the head from below through the vagina, let them start now *before* the uterus is opened; if you postpone this until after the uterus has been opened, the shoulder will prolapse into the incision making delivery more difficult
- Make a transverse incision in the lower segment.
  Choose the level of the incision carefully:
  - if it is too high, delivery of the baby will be difficult
  - if it is too low you may enter the vagina
- *Take time to deliver the baby.*
  - between the contractions work two to four fingers between the uterine wall and the head until they are under it

- lift the head from the pelvis by flexing your fingers
- try to avoid "levering" the head out with your whole hand because this often causes vertical, downward tears in the lower segment

- After delivery of the baby and placenta, repair the uterus
- Clean the abdomen very carefully, if the liquor was purulent or offensive smelling, wash the pelvis with warm saline

BREECH PRESENTATION
There should be no difficulty. Make sure, however, that you deliver the baby through the incision with exactly the same manoeuvres that you would use for a vaginal delivery. Failure to do so may cause extensive tearing of the lower segment.

TRANSVERSE LIE
The choice of the incision in the uterus is what matters here.
You will meet the following situations

- **Labour obstructed**
  Most of the baby is in the overdistended lower segment. Simple delivery through a transverse lower segment incision will cause extensive tears. Therefore:
  - if the baby is dead
    - make a transverse incision in the lower segment
    - decapitate or eviscerate the baby
    - now deliver it whichever way is convenient
  - if the baby is alive
    - make a vertical incision in the lower segment
    - extend the incision into the upper segment until you have enough room to deliver the baby safely

- **The patient is in early labour but the lower segment is poorly developed. Most of the baby is in the upper segment**
  - make a transverse incision in the upper segment
  - deliver the baby by breech extraction

- **The patient is in early labour, the lower segment is well developed and the membranes are still intact**
  - make a transverse incision in the lower segment
  - deliver the baby by breech extraction

PLACENTA PRAEVIA
Usually the normal transverse incision in the lower segment is possible. If the lower segment is too small for an adequate incision or if it is very vascular, make a transverse incision in the lower part

of the upper segment. If this is also very vascular, make a classical incision.

CONSTRICTION RING

Sometimes the cause of obstruction is a constriction ring either in the lower segment or between the lower and upper segment.

If the baby is entirely above it, make a transverse incision above the constriction. If the constriction is round the baby's neck, make a vertical incision across the constriction.

OTHER PROCEDURES DURING CAESAREAN SECTION

FIBROIDS

Leave these alone. Removal will cause heavy bleeding. If necessary, they can be removed three months later by a second operation.

OVARIAN CYSTS/TUMOURS

These should be removed. Ovarian cystectomy is possible but if bleeding is a problem, salpingo-oophorectomy may be quicker and safer.

ADHESIONS

Adhesions should be separated sufficiently to gain good access to the uterus. However, there is no point in removing adhesions round the adnexa. This often causes troublesome oozing and the adhesions will invariably form again.

BLADDER INJURY

See Chapter 47

TUBAL LIGATION

See Chapter 52

POSTOPERATIVE ORDERS

Routine are:

- intravenous fluids: one to three litres over the first 24 hours, depending on the patient's condition
- pain relief : pethidine 50 – 100 mg six hourly for two days; after that a simple analgesic like aspirin
- antibiotics : as outlined under PREPARATION
- catheter : open drainage only when indicated (blood stained urine, bladder repair, obstructed labour)
- observations: vital signs, fundus, vaginal bleeding

Chapter 45

REPAIR OF A RUPTURED UTERUS

INTRODUCTION : REPAIR OR HYSTERECTOMY?

In the course of an operation for ruptured uterus you will have to decide what to do; repair the rupture or do hysterectomy. The following hints are meant to help you make the right decision.

If you have very little or no experience of hysterectomy, repair of the uterus is nearly always best. Hysterectomy will take longer and can cause more bleeding. Only do a hysterectomy when extensive tearing of the uterus makes a repair impossible.

If you do have some hysterectomy experience, your decision can depend on the situation.

Factors in favour of a repair are:
- rupture not too large
- edges clean and easy to see
- little or no infection present.

Factors in favour of hysterectomy are:
- extensive or multiple tears of the uterus
- edges which are necrotic or not easy to reach for suturing (some posterior ruptures, ruptures extending down into the vagina)
- gross infection of the uterus

This chapter describes repair of the uterus, hysterectomy is dealt with in the next chapter.

PREPARATION

Rescuscitate the patient
- Put up i.v. drip with large bore needle (No. 18) or cannula
- Give 1 – 2 litres of saline or sodium lactate before starting the operation
- x-match 2 pints of blood

Antibiotics
- Give, for example:
  - x-penicillin 5 mega i.v. stat. + streptomycin 1 gm i.m. stat

    or
  - chloramphenicol 1 gm i.v. stat.
- Catheterise the bladder

ANAESTHESIA

If the patient's condition is poor, local infiltration anaesthesia [see Chapter 44] is safest.

If general anaesthesia is used, endotracheal intubation is essential. Do not use spinal anaesthesia for patients with a ruptured uterus.

STAFF AND INSTRUMENTS

Needed are:

- you, the surgeon
- a scrubnurse
- if at all possible, a second scrubbed assistant
- a "runner"
- an anaesthetist

The set of instruments used for caesarean section will do, provided you add some large curved clamps or artery forceps.

TECHNIQUE

- Open the abdomen through a midline incision
- Remove fetus and placenta:
  - this is easy if they are free in the abdomen
  - if the fetus is in the broad ligament, open the broad ligament: this is often most easily done by dividing the round ligament over it
  - if the fetus is still inside the uterus (with a posterior rupture for example) you may have to make the transverse incision in the lower segment, as for caesarean section, in order to deliver the baby
- Suck away most of the blood and liquor
- Lift the uterus from the abdomen and assess the damage
- Identify the edges of the tear along its whole length
- Make sure to separate the bladder well away from the edge*
- Divide the round ligament if this makes the tear easier to see
- Trim obviously dead tissue away. Do not trim too much as this makes the repair more difficult and causes bleeding
- Repair the tear in one layer with a continuous chromic 1 or 2 suture. A vertical tear going down to the cervix can be repaired from below upwards but sometimes the other way round is easier: traction on the suture helps to bring the lower end of the tear into view. Carefully identify the edges before

*For repair of bladder injury See Chapter 47.

putting in the stitches in order not to include the ureter
- If there is oozing from the broad ligament, put in a drain. This can be brought out either through the tear into the vagina or – preferably extraperitoneally – through the abdominal wall
- Repair the peritoneum over the uterus
- Tie the Fallopian tubes
- Clean the abdomen and wash it with warm saline
- Close the abdominal wall in layers; use deep tension sutures if you expect peritonitis

POSTOPERATIVE ORDERS

- I.v. fluids and blood depending on the patient's condition
- continue antibiotics, for example:
  - x-penicillin 2 mega i.v. six hourly + streptomycin 1 gm daily for seven or 10 days

    or
  - chloramphenicol 0.5 gm i.v. six hourly for seven or 10 days
- Pethidine 50 – 100 mg i.m. six hourly for two days
- Remove the drain after one or two days
- Open bladder drainage for 10 – 14 days if the bladder was damaged
- Nasogastric tube if the bowels are distended or peritonitis is expected.

Chapter 46

SUBTOTAL HYSTERECTOMY

INDICATIONS

There are two situations in which even the inexperienced surgeon must attempt hysterectomy if somebody more senior is not available:

- a ruptured uterus with tearing so extensive that repair is impossible
- postpartum haemorrhage not responding to treatment [see chapters 34, 49, and 56].

PREPARATION

Resuscitate the patient

- Put up an i.v. drip with a large bore (No. 18) needle or cannula
- Give 1 – 2 litres of saline or sodium lactate before starting the operation
- x-match 2 pints of blood

Antibiotics

- Give, for example:
  - x-penicillin 5 mega i.v. stat. + streptomycin 1 gm i.m. stat.

    or
  - chloramphenicol 1 gm i.v. stat.

Catheterise the bladder

ANAESTHESIA

If the patient's condition is poor, local infiltration anaesthesia [see chapter 44].

If general anaesthesia is used, endotracheal intubation is essential. Do not use spinal anaesthesia.

STAFF AND INSTRUMENTS

Needed are:

- you, the surgeon
- a scrubnurse
- a scrubbed second assistant (essential!)
- a "runner"
- an anaesthetist

The set of instruments used for caesarean section will do, but you *must* add large curved artery forceps or kochers, at least 12! A self-retaining abdominal retractor is a great help.

GENERAL POINTS OF TECHNIQUE

Subtotal hysterectomy, which leaves the cervix and perhaps part of the lower segment in place, is easier to perform than total hysterectomy. It causes less bleeding and there is almost no danger to the ureters. Subtotal hysterectomy is still possible when a uterine rupture extends down into the cervix and vagina. In that case the tear in the cervix and vagina is repaired after the body of the uterus has been removed.

Removing the adnexa (adnex = tube + ovary) is often easier than leaving them in place. The reason is that the pedicle of the infundibulopelvic ligament is usually smaller and easier to handle than the pedicle of the cut Fallopian tube and ovarian ligament.

Traction on the uterus throughout the procedure is the key to success in hysterectomy. Traction makes it easier to identify the structures that have to be divided and it helps to keep bladder and ureters out of the way.

The anatomy. Make sure to identify the important structures and landmarks *before* you start removing the uterus. With a ruptured uterus the anatomy can be difficult to recognise and this does not become any easier if you start cutting without knowing exactly what you are doing.

Control of bleeding. For the control of bleeding concentrate on:

- the ovarian vessels either in the pedicle of the infundibulopelvic ligament or in the stump of the cut tube and ovarian ligaments.
- the uterine vessels
- the stump of the cervix or lower segment.

There can be some bleeding from other small vessels but this does not usually cause problems.

TECHNIQUE IN DETAIL

(AS FOR RUPTURED UTERUS)

- Open the abdomen
- Remove fetus and placenta [see chapter 45]
- Clean away most of the blood and liquor

- Insert a self-retaining abdominal retractor if this is available
- Lift the uterus from the abdomen
- Maintain traction on the uterus with one hand or put in a traction suture
- Identify the following structures:
  - the corpus uteri
  - the round ligaments
  - tube and ovary on both sides
  - the infundibulopelvic ligaments on both sides
  - the avascular area in each broad ligament
  - the lower segment
  - the bladder
  - the rectum

  [see figure 46.1]

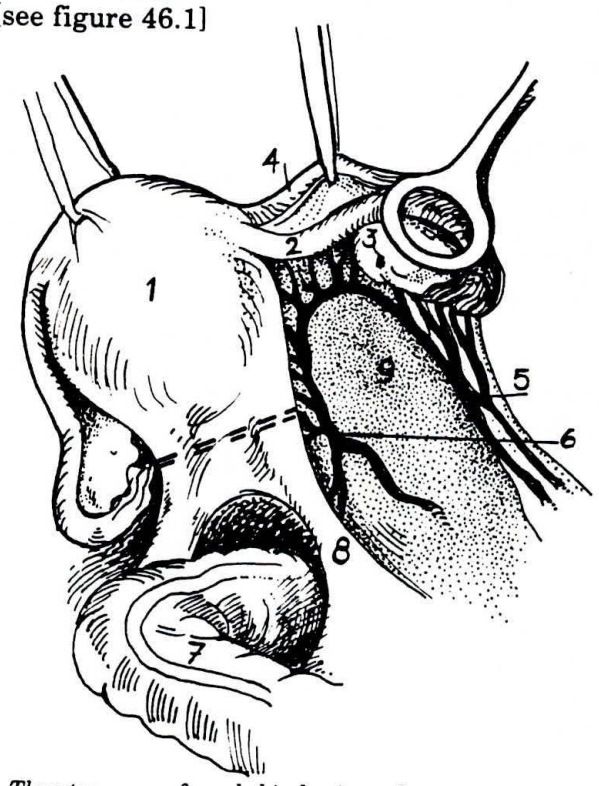


Figure 46.1 The uterus seen from behind prior to hysterectomy

1. uterine corpus
2. Fallopian tube
3. ovary
4. round ligament
5. ovarian vessels
6. uterine vessels
7. rectum
8. sacro-uterine ligament
9. avascular area in broad ligament

Note that the uterus is being pulled over to the left and that the right adnexa are being lifted in order to show the anatomy clearly

- Identify the rupture and clamp obvious bleeding points
- Pull the uterus to the left and divide the right round ligament between clamps about 2 cm from the uterus; this step opens the anterior peritoneal leaf of the broad ligament
- Enlarge the opening in the anterior leaf of the broad ligament with scissors in a downward direction towards the bladder
- Lift the right adnexa with one hand and push a finger of the other hand from behind through avascular area in the broad ligament; this step helps to define the infundibulopelvic ligament
- Clamp the infundibulopelvic ligament with two artery forceps and cut it
  Alternatively, if you wish to leave the adnexa in place, clamp and divide the tube and ovarian ligament near the uterus. If the tube and ovarian ligament are very thick and vascular, the clamping and cutting may have to be done in two steps
- Suture ligate the pedicles of the round ligament and infundibulopelvic ligament (or the cut tube and ovarian ligament)
- Repeat the same procedure on the left side
- Now pull the uterus well up in the midline and cut the peritoneum between the uterus and bladder; extend the incision laterally to meet the incisions in the anterior leaves of the broad ligaments
- Push the bladder off the lower segment with your finger or a swab on a holder; two or three centimeters is enough, pushing it down further can cause bleeding;
  if the rupture is in the anterior lower segment, you have to put its edge on stretch with Green-Armytage forceps before you can separate off the bladder
- Now expose the posterior lower segment by pulling the uterus forward over the symphysis pubis
- Divide the peritoneum over the posterior lower segment at about the same level as this was done anteriorly
- Extend the incision laterally to join the openings in the broad ligaments
- Push the lower flap of the peritoneum off the lower segment with a swab on a holder or if this is difficult, cut it loose with scissors
- Now review the situation:
  on either side of the uterus you should see a bundle of loose

connective tissue which holds the uterine vessels; you may have to strip down the peritoneum of the broad ligaments a little further to see them more clearly

- Pull the uterus to the left and clamp the uterine vessels on the right with strong curved kocher or artery forceps just above the level where the bladder is still attached to the lower segment; make sure the points of the clamp are very close to the uterus (there is no harm in including a little uterine wall!)
- Place a second clamp inside the first and cut the uterine vessels in between
- Sutureligate the pedicle
- Repeat this procedure on the left
- Now amputate the uterus through the lower segment just above the level of the cut uterine vessels; have artery forceps ready to pick up the cut edge of the lower segment before it disappears in the depth of the pelvis
- Clamp obvious bleeders
- If there is a downward tear in the cervix, repair this now after making sure that bladder and ureters are well out of the way
- Now suture the anterior wall of the lower segment to the posterior wall with figure-of-8 stitches; make sure you include the angles on the left and right as these tend to bleed; leave the centre open for drainage
  At this stage the pelvis should be more or less dry.
- Look for remaining bleeding points and ligate these
- If there is a lot of oozing from one of the broad ligaments, place a rubber drain in that area and bring it out either through the cervix into the vagina or (preferably extra-peritoneally) through the abdominal wall
- Close the pelvic peritoneum with a continuous suture; start on the left at the pedicle of the infundibulopelvic ligament and suture the anterior edge of the peritoneum to the posterior edge and place all vascular pedicles under the peritoneum
- Wash the abdomen with warm saline and close it.

POSTOPERATIVE ORDERS

- i.v. fluids and blood depending on the patient's condition
- Continue antibiotics, for example:
  - x-penicillin 2 mega i.v. six hourly + streptomycin 1 gm daily for seven or 10 days

or

- chloramphenicol 0.5 gm. i.v. six hourly for seven or 10 days

- Pethidine 50 – 100 mg i.m. six hourly for two days
- Remove the drain after one or two days
- Open bladder drainage for 10 – 14 days if the bladder was damaged
- Nasogastric tube if the bowels are distended or peritonitis is expected.

Chapter 48

DESTRUCTIVE OPERATIONS

GENERAL

You should try not to do a caesarean section for obstructed labour, if the baby is already dead. Often a destructive operation is easier and safer, because it carries less risk of bleeding and infection and also because it leaves no uterine scar. However, for a destructive operation to be safe, three points should always be observed:

- the indication must be correct
- you should follow the correct operative technique
- you should be able to do an immediate laparotomy when you discover a rupture of the uterus during the operation.

The following sections explain how destructive operations should be done.

CRANIOTOMY

(The destructive operation for cephalic presentations)

INDICATION

You should do craniotomy if:

- the fetus is dead
- the head presents
- 2/5 or less of the head is above the brim (if the head is higher, caesarean section is usually safer!)
- the cervix is fully dilated
- the uterus is not ruptured

PREPARATION

In the labour ward

- put up an i.v. drip with dextrose 5% in water
- give high doses of antibiotics, e.g.
  x-penicillin 5 mega i.v. stat, with streptomycin 1 gm i.m. stat
  or
  chloramphenicol 1 gm i.v. stat
- give painrelief, e.g.
  pethidine 50 mg slowly i.v.
- take bloodsamples for haemoglobin and x-matching
- shave for a vaginal operation and laparotomy

In theatre (Do not do a craniotomy anywhere else!)

- check the preparations done in the labour ward
- check the i.v. drip
- check the instruments on the trolley
- check that everything is ready for laparotomy

Staff

Needed are:

- you, the surgeon
- one anaesthetist
- one scrubnurse
- one "runner"

Anaesthesia

General anaesthesia with intubation is best. *Do not use general anaesthesia without sia without intubation.* If general anaesthesia is not possible, use spinal anaesthesia or local infiltration anaesthesia of the perineum and vulva.

If local infiltration anaesthesia is used, sedate the patient with:

- pethidine 25 – 50 mg i.v. slowly (N.B. Check what she was given in the labour ward)
- diazepam 10 – 20 mg i.v. slowly.

Technique

- Put the patient in lithotomy position
- Clean and drape the vulva and perineum
- If local anaesthesia is used, infiltrate the perinuem with ½ or 1% lignocaine
- Catheterise the bladder with a rubber or plastic catheter [see Chapter 38]
- Put one or two Sims specula into the vagina so that you can see the head well. Ask an assistant to hold the specula
- With the knife make a cross-shaped incision through the skin of the head right down to the bone
- With a finger feel for a gap (a suture line or a fontanel) between the bones
- Push a closed pair of scissors between the bones
- Now open and close the scissors a few times while turning them round (the brain should now be coming out from the hole)
- Put a finger through the hole in the skull and check that all brain compartments have been broken up
- Put 3 or 4 strong volsellum forceps or kochers (even better are Willet's forceps) on the skin or the skin and the bone
- Pull on these forceps and try to turn the posterior fontanel under the symphysis

- If sharp edges of bone come sticking out, protect the vagina with your fingers or remove the offending bone
- Make a large episiotomy
- Deliver the head

After delivery of the head, sometimes delivery of the shoulders is still difficult. In that case:

- Put a hand behind the baby in the vagina and turn the shoulders through 90° or even 180°. Try delivering the shoulders again.

  If the shoulders cannot be delivered by turning them, you must bring down the arms one by one.
- Put a hand behind the fetus in the vagina and feel for the posterior shoulder and arm. Pull the arm down gently (the arm can break, but you should not damage the cervix or vagina).
- After delivering the first arm turn the fetus 180° and deliver the second arm in the same way. Further delivery should now be easy.

After delivery of the fetus:

- remove the placenta manually
- Give ergometrine 0.5 mg i.v. stat.
- After removal of the placenta feel immediately for tears of the uterus or lower segment
- Inspect the cervix, vagina and vulva carefully for tears
- Repair the episiotomy and tears
- insert an indwelling catheter for open bladder drainage
- If the uterus is not well contracted, put pitocin 10 – 40 units per 1,000 ml in the i.v. drip.

POSTOPERATIVE ORDERS

- continue the i.v. drip slowly for about 24 hours
- continue with antibiotics in high doses, for example:
  - x-penicillin 2 mega six hourly and streptomycin 1 gm i.m. daily for seven days or
  - chloramphenicol 500 mg six hourly for seven days
- open bladder drainage for 14 days

DESTRUCTIVE OPERATIONS FOR TRANSVERSE LIE

GENERAL

Obstructed labour with a transverse lie and a dead baby is a difficult problem. Destructive operations for transverse lie through the

vagina are more difficult than craniotomy. However caesarean section also has its dangers and should – where possible – be avoided. The operations that can be done are the following:

Decapitation : The fetus' neck is divided and the body and head are then delivered separately

Evisceration : The fetus' chest and/or abdomen are opened and all internal organs are removed. The trunk collapses and delivery by either internal version or decapitation becomes much easier.

Caesarean section in combination with destruction : A **transverse** incision is made in the lower uterine segment. Decapitation or evisceration is done through the uterine incision.

IMPORTANT DON'TS

Never attempt internal version without doing evisceration first. The risk of rupturing the uterus is enormous. Cutting off the prolapsed arm does not make version any safer!

Do not attempt decapitation or evisceration through the vagina if the fetus is still high in the birthcanal. It is dangerous because you will not be able to protect the vaginal wall and cervix adequately during the operation.

At caesarean section do not attempt to deliver the fetus intact because this will cause severe tearing of the lower segment.

Do not make a classical or inverted T incision in the uterus for a dead fetus.

CRITERIA FOR DECAPITATION OR EVISCERATION BY THE VAGINAL ROUTE

- the fetus is dead
- the lie is transverse
- the cervix is 8 cm or more dilated
- the uterus is not ruptured

You can only decide which operation you are going to perform *after* you have examined the patient under anaesthesia.

Preparation

The preparation of the patient in the labour ward is exactly as for patients undergoing craniotomy. In theatre the preparations are also the same

Anaesthesia

See the section on craniotomy. Good anaesthesia is even more important than with craniotomy because the operation is done higher in the birthcanal.

Technique

- put the patient in lithotomy position
- clean and drape the vulva
- catheterise the bladder

Now with the patient under anaesthesia examine her again. Put one hand in the vagina and support the fundus with the other. Note the following:

- cervical dilatation : If it is less than 8 cm, caesarean section is probably safer
- the lower uterine segment : explore it as far as you can without using force. If you find it ruptured, do a laparotomy now
- the exact position of the fetus : which arm has prolapsed?
  where are the head and the neck?
  where are the chest, abdomen and back?

Now decide:

- if the neck and the body are both still high in the birthcanal, do a caesarean section
- if the neck can be reached easily, attempt decapitation
- if the neck is difficult to reach but the body is well down, attempt evisceration

Decapitation

a) Using the decapitation saw (this is very well described in Lawson and Stewart's Obstetrics and Gynaecology in the Tropics)
   - hook the end of the saw in the thimble
   - put the thimble on the best finger of your best hand and try to bring it round the neck
     This is often difficult because there is little room between the neck, the head and the chest. Sometimes it is easier to put the saw over the neck and under the arm
   - when the saw is in position, protect the vagina with specula
   - apply firm traction and saw through the neck
   - pull on the arm : usually this delivers the body
   - put a hand in the vagina and turn the head so that the neck points downwards
   - put one or two volsellum forceps on the neck and deliver the head like the aftercoming head of a breech

- if the head was delivered first, deliver the body by pulling on the other arm. Don't do a version, the cut neck might damage the uterus.

b) Using scissors
- hook one or two fingers round the neck and pull it down
- protect the vaginal wall with a speculum held by an assistant
- carefully cut the neck with a pair of strong scissors
- further delivery will be as described above.

Evisceration
- your assistant should pull on the prolapsed arm
- protect the vaginal wall with one or two specula
- with a knife or a pair of strong scissors make a large opening in the abdomen and/or chest
- put one or two fingers into the opening and remove all internal organs. Make sure you remove the liver, the heart and the lungs. Sometimes the diaphragm has to be perforated with scissors.
- Now reassess the situation:
- sometimes the breech can be brought down easily by hooking a few fingers behind the fetus pelvis; further delivery is then no problem
- sometimes a foot or a leg can be felt easily and this can be brought down. The operation is then completed by a very gentle version and breech extraction
- if the breech cannot be delivered easily, the neck can be brought down for decapitation by pulling on the arm
- in the unlikely event that all this fails, don't hesitate to do a caesarean section.

After delivery of the fetus see the section or craniotomy

POSTOPERATIVE ORDERS

See the section on craniotomy. Obstructed labour with a transverse lie usually does not cause pressure necrosis of the vagina and bladder. Open bladder drainage for a few days is sufficient.

HYDROCEPHALUS

DIAGNOSIS

On abdominal palpation

The head is large in proportion to the fetal body

On vaginal examination
With a cephalic presentation the wide sutures and fontanels are felt. If the patient presents with a stuck breech, bimanual palpation will reveal the large size of the fetal head.

x-ray
An abdominal x-ray may confirm the diagnosis but beware with breech presentations: on the x-ray the head may seem much bigger than it actually is (this is due to the way it is projected onto the film)

RISK
Obstructed labour with rupture of the uterus

MANAGEMENT
Cephalic presentation
If progress in the first stage is good, prepare for vaginal delivery.

- When the cervix is about 7 cm dilated, insert a good size needle (lumbar puncture needle, for example) or plastic cannula into the head through a suture and drain the cerebrospinal fluid. The head will collapse and delivery becomes easy
- Do not wait for full dilatation (the large head will stay high and full dilatation may never come)
- If, during the first stage of labour, progress is poor, do caesarean section. At caesarean section drain the cerebrospinal fluid from the head with a needle before you deliver it. If you do do not do that, there can be nasty tears of the lower segment.

Breech presentation
If progress is good, wait until the trunk has been delivered up to the neck. Insert a needle through and then under the skin of the neck into the head and drain the cerebrospinal fluid. Delivery then becomes easy.

If progress in the first or second stage is poor, do a caesarean section but drain the cerebrospinal fluid from the head before delivering it through the uterine incision.

IMPORTANT DON'TS
- Do not try to force a too large head through the pelvis
- Do not use pitocin

THE STUCK BREECH

DIAGNOSIS
The usual manoeuvres to deliver the head (Smellie – Veit, supra pubic pressure) have failed and the baby is dead.

CAUSES

- cephalopelvic disproportion
- incompletely dilated cervix
- hydrocephalus

MANAGEMENT

- For management of the hydrocephalic head see previous section
- In other cases sedate the patient with pethidine 50 mg i.v. + 50 mg i.m.
- Wait for about an hour, preferably with the patient in lithotomy position and the baby's body hanging down; often the head is delivered spontaneously after it has had time to mould.

If this fails, craniotomy is necessary. This is best done in theatre under general anaesthesia but it can be done in the labour ward.

- Retract the anterior vaginal wall with a Sims' speculum and expose the posterior aspect of the neck
- With scissors cut a small opening in the skin of the neck
- Make a tunnel under the skin and push the scissors into the head
- Open and close the scissors a few times in different directions to break up the brain compartments
- Pull gently on the neck and while the brain gradually escapes, the head is delivered.

IMPORTANT DON'T

- Do not pull the head with great force through an incompletely dilated cervix: this can cause cervical tears which extend into the lower segment.

Chapter 53

PUERPERAL INFECTIONS

DEFINITIONS

Fever postpartum : A temperature of 37.5 C° (under the arm) or more on any two days within 14 days after delivery

Puerperal sepsis : Infection of the genital tract following delivery.

CAUSES OF FEVER POST PARTUM

PUERPERAL SEPSIS

Micro-organisms

Many different micro-organisms can cause puerperal sepsis. They can be classified as follows:

- **sexually transmitted organisms** : gonococci, chlamydia
  These organisms are present in the cervix before delivery
- **large bowel bacteria**
  There are many different kinds of large bowel bacteria. Important examples are : Escherichia coli and Bacteroides fragilis. These bacteria are carried from the perineum into the birthcanal for example by a vaginal examination.
- **other bacteria**
  For example : staphylococci, beta-haemolytic streptococci etc.

Factors which encourage puerperal sepsis

These include:

- poor hygiene or poor aseptic technique during delivery
- manipulations high in the birthcanal
- the presence of dead tissue in the birthcanal after delivery, for example retained products or sloughing vaginal wall following obstructed labour.

Forms

Depending on how the infection has spread puerperal sepsis can present as:

- endometritis
- salpingo-oophoritis
- parametritis (= pelvic cellulitis) : the infection has spread through the wall of the uterus into the broad ligament

- generalised peritonitis
- septicaemia: the infection attacked a vein in the pelvis (a branch of the ovarian or uterine veins) and infected emboli are discharged into the circulation.
- abcesses:
  - in the pelvis as:
    - tubo-ovarian abcess
    - broad ligament abcess
    - abcess in the pouch of Douglas
  - in the subphrenic spaces
  - in multiple places in the abdomen:
    - in the paracolic gutters
    - between small bowel loops

CAUSES OF FEVER OTHER THAN PUERPERAL SEPSIS

Urinary tract infection
- Wound infection (episiotomy, abdominal wound)
- Chest infections : pneumonia or lung abcess (due to aspiration during anaesthesia)
- Mastitis
- Deep vein thrombosis
- Medical conditions: malaria, typhoid, meningitis etc.

ASSESSMENT

Take a history and examine the whole patient for possible causes of fever. Include a rectovaginal examination if the cause of fever is not immediately obvious.

After your clinical assessment you will find one of the following situations:

1. **The cause of fever is (reasonably) certain**
   For example : endometritis or urinary tract infection
   - Treat the patient according to your diagnosis

2. **No cause of fever is found**
   If the patient is not very ill:
   - send blood for haemoglobin, white blood count and malarial parasites
   - Prescribe a full chloroquin course
   - review the patient daily : look for localising signs or signs of improvement

If the patient is very ill:

- send blood for haemoglobin, white blood count and malarial parasites
- send urine for microscopy and culture if possible (take specimen by suprapubic aspiration or catheter)
- do, if possible, one or more blood cultures*
- order a chest x-ray
- prescribe a full chloroquin course
- start a broad spectrum antibiotic *after* the cultures have been taken
- review the patient daily, look for "hidden" causes of fever [see below]

"Hidden" causes of fever

1. **The "hidden" abcess**
   - Suspect an abcess when the patient has been ill with fever for more than one week
   - Look for:
     - **a subphrenic abcess**. Useful signs are:
       - poor air entry over the lower lobe of the lung on the affected side
       - tenderness on palpation between the lower ribs
       - a raised hemidiaphragm on the chest x-ray
     - **a pelvic abcess**. Sometimes it takes a while before an abcess in the pelvis becomes palpable: repeated recto-vaginal examinations every 3 – 4 days are necessary!
     - **(multiple) abcesses in the abdomen**. Abcesses between the bowel loops are often difficult to find. Continuing abdominal distension is often the only sign apart from fever.

2. **Septicaemia**
   In the beginning (spiking) fever and chills are the only sign. Signs of endometritis or infection elsewhere in the pelvis are usually minimal or absent.
   After a while signs of "metastatic" infection may appear, for example: pneumonia or lung abcess; liver involvement (jaundice!).
   Often after days or weeks an abcess develops at the site of the infected vein in the broad ligament.

* The value of the high vaginal swab, although it is often done, is very limited. It is difficult to exclude contamination with material from the lower vagina and many of the organisms causing puerperal sepsis do not grow in our laboratories (for example, gonococci, chlamydia, B. fragilis)

3. **Generalised peritonitis and/or multiple abcesses in the abdomen following caesarean section or ruptured uterus**
This diagnosis is often made too late.
Suspect generalised peritonitis if, in the presence of fever:
- three or four days after the operation the abdomen is still distended
- the abdomen remains tender:
  - sometimes all over
  - sometimes only in the flanks where most of the pus collects

Additional signs can be:
- vomiting
- poor bowel sounds
- diarrhoea

The diagnosis is certain and laparotomy urgently needed if these signs persist for more than a week after the original operation.

MANAGEMENT OF PUERPERAL SEPSIS

THE USE OF ANTIBIOTICS

General rules

- Use broad spectrum antibiotics (reason, you do not know which organisms you are dealing with)
- Give high doses (reason: many of the bacteria are not very sensitive to antibiotics)
- If the infection develops in a patient who had prophylactic antibiotics with a caesarean section, do not use the same antibiotics to treat the infection (reason: the infection is probably due to a bacteria resistent to your prophylactic antibiotics)
- If infection develops in a patient who is already on antibiotics, change the antibiotics unless they were started only one or two days ago.
- Do not in general change antibiotics too soon: they need at least three or four days to do their work

Choice of antibiotic

Patient not very ill. Useful regimens are:
- ampicillin 500 mg per os or per injection six hourly
- x-penicillin 2 mega i.m. or i.v. six hourly + streptomycin 1 gm i.m. daily
- bactrim 2 tablets bd
- tetracyclin 500 mg per os six hourly

All these regimens must be given for at least five days, preferably seven

Note that:
- ampicillin or x-penicillin/streptomycin are not effective against chlamydia
- none of these regimens is effective against B. fragilis

Patients severely ill. Often more than one micro-organism is involved. B. fragilis is frequently one of the micro-organisms. B. fragilis only responds to: chloramphenicol, metronidazole or clindamycin.

Useful regimens are:
- ampicillin 500 mg by any route six hourly + metronidazole 400 mg eight hourly
- x-penicillin 2 mega i.v. six hourly + chloramphenicol 500 mg i.v. six hourly

These regimens must be given for at least one week.

Follow-up
- Review the patient daily
- If she does not improve, consider:
  - is the original diagnosis correct?
  - is there an abcess anywhere?
  - is she on the right antibiotic?
- Do not change the antibiotics until you have answered the first two questions.

MANAGEMENT OF THE VARIOUS FORMS OF PUERPERAL SEPSIS

Endometritis

After vaginal delivery

- mild : – ergometrine tablets I tds for five days
  – simple analgesic
- severe: – same + antibiotics

After caesarean section

- antibiotics in all cases

Salpingo-oophoritis or parametritis

- antibiotics
- pain relief: simple analgesic, pethidine 50 – 100 mg six hourly if necessary

Generalised peritonitis

- Treat on suspicion alone
- Antibiotics
- i.v. fluids
- Pethidine 50 – 100 mg i.m. six hourly
- Nasogastric tube

If no marked improvement after 24 hours, laparotomy. This is a major procedure. Refer to gynaecologist or surgeon if possible. Do not postpone.

Septicaemia

- Antibiotics
- Consider adding: heparin 5,000 – 10,000 units i.v. six hourly for 10 days
- Refer to gynaecologist if possible

Abcesses

- Posterior colpotomy for abcesses in the pouch of Douglas*
- Laparotomy for abcesses elsewhere in the abdomen.
- Refer to gynaecologist if possible.

*The effect of a posterior colpotomy on the patient's feeling of well-being should be dramatic and manifest within one or two days. If the temperature remains high and she is still ill after two to three days, do a laparotomy to drain the remaining abdominal abcesses.

Chapter 54

SECONDARY POSTPARTUM HAEMORRHAGE

DEFINITION

Bleeding from the genital tract in excess of normal lochial loss after the first 24 hours postpartum and until the end of the puerperium.

CAUSES

- Retained products (membranes, placenta)
- Endometritis
- Sloughing of dead tissue (cervix, vagina, bladder, rectum) following obstructed labour
- Breakdown of the uterine wound after caesarean section or ruptured uterus

RISK

- Repeated attacks of (very) heavy bleeding
- maternal death, particularly if it happens far from hospital

MANAGEMENT

- Admit into hospital as an emergency
- Check the haemoglobin
- x-match a pint of blood
- Give ergometrine 0.5 mg i.m. or i.v.
- Put up an i.v. drip
- Add 10 – 40 units of pitocin per litre to the drip, if necessary
- Start broad spectrum antibiotics in high doses by injection. For example:
  - x-penicillin 2 mega i.v. 6 hourly + streptomycin 1 gm i.m. daily

    or
  - chloramphenicol 0.5 gm i.v. 6 hourly
- Do an examination under anaesthesia as soon as possible. *Do not postpone this*!
- Treat according to your findings:

Retained products or endometritis

- finger curettage
- avoid the use of a curette if possible; if it has to be used, it should be large and blunt.

Sloughing of dead tissues

- remove the slough
- pack the bleeding area tightly for 24 – 48 hours
- if packing does not not stop the bleeding, hysterectomy or ligation of the internal iliac arteries may be necessary.

Breakdown of the uterine wound after caesarean section or ruptured uterus

- do laparotomy
- resuture the wound or do hysterectomy

Chapter 55

COMPLICATIONS FOLLOWING OBSTRUCTED LABOUR

The main complications following obstructed labour are:
- puerperal sepsis [see Chapter 53]
- secondary post partum haemorrhage [see Chapter 54]
- urinary or rectal fistulae
- nerve injuries

URINARY FISTULAE

CAUSES

The common cause is pressure necrosis of bladder and/or urethra during delivery

Less common causes are:
- injury to bladder or urethra during:
  - caesarean section
  - the operation for ruptured uterus
  - symphysiotomy
- injury to the ureter during:
  - caesarean section
  - the operation for ruptured uterus

DIAGNOSIS

The diagnosis is usually obvious: the patient is continuously wet.
Confusion is possible with:
- severe stress incontinence, in which the urine flows from the urethra
- retention and overflow, in which the (over)full bladder is easily demonstrated

MANAGEMENT

- Continue open bladder drainage for about three weeks to promote healing of the vagina. This is easy if the fistula is small. With a large fistula it can be difficult to keep the catheter in the bladder. Try with a finger in the vagina to guide the catheter into the bladder and inflate the balloon enough to keep it there. If this does not work, remove the catheter and allow the urine to drain through the fistula
- Treat infection with antibiotics
- Prescribe sitbaths once or twice a day (vaginal douches are even better)

- Remove sloughs in theatre if necessary
- Discharge the patient home when all dead tissue has sloughed and the vagina is clean

After four months and *not earlier*, refer the patient to a gynaecologist for repair of the fistula.

Before referral check that:

- the patient's general condition is good
- the haemoglobin is 11 gm% or more
- the vagina and vulva are clean
- urinary tract infection and bilharzia have been treated

RECTAL FISTULAE

CAUSES

The most common cause is pressure necrosis during labour. A less common cause is the placing of sutures through the rectum by mistake during the repair of an episiotomy or perineal tear

MANAGEMENT

- Treat infection with antibiotics
- Clean the vagina with sitbaths or vaginal douches
- Remove sloughs if necessary
- Refer to gynaecologist for repair about four months after delivery

NERVE INJURIES

PRESENTATION

Common : – dropfoot on one or both sides

Less common : – weakness of the hip muscles
– weakness of the quadriceps muscle

CAUSES

The most probable cause is pressure during labour

DIAGNOSIS

- Look for signs of nerve injury in every patient who has had obstructed labour
- Check that she can move her toes, ankles, knees and hips in all directions

Nerve injuries are very easily missed if the patient is completely bed-ridden for a few weeks (due to puerperal sepsis for example). If they are missed, contractures develop very quickly.

MANAGEMENT

Principles

- Await spontaneous healing of the nerves. This usually does occur, but may take a long time (months)
- Prevent contractures from developing during the time the muscles are paralysed

In Practice

- Keep the weight of bed sheets and blankets off the legs by using a bed cradle
- Move the affected joints through their full range of movement a few times each day (encourage a relative to help with this)
- For a dropfoot a backslab during the night can be useful
- Encourage the patient to walk

B

8

Obstructed Labour

R. H. PHILPOTT

Definition

Failure of descent of the fetus in the birth canal for mechanical reasons in spite of good uterine contractions.

Incidence

This will be related to the incidence of cephalopelvic disproportion present in the community and to the availability and quality of antenatal and intrapartum care. Unfortunately disproportion is most prevalent in areas where health services are deficient as poverty is an underlying cause of both these factors. Where obstetric care is optimal, obstructed labour should never occur, even in communities where disproportion is prevalent. Because of the great improvement in obstetric care in developed countries very little has been written about obstructed labour in recent years and most of what follows represents the unpublished experience of a team working in an area of transition.

CAUSES

Cephalopelvic disproportion (CPD). This may be due to faults in the pelvis or to faults in the fetus, or a combination of both.

Faults in the pelvis: small or abnormal in shape.
Faults in the fetus:
- a large baby;
- a large defect, e.g., hydrocephaly, ascites or tumours of the fetus;
- fetal monsters;
- locked twins.

Malpresentations or malpositions of the fetus.
Breech presentation:
- impacted, large breech;
- extended arms;
- arrested aftercoming head due to either hydrocephaly, undilated cervix, deflexion of the head or CPD.

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Transverse lie
Brow presentation
Mentoposterior position
Occipitoposterior position.

Impacted shoulders following delivery of the head.

Tight perineum, particularly in the primigravida.

Abnormalities of the vagina: transverse or longitudinal congenital septa; scarring from the use of caustic traditional medications.

Abnormalities of the uterus: fibroids, congenital malformation.

Ovarian tumours.

COMPLICATIONS

These differ in the primigravid and the multigravid patient. The advanced complications are seen only when the patient has not received proper obstetric care.

The primigravid patient

Prior to obstruction, there is delay in the rate of dilatation of the cervix in the active phase of the first stage of labour to a rate less than 1 cm per hour. If oxytocin augmentation is used and the CPD is minimal, the rate of dilatation may increase, but if the CPD is gross the rate of dilatation may increase or it may not increase at all. Obstruction usually occurs before full cervical dilatation. If this is neglected, the sequence of events is as follows.

There will be excessive pressure on the placenta from prolonged uterine activity leading to fetal asphyxia, and compression of the head leading to cerebral birth trauma. The effects of the head compression are compounded when there is fetal asphyxia as the latter may cause a clotting defect. Avascular pressure necrosis will develop in a ring in the pelvis at the level of the obstruction. If this is severe and prolonged, the cervix, and even the lower segment, will slough and eventually a dead, compressed and moulded baby will be delivered. This might take two or three or more days. When the ring of pressure necrosis sloughs further this may leave a large vesicovaginal fistula involving the proximal half of the urethra and the bladder neck up to the ureteric orifices. About 15 per cent of those who develop a vesicovaginal fistula also develop a rectovaginal fistula at the level of the pressure ring. Healing of the ring of necrosis in the vagina leads to considerable contracture and often almost complete stenosis of the vagina.

Other complications include septicaemic shock, peritonitis with abscess formation and an atonic postpartum haemorrhage. A few days after the delivery some patients develop foot drop from sciatic nerve involvement. The mechanism of this is uncertain, though it is thought to be due to

compression of the sciatic nerve root or possible protrusion of a lumbar disc during prolonged bearing down. In some parts of the world untrained assistants apply excessive pressure to the abdomen, even to the extent of causing rupture of the liver.

It is difficult to comprehend the degree of psychological trauma that these patients suffer as a result of this terrible experience. Most are young teenagers and whether the pregnancy has been planned or not, it must leave an indelible emotional scar. Even if the resultant fistulae can be repaired, and this is only possible in about 80 per cent of cases, many will be permanently infertile and some will have so much scarring that further coitus is impossible. This will mean that, for the majority, there will be no chance of marriage, and in some cultures this will leave her an outcast and a recluse. For the few whose injuries are not so severe, and another pregnancy is possible, incipient tears in the uterine wall may lead to rupture in subsequent labours.

The multigravid patient

Prior to obstruction, progress in the rate of dilatation of the cervix may be normal and the only evidence of the impending obstruction may be the failure of the presenting part to descend in the birth canal. However, in many multigravid patients the abnormality in the cervical dilatation pattern is similar to that seen in the primigravid in that initial progress is good and then, during the active phase of the first stage, there is secondary arrest of dilatation. If left untreated this does eventually progress to full cervical dilatation.

After full cervical dilatation, if the obstruction is not relieved, the normal pattern of uterine action continues to excess. Retraction and thinning of the lower segment continues so that the junction ring between lower and upper segment rises progressively, often to the level of the umbilicus. It is then called the pathological retraction ring or Bandl's ring. The thin lower segment becomes ballooned out and the myometrium is oedematous and bruised. The bladder is also drawn up into the abdomen and with continuing pressure of the fetus against the pubis, the bladder wall becomes oedematous. The next event in neglected obstructed labour in the multigravid is rupture of the uterus. The rent starts in the thin lower segment and often extends laterally on one side down into the vagina and upwards into the fundus of the uterus. The fetal presenting part may remain jammed in the pelvis and so preventing severe haemorrhage from the torn uterine vessels, or the fetus may be expelled into the peritoneal cavity with severe haemorrhage both intraperitoneally and per vaginam. Sometimes the bladder will rupture also, particularly if it is adherent to the lower uterine segment following a previous caesarean section. Rupture of the uterus in obstructed labour carries with it a maternal mortality rate that varies from 10 to 25 per cent depending on the duration of the rupture and the facilities available for resuscitation and surgery.

From this description it will be seen that rupture of the uterus is extremely uncommon in obstructed labour in the primigravid patient and fistulae from pressure necrosis are seldom seen in the multigravid. Because obstructed

labour in the primigravid is virtually always preceded by delay in the rate of cervical dilatation, this latter feature acts as a reliable early warning signal. In the multigravid obstruction may occur without a preceding change in the normal pattern of cervical dilatation, and in those circumstances the problem is more difficult to detect and is then only recognized by the slow or arrested rate of descent of the presenting part, and increasing moulding if it is a cephalic presentation.

CLINICAL PRESENTATION

The primigravid

The patient is usually a young teenager who may even have become pregnant before her first menstrual period. The majority will have received no antenatal care, either because they were hiding an unplanned pregnancy or because of inadequate provision of obstetric services. There will be a history of a very prolonged labour at home, often extending to days rather than hours.

On general examination the patient will be tired, exhausted and anxious. She will be dehydrated and acidotic, pyrexial with a tachycardia but not shocked (unless there is septicaemia). On examination of the abdomen there is often evidence of distended, atonic bowel due to hypokalaemia. Uterine contractions will either be hypotonic or they will be strong and painful with poor relaxation between contractions. In advanced cases of obstruction the uterus may be distended with gas and be tympanitic to percussion. The cause of the obstruction may be apparent, for example a high fetal head overlapping the pelvic brim or a transverse lie. The liquor will have drained away and the uterus will be moulded around the fetus. The fetal heart will give evidence of fetal distress with a tachycardia and decelerations that start early in the contraction and are delayed in their return to the baseline until well after the contraction is over. In more advanced cases the fetus will be dead. The bladder is often distended with retained urine, or thick and oedematous from compression and containing surprisingly little or no urine. Catheterization may be very difficult and it may be necessary gently to dislodge the presenting part with two fingers in the vagina while passing the catheter. Because the bladder is drawn up, the catheter may have to be passed a long distance to reach the bladder. The urine is often blood stained.

On vaginal examination, if there has been prolonged and even premature bearing down, vulva and cervix may be very oedematous. The vagina is dry and the cervix not yet fully dilated unless it has already sloughed. The liquor is meconium stained and often foul-smelling from intrauterine infection. There will be evidence of the obstruction, for example a high head with excessive moulding and caput.

The multigravid

The clinical picture varies according to whether the patient is seen prior to or after uterine rupture.

Prior to uterine rupture. The general findings will be the same as for the primigravid. On examining the abdomen there is often the 'three tumour abdomen' with an oedematous, enlarged bladder, a distended, tender lower uterine segment, a Bandl's ring near the level of the umbilicus and a tonically contracted upper uterine segment above the ring. The round ligaments can be palpated and feel like attenuated guy ropes on either side of the ballooned lower segment. The bowel is distended. The fetus may be difficult to palpate because the liquor has drained away and the uterus is tonically contracted, but it should be possible to detect the cause and evidence of the obstruction. On vaginal examination, the cervix is usually fully dilated and the presenting part high.

After uterine rupture. Here again there are two different clinical pictures. In the one, though rupture has occurred, the presenting part is so impacted that it has produced a tamponade effect on the torn uterine vessels and there is therefore no haemorrhage or hypovolaemic shock. This clinical picture is similar to that prior to uterine rupture. The other picture is more dramatic with all the features of profound shock, often both hypovolaemic and septicaemic.

The patient with an evident rupture of the uterus will often give a strange story of feeling that the baby was moving up rather than down with each contraction, a sensation that they recognize prior to the rupture. After the rupture, the contractions may no longer be felt but they are replaced by continuous very severe abdominal pain with the patient hardly able to move. There may be a history of vaginal bleeding. She will appear extremely anxious and distressed with dehydration and shock. The pulse and blood pressure may be absent and the central venous pressure low. Sometimes the patient is moribund or dead on admission to hospital.

The abdomen will be grossly distended and the uterus difficult to feel. Though the fetal parts may be easily palpable outside the uterus often the degree of peritonitis and tenderness is such that palpation is extremely difficult. It may be possible to elicit shifting dullness but, again, the degree of pain and tenderness is so great that it is difficult to move the patient. Abdominal aspiration with a syringe and needle in the flank may demonstrate blood in the peritoneal cavity, but the diagnosis is usually so obvious that this is not necessary. The fetus will be dead.

On vaginal examination the presenting part may be jammed in the pelvis, or it may have receded above the pelvic brim. Catheterization may produce heavily blood-stained urine, particularly if the bladder is also ruptured.

MANAGEMENT

Prevention

Obstructed labour should never occur if patients receive optimal antenatal and intrapartum care and the requirements of such care are not sophisticated, elaborate or expensive. The type of care to be provided will need to be

tailored to the immediate resources of the community. Where feasible, the ideal is hospital care for all, but in the very communities where obstructed labour is prevalent this is not possible at present. The next best alternative is a system of well-supervised, midwife-run satellite clinics within easy reach of all women, and groups of these clinics related to a base hospital. This relationship must include detailed protocols of management with well-defined indications for transfer, ready communication with the base hospital and adequate transport for referrals. Even these provisions are outside the minimum facilities available to millions of women in the developing world, but they must be strived for, as without them the casualties of obstructed labour will continue to be high. In many parts of the world the traditional birth attendant cares for women in their homes, and has the respect of the whole community. These attendants must also be provided with basic training in antenatal care and intrapartum management, and be recognized as an integral part of the maternity services of the country.

Where distances are great and the population is scattered it may not be possible to ensure that all patients can get to a clinic or a hospital in time for a supervised labour. In these circumstances the provision of a simple 'Mothers Waiting Area (MWA)' near to each clinic and hospital will ensure that patients receive complete intrapartum supervision from early in labour. The MWA should consist of simple housing similar to that in the patient's village, and the patient, who arrives at the MWA in late pregnancy, is cared for by a relative. At a hospital in eastern Nigeria, Ross (1970, personal communication), reported a perinatal mortality of 70 and maternal mortality of 7 among 109 emergency admissions for severe CPD whereas in 134 similar patients admitted to their MWA the figures were 6 and zero respectively for 134 CPD admissions.

In the antenatal care of the individual patient the past obstetric history of difficult deliveries in the multigravid must alert the midwife to the high risk category of the present pregnancy. Patients short in stature need to be watched carefully, and in peripheral clinics midwives need to be trained to do pelvic assessments at 36 weeks of pregnancy. During labour, the use of simple partograms with guidelines to help in the recognition of slow dilatation of the cervix are of great value in predicting and detecting mechanical problems in labour. Each labour needs to be conducted with the same meticulous care and accuracy of clinical observations as in a trial of labour, and for that matter each patient should be regarded as having potential CPD until delivery is complete.

Because many of these patients are very young primigravidas, often only 12 to 14 years of age, more attention needs to be given to home and community education in an endeavour to avoid these very early teenage pregnancies.

Resuscitation

If the patient is first seen at a peripheral clinic, immediate transfer needs to be arranged by the quickest means available. Depending on the facilities available, and it is recognized that these may be severely limited, the

patient's prognosis can be improved by giving first-aid treatment before and during transfer. If it is possible to communicate with the referral hospital to warn that the patient is on her way, this helps to prepare for her arrival. Accurate information, preferably on a labour graph if the patient has been labouring in the clinic, should accompany the patient. Many clinics are able to set up an intravenous infusion of an electrolyte solution and give a parenteral broad-spectrum antibiotic before the patient leaves the clinic.

On arrival in hospital, resuscitation needs to be fairly rapid as operative delivery is usually very urgent. If an expert anaesthetist is available to help in the resuscitation this is a great advantage. Again it is recognized that the quality of resuscitation depends not only on the duration of the obstruction, but also on the facilities and resources available. Where these are limited it is probably best to concentrate them in referral hospitals and leave the peripheral clinics to cater for the normal deliveries. If, as is usual, urgent operative delivery is indicated, it is a good idea to admit the patient straight to the operating theatre area and carry out the resuscitative measures in the theatre. This avoids moving the patient again and permits operation just as soon as the patient is in optimal condition.

The first step is to set up an intravenous infusion and to correct dehydration, electrolyte deficit and acidosis. If it is possible to measure the serum electrolytes and blood gases this is valuable, but usually delivery needs to be attended to before these results become available. For this reason it is advisable to give a Plasmolyte solution that contains sodium bicarbonate or to give sodium bicarbonate separately.

If there is evidence of shock, this may be either hypovolaemic or septicaemic shock or both together. It is then mandatory to set up a simple central venous pressure (CVP) manometer and regulate further fluid replacement according to the CVP measurements. It is best to maintain a CVP reading of between 5 and 8 cm of water. If the CVP is within this range or higher and the blood pressure is still low, it is presumed that part of the problem is septicaemic shock. The blood pressure, pulse, CVP and urinary output must be recorded frequently throughout management.

If there is hypovolaemic shock this should be corrected by blood transfusion as soon as this is available, but in the meantime electrolyte solutions may be used. Fresh whole blood is ideal but packed red cells plus fresh dried plasma may be more readily available. If there is a concomitant anaemia this should be attended to at the same time. If there is septicaemic shock, use steroids and broad-spectrum antibiotics in the first instance. Different hospitals favour different antibiotic regimens dependent on the type and sensitivity of organisms prevalent locally. We use parenteral Ampicillin, Kanamycin and Metronidazole. If this does not correct the hypovolaemic shock and the blood pressure is still low with poor urinary output and constricted peripheral vessels, the best treatment is a titrated infusion of dopamine. This will result in peripheral vasodilatation and a drop in the CVP, which must be corrected immediately by more intravenous fluids. In diseases of obstructed labour, infection must be assumed and the possibility of septicaemic shock predicted and therefore the same regimen of antibiotics as outlined above should be commenced prophylactically.

With the urgency of resuscitation and operative treatment we often fail to communicate with the very distressed patient. Recognizing the magnitude of suffering they have already experienced (and their probable fear of institutional treatment), it is important to give some time to allaying their fears and giving them reassurance.

Anaesthesia

Where an anaesthetist who is expert in handling this type of clinical problem is available, the decision on the best method of anaesthesia can be left in his hands. Unfortunately, as with the skills of resuscitation, it is in those parts of the world where obstructed labours are most common that expertise in anaesthesia is least available. The expert anaesthetist will probably choose a general anaesthetic with endotracheal intubation as the method of choice for abdominal operations. If that expertise is not available, then the safest technique for the single-handed surgeon is local infiltration with a local anaesthetic. If there is no shock present or expected, the single-handed surgeon will find it easier to operate with (and this is more comfortable for the patient) a spinal 'saddle-block' or an epidural block. These can be supplemented with local infiltration to the upper part of the abdominal incision. Each of these techniques is best learnt by observing an expert.

If the delivery is to be by the vaginal route then a pudendal block, saddle-block or epidural block will be most suitable.

Of very great importance is the avoidance of inhalation of acid gastric contents before, during or after the anaesthetic. If this occurs, as it well might if strict care is not taken, it can prove lethal. A stomach tube should be passed to the empty stomach. The counsel of perfection is to give a non-particulate oral antacid within an hour of surgery, followed by Cimetidine, Metaclopramide and Glycopyrrolate. This combination of drugs reduces the acidity of gastric juice, empties the stomach downwards and reduces the production of gastric acid. These drugs are expensive and may not be readily available, though the high maternal mortality rate from acid gastric aspiration merits their use. If they are not available Mist. Magnesium Trisilicate orally and Atropine intramuscularly should be used.

It is important to continue frequent (every five minute) checks of pulse, blood pressure, CVP and urinary output measurements throughout the operation and then to provide intensive care observations in the postoperative period.

Operative Delivery

The mother's life will often depend on the obstetrician making the correct choice of operative procedure. The various procedures will be discussed first, and then the management of the different causes of obstructed labour will be considered.

Episiotomy

In primigravid patients who have received no intrapartum care, sometimes

all that is needed is a wide episiotomy. These patients are often found to have an occipitoposterior position of the vertex. Putting the patient in the lithotomy position may further facilitate delivery.

Ventouse and forceps delivery

In those patients in whom there is definite CPD the use of the forceps or the ventouse is absolutely contraindicated. This is the case, in vertex presentations, when there is marked moulding and more than one-fifth of the head is palpable above the brim of the pelvis. On the other hand, labour may be obstructed due to an occipitotransverse or occipitoposterior position without CPD with the head no more than one-fifth above the pelvic brim. Then an assisted vaginal delivery is indicated.

It must be emphasized that there should never be a difficult operative delivery, and where there is already fetal asphyxia the assisted delivery should be no more than a 'lift out'. The accurate assessment of head level by abdominal palpation and the degree of moulding as assessed by vaginal examination are crucial in making these decisions.

If the head is no more than one-fifth above the brim and the fetus is alive, the decision has to be made whether to use the ventouse or the forceps. Personal preference and experience with the instrument are determining factors. When there is not much moulding or caput, either instrument is suitable, and possibly the ventouse is preferable as it is easier to use. When the moulding and especially the caput are more evident, the fit of the head in the pelvis is that much tighter and more traction will be required. It is then that the forceps are to be preferred. If the head is not in the occipitoanterior position, a Kielland's rotation is to be preferred to a manual rotation, as the latter might displace the head upwards.

If the ventouse is chosen, then the 'rule of the three pulls' must be adhered to. The first pull must dislodge the head from its arrested position, the second pull must bring the head to the pelvic floor and the third pull deliver or at least crown the head. If any one of these three pulls does not achieve its purpose then further traction must be desisted and an alternative method of delivery carried out. If the baby is alive this will be either a symphysiotomy or a caesarean section. If the baby is dead, a craniotomy. It is always best to have predicted the difficult delivery and to have chosen the symphysiotomy or caesarean section in the first instance. If there is fetal asphyxia present this is doubly imperative.

Symphysiotomy

This is an operation that needs to be reinstated and given its place in the range of operative delivery procedures. It has fallen into a degree of disrepute mainly because there was a time when it was used to overcome gross disproportion and this led to major complications. It is not used at all in parts of the world where CPD is almost non-existent. This is a problem for it is in these countries that the textbooks are written and the trends are set. In countries where CPD is prevalent, symphysiotomy is an excellent procedure

in labours where the degree of CPD is borderline. Caesarean section must still be employed where the CPD is marked. The skill is to recognize the difference.

This operation has its best place at a strategic moment in a well-planned trial of labour, when borderline CPD is evident and before fetal hypoxaemia occurs. In well-chosen cases it can be shown to be preferable to a caesarean section and avoids the difficult or traumatic operative vaginal delivery. In neglected, obstructed labour it also has a place, for it will avoid the complications of a major abdominal operation in a high-risk patient. However, in such patients the exact place of symphysiotomy needs to be carefully defined.

It is only indicated when the baby is alive, in a cephalic presentation with the head not less than one-fifth and not more than two-fifths above the brim, with moulding of the fetal head. This represents borderline disproportion. When none of the head is felt above the brim, the ventouse or forceps can be used and when more than two-fifths of the head are felt above the brim the complications of symphysiotomy become unacceptable and caesarean section is to be preferred. The fetus should not be under 2.5 kg or over 4 kg in weight.

If the fetus is under 2.5 kg, the degree of pelvic contracture must be so great that it is almost certain that, with a normal-sized baby in the next pregnancy, a caesarean section will be required. This outweighs one of the major benefits of symphysiotomy, that it provides permanent enlargement of the pelvis and allows for normal vaginal deliveries in subsequent pregnancies. If the fetus is over 4 kg in weight the amount of symphyseal distraction may be so great as to produce an unstable pelvis and a strong likelihood of urinary stress incontinence.

There must be no evidence of rupture or impending rupture of the uterus and though the operation is most commonly performed in the primigravid patient, it can be done in a multigravid. It is usually done at full cervical dilatation but is sometimes done at 8 or 9 cm dilatation when fetal distress makes delivery urgent. Some obstetricians do symphysiotomy much earlier in labour to reduce the amount of head compression in late labour, but this practice does lead to a number of unnecessary symphysiotomies.

The operation is also indicated for unexpected CPD with the aftercoming head in breech presentation with a live baby. In such cases the decision must be made very quickly and the operation performed immediately, otherwise the baby will die of asphyxia or intracranial birth trauma.

Caesarean section

The patient in obstructed labour is a very serious operative risk and the operation should not be embarked upon lightly. The surgeon should be experienced in this kind of problem as the price of inexperience can be death for the patient. Though the operation needs to be proceeded with urgently, adequate time must be spent in thorough resuscitation of the patient as outlined earlier. The anaesthetic hazards are also considerable and require experience if these are to be avoided.

Dependent on the patient's circumstances and the facilities available, some surgeons will be liberal with caesarean section even when the baby is dead; others will try to avoid caesarean section whenever possible. If it is not possible to ensure that the patient will have good antenatal and intrapartum care in a subsequent pregnancy, and if the facilities for a safe caesarean section in this admission are not good then a section will be avoided if there is any alternative. The decision is a critical one (Lawson, 1972).

While preparing for the caesarean section continuing uterine activity can be reduced by giving tocolytic β-stimulant drugs by intravenous infusion. The anaesthetist needs to be aware that these can lower maternal blood pressure.

Caesarean section is indicated in obstructed labour when the fetus is alive and symphysiotomy is not suitable; if the cervix is not yet fully dilated and delivery is urgent for maternal reasons, whether the baby is alive or dead; if there is evidence of imminent uterine rupture, even if the fetus is dead. In the latter circumstance it is feasible to open the abdomen and if the lower segment is found to be intact, to proceed to a destructive operation from below. This saves the extreme hazard of a destructive operation with a uterus that might rupture, and at the same time avoids a caesarean section for a dead baby in the presence of intrauterine infection.

The alternative types of caesarean section for obstructed labour

Extraperitoneal caesarean section. This is indicated when there is established or potential intrauterine infection in cephalic presentations, and has been the means of reducing the incidence of severe postoperative peritonitis in such patients. The technique used is that described by Crichton (1973). The abdominal wall can be opened longitudinally or transversely, but the parietal peritoneum is opened transversely. When the visceral peritoneum has been opened and the bladder reflected downwards, the upper flap of the visceral peritoneum is sutured to the upper flap of the parietal peritoneum and the lower flap of the visceral to the lower flap of the parietal peritoneum. This artificially excludes the lower segment from the peritoneal cavity by rendering it extraperitoneal. After delivering the baby and placenta and suturing the lower segment, the peritoneum over the uterine wound is left as was and a drain placed over the wound.

De Lee incision. This is a low longitudinal uterine incision. It is indicated when the lower segment is thin and distended and there is danger of lateral tears when extracting the fetus. It is done in cephalic presentations, but very particularly in transverse lie with a prolapsed arm and a live baby. It is also the incision of choice when there is an uncorrectable (with, for example, amyl nitrite) constriction ring. This incision is made by opening the visceral peritoneum transversely and reflecting the upper flap as high as possible and the lower flap as low as necessary. To gain adequate access, though two-thirds of the incision will be in the lower segment, one-third will extend into the upper uterine segment.

Lower segment, transverse incision. Normally when performing a caesarean

section this is the incision of choice, and it will be so in most cases of obstructed labour. However, it is dangerous and should not be done if there is intrauterine infection (then an extra peritoneal incision is indicated) or lateral extension tears are likely to result (then a de Lee incision is indicated). The dangers of lateral tears cannot be overemphasized. Apart from compromising the blood supply to bruised and infected myometrium, the attempts to secure haemostasis can endanger the ureter if great care is not taken. In obstructed labour the distorted presenting part may be difficult to extract through a lower segment incision. Not only will a tear be dangerous, but the alternative of doing an inverted-T incision to deliver the baby is also hazardous, for it does not heal well. For all these reasons it is critical to make a careful assessment before making the incision in the uterus, and only doing a standard transverse incision if this is safe. Because the final decision is not made until the abdomen is opened and the uterus is inspected, it is best in these circumstances to open the abdomen through a midline subumbilical longitudinal incision rather than the more usual transverse incision. The peritoneal cavity should be entered high up in the longitudinal incision to avoid injury to the bladder which is often much higher than expected. When deflecting the bladder downwards, after opening the vesical peritoneum, great care must be taken as it is often oedematous and fragile.

If it is decided to do a transverse lower segment uterine incision, there are important steps that must be taken to avoid lateral tears if the head is jammed in the pelvis. Once the abdomen is open and the visceral peritoneum incised, an assistant should slowly and carefully disimpact the fetal head per vaginam, before the uterus is opened. If this is delayed until after incising the uterus, the fetal shoulder will prolapse into the wound making further delivery very difficult. The uterus should be opened with scissors to ensure the exact directions of the opening. The surgeon should then guide the delivery of the fetal head with a hand *outside* the lower flap of the lower segment. Once the head has been disimpacted to the level of the incision it is preferable to deliver the head with Wrigley's forceps with the sagittal suture in line with the uterine incision and a degree of anterior asynclitism. If, when the forceps are applied, it is recognized that the incision will not be long enough to deliver the head without a lateral tear, the lateral ends of the incision should be cut with scissors upwards so that the whole incision now forms a broad U-flap.

If an extensive lateral tear does occur, and there is much haemorrhage, it is wise to open the broad ligament by cutting the round ligament and so making it easy to palpate the ureter before applying any clamps. The extent of the tear can be found by applying Green-Armytage forceps to the edges of the wound and drawing the angle into clearer vision. Bleeding can always be controlled in the first instance by direct pressure with a dry pack and then the vessels can be located and tied. Sometimes complete control of the haemorrhage is obtained only by tying off the internal iliac artery on that side.

Caesarean hysterectomy

When the lower segment is severely bruised, major uterine vessels have

been torn and there is potential or established intrauterine infection, and the patient is not planning further pregnancies, caesarean hysterectomy is the procedure of choice.

Destructive operations

These are unpleasant to perform but are the procedures of choice in obstructed labour when the fetus is dead and the cervix is fully dilated. They are an alternative to an unnecessary and hazardous caesarean section or a vaginal delivery that would otherwise cause severe maternal trauma. They are contraindicated where the uterus is ruptured or where rupture is imminent. Thus, if there has been vaginal bleeding or the lower segment is ballooned and tender, a laparotomy is essential. If this confirms dangerous thinning of the lower segment, caesarean section is safest, though hazardous in itself. If there has not been excessive thinning and bruising of the lower segment, the vaginal destructive operation may be proceeded with and the abdomen closed without opening the uterus. It is always imperative to explore the uterine cavity, the cervix and the vagina for rupture or lacerations after performing any destructive operation. If there has been prolonged pressure of the presenting part on pelvic structures, there is danger of fistula formation and a self-retaining catheter should be left in the bladder to keep the bladder empty and at rest for 14 days. Because the uterus is liable to be atonic in the third stage of labour, a postpartum haemorrhage must be avoided by giving ergometrine intravenously with the delivery of the baby and then immediately to commence an infusion of 1 l of Dextrose in saline containing 40 u of oxytocin.

For a description of the indications and method of performing the various destructive operations see the chapter 'Delivery of the Dead or Malformed Fetus' by Lawson, in this issue.

Rupture of the Uterus

Rupture of the unscarred uterus is the end result of obstructed labour in the multigravid patient. The aetiology, diagnosis and principles of preliminary management are referred to under that heading.

Many authors (Lawson, 1967; Groen, 1974) advise the simplest and quickest operation possible in these seriously ill patients. They recommend an abdominal repair of the rupture in most instances. For many years now we have found that, in most cases, total abdominal hysterectomy gives much better results (Mokgokong and Marivate, 1976; Skelly, Duthie and Philpott, 1976). Usually, there is severe infection present from the prolonged rupture of the membranes, the uterine muscle is bruised and oedematous and the rupture has torn one or both uterine arteries, leaving the muscle without a good blood supply. When this type of rupture is repaired, the healing is poor and postoperative infection is common. If a repair is done, it is almost always necessary to do a tubal ligation as subsequent pregnancy would be a great risk. For these reasons we have preferred total hysterectomy which can be done about as quickly as a repair. Only when the tear mimics a transverse

lower segment caesarean section incision and the patient is anxious for more children do we consider a repair. If the surgeon is not experienced at hysterectomy, repair may for him be the better option.

The basic steps of the operation are similar to a standard abdominal hysterectomy, but a few points are worthy of emphasis. When the fetus and placenta have been removed, the first step is to control the haemorrhage. The direct pressure of a dry pack will stop the bleeding in the first instance. Green-Armytage forceps are applied to the edges of the rupture until the lowermost angle is found. The bladder is reflected downwards and once the broad ligament is opened, the ureter is felt all the way to its entrance into the bladder. Only then can the pack be slowly removed and bleeding vessels clamped. With the uterus open it is easy to see the level of the cervix and a total hysterectomy is nearly always possible. There is often an extensive haematoma tracking up from the torn uterine vessels on one side, between the layers of the broad ligaments, and often upwards towards the kidney. This must be evacuated and torn vessels ligated.

We used to pack the raw pelvic floor extraperitoneally at the end of the operation, but in recent years have found that this is seldom necessary. We leave an abdominal drain in that area to give early warning of secondary haemorrhage. Continuous bladder drainage is necessary if there has been prolonged pressure on the bladder or if there is haematuria at the end of the operation.

MANAGEMENT OF INDIVIDUAL CAUSES OF OBSTRUCTED LABOUR

This is presented in abbreviated note form to clarify the best method of management in the various conditions causing obstructed labour.

Cephalic presentations

Vertex. If the cervix is not fully dilated, caesarean section should be performed. If the cervix is fully dilated and rupture imminent, caesarean section should be performed, but if rupture is not imminent then management depends on the level of the head, the degree of moulding and evidence of fetal distress:

0/5 above and minimal moulding – episiotomy and ventouse or forceps;
1/5 above and marked moulding – forceps;
1/5 above with marked moulding and fetal distress – symphysiotomy (or caesarean section);
1/5, 2/5 or 3/5 above with dead baby – craniotomy;
4/5 above with dead baby – may need caesarean section;
2/5 above with moulding and baby alive – symphysiotomy (or caesarean section);
3/5 above with moulding and live baby – caesarean section.

Brow. Caesarean section should be carried out.

Mentoposterior. If the cervix is fully dilated, the baby alive, no CPD, no imminent rupture – Kielland's forceps rotation and delivery. If CPD – caesarean section. If baby is dead and cervix fully dilated – craniotomy.

Aftercoming head of the breech

If the fetus is dead, craniotomy should be performed by perforating the head through the occiput. If the fetus is alive, management must be immediate and depends on the cause. If it is a hydrocephalic head, perforate and drain the CSF. If it is an undilated cervix trapping the head, lift up the body by the feet and cut the cervix right-posteriorly (at eight o'clock) and left-posteriorly (at four o'clock), and then deliver the head with Wrigley's forceps. If the head is deflexed deliver by the Mauriceau-Smellie-Veit manoeuvre. If this fails, there is CPD and if the fetus is still alive the only management is an immediate symphysiotomy.

Transverse lie

If the baby is alive, caesarean section should be performed. If the membranes are intact or recently ruptured this should be a lower segment caesarean section, but if the arm is prolapsed it should be a de Lee incision.

If the baby is dead and the cervix fully dilated with no imminent rupture, do a decapitation. If rupture is imminent or the cervix is not fully dilated, do a caesarean section. This should be a lower segment, transverse incision. If necessary the baby can be dismembered to remove it through the transverse incision.

There is no place for internal version and breech extraction in obstructed labour with a transverse lie. Rupture of the uterus is almost inevitable if this rule is broken.

Congenital septum of the vagina

If this is the cause of an obstructed labour it is seldom feasible to incise the septum and deliver the baby vaginally. The septum is usually too thick and a caesarean section is necessary. The septum can be excised in the non-pregnant state.

Ovarian tumour or uterine fibroid

If a tumour is obstructing labour a caesarean section will be necessary. If this is an ovarian tumour, it can be removed at the completion of the caesarean section. If it is a uterine fibroid it is best to leave it alone and deal with it as an interval procedure.

Follow-up advice

If there is the possibility of a future pregnancy, it is important to ensure that,

if this obstructed labour has been due to neglected obstetric care, the opportunity is taken to plan for thorough care in the next pregnancy. This entails contraceptive advice to help plan the timing of the next pregnancy and good antenatal and intrapartum care in that pregnancy. It is probable that an elective caesarean section will be needed next time.

REFERENCES

Crichton, D. (1973) A simple technique of extraperitoneal lower segment caesarean section. *South African Medical Journal*, **47**, 2011–2012.

Groen, G. P. (1974) Uterine rupture in Nigeria. *Obstetrics and Gynecology*, **44**, 682–687.

Lawson, J. B. (1967) Rupture of the uterus. In *Obstetrics and Gynaecology in the Tropics and Developing Countries* (Ed.) Lawson, J. B. & Stewart, D. B. p. 189. London: E. Arnold.

Lawson, J. B. (1972) The place of caesarean section in developing countries. *Tropical Doctor*, **2**, 30–32.

Lawson, J. B. (1974) Embryotomy for obstructed labour. *Tropical Doctor*, **4**, 188–191.

Lister, U. (1960) Obstructed labour. *Journal of Obstetrics and Gynaecology of the British Commonwealth*, **67**, 188–198.

Mokgokong, E. T. & Marivate, M. (1976) Treatment of the ruptured uterus. *South African Medical Journal*, **50**, 1621–1624.

Seedat, E. K. & Crichton, D. (1962) Symphysiotomy: technique, indications and limitations. *Lancet*, **i**, 544–558.

Skelly, H. R., Duthie, A. M. & Philpott, R. H. (1976) Rupture of the uterus. *South African Medical Journal*, **50**, 505–509.

Obstetric Care

Symphysiotomy

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"The main barriers against symphysiotomy remain in the minds of obstetricians," says A. D. H. Browne (1968), and this operation has had a "most chequered history" (Moir 1964). Its performance dates back to 1777 when, on the night of September 30, Sigault undertook it to ensure the safe delivery of Madame Souchet, a rachitic Parisienne. There had been four previous stillbirths delivered by destructive operations. That it is in fact older than this is suggested by both Bowesman (1960) and Pereira (1964) who have produced evidence of its being undertaken for many years by tribal practitioners in unsophisticated areas in Africa.

The purpose of symphysiotomy is to divide one side of a disproportionately small and irregular cylinder, the maternal pelvis, to permit the easier passage of a global object, the fetal head, thereby securing spontaneous or gently assisted delivery. If this is undertaken skilfully and with proper indication, there should be no harm to the fetus but a permanent change will occur in the maternal skeletal system. This alteration does not necessarily cause disablement but may prove beneficial in future pregnancies. Done badly, or with improper indication, the trauma which can be inflicted upon the maternal hard and soft tissues may be great and severe morbidity may follow.

It is the purpose of this article to describe the indications for symphysiotomy, the conditions which must be present before it is done, and the dangers and difficulties which may be encountered with particular reference to how they may be avoided.

Most symphysiotomies are undertaken for cephalopelvic disproportion with the vertex presenting and a live fetus. Furthermore they are performed either late in the first stage of labour or in the second stage. As such it is an alternative to either Caesarean section or to a difficult and often traumatic operative vaginal delivery. To begin with, therefore, the operation will be described in this context and reference will be made later to less common circumstances in which symphysiotomy may be useful.

INDICATIONS

When a contracted pelvis is diagnosed during the antenatal period, the obstetric practitioner is forewarned of possible cephalopelvic disproportion. Provided there are no contraindications such as a previous bad obstetric history, a previous Caesarean section, or significant maternal disease, a trial of labour is the rule. The progress of the subsequent labour will determine whether the initial surmise was correct or not. At any time during labour, the trial may have to be terminated by artificial means for one or more of several reasons. These will include fetal distress, failure to progress, and prolonged labour. If there has been no antenatal supervision the woman may be admitted as an emergency at any time during labour and the assessment will of necessity have to be made more rapidly. Along with such decision, the most appropriate method of operation should be chosen. The choice lies among Caesarean section, operative vaginal delivery by forceps or vacuum extraction, and symphysiotomy. Whichever method is decided upon will depend upon three related factors, the station or descent of the fetal head, the degree of overlap, and the dilatation of the cervix.

Station or descent of fetal head

It is current practice to describe fetal head descent or station as the relationship of the level of the presenting part to the maternal ischial spines. In cephalopelvic disproportion this is dangerous as caput formation and fetal head moulding falsify the extent of fetal head descent. It is better to use the classification originally suggested by Crichton and recently illustrated by Simons and Philpott (1973) of dividing the fetal head into fifths and describing descent as the number of fifths of the fetal head which have passed into the brim of the maternal pelvis. Better still for present purposes is to divide the fetal head into three equal portions or thirds and relate these to the brim of the maternal pelvis.

Thus, less than one third, between one third and two thirds, or over two thirds of the fetal head may be described as having entered the pelvic brim.

No symphysiotomy should be undertaken unless more than one third of the fetal head has entered the pelvic brim. If this has been the maximal descent of the fetal head which has been possible either labour has not progressed far enough or the cephalopelvic disproportion is severe.

Symphysiotomy may be indicated when one third or more of the fetal head has entered the pelvic brim, provided other circumstances are favourable.

Overlap

During descent of the fetal head the anterior parietal eminence passes underneath the pubic symphysis. If disproportion is present, fetal head moulding will be necessary before this can happen. Progress with regard to this is easily determined when, with the bladder empty, the flat of a hand is placed along the anterior surface of the symphysis pubis and the lower abdominal wall. Either the parietal eminence will not be felt (no overlap), or it will be flush with the anterior aspect of the pubic symphysis (first degree overlap), or it will be felt jutting out in front of the pubic symphysis (second degree overlap).

It is unwise to attempt symphysiotomy if there is second degree overlap.

Symphysiotomy may be indicated when more than one third of the fetal head has entered the pelvic brim and there is less than second degree overlap, provided other circumstances are favourable.

Dilatation of the cervix

After division of the pubic symphysis, it is essential to deliver the baby within a reasonable period of time. Accordingly, labour should have progressed to either late first stage or into the second stage. Very often when there is cephalopelvic disproportion, labour will initially progress satisfactorily until the dilatating cervix becomes compressed between the fetal head and the pelvic brim. Stasis will occur within the cervix and further dilatation will not take place. Instead, the cervix will become oedematous. Relief of the disproportion is invariably followed by rapid cervical dilatation. It is safe to consider symphysiotomy when the cervix is more than 5 cm dilated in a multiparous patient or 7 cm dilated in a primigravida.

Symphysiotomy may be indicated when more than one third of the fetal head has entered the pelvic brim, when there is less than second degree overlap, and when the cervix is more than 5 cm dilated in a multipara or more than 7 cm dilated in a primigravida.

Failed vacuum extraction

There remains one further indication for symphysiotomy. When vacuum extraction has been attempted in seemingly favourable circumstances and delivery has failed after 15 minutes' skilful traction, a symphysiotomy may be performed. This is the origin of "trial of vacuum extraction". Too many such trials are not recommended. When the head is relatively high, the second stage not yet reached, and when a clinical diagnosis of disproportion is made, it is best to undertake symphysiotomy before wasted attempts at operative vaginal delivery are made.

If the situation has been well chosen, division of the symphysis pubis will be followed by rapid progress in labour and spontaneous delivery. If delivery is delayed, the vacuum extractor should be applied to assist. Forceps should not be used as the soft tissues under the symphysis are by now completely unprotected.

THE OPERATION

The description of the operation which follows is essentially the one first suggested by Seedat and Crichton (1962). A closed technique is preferable to an open surgical procedure as it may be done rapidly and without general anaesthesia. Good results have also been obtained by following the principles of Zarate (1955) but this particular technique appears to be more complicated.

(a) Position of the patient

Throughout the operation the patient's thighs should be held at an angle of no greater than 90 degrees (Fig. 1). If assistants are present, one should hold each leg. With no assistance, the lithotomy position should be used and a bandage tied between the patient's knees to prevent over-abduction of the thighs. This position, which should be maintained throughout the operation, is necessary to prevent over-separation of the symphysial joint. If the joint is widely separated there will be an associated strain or even subluxation of the sacroiliac joints.

(b) Catheterization

A catheter should be passed and the bladder emptied (Fig. 1). To do this, the head may need to be displaced upwards if the disproportion is significant. A firm catheter should be used as there may be difficulty in inserting a soft rubber one. Haematuria, if present, should be noted.

(c) Local anaesthesia

The skin and tissues in front of, above, and below the pubic symphysis should be liberally infiltrated with local anaesthesia. Ten to 15 ml of a 1% solution of procaine or lignocaine are usually sufficient. Particular attention should be made to the area just below the pubic symphysis where there is a large concentration of sensory nerve endings (Fig. 1). The perineum should also be anaesthetized in preparation for an episiotomy. A full pudendal block is not necessary as forceps delivery is not contemplated.

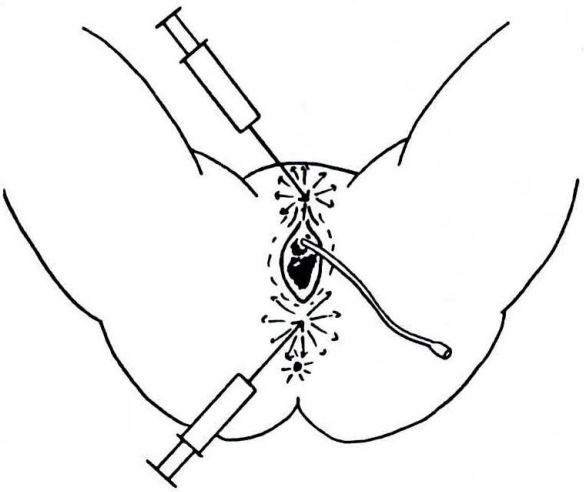

Fig. 1. The patient's legs are held at an angle of abduction of less than 90°; a catheter is inserted; local anaesthesia is inserted over the pubic symphysis and into the perineum.

(d) Displacement of urethra

The index finger of the left hand is inserted into the vagina between the fetal head and the posterior aspect of the pubic symphysis (Fig. 2). To do this the fetal head may again need to be displaced upwards. While inserting this finger, the catheter and with it the urethra are displaced to one side of the midline.

The catheter and the finger will remain in position until the operation has been completed.

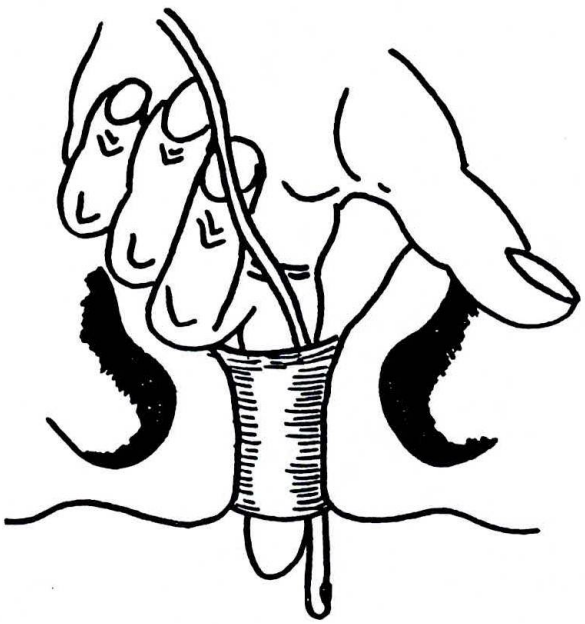

Fig. 2. The index finger of the left hand, inserted behind the symphysis pubis, displaces the ureter to one side.

(e) The incision and division of the symphysis

A solid-bladed scalpel is taken in the right hand and inserted through a stab incision into the centre of the joint. The blade should be pointing downwards (Fig. 3). If the joint has been entered correctly there should be little resistance and very little force is required. Pressure should continue until the tip of the scalpel is felt by the index finger within the vagina. If the knife is pressed too far into the joint little damage to the mother will be inflicted but the operator will cut his own finger. The knife is now rotated upwards, the junction of the upper part of blade and the anterior surface of the symphysis pubis being the fulcrum for rotation. This action will divide the greater part of the lower half of the joint and the attendant ligaments (Fig. 3).

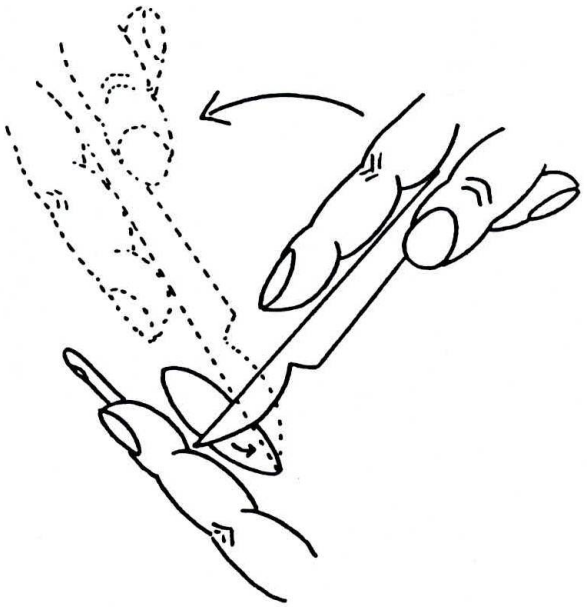

Fig. 3. Division of the lower joint fibres.

The scalpel is then removed, rotated through 180 degrees and reinserted through the same stab incision with the cutting surface upwards. The upper part of the joint is divided by rotating the scalpel downwards (Fig. 4).

By now most of the joint and its ligaments will have been divided and the joint will begin to separate. Some of the ligaments will, however, still be intact. These can readily be felt by the vaginal finger and it

may be used to guide the scalpel blade to them when division may be completed. When the vaginal finger can be inserted into the gap created by the joint division, the operation is finished. The scalpel and vaginal finger are withdrawn. If the operation has been correctly undertaken, the head will now descend and full cervical dilatation will occur if it has not already done so.

Episiotomy

To avoid injury to the vestibule, an episiotomy is obligatory unless the perineum is markedly deficient.

Delivery

Whether spontaneous or assisted by vacuum extraction, the baby should be delivered over the perineum and not, as is usual, upwards over the mother's abdomen. This manoeuvre will avoid trauma to the soft tissues under the symphysis pubis.

Repair

The stab wound should be closed. One catgut suture is usually sufficient. This suture should be inserted fairly deeply as the edges of the skin incision usually bleed freely. The episiotomy should also be repaired.

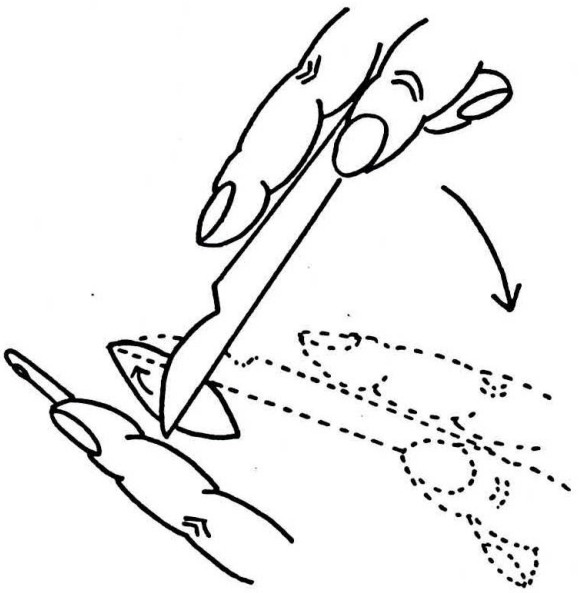

Fig. 4. Division of the upper joint fibres.

AFTERCARE

If there is no haematuria at any stage during the operation, bladder drainage is not required. If haematuria is present, continuous bladder drainage should be undertaken until the urine has been clear for at least three days. It has been found that strapping is not required. The patient should be sedated for about eight hours. From then on ambulation should be encouraged as soon as the patient wishes to get up. Care should be taken to ensure that someone is present the first few times that she gets out of bed to prevent falling or other injury. As far as possible it is the patient herself who should decide limitation of movement. At first, walking should be aided by her supporting herself round the bed and from bed to bed. She should use short shuffling steps or walk initially with a broad base. A physiotherapist, when available, may be of considerable assistance. The patient may be discharged when her walking is confident and when she is free of pain. The immediate convalescence may vary from five to 14 days. On discharge she should be warned against undue exercise for a period of three months.

COMPLICATIONS

Immediate complications from symphysiotomy are not common. Haemorrhage from the vascular area over the pubic symphysis is sometimes alarming. The bleeding almost always stops as soon as the baby is born and may be controlled before delivery by firm pressure. Occasionally large haematomata occur which track into the vulva or to the perivesical or parametrial areas. Such bleeding is not dangerous if recognized and dealt with promptly. Infection at the operation site may also occur. If left unchecked it may affect the joint and bones of the pubis. Severe infection is readily prevented by the judicious use of antibiotics. Urinary infection is as frequent as it is in any patient who has been catheterized in labour. Soft tissue injury is rare if the operation is reserved for cases in which disproportion is not gross, although urethral incontinence, due to the avulsion of the urethra from its normal anatomical situation, is encountered. Treatment of such a complication is not easy. Fortunately its occurrence is rare and it is doubtful if it is more frequent than ureteric injury during Caesarean section. Of greater importance is permanent pelvic injury with subsequent ambulatory difficulty. It is not certain how frequently women who have had symphysiotomy develop such a complication. Follow-up is not easy in the areas where symphysiotomy is frequently undertaken, but any evidence available suggests that ambulatory difficulty is not as common as might be expected. The stability of the pelvis is dependent mainly on the integrity of the sacro-iliac joints. Apart from the intrinsic joint structure, there are powerful anterior ligaments to prevent subluxation. When the pubic symphysis separates spontaneously in labour,

there is almost always associated damage to the sacro-iliac joints with accompanying pain and often severe ambulatory problems. During surgical symphysiotomy, the sacro-iliac joints are protected by controlled femoral abduction which will prevent dangerous separation in the sacro-iliac joints. In surgical symphysiotomy, too, the strain upon the sacro-iliac joints is present for a short space of time, whereas when the symphysis separates spontaneously during labour a considerable time may elapse before delivery. Healing within the symphyseal joint is by fibrous union, which may be as strong or even stronger than it was before.

There can be little maternal mortality from symphysiotomy provided the operator is careful. Haemorrhage is a possibility as it is in any operation. Sepsis is less likely to cause death as general spread from such a limited area is not easy. The main complications are therefore intractable urethral incontinence, injury to the urethra and bladder, and pelvic instability. The first is seldom encountered, the second is due to failure to undertake the operation properly, and the last is probably less likely in practice than in theory. All major complications will be due to bad selection of cases, in particular the attempt to undertake the operation in the presence of gross disproportion. From the fetal point of view there can be no doubt regarding the safety of the operation. From the time of decision to undertake symphysiotomy until the actual delivery most operations take less than 15 minutes and the baby is born in much the same condition as it was at the time the operation was considered necessary.

SYMPHYSIOTOMY IN TRIAL OF LABOUR

Although symphysiotomy has been accepted by many doctors who work in developing countries as a useful operation in an emergency situation, its place in the conduct of a trial of labour in hospital is in dispute. Such patients may have attended an antenatal clinic regularly and it is likely that they will return for subsequent delivery. It is argued, therefore, that Caesarean section, followed thereafter by a series of such operations is preferable to symphysiotomy. This is not necessarily the case. Many patients, having once had a Caesarean section, may wish to prove to themselves that normal vaginal delivery is possible and ignore the medical advice. They may not come to hospital during the next pregnancy and be seen only when the uterus has already ruptured. The only justifiable argument against symphysiotomy is that the complication rate can be high, not only immediately post-operative but also at a later date. If the complication rate is likely to be small then the operation is justifiable in any circumstance.

SYMPHYSIOTOMY BEFORE LABOUR

At one time the operation was advocated as an elective procedure either before pregnancy or at the time of emergency Caesarean section for proven disproportion in the hope that the consequent pelvic enlargement would ensure subsequent normal delivery. Such practice has little to commend it. Disproportion cannot easily be diagnosed prospectively unless the pelvis is extremely small or deformed, and these very small pelves cannot be enlarged sufficiently by symphysiotomy to guarantee future adequacy without gross damage to surrounding soft tissues.

SYMPHYSIOTOMY IN EARLY LABOUR

It is equally unwise to undertake symphysiotomy early in labour. The operation may easily be undertaken unnecessarily. Alternatively, and of greater importance, prolonged strain on the sacro-iliac joints which accompanies division of the symphysis without rapid delivery may lead to ambulatory difficulties after delivery in the same way that this follows spontaneous separation of the symphysis during labour. It is also notable that haemorrhage from the operation site usually does not cease until the baby is delivered, and when rapid delivery does not follow symphysiotomy, this haemorrhage may be impossible to control.

SYMPHYSIOTOMY IN ABNORMAL PRESENTATION

Transverse lie

There is no place for symphysiotomy in transverse lie, no matter the circumstances.

Brow presentation

When the pelvis is capacious, and the obstruction is due to brow presentation, symphysiotomy may be undertaken provided the rules regarding fetal head descent overlap and cervical dilatation are followed. Such circumstances are rare and only found in emergency situations when the presentation is obscured by a large caput succedaneum. The diagnosis is then made with surprise at delivery. There is, however, no justification in permitting labour to continue when the diagnosis is made in early labour in the hope that a symphysiotomy will eventually be possible.

Face presentation

Symphysiotomy may be undertaken in face presentation. Subsequent vacuum extraction is, however, impossible and it is important to ensure that further descent of the fetal head and greater dilatation of the cervix has occurred before attempting the operation. It is therefore limited to the occasional case when the

second stage has been reached, the chin anterior and the head engaged.

Breech presentation

The place of symphysiotomy in breech presentation is quite different from when the head presents. If the pelvis is small and the fetus of fair size, the best results for fetal survival will be obtained when Caesarean section is undertaken as an elective procedure. However, unless all breech presentations are to be delivered in this way and until emergency situations have been eliminated from clinical practice, symphysiotomy is often useful to reduce some of the very high perinatal mortality in such deliveries. If the fetal head is disproportionately large for the pelvis and this has not been anticipated, great difficulty in delivery is encountered with much mortality and morbidity to the fetus. In this dangerous situation a speedy symphysiotomy undertaken for delivery of the aftercoming head may eliminate the difficulty, but the operation cannot be expected to give good results. However quick it may be, the time factor may be too great for fetal survival and there is much greater chance of the inexperienced causing severe damage to the maternal soft tissues. It is possible to reduce fetal mortality in such a situation but impossible to eliminate it.

The operation may, however, be undertaken earlier in the second stage in breech presentation. When there is slow descent of the buttocks in spite of good uterine and maternal effort, difficulty in delivering the aftercoming head may be anticipated. Undoubtedly symphysiotomy at this stage, provided the buttocks have descended to mid-cavity, may be followed by rapid progress and easy delivery. In the 15 cases personally undertaken in this situation, all babies have survived.

Symphysiotomy in the presence of a dead fetus

If the baby is dead and the delivery imperative, destructive operations are best provided there is no danger of uterine rupture. Occasionally, when destruction is not easy at a high level and the mother's condition is poor, it may be better to undertake symphysiotomy rather than Caesarean section.

Symphysiotomy in the presence of a previous Caesarean section scar

During the antenatal assessment of a patient with a previous Caesarean section scar a decision must be taken as to whether to permit a test of labour (or trial of scar) or to undertake an elective Caesarean section. If the patient has had more than one Caesarean section or if the previous Caesarean section has been for cephalopelvic disproportion, an elective Caesarean section should be undertaken. There is no place for permitting labour in the hope that eventually a stage will be reached when the abdominal and vaginal findings will allow symphysiotomy. If labour is permitted and operative delivery becomes necessary because of unsuspected disproportion, Caesarean section rather than symphysiotomy should be undertaken. In an emergency situation when the patient is admitted in advanced labour and conditions are favourable for symphysiotomy, the operation may occasionally be justifiable in the fetal interest. After delivery uterine exploration should be undertaken to ensure that the uterus is intact. Wherever possible, however, symphysiotomy is to be avoided where there is a uterine scar.

FAILED SYMPHYSIOTOMY

In the past eight years I have undertaken and assisted at over 500 symphysiotomies. There have been three failures. The reason for such failures is worth reporting. In the first case, the patient had outlet disproportion which is unusual in Africa. Symphysiotomy, when recommended at all in Western practice, is considered to be suitable only for disproportion at the outlet. In this case, although the symphysis was well divided, there was no appreciable separation at the outlet. The second case is equally interesting as it demonstrates the importance of obeying the rules. A primigravida was admitted in obstructed labour. The fetal head was present and on vaginal examination the head could be seen on separating the labia. There was, however, second degree overlap present which was at first thought to be a shoulder. Division of the symphysis was not followed by descent of the head and at the subsequent Caesarean section a hydrocephalic fetus was delivered. The third failure had had a previous symphysiotomy undertaken in another hospital. She arrived late in labour and because the vaginal and abdominal findings suggested disproportion of first degree a repeat operation was attempted. This proved impossible as the fibrous union between the joint surfaces was dense and impossible to divide, thus demonstrating the soundness of the joint.

SYMPHYSIOTOMY IN THE FUTURE

There is no evidence to suggest that the frequency of cephalopelvic disproportion is decreasing in developing countries. Kwashiorkor and allied diseases are as prevalent as ever and as long as these diseases exist in infancy there will be disproportion for a period of 40 years thereafter. Developing countries tend to increase their population at alarming rates to such an

extent that the medical services are unable to keep pace. More and more doctors are being trained for service in these countries. This has as one of its results a tendency to increase the number of Caesarean sections undertaken as that operation is often an easy way out of an obstetric difficulty. It is as easy to teach a doctor the indications for and the technique of symphysiotomy as it is the indications for and the technique of Caesarean section.

To train young doctors in the use of the vacuum extractor or forceps is not difficult either. In practice, however, where cephalopelvic disproportion exists, delivery is not often easily accomplished without some injury to the fetal head. As long ago as 1935, Sir Albert Cook, pioneer of medicine in East Africa, stated, "When I left England in 1896, it was with the firm belief in the efficiency of extraction by forceps in difficult labour. Greater experience has taught me the folly and danger of this course."

Symphysiotomy is able to reduce the number of Caesarean sections which are undertaken. Moreover, it can eliminate all cases of difficult vaginal delivery. That it is not used more frequently is entirely due to the seeds of prejudice sown in the minds of doctors in the nineteenth and early twentieth centuries from ill-chosen and illogical evidence. The results which were produced at the time by those who undertook symphysiotomy in a rational fashion were good. The operation has stood the test of time and will continue to be practised in spite of this prejudice.

REFERENCES

Bowesman, C. (1960). *Surgery and Clinical Pathology in the Tropics*, p. 665. Edinburgh: E. & S. Livingstone.

Browne, A. D. H. (1968). Emergency symphysiotomy. *Practitioner*, **200**, 537.

Cook, A. (1933). The influence of obstetric conditions on vital statistics in Uganda. *E. Afr. med. J.*, **9**, 316.

Moir, J. C. (1964). In Munro Kerr's *Operative Obstetrics*, 6th edition, p. 621. London: Baillière, Tindall and Cox.

Pereira, J. C. (1964). Symphysiotomy in modern obstetrics. *An. Inst. Med. trop. (Lisboa)*, **21**, 153.

Seedat, E. K., and Crichton, D. (1962). Symphysiotomy; technique, indication and limitations. *Lancet*, **1**, 554.

Simon, E. J., and Philpott, R. H. (1973). The vacuum extractor, *Tropical Doctor*, **3**, 34.

Zarate, E. (1955). *Subcutaneous partial symphysiotomy*. English edition, T.I.C.A. Buenos Aires.

Management of rupture of the gravid uterus

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INTRODUCTION

Rupture of the gravid uterus is an obstetrical catastrophe associated with a high maternal and fetal mortality rate. The incidence is particularly high in developing countries: e.g. 1 in 112 hospital deliveries in Nigeria with a maternal mortality rate of 7.6% (Groen 1974), against an incidence of 1 in 6673 deliveries in the USA with a maternal mortality rate of almost 0 (Spaulding & Gallup 1979). The reason for the high frequency in developing countries is that cephalo-pelvic disproportion is common because of growth stunting of future mothers in childhood and adolescence, through malnutrition and recurrent untreated infections. Also, in the absence of prenatal care, disproportion and malpresentations are undetected until the resulting obstructed labour brings the patients to hospital when rupture of the uterus is imminent or has already occurred. Unfortunately, unskilled manipulations, either by untrained attendants or inexperienced doctors, may also contribute to the increased incidence of uterine rupture in developing countries. The extension of antenatal screening to detect patients at high risk would certainly reduce the incidence. Furthermore, the proper management of disproportion and obstructed labour is important in the prevention of uterine rupture (Philpot 1982).

The high fetal and maternal mortality rate of uterine rupture could be reduced by early diagnosis and active pre-, intra- and post-operative management of these patients. This paper will concentrate on these curative issues.

DEFINITIONS AND AETIOLOGY

Rupture of the uterus means the development of a tear of the uterine wall. We will limit ourselves here to intrapartum rupture. The site of the rupture may be anywhere in body and lower segment, either anterior or posterior, and the direction of the rent may be transverse, vertical, or a combination (T- or L-shaped tears). Site and type of the rent can be related to the cause: for instance, an anterior, transverse tear may be due to dehiscence of the scar of a previous lower segment caesarean section: or a posterior tear may be due to the "boot scraper" effect of the fetal head in a forceful breech extraction.

Uterine rupture usually occurs spontaneously, i.e. without (iatrogenic) trauma, and is caused by cephalopelvic disproportion, malposition and malpresentation. Traumatic rupture may occur during obstetric intervention, either instrumental, manipulatory or pharmacological.

Rupture of a caesarean section scar may occur either spontaneously or as a result of trauma and offers a somewhat different picture. In particular, the classical caesarean section scar in the body of the uterus is at risk of rupturing in subsequent deliveries.

Uterine rupture is rare in the primigravid, but "the grand multigravid uterus is prone to rupture" (Smith 1982).

CLINICAL SIGNS AND SYMPTOMS

Rupture of the uterus is in many cases the final result of obstructed labour. For recognition and management of obstructed labour, the reader is referred to specific texts (Lawson & Stewart 1967, Philpott 1982). When obstructed labour is not relieved without delay, impending rupture of the uterus will develop. The junction ring between body and lower segment (the ring of Bandl) rises and the lower segment becomes stretched and painful to touch, even between contractions, which are increasing in strength and duration. The patient becomes anxious and restless, with a rapid pulse and irregular respiration. The bladder may be distended and catheterization may yield blood-stained urine. At this stage immediate intervention is required to prevent rupture. However, injudicious manipulations may further stretch the already thinned lower segment and produce rupture. When the fetus is dead, caesarean section is to be avoided by the performance of embryotomy (Lawson 1974). When the fetus is still alive, symphysiotomy and ventouse extraction should be seriously considered. Caesarean section may be inevitable to deliver a live baby which is in transverse lie or compound presentation.

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Table 1. Diagnostic features of uterine rupture

Impending rupture
Anxiety, restlessness
Painful lower uterine segment
Rising contraction ring (of Bandl)
Distension of bladder
Blood-stained urine
Rapid pulse rate, irregular respiration
Rupture of the uterus
Sudden cessation of contractions (history and examination), followed by:
Little or no pain (often), or severe continuous pain (seldom)
Cessation of fetal heart sounds
Haemorrhage per vaginam (often only a little)
Fetal parts felt in abdominal cavity
Abdominal distension
Hypovolaemic shock (varying from mild to severe)
Vaginal examination

The diagnostic features of uterine rupture are listed in Table 1. When rupture actually develops, the clinical picture may be either dominated by severe haemorrhage and hypovolaemic shock, or it may be more insiduous if the presenting part exerts a tamponading effect on the tear. In both instances, contractions come to a sudden end, sometimes to be followed by a continuous severe pain; but more often pains stop completely or almost completely. The patient is sometimes rather talkative, which may mislead attendants into thinking she is less ill than she is. External vaginal haemorrhage may be surprisingly little, even in shock. Often fetal parts can be felt easily through the abdominal wall (usually the fetus lies in the peritoneal cavity). There is usually some distension of the bowel: infrequently this is gross – when the patient presents late. Vaginal examination may demonstrate disengagement of the presenting part: often the examining hand passes easily through the rupture into the abdominal cavity. Sometimes the placenta is born before the fetus. Infrequently, loops of intestine prolapse through the rupture into the vagina.

In some instances, uterine rupture will only be detected at vaginal examination after an operative vaginal delivery, although this does not necessarily mean that the obstetric interference caused the rupture.

PREOPERATIVE MANAGEMENT

Once uterine rupture has been diagnosed, preparations should be made for emergency laparotomy. There is no room for conservative treatment, but a short period of intensive resuscitation, preferably in the operating theatre, is justified. Preoperative management is summarized in Table 2.

At this point, it should be emphasised that any attempt to extract the fetus in this period will not only remove the tamponading effect but also increase shock and extend the rupture; it should therefore be discouraged strongly.

First, at least one large-bore drip should be set up. If necessary, the internal jugular or subclavian route can be used, and are preferable to a cutdown. Normal saline is still the best resuscitation fluid in shock, and at least 1 litre should be given before anaesthesia is started. Sodium bicarbonate, 100 ml of 8.4% solution, will help to correct metabolic acidosis. It is of course desirable to establish an adequate circulation, with warm extremities and a recordable blood pressure, but if haemorrhage is continuing, this aim may not be achieved without surgical measures to stop the bleeding. Transfusions have to be started as soon as blood becomes available – preferably fresh, because of clotting disturbances like disseminated intravascular coagulation.

Vasopressor agents are of little use in hypovolaemic shock, but dopamine may be useful in relatively low dosages (up to 10 μg/kg per minute), to improve renal blood flow and protect against acute tubular necrosis. Higher infusion rates of dopamine result in an alpha-adrenergic vasoconstrictor effect that is useful in septic shock. Monitoring of the

Table 2. Preoperative management of uterine rupture

Correction of hypovolaemia:	Normal saline, 1–2 litres Sodium bicarbonate 8.4%,100ml Blood transfusion
Antibiotic treatment:	Chloramphenicol 500 mg qds i.v. Metronidazole 500 mg tds p.r. (much cheaper than i.v. route)
Prevention of aspiration:	Nasogastric tube Aspiration of gastric contents through tube Antacids e.g. Mist. Magn. Trisil.
Circulatory support:	Dopamine, 10 μg/kg per minute Digitalis preparations
DO NOT EXTRACT FETUS WITHOUT LAPAROTOMY	

central venous pressure is time consuming and usually unnecessary, unless there are signs of congestive heart failure, in which case digitalis preparations are also indicated.

Antibiotics should be started in the preoperative phase as well. As faecal flora are the main contaminent, a combination of chloramphenicol and metronidazole is rational and, in our experience, very effective.

ANAESTHESIA

Always pass a nasogastric tube before induction of anaesthesia, empty the stomach carefully and instil 20 ml of Mist. Mag. Trisil. to counteract acid contents and prevent regurgitation into the airway. The choice of anaesthetic methods will be as limited as the number of expert anaesthetists in most rural hospitals. In fact, many doctors will have to deal with these patients single-handed. General anaesthesia with tracheal intubation is the method of choice, when available. Cricoid pressure should be used during intubation to close the oesophagus and prevent reflux of stomach contents. Ketamine drip appears a safe alternative, as this agent does not lower the blood pressure, but it gives no relaxation of the abdominal muscles. Local anaesthesia may be resorted to in some instances when no other method is available. Spinal or epidural anaesthesia are contra-indicated because of their hypotensive effect.

THE OPERATION

There are two ways to deal with the ruptured uterus: to repair it, or to remove it. Each policy has its advocates, but all studies published are biased by the authors' preference, and no controlled trials have been performed on the results of each method.

The advocates of repair of the ruptured uterus argue that this operation is usually easier and speedier to perform, with less trauma and blood loss than in hysterectomy (Agüero & Kizer 1968, Sheth 1969, Groen 1974, Nasah & Drouin 1978). Others prefer to extirpate the poorly circulated and contaminated uterus to prevent haemorrhagic and septic complications (Paydar & Hassanzadeh 1978, Rahman & Fothergill 1979). However, it seems wise to tailor the operation to the individual situation, thereby aiming at the smallest possible procedure that gets the patient off the table as soon as possible, and in the best possible condition (Mokgokong & Marivate 1976, Golan *et al.* 1980). An example of an algorithm to help in decision-making is presented in Figure 1.

The abdomen is opened by a generous midline incision. First the fetus and placenta are extracted. Large bleeders in the uterine tear are grasped, taking care to avoid bladder and ureters. Diffuse oozing is controlled by dry gauze packs or towels.

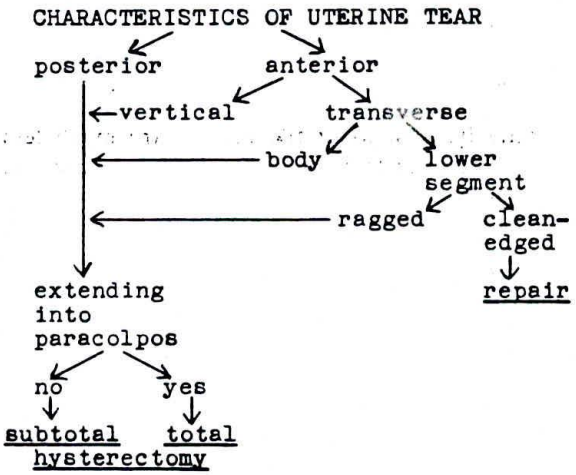

Figure 1. Algorithm for surgical management of uterine rupture

After the bleeding has been temporarily arrested in this way, and while fluid resuscitation is continued with all efforts to re-establish the circulation, it is time to assess the damage and to decide on the further management.

When the tear appears suitable for repair, the bladder is deflected first, as in lower segment caesarean section. The broad ligament is now open and both ureters can be identified by palpation. The angles of the rent are located next and two corner stitches are inserted to aid in exposure. Then the rent can be sutured by a haemostatic running stitch, taking large bites of uterine tissue. Subsequently, additional bleeding points are ligated until the whole field is dry. Finally, bilateral tubal ligation is performed, because the scar that results from repair of a uterine rupture is not sound enough to withstand a subsequent labour. The only exception to this rule is when a ruptured lower segment caesarean scar has been repaired in a patient who is likely to return for an elective repeat section before the onset of labour next time. In all other patients bilateral tubal

ligation is necessary to prevent another calamity in the future.

If the patient's condition is still not stable at this point, it is probably wise to finish the operation and close the abdomen. In most cases, however, the combined resuscitative and operative efforts will have resulted in a stable patient, and a search can be made for additional injuries, particularly of the urinary tract. Inspection of the bladder may reveal a tear, but to be certain about its integrity, Bonney's blue should be instilled via the catheter. Full-thickness tears should be closed in two layers and a catheter be left in the bladder for ten days post-operatively. Lesions of the ureters are much less common and more difficult to detect. Intraveneous injection of methylene blue or indigo carmine may help to discover leaks of a ureter. If there is serious suspicion that one of the ureters has been caught in a ligature, retrograde cannulation after opening the bladder is indicated. If severe damage is confirmed, reanastomosis over a splint, or reimplantation in the bladder is necessary to preserve the kidney. Other organs, especially the bowel, should be inspected carefully for injuries, and then the abdomen is meticulously cleansed. Lavage with at least two litres of warm saline reduces bacterial contamination by dilution. A drain should be left in the pouch of Douglas as an early warning should secondary haemorrhage occur. It must be removed after 24 hours.

Hysterectomy is the operation of choice in all complicated tears of the uterus. It is sometimes surprisingly easy to perform when the tear is extensive and the uterus almost completely detached. In general, attempts to remove the cervix routinely are not only unnecessary but also harmful, for the urinary tract may be damaged during the procedure and precious time and blood may be lost. Subtotal hysterectomy should not be spurned in these circumstances when that is sufficient to obtain haemostasis. Also, the cervix may be very difficult to identify when the pelvic tissues are oedemateous and bruised.

For hysterectomy, the bladder should be deflected and the ureters identified over their whole length in the operative field. The round ligaments and adnexal attachments are clamped and divided and the broad ligament opened. The uterine vessels are clamped, after checking the ureters and the uterus can be amputated at the supravaginal level unless the tear extends into the cervix. In that case, removal of the cervix is the only method to obtain haemostasis. Finally, the cervical remnant or vaginal cuff can either be closed with a running stitch or sutured circumferentially with a haemostatic stitch, leaving a communication with the vagina for drainage of the haematoma. As in repair, the peritoneal cavity is carefully cleansed and rinsed with several litres of normal saline, a drain is left in the pouch of Douglas and the abdomen is closed.

POSTOPERATIVE MANAGEMENT

Even when the patient is stable towards the end of the operation, intensive postoperative treatment will be required, as many complications may occur (Table 3).

Table 3. Postoperative management

Circulation :	Monitoring of blood pressure, pulse rate, hourly urine output, peripheral temperature Fluid administration (supportive drugs)
Respiration:	Physiotherapy Antibiotics if necessary
Nutrition:	Oral intake as soon as possible Parental feeding in peritonitis
Sepsis:	Antibiotics Surgical drainage
Psychological support	

Circulation

Close observation after the operation is necessary to keep the fluid balance in order, and to detect secondary haemorrhage as early as possible. The best parameter for the circulation is the urine output, which should be at least 1 ml/kg per hour. Fluids should be administered in order to attain this output. Blood pressure, pulse rate and peripheral temperature (e.g. of the hallux) are also helpful, but interpretation may be difficult when peripheral vasodilatation occurs in the course of septicaemia. If urine output decreases in spite of large amounts of fluid, the patient may have acute tubular necrosis as a result of (prolonged) shock. In that case, blood pressure is usually normal again and fluid administration should be restricted to prevent severe overloading of the circulation. Enough fluids should be given to compensate for the previous day's losses. In most cases of acute tubular necrosis, the anuria is reversible and is followed by an episode of polyuria as a sign of recovery of the kidneys (Lawson & Stewart 1967). As mentioned above, low doses of dopamine in the acute phase may exert a protective effect on the kidneys.

Respiration
Respiratory problems are common in the postoperative period. The risk of aspiration of gastric contents has been mentioned and remains actual in the postoperative period. Therefore, the naso-gastric tube should be left in place for at least 48 hours. Atelectasis due to elevation of the diaphragm and to pain should be anticipated early and combatted by physiotherapy, mobilization and adequate analgesia. Antibiotic treatment is necessary when pulmonary infiltrates develop.

Septic complications
Peritonitis is likely to occur after laparotomy for a heavily contaminated uterine rupture. Therefore, antibiotic treatment should be continued for at least 48–72 hours after the operation until one is certain that there are no signs of intraabdominal sepsis. General peritonitis may develop, with a continous fever, abdominal distension and ileus, and massive fluid requirements because of third space losses and respiratory problems. Alternatively, localized intraperitoneal abscesses may develop in the second postoperative week, for instance in the pouch of Douglas or in the subphrenic space. A spiking temperature and clinical deterioration should initiate a search for these abscesses by physical examination and chest X-ray. Drainage is indicated, preferably by the extraperitoneal route, but relaparotomy may be inevitable when circulatory collapse is impending.

General remarks
Continuous bladder drainage via an in-dwelling urethral catheter should be maintained for at least one week in all instances where labour has been obstructed by disproportion, in the hope of avoiding or limiting full-thickness pressure necrosis of the bladder and subsequent fistula formation.

Nutrition is another important aspect of the severely ill patients. When there are no signs of peritonitis, oral feeding should be started a few days after the operation. High calorie and protein feeds can be made by adding sugar and electrolytes to milk and administering these by nasogastric tube if necessary. Total parenteral nutrition via a centrally placed catheter is ideal in general peritonitis, but is beyond the scope of most rural hospitals. Alternatively, calories can be given via a peripheral drip as Intralipid.

Finally, the psychological aspects should not be forgotten in these women, who have often not only lost their baby but also the possibility of having another.

REFERENCES

Agüero O & Kizer S (1968) *Obstetrics and Gynecology* **31**, 806–809
Golan A, Sandbank O & Rubin A (1980) *Obstetrics and Gynecology* **56**, 549–554
Groen P (1974) *Obstetrics and Gynecology* **44**, 682–687
Lawson J B (1974) *Tropical Doctor* **4**, 188–191
Lawson J B & Stewart B D (1967) Obstetrics and Gynaecology in the Tropics. Edward Arnold, London; pp 203–210
Mokgokong E T & Marivate M (1976) *South African Medical Journal* **50**, 1621–1624
Nasah B T & Drouin P (1978) *Tropical Doctor* **8**, 127
Paydar M & Hassanzadeh A (1978) *International Journal of Gynaecology and Obstetrics* **15**, 405–409
Philpott R H (1982) *Clinics in Obstetrics and Gynecology* **9**, 625–640
Rahman M S & Fothergill R J (1979) *Journal of the Royal Society of Medicine* **72**, 415–420
Sheth S S (1969) *American Journal of Obstetrics and Gynecology* **105**, 440–443
Smith A M (1982) *Journal of Obstetrics and Gynaecology* **2**, 245–248
Spaulding L B & Gallup D G (1979) *Obstetrics and Gynecology* **54**, 437–444

Obstetric Care

Embryotomy for obstructed labour

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TROPICAL DOCTOR, 1974, 4, 188–191

This article is the fourth in a series on obstetric operations commonly performed in the tropics to relieve mechanical difficulties in labour. The first article, on Caesarean Section, appeared in the January 1972 issue. The second, on the Vacuum Extractor, by Simons and Philpott in January 1973, and the third, on Symphysiotomy, by Gebbie in April 1974.

Destructive operations on the fetus are hardly ever indicated nowadays in Europe, North America, and other developed regions. Disproportion and malpresentations are usually detected during pregnancy: even when they are not, the resulting mechanical difficulties are dealt with early in labour before the stage of obstruction is reached.

In developing countries, however, skilled antenatal care is by no means universally available. Contracted pelvis is much more common, due to stunting of the growth of future mothers by malnutrition and disease in childhood and adolescence. Lack of confidence in modern obstetric care may cause delay in seeking treatment, and if the nearest hospital can only be reached after an arduous journey, disaster may be imminent by the time patients in prolonged labour arrive.

The case against Caesarean section

At first sight, Caesarean section might appear to be the complete answer to the relief of obstructed labour. However, this operation carries immediate and remote risks which cannnot be ignored.

Caesarean section is considerably less safe in small rural hospitals, where most obstructed labours have to be dealt with, than in well-equipped obstetric units staffed by specialists. The operation itself may carry considerable risks when performed by the "occasional surgeon", particularly from haemorrhage when stored blood is not available. The difficulties of anaesthesia for Caesarean section when the patient is in poor condition after a prolonged labour may defeat the anaesthetic skills available in these surroundings. Furthermore, Caesarean section late in labour when infection is already established carries grave danger of general peritonitis which even massive doses of broad-spectrum antibiotics may not control.

The later risk of rupture of the uterine scar in a subsequent labour is even more important, although less obvious. A woman who does not come to hospital until she has been in labour for several days does so only as a last resort. Next time she is pregnant, she may deliberately avoid hospital care because she associates a frightening operation and an uncomfortable puerperium with hospital delivery. If a section does not result in a live baby, she may attribute the loss of her child to the operation, and thus be even less likely to return. In rural areas, many women live so far from hospital that they cannot get there in labour even when they wish to do so, particularly in nomadic communities.

Another neglected obstructed labour after a Caesarean section will probably be disastrous, as the uterine scar will almost certainly rupture. Operative vaginal deliveries should therefore be preferred, particularly if the fetus is dead, if the patient is unlikely to return to hospital for the next delivery What kind of operative vaginal delivery?

Labour obstructed: fetus alive

If the fetus is still alive and labour is obstructed by only a moderate degree of cephalo-pelvic disproportion, symphysiotomy should be seriously considered. If there is gross disproportion, however, this will not secure delivery and Caesarean section may have to be performed in spite of the risks.

When labour is obstructed by transverse lie or compound presentation and the fetus is still alive, Caesarean section is nearly always indicated. Internal version and breech extraction is not a safe alternative: when the uterus is firmly contracted round the fetus, an attempt at version is almost certain to rupture the lower segment.

Labour obstructed: fetus dead

When the fetus is dead, obstruction due to cephalopelvic disproportion can be relieved by reducing the size of the head by craniotomy, and obstruction due to transverse lie can be similarly relieved by decapitating the fetus. These procedures are not difficult

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with practice, and are safe provided they are gently performed. Certain rules must be observed, however, if an embryotomy is to be successful.

Pre-operative management

Before embarking on any operation to relieve obstruction, correction of the effects of the preceding prolonged labour should be started. Dehydration and ketoacidosis indicate the rapid intravenous infusion of at least one litre of 5% dextrose. To combat the inevitable intra-uterine infection, the circulation should be flooded with a broad-spectrum antibiotic, preferably intravenous ampicillin or tetracycline. If stored blood is available, at least two units should be cross-matched. These measures should be initiated while preparations are being made for operative delivery, but they should not be allowed to cause undue delay.

Since a rupture of the uterus may be discovered during or immediately after delivery, all destructive operations must be performed under general anaesthesia in the operating theatre, with a trolley of laparotomy instruments ready for immediate use if a rupture is found.

Immediately before embarking on a destructive operation, the abdomen should be re-examined for signs of uterine rupture. It should be established by vaginal examination that the true conjugate of the pelvic brim is not less than 8 cm.: the cervix should be at least three quarters dilated.

CRANIOTOMY

When labour becomes obstructed in a cephalic presentation, the head is usually driven down firmly into the pelvic brim where it becomes impacted: craniotomy is then fairly easy. However, if the head is high and mobile above the pelvic brim, craniotomy is difficult and dangerous and subsequent extraction may even be impossible. In these rare circumstances, delivery of the dead fetus by Caesarean section, with all its risks, will be safer.

Technique

The skull is perforated, preferably with a Simpson's perforator. The instrument is passed into the skull up to the shoulders of the blades and opened widely: it is then closed and turned through 90° and opened again, to produce a cruciate opening in the vault. The closed perforator is then inserted deep into the skull, opened and rotated briskly to break up the septa and the brain substance. The obstruction has now been relieved by reducing the size of the head, so extraction of the fetus can proceed.

Crushing instruments such as the cephalotribe and cranioclast are completely obsolete: the three-bladed

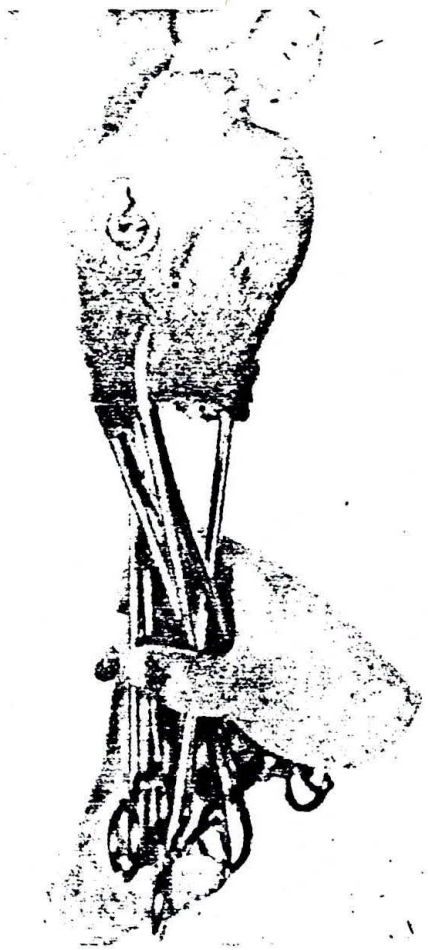

Fig. 1. Extraction, using Morris's forceps, after craniotomy.

combined instrument is particularly clumsy and should be relegated to the museum. Extraction is most easily achieved by pulling on several pairs of forceps attached to the edges of the hole in the skull. (See Fig. 1). Morris's craniotomy forceps, which are strong 10 inch clamps with curved toothed blades, are most suitable for this: if they are not available, strong volsella or even heavy hysterectomy clamps can be used instead.

The bones of the vault are firmly grasped by up to four pairs of forceps, care being taken that folds of vaginal wall or cervix are not accidentally included. Firm traction on the bundle of forceps (and also usually rotation) will cause the collapsed head to descend. Sometimes a piece of the cranium to which one of the forceps is attached will pull off: this does not matter as the instrument can be reapplied taking a deeper bite, bringing the point nearer to the base of

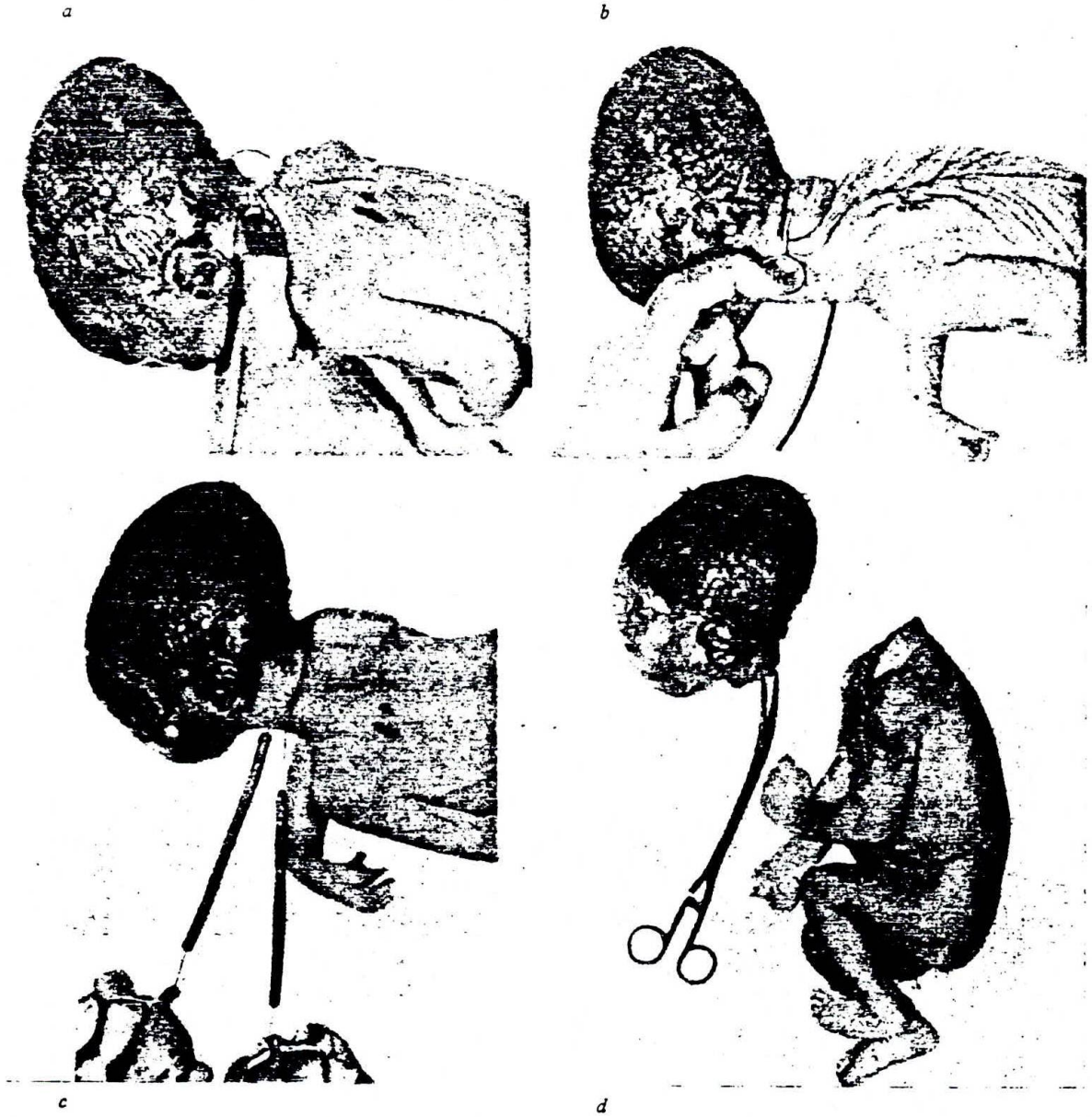

Fig. 2. Decapitation using Blond-Heidler saw. (a) Passing the thimble with saw attached up to the neck. (b) Drawing the thimble down over the other side of the neck. (Posterior view.) (c) Severing the neck with the saw. (d) Volsellum attached to the stump of the neck to deliver the after-coming head.

the skull. With this method, the collapsed head is elongated by traction on its apex. Crushing is therefore not required and jagged pieces of bone cannot lacerate the vagina.

If the fetus is very large, reduction in the size of the shoulder girdle may be required after delivery of the head. This is achieved by cleidotomy, in which one or both clavicles are divided with stout embryotomy scissors.

DECAPITATION

When labour is obstructed by a transverse lie, a preliminary reconnaissance *per vaginam* determines the exact position of the fetal neck. If possible, an arm is brought down and firmly pulled on by an assistant. This prevents upward displacement of the fetus during manipulations and thus limits further stretching of the distended lower segment, and it also brings the neck lower to make it more accessible.

Technique

If the fetus is small or macerated, the neck can usually be severed without difficulty with embryotomy scissors. (The decapitation hook is clumsy and difficult to use, particularly as the blade is usually blunt.) If the fetus is large or the neck is relatively inaccessible, the Blond-Heidler decapitation saw is best. (See Fig. 2).

The thimble of the Blond-Heidler set to which one end of the wire saw blade is attached is passed up behind the fetal neck. The thimble is then drawn over the neck and brought down in front of it. Next, the handles are attached to the ends of the saw and, keeping them close together so that the vagina is not injured, a few firm strokes soon sever the neck. The trunk is then delivered by traction on the arm: the operator's hand protects the vagina from laceration by jagged spicules of bone protruding from the thoracic inlet.

To deliver the after-coming head, the operator rotates it in the uterus until the stump of the neck is pointing down the birth canal. The stump is then grasped with a heavy volsellum and, with a finger in the mouth to flex it, the head is delivered by traction on the volsellum as if it were the after-coming head of a breech. This is a simple procedure which prevents the stump of the neck from injuring the birth canal.

AFTER-TREATMENT

Extraction of the fetus after a destructive operation should be followed immediately by manual exploration of the uterus to detect rupture and remove the placenta. Delay in diagnosing rupture of the uterus is disastrous, as laparotomy must be quickly performed if the patient is to survive. Indeed, if a rupture is discovered during an embryotomy before the fetus is delivered, vaginal manipulations must be abandoned immediately and delivery effected *per abdomen* without delay.

Having excluded uterine rupture the cervix and vagina are examined and any lacerations are repaired. A self-retaining urethral catheter should then be inserted to drain the bladder continuously for at least 48 hours. If the fetal head has been impacted in the vagina for a long time before delivery, pressure necrosis of the bladder wall is likely. In these cases, therefore, bladder drainage should be continued for at least 10 days in the hopes of preventing full-thickness sloughing and thus the formation of a vesico-vaginal fistula.

During the post-operative period, the correction of dehydration and keto-acidosis begun before delivery will necessitate further intravenous therapy for at least 24 hours. Similarly, antibiotic therapy should be continued intravenously until the oral route can be substituted.

LOOK TO THE FUTURE

When the patient has recovered, the cause of her traumatic experience must be fully explained both to her and to her relatives. That it could have been prevented by adequate obstetric care should be firmly emphasized.

If the patient is satisfied with the number of surviving children she has, sterilization or contraceptive advice should be offered. If further pregnancies are desired, however, Caesarean section will be required next time. (It may sometimes be unwise to tell the patient this before discharge, if it would deter her from returning to hospital for her next delivery.) In any case, it is essential to convince the patient before she leaves hospital of the importance of skilled obstetric care in all subsequent pregnancies and deliveries.

APPENDIX

The following instruments are recommended for the labour ward embryotomy set:

4—Morris's craniotomy forceps.
1—Simpson's perforator.
1—Queen Charlotte's pattern embryotomy scissors.
1—Blond-Heidler decapitation saw with spare blades.
1—Combined breech hook and crotchet.

Obstructed Labour at the University Teaching Hospital, Lusaka, Zambia—April 1972-December 1973

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SUMMARY

Sixty-three cases of obstructed labour encountered at the University Teaching Hospital, Lusaka, Zambia, are analysed for the period April 1972 - December 1973. For the same period there were 27 348 deliveries and 1 432 Caesarean sections. The management of choice was Caesarean section, because of a lack of experienced medical staff and the poor results obtained, together with the serious complications which follow destructive operations before vaginal deliveries. Eighty-five per cent of the babies were delivered alive. There was no maternal death. Twenty-six mothers remained in hospital for longer than 10 days. There was 1 case of a burst abdomen.

S. Afr. Med. J., **49**, 1204 (1975).

Antenatal clinics are the backbone of well-run obstetric services in developed countries. It is at these clinics that the mothers 'at risk' are separated in time for appropriate management to achieve a successful outcome of the pregnancy. As a result, complications of uncorrected abnormalities and malpositions are rarely encountered in the labour wards.

It is equally true to say that the standard textbooks of obstetrics in developed countries such as the USA and the UK mention in passing rather than discuss in detail, the subject of obstructed labour. In the developing countries obstructed labour is a major complication which must be diagnosed early or, better still, must be anticipated, if disasters are to be averted.

When it arises, it also requires doctors skilled and experienced in the practice of obstetrics in the tropics.

In this Unit as far back as 1971, it was generally accepted by the senior members of the medical staff that Caesarean section should be the treatment of choice in cases of obstructed labour, destructive operations and vaginal deliveries assisted by instruments, since fistulae (urinary and faecal), severe perineal and pelvic injuries and infections were well-known serious life-threatening complications which may follow such difficult vaginal deliveries when labour is obstructed.

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Date received: 28 January 1975.

MATERIAL

Obstructed labour was diagnosed in 100 patients during the period April 1972-December 1973. Only 71 case records were available and, of these, 8 were rejected as not suitable for study, leaving 63 to form the basis of this study. For the same period there were 27 348 deliveries and 1 432 Caesarean sections.

PRESENTATION AND CLINICAL SUMMARIES

Head Presentation

There were 19 cases where the head presented. Nine were brow presentations, 1 a face presentation, 2 occipito-posterior, and in 8 the exact position was not determined owing to marked caput formation. Seventeen patients had audible fetal heart sounds on admission, and 12 patients had 8 cm or full dilatation of the cervix. In 1 patient the degree of dilatation could not be assessed and in 7 cases the cervical dilatation was less than 8 cm. Four patients were febrile on admission. In the group of 20 patients with the head presenting, only 1 was delivered vaginally, the fetus presenting by the face, and the remaining 19 patients were delivered by Caesarean section, which resulted in 15 live babies and 5 stillborn babies (2 macerated). Sixteen babies weighed over 2,5 kg, and only 3 weighed less than 2,5 kg. One baby's weight was not recorded. There was only 1 baby with an Apgar score of 4/10, and in 14 babies the Apgar score ranged from 6 to 10. Postoperatively, 8 patients became pyrexial. Ten patients were discharged within 10 days and 9 remained in hospital for longer than 10 days; 1 patient absconded after 8 days. There was 1 case of a burst abdomen in this group.

Compound Presentation

There were 7 patients in this group. On admission 6 patients had a cervical dilatation of less than 8 cm and 6 had fetal heart sounds recorded; 2 patients were pyrexial. Caesarean section was performed to deliver them all, resulting in 7 live births; all but 1 weighed more than 2,5 kg. Two mothers had puerperal pyrexia; 5 were fit for discharge within 10 days and 2 remained more than 10 days. There was no fetal loss in this group.

Transverse Lie without Prolapse of a Limb

There were 7 patients in this group. In all, the membranes had ruptured before admission. One patient had undergone 2 previous Caesarean sections. Two patients had reached 8 cm or full dilatation of the cervix. The remaining 4 had a cervical dilatation of less than 8 cm. Caesarean section was the mode of delivery in all, resulting in 6 live infants; all weighed more than 2,5 kg. Two mothers remained in hospital for more than 10 days. Five had puerperal pyrexia.

Shoulder Presentation with Arm or Hand Prolapse

There were 27 patients, 6 of whom had twins. Three patients were pyrexial on admission; 8 patients had 8 cm or full dilatation of the cervix on admission, and 21 had reached less than 8 cm. Fetal heart sounds were recorded in 18 mothers and in 5 they were not heard. One patient had internal version for breech, followed by extraction resulting in the stillbirth of an infant weighing 1,9 kg (no fetal heart sounds on admission). The remaining 28 mothers were delivered by Caesarean section. Six healthy sets of twins and 19 singletons were born, while 4 babies were stillborn. The firstborn of each of 4 sets of twins presented with prolapse of the arm The fifth patient had a normal vaginal delivery of the first twin at home, but on admission she had a Bandls' ring, and a Caesarean section was performed. The sixth patient also had home delivery of the first twin and on admission to the hospital the second twin's arm had prolapsed into the vagina. A Caesarean section was performed, and a live baby was delivered. Seventeen patients in this group had pyrexia on admission. There were 15 mothers who remained in hospital for less than 10 days and 12 stayed more than 10 days. Thirteen babies, including 9 of the twins, weighed less than 2,5 kg, and 18, including 2 of the twins, weighed more than 2,5 kg.

Of the 5 babies who were stillborn, 1 was thought to have had feeble heart sounds; at 8 cm cervical dilatation a Caesarean section was performed and a stillborn baby weighing 2,5 kg was delivered. Two patients had no fetal heart sounds on admission, but the cervical dilatation was less than 5 cm. Caesarean sections were performed, delivering 2 stillborn babies, each weighing 2,8 kg. The fourth stillborn baby, weighing 1,9 kg, had had internal version and breech extraction.

There were 3 mothers, paras 6, 9 and 4, who had previous Caesarean scars — the first 2 for the fourth and third pregnancies respectively, and the third mother for the second and fourth pregnancies. All 3 had cervical dilatations of less than 8 cm. In 1 no fetal heart sound was present on admission. Two of the babies survived, each weighing 2,5 kg.

The parities are shown in Table I.

COMMENT

Obstructed labour is a challenge to the midwife and obstetrician; if unrelieved, death of the fetus is the outcome. The mother runs the risk of dying undelivered, from a rupture of the uterus. The mother may deliver, but may succumb to infection from general peritonitis or after fistula formation and the concomitant pelvic infection with or without renal failure.

Success in management of obstructed labour depends on (*a*) early diagnosis; (*b*) early presentation of the mother in the labour ward; (*c*) expert active management to relieve the obstruction.

In our circumstances the Caesarean section offers the best mode of treatment, because the majority of our staff, both medical and nursing, have been trained in countries where obstructed labour has virtually disappeared from the labour wards. It is our policy that Caesarean section be the treatment or management of choice, and vaginal delivery, with or without a destructive operation, is left to experienced and senior medical staff members, even in cases where the fetus is dead, for unless the cervix is fully dilated there will be minimal intra-uterine manipulation under good anaesthesia, and the uterus will contain a fair amount of liquor amnii. Unless these conditions are present, we strongly condemn vaginal delivery in cases of obstructed labour. Symphysiotomy may be offered as an alternative.

There is still a small place for destructive operations in our circumstances: the lack of experienced personnel, the type of pelvis, the not so common severe injuries to the perineum and the complications that follow the so-called easy vaginal deliveries after destructive procedures, make these procedures undesirable. Perhaps the time is ripe for extraperitoneal Caesarean section as practised by Mokgokong and Crichton[1] in Durban to be encouraged. This, we believe, would result in the birth of more healthy babies.

TABLE I. PARITY INCIDENCE

Presentation	Parity										
	0	1	2	3	4	5	6	7	8	9	Total
Brow and face	8	2	0	1	4	4	0	0	0	0	19
Compound presentation	3	1	1	1	0	1	0	0	0	0	7
Transverse lie	0	1	1	1	1	2	1	0	0	0	6
Shoulder presentation with arm or hand prolapse (singletons)	1	2	6	4	3	4	1	0	0	0	21
Shoulder presentation with arm or hand prolapse (twins)	2	1	1	1	0	0	0	0	0	1	6
Total	14	7	9	8	8	11	2	0	0	1	59

In our circumstances we have often witnessed destructive operations performed on so-called well-chosen patients, with disastrous results. We agree with Philpott *et al.*[2] that 'decapitation and extraction is a procedure which has caused rupture of too many uteri . . . if there is evidence of severe thinning of the lower segment any vaginal procedure will rupture the uterus. Caesarean section is the best of the bad alternatives.' Lawson and Stewart[3] agree in principle with this, although they still think that craniotomy is a good operation. This, in our experience, is not so, because in the majority of these cases of obstructed labour the head is high, and even in neglected shoulder presentation cases with the arm prolapsed, the neck has not been stretched sufficiently to allow easy access for decapitation.

Rupture of the uterus is still fairly common in our labour wards,[4] and any procedure or management which prevents its occurrence, is welcome. Crichton and Boulle[5] have enlightened us on this disaster in unscarred uteri and have sounded a clear warning that in the neglected transverse lie, manipulation with a view to vaginal delivery should be done by the experienced. Ampofo,[6] writing in 1969, stated that he found obstructive labour to be the main cause of 59 maternal deaths over a 5-year period in a West African maternity hospital.

In our series, 27 348 deliveries and 1 432 Caesarean sections were performed in 21 months — a heavy workload which taxed our meagre facilities of manpower and equipment. Sixty-three mothers had obstructed labour, 57 of which were single pregnancies, and 6 twin pregnancies. There was no maternal death. and 69 babies were delivered. Sixty babies (85,7%) were delivered alive. Of these, 43 weighed more than 2,5 kg, and 14 were of low birthweight. Three babies' weights were not recorded. There were 9 stillbirths, 2 being macerated. The corrected fetal loss was 11,4%.

The over-all picture is certainly commendable — 1 burst abdomen and 26 patients remaining more than 10 days in hospital because of pyrexia, wound infection and clinical intraperitoneal infection, was the price paid. The latter complication, in our opinion, speaks in favour of extraperitoneal Caesarean section.

We wish to thank the Permanent Secretary for Health for permission to publish. We also wish to thank the medical and nursing staff of the Units of the Department of Obstetrics for their co-operation and vigilance.

REFERENCES

1. Mokgokong, E. T. and Crichton, D. (1974): S. Afr. Med. J., **48**, 788.
2. Philpott, R. H., Sapire, K. E. and Axton, J. H. M. *Obstetrics, Family Planning and Paediatrics. A Manual of Practical Management for Doctors and Nurses*, p. 31. Family Planning Association of Rhodesia.
3. Lawson, J. B. and Stewart, D. B. (1967): *Obstetrics and Gynaecology in the Tropics*, pp. 172 - 218. London: Edward Arnold.
4. Mphahlele, M. (1971): S. Afr. J. Obstet. Gynaec., 9, 45.
5. Crichton, D. and Boulle, P. (1964): Lancet, 1, 360.
6. Ampofo, A. D. (1969): West Afr. Med. J., 18, 77.

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Destructive Operations in Obstructed Labour

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Obstructed labour is still prevalent amongst rural mothers in the developing countries. An incidence of 2.3 per cent and a maternal death rate of 11.4 per cent are enough to indicate its prevalence and the magnitude of the risk involved (Dutta and Pal, 1978). Specialists either trained in urban based institutions of the country or abroad are confused at time, in tackling such cases in odd environments. With this objective, a critical evaluation has been attempted about the use of destructive operations in tackling such cases who are rushed to the referral hospitals in poor condition.

MATERIAL AND METHOD

The materials were collected from the personal series, while the author was attached to the District Hospitals of Jalpaiguri, Suri and Chinsurah, West Bengal, covering the period from 1965 to 1973. During this period, 173 destructive operations were performed amongst 324 obstructed labour cases, showing a frequency of 53.2 per cent. For comparative analysis, the hospital statistics of Suri (1967) and of Nilratan Sircar Medical College and Hospital, Calcutta (1976), were also taken into account.

OBSERVATIONS

Duration of labour—Labour was prolonged for more than 48 hours in 24.9 per cent, between 25-48 hours in 54.3 per cent and less than 24 hours in 20.8 per cent cases.

Causes of obstructed labour—The causes of obstructed labour, which necessitated destructive operations, is shown in the Table 1.

Table 1—*Showing the Causes of Obstructed Labour*

Causes	No. of cases
Contracted pelvis and disproportion	122 (64.7%)
Transverse lie	41 (23.7%)
Occipitoposterior presentation	8 (4.6%)
Face and brow presentation	7 (4.0%)
Hydrocephalus	2 (1.2%)
Foetal ascites	2 (1.2%)
Conjoined twin	1 (0.6%)
Total	173 (100%)

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Craniotomy was done in 129 (74.6 per cent) cases and evisceration in 41 (23.7 per cent) cases. Ascites producing obstruction was relieved by puncture of the foetal abdominal wall in 2 (1.1 per cent) cases. In the single case of undiagnosed conjoined twin of 28 weeks, decapitation was done.

Table 2 shows gross complications after destructive operation.

Table 2—*Showing the Gross Complications After Destructive Operations*

Complication	No. of cases	
Uterine rupture		7 (4.0%)
Craniotomy (129)	2 (1.5%)	
Evisceration (41)	5 (12.2%)	
Vesicovaginal fistula		5 (3.0%)
Complete perineal tear		2 (1.5%)
Maternal deaths		10 (5.8%)

DISCUSSION

Obstructed labour, which is almost a preventable condition and became a forgotten chapter in the obstetrics of the developed countries, is still prevalent in the developing countries, especially in rural areas, comprising about 75 per cent of the population. Ill-nourished mothers, with pre-existing anaemia and frequent co-existing toxaemia, with evidences of sepsis, are rushed to the referral hospitals in poor condition. Due to lack of communication or otherwise, there is inevitable delay in reaching the referral hospitals. As many as 1/4th of the patients in the series were admitted with labour, lasting more than 48 hours.

Place of destructive operation vis-a-vis *caesarean section*—Controversy in teaching and in practice prevails between the developed and developing countries about the use of destructive operations *vis-a-vis* caesarean section in such types of cases. The extensive use of caesarean section in the developed countries was advocated by Myerscough (1977). Emphasising the safety of caesarean section Taylor (1966) even advocated caesarean section in dead babies, especially in transverse lie and face presentation.

Table 3 shows comparative risks in caesarean section and destructive operation in obstructed labour.

Table 3 shows that there was 12.5 per cent of maternal deaths, out of 120 patients who underwent caesarean section, in contrast to that of 5.8 per cent in case of destructive operations. The difference in the death rate was found to be statistically significant ($P < .05$).

Although the materials are not identical, the comparative result of caesarean section and des-

Table 3—*Showing the Comparative Risks in Caesarean Section and Destructive Operations in Obstructed Labour*

Operation	Total No. of cases	No. of maternal deaths	No. of stillborn	No. of neonatal deaths	No. of perinatal deaths
Caesarean section:					
Personal series (1965-1973)	68	6 (8.7%)	15	10	25 (36.8%)
District Hospital, Suri (1967)	27	6 (22.2%)	9	2	11 (40.7%)
Nilratan Sircar Medical College and Hospital, Calcutta (1976)	25	3 (12%)	2	1	3 (12%)
Total	120	15 (12.5%)	26	13	39 (32.5%)
Destructive operations:					
Personal series	173	10 (5.8%)	173	—	173 (100.0%)

tructive operation as shown in Table 3 is enough to indicate that caesarean section is neither safe for the mother, nor appreciably improves the foetal salvage. A fatality of 12 per cent at Nilratan Sircar Medical College and Hospital, Calcutta, substantiates the fact, if the quality of the patient is poor, even improved ancillary aids and good environment cannot improve the results significantly.

There remains no room for controversy in deploying destructive operation where the baby is dead. Similar views have been endorsed by Bhowmick (1974) and Gogoi (1971). Whether it is to be extended selectively, even in a living baby with pronounced effect of obstruction on the mother with sepsis, is to be thought of, as an alternative to caesarean section. Similar view was also expressed by Jhirad (1954). The risk involved in caesarean section, apart from death, has been pinpointed by the author in previous communication (Dutta and Pal, *loc. cit.*). Lister (1960) mentioned of the number of stillbirth to be 10 out of 41 patients, who underwent caesarean section, having audible foetal heart sound at the beginning of the caesarean section. In the present series, out of 65 patients with audible foetal sounds at the beginning of the caesarean section, 15 gave birth to stillborn babies.

Craniotomy—It is the commonest method of extraction of the baby in obstructed labour (3/4th in the series). One may find at times difficult to introduce a catheter to empty the bladder which is only possible with decompression of the head following perforation leading to the escape of the brain matter. While in hydrocephalic head, a pair of sharp pointed scissors is enough to perforate the skull, in others a perforator have to be used. Because of too much moulding of the head and formation of big caput, the suture line is mostly not demarcated but the perforation may be done in the dependent area of the vertex. After decompression of the head the extraction of the baby is completed by either using cranioclast or giant vulsellum (Lyon's forceps) holding the perforated margin. Care should be taken during delivery of the shoulder to avoid perineal injury.

Decapitation or evisceration—The classic teaching to relieve obstruction in transverse lie is decapitation if the neck is easily accessible and evisceration if the neck is high up. Whatever method is employed, the theme is decompression with minimum intra-uterine manipulation. There should not be any dogmatism and the individual can employ his conversant skill and judgement best suited for the case and the environment. The author performed evisceration in all cases even as an alternative to decapitation. Decompression could be achieved with minimal intra-uterine manipulation, a pair of sharp pointed scissors and 2 giant vulsellum forceps are the only instruments required (sharpness of the knife attached with decapitation hook is probably lost after 2 operations) and can be employed whether the neck is accessible or not. After taking out the viscerae, the trunk is delivered using 2 giant vulsellum forceps giving successive traction until the podalic pole is delivered. In case of difficulty spondylotomy may be done. This is followed by delivery of the rest by breech extraction.

Exploration following destructive operation—Routine exploration of uterus following destructive operations should be mandatory. It is indeed difficult at times to detect the rent because of soft, thin and flabby lower segment. All the 7 cases so detected were promptly dealt with by hysterectomy without fatality. In 5 out of 7 cases, the margins of the rent were found gangrenous with thrombosed blood vessels suggestive of sloughing of the tissues by pressure necrosis and in fact those were cases of pre-existing unsuspected uterine rupture and should have been dealt with by primary laparotomy.

Routine postoperative bladder drainage—Continuous catheter drainage is a must following destructive operation. Not only it gives adequate rest to the bladder but by preventing repeated catheterisation minimises chance of infection. Cumulative effect of these favour healing of the bladder necrosis, if any. How long the catheter is to be put in depends on the degree of obstruction, colour of urine and regaining of bladder tone. One may have to keep it for 48 hours to as long as 7 days or more. In the present series out of 5 sloughing vesicovaginal fistulae, 3 developed soon after operation and 2 developed on the 3rd day. In all the cases, the duration of labour had been more than 48 hours. Continuous catheter drainage was given in 4 cases up to 2 weeks. In one, it was kept for 3 weeks when there was spontaneous closure of the fistula.

Prevention of perineal tear—In long-standing obstructed labour, the perineal and the adjoining tissues become oedematous and infected and one is tempted to deliver the baby without episiotomy especially in primigravida, rightly so because of inevitable non-union of the wound. While the compressed head could be delivered uneventfully without damaging the perineum, one should take an attitude of caution in delivering the shoulder. Preliminary cleidotomy either unilateral or bilateral minimises the girth of the shoulder and thereby prevents injury of the perineum.

Maternal Mortality—There was 10 maternal deaths, 4 within 24 hours and 6 after varying interval between 3-7 days. The causes of deaths were due to combined effect of dehydration, sepsis and anaemia. Rapid infusion of few bottles of 5 per cent glucose to correct ketoacidosis soon after admission, administration of appropriate antibiotics and blood transfusion are the essential adjuvant to reduce the death rate.

SUMMARY

Consecutive 173 destructive operations performed in 325 obstructed labour cases, giving a frequency of 53.2 per cent were analysed. Comparative maternal risk in caesarean section and destructive operation in obstructed labour showed statistically significant increase of maternal deaths in the former ($P < .05$). Craniotomy was done in 74.6 per cent and evisceration in 23.7 per cent cases. Practical guidelines about the steps of destructive operation were discussed. Complications included uterine rupture in 7, vasicovaginal fistulae in 5, complete perineal tear in 2 and maternal deaths in 10 (5.8 per cent).

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REFERENCES

BHOWMICK, A. C.—*J. Obstet. Gynaec. India*, **24**: 9, 1974.

DUTTA, D. C. and PAL, S. K.—*Ibid.*, **28**: 55, 1978.

GOGOI, M. P.—*J. Obstet. Gynaec. Brit. Comm.*, **78**: 373, 1971.

JHIRAD, J.—*J. Obstet. Gynaec. India*, **5**: 231, 1954.

LISTER, U. G.—*J. Obstet. Gynaec. Brit. Emp.*, **67**: 188, 1960.

MYERSCOUGH, P. R.—Munro Kerr's Operative Obstetrics, 9th ed., 1977, Bailliere Tindall, London, p. 573.

TAYLOR, E. S.—Beck's Obstetrical Practice, 8th ed., 1966, Williams and Wilkins, Baltimore, p. 549.

3

Lung Abscess

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The importance of lung abscess, as a therapeutic challenge to the clinicians, has steadily declined since the advent of antibiotics (Walcott, 1957 ; Ghosh *et al.*, 1966 ; Saha, 1966 ; Chakraborty and Naidu, 1966; Shankar, 1969 ; Jha *et al.*, 1972 ; Nigam *et al.*, 1973 ; Chidi and Mendelsohn, 1974). Besides modern anaesthesia, refinements in the techniques of oropharyngeal surgery and better understanding of its pathogenesis have contributed considerably towards this end. Consequently, many lung abscesses get arrested in the stage of pneumonitis and mortality and morbidity rates have also remarkably diminished. Newer antibiotics have further augumented the aramentarium (Chidi and Mendelsohn, *loc. cit.*). However, this trend is still quite slow in developing countries where the incidence of suppurative lung diseases is still high (Misra *et al.*, 1969). Naturally, this continues to be a major health problem. This presentation aims at documenting the experience in the management of 32 consecutive cases of lung abscess treated at the institution and attempts to update its treatment relevant to the needs of the developing world with a brief review of related literature.

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Postnatal care*

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This is the last in a series aimed at outlining the essential elements of an obstetric service run by a nonspecialist doctor working in a district or mission hospital. Although postnatal care is the last activity performed in the management of pregnancy, it is not the least important. It is, however, a relatively circumscribed subject, ideally suited for delegation to midwives or other staff, e.g. clinical officers, provided clear protocols of management are available. This policy of delegation with supervision has been stressed in other contributions to this series.

We can begin with an aspect of care which affects every mother delivered of a living baby, and that is the contact which occurs between mother and baby after birth. The ways in which immediate skin-to-skin contact promotes bonding, and the beneficial effect early breastfeeding has on subsequent breastfeeding performance have been widely documented. This can be seen in an extensive review of the subject[1]. Although it is invariably midwives who implement such a policy, it is the responsibility of doctors to see that it is put into practice. A rule that breastfeeding should be begun in the labour ward makes supervision of the policy more possible.

SEPARATION OF ABNORMAL FROM NORMAL CASES

After a normal pregnancy and labour, and a spontaneous delivery, mothers require little except hygienic surroundings, rest and observation by midwives. However, not every woman is so fortunate, and many do require very careful and frequent nursing and medical care. In the crowded conditions common in maternity units in developing countries such patients can easily be overlooked among the mass of healthy mothers. In these conditions the first essential to ensure efficient postnatal care is a physical separation of normal from abnormal cases. If a separate ward cannot be provided, then at least certain beds must be put aside for the purpose, so that midwives and doctors may identify those needing special care. Guidelines as shown in Table 1 will ensure that such a policy is implemented efficiently.

Table 1. Patients requiring admission to abnormal postnatal ward

Category 1: Complications of pregnancy	*Care required*
Anaemia	Investigation and treatment of persistent abnormality. Advice about recurrence
Hypertensive disorders of pregnancy	
Bad obstetric history	
Antepartum haemorrhage	
Almost all conditions which result in antenatal admission	
Category 2: Complications of labour	
Caesarean section	Post-operative care. Advice about recurrence
Ruptured uterus	
Destructive operations	
Instrumental deliveries (except for low vacuum extractions)	
Symphysiotomy	
Retained placenta	
Postpartum haemorrhage	
Third-degree perineal tears	
Category 3: Fetal and neonatal disorders	
Stillbirth	Sympathetic understanding of midwives and doctors. Advice about causation. Advice about recurrence
Congenital abnormality	
Growth retarded fetus	
Pre-term infant	
Baby at risk for social reasons, e.g. unmarried or very young or old mother	
Baby in neonatal nursery for any other reason	

INFLUENCING THE OUTCOME OF FUTURE PREGNANCIES

By giving good advice to patients and by recording our findings and opinion about how the next pregnancy should be managed, we can influence the outcome of future pregnancies. The more usual forms of advice required concern the need for antenatal clinic attendance, and the need for hospital delivery because of the likely recurrence of an abnormality. The need for an elective Caesarean section in the next pregnancy must also often be explained; less frequently patients must be advised that future pregnancies should be avoided, and sterilization offered. Such advice is often not initially understood and, if it is, is readily forgotten. Midwives therefore need encouragement to repeat

*Last of a series on The Essentials of an Obstetric Service. See also: Volume 17 (1987), pages 77, 124, 174; Volume 18 (1988), page 25

it with further explanation when they can, and routinely on discharge of the patient.

The more certain way of having this advice and opinion about future management acted on is to record it on a permanent record kept by the mother. Optimally this will be a specially designed "mother's card" which contains space for details of a woman's entire reproductive history. Such a document can be as essential to the mother as an under-5 clinic card is to her child, and yet is lacking in many maternity services. The best alternative is to record the details on a stiff cardboard outpatient card. These are often kept for years, in contrast to notes written on ordinary paper. A letter written to a referring doctor or midwife, and the hospital inpatient notes are the documents least likely to be available when needed.

The value of passing on details of a pregnancy and delivery can be illustrated by taking an example from each of the three main reasons for admission to the abnormal postnatal ward.

Antenatal problem: A patient had persistent unstable lie, and congenital uterine abnormality was finally diagnosed at Caesarean section. Record this and what type of abnormality you found. This will make it clear that elective Caesarean section will be needed in the next pregnancy if the lie is again unstable.

Problems of labour: A stillborn infant was delivered by vacuum extraction after a prolonged labour at home. Postnatal pelvic examination showed the pelvis to be contracted and lateral erect X-ray pelvimetry confirmed this. Record this and your opinion that elective Caesarean section will be necessary in future. If these details are not known, the woman may be allowed to labour again next time, with the same fatal result for the infant.

Fetal or neonatal problems: In a case of intrauterine death with a fresh stillbirth the baby was light for dates (below the 10th centile of weight for gestation), and the placenta was small and infarcted. There was no fetal abnormality and so intrauterine growth retardation was suspected. From other clinical details you may have decided that the vital factor in antenatal care in the woman's next pregnancy will be the early treatment of hypertension or regular treatment with antimalarials, or nutritional supplements, or rest and observation in hospital, or all of these. Record these clearly. Initial care may be undertaken by a midwife in a peripheral clinic, who might otherwise take no action.

Investigation of cause of perinatal death

Before leaving the subject of the information and advice patients require, we must give further attention to the subject of perinatal death. Although in traditional culture such a happening is often not questioned but attributed to a misdemeanour of one or other parent, this must not dissuade us from looking hard for the cause.

The mother's obstetric history and the clinical features of the pregnancy and labour may make diagnosis obvious. Nevertheless, there should be a standing order in the labour ward that all stillborn babies and their placenta, and the bodies of all babies dying early in the neonatal period should be kept for examination. A scheme for investigation is shown in Table 2, although it is recognized that many of these tests will not be possible under the conditions of rural hospitals. To make a diagnosis of the many possible congenital syndromes it is helpful to have a book of illustrative photographs. If chromosomal analysis of the baby's tissues is not possible the parents can be sent for karyotyping at a later date.

COMMON CLINICAL PROBLEMS

A number of clinical problems are so common in the puerperium that there should be an agreed plan of management, preferably detailed in a ward protocol. Ward staff can then investigate and

Table 2. Investigation of perinatal death

	Look for evidence of:
Baby	Congenital abnormality, trauma, hydrops, growth retardation, macrosomia of diabetes mellitus
Placenta	Abruption, infarction, small size in relation to baby
Cord	True knots, abnormal vessels
Further investigation on baby	
X-ray for skeletal abnormalities	requiring increasing facilities and expertise
Bacterial culture from blood, skin and pharynx	
Autopsy	
Chromosomal analysis	
Maternal investigations	
Serological tests for syphilis	in all unexplained stillbirths
GTT within first week of puerperium	
Viral studies	where appropriate
Sickling test	

have sub-epicranial haematomas containing more than 200 ml. of blood.

It is claimed by enthusiasts that the vacuum extractor can be used to flex and draw down the head to a level at which forceps can be used successfully. The writer has no personal experience of this: even if the procedure is worth employing when labour is delayed solely by ineffective uterine action (which is doubtful), it is not likely to be helpful when labour is obstructed by disproportion.

If labour is obstructed by a combination of disproportion and malrotation, there is no doubt that Kielland's forceps are more effective, but the efficiency is achieved at the risk of damage to both the fetus and the mother. Comparison between the two instruments merely emphasizes that both the vacuum extractor and the obstetric forceps are seldom suitable for completing delivery when labour is obstructed by cephalo-pelvic disproportion. The beginner, however, may do less harm with the vacuum extractor, particularly if he is wise enough to desist after three pulls if they have not produced considerable progress in rotation and descent of the head.

One useful function of the vacuum extractor in obstructed labour, however, is to complete delivery after symphysiotomy. In these circumstances it is extremely valuable, and far less dangerous to the mother than obstetric forceps.

Symphysiotomy

Enlargement of the pelvis by dividing the symphysis pubis is one way of dealing with a common problem in tropical obstetrics. This is posed by the patient who arrives in hospital with labour obstructed by cephalo-pelvic disproportion, having so far received no obstetric care. The fetus is still alive: a difficult forceps delivery would almost certainly result in a stillbirth and possibly in severe maternal injury. Caesarean section is also unattractive, because of the very real risk of rupture of the scar in a future unsupervised labour. In such a case, the balance of risks between this and the possible sequelae of symphysiotomy may justify division of the symphysis, provided it is correctly performed on carefully selected patients.

The value of symphysiotomy has until recently been obscured by the uncritical enthusiasm of its advocates, especially those anxious to avoid repeated Caesarean sections because of the eventual necessity for sterilization. However, Seedat, Lasbrey and Crichton of Durban have now exhaustively evaluated symphysiotomy and have perfected a safe technique.

Indications. The great difficulty is to decide when symphysiotomy is indicated. Too ready recourse to it will result in unnecessary operations in cases when spontaneous delivery would occur in time. On the other hand, if it is performed when disproportion is too gross, either vaginal delivery

will not follow and Caesarean section will still be necessary (the worst of both worlds), or delivery will take place at the cost of excessive separation of the symphysis which may result in serious urinary and locomotor disabilities.

In the opinion of the writer, the operation undoubtedly has a place in the relief of *established* obstruction due to contracted pelvis, but it should not be employed to *anticipate* obstruction; that is, not in the planned management of labour complicated by disproportion. If its use is limited in this way, unnecessary symphysiotomies will be avoided.

It should be confined to patients who have had no previous obstetric care, or at least to poor attenders at antenatal clinics and those who live far from medical aid. These are the women who are particularly exposed to the risk of ruptured scar in subsequent labours if a Caesarean section is performed.

Disproportion must be of moderate degree only: not more than half of the fetal head should be still palpable above the pelvic brim. Asymmetry of the pelvis or extreme degrees of contraction (true conjugate less than 8 cm. or brim area less than 70 sq. cm.) or a very large fetus (one estimated to weigh more than 9 lb. or 4 kg.) are contra-indications to symphysiotomy.

The cervix must be at least half dilated: the head will descend into the pelvis after it has been enlarged and fit snugly into the cervix, which will reflexly stimulate better contractions: full dilatation of the cervix and expulsion of the fetus should then soon follow.

Symphysiotomy is contra-indicated if labour is obstructed by a breech, brow or mento-posterior face presentation. In the opinion of the writer, a "crash" symphysiotomy has no place in the delivery of an arrested aftercoming head.

Symphysiotomy should not be performed on a woman with a pre-

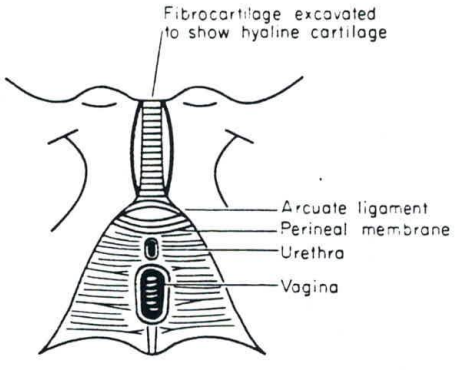

FIG. 11.7. Anatomy of the symphysis pubis. (From Crichton, D. and Seedat, E. K. (1963). *S. Afr. med. J.*, 37, 227).

existing locomotor disturbance (such as hip joint disease), or gross obesity. Minor degrees of sacro-iliac instability after the operation may be crippling when superimposed on these conditions.

In a patient who has been sectioned before, symphysiotomy should not be used to avoid repeating the operation. A scarred uterus should not be expected to withstand the extra strain required to overcome disproportion.

Lastly, the fetus must of course be alive. If it is dead, craniotomy and extraction is obviously the proper treatment.

Points of technique. The subcutaneous closed technique is recommended. The operation is performed in the lithotomy position after infiltration with local anaesthetic. The legs are supported by assistants to limit abduction of the thighs to an intervening angle of 80 degrees, to prevent excessive separation of the symphysis.

Before dividing the joint, a catheter is placed in the urethra. The plate of fibro-cartilage in the middle of the joint (*see* Fig. 11.7) is identified with a needle, which is left in position as a guide. A stab incision is then made with a strong, solid-bladed scalpel through the central plate, 0·5 cm. below the upper border of the symphysis. This incision is extended downwards to divide the lower half of the symphysis and arcuate ligament, stopping short of the perineal membrane, and then upwards to complete the transection of the joint. The fingers of the left hand in the vagina displace the urethra to one side to prevent it from being injured, and warn when the knife is penetrating too deeply through the joint.

The incision must be made strictly in the midline. This avoids injury to the hyaline cartilage covering the articular surfaces of the pubic bones (*see* Fig. 11.7), and thus limits post-operative pain in the symphysis and reduces the risk of osteitis: it also considerably reduces the amount of bleeding.

After the joint has been divided, the two sides will be felt to separate. *This separation should be limited to 2·5 cm.,* which corresponds to a gap which will just take the thumb. This enlarges the capacity of the pelvis by up to 25 per cent, the main expansion, of course, being in the transverse diameter. Wider separation than this will strain the sacro-iliac joints and endanger the perineal membrane: if this is damaged, disturbance of the control of micturition will result.

The head usually starts to descend as soon as the symphysis separates. *At this point, it is essential to perform a wide episiotomy in all cases.* This prevents excessive stretching of the anterior vaginal wall: without it, vestibular tears are common, sometimes involving the urethra.

Descent of the head must be controlled, as anterior lacerations will be produced if it is too rapid. It is wise to adduct the thighs during delivery of the head to prevent excessive separation of the symphysis. *The thighs should*

never be forcibly abducted to increase the separation of the joint: tremendous leverage can be exerted which may cause severe damage.

If spontaneous delivery does not occur very soon after the symphysis has been divided, the vacuum extractor should be applied to the fetal head, which is then delivered by controlled traction downwards and backwards. *Obstetric forceps should not be used, and rotation with Kielland's forceps is especially dangerous.* The forceps blades increase the distension of the vagina and thus the risk of anterior lacerations. Rotation with forceps is particularly liable to damage the unsupported urethra and bladder neck.

After delivery, the divided symphysis is compressed for some minutes between the fingers in the vagina and the thumb in front of the joint to expel clot and arrest venous oozing. When the third stage of labour is complete, the episiotomy and any lacerations are repaired, and the skin incision over the symphysis is closed with a single stitch. A Foley's catheter with a 5 ml. bulb is inserted for continuous drainage of the bladder, the legs are adducted and lowered and the knees are strapped together temporarily for 24 hours.

Aftercare. The patient is kept in bed for 3 days and nursed on her side: at the end of this period the catheter is removed and the patient is allowed to sit out of bed. Ambulation begins on the fifth day, with the aid of rubber-tipped walking sticks. If the patient is very unstable initially, a broad belt encircling the great trochanters is helpful, although not necessary as a rule. The patient is usually walking well with minimal symptoms by the tenth day, but undue muscular effort and lifting weights should be avoided for at least a further month.

Complications. Sepsis and haematomas at the site of operation and injuries of the urethra and bladder neck should be very rare if the operation is limited to suitable cases and the correct technique is employed.

Stress incontinence is a fairly common sequel to symphysiotomy, but full control of micturition is usually rapidly regained without specific treatment.

Locomotor disturbances are particularly important in communities where the women do strenuous work on the farms or carry heavy weights on their heads. Laxity of the sacro-iliac joints usually results from excessive separation of the symphysis during delivery, and should be avoided by following the rules laid down above. However, pubic pain and backache may persist for a long time, and constitute the main objection to the operation.

Pregnancy and labour after symphysiotomy. The divided joint heals by fibrous union: along with the pelvic ligaments, this softens during subsequent pregnancies, which may lead to pelvic instability. As a result, a woman who has previously had no symptoms may suffer from pubic pain

CHAPTER TWELVE

Sequelae of Obstructed Labour

J. B. Lawson

Rupture of the uterus

In the previous chapter the response of the uterus to obstructed labour was described. If the obstruction is not relieved, the overstretched lower segment will eventually rupture spontaneously. Rupture may also be induced by oxytocics or by operations for the relief of obstruction which further distend the vulnerable lower segment.

The liability of the uterus to rupture in obstructed labour is influenced by parity to some extent. Spontaneous rupture is very rare in a first labour, although it does occasionally occur after very prolonged obstruction The grande multipara, on the other hand, is at particular risk because her uterus is weakened by an increased proportion of fibrous tissue. However, the peak incidence of spontaneous rupture is in third and fourth labours: presumably this is because, after the second pregnancy, the progressive increase in birth weight is likely to produce a fetus large enough to cause obstruction when the pelvis is contracted.

Spontaneous and induced ruptures of the uterus following obstructed labour all start in the lower segment, although they may extend into the upper segment. It is customary to distinguish between complete and incomplete ruptures, depending on whether the peritoneal coat is involved. This is unimportant, however, as the treatment is the same.

The anterior wall is most commonly involved, in which case the direction of the tear is usually transverse, often with a vertical extension at one end which makes the defect L-shaped: sometimes the neighbouring bladder is also torn. Longitudinal ruptures of the lateral wall of the lower segment are quite common, and may extend up to the fundus or downwards into the vagina. These lateral tears open up the broad ligament and may involve the uterine artery or its main branches. Posterior ruptures are least common and are usually transverse. Occasionally multiple ruptures occur, in which case the uterus may be almost detached.

Diagnosis

Dramatic symptoms are unusual at the moment of spontaneous rupture

in an obstructed labour. There is no sensation of something having given way, such as is felt when a Caesarean scar ruptures, nor is cessation of labour pains obvious, as intermittent uterine contractions have usually already been replaced by tonic contraction before rupture occurs. If the rupture involves major blood vessels in the broad ligament, intraperitoneal haemorrhage soon produces collapse, but more commonly signs of shock develop at the end of a period of slow deterioration. The appearance of blood at the vulva when labour is obstructed usually indicates that the uterus is rupturing. Blood in the uterus may not be able to escape if the presenting part is firmly impacted, however, so this important sign is not always present. If palpation of the lower segment produces severe pain, this is very significant, and it is later followed by generalized tenderness all over the abdomen as blood and liquor leak into the peritoneal cavity. The contour of the uterus may alter when part of the fetus begins to extrude through the rent.

In view of the difficulty of diagnosing rupture of the uterus in its early stages, it is wise when in doubt to anaesthetize the patient in an operating theatre prepared for both operative vaginal delivery and for laparotomy. Further examination may then confirm that rupture has occurred, or the tear may be felt during extraction of the fetus. If so, vaginal manipulations must be abandoned immediately and the abdomen opened, as otherwise extension of the rent and removal of the tamponading effect of the fetus will increase the blood loss.

In patients seen at a later stage, when the fetus has already been extruded into the peritoneal cavity, clear physical signs usually make the diagnosis obvious, although the patient often experiences a temporary feeling of relief. The tense uterus no longer fills the centre of the abdomen, which becomes flattened, with generalized distension filling out the flanks. Tenderness all over the abdomen becomes more marked, and a fluid thrill and shifting dullness can often be elicited. The fetal limbs usually become abnormally easy to feel, and the presenting part may move away from the pelvic brim into which it was previously firmly impacted. The empty uterus can sometimes be felt separate from the fetus either in front of it or to one side, although it may be concealed behind the fetus.

Catheterization of the bladder is usually easy as the urethra is no longer compressed by the impacted presenting part. The urine is nearly always blood-stained: if copious bright red blood escapes through the catheter the rupture has probably involved the bladder. Vaginal examination may confirm that the uterus is empty, but more commonly the lower pole remains in the uterus after the rest of the fetus has escaped through the rent. In these circumstances, gentle upward pressure on the presenting part shows it to be surprisingly mobile, and displacement releases a gush of blood.

The placenta usually follows the fetus into the peritoneal cavity, but

occasionally it is expelled per vaginam. In an obstructed labour, the appearance of the placenta at the vulva when the fetus is still undelivered indicates rupture of the uterus.

Sometimes the rupture may not be discovered until after the fetus has been removed vaginally, particularly if it has been induced by an obstetric manoeuvre. The importance of digital exploration of the lower segment immediately after all vaginal operations to relieve obstructed labour has already been stressed.

The diagnosis is easily missed in cases seen for the first time an hour or two after delivery, as vaginal bleeding and shock may be attributed to haemorrhage from the placental site. If a patient who is in shock after a difficult delivery of a stillbirth does not immediately respond to liberal blood transfusion, rupture of the uterus should be suspected, particularly if the placenta is still retained.

Occasionally patients are brought to hospital many hours or even days after a delivery during which the uterus has ruptured. Abdominal distension develops very quickly due to reflex ileus, and a tender broad ligament haematoma may be felt beside the uterus: this is commonly accompanied by retention of urine. In later cases, general peritonitis may be already established, and sometimes loops of intestine are found prolapsed into the vagina through the rent in the uterus, which carries a grave prognosis.

The differential diagnosis of rupture of the uterus is not as a rule difficult. However, it should not be forgotten that collapse during an obstructed labour does not necessarily mean that the uterus has ruptured, as circulatory failure may be the sequel of intrapartum sepsis, dehydration and electrolyte imbalance. Massive concealed haemorrhage due to abruptio placentae, in which there is severe shock coupled with a tense, tender uterus, absent fetal heart sounds and vaginal bleeding, is not preceded by prolonged labour, but the physical signs may lead to misdiagnosis if the patient is too ill to give a history. However, vaginal examination is conclusive, as in abruptio the cervix is usually closed or only slightly open. A full-term extra-uterine pregnancy can be mistaken for a fetus which has been extruded through a uterine rupture, although again the history and vaginal findings are distinctive.

It is much better to diagnose rupture of the uterus too readily than to miss it, as any delay gravely impairs the patient's chances of survival.

Management

Attempts to repair uterine ruptures per vaginam are ineffective and dangerous, except occasionally when a cervical tear has extended an inch or two into the lower segment. Packing the rent from below usually does more harm than good; with the whole hand in the vagina, however, massive

bleeding after an induced rupture can sometimes be temporarily arrested by pressing a rolled-up perineal pad through the rent firmly against the pelvic sidewall while preparations for laparotomy are completed.

Almost all ruptures of the uterus must be dealt with by the abdominal route, and speed is vitally important: even if the patient's condition may still appear to be quite good, it will soon deteriorate. In the need for haste resuscitation must never be neglected: superimposed on the effects of the preceding labour, shock from blood loss may otherwise be fatal.

An intravenous drip must be set up immediately in all cases, starting with 5 per cent glucose. A large vein in the arm should be chosen to ensure a rapid flow, and if there is any difficulty in inserting a wide-bore needle, a cannula should be introduced by the cut-down technique without hesitation. Meanwhile, the patient's blood group is determined, and if stored blood is available the first bottles are given very rapidly after the quickest possible cross-matching has been done (*see* Appendix I). Since massive transfusion is almost always required, at least five bottles should be prepared, particularly as hypofibrinogenaemia occasionally increases the blood loss. If blood is not available, the circulation may have to be maintained with plasma but this, of course, is much less effective.

It is not often possible to complete the resuscitation of the patient before beginning the operation, as the rise of blood pressure increases the bleeding, but at least the laparotomy should not be started until the patient's condition is improving. However—usually when insufficient blood is available—the patient occasionally remains so deeply shocked that her blood pressure cannot be raised to recordable levels. In these circumstances it may be necessary to operate with the circulatory failure uncorrected, a forlorn hope which sometimes ends in success. An improvement often follows the removal of the fetus from the peritoneal cavity, and with the abdomen open 1 or 2 pints can be transfused under pressure direct into the common iliac artery, which usually has a dramatic effect.

Resuscitation must be continued energetically during the operation. The aim should be to maintain the systolic blood pressure above 100 mm. throughout, so that unsecured bleeding points are revealed and dealt with before the abdomen is closed, which prevents reactionary haemorrhage later. The importance of starting the treatment of sepsis as soon as possible with intravenous antibiotics should not be forgotten.

Surgical technique. As soon as the abdomen is open, if the patient is still undelivered the fetus and placenta are removed. If they are free in the peritoneal cavity this offers no difficulty, but if only part of the fetus is extruding through the rent this should be extended towards the midline to permit removal of the fetus and placenta through it. In posterior ruptures, it

is usually necessary to make a transverse incision through the anterior wall of the lower segment to evacuate the uterus.

When the uterus is empty, it should be eventrated and carefully inspected, including the posterior wall where there may be an unsuspected second rupture. Any obvious arterial spurters are then tied off, and oozing from the depths of the broad ligament is temporarily arrested by pressure with a hot pack. The rent in the uterus must now be dealt with.

The aim should be to secure haemostasis and close off the infected birth canal from the peritoneal cavity as quickly as possible, producing the minimum shock in the process. As a rule, repairing the rent is easier and quicker than hysterectomy, except when the rupture is very extensive. The decision to repair the uterus should not be influenced by a desire to conserve childbearing function or menstruation, nor should hysterectomy be performed just because it removes a damaged and infected organ. *The correct procedure in each individual case is the one which is shortest and produces the least shock, and thus gets the patient off the operating table in the best condition.*

When repairing the uterus, no attempt should be made to excise the edges of the tear or to repair the defect in layers to produce a sound scar. The irregularity of the rent and the widespread infarction and softening of the muscle makes this impossible when the rupture has followed obstructed labour (although it is often practicable when repairing a ruptured Caesarean section scar). The defect should therefore be rapidly closed with a continuous haemostatic suture which takes large bites through the full thickness of the muscle.

When repairing anterior transverse ruptures, particular care must be taken to avoid penetrating the posterior wall of the bladder and including it in the sutures. It is therefore wise first to reflect the bladder downwards off the inferior flap of the lower segment, as in a Caesarean section, so that it is well out of the way.

Lateral ruptures are more difficult to deal with than anterior ones because efforts to control associated haemorrhage from the depths of the broad ligament endanger the ureter. After opening the peritoneal roof of the broad ligament widely to give access, visible bleeding points should be tied off individually. Often there is also a general ooze which has to be dealt with by under-running stitches. These may catch the ureter, particularly if they include the posterior leaf to which it is related. To prevent damage to the ureter in these cases, it should be identified on the pelvic sidewall and traced down, if necessary passing a tape under it with which to draw it out of the way.

The repair of a lateral longitudinal rupture should start at the apex of the tear and work downwards: traction on the running suture will then bring the depths of the tear into view. The repair should stop short of the inferior

margin, to leave a defect through which a strip of corrugated rubber is passed into the vagina to drain the cavity in the broad ligament. If there is still much oozing here, before closing the visceral peritoneum the cavity can be packed with gauze bandage which is brought out into the vagina instead of the rubber drain.

Because the scar of the repair is very likely to rupture in a subsequent pregnancy, particularly if labour becomes obstructed again, *the Fallopian tubes should be tied before closing the abdomen.* This can be done without appreciably lengthening the operation.

The alternative surgical management, hysterectomy, is simple when it is confined to cases where the uterus has been almost detached by very extensive damage to the lower segment. It is also usually indicated in posterior ruptures (which are difficult to repair), especially if the fetus has had to be removed through an anterior transverse incision, which will leave only the lateral walls intact.

No attempt is made to remove the cervix. The tubes and ovaries are conserved in the usual manner and, after securing the vascular bundles on either side of the isthmus, the part of the lower segment which remains intact is divided between clamps and oversewn. Having secured haemostasis in the broad ligaments in the manner already described, a continuous suture across the pelvis closes both the visceral peritoneum and the stump of the uterus in a single layer.

Occasionally, the bladder is also torn when the anterior wall of the lower segment is ruptured. Handling the bruised and haemorrhagic tissues very gently, the bladder should be dissected down off the lower segment, taking care not to extend the rent in the bladder wall. When its margins are mobilized and clearly exposed, the defect is accurately repaired in two layers. The bladder should subsequently be drained with an indwelling catheter for 14 days. If the patient is in poor condition and the need to complete the operation is therefore urgent, it may be necessary to close the bladder quickly over a wide-bore suprapubic tube. A vesico-uterine fistula is quite likely to follow, which will have to be dealt with later (*see* Chapter 29).

There appears to be little advantage in draining the peritoneal cavity after dealing with a ruptured uterus. Peritonitis is almost inevitable, but is usually controlled by systemic antibiotics. Localized collections of pus can be drained later as they occur, although they are surprisingly infrequent. Extraperitoneal drainage into the vaginal vault is a different matter, and the method described above is strongly advocated for all cases in which the broad ligaments have been opened up. Otherwise, a pelvic abscess from an infected haematoma is very likely.

After-treatment. In the first few hours after operation it is most important to complete the correction of shock by liberal blood transfusion.

When the blood volume has been made up, the keto-acidosis resulting from the preceding obstructed labour must be dealt with along the lines described in Chapter 11, whilst keeping a careful watch for circulatory overload and pulmonary oedema.

Sepsis must be energetically treated from the outset by broad-spectrum antibiotics by the intravenous or intramuscular route. On the assumption that peritonitis is certain to develop, it is wise to pass a Ryle's tube soon after recovery from the anaesthetic, so that continuous gastric aspiration can be begun immediately. This is maintained for at least the first 48 hours, with appropriate intravenous replacement of fluid and electrolytes, until the bowel sounds return and the aspirate is normal. The gastric tube can then be removed and oral feeding cautiously begun.

Prognosis

The prospects for survival depend firstly on the duration of the interval between the rupture of the uterus and the start of effective treatment, which emphasizes the importance of early diagnosis. Secondly, the speed and effectiveness of resuscitation is decisive, particularly the provision of large quantities of blood for transfusion. Thirdly, competent surgery and anaesthesia are important, although less so than the first two factors mentioned. Fourthly, energetic after-treatment will preserve the life of patients who have survived the initial surgical phase: skilled nursing plays a large part in this.

An analysis of 91 consecutive cases treated in Ibadan between 1953 and 1959, 37 of whom died, emphasizes these points. Of 11 patients who died without surgical treatment, in 3 the rupture was not diagnosed until after death and 8 others could not be made fit for operation. Eighteen patients who were operated upon died within 24 hours, 8 of them on the table: incomplete correction of shock was the main factor in these deaths. Eight more patients died between 24 and 72 hours after operation, of general peritonitis. There were no deaths from reactionary haemorrhage or pulmonary complications. None of those who were still alive after 72 hours died subsequently, although their convalescence was often very stormy.

Seventy-two per cent of the patients survived in the last two years of the period reviewed, compared with only 56 per cent in the first five years. The improvement was largely due to much more stored blood being available. More recent experience has shown that the salvage can be raised to about 90 per cent, but patients who are already moribund when admitted make further improvement beyond this figure unlikely.

As far as remote prognosis is concerned, intestinal obstruction from adhesions is the main hazard. If those treated by repair of the rupture are not sterilized, however, there is a grave danger of death from rupture in a

subsequent pregnancy or labour. The forceful statement of Etienne Tarnier at the Paris Congress of Obstetrics in 1897 cannot be improved upon: "If a woman in the battle to reproduce her race has ruptured her uterus, she should be invalided from the service, for it is not with cripples that an army takes the field."

Suggested further reading

BOULLE, P. and CRICHTON, D. (1964). Rupture of the unscarred uterus. *Lancet*, **i**, 360.

KRISHNA MENON, M. K. (1962). Rupture of the Uterus. *J. Obstet. Gynaec. Brit. Emp.*, **69**, 18.

HASPELS, A. A. (1961). *Uterine rupture in Central Java*. Oosterbaan and Le Cointre N. V., Goes, Netherlands.

MOIR, J. C. (1964) *Munro Kerr's Operative Obstetrics*. 7th Edition. Baillière, Tindall and Cox, London. Chapter 32.

EASTMAN, N. J. and HELLMAN, L. M. (1966) *Williams' Obstetrics*. (13th Edition). Appleton-Century-Crofts, New York. Chapter 34.

LATER SEQUELAE OF OBSTRUCTED LABOUR

Lower genital tract injuries

Unrelieved obstructed labour may cause very severe damage to the lower genital tract. This results from necrosis of the soft tissues subjected to prolonged compression between the maternal pelvis and the presenting part of the fetus. Sepsis increases the area and depth of the sloughing which follows. In many cases, the full thickness of the vaginal wall is involved. Sometimes the whole vagina may be sloughed piecemeal, and very occasionally it comes away as a complete cast.

Necrosis deep to the anterior vaginal wall may involve the posterior wall of the bladder and urethra, in which case a vesico-vaginal fistula will result when the sloughs separate (*see* Fig. 12.1 Plate 2). This usually occurs between the second and tenth day after delivery, but occasionally a fistula may be already present at the time of delivery if labour has been exceptionally prolonged. Posteriorly, sloughing may result in a recto-vaginal fistula. In severe cases, the whole of the recto-vaginal septum and the perineum may be destroyed. In these circumstances, the unfortunate sufferer is totally incontinent of urine and faeces through a gaping cloaca.

Although continuous drainage of the bladder after an obstructed labour may prevent some fistulae from forming (*see* Chapter 29), once full thickness sloughing has occurred, urine tends to drain through the defect rather than through the catheter unless the fistula is very small. It is sometimes possible to drain all the urine through the catheter by applying continuous suction with an electric pump: this not only keeps the patient dry but also encourages

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12. Maternal mortality

In collaboration with C. E. ROSSITER

Summary. There were 238 maternal deaths. Five deaths occurred after delivery among booked women who had no antenatal complications (0·4 deaths per 1000 deliveries); 14 deaths were among booked women who developed complications during pregnancy (3·7 per 1000); and 219 deaths were in the emergency admissions (28·6 per 1000). Bacterial infections, eclampsia, anaemia, haemorrhage and disproportion together with its consequences, were the leading causes. The principal high-risk factors were lack of antenatal care, early teenage pregnancy, high parity and high child mortality rate from previous births. In the emergency admissions the operative delivery rate was 25% in the women who survived and 49% in those who died. In severe eclampsia and in neglected obstructed labour, a high haematocrit (≥0·45) and, to a lesser extent, a low haematocrit (≤0·14) were of ominous significance, mortality rate being 25–60% in such cases compared with <10% in most other obstetric complications. Measures to reduce maternal mortality should aim to lower the proportion of high-risk women (40% at present) and also make it possible for operative deliveries, especially caesarean section, to be performed as soon as the need arises.

Since the early sixties, attention has increasingly been drawn to the high maternal mortality rates of around 10 deaths per 1000 deliveries in many areas in West Africa (Lawson 1962; Waboso 1973; Ojo & Savage 1974; Megafu 1975; Caffrey 1979; Ademowore 1980; Okojie 1980). Cannon & Hartfield (1964), then working under difficult conditions in a rural and semi-urban environment in Western Nigeria, showed how improved standards of health care, together with better organization of basic health services, helped to bring about a reduction in both maternal and fetal mortality and morbidity. Despite the success which Cannon & Hartfield (1964) achieved, they were quick to point out that wherever socio-economic deprivation exists on a large scale and maternal mortality rates are high, the enormous loss of maternal lives cannot be brought under control permanently until living conditions for the general population are improved.

This chapter presents the cold facts about the maternal health situation in the Zaria area and at the same time it attempts to bring to people's notice the underlying human tragedy and suffering. Knowing that the principal conditions associated with maternal death are bacterial infections, anaemia, eclampsia, haemorrhage, disproportion and its consequences, our material was further explored to throw up additional factors which often combined with the obstetric complications in worsening maternal prognosis.

Decision on avoidable factors in maternal death

At the time this material was being collected, it was felt that in the case of the maternal deaths, further information about them was necessary. Therefore, the circumstances surrounding each maternal death were an important part of the discussions at weekly meetings attended by all medical and nursing staff of the Department of Obstetrics and Gynaecology. A consensus was reached as to the clinical causes of death and what avoidable factors there might have been. Such avoidable circumstances were categorized as predominantly due to the patient, the environment, cultural beliefs or to defects in the health services.

An important patient factor was the failure of the women with high-risk pregnancies to report for antenatal care when they should have done

so. Another was the fact that some people did not readily submit themselves to emergency operations, preferring instead to withhold consent for operations for as long as possible. For example, rather than give consent for an emergency caesarean section, some of those admitted in early labour with disproportion took their own discharge at that stage, only to return to us later, still undelivered but gravely ill. Cultural practices detrimental to maternal health have already been described (chapter 2). Environmental factors were those connected with difficulties in transportation experienced by women who lived in remote rural areas. In doubtful cases, confirmation was sought from medical social workers and such information enabled us to determine the distance that the woman who died had had to travel to reach the Zaria hospital. Errors of clinical judgement and problems with shortages of, or interruptions to, the supply of piped water, electric power, telecommunications systems, fuel, drugs, linen and other items of essential equipment, all came under avoidable factors within the hospital health services.

Preliminary statistical analysis and social factors

There were 238 maternal deaths (10·5 deaths per 1000 deliveries) of whom 49 died undelivered and 68 gave birth at home before their arrival at hospital. Throughout this text, maternal mortality refers to deaths during pregnancy and up to 42 days afterwards.

Appendices 12.1 and 12.2 show the relation between maternal mortality and antenatal care, address, religion, ethnic group, education, age and parity.The most striking observation is that 219 of the 7654 women who did not receive antenatal care died (28·6 deaths per 1000 deliveries) compared with only 19 of the 15 020 booked delivered women (1·3 deaths per 1000 deliveries).

Of course many women who did not have antenatal care never came to the hospital and were delivered at home. Their number is unknown but must have been at least two to three times the number admitted as an emergency. Even so, the perinatal and maternal mortality among the excluded population of unbooked women is still very much higher than those who received antenatal care.

Another striking observation is that maternal mortality is greatly affected by maternal age. The death rate was highest in girls aged ≤15 years, falling to the lowest level between the ages of 20 and 24 years, then rising again to another peak in the oldest women aged ≥30 years.

Considering just those women who did not receive antenatal care, maternal mortality was still significantly related to both ethnic group ($\chi^2 = 9{\cdot}72$, d.f. = 1, $P<0{\cdot}01$) and religion ($\chi^2 = 7{\cdot}87$, d.f. = 1, $P<0{\cdot}01$) after allowing for maternal age. It is impossible statistically to determine which of these two factors—ethnic group and religion—predicts maternal mortality better, as they are so closely related to each other. Among the unbooked, education, address and parity did not contribute much more to the prediction of maternal mortality after allowing for the other variables, but of course educated mothers rarely failed to receive antenatal care.

Because the distribution of maternal characteristics differed between the booked and unbooked groups (Appendices 12.1 and 12.2), maternal deaths in the two groups will be considered separately.

Maternal mortality in booked patients

There were 19 deaths in the booked group and five of them had no antenatal complications whatsoever and all died after delivery. Two of these five had been discharged within 24 h of normal delivery only to be readmitted 10 days later, when they both died within the first hour of admission, one from severe bronchopneumonia and the other from cerebrovascular accident due to severe postpartum hypertension. Of the other three, one was an anaesthetic death during the repair of a third degree perineal tear; another had severe postpartum haemorrhage and died within minutes before blood for transfusion was available; the third patient in this group had torrential postpartum haemorrhage successfully arrested by hysterectomy, only to succumb to septicaemia later.

Two further deaths were related to HbSS with one dying from pseudotoxaemia (Hendrickse *et al.* 1972) after puerperal sterilization by tubal ligation. The other had active tuberculosis early in the antenatal period. Good progress was being made on drug therapy until pre-eclampsia with sickle cell painful crises developed at 30 weeks, followed 2 weeks later by fatal pericarditis. Being HbSS, her haematocrit, despite multiple transfusions, was still only 0·26.

Nine of the remaining 12 deaths were associated with the following complications: eclampsia (6), post-caesarean section genital sepsis and/or septicaemia (4) and post-caesarean section bronchopneumonia (1). Of these nine women, only one, an eclamptic, died undelivered, two gave birth spontaneously and the remaining six by caesarean section. Spontaneous delivery took place in two eclamptics, one of whom had a twin pregnancy and placental abruption. The indications for caesarean section were severe eclampsia (2), severe eclampsia and twin pregnancy (1), disproportion and intrapartum pre-eclampsia (1), breech presentation and contracted pelvis (1), transverse lie and uterine fibroids (1). In all, six in this group of nine deaths also had mild anaemia (haematocrit 0·24–0·29) in early puerperium as a result of uncorrected blood loss. As is so often the case case in West Africa (Ekwempu 1980), eclampsia was fulminating in five of the six deaths. All five had already had eclamptic fits at home before their arrival in hospital; there had been no warning signs during their weekly antenatal visits.

The remaining three deaths were from acute pyelonephritis in pregnancy (1), pyrexia of unknown origin (1) and postpartum haemorrhage followed by septicaemia after a normal delivery in a patient who had pre-eclampsia.

By the prevailing standards in Zaria, death was reckoned to be unavoidable only in three of the 19 booked deaths. In the rest, the avoidable circumstances were early teenage marriage in three (aged 13–15 years) and defects in our health services in the rest. Of the 19 deaths, 17 were Zaria residents and the other two lived within 50 km. Six had received formal education, although none had had more than primary education. Particularly noteworthy was the fact that in the booked group the death rate was much lower in the women who were healthy throughout pregnancy (five deaths in 11 261 deliveries; 0·44/1000) than in those who developed antenatal complications (14 deaths in 3759 deliveries; 3·7/1000).

Maternal mortality in the unbooked women

General considerations and social characteristics

The unbooked women who died constituted the crux of the problem. Because they were so many (219) and because nearly all presented very late for treatment, they made enormous demands on our limited resources.

Their distribution according to ethnic group, address, religion, age and parity is shown in Appendices 12.1 and 12.2. All the Zaria residents who died and 82% of those whose homes were outside Zaria (range of distances from Zaria, 20–200 km) had access to good roads, by which it is meant that their homes were within 2 km of an all-season road. None of the unbooked women who died had received any formal education.

Table 12.1. Major obstetric and medical complications in 7654 unbooked women of whom 219 died

Obstetric and medical complications	No. of affected women	No. of deaths: One abnormal condition only	No. of deaths: Two or more abnormal conditions
Obstetric			
Genital infection	609	26	28
Eclampsia	390	18	24
Anaemia			
In pregnancy	917	11	50
In puerperium	988	3	48
Haemorrhage			
APH	544	2	21
PPH	391	2	25
Rupture of uterus	177	1	28
Disproportion	1070	0	56
Prolonged labour	988	1	55
Retained placenta	894	2	24
Pre-eclampsia	492	0	12
Postpartum hypertension	559	0	11
Advanced abdominal pregnancy	4	1	0
Non induced abortion	NK	0	2
Medical or surgical			
Sickle cell disease	5	0	1
Specific infections	31	14	4
Other infective conditions	73	0	22
Surgical conditions	NK	3	0
Malignancies	6	1	0
Other non-infective	53	0	7
Traditional surgery			
Gishiri cut	88	1	7
Breast gangrene	7	0	1
Uvulectomy	12	0	1

NK. Not known.

APH, antepartum haemorrhage; PPH, postpartum haemorrhage.

There were avoidable factors related to the patients themselves in 89% of the deaths, to the health services in 53%, to cultural practices in 27% and to the environment in only 9%.

Obstetric and medical complications

Table 12.1 lists the main obstetric and medical complications found in the unbooked women, including those who died. Those cases where death occurred in the presence of a single obstetric or medical complication were in the minority. The more common pattern was death from the combined effect of two or more obstetric complications. For example, while eclampsia was the sole obstetric disease present in 18 deaths, it was accompanied by one other complication in a further 15 deaths, and by two or more other complications in nine. Anaemia was due to the combined effects of malaria and dietary deficiencies of iron and folic acid, sometimes to blood loss and occasionally to sickle cell disease. Where severe anaemia was the only cause of death, the haematocrit ranged from 0·05 to 0·19. Uterine rupture resulted chiefly from disproportion and fetal malpresentations, mostly transverse lie of the fetus.

The surgical conditions associated with maternal deaths were intussusception, volvulus and appendix abscess. Specific infections associated with maternal deaths were typhoid (7), meningitis (5), tetanus (4), hepatitis (1), and amoebiasis (1). Under 'other infective conditions' were 22 fatalities, mostly from pyrexia of unknown origin. Under 'other non-infective' were deaths from peripartal cardiac disease (3), severe bronchial asthma (1), renal failure of unknown cause (1), circulatory overload during intravenous infusion (1) and renal failure from mismatched blood transfusion (1). There were six malignant neoplasms: primary hepatoma (1), malignant trophoblastic disease in remission (4), and goitre (1). The only death was from respiratory obstruction caused by the huge goitre. 'Traditional' surgery describes three procedures. One was the gishiri cut (chapter 2), followed by fatal haemorrhage. Another was burns on the breasts complicated by fatal gangrene and septicaemia. These breast injuries were sustained at home, and followed a traditional form of treatment for breast discomfort in early puerperium. What happened was that a heated metal rod was directly applied to the breasts while it was still very hot. The last procedure was the excision of the uvula by traditional healers complicated by haemorrhage, respiratory infection and septicaemia. This operation, carried out under unhygienic conditions, is for the treatment of sore throat; the practice is widespread but fatalities are apparently rare.

Another matter of interest was a multiple pregnancy rate of one in 19 among the survivors and one in 11 among the deaths. There were 379 twin, nine triplet and two quadruplet pregnancies among the survivors and 14 twin and one triplet pregnancies among the deaths.

The 46 women who died undelivered, were associated with the following conditions: eclampsia (9), severe anaemia with haematocrit of 0·08–0·14 (8), uterine rupture (8), prolonged labour (9), placenta praevia (1), placental abruption (1), haemorrhage from a gishiri cut (2), meningitis (2), pre-eclampsia with anaemia, haematocrit 0·15–0·19 (2), pyrexia of unknown origin (5) and cardiac failure of unknown cause (1).

Of the 1638 women who gave birth at home before arrival in hospital 64 died. The number of survivors and deaths for each complication in this group of emergency admissions was as follows: retained placenta (804, 23), postpartum haemorrhage (181, 16), eclampsia (45, 3), rupture of uterus (14, 2), anaemia in puerperium (530, 27), genital sepsis (223, 21), septicaemia (5, 10), vesicovaginal fistula (10, 3) and secondary PPH (46, 1)

Knowing the principal obstetric and other conditions associated with maternal deaths, analysis was carried a stage further. Attempts were made to determine the relation between each obstetric complication and several other important variables pertinent to local conditions.

Time of death and duration of stay in hospital

Examined in this way, 30 (13·7%) of the deaths took place within the first hour of arrival in hospital, 47 (21·5%) within 1–6 h, 57 (26·0%) within 7–24 h, 55 (25·1%) within 1–7 days and 30 died after more than a week in hospital. However, the pattern varied according to the nature of the underlying obstetric complication. Over 25% of those who died from retained placenta and postpartum haemorrhage but nearly 15% of those with ruptured uterus, anaemia in pregnancy and prolonged labour, died within the first hour in hospital. By contrast, in genital sepsis and anaemia in the puerperium, most deaths (65%) occurred towards the end of the first week

of the puerperium. As many as 72% of all who died after embryotomy (13 out of 18) but only 19% of those who died after caesarean section (five out of 27) did so within 24 h after these procedures. This difference in prognosis reflects the difference in severity of the underlying obstetric complications rather than in the operations themselves (see below).

Events of labour and maternal mortality

In the group of emergency admissions, 90% (6719) of the 7481 women who survived and 65% (143) of the 219 who died were in labour when they arrived at hospital for the first time; 25% of the survivors but 44% of those that died were already either in the second or in the third stage of labour. The operative delivery rate for singleton births among the survivors was 24·6% (vaginal breech delivery 2·2%, forceps 3·5%, caesarean section 14·6%, embryotomy 2·7% and other deliveries 1·6%) compared with 53·2% for those who died (vaginal breech delivery 1·9%, forceps 9·5%, caesarean section 16·5%, embryotomy 11·4% and other deliveries 13·9%). The difference in distribution was very significant ($\chi^2 = 188$, d.f. = 5, $P < 0{\cdot}001$). Particularly striking were the differences in the proportions of women who required embryotomy and 'other' deliveries between those who died and those who survivied. The term 'other deliveries' throughout this text refers to a total of 144 patients shown in Table 12.2, 113 of whom were abdominal deliveries following uterine rupture. Not shown in Table 12.2 are those women in whom uterine rupture was detected only after vaginal delivery, some in hospital (64) and some at their homes (16). Also not shown are eight others who died undelivered, with uterine rupture present.

Maternal age, obstetric complications and mortality

Fig. 12.1 shows that within each of the seven age-groups, the case fatality rate was always less than 10% of all those affected by pre-eclampsia. The same was true for disproportion and prolonged labour. Case fatality rate exceeding 10% occurred in the following groups: early teenage girls with gross anaemia (haematocrit $< 0{\cdot}14$), eclampsia and postpartum haemorrhage; the over 30s with eclampsia; in all age-groups where uterine rupture took place, that is multiparous mothers aged ≥ 17 years. In the 17–19 age-group, where mortality associated with rupture of the uterus was highest (37·5%), the number of women affected (three deaths out of eight) was small compared with 6–8 deaths out of 32–74 women affected in the age-groups 20–24, 25–29 and ≥ 30 years.

Modes of delivery, obstetric complications and mortality

Maternal death rate varied according to the mode of delivery and the nature of the obstetric complications (Fig. 12.2). As expected, spontaneous delivery was associated with the lowest

Table 12.2. Mode of 'other delivery' in 144 emergency admissions

Diagnosis	Mode of delivery	No. of women	
		Survivors	Deaths
Rupture of uterus	Laparotomy, repair of ruptured uterus	79	13
Rupture of uterus	Laparotomy, hysterectomy	14	7
Suspected rupture of uterus	Laparotomy followed by spontaneous delivery	1	0
Suspected rupture of uterus	Laparotomy followed by breech delivery with perforation of aftercoming head	1	0
Placenta praevia intrauterine death	Braxton Hicks bipolar podalic version followed by spontaneous delivery	6	0
Obstructed labour	Symphysiotomy	9	2
Hydrocephaly	Spontaneous delivery after aspiration	2	0
Advanced extra-uterine pregnancy	Laparotomy and delivery	3	1
Transverse lie and intrauterine death	Internal version and breech extraction	2	0
Constriction ring	Assisted vaginal delivery	1	0
Others	Not stated	3	0
Total		121	23

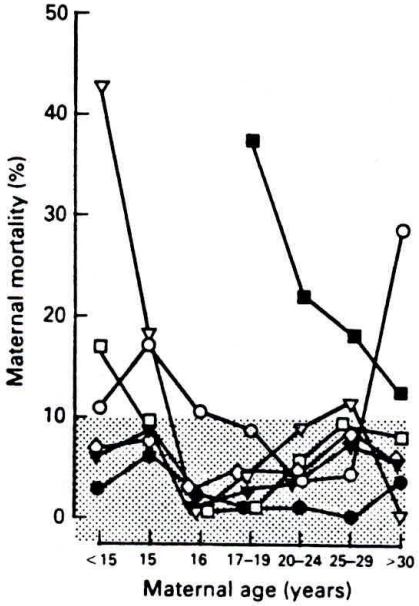

Fig. 12.1. Maternal age, obstetric complications and maternal mortality. ▽ Severe anaemia (haematocrit <0·14); ● pre-eclampsia; ○ eclampsia; ▼ disproportion; ◇ prolonged labour; □ PPH; ■ uterine rupture.

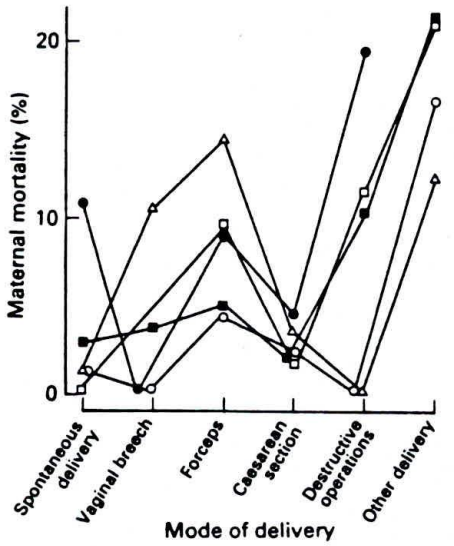

Fig. 12.2. Mode of delivery, obstetric complications and maternal mortality. △ APH; ○ pre-eclampsia; ● eclampsia; □ disproportion; ■ prolonged labour.

case fatality rates (<3%) except among the eclamptics (mortality 11%). Caesarean section performed for whatever reason was always comparatively safe (case fatality <5%). Both embryotomy and other deliveries carried out in the presence of prolonged obstructed labour and

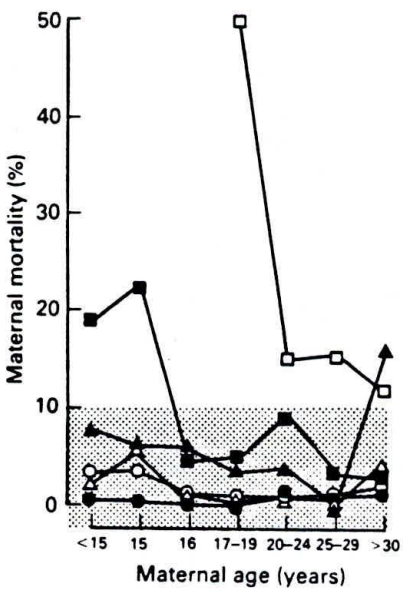

Fig. 12.3. Maternal age, mode of delivery and maternal mortality. ○ spontaneous delivery; ● breech; ▲ forceps; △ caesarean section; ■ embryotomy; □ other deliveries.

eclampsia were associated with the highest case fatality rate of around 20%.

Maternal age, mode of delivery and mortality

Fig. 12.3 shows that spontaneous delivery, vaginal breech delivery and caesarean section were comparatively safe as they were all associated with a case fatality rate of under 8%. By contrast, in early teenage girls treated by embryotomy, in the over 30s delivered by forceps (mostly in the presence of eclampsia) and in those who underwent 'other deliveries', irrespective of their age, case fatality rates exceeded 10%.

Maternal haematocrit values and maternal death

Although the aim was to know the venous haematocrit value of every emergency on admission into the labour ward, operational reasons (see discussion) permitted this in only 22% of those who survived and in 55% of those who died.

Haematocrit at delivery (or admission) and time of death. In Fig. 12.4 the haematocrit values on admission were all plotted against the interval between admission to hospital and death. No woman with haematocrit of ≥0·40 died within the first 6 h after admission, even though there

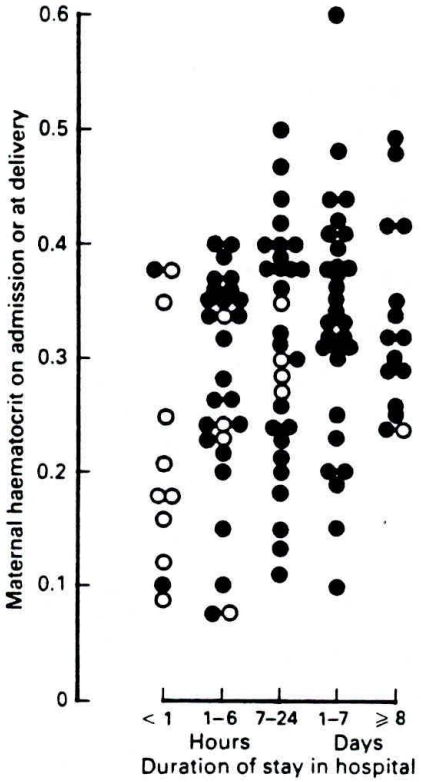

Fig. 12.4. Maternal haematocrit at delivery and interval between admission and death. ○ Born before arrival: ● delivery in hospital.

were among them seven with retained placenta, 21 with ruptured uterus, five with postpartum haemorrhage and one with severe APH. Of those with haematocrit $<0{\cdot}25$ and who died within the first 6 h of arrival in hospital, 10 out of the 19 had already given birth at home before arriving in hospital with acute blood loss from retained placenta or postpartum haemorrhage or both combined.

Maternal haematocrit at delivery, obstetric complications and maternal death rate. Table 12.3 relates maternal mortality not only to the haematocrit values at delivery but also to various abnormal conditions. Two groups of women were at the highest risk: those with disproportion, prolonged labour and rupture of uterus in whom the haematocrit value was $\leq 0{\cdot}14$, and those with haematocrit values of $\geq 0{\cdot}45$, irrespective of the underlying disease. As expected, where there had been haemorrhage, maternal haematocrit reading rarely exceeded 0·39. Even so, in women with PPH, maternal death rate was as high as 40% when the haematocrit was 0·35–0·39 compared with between 5% and 16% when the haematocrit was $<0{\cdot}35$.

Blood transfusion, haematocrit values and maternal mortality rates. Table 12.4 shows that major operative deliveries had to be performed in the presence of gross maternal anaemia. More importantly, blood transfusion was associated with improved maternal outcome when maternal haematocrit at delivery was $<0{\cdot}20$, but not necessarily when the haematocrit was between 0·20 and 0·34, and quite definitely not when the haematocrit was $>0{\cdot}35$.

High maternal haematocrit and pregnancy outcome. Eight of the 36 women admitted with a haematocrit of $\geq 0{\cdot}45$ died compared with death rates of 4–9% in the other seven haematocrit groups (Table 12·3). Table 12.5 compares the survivors with the deaths among women with high haematocrit values. Antepartum haemorrhage, pre-eclampsia and retained placenta occurred in the survivors but not in those who died. About half of those with eclampsia and ruptured uterus died. All women delivered by caesarean section survived and at the time the operation was performed, the fetus was alive in every case.

Major puerperal complications and maternal deaths. Of all the complications in the puerperium, genital sepsis and anaemia (haematocrit $\leq 0{\cdot}29$) were the most frequent, both in the survivors and in the fatalities. Of a total of 7481 survivors, 721 (10%) had anaemia, 339 (4%) had genital sepsis, 216 (3%) had both and 6205 (83%) had neither anaemia nor genital sepsis. Of the 219 deaths, 24 (11%) had anaemia, 27 (12%) had genital sepsis, 27 had both and 141 (65%) had neither. The difference in distribution between the survivors and deaths was very significant ($P<0{\cdot}01$). The other major puerperal complications, together with the number of survivors and number of deaths, were as follows: wound infection (142,9); obstetric fistula (64,12); obstetric palsy (27,2); secondary postpartum haemorrhage (58,3); septicaemia (12,25); and puerperal psychosis (32,2). As well as having the above complications, nearly 62% of the survivors and just over 80% of the deaths (90% in the case of vesicovaginal fistula and palsy) had genital sepsis, anaemia, or both.

Table 12.3. Maternal mortality (%) by haematocrit at delivery and obstetric complications in the unbooked women

Abnormal conditions	Maternal mortality (%) in relation to haematocrit at delivery							
	≤0·14	0·15–0·19	0·20–0·24	0·25–0·29	0·30–0·34	0·35–0·39	0·40–0·44	≥0·45
General anaesthesia	3	3	10	8	8	8	12	23
	(32)	(61)	(83)	(140)	(138)	(171)	(91)	(22)
Eclampsia	0	17	14	9	23	18	25	50
	(1)	(6)	(7)	(11)	(40)	(50)	(28)	(6)
Disproportion	33	0	21	10	8	8	10	29
	(3)	(9)	(30)	(39)	(83)	(119)	(63)	(17)
Prolonged labour	38	0	20	12	10	10	15	25
	(8)	(12)	(30)	(41)	(71)	(89)	(48)	(12)
Uterine rupture	33	0	67	8	8	18	21	57
	(3)	(4)	(6)	(13)	(12)	(17)	(14)	(7)
Antepartum haemorrhage	3	10	3	9	7	17	0	0
	(35)	(50)	(64)	(47)	(30)	(12)	(9)	(1)
Postpartum haemorrhage	7	5	16	9	15	40	0	—
	(15)	(19)	(31)	(43)	(20)	(10)	(5)	(0)
Retained placenta	6	2	6	4	2	10	0	0
	(35)	(86)	(102)	(112)	(45)	(21)	(4)	(3)
No. of all women	122	185	241	331	346	346	170	36
No. of deaths	11	10	20	14	19	24	15	8
% deaths	9	5	8	4	5	7	9	22

Results are percentages with the numbers of affected women shown in parentheses.

Table 12.4. Maternal mortality (%) by mode of delivery and blood transfusion in the unbooked women[a]

Haematocrit at delivery	Spontaneous delivery breech and forceps		Caesarean section		Other deliveries		All deliveries	
	Trans-fused	Not transfused	Trans-fused	Not transfused	Trans-fused	Not transfused	Trans-fused	Not transfused
≤0·14	6	100	7	—	0	—	5·9	100
	(100)	(1)	(15)	(0)	(3)	(0)	(118)	(1)
0·15–0·19	1	29	10	—	0	—	1·8	28·6
	(142)	(14)	(20)	(0)	(6)	(0)	(168)	(14)
0·20–0·24	6	6	7	18	22	0	7·0	7·6
	(133)	(54)	(30)	(11)	(9)	(1)	(172)	(66)
0·25–0·29	1	2	2	0	18	0	2·8	1·9
	(118)	(139)	(41)	(12)	(17)	(3)	(176)	(154)
0·30–0·34	2	2	12	3	11	30	7·6	3·6
	(40)	(207)	(33)	(34)	(19)	(10)	(92)	(251)
0·35–0·39	18	3	4	2	13	21	8·8	4·1
	(17)	(183)	(51)	(44)	(23)	(19)	(91)	(246)
0·40–0·44	25	6	5	3	20	13	13·3	5·6
	(8)	(81)	(22)	(35)	(15)	(8)	(45)	(124)
≥0·45	33	13	0	0	43	50	33·3	12·5
	(3)	(15)	(2)	(7)	(7)	(2)	(12)	(24)
Not recorded	3	0·5	1	0·5	11	3	3·2	0·6
	(623)	(4339)	(350)	(379)	(119)	(104)	(1092)	(4822)

[a]Excludes data on women who died undelivered.
Results are percentages with the numbers of affected women shown in parentheses.

Table 12.5. Maternal outcome and intrauterine fetal death by obstetric complications and mode of delivery (unbooked women with haematocrit of ≥0·45 only)

Factors	Total	Survivors	Deaths
Total no.	36	28	8
Obstetric complications			
Antepartum haemorrhage	1	1	0
Pre-eclampsia	4	4	0
Postpartum haemorrhage	0	0	0
Retained placenta	3	3	0
Eclampsia	6	3	3
Disproportion	17	12	5
Prolonged labour	12	9	3
Uterine rupture	7	3	4
Genital sepsis	5	1	4
Treatments			
General anaesthesia	22	17	5
Blood transfusion	12	7	5
Mode of delivery			
Spontaneous delivery	12 (6)	10 (5)	2 (1)
Vaginal breech	1 (1)	0 (0)	1 (1)
Forceps	5 (1)	4 (0)	1 (1)
Caesarean section	9 (0)	9 (0)	0 (0)
Destructive operations	2 (2)	1 (1)	1 (1)
Laparotomy for ruptured uterus	7 (6)	4 (3)	3 (3)

Results are numbers of women, with numbers of intrauterine fetal deaths on admission shown in parentheses

Mode of delivery, genital sepsis, puerperal anaemia and mortality

Table 12.6 shows that among those admitted to hospital after home delivery, whether they eventually survived or died, the risk of puerperal anaemia and genital sepsis was high: more than 40% of them had either anaemia or genital sepsis or both combined. Following hospital delivery, however, the prevalence of anaemia and genital sepsis varied depending on the mode of delivery between 4% and 43% in those who survived and between 20% and 76% in those who died.

Fetal outcome

Table 12.7 shows the fetal outcome in the women who died and in those who survived: fetal survival for hospital and home births was similar in the surviving women ($\chi^2 = 4{\cdot}8$, d.f. = 2, $P = 0{\cdot}09$), whereas in the women who died, the proportion of stillbirths in hospital deliveries was 2·5 times greater than among home births ($\chi^2 = 38$, d.f. = 2, $P<0{\cdot}01$). Table 12.8 shows that 38% of babies born to the women who died were normal-birthweight babies who had all died *in utero* before arrival at the hospital. Only 8% of the babies of the surviving women were in that category. A total of 2317 babies, including those that were motherless, were weighed on discharge from hospital; 39% of the babies of the surviving mothers and 40% of the motherless babies weighed ≤2·5 kg at that time.

Past obstetric history and maternal mortality

Information about previous children was available from 7006 of the surviving women and 202 of those who died. The women who survived

Table 12.6. Puerperal anaemia, genital sepsis, mode of delivery and maternal deaths (unbooked women)

Mode of delivery	No. of women		% with anaemia, genital sepsis, or both	
	Survivors	Deaths	Survivors	Deaths
Home births*	1574	64	40	52
Hospital births				
Spontaneous delivery	4079	24	4	76
Vaginal breech	197	3	8	33
Forceps	257	15	14	20
Caesarean section	1049	27	33	52
Embryotomy	203	18	31	50
Other deliveries	121	23	43	66
Major operations				
Repair of ruptured uterus	113	18	51	72
Hysterectomy	30	5	57	60

*Born before arrival at hospital

Table 12.7. Maternal and fetal outcome by place of birth (unbooked women, singleton and multiple births combined)

Fetal outcome	Survivors			Maternal deaths		
	Number	% of group	% of total	Number	% of group	% of total
Hospital births						
Live birth	4696	75·3	59·6	28	23·5	15·0
IUD on admission	838	13·4	10·6	66	55·5	35·2
IUD after admission	224	3·6	2·8	10	8·4	5·3
Neonatal death	477	7·7	6·1	15	12·6	8·0
Home births*						
Live birth	1226	74·6	15·6	47	69·1	25·1
Stillbirths	266	16·2	3·4	16	23·5	8·5
Neonatal death	152	9·2	1·9	5	7·4	2·7

*Born before arrival at hospital.
IUD, Intrauterine death

Table 12.8. Fetal birthweight by fetal outcome in babies of surviving women and in motherless babies

Fetal birth-weight (kg)	Fetal outcome	Babies of surviving women		Motherless babies	
≤2·5	Live	759	(13·5)	9	(8·7)
	IUD on admission	286	(5·1)	16	(15·5)
	IUD after admission	79	(1·4)	4	(3·9)
	Neonatal death	169	(3·0)	9	(8·7)
>2·5	Live	3584	(63·9)	16	(15·5)
	IUD on admission	451	(8·0)	39	(37·9)
	IUD after admission	98	(1·7)	5	(4·9)
	Neonatal death	187	(3·3)	5	(4·9)
Total		5613	(100·0)	103	(100·0)

Results are numbers, with percentages in parentheses.
IUD, Intrauterine death

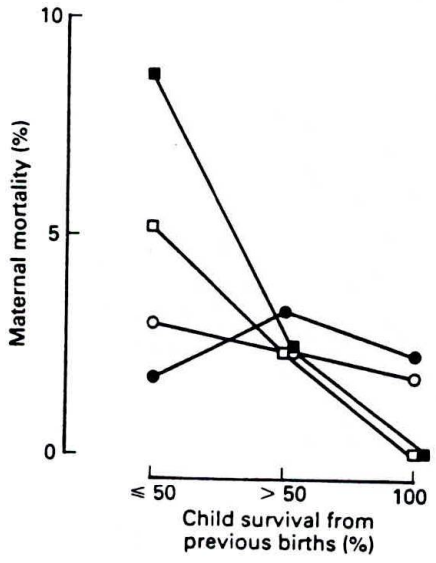

Fig. 12.5. Child survival, previous births (○ 1–2; ● 3–6; □ 7–9; ■ ≥ 10) and maternal mortality.

had a total of 15 788 children from previous births (parity 0–16) and the women who died had a total of 505 children (parity 0–13), giving a mean number of 2·25 children per woman who survived and 2·50 for those who died. However, the proportion of surviving children was 71% (1·61 per woman) for the surviving women and only 58% (1·44 per woman) for the dead women.

Fig. 12.5 and Table 12.9 present the proportion of live children from previous births against maternal mortality rate at each parity group. Maternal mortality rate rose as child survival worsened, particularly in those with seven or more previous births.

Discussion

The statistics reported here display a maternal death rate which is high even by Third World standards (Makokha 1980; Mtimavalye *et al.* 1980; Chi *et al.* 1981; MacPherson 1981). Too many women died because they reported for treatment when their illness had reached an advanced stage. The nature of the obstetric complications, the frequent resort to embryotomy,

Table 12.9. Child mortality, previous births and maternal death rate (unbooked women)

	% of children alive from previous births								
	≤50			>50			100		
	Total	Maternal deaths		Total	Maternal deaths		Total	Maternal deaths	
Parity	no.	*n*	%	no.	*n*	%	no.	*n*	%
1–2	506	15	3·0	—	—	—	1055	20	1·9
3–6	509	9	1·8	599	20	3·3	654	16	2·4
7–9	192	10	5·2	311	7	2·3	57	0	0·0
≥10	116	10	8·6	84	2	2·4	6	0	0·0

the large proportion of women dying within the first 6 h of arrival in hospital, and the high stillbirth rate among babies of normal birthweight, all attest to this fact.

Data analysis on maternal mortality in Zaria is compounded by there being more than one obstetric or medical cause for most maternal deaths. Faced with this problem, the practice in many places is to ascribe death to one principal or major cause, regarding all others as merely secondary or contributory. This system of classification is difficult to justify in Zaria where, for cultural and religious reasons, autopsies are not performed. In presenting the principal diseases or complications associated with maternal mortality, the system adopted both here and in a previous report (Harrison 1980) is one which reflects all the major circumstances surrounding each maternal death. In this way, the contribution each obstetric complication made to the overall spectrum of maternal death becomes clearer, a point borne out by the analysis of the relation between maternal haematocrit levels and other obstetric complications (Table 12.3).

An intriguing finding is the association of high maternal haematocrit level with poor maternal prognosis in eclampsia. Koller (1982) argued that by its effect in increasing blood viscosity and hence causing placental infarcts, a high maternal haemoglobin level is associated with intrauterine fetal death. In chapter 11, fetal outcome was shown to be best when maternal haematocrit level at delivery was between 0·30 and 0·40, and that at higher haematocrit levels, the risk of low birthweight and perinatal death increased. Apparently the relation between maternal haematocrit level and pregnancy outcome does not end there. According to this report, there are at least two obstetric conditions—anaemia and eclampsia—where maternal haematocrit level gives some indication of the severity of the underlying condition. In anaemia, maternal risk increases as the haematocrit value drops, whereas in eclampsia, mortality rises as the haematocrit level rises above 0·40. A very high haematocrit level was also a feature of prolonged obstructed labour, especially when this culminated in uterine rupture (Table 12.5). In this case, haemoconcentration from dehydration was the probable cause, whereas in eclampsia, the mechanism for the rise in haematocrit was volume depletion through vasoconstriction and altered vascular permeability (Gallery *et al.* 1979). In either case, resort to delivery by caesarean section was apparently safer than any other form of delivery (Table 12.5). But such a result was principally due to selection. In women with less advanced disease, the fetus was still alive, and so delivery by caesarean section was favoured but in those with more severe disease, the fetus was often already dead *in utero*, and so the practice was to avoid caesarean section.

There is no doubt that fetal and maternal survival are strongly linked. For example, in this series, even among the women who failed to receive antenatal care, the survivors achieved better fetal results than those who died. This connection between maternal and fetal outcome was also evident when child survival rates from previous births were compared between the survivors and those who died. Again, the survivors had a marked advantage over those who died. Indeed in the situation in Zaria, there is some justification for regarding a high child mortality rate by itself as a maternal risk factor, perhaps on a par with high parity and early teenage pregnancy. Of course all these three reproductive

patterns are closely linked and they are indicative of the serious defects in the living conditions in the area.

As many as 80% of deaths occurred in women who had reasonable access to health care as they lived less than 2 km from a main road. This was an unexpected finding and it carries wider implications. For a full appreciation of what these implications are, it is necessary first of all to recall that the illness from which the emergency admissions died always started at their homes. When they realized that expert intervention was required and because road communication for them was comparatively easy, they eventually reached hospital where they died. For those living in remote areas without access to hospital (perhaps 60% of the population) the deaths from complications needing operative treatment are almost certainly greater than the hospital statistics would suggest. On the other hand, it can also be argued that in places such as Zaria, where vital statistics for the whole area are not kept, it is not possible to say with confidence whether maternal mortality rates among the rural dwellers were any higher than those observed at the hospital. There is another side to this argument. Most of those with homes outside Zaria, whether they live close by or far from a main road, belong to the same sociocultural–ethnic group (Murphy & Baba Tukur 1981). Their attitudes to life are the same (Lister 1980) and so it is very likely that the obstetric conditions needing operative intervention, such as obstructed labour and eclampsia, will arise just as often, and that in the absence of effective treatment, the mortality among the rural dwellers in remote areas must be very high indeed. Exactly how many perish in this way is not known, but the fact that each year there were nearly 300 fresh cases of vesicovaginal fistula attending the gynaecological clinic in Zaria, many from the rural background, gives some indication of the scale of maternal morbidity and mortality among the rural dwellers.

A recent report of 20–24 maternal pregnancy-related deaths per 1000 women of childbearing age in certain isolated villages in Gambia, West Africa (Lamb *et al.* 1984) nearly match the maternal mortality rate in the unbooked women in our Zaria study, 29 per 1000, these rates are between 2 and 20 times the rates commonly reported from urban hospitals in developing countries. It may well be that the relatively 'low' maternal mortality rates from urban centres grossly underestimate the magnitude of the problem at least in the poverty stricken parts of West Africa. All this is very reminiscent of the situation in 18th century rural England with its mortality rates of 24–29 maternal deaths per 1000 baptisms (Dobbie 1982).

As in many societies, maternal mortality in Zaria has now been shown to vary with maternal age. Maternal mortality, high among the early teenage mothers, fell to the lowest level between the ages of 20 and 29 years, and rose again with advancing age. This age effect on maternal survival was quite pronounced in eclampsia, severe anaemia, prolonged labour, postpartum haemorrhage, uterine rupture and even after certain operative deliveries. In most cases, except eclampsia in the over 30s, it was the teenage girl who came out worst of all. Exactly why this is so is not clear from the analysis, but it may be a consequence of one of the important traditional customs in the area. There is a strongly held belief that home delivery is best for young teenage girls. So it would seem likely that when things went wrong during labour, people were slow to seek expert help whenever teenage expectant mothers were the ones affected.

Complications of early pregnancy featured very little in these Zaria maternal deaths partly because of the selective nature of this survey and partly because of people's attitude towards health care. Although each year about 600 women with incomplete abortion and 90 with ectopic gestation were being treated, the vast majority, having been discharged early, were lost to follow-up. Attitudes to child-bearing remain very traditional among most people in Zaria. Only a tiny minority practise effective contraception, and pregnancy termination—except for medical reasons—is seldom resorted to. Therefore, death from criminal abortion, which is rampant in many Third World cities, did not occur in Zaria during the period of this survey. As many as 88% of those who reported to hospital for antenatal care did so for the first time in the second half of pregnancy. Therefore, in the Zaria area, fatalities from early pregnancy complications, such as spontaneous incomplete abortion and molar pregnancy, might well have taken place outside hospital without attracting much notice.

Regarding the motherless babies, the results presented here would suggest that while these babies were in hospital, the support given to them was probably no worse than that received

by the other babies. The proportion that weighed ≤ 2·50 kg on discharge was the same for both the motherless babies and the rest. The existing infant welfare clinic and a home for motherless babies in Zaria both served to complement whatever care these babies received at their homes.

Attention must now be turned to the events in the hospital itself and to some other results of this study. These include the high prevalence of bacterial infections, the circumstances surrounding blood transfusion, and also the predictive value of maternal haematocrit. Judging from the maternal haematocrit values at delivery, there is no doubt that many emergency admissions were in poor health. They were clearly high operative risks at the time they were subjected to major operative procedures. Thirteen per cent of those who had general anaesthesia, 10% of those subjected to either repair of ruptured uterus or hysterectomy and 30% with retained placenta, some of whom subsequently needed manual removal of the placenta, arrived at hospital with venous haematocrit values <0·20. Among the survivors were women admitted in obstructed labour with haematocrit of 0·09, eclamptics with haematocrit of 0·13, and those who, despite a haematocrit of only 0·07, had to have manual removal of placenta carried out shortly after admission.

Under these circumstances, blood transfusion played a crucial role in the management of the emergency admissions in Zaria, with as many as 24% of the survivors and 48% of those who died receiving transfusion. However, there were problems. Shortage of donor blood was not one of them but delay in getting transfusion started was. The major constraints were faults in the transportation and in the telecommunication systems and frequent interruptions to the electric power supply. Occasionally, the hospital ran out of supplies of very basic items such as blood giving sets, suitable serum needles and intravenous cannulae. Blood that was not cross-matched was hardly ever transfused, although the use of blood cross-matched for less than 2 h was commonplace. In spite of these shortcomings, there is no doubt that blood transfusion proved life-saving when used to raise the circulating haemoglobin level quickly in patients found to be grossly anaemic during labour or shortly afterwards (Harrison 1982). However, there is no ready explanation as to why, when maternal haematocrit was between 0·20 and

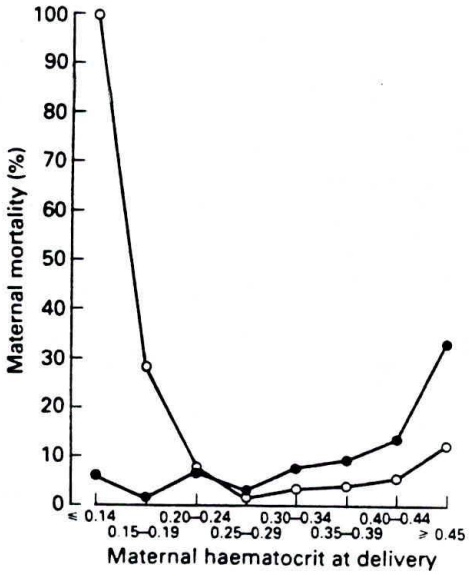

Fig. 12.6. Maternal haematocrit at delivery, blood transfusion and maternal mortality. ● Transfused; ○ not transfused.

0·39, blood transfusion failed to show the same sort of advantage as it did when the haematocrit was <0·20. In the case of women with high haematocrits (≥0·45), the increased risks they ran when they were transfused, as opposed to when they were not transfused (Fig. 12.6) would suggest that the use of blood transfusion was inappropriate, or that such patients were being over-transfused, or that insufficient attention was being paid to coexisting biochemical disturbances. It may also be that those who were transfused had the more severe disease. If so, the poor results they had may be due not so much to the transfusion itself as to the severity of the underlying disease, be it eclampsia, prolonged obstructed labour or rupture of the uterus. Whatever the explanation, there is the whole question of body fluid replacement during emergency operative procedures in these volume-depleted patients with high haematocrit and possibly metabolic acidosis (Akinkugbe *et al.* 1977). All these and other issues about these patients deserve further study. Meanwhile, an important step towards reducing maternal mortality in places such as Zaria would be the installation of a microhaematocrit centrifuge in the labour ward itself, so that the haematocrit value of all emergency admissions in labour could be determined on the spot and the results made known promptly.

Further cause for concern in Zaria was the mortality associated with bacterial infection in the puerperium. Both booked and emergency admissions who died were almost equally affected. Faults in the hospital environment and improper hygiene were chiefly the cause (see chapter 2).

It is obvious that the majority of the obstetric and medical complications associated with maternal mortality, related as they were to the prevailing social attitudes and severe deprivation, were largely preventable. However, the fact remains that the fundamental problem of maternal health in the Zaria area is the existence of an exceedingly large proportion of high-risk women—early teenage primigravidae, high parity, and lack of antenatal care—making up 40% of the survey population compared with only 2%, for example, in Australia (Lumley 1980). If maternal mortality is to fall, the long-term need is a reduction in the proportion of women with these three high-risk factors. The way to do so is to improve living standards (Chalmers 1980), never neglecting universal formal education in the process (chapter 3). In the short-term, however, it should be possible to improve the health of the pregnant women through antenatal care, and then gain acceptance in the population so that operative deliveries, especially caesarean sections, can be performed as soon as the need arises.

Appendix 12.1. Maternal mortality by social factors and booking status

Social factors	Maternal mortality rate/1000											
	Unbooked				Booked				Not stated			
	Hausa–Fulani	Other Nigerians	Others	Not stated	Hausa–Fulani	Other Nigerians	Others	Not stated	Hausa–Fulani	Other Nigerians	Others	Not stated
Residence												
Zaria	27·8	7·5	0·0	0·0	1·8	1·0	0·0	0·0	0·0	0·0	—	—
	(2593)	(666)	(8)	(16)	(3890)	(9989)	(105)	(25)	(15)	(21)	(0)	(0)
Outside Zaria	35·2	15·0	0·0	0·0	3·9	0·0	0·0	—	0·0	—	—	—
	(3778)	(200)	(7)	(2)	(517)	(335)	(7)	(0)	(11)	(0)	(0)	(0)
Not stated	19·5	0·0	—	0·0	0·0	0·0	—	0·0	0·0	—	—	0·0
	(308)	(47)	(0)	(29)	(78)	(69)	(0)	(5)	(2)	(0)	(0)	(2)
Religion												
Christian	0·0	8·9	0·0	0·0	0·0	1·0	0·0	0·0	—	0·0	—	—
	(25)	(562)	(4)	(23)	(72)	(7028)	(40)	(16)	(0)	(11)	(0)	(0)
Islam	31·9	11·7	0·0	0·0	2·1	0·7	0·0	0·0	0·0	0·0	—	0·0
	(6617)	(256)	(9)	(10)	(4365)	(2773)	(27)	(5)	(26)	(9)	(0)	(1)
Others	—	0·0	—	—	—	0·0	0·0	—	—	—	—	—
	(0)	(5)	(0)	(0)	(0)	(12)	(9)	(0)	(0)	(0)	(0)	(0)
Not stated	0·0	0·0	0·0	0·0	0·0	1·7	0·0	0·0	0·0	0·0	—	0·0
	(37)	(90)	(2)	(14)	(48)	(580)	(36)	(9)	(2)	(1)	(0)	(1)
Formal education												
Education	0·0	0·0	0·0	—	9·6	2·3	0·0	0·0	—	0·0	—	—
	(6)	(50)	(3)	(0)	(104)	(2193)	(76)	(3)	(0)	(2)	(0)	(0)
None	31·8	9·4	0·0	0·0	1·8	0·6	0·0	0·0	0·0	0·0	—	0·0
	(6636)	(849)	(12)	(47)	(4347)	(8093)	(29)	(27)	(28)	(19)	(0)	(2)
Not stated	0·0	0·0	—	—	0·0	0·0	0·0	—	—	—	—	—
	(37)	(14)	(0)	(0)	(34)	(107)	(7)	(0)	(0)	(0)	(0)	(0)
All deaths	211	8	0	0	9	10	0	0	0	0	0	0
All deliveries	6679	913	15	47	4485	10 393	112	30	28	21	0	2

Numbers of deliveries are shown in parentheses

Appendix 12.2. Maternal mortality (deaths per 1000 deliveries) by age, parity and booking status

Maternal age (years)	All deliveries				All primigravidae				All multigravidae				Parity ≥5			
	Un-booked	Booked	Not stated	Total	Un-booked	Booked	Not stated	Total	Un-booked	Booked	Not stated	Total	Un-booked	Booked	Not stated	Total
<15	56·1	10·5	—	37·8	56·7	10·8	—	38·5	0·0	0·0	0·0	0·0	—	—	—	—
15	71·3	2·1	0·0	39·7	73·6	2·4	0·0	41·9	32·2	0·0	—	12·7	—	—	—	—
16	32·0	0·0	0·0	14·3	32·9	0·0	0·0	14·6	28·2	0·0	—	12·7	—	—	—	—
17–19	20·8	0·9	0·0	7·6	21·0	0·0	0·0	8·0	20·5	1·8	0·0	7.1	0·0	0·0	—	0·0
20–24	19·6	1·0	0·0	5·8	11·8	1·1	0·0	4·8	22·5	1·0	0·0	5·9	22·0	0·0	—	9·7
25–29	24·9	1·3	0·0	7·4	17·5	0·0	0·0	6·1	25·0	1·4	0·0	7·3	27·1	1·5	0·0	11·6
≥30	36·8	1·6	0·0	15·1	19·2	0·0	—	10·1	37·8	1·7	0·0	15·3	45·3	1·5	0·0	20·1
Not recorded	1·7	0·0	0·0	1·1	0·0	0·0	—	0·0	2·4	0·0	0·0	1·6	0·0	0·0	—	0·0
Total no. of deliveries	7654*	15 020*	51*	22 725*	2767	3543	13	6323	4804	11 460	36	16 300	1693	2174	12	3879
Total no. of deaths	219	19	0	238	92	4	0	96	125	15	0	140	59	3	0	62
Deaths per 1000 deliveries	28·6	1·3	—	10·5	33·2	1·1	—	15·2	26·0	1·3	0·0	8·6	34·8	1·4	0·0	16· 0

*Data on total deliveries include those on 102 mothers (83 unbooked with two deaths, 17 booked and two not stated) with missing parities

(1) Again the marking of the date of consultation in the first column is sometimes difficult.
(2) The drawing in the second column reminds the TBA to give appropriate nutritional advice.
(3) A cross (X) should be placed in the third column if malaria prophylaxis has been given.
(4) The dispensing of iron tablets (with folic acid) and/or multi-vitamin tablets should be marked in the fourth column
(5) The dates for tetanus toxoid immunization, which has to be given by the supervisor twice during pregnancy, should be noted in the fifth column.
(6) Finally, referrals to higher levels of health care (health centre or hospital) should be noted in the last column.

DISCUSSION

The introduction of an antenatal card for use by illiterate TBAs is not easy. First of all, it is important to discuss the idea with whoever will later teach the TBAs and use it during their supervision in the villages. Their commitment to using the card to improve the performance of the TBAs is essential. Therefore they should also be involved in the design and content of the various drawings on the card. Once the card has been designed, it should be field tested by the nurses and midwives who will train and subsequently supervise the TBAs. Changes should be made according to their experiences.

Secondly, the antenatal card will only prove useful if it can: identify the problems of a particular pregnancy (e.g. anaemia, insufficient fetal growth, wrong presentation), and the at-risk cases; help TBAs interpret their findings, by giving a clear set of instructions and standing orders on what to do in each situation (these instructions should be taught together with the use of the card).

These two conditions can only be met by continuously supervising the TBA's performance and discussing the findings with her. In this way the card can provide a framework of things to look for during the supervision, and so enhance its effectiveness. At the same time it can improve the TBA's performance by showing her any deficiences in her skills or knowledge. Thus it can help to direct TBAs' training, and supervisors' attention, more specifically towards aspects that need emphasis.

Finally, the card described here needs evaluation. At present, it is too early to suggest how successfully it identifies women with a high obstetric risk through the regular control of TBAs. Studies of the sensitivity of the antenatal cards (i.e. the proportion of pregnant women with high-risk factors detected through their use) are badly needed, not only for the card presented in this paper, but also for the antenatal cards used by nurses, midwives and doctor.

This antenatal card has been a considerable help in the process of improving the performance of TBAs and represents a first step in making their antenatal care more effective. Detailed studies of this aspect of primary health care are urgently needed to make the training of TBAs a more worthwhile activity.

REFERENCES

Chabot H T J & Savage F (1984) A Community Health Project in Africa (slide set). Teaching Aids at Low Cost (TALC), PO Box 49, St Albans, Herts, AL1 4AX, UK
Essex B J & Everett V J (1977) *Tropical Doctor* **7**, 134–138
Sims P (1978) *Tropical Doctor* **8**, 137–140
Watson D S (1984) *Tropical Doctor* **14**, 133–135
Williams M (1980) The Training of TBAs: Guidelines for Midwives Working in Developing Countries. Catholic Institute for International Relations, 22 Coleman Fields, London N1 7AF. (New edition in preparation)

Should vesicovaginal fistula be treated only by specialists?

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INTRODUCTION

Vesico-vaginal fistulas (VVFs) are still common in many developing countries. The largest series ever reported (Tahzib 1983) refers to the period 1969–80, during which no less than 1443 cases were collected at one university hospital in Northern Nigeria. This report is typical of most papers from developing countries on VVFs which are usually derived from large numbers referred to teaching hospitals, including many difficult cases referred after treatment elsewhere has failed. Such reports give the impression that fistula repairs should only be attempted by expert vaginal surgeons. Unfortunately experienced gynacologists are rare in the rural areas of developing countries where most fistulas occur, so the majority of repairs are probably

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carried out there by doctors without this special training, who individually operate on only a few cases in a lifetime. This paper reports the results of a small series of 13 cases from Chogoria, a small hospital in rural Kenya, which indicates that with orthodox methods good results can be obtained by nonspecialist doctors.

Before 1970, VVF repair was rarely attempted at Chogoria. Patients were either referred, or if that proved impossible, the ureters were transplanted into the colon. This was an unsatisfactory procedure, and although the author has seen two patients still living between 10 and 15 years following operation, most eventually die of renal failure (Preston 1951). Since then, with the initial encouragement of Professor Donald Gebbie, at that time Professor of Obstetrics and Gynaecology at Nairobi, vaginal repair has been attempted in all suitable cases. This experience has provided the material for this paper.

MATERIALS AND METHODS

Fourteen fistulas were seen over a period of twelve years, 1972–83. All were of obstetric origin, and all but two had followed delivery outside Chogoria Hospital, mostly at home. Of the two fistulas which occurred in this hospital, one was caused by Caesarean section and the other followed vaginal delivery in a woman who had previously had a Caesarean section. No fistula following gynaecological surgery was seen, and malignant fistulas have not been included.

One large fistula was referred without any attempt at repair, and no further details are available. Of the 13 fistulas repaired, 5 were juxta-urethral, 3 mid-vaginal and 5 juxta-cervical. Only one patient had undergone a previous attempt at repair (elsewhere, per abdomen). A minimum period of three months was allowed between delivery and repair. The longest period of delay was ten years.

Eight different doctors carried out the repair operations, none of them being responsible for more than three. The only specialist gynaecologist amongst them, Professor Gebbie, operated on two of the patients.

All fistulas were repaired per vaginam, except for one vesicocervical fistula which was repaired per abdomen. The vaginal operations were performed with the patient in the lithotomy position. This makes the repair of low fistulas adherent to the back of the pubis rather difficult, and some authors, notably Lawson & Stewart (1968), have advocated the knee-chest position for them. However, this is difficult for inexperienced theatre staff and anaesthetists to maintain, and we have therefore not attempted it.

A two- or three-layer repair technique was used. Chromic catgut was used for a one- or two-layer bladder repair, and monofilament nylon for the vagina. In one case a Martius pedicle graft of fat from the labium majus was used. Postoperative drainage was always via an indwelling urethral catheter, held in place with a suture rather than a balloon, which was left in for a minimum of 14 days. Continuous catheter suction was never used.

RESULTS

Twelve of the thirteen fistulas were successfully closed at the first attempt. In the remaining case a pinhole residual fistula was successfully repaired three months after the primary operation.

DISCUSSION

Although this is a small series of VVF repairs, it is of interest because it shows that good results can be obtained by relatively inexperienced doctors in a small hospital. It could be argued that we were just lucky and that nonspecialists should not attempt VVF repair. However, travel and accommodation costs and long waiting-lists often prevent successful referral. Patients may misunderstand a specialist from far away when he tells them to return in a few months for surgery. They may believe he cannot cure them but is unwilling to say so.

In these situations we would advise nonspecialists to study the writings of Chassar Moir (1967) and Lawson & Stewart (1968), whose books have guided us. They should refer circumferential fistulas, massive fistulas extending from cervix to urethra, cases complicated by severe scarring, cases with a concurrent rectovaginal fistula, and failures which have not been cured by simple second operation. They can attempt the rest with a good chance of success.

ACKNOWLEDGEMENT

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REFERENCES

Chassar Moir J (1967) The Vesicovaginal Fistula, 2nd edn. Baillière, Tindall & Cassell, London

Lawson J B & Stewart D B (1968) Obstetrics and Gynaecology in the Tropics and Developing Countries. Edward Arnold, London

Preston P G (1951) *Journal of Obstetrics and Gynaecology of the British Empire* **58**, 282–290

Tahzib F (1983) *British Journal of Obstetrics and Gynaecology* **90**, 387

Obstetrics and Gynaecology

Obstructed labour—a four-year survey at the University of Benin Teaching Hospital, Benin City, Nigeria*

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In spite of its rarity in the developed countries, obstructed labour still contributes immensely to high maternal and perinatal mortality and morbidity in many developing countries of the world, like Nigeria. Culture factors, poverty, and inadequate health facilities are some of the contributing factors to obstructed labour in our area. Malnutrition, uncontrolled infectious diseases in childhood, and the resultant poor skeletal development during the reproductive age have also been blamed for obstructed labour in the developing countries (Baird 1963; Gilles *et al.*, 1956; Lister 1960). A multifaced approach is therefore necessary if obstructed labour is to be eliminated from all obstetrical units in Nigeria. A review such as this aims at sustaining interest in this problem.

MATERIALS AND METHOD

The post-partum records of all mothers delivered at the University of Benin Teaching Hospital. Benin City, Nigeria from April 1, 1973, to March 31, 1977, were reviewed. During this period, there were 6,369 deliveries recorded and 136 cases or 2% of the patients had obstructed labour. During the same period, 520 Caesarean sections were performed in the unit, 102 of which were carried out because of obstructed labour. One hundred and twenty-six case notes were suitable for analysis and these form the basis of this study. Most of the women were brought moribund from neighbouring villages and homes, having been in labour for days. Some of them were originally booked for antenatal care but absconded to avoid possible Caesarean deliveries. A small group was also referred belatedly from some maternity homes, where either because of inadequate facilities and/or due to ignorance the patients had waited too long. Table 1 shows the distribution of causes of obstructed labour.

In the three cases of fetal abnormality, two were of anencephalus and one hydrocephalus. Table 2 shows the various presentations among the cases and their relationship to parity. Details of these cases were as follows:

Vertex presentation. Seventy-nine cases presented with the head and 11 of these patients were booked for antenatal care. There were 19 cases of occiput-posterior, nine brow, three face and 48 undetermined because of marked caput formation. Fetal heart sounds were absent in 17 patients and queried in two. The cervical dilatation was more than 8 cm in 61 patients, less than 8 cm in seven and not recorded in 11 patients. There were three cases of Caesarean sections (for cephalo-pelvic disproportion) in this group. There were 10 laparotomies for ruptured uterus, two of which were previous sections, and nine craniotomies, two of which were for malformed babies. Sixty emergency lower segment Caesarean sections were performed. There was a total of 21 stillbirths (four fresh and 17 macerated) and 58 live births. Fetal weight was more than 2.5 kg in all 70 cases with operative deliveries.

Transverse lie. There were 12 cases with the fetus in transverse lie. Two patients had had two previous sections each for cephalo-pelvic disproportion and one patient had had a previous Caesarean section for an unknown cause. There were two cases of ruptured uterus (both of which were previous Caesarean sections). Fetal heart sounds were absent in three patients and questionable in two others. The

Table 1. Causes of obstructed labour

Feto-pelvic disproportion	103
Impacted transverse lie	12
Mento-posterior/face presentation	6
Shoulder dystocia	2
Fetal abnormality	3
Total	126

* This paper was presented at the first International Conference of the Nigerian Society of Obstetrics and Gynaecology at Ibadan, Nigeria, in October 1977.

Table 2. Parity incidence in relation to various causes of obstructed labour in Benin

Presentation	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Vertex	37	7	0	19	6	6	4	0	0	79
Transverse lie	0	2	1	1	6	2	0	0	0	12
Compound presentation	0	0	2	0	2	0	0	0	0	4
Shoulder presentation with arm or hand prolapse (singleton)	1	0	1	1	0	2	1	0	0	6
Shoulder presentation with arm or hand prolapse (twins)	0	0	0	1	0	0	2	1	0	4
Breech	2	1	0	1	4	0	1	0	0	9
Fetus lying free in peritoneal cavity	1	0	1	0	0	1	0	0	0	3
Not recorded	0	0	2	0	1	3	1	0	2	9
Total	41	10	7	23	19	14	9	1	2	126

cervical dilatation was less than 8 cm in all 12 cases. Abdominal delivery was carried out in all 12 patients resulting in four stillbirths (one macerated) and eight live births. Eight babies weighed more than 2.5 kg. All three previous sections were booked patients who defaulted to avoid repeat section.

Compound presentation. There were four patients with compound presentation. One patient had a previous Caesarean section for unknown indication. Fetal heart sounds were present in all patients and the cervical dilatation on admission was less than 8 cm. Caesarean section was the mode of delivery in all patients resulting in live births. Fetal weight was more than 2.5 kg in all cases.

Shoulder presentation with arm or hand prolapse (singleton). There were six patients in this group. Fetal heart sounds were present in five and absent in one. The cervical dilatation on admission was more than 8 cm in four patients. Caesarean section was carried out resulting in five live births and one fresh stillbirth. All babies weighed more than 2.5 kg. Two of these six patients were booked for antenatal care.

Shoulder presentation with arm or hand prolapse (twins). Four patients with twin pregnancies, three of whom delivered their first twin at home, were admitted with arm prolapse of the second twin. The fourth patient delivered her first twin in the hospital and was subsequently obstructed with the second twin. All four babies were delivered by Caesarean section resulting in three live births and one stillbirth. Three of these patients were booked cases. All four babies weighed less than 2.5 kg. The cervical dilatation on admission was less than 8 cm in two patients.

Breech presentation. There were nine such cases in the series. Fetal heart was queried in one patient and the cervix on admission was dilated more than 8 cm in five patients. Deliveries were by Caesarean section in all cases resulting in one stillbirth and eight live births. All babies weighed more than 2.5 kg. Seven of these patients were booked for antenatal care, but defaulted in their last trimester to avoid Caesarean section.

Fetus lying free in the peritoneal cavity. In three patients, the fetuses were lying free in the peritoneal cavity following uterine rupture. Laparotomy was done resulting in three stillbirths (two macerated). One baby weighed more than 2.5 kg. The macerated fetuses were not weighed. The cervical dilatation was also not recorded.

Presentation not recorded. In nine patients the presentation was not recorded. Fetal heart sounds were absent in three cases and the cervix dilated more than 8 cm in six patients. Caesarean section was performed and there were six live births and three stillbirths (fresh). All babies weighed more than 2.5 kg. One patient had had a previous section for antepartum haemorrhage in this group.

MANAGEMENT

The management of our 126 cases is shown in Table 3

Table 3. Summary of management

Emergency lower segment Caesarean section	102
Caesarean hysterectomy	4
Sub-total hysterectomy	1
Repair of uterus	7
Repair of uterus with bilateral tubal ligation	3
Craniotomy	9
Total	126

Table 4. Associated diagnosis on admission of cases of obstructed labour

Ruptured uterus with intrauterine fetal death	15
Intrauterine death with intact uterus	10
? intrauterine death	6
Fetal heart beat present	95
Total	126

Obstruction was relieved in nine patients by destructive operation; seven of these patients had no fetal heart beat. The remaining two patients with fetal heart beat present were one case of anencephalus and one of hydrocephalus.

Fifteen patients with ruptured uteri were subjected to laparotomy. Four had Caesarean hysterectomy, one had subtotal hysterectomy, and 10 had uterine repair. Three of the patients with uterine repair also had bilateral tubal ligation. Emergency lower segment Caesarean section was carried out in 102 cases, resulting in 92 live births and 10 stillbirths.

COMPLICATIONS

The complications associated with the diagnosis of obstructed labour are shown in Table 4.

The complications arising from the mode of management in each case are shown in Table 5.

Following craniotomy in nine cases, there were two vesico-vaginal fistulae, one of which eventually succumbed due to sepsis. Fifteen laparotomies performed for ruptured uteri resulted only in stillbirths with eight of the mothers sacrificing their childbearing function. Emergency lower segment Caesarean section was carried out in 102 cases resulting in one vesico-vaginal fistula, 10 fresh stillbirths, and five neonatal deaths. The overall perinatal mortality was 309.5/1,000 and maternal mortality of 8/1,000 births. The average hospital stay was 26 days with a few patients staying up to six weeks.

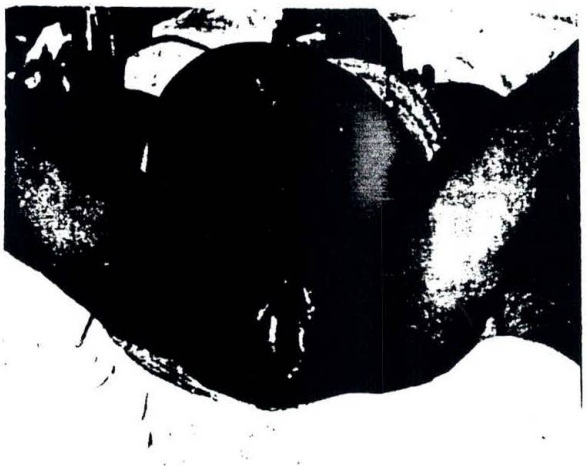

Fig. 1. Oedema of the vulva in obstructed labour.

DISCUSSION

At a time of increasing emphasis on good perinatal medicine in the developed world, it is an irony that in Nigeria, as in other developing countries, obstructed labour still remains a prominent feature of our obstetric casualties. Many mothers and children either perish or are being maimed in the process of childbirth due to obstructed labour. Ampofo (1969) attributed 61 maternal deaths during a five-year period (1963–1967) in Ghana to obstructed labour. Obstructed labour constitutes by far the commonest cause of ruptured uteri in Nigeria. In our series the cause of obstruction was due to disproportion in 103 cases out of 126 or 81.4%. This is similar to the experience of other workers from the developing countries (Ampofo 1969; Cannon and Hartfield 1964; Lawson 1965).

Table 5. Results of management of 126 cases of obstructed labour

Procedure	*Number*	*Loss of child-bearing function*	*Vesico-vaginal fistula*	*Stillbirth*		*Neonatal death*	*Perinatal death*	*Maternal death*
				Fresh	*Macerated*			
Craniotomy	9		2	2	7		9	1
Laparotomy	15	8	–	2	13		15	–
Emergency lower segment Caesarean section	102	–	–	10	–	5	15	
Total	126	8	2	14	20	5	39	1

There was a total of eight previous Caesarean sections (six primary and two previous sections), four of which ruptured following obstruction. Four out of eight previous sections rupturing would tend to support the views of those who deplore Caesarean section for dead babies and hesitate to perform it in the presence of live babies in order to avoid scarring of the uterus that may be subsequently obstructed (Lawson 1965). In one of the largest incidences of ruptured uteri yet described (171 cases out of 15,908 deliveries) only 38 cases or 22% were ruptured scars (Rendle Short 1966). It thus seems that in the planned management of obstructed labour it does not matter much if a scar is left in the uterus. Many destructive operations have been performed on apparently well chosen patients with disastrous results (Mokgokong and Crichton 1974). Crichton and Boulle (1964) reporting on rupture of the unscarred uterus gave five criteria for intra-uterine manipulation of neglected obstructed labour. These are as follows: (1) full dilatation of the cervix; (2) relaxed uterus; (3) intact or recently ruptured membranes; (4) reasonably sized pelvis; and (5) baby whose weight is not above average. Rarely are those criteria met in most cases of obstructed labour so that fistulae formation and ruptured uteri are apt to occur with increasing frequency particularly in inexperienced hands.

Thus we believe that in the management of neglected obstructed labour, Caesarean section should be liberalized. Extraperitoneal Caesarean section may find practical application in our set-up as shown by Mokgokong and Crichton (1974). There may still be a limited place for destructive operation in obstructed labour but this must be done by those skilled in the art, if the associated mortality and morbidity are to be avoided.

ACKNOWLEDGEMENT

We are grateful to our consultant colleagues who allowed us to include their patients in the series and also to Mr James Okhakhu for secretarial services.

REFERENCES

Ampofo, A. D. (1969). *West Afr. med. J.*, **18**, 17.
Baird, D. (1963). *British Obstetrics and Gynaecological Practice*, 2nd edition, p. 753. London: Heinemann.
Crichton, D., and Boulle, P. (1964). *Lancet*, **1**, 369.
Cannon, D. S. H., and Hartfield, V. J. (1964). *J. Obstet. Gynaec. Brit. Cwlth*, **71**, 940.
Gilles, H. M. *et al.* (1956). *Brit. med. J.*, **2**, 686.
Lawson, J. B. (1965). *J. Obstet. Gynaec. Brit. Cwlth*, **72**, 877).
Lister U. G. (1960) *J. Obstet. Gynaec. Brit. Emp.*, **67**, 188.
Mphahlele, M., and Van Der Meulen, A. J. (1975). *S. Afr. med. J.*, **46**, 1204.
Mokgokong, E. T., and Crichton, D. (1974). *S. Afr. med. J.*, **48**, 788.
Rendle Short, C. W. (1961). *J. Obstet. Gynaec. Brit. Cwlth*, **68**, 44).
Rendle Short, C. W. (1966). *Amer. J. Obstet. Gynaec.*, **79**, 1114.

Notes and News

Audio-visual training in tropical diseases

In cooperation with the World Health Organization, the Royal Tropical Institute in Amsterdam and the Liverpool/London Schools of Tropical Medicine are developing audio-visual packages in the form of microfiches and strips of unmounted slides (84 slides each) on eight important groups of tropical diseases (malaria, schistosomiasis, leishmaniasis, leoprosy, geohelminthic infections, amoebiasis, other helminthic infections, other protozoal infections). These slides/microfiches are intended for the training of health workers of various levels and categories engaged in the control and study of tropical diseases. The accompanying texts are available in English, French, and Spanish.

The first two of these series (malaria and schistosomiasis) are completed; the others are in preparation.

These teaching aids are not only aimed at medical schools, but also at institutions which train intermediate and primary health workers. We would be very grateful to you if you could provide us with an estimate of how many sets you might be interested in purchasing and a list of institutions which would be specially interested in the slide series on malaria. The cost of each of these sets is $9.00 for microfiche edition and $15.00 for unmounted 35mm slides edition. Orders should be addressed to Royal Tropical Institute, Dept. Tropical Hygiene, Section M.O.N., Mauritskade 63, 1092 AD Amsterdam, Netherlands.

Antenatal care in a district hospital*

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TROPICAL DOCTOR, 1987, 17, 124–127

Although the aims of antenatal care are the same all over the world, the actual practice varies from one region to another. Even in the same country the practice in a teaching hospital in an urban area very often differs from that in a district hospital in a rural area. It is important, therefore, that the provider of antenatal care in a rural setting should understand the circumstances and peculiarities of the district, including the human, technical and financial resources available, in order to give a service that is responsive to the needs of the people served. For this reason I intend to dwell more on the administrative and organizational aspects than on the routine aspects of antenatal care.

INVENTORY OF RESOURCES

Let us assume that a doctor has just been posted to a district where he has never worked before. One of the first things he should do is to make a quick inventory of the resources available in the district for antenatal care.

Human resources: The numbers, and levels of training, of nurse/midwives, paramedical staff, and traditional birth attendants (TBAs) who provide antenatal care in both static and mobile clinics should be ascertained. The standard (and type) of coverage of antenatal services will, to some extent, depend on the number and calibre of the staff who give this service.

Infrastructure: This includes the number, quality, and location of health centres and maternity units (both static and mobile) that are available in the district. The quality of roads during the rainy season and the availabilty of transport are equally important.

Financial resources: Although most medical schools do not prepare medical students in aspects of financial management, the new district medical officer will find himself being confronted with this problem. It is wise to sit down with the hospital administrator or accountant to find out what money is available for maternal and child health work. It is only when one appreciates financial constraints that one can tailor one's plans to the resources available. The drugs to be stocked and the type of laboratory tests to be done during antenatal care will depend on the facilities and money available.

*Second in a series on Essentials of an Obstetric Service. See: April 1987, p. 77

AT-RISK APPROACH

A typical district hospital in the tropics is unlikely to have all the staff and facilities that one might wish in order to reduce maternal and perinatal mortality and morbidity. The at-risk approach essentially involves: (*a*) taking an inventory of the main causes of maternal and perinatal mortality and morbidity in the hospital and the district it serves; (*b*) arranging these problems in some order of priority or importance, based on figures obtained in the district; (*c*) working out a system that ensures that women at high risk are picked out easily, so that they can be given the special care that they need. How can this be done?

ACTION-ORIENTATED ANTENATAL CARD

There is no substitute for a well-motivated, properly-trained and alert midwife when it comes to identifying the at-risk antenatal patient, but the majority of district hospitals do not have this ideal midwife. Firstly, there are never enough midwives, and secondly the workload is such that in any one day the same midwife is expected to run clinics (nutrition surveillance, immunization and antenatal care), look after a ward, and perform a number of other tasks. In these circumstances, the traditional antenatal cards, which expect the midwife to look for each of the risk factors and then decide what to do in any particular case, might lead to some at-risk patients being missed and not being referred on time.

On the other hand, no antenatal card, however well-designed, can possibly display all the known risk factors – with appropriate action inserted. To do this it would have to stop being a card and become a manual of obstetrics. Clearly one needs to look at the most important risk factors in each country or district and then design a card that ensures that these conditions are not missed. It follows that no one card can be ideal for every country.

Many action-orientated cards have been designed. Some have a check-list of the most important risk factors regarding the past history as well

as the current pregnancy, and the midwife need only tick off the appropriate column. In some, no attempt is made to give a score for each risk factor; others give a score for each risk factor so that one can grade the degree of risk that a particular mother has. Yet another approach is to use a colour scheme: the card is designed in such a way that the answers to questions on the check-list are ticked in either white or red squares; all ticks in red squares denote risk, and all the midwife has to remember is that any mother with a tick in a red square needs to be referred for further attention by a clinical officer, doctor or specialist, as the nature of the case demands. This is the card used in Malawi.

Whichever method is used, the important thing is that the midwife should be able to decide at a glance which mother needs to be referred higher up the health service hierarchy for further attention by someone with the necessary expertise to handle the problem.

In our experience the main problem with the action-orientated card is that the less motivated and less able midwife will tend to stop at the conditions listed on the card. Such nurses fail to ask questions related to conditions not listed. This is not a condemnation of the at-risk card but a reminder that midwives must constantly be reminded, through refresher courses, about other risk factors that need to be looked for (of which an exhaustive check list is contained in explanatory notes that accompany the card). However, if the card is designed after looking at the commonest and most important risk factors in each community, then it will ensure that the majority of women with the most common risk factors will be identified by use of the card. This is good enough; even in countries with the best facilities, detection of risk factors is not 100% accurate[1,2].

ASSESSMENT OF FETAL GROWTH

The assessment of fetal growth and condition is one of the most important aspects of antenatal care, yet it is often not done very well. The time-honoured method of assessment by abdominal palpation and use of fingerbreadths above and/or below the umbilicus (or above the symphsis pubis, or below the xiphisternum) has been shown to be inaccurate, even in the hands of senior obstetricians. The more modern and accurate methods (e.g. serial measurement of the biparietal diameter using ultrasound, or the serial measurement of serum or urinary oestriols) are not available in most developing countries.

Recently, there has been a lot of excitement about the use of an ordinary measuring-tape to assess the symphysis-fundus (SF) measurement, which can be plotted on a graph on the antenatal card so that progress can be seen at a glance. Various workers have shown that when the last menstrual period is known accurately, a normal propagation of the SF measurement is almost always associated with a normal-for-dates baby. When the growth curve goes below the 10th percentile the result is usually a small-for-dates baby. When the growth curve is above the 90th percentile one should suspect multiple pregnancy, polyhdramnios or a large-for-dates baby.

Some authors[3] have suggested that the SF measurement is not as accurate as was once thought. From a study they concluded that SF measurement was so variable that it was not very reliable as an index of uterine (and fetal) growth. Not only were there variations between observers, but also variations by the same observer on the same patients. This was attributed to a number of factors, such as movements of the fetus and position changes (at close intervals of time), and intermittent physiological contractions of the uterus.

Where does this leave us? I think that no one method of clinical assessment of fetal growth and condition is perfect. Even the most enthusiastic SF measurers accept this. In our community in rural Malawi only 50% of women remember their last menstrual period with any degree of certainty. Reliance on SF measurement alone in these circumstances is likely to be inaccurate. Supplementation with abdominal palpation is probably still necessary.

DATA TO BE RECORDED ON ANTENATAL CARD

What are the acceptable minimum of measurements that should appear on the antenatal card?

Height: Many authors have shown that height is related to obstetric performance[4,5]. Women of short stature are more likely than taller ones to have problems related to cephalopelvic disproportion. It is important for each country or district to work out, on the basis of local experience, what is the minimum "acceptable" height. All women below that height should then be referred.

It is easy to put a mark on a wall of the antenatal clinic. All women below that mark will need to be referred. Another method suggested[5] is to put a bar at an appropriate height at the entrance to the clinic. Those who can walk in without stooping need to be referred.

Fundal height (SF) has been discussed above.

Weight: Weight gain in pregnancy may be negligible or high, depending on circumstances. In many African women weight gain is minimal and often erratic, even when the fetus is growing well. This makes it difficult to ascertain how important weight gain is. However, if there is no weight gain, or if weight is lost, in the presence of other warning signs (e.g. static SF measurements and reduction of abdominal girth) then one should suspect intrauterine growth retardation. Excessive weight gain would make one suspect the possibility of multiple pregnancy or impending preeclampsia.

As with SF measurements, the weight can either be tabulated or shown in graphic form on the antenatal card.

Blood pressure: In some parts of the tropical world preeclampsia/hypertension is an important contributor to maternal and perinatal mortality and morbidity. A country where such a problem exists should ensure that no antenatal clinic is without a sphygmomanometer. It is best to invest in a wall-mounted type (or one with a tripod), which is expensive initially but lasts longer and is therefore eventually cheaper.

Haemoglobin and blood group: Most district hospitals can perform haemoglobin (Hb) examinations. As anaemia is a major contributor to maternal and perinatal mortality and morbidity, each mother should have at least one examination at the beginning of antenatal care. Those with a low Hb can be given appropriate treatment and prophylaxis; it is also prudent to repeat the Hb examination, in those cases, towards term. Most rural clinics cannot afford to do more than two Hb estimations.

Urine/stool testing: In communities with heavy worm infestations it is prudent to examine the stool in those with anaemia. Testing urine for the presence of protein is useful in those areas with problems of hypertension. Testing for glucose is also advisable if diabetes is a common problem; it may not be necessary as a routine examination in all areas.

Sexually transmitted diseases (e.g. syphilis): These are increasingly important in most countries. If this is a problem in your community, then VDRL (or some other test) should be performed at the start of antenatal care.

Sickling: This test is not done routinely, but only when indicated in appropriate populations.

MEDICATION DURING PREGNANCY

Iron and folic acid

Anaemia is one of the most important problems in pregnant women in the tropics. In Malawi anaemia (Hb<10g/dl) appears in about 10% of the obstetric population. Nutritional factors appear to be important in the aetiology of anaemia in the tropics, although worm infestation, bilharzia and malaria are also important factors.

The prophylactic use of iron in pregnancy is widely accepted and there is a strong case for training traditional birth attendants to distribute iron to their clients. In addition, folic acid should be given in cases of multiple pregnancy and severe anaemia. If worms are present they should be eradicated by appropriate treatment. With regard to bilharzia, we recommend that treatment be deferred until after delivery.

Antimalarials

To all intents and purposes chloroquine is the only safe drug to be used for malaria suppression in pregnancy. Its efficacy is, however, considerably reduced in those countries of Asia and East Africa where resistant strains of *P. falciparum* to chloroquine have been reported. Pregnant women should be advised to avoid, where possible, being bitten by mosquitoes (e.g. by use of mosquito nets, coils and repellents), in addition to taking their weekly chloroquine (300 mg base per week). They should also be advised to drain stagnant water and clear the bush near their houses. They should seek medical advice immediately in case of fever, and in those areas where resistance to chloroquine is a big problem alternative drugs should be available for use (e.g. amodiaquine, quinine, Fansidar).

Tetanus toxoid

Neonatal tetanus is a problem in most tropical countries (Table 1). It is also one that can easily be

Table 1. Neonatal tetanus deaths (modified from *Population Reports, Series L,* No. 5, March–April 1986)

	Deaths per 1000 live births
Yemen Arab Republic	3
Thailand	5
Sudan	9
Malawi	10
Somalia	21
Nepal	15
Bangladesh (various surveys)	22–37
Pakistan	31
India (various surveys)	5–67

eradicated if nonimmune pregnant women are given tetanus toxoid at least twice during pregnancy. The two doses of tetanus toxoid must be given at least 4 weeks apart, the first dose early in the second trimester and the last at least 2 weeks before delivery. Not only does this protect the baby against tetanus (for 5 months after delivery) but it also protects the mother should she happen to deliver in unhygienic conditions. Two doses protect the woman for at least 2 years. After the third dose protection lasts for 5 years.

Other immunization

There is very little justification for other forms of immunization during pregnancy. Prophylaxis against other diseases, e.g. rubella, should be given before pregnancy. (This is rarely done in the tropics.)

PLACE OF DELIVERY

As indicated above, the aim of the at-risk approach is to identify those at high risk so that they can deliver at a unit which is best suited to deal with their problem. For instance, a mother with one previous caesarean section should be referred to a unit with facilities to perform a repeat caesarean section should this become necessary.

Some multigravidas (gravida 2–4) with no risk factors can be delivered in a rural clinic or by the traditional birth attendant. Women of high parity (gravida 5 and above) are best delivered in better staffed and equipped units, as the likelihood of problems is greater in this group.

WAITING MOTHERS' AREA AT DISTRICT HOSPITALS

The majority of district hospitals in rural areas do not have enough ward space to accommodate all waiting mothers. It has been found appropriate in some district hospitals to construct low-cost buildings to accommodate those mothers who do not require close observation. This enables the nurses to give closer attention to those who are sick and in greater need of assistance. The mothers in the waiting area can be reviewed regularly in the clinic as their cases demand, and they are close enough to the ward to come for immediate admission should labour start.

It is important that a midwife be assigned to check on these women regularly, because some women may not recognize signs of impending problems. It would be sad if tragedies were to arise when the mother is so close to the hospital. Some women regard the waiting area as second-rate health care. Tact and explanation are important in order to avoid people leaving the waiting area for home. This usually happens where the quality of the building and/or the food is poor.

CONCLUSION

Antenatal care at a district hospital should start with an understanding of the problems peculiar to that district, followed by an inventory of resources available. On this basis a rational approach can be made to the level of care that is possible and appropriate within the constraints of manpower, money, and infrastructure. Health for all by the year 2000 can never mean the same thing to every country. Priorities in each country have to be identified and steps taken to provide services that will address those priorities.

REFERENCES

1 Hall MH, Chng P, MacGillivray I. Is routine antenatal care worth while? *Lancet* 1980;ii:78–80
2 Chng PK, Hall MH, MacGillivray I. An audit of antenatal care: the value of the first antenatal visit. *Br Med J* 1980;**281**:1184–6
3 Bagger PV, Eriksen PS, Secher NJ, Thisted J, Westergaard L. The precision and accuracy of symphysis-fundus distance measurements during pregnancy. *Acta Obstet Gynaec Scand* 1985;**64**:371–4
4 Baird D. *Combined textbook of obstetrics and gynaecology.* Edinburgh: Livingstone, 1962
5 Everett VJ. The relationship between maternal height and cephalopelvic disproportion in Dar es Salaam. *East Afr Med J* 1975;**52**:251–6

Complication of cervical cerclage

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TROPICAL DOCTOR, 1987, **17**, 127–128

Cervical cerclage is a well established and frequently performed procedure for the treatment of incompetence of the internal cervical os. With due care in management, the procedure has a low complication rate and can be regarded as relatively harmless. Neglect, however, can result in major complications, which might be expected to occur

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Antenatal card for illiterate traditional birth attendants

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INTRODUCTION

The importance of accurate and regular recording of the findings during antenatal consultations is generally accepted. Various control cards for antenatal clinics exist (Sims 1978, Watson 1984, Kennedy – personal communication, Essex & Everett 1977). All of them are designed for use by trained (auxiliary) nurses and/or midwives. With various degrees of complexity, the aim of these cards is to identify important risk factors during pregnancy so that appropriate action can be taken.

In Guinea Bissau, the training of traditional birth attendants (TBAs) as part of the primary health care (PHC) programme was started in 1977 (Chabot & Savage 1984). Almost all TBAs are illiterate. After some years it became apparent that their work was not as effective as had been expected: for example, neonatal tetanus was still occurring in villages with TBAs. However, it was difficult to supervise and support their work, as no records were kept of what was actually done.

The need for an antenatal card that could be used by illiterate TBAs became apparent. The card presented in this paper was developed by the Ministry of Health and Social Affairs and has been used nationally since 1982. A good description of the contents and methods of TBA training has been given elsewhere (Williams 1980), so this aspect will not be discussed here.

AIMS OF ANTENATAL CARD

(1) To help the nurse-supervisor discover and correct mistakes made by TBAs. The card was therefore designed as a tool for teaching and supervision by the health staff, enabling them to explain misunderstandings to the TBAs, while caring for the pregnant women in their villages.
(2) To help TBAs remember what to look for during antenatal consultations, so as to take appropriate action. The card should therefore help TBAs to interpret results correctly.

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(3) To enable TBAs to identify pregnant women at risk, and refer them when necessary. All essential information for discovering women at risk should therefore be included on the card.

HOW TO USE THE CARD

As the card is to be used by illiterates, the need for writing has been minimized. All essential information can be recorded by putting a cross (X) in the appropriate box, or by putting the necessary number of ticks in the correct place. Only the administrative information (name, age and village) needs to be written down, and this has to be done only once during the whole pregnancy. A local schoolteacher or literate member of the community can help with this. The pictorial symbols used in the card were developed and tested in the field with the PHC nurses. They were designed by an artist who had also participated in the national training guide for VHW/TBAs.

As with the road-to-health chart, the woman keeps her own antenatal card (in a plastic bag if available), as a record for other health workers of her present and previous pregnancies.

DESCRIPTION OF THE ANTENATAL CARD

The card is divided into three main parts: history, examination, and care.

History

The front page (Figure 1) gives four pieces of information on the reproductive life of the pregnant woman:
(1) The number of her children alive.
(2) The number of her children that have died.
The total number of pregnancies can then easily be obtained by adding the number of live and dead children. In this way parity is known more accurately than by asking "How many pregnancies have you had?" as women tend not to mention their children that have died. Furthermore, TBAs find it difficult to ask pregnant women in a reliable way how many of their children were born dead and how many were born alive: it is much easier to ask the number of children actually alive and dead. Once this is known, the supervisor can find out the number of stillbirths among the children that have died by looking through the answers. The first (empty) box is meant for women with no previous pregnancies.
(3) The number of abortions can be indicated by writing the number or by putting the right number of ticks (✓) in the open space.

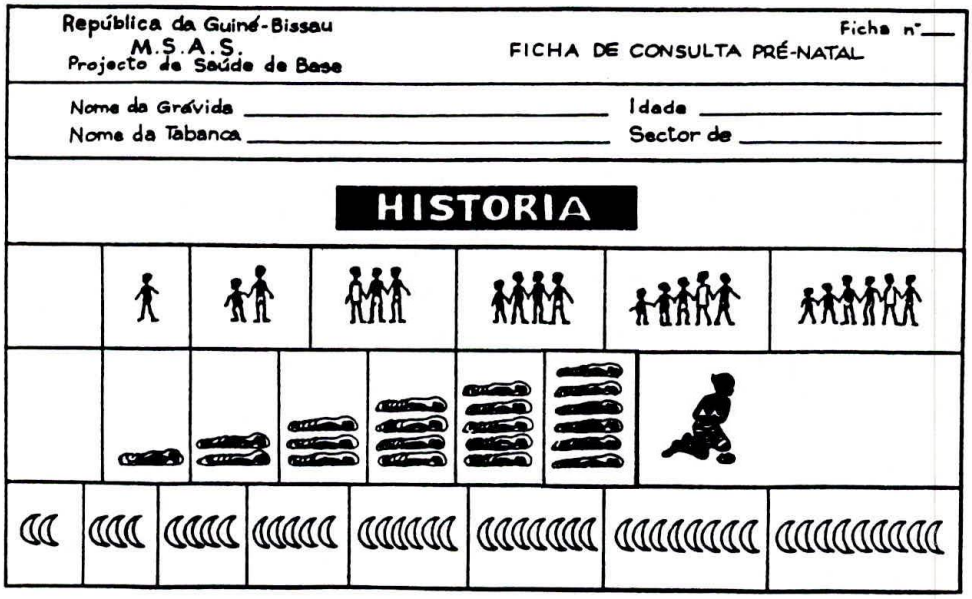

Figure 1. Front of antenatal card: history

(4) The TBA indicates the number of "moons" the pregnant woman thinks she is pregnant by putting a cross (X) in the appropriate box during the first antenatal visit.

Examination

The inside of the card (Figure 2) gives information about the results of the physical examination done by the TBA.

(1) The date of each consultation is a piece of information that has to be written. If the TBA cannot write (in Portuguese or Arabic), someone else in the village should be asked for help.

(2) If there are no scales in the village or if the TBA cannot read its numbers, this column should be left empty. However, during the supervisory visit the nurse or midwife can mark the correct weight here.

(3,4) The important signs of anaemia and oedema should be looked for by the TBA, and she can be taught how to do this. Confusion might arise as to what is meant by "+" and "−". While field-testing the card we found that for most TBAs it was "logical" to mark the presence of anaemia in the "−" column. After all, to be anaemic is a negative thing. In the same way, the absence of oedema should be noted in the "+" column. Instructions for the trainers of TBAs have since been changed accordingly.

(5) The TBA can find the height of the uterus by using a measuring tape or a cord with knots at the corresponding heights for every month of pregnancy, from 5 months (umbilicus) upwards. The result of this finding can be noted down by the TBA as the number of "moons" of pregnancy, or by the corresponding number of ticks at the appropriate date of consultation. In this way both the TBA and the supervisor can check whether the uterus is growing or not.

(6,7,8) These diagrams show the position of the fetus. A cross (X) is put at the corresponding date for the particular position found. A clear explanation of what to do in various circumstances should be given during training.

(9) This drawing will be changed, as its meaning is not clear. The intention was to ask the pregnant woman if she felt fetal movements. In case of a positive reply, it should be marked down in the "+" column.

(10) Here the TBA should mark whether she hears fetal heart-sounds or not.

(11) Urine analysis with Albustix is only done if the pregnant woman has signs of oedema. Results indicated by the number of "+" signs are marked down as shown on the tube itself.

Care

The back page (Figure 3) of the antenatal card helps the TBA to decide what care to give.

02458
MP-100
COMMUNITY HEALTH CELL
326, V Main, I Block
Koramangala
Bangalore-560034
India

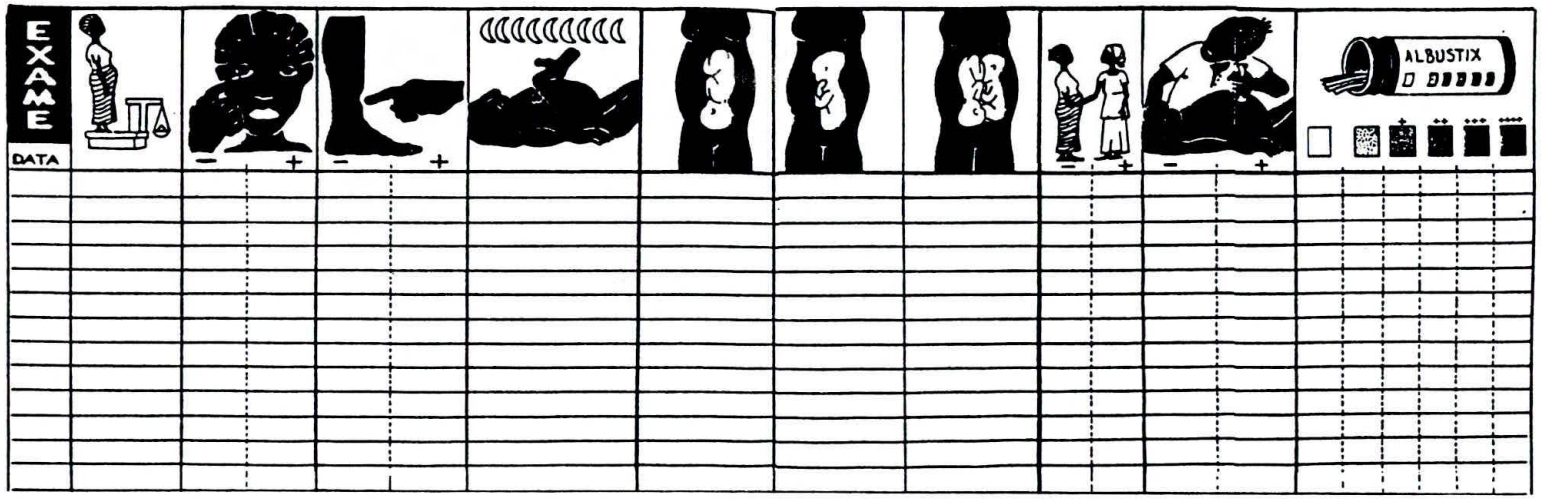

Figure 2. Illustrations on inside of antenatal card: examination

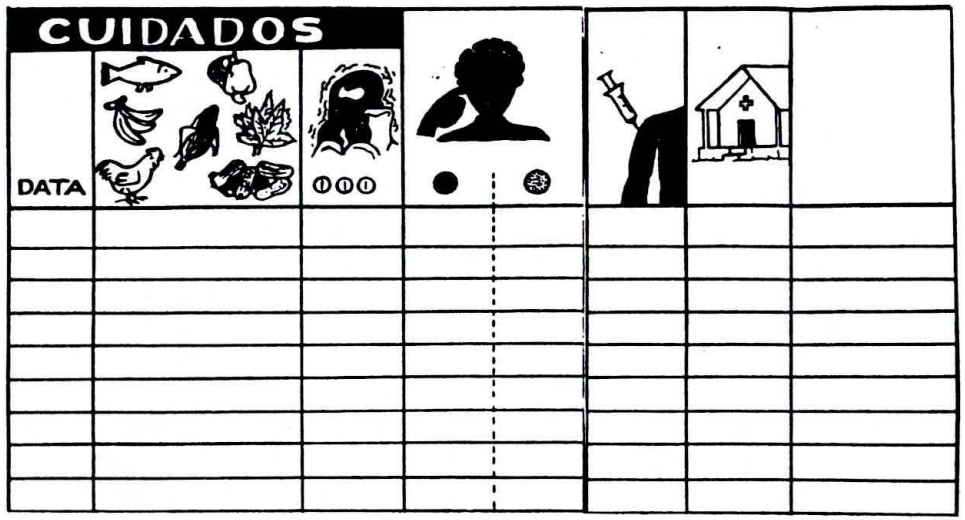

Figure 3. Illustrations on back of antenatal card: care

(1) Again the marking of the date of consultation in the first column is sometimes difficult.
(2) The drawing in the second column reminds the TBA to give appropriate nutritional advice.
(3) A cross (X) should be placed in the third column if malaria prophylaxis has been given.
(4) The dispensing of iron tablets (with folic acid) and/or multi-vitamin tablets should be marked in the fourth column.
(5) The dates for tetanus toxoid immunization, which has to be given by the supervisor twice during pregnancy, should be noted in the fifth column.
(6) Finally, referrals to higher levels of health care (health centre or hospital) should be noted in the last column.

DISCUSSION

The introduction of an antenatal card for use by illiterate TBAs is not easy. First of all, it is important to discuss the idea with whoever will later teach the TBAs and use it during their supervision in the villages. Their commitment to using the card to improve the performance of the TBAs is essential. Therefore they should also be involved in the design and content of the various drawings on the card. Once the card has been designed, it should be field tested by the nurses and midwives who will train and subsequently supervise the TBAs. Changes should be made according to their experiences.

Secondly, the antenatal card will only prove useful if it can: identify the problems of a particular pregnancy (e.g. anaemia, insufficient fetal growth, wrong presentation), and the at-risk cases; help TBAs interpret their findings, by giving a clear set of instructions and standing orders on what to do in each situation (these instructions should be taught together with the use of the card).

These two conditions can only be met by continuously supervising the TBA's performance and discussing the findings with her. In this way the card can provide a framework of things to look for during the supervision, and so enhance its effectiveness. At the same time it can improve the TBA's performance by showing her any deficiences in her skills or knowledge. Thus it can help to direct TBAs' training, and supervisors' attention, more specifically towards aspects that need emphasis.

Finally, the card described here needs evaluation. At present, it is too early to suggest how successfully it identifies women with a high obstetric risk through the regular control of TBAs. Studies of the sensitivity of the antenatal cards (i.e. the proportion of pregnant women with high-risk factors detected through their use) are badly needed, not only for the card presented in this paper, but also for the antenatal cards used by nurses, midwives and doctor.

This antenatal card has been a considerable help in the process of improving the performance of TBAs and represents a first step in making their antenatal care more effective. Detailed studies of this aspect of primary health care are urgently needed to make the training of TBAs a more worthwhile activity.

REFERENCES

Chabot H T J & Savage F (1984) A Community Health Project in Africa (slide set). Teaching Aids at Low Cost (TALC), PO Box 49, St Albans, Herts, AL1 4AX, UK
Essex B J & Everett V J (1977) *Tropical Doctor* **7**, 134–138
Sims P (1978) *Tropical Doctor* **8**, 137–140
Watson D S (1984) *Tropical Doctor* **14**, 133–135
Williams M (1980) The Training of TBAs: Guidelines for Midwives Working in Developing Countries. Catholic Institute for International Relations, 22 Coleman Fields, London N1 7AF. (New edition in preparation)

Should vesicovaginal fistula be treated only by specialists?

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INTRODUCTION

Vesico-vaginal fistulas (VVFs) are still common in many developing countries. The largest series ever reported (Tahzib 1983) refers to the period 1969–80, during which no less than 1443 cases were collected at one university hospital in Northern Nigeria. This report is typical of most papers from developing countries on VVFs which are usually derived from large numbers referred to teaching hospitals, including many difficult cases referred after treatment elsewhere has failed. Such reports give the impression that fistula repairs should only be attempted by expert vaginal surgeons. Unfortunately experienced gynacologists are rare in the rural areas of developing countries where most fistulas occur, so the majority of repairs are probably

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USE OF THE LABOR GRAPH IN MALAWI

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ABSTRACT

This article describes in detail the use of a one-sheet labor record available in every maternity unit in Malawi, Africa. These graphs are provided by the government and are a good method of ensuring that patients make appropriate progress in labor and are referred to medical staff as necessary.

Malawi is a small, densely populated country in southern Africa. The estimated population of 6 million is 90% rural. Sixty-five percent of the total population consists of children under 14 years old and women 15 to 44 years of age. The annual growth rate is 2.6% with infant mortality (up to age 1) 50 per 1000 live births, and child mortality (children under 5) just over 50%. Total fertility is high, averaging 7.7 births per woman of completed fertility.[1]

There are 350 maternity units in Malawi run by the central and local government, religious groups, and private individuals. Approximately 45% of deliveries nationwide occur in these facilities. The majority of women deliver with traditional birth attendants. Staff in the maternity units may be physicians (all of whom are trained outside of the country), clinical officers or medical assistants, state registered nurse-midwives, enrolled nurse-midwives (about equivalent to licensed practical nurses with midwifery training), or nonprofessional personnel. Skill and knowledge vary widely among individuals in differently staffed facilities. The use of a nationwide labor chart is, therefore, an excellent way to ensure the best possible care for the parturient during labor and to maximize appropriate use of referrals.

In 1972, in Southern Rhodesia (now Zimbabwe), R. H. Philpott developed a simple, visual labor graph that was suitable for use in both central hospitals and outlying units. The graph is easy to use and is helpful for identification of high-risk mothers even by nonprofessional personnel who may not understand the physiologic reason for a problem, but who are very capable of identifying it. The main feature of the graph is the use of "alert" and "action" lines. The alert line ". . . is a modification of the mean cervicometric progress of the slowest 10% of normal African primigravid patients admitted in the active phase of labour, that is, with the cervix dilated at least 3 cm and 100% effaced."[2] The action line is arbitrarily "drawn parallel and four hours to the right of the alert line. This allows time to transfer the patient without impairing the success of the essential management and also allows many normal patients to deliver vaginally without active intervention."[3] For practical purposes, active labor on the labor graph used in southern Africa is defined as beginning when the patient is 3 cm dilated and 100% effaced in the primigravida, or 3 cm dilated regardless of effacement in the multigravida. If the patient is admitted before she has reached 3 cm dilation, progress is charted either on a blank graph without an alert line or to the left of the alert line. When she has dilated to 3 cm, the time and dilatation measurement are placed on the alert line. If a multigravida comes in having contractions and the head is deep in the pelvis but is dilated <3 cm, she also is started on the graph.

The labor chart currently used in Malawi is based on Philpott's work (Table 1). All of the maternity units in the country use the same chart, provided by the Ministry of Health. One side contains demographic and admission data and a preprinted graph for evaluating labor progress. The reverse side has space for pelvic assessment, information about the second and third stages of labor, and space for up to 6 days' postpartum observation of mother and infant. This single sheet can serve as the pa-

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tient's entire chart during her maternity stay.

The demographic data section includes the patient's name, address, age, gravidity, parity, last menstrual period, estimated date of confinement, by whom she was brought to the health facility (most patients hospitalized in Malawi are accompanied by a guardian who stays with them), and past/current pregnancy problems. Admission information includes date and time of admission, date and time of onset of labor, whether labor was spontaneous or induced, status of membranes, abnormal symptoms, vaginal bleeding, and presence or absence of preeclampsia. There also are spaces to check whether or not the woman has had sleep, food, or homemade medicine (often given in the villages to induce labor). A section on the general physical examination follows, and at the bottom of the chart there is a space for writing referrals, if necessary.

If the patient is in the latent phase at the time of admission, the dilatation is plotted on the line at 0 time and the actual time is charted below. When patients are in established labor (regular contractions at least once every 10 minutes), vaginal examinations are done every 4 hours in primigravidas and every 3 hours in multiparas. If the patient has been in the latent phase of labor for greater than 8 hours from the time of admission, the risk to the fetus increases; if the woman is in a health center, she should be transferred to a hospital.[4] Once the patient's cervix has dilated to 3 cm, the dilatation and time are plotted on the active phase section and the labor progress is observed closely. Each horizontal square represents 1 cm of dilatation. The alert line is drawn to represent 1 cm per hour of progress, and the majority of women will deliver within 7 to 8 hours of initial marking on this line. The action line is parallel to and 3 hours to the right for multigravidas and 4 hours for primigravidas. The heavy dotted vertical line drawn from the top of the alert line represents the estimated time of delivery.

The other main feature of the graphic part of the labor chart is a record of fetal descent. Cephalopelvic disproportion is a major cause of perinatal morbidity and mortality in Africa.[5] Descent of the head is measured abdominally every hour and plotted on the chart. Descent is measured in "fifths" of head palpable above the pelvic brim (Table 2). Landmarks used in describing "fifths" of fetal head descent are the fetal occiput and sinciput, and the maternal pelvic brim. According to Myles,[6] "When the head is engaged the biparietal diameter has passed through the pelvic brim, the occipital prominence can be felt only with difficulty from above. The sinciput still may be palpable above the brim because of the increasing flexion of the head until the occiput reaches the pelvic floor and rotates forwards."

Studd[7] argues that this method is ". . . quantitative and reproducible and removes the problems of variability that may be created by caput, moulding, or a different depth of pelvis—factors that can be confusing in following abnormal and prolonged labors." Because the head does not become engaged in African primigravidas until late in the first stage,[8] accurate measurement of descent is important in identifying possible problems with cephalopelvic disproportion.

With each abdominal examination for descent, determination of the position changes of the occiput and sinciput are noted. Determination of abdominal descent is less invasive than descent noted vaginally, and is done every hour, affording the care-giver time to assess potential problems before much time has passed.

Other essential information about labor is charted conveniently on top of or underneath the graph. Fetal heart rate (FHR) monitoring is done every 30 minutes or more frequently if needed. Dips heard in the heart rate can be indicated as type 0 (FHR irregular all of the time), type 1 (decrease with a contraction but picks up before the end of the contraction), or type 2 (drop with a contraction and picks up after the contraction has ended (see Table 3).[9]

Patients who exhibit fetal distress are turned on their left side and given oxygen if it is available. They are checked for cord prolapse and referred to the physician, if available, or to the senior-most health personnel with midwifery or obstetric training. Mothers with fetal distress are given an immediate dose of 50 mL of 50% dextrose by intravenous push; then an infusion of D_5W is started. In a maternity center, if there is no improvement within 30 minutes, then the patient should be referred to a hospital.[4]

If the membranes are intact, they are recorded as I in the appropriate column. If the membranes are ruptured artificially, the time is recorded on the graph. Artificial rupture of the membranes by the midwife is permitted when the patient's cervix is 3 cm dilated with the head at four-fifths above the pelvic brim.

Molding also is an important way to detect possible cephalopelvic disproportion. Four degrees of molding are used[9]: − means the bones are normally separated; + indicates that the skull bones are touching each other; + + indicates that the skull bones are overlapping but on digital pressure can be separated easily; and + + + means that the bones are overlapping and on digital pressure cannot be separated easily. When molding is 2+ or 3+, if the patient is in a hospital, then the medical officer should be informed. If the pa-

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TABLE 1
Labor chart and information currently used in Malawi, originally prepared by R. H. Philpott

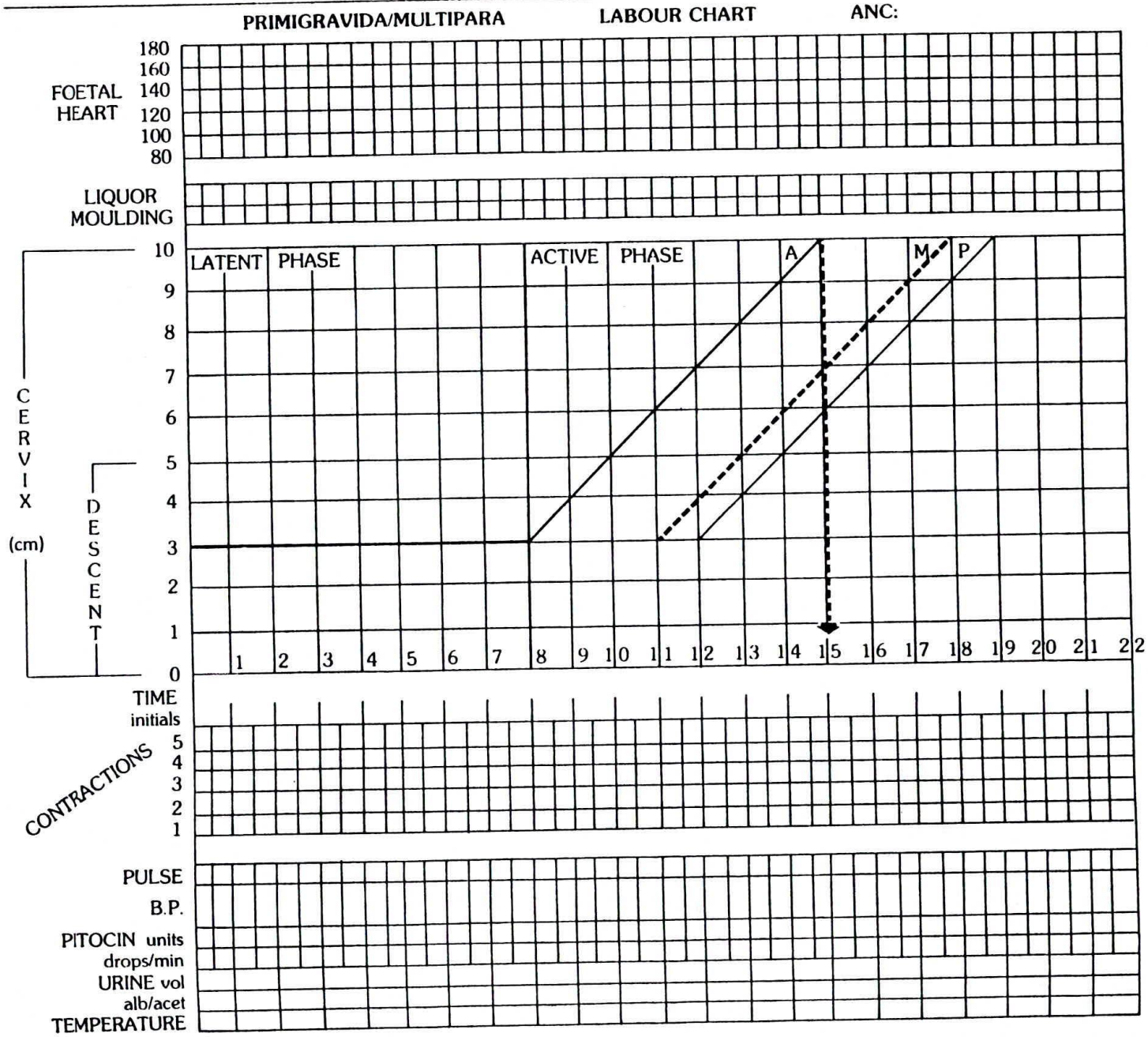

TABLE 1—*Continued*

Hospital _____ No. _____
Name _____
Address _____
Brought by _____
Age _____ Gravida _____ Para _____
LMP _____ EDD _____ Gestation _____
Past pregnancy problems _____
_____
Problems this pregnancy _____
_____

Admitted _____ a.m./p.m. _____ 19___
Labour: spontaneous/induced
Onset _____ a.m./p.m. _____ 19___
Membranes ruptured _____ a.m./p.m. _____ 19___
Has she had food? _____ Sleep? _____
Home-made medicines _____
Abnormal symptoms _____
Vaginal bleeding yes/no amount _____
Pre-eclampsia yes/no

EXAMINATION ON ADMISSION

General condition _____
Height _____ Anaemia _____ Oedema _____
Fundus _____ weeks, and _____ fingers below xiphisternum. Lie _____
Presentation _____ Position _____
Bladder _____ F.H.: _____

REFERRAL _____ a.m./p.m. _____ 19___
Reason _____
_____
Transport arrived _____ a.m./p.m. _____ 19___

FIRST VAGINAL EXAMINATION

Show _____
Soft tissues _____
CERVIX: State _____
Effacement _____ Dilatation _____
Application _____
MEMBRANES: Ruptured/intact
Liquor: colour _____
CORD: _____
PRESENTING PART:
What is presenting: _____
Position: sutures and fontanelles:
_____
Level in relation to ischial spines:
_____
Caput: nil/mild/moderate/severe

PELVIC ASSESSMENT

Shape of brim _____
Sacrum _____
Sacral promontory _____
Sacrospinous ligaments _____
Ischial spines _____
Sub-pubic arch _____
Intertuberous diameter _____

CONCLUSION ABOUT PELVIS:

_____
Anticipated course of labour and delivery
_____
Admitted by: _____

SECOND STAGE OF LABOUR: Fully dilated at _____ a.m./p.m. _____ 19___
Delivery _____ a.m./p.m. _____ 19___
Twin 2: _____ a.m./p.m. _____ 19___

TABLE 1—*Continued*

METHOD: SVD/breech/vac extr/forceps/C.S/other _____

Apgar 1 min. _____ 5 min. _____

Live/full term/prem/SB/Mac/NND

Sex: Female/male

Abnormalities _____

Weight: _____ Grammes (_____ lb. _____ oz)

Length _____ cm Head circumference _____ cm

Delivered by _____ First bath by _____

Baby to nursery for observation yes/no

Twin 2: Method _____

Twin 2: Apgar 1 min. _____ 5 min. _____

Twin 2: Live/full term/prem/SB/Mac/NND

Twin 2: sex: female/male

Twin 2: Abnormalities _____

Twin 2: Weight _____

Twin 2: Length _____ Head circumference _____

Eye drops _____

Vitamin K given _____

THIRD STAGE OF LABOUR: Time of delivery of placenta _____ a.m./p.m. _____ 19 ___

Mode of delivery _____ ergometrine _____ Blood loss _____ ml

PLACENTA: complete/incomplete. Membranes: complete/incomplete. Weight _____ lb. _____ oz.

Cord length _____ cord insertion _____ No. of blood vessels _____

Condition _____ Abnormalities _____

Delivered by _____ Checked by _____

PERINEUM: Intact/tear/episiotomy. Repaired by _____

POST-NATAL CHECKS: Immediately after delivery, B.P. _____ Pulse _____

One hour after delivery: B.P. _____ Pulse _____ Temp _____ Uterus _____

Lochia _____ Urine passed _____ a.m./p.m. _____ 19___ amount _____ ml

SUMMARY OF LABOUR: 1st stage _____ hours _____ min. 2nd stage _____ hours _____ min.

3rd stage _____ hours _____ min. Total _____ hours _____ min.

PUERPERIUM

MOTHER						BABY					
Date	Temp	Ht. of fundus	Lochia	Perineum	NOTES	Date	Temp	Weight	Cord	Eyes	NOTES

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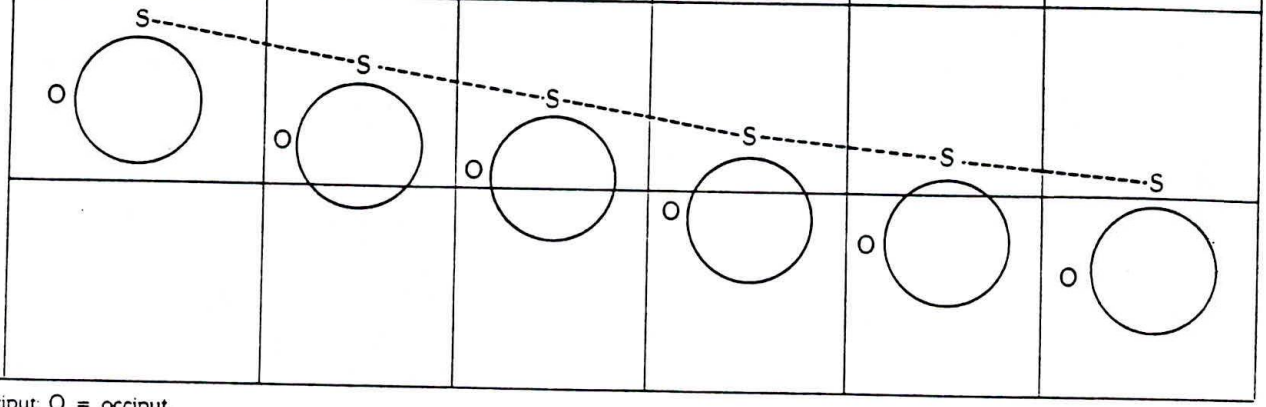
TABLE 2
Level of fetal head (in fifths) above the brim

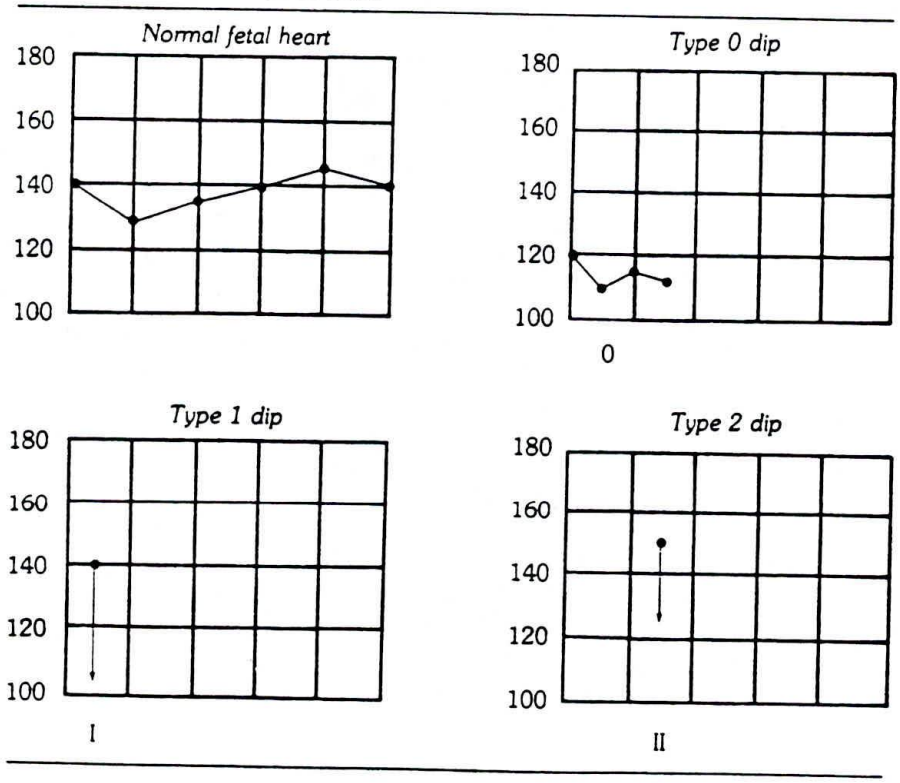
	5/5	4/5	3/5	2/5	1/5	0/5
	Completely above	Sinciput high Occiput easily felt	Sinciput easily felt Occiput felt	Sinciput felt Occiput just felt	Sinciput felt Occiput not felt	None of head palpable
	Head floating			Nearly engaged	Engaged	Deeply engaged
Brim						

S = sinciput; O = occiput.
[a] Adapted from: Philpott RH, Castle W.[8] and "The Labour Graph" Procedure Manual, Kamuzu Central Hospital, Lilongwe, Malawi, Africa.[9]

tient is in a health center, then she should be transferred to the hospital.[4]

The frequency of contractions is recorded every 30 minutes as the number and duration in a 10-minute period. Blocks are numbered from 1 to 5. If there are 3 contractions in 10 minutes, 3 blocks are shaded. Duration is represented by three types of shading: dots represent a duration of less than 20 seconds; diagonal lines indicate contractions lasting 20 to 40 seconds; and very close vertical lines represent contractions lasting longer than 40 seconds. Spaces are available for recording pulse, blood pressure, and use of Pitocin every 30 minutes, and urine volume measurement every hour.

TABLE 3
Charting of fetal heart sounds



The labor graph is used to help make decisions about management of patients. The alert line is a warning system. Once a patient's dilatation moves to the right of the line, she should be transferred so that if and when the dilatation appears on the action line, she will be at a facility equipped for an operative delivery. Patients with abnormally high fetal heads should be transferred even if the dilatation is progressing normally.

In a setting where the majority of delivery facilities are in rural areas and the most skilled people and best equipment are located in major population centers, a clear, easy-to-use method of recording labor progress can be helpful in improving maternal

and fetal outcome. The labor record used in Malawi is an excellent tool for this purpose.

REFERENCES

1. Chiphangwi JD: Obstetric problems in a developing country—Experience in Malawi. J Med Assoc Malawi 13:5, 1983.

2. Philpott RH: Graphic records in labour. Br Med J 4:164, 1972.

3. Philpott RH: Graphic records in labour.[2] p 165.

4. Kwast BE: For doctors: Guidelines for the Management of a patient on the labour graph, in Procedure manual. Lilongwe, Malawi, Kamazu General Hospital, 1974.

5. Philpott RH: Foetal quality preserved in cephalopelvic disproportion in the primigravida. South Afr Med J 47:2021, 1973.

6. Myles MF: Textbook for midwives. Edinburgh, Churchill Livingston, 1972, p 262.

7. Studd JW: A visual method of charting labour: The partogram. Contemp Obstet Gynecol 18:25, 1981.

8. Philpott RH, Castle WM: Cervicographs in the management of labour in primagravidae. J Obstet Gynaecol Br Commonw 79:596, 1972.

9. The labour chart, in Procedure manual. Lilongwe, Malawi, Kamazu Central Hospital, 1974.

SUGGESTED SUPPLEMENTARY READING

Philpott RH, et al: Obstetrics, family planning, and paediatrics. Pietermaritzburg, South Africa, University of Natal Press, 1977.

Philpott RH: Recognition of cephalopelvic disproportion, in Clinics in Obstetrics and Gynaecology: Obstetric Problems in the Developing World. 9(3):609–624, 1982.

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CERVICOGRAPHS IN THE MANAGEMENT OF LABOUR IN PRIMIGRAVIDAE

I. The Alert Line for Detecting Abnormal Labour

BY

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Summary

Adding a particular Alert Line to the cervicographs of Rhodesian African primigravidae has simply and effectively screened normal patients from those with reduced pelvic size and inefficient uterine action. The method can be applied by midwives working in isolated areas. This paper describes the derivation of the line and the results of a prospective study of 624 consecutive patients, whose management in labour was based on its use. The Alert Line would have relevance to practice elsewhere.

RHODESIA, in common with other developing countries, has a serious shortage of doctors. Their distribution is such that, although the larger cities and towns are well covered, the rural areas have a doctor to patient ratio of only 1 : 80 000. There is, therefore, a necessity for the medical profession to utilize midwives and maternity assistants extensively. In this situation, one of the functions of a University Obstetrical Department is to provide training for the midwife and to establish simple, accurate guide rules.

Cephalopelvic disproportion and inefficient uterine action are two of the biggest obstetrical problems in the African primigravidae. In 1970, for example, 81 new cases of obstetrical vesicovaginal fistula, 12 with a concomitant rectovaginal fistula, were admitted to the gynaecological wards of the local teaching hospital. Our difficulty is not only that of evaluating the degree of disproportion in the individual but also that of teaching the midwives how best to assess these patients in the rural areas. All primigravidae are managed with a trial of labour and a simple efficient method of conducting such a trial, we have found, is the analysis of a cervicographic record of progress, as first propounded by Friedman (1967). This is based on the recognition that cephalopelvic disproportion in the primigravidae is accompanied by inefficient uterine action and that this will be most evident on the cervicograph.

We have gone further and from a clinical study have established a set of guide rules based on the cervicograph. For the midwife working in the periphery or the junior doctor working in the hospital, we have constructed an Alert Line for primigravidae at an acceptable statistical limit of normal cervicographic progress. Should a patient's cervicographic progress cross this Alert Line, then arrangements are made to transfer her to the intensive care area of the Central Unit so that, within four hours of crossing the Alert Line, active management can be effectively commenced.

METHOD

An Alert Line must satisfy two criteria. First, it must be simple to use. It must also separate efficiently the majority of the normal patients

from the abnormal patients in sufficient time to transfer the latter safely to the Central Unit for treatment.

We tried to establish that the rates of cervical dilatation of our normal African primigravidae were so similar to the pattern described by Friedman that we could apply his curve (Fig. 1) as a yardstick against which to measure progress of labour in our patients. This proved not to be the case. This was firstly because we were unable to define the commencement of labour in our cases, and secondly because the rate of progress during the "phase of maximum slope" of 100 consecutive normal African primigravidae was half that of American patients (Table I). Although we are still studying the details, we presume that this is because of the higher prevalence of mild cephalopelvic disproportion among our "normal" patients.

TABLE I
Comparison of maximum rates of cervical dilatation in normal primigravidae

	Friedman	This series
Mean (cm./hr.)	3·00	1·60
Median (cm./hr.)	2·75	1·25
Mode (cm./hr.)	1·50	1·00

Like Hendricks *et al.* (1970) we decided to designate time of arrival at hospital, rather than the problematical time of onset of labour, as zero time. Figure 2 shows the average of the slowest 20 per cent of Hendricks' patients compared with that of our own series of 100 consecutive normal primigravidae. Again, our patients took twice as long in the "phase of maximum slope", although they were delivered more quickly than Hendricks' patients. Our patients tended to arrive at hospital later in labour.

For simplicity we hoped to be able to construct a single Alert Line for all patients regardless of cervical dilatation on admission to hospital, even though cervical dilatation on admission is directly related to progress in the individual case. Our series of Hendricks-type graphs (Fig. 3) based on a study of groups of at least 50 normal primigravidae arranged according to cervical dilatation on admission showed that this was not possible. We have, however, shown that we can use a single straight Alert Line for all primigravid patients arriving at hospital with a dilatation of 3 cm. or more. The Alert Line joins points representing 1 cm. dilatation at zero time (admission) and full dilatation (10 cm.) nine hours later, a rate of 1 cm. per hour. It is a modification of the mean rate of cervical

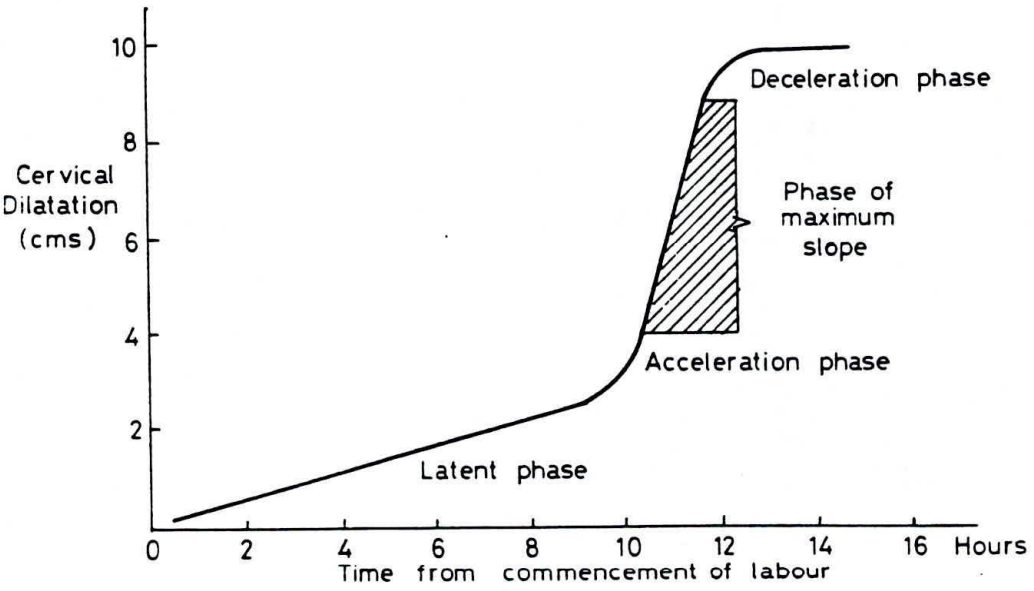

FIG. 1
Friedman's curve showing phase of maximum slope.

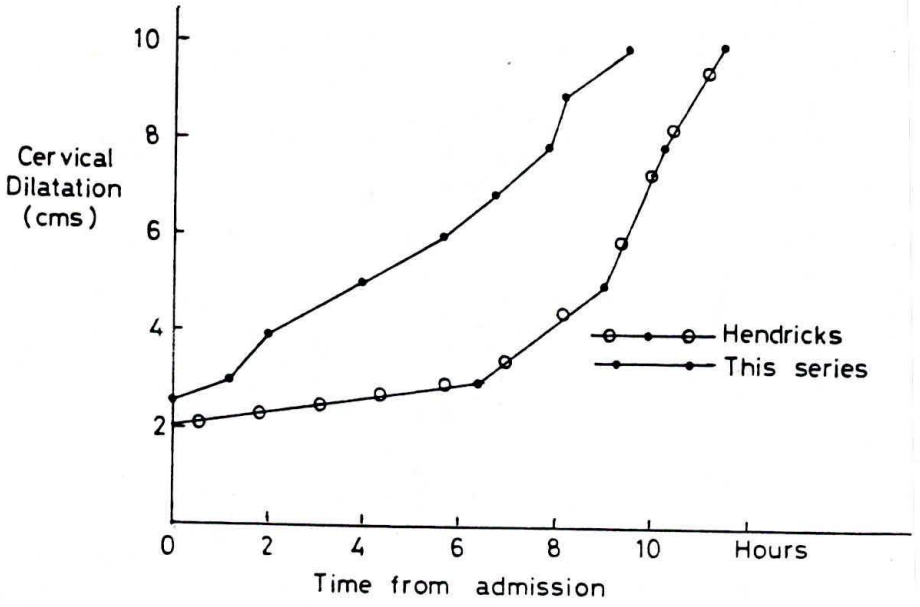

FIG. 2
Mean cervical dilatation of slowest 20 per cent of primigravidae compared to time from admission.

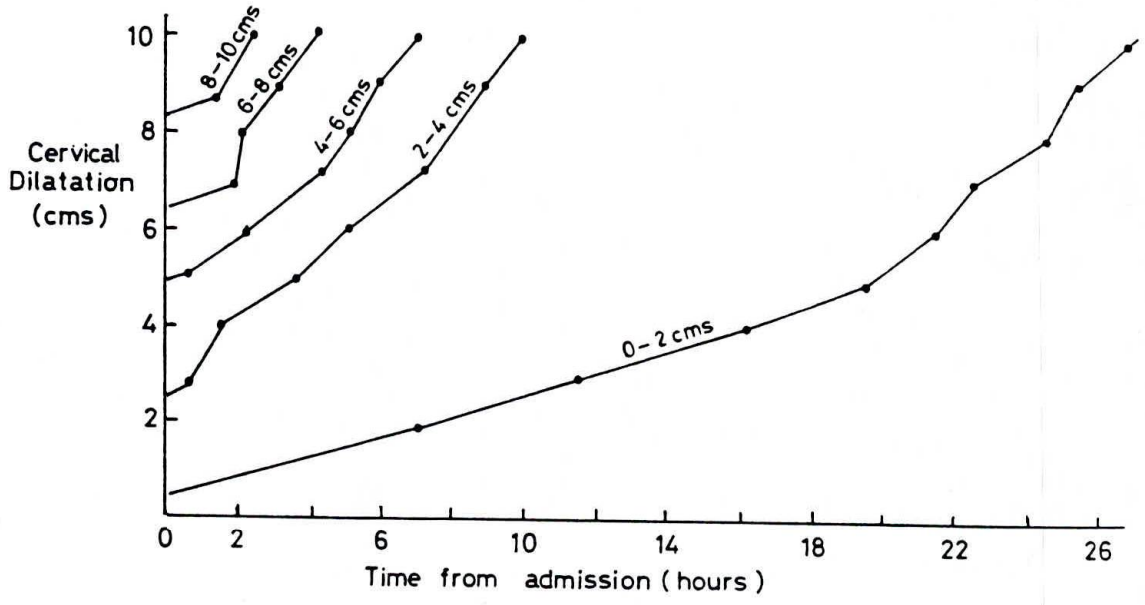

FIG. 3
Mean cervical dilatation of slowest 20 per cent primigravidae, with patients grouped according to cervical dilatation on admission.

dilatation of the slowest 10 per cent of primigravid patients in the active phase and is slower than Friedman's statistical limit for "the phase of maximum slope" of 1·2 cm. per hour.

Our Alert Line is both simple and efficient. It separates, when compared to other possible lines, the highest proportion of normal from abnormal patients, allowing time for transfer of those who are abnormal to the Central Unit for active management (Fig. 4). It is a statistically better line than the mean 95th percentile (using Hendricks' method) of patients, either pooled together or separated into groups according to their cervical dilatation on admission. Our Alert Line compares favourably with all lines parallel to it. We also considered applying an Alert Line based on an individual patient's cervical dilatation on arrival. The chosen Alert Line is statistically better than these alternatives for patients arriving with the cervix already 3 cm. dilated, and it is now being studied prospectively on patients arriving at less than 3 cm. dilatation.

Results

The use of the Alert Line in the management of labour in primigravidae has alerted medical staff to potential problems at an early stage, and midwives in this hospital, in a local Mission hospital and in Queen Elizabeth Hospital, Blantyre, are employing the line correctly and enthusiastically.

We present a prospective study of 624 consecutive primigravid patients who were found to have a cervix that was already 3 cm. dilated on admission. The only patients excluded from this study were those with abnormal presentations (transverse lie, breech and brow), placenta praevia, multiple pregnancy or eclampsia. For the purpose of the study, patients were divided into three main clinical groups (Fig. 4). Group 1 included all patients who were delivered before their cervicograph reached the Alert Line, Group 2 those whose cervicograph crossed the Alert Line but were delivered before it crossed a line parallel to the Alert Line, arbitrarily drawn

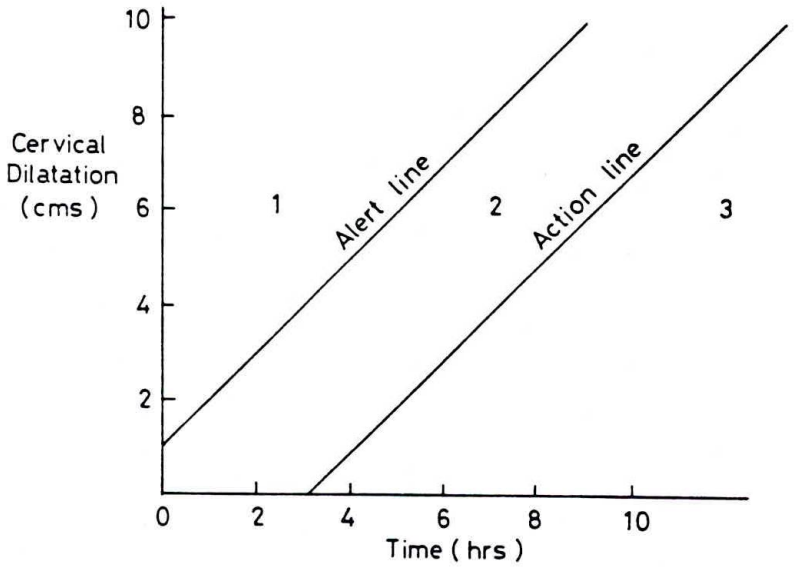

Fig. 4

The Alert Line on the cervicograph, showing the clinical subgroups: Group 1: Those delivered before cervicograph reached the Alert Line. Group 2: Those whose cervicograph crossed the Alert Line but who were delivered before it reached Action Line. Group 3: Those whose cervicograph crossed the Action Line.

TABLE II

Average of various parameters for patients whose cervicograph did not cross (Group 1) or did cross (Groups 2 and 3) the Alert Line

Parameter	Group 1 (488 patients)	Groups 2 and 3 (136 patients)	Statistical conclusion
Rate of cervical dilatation after 4 cm.	1·75 cm./hr.	0·44 cm./hr.	$p<0·001$
Area of brim	100·47 sq. cm.*	87·33 sq. cm.†	$p<0·001$
Transverse diameter of brim	11·85 cm.*	10·90 cm.†	$p<0·001$
True conjugate	10·75 cm.*	10·17 cm.†	Not significant
Dilatation of cervix on admission	5·20 cm.	3·84 cm.	$p<0·001$
Head level on admission	3·30 (fifths of head above brim)	4·08 (fifths of head above brim)	$p<0·001$
Age	18·29 years	18·34 years	Not significant
Height	1·578 m.	1·571 m.	Not significant
Birthweight	2·989 kg.	3·051 kg.	Not significant

* 15 patients. † 60 patients.

four hours later and called the Action Line, and Group 3 consisted of all those whose cervicograph crossed the Action Line.

Table II records the details of the differences in various parameters between patients who were delivered before their graph reached the Alert Line (Group 1) and those whose graph crossed the Alert Line. The scale which we have used to measure the level of the fetal head was that first described by Crichton (1962) and is illustrated in Figure 5. To determine whether there are any other factors at the time of crossing the Alert Line which would guide the midwife as to outcome, a comparison has been made between patients in Group 2 and those in Group 3 (Table III). Table IV shows the delivery outcome in each of the subgroups. The patients in Group 3 and their management have been discussed elsewhere (Philpott and Castle, 1972).

TABLE III

Comparison of factors in cases separated by the Alert Line between Group 2 and Group 3

Significant Factors:

1 Rate of dilatation after 4 cm. ($p<0·001$)
2 Dilatation at Alert Line ($p<0·01$)
3 Level of the head at the Alert Line ($p<0·05$)

Non-significant Factors:

1 Age
2 Height
3 Dilatation on arrival
4 Level of head on admission
5 True conjugate
6 Transverse diameter of brim
7 Area of brim

TABLE IV

Delivery outcome in each of the three subgroups

	Group 1	Group 2	Group 3
Spontaneous delivery	438	54	0
Spontaneous delivery after oxytocic stimulation	0	0	19
Vacuum extraction	48	14	35
Caesarean section	2	0	14
Totals	488	68	68

DISCUSSION

A study of the parameters in Table II shows that our Alert Line separated efficient from inefficient labour as reflected in the rate of dilatation of the cervix. Furthermore, the Alert Line separated patients with small pelvic size from those of adequate size, as shown in the smaller brim area and transverse brim diameter of those whose graphs crossed the Alert Line. This is of major importance to those without X-ray facilities.

Other differentiating features that were statistically significant, though of less practical value, were the cervical dilatation on admission, which in this series probably reflected the efficiency of labour prior to coming to hospital, and the level of the fetal head on admission. Table II shows that in the African primigravidae the head is not engaged at the onset of labour, and in fact does not become so until late in the first stage.

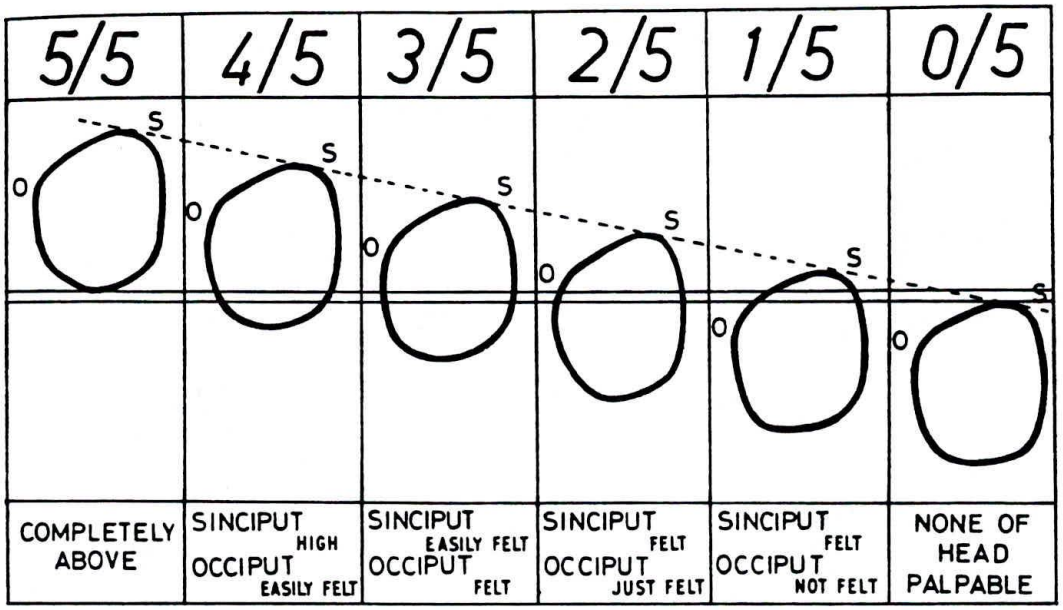

FIG. 5

The level of the fetal head measured by abdominal palpation and expressed in terms of fifths above the brim. S = sinciput, O = occiput.

Recognition that the chosen Alert Line is applicable from 3 cm. dilatation of the cervix onwards fits in with Friedman's differentiation between the latent and active phases of the first stage of labour. We are at present studying those patients admitted in the latent phase by applying the Alert Line to their cervicographs immediately after cervical dilatation of 3 cm. or more.

Although in patients seen in Aberdeen by Bernard (1952) the outcome of labour was related to maternal height, in our patients there was no relationship between maternal height and dysfunctional labour. The probable explanation is that our patients had an average height of under 1·6 m., and this means that we cannot use maternal height as a screening method for planning hospital deliveries for Rhodesian Africans.

Analysis of the vacuum extractions carried out in Group 1 showed that these were more simple than those extractions performed in Group 2 and could therefore be carried out by experienced midwives. Of the two Caesarean sections in Group 1, one was for a prolapsed cord and the other was for severe intrauterine infection on admission. Both these cases would have been sent to a Central Unit in any event. Thus, in the absence of other complications, patients whose cervicographs keep to the left of the Alert Line may be safely managed in the peripheral unit. Table IV also reveals that the cervicograph of 22 per cent of patients crossed the Alert Line. Outside the Central Unit these would be considered for referral and, in fact, half of them were delivered normally within the following four hours, while the rest were the problem cases requiring skilled attention.

Once the cervicograph of a patient has crossed the Alert Line, the only statistically significant factors guiding the midwife as to whether the patient would still have a normal delivery (Group 2) or would require intervention (Group 3), are, of course, the rate of cervical dilatation and also the level of the head at that time (Table III). The difference in head levels was, however, minimal and of little or no practical value.

There would seem to be a need in other parts of the world for a simple screening guide line such as the Alert Line to be used by midwives, doctors in general practitioner units and house surgeons in larger hospitals. As our application of the Alert Line after 3 cm. dilatation of the cervix coincides with Friedman's active phase, and it is only slightly slower than his statistical limit for that phase of labour, we believe that it could have universal application in the management of primigravidae.

ACKNOWLEDGEMENTS

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REFERENCES

Bernard, R. M. (1952): *Edinburgh Medical Journal*, **59**, 1.

Crichton, E. D. (1962): Paper read at Congress of the South African Society of Obstetricians and Gynaecologists.

Friedman, E. A. (1967): In *Labor, Clinical Evaluation and Management*. Appleton-Century-Crofts, New York. p. 27.

Hendricks, C. H., Brenner, W. E., and Kraus, G. (1970): *American Journal of Obstetrics and Gynecology*, **106**, 1065.

Philpott, R. H., and Castle, W. M. (1972): *Journal of Obstetrics and Gynaecology of the British Commonwealth*, **79**, 599.

7

The Recognition of Cephalopelvic Disproportion

R. H. PHILPOTT

The problem of definition

The definition of cephalopelvic disproportion (CPD) should be 'the failure of the fetus to pass safely through the birth canal for mechanical reasons'. The mechanical reasons referred to in this definition are the relative size of the maternal pelvis and the fetal presenting part. The difficulty is that these two components each vary from one labour to another in their three-dimensional size and shape and also in the degree to which the fetal head may be permitted to undergo compression without immediate or later damage to the fetal brain. Each of these factors are difficult to quantify and even more difficult to put together as one measurement.

The causes of CPD

The commonest cause of CPD in the developing world is a contracted pelvis with an average-sized fetus. The pelvis may be contracted for genetic or nutritional reasons or as a result of trauma. In some parts of the developing world women are in a stage of transition. During their childhood and formative years poor nutrition led to poor pelvic growth. In their reproductive years there may have been improvement in socioeconomic conditions in their community and fetal growth has been optimal. This has led to a considerable prevalence of CPD. In the Shona women of Zimbabwe the mean pelvic brim area of primigravidas who at the end of a trial of labour were found to have CPD, was 83.4 cm^2 and the mean birthweight was 3118 g (Stewart, Cowan and Philpott, 1979). The mean value for Shona women who delivered spontaneously without CPD was 102.2 cm^2 whereas in English women studied by Ince and Young (1940) the mean brim area was 126.8 cm^2. In the series presented by Stewart et al the main pelvic abnormality was either a small gynaecoid or a platypelloid pelvis.

Sometimes the cause of the CPD is a large baby with an average-sized pelvis. This may even occur in a multipara who has previously had normal deliveries. There is also evidence that some women of high parity develop a forward subluxation of the lumbar vertebrae thus reducing the antero-posterior diameter of the pelvic brim compared with the diameter earlier in their reproductive years. This can lead to CPD with a small baby after having

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delivered larger babies successfully in the past. Other fetal causes for CPD are hydrocephaly or a malpresentation such as a brow or mentoposterior position.

In parts of the world where absolute CPD is not prevalent, relative CPD due to occipitoposterior positions is probably the commonest cause of CPD. Here the fetal head is not too large to pass through the pelvis in an anterior position, but with the larger presenting diameters of the fetal head in occipitoposterior positions CPD can occur. It can cause delay in the first stage of labour in the primigravida but this will usually respond well to oxytocic augmentation of uterine activity as long as there is no absolute CPD. The evidence of absolute CPD would be increasing moulding of the fetal head with failure to descend. Where contracted pelvis is common, occipitoposterior positions may be seen more frequently than occipito-anterior. In Zulu primigravidas the commonest position in the first stage of labour is left occipitoposterior with the occiput at a four o'clock position in the pelvis. In these circumstances little attention is paid to the position of the head during the first stage, and delay is managed according to whether or not there is absolute CPD and not according to the position of the head.

The prevalence of CPD in different parts of the world

This is a condition that is seldom seen in the developed world and, even when it is diagnosed, the problem is more often inefficient uterine action than true disproportion. In the developing world the prevalence of CPD differs greatly from country to country and even between tribes within a country.

The complications and effects of CPD

These are maternal and fetal and they tend to differ between primigravidas and multigravidas. They are detailed in Chapter 8, on 'Obstructed Labour'.

The problems of over and underdiagnosis of CPD

This will be a particular problem in countries where CPD is common for, not only will major CPD be prevalent (requiring caesarean section), but also borderline CPD will be prevalent (which may or may not require ceasarean section). An easy solution is to be liberal with caesarean sections, both electively when CPD is suspected before the onset of labour, and as an emergency during labour whenever there is delay in progress, or fetal distress, with a suspicion of CPD. This approach can lead to maternal risks, for caesarean section carries a higher mortality and morbidity rate than vaginal delivery and there is always the risk of rupture in a subsequent pregnancy.

The other solution is to practise active management in trial of labour for all primigravidas. This is good management as long as the attendant is skilled in observing fetal condition throughout the labour. If this cannot be ensured then there will be a high price to pay in fetal cerebral birth trauma and asphyxia.

The skill of obstetrics in these circumstances is to keep the caesarean section rate as low as possible while ensuring good fetal quality.

An assessment of the different parameters used in diagnosing CPD

There is no one measurement that will diagnose CPD and each of the following need to be taken into consideration.

History. Information regarding previous skeletal injury or disease would suggest the possibility of contracted pelvis. In a multigravid patient a detailed history of previous labours will be a valuable guide, particularly if the labours were conducted under the supervision of an accurate observer and recordings were detailed and accurate.

Height and external measurements. Bernard (1952) showed that, in a study of labour in a group of Scottish women, the degree of mechanical difficulty in labour was inversely proportional to the patient's height. In the study of Shona and Zulu women done by Stewart, Cowan and Philpott (1979) the mean height of women with major CPD was less than that of those with no CPD, but there was a wide range, and so the individual patient's height could not be used as a predictive factor. In Shona women with major CPD the mean height was 151.32 cm and in the controls who delivered without CPD the mean height was 156.8 cm. Likewise, foot and external measurements, though smaller on average, had a wide range and could not be used for prediction or even screening purposes.

Abdominal and pelvic assessment. In the caucasian primigravid patient the fetal head is normally engaged in the pelvis from the 38th week of pregnancy and a high head at term can be an indication of CPD. In the African patient the head is often above the brim of the pelvis until late in the first stage of labour and then descends quickly and easily. It is thought that this is due to a high angle of inclination of the pelvic brim (Stewart, Cowan and Philpott, 1979) though others (Briggs, 1981) believe there is no difference in the angle of inclination and believe that it is due mainly to increased head circumference.

The head-fitting test of Munro Kerr can be used, pushing the head into the pelvic brim with an abdominal hand while assessing descent with two fingers of the right hand in the vagina and the thumb above the symphysis pubis. If this test is positive, it is valuable. If it is negative, it may be due to many factors other than CPD, including poor formation of the lower uterine segment.

Digital pelvic measurement in late pregnancy is less accurate than most realize or will admit. If all patients were to labour under supervision, with immediate access to caesarean section if needed, it would be better to drop pelvic assessment in late pregnancy and depend on a trial of labour. However, such facilities are not always available and it is necessary to make an attempt at screening in late pregnancy those primigravidas who have

small pelves and arrange for them to have a trial of labour in a maternity institution.

The one measurement that is more reproducible and reasonably accurate is the diagonal conjugate of the brim. Accuracy can be improved by touching the sacral promontory, marking off the point on the proximal part of the index finger that touches the under surface of the symphysis and then measuring that distance on the fingers with a ruler. The true conjugate can be estimated by subtracting 1.5 cm from the diagonal conjugate. If the true conjugate is less than 10 cm, then CPD must be suspected. To improve clinical skill, whenever a patient is going for an X-ray pelvimetry, assess the diagonal conjugate digitally first and compare the findings. Other clinically estimated measurements of the pelvis, particularly the transverse measurements, are of such poor accuracy as to be of little value.

X-ray pelvimetry

Suitable facilities and technical expertise to carry out x-ray pelvimetry are often not available. Furthermore, in a community where CPD is prevalent, pelvic measurements on their own tend to influence the obstetrician to do more caesarean sections than are necessary. There is really no indication to do an antepartum x-ray pelvimetry on a primigravida who has no other problem than suspected CPD, for she is best managed by a careful trial of labour. Even when there is delay in progress in labour in the primigravida it is not difficult to recognize, at that stage, the patient with major CPD who requires an immediate caesarean section. The rest are best managed by a carefully controlled oxytocic augmentation of labour, which will reveal any evidence of hitherto unrecognized true CPD before there is any harm to the mother or fetus. This is a more accurate, yet safe, means of assessing CPD in the primigravida than the use of intrapartum x-ray pelvimetry.

The situation is different with the multigravida. If there is delayed progress in the first stage of her labour it is imperative that even minor degrees of CPD are detected, for oxytocic augmentation of labour in those circumstances can lead to uterine rupture (this virtually never happens in the primigravida). Here is a valuable place for intrapartum x-ray pelvimetry. If the head is still high with an average-sized baby and x-ray pelvimetry measurements show a true conjugate diameter of less than 10.5 cm, oxytocic augmentation of labour would be unwise and caesarean section would be indicated.

The indications for antepartum x-ray pelvimetry are in the patient who has suspected CPD plus another obstetric problem that would contraindicate a trial of labour, for example cardiac disease, a previous caesarean section scar, a malpresentation (e.g., a breech) or a multigravida with a history of previous pregnancy loss from a long or difficult labour.

TRIAL OF LABOUR

For the reasons given above the ultimate method of assessing CPD in the

otherwise uncomplicated primigravida will be by trial of labour. Comment will be made about CPD in the multigravida later, and this section will be devoted to the primigravida only. Having said this, in parts of the world where CPD is prevalent (and possibly everywhere else too), every primigravida should be regarded as having possible CPD until she is safely delivered. For this reason every otherwise uncomplicated primigravid labour is managed as a trial of labour. The only primigravidas who would not have a trial of labour would be those with malpresentations such as breech and transverse lie, those with evidence of placental insufficiency or severe maternal disease, for example cardiac disease or severe hypertension.

Ideally, a trial of labour should be conducted in hospital where clinical expertise and facilities for operative delivery are available. However, in parts of the world where CPD is most common, hospital delivery is not feasible for all primigravidas. In those circumstances, patients can be observed in labour in a peripheral midwife-run clinic and with experience and use of the partogram, problems can be detected early and patients transferred to hospital in good time, while the rest deliver normally in the clinic.

Definition

A trial of labour is conducted in a patient in whom CPD is suspected, in order to determine whether it is safe for the patient to deliver vaginally or not. The trial continues as long as there is no fetal or maternal distress (that cannot be corrected) or delay in the progress of the labour. Each of these determinants in a trail of labour need to be defined. They can each be recorded on a partogram.

The use of the partogram

There are many variants of the partogram, but essentially they enable one to record the three main determinants of a trial of labour, viz. fetal condition, labour progress and maternal condition. Figure 1 illustrates an example of one currently in use. The graphic recording of labour enables the midwife or doctor to recognize deviations from normal labour, particularly when an Alert Line is used as a reference. The partogram is valuable in any labour, but particularly for the midwife managing a labour in a peripheral clinic. When she finds it necessary to transfer a patient to a referral hospital the partogram should go with the patient to facilitate continuity of management.

In addition to the recordings on the partogram there should be a separate admission examination record and also a four-hourly, or more frequent, evaluation of the recordings of fetal condition, labour progress and maternal condition. This evaluation should always be followed by a written decision on the management indicated by the evaluation.

Assessment of fetal condition

This can be assessed with different degrees of sophistication, depending on facilities available. There is little doubt that the cardiotocograph and fetal

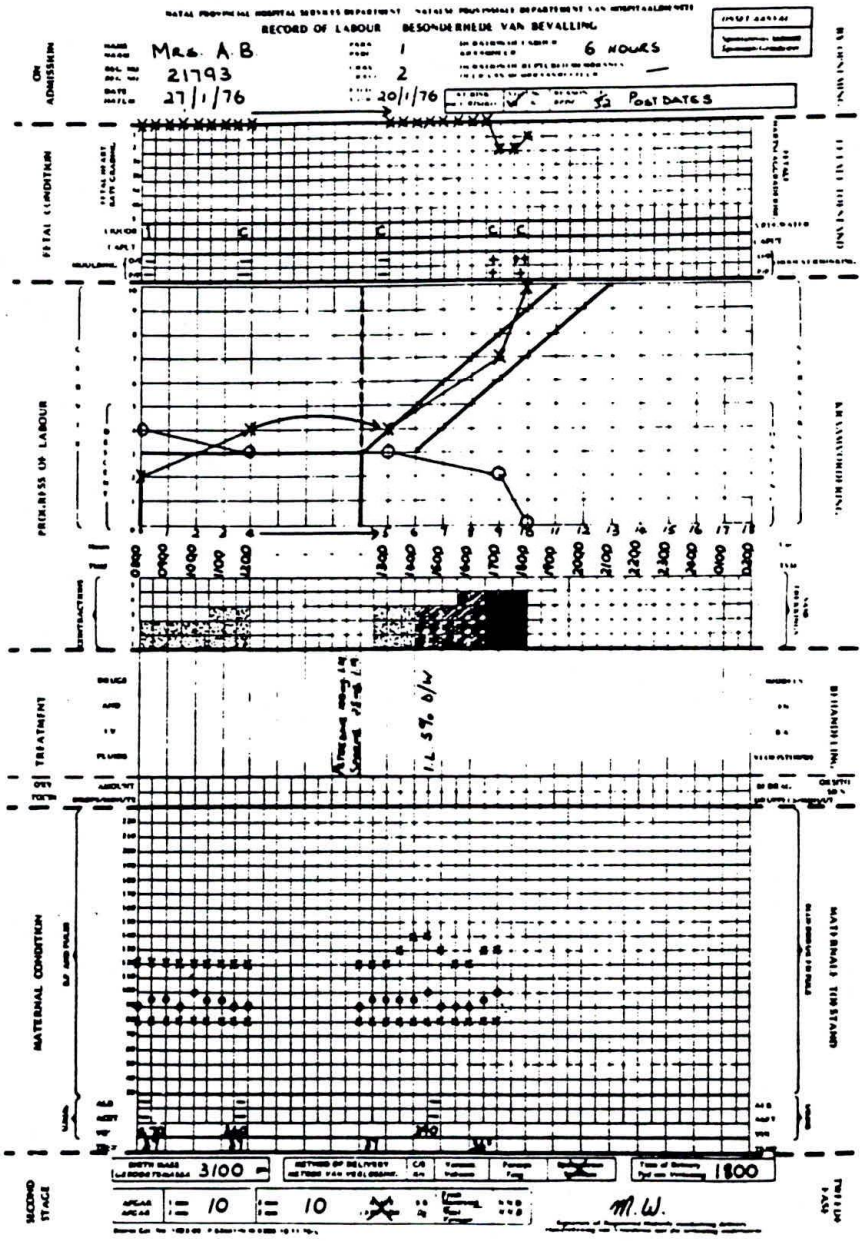

Figure 1. Example of a composite labour graph

scalp blood sampling enables the observer to assess fetal asphyxia with greater degrees of accuracy. It is also true that, in a trial of labour for suspected CPD, where there has been no previous placental insufficiency, a trained observer can assess fetal condition very well without this equipment. Doctors and midwives working in busy referral hospitals in the developing world where a few cardiotocographs, though not sufficient, are becoming available, face a very particular problem. It is easy to become over-dependent on the few monitors and lose one's skills when one has to care for the larger number of patients for whom monitors are not available.

In these circumstances a few principles are worth mentioning. Firstly, if money does become available to purchase equipment (and other basic health care needs have been met) the first item to be purchased should be equipment for measuring the fetal scalp blood pH. This will help avoid the tendency to over-diagnose fetal asphyxia if only the cardiotocograph is used. Before purchasing the very expensive cardiotocographs there is greater cost benefit in purchasing simple ultrasound fetal heart detectors which cost about one-tenth as much as a cardiotocograph. When the first cardiotocograph is purchased it should be regarded as a teaching aid before it is used as a service monitor. (In practice we use them firstly as antepartum monitors, and only if there is unused time on the monitor do we use them in labour.) In labour they should be used to teach doctors and midwives to detect the different fetal heart rate patterns clinically, so that they do not become totally dependent on the monitors. If the number of monitors available is insufficient to monitor all high-risk labours continuously, then it is a good idea to monitor a number of patients for 20 to 30-minute intervals in rotation on the one monitor.

Having made these comments with regard to the use of monitors, the truth of the matter is that, for the foreseeable future, the assessment of fetal condition in labour in the developing world will be dependent entirely on the clinical skills of the observer, without the availability of monitors. These skills need to be refined and eventually challenged by the frequent review of perinatal outcome. Postmortems need to be carried out on all perinatal deaths to reveal the evidence of gross fetal asphyxia and cerebral birth trauma and neonatal and infant follow-up needs to be done to reveal lesser degrees of labour pathology.

The fetal heart rate should be listened to before, during and after a contraction to elicit abnormalities in the base-line rate and to time any decelerations in relation to the contractions. As head compression increases and there is reduced placental blood flow with contractions there will be early decelerations with a gradually increasing base-line rate. Then the decelerations become more prolonged and an advanced feature of fetal distress in CPD is a deceleration that starts early in a contraction and persists long after the contraction is over. This is in effect a combination of an early head-compression deceleration and a late placental insufficiency deceleration (Stewart and Philpott, 1980). Only a cardiotocograph can detect the other sinister fetal heart rate change of loss of beat-to-beat variation.

Seldom is there significant CPD in labour without the presence of meconium in the liquor. It is interesting, and difficult to explain, that in the

presence of CPD, the meconium often appears in the liquor before the fetal head has been driven sufficiently into the pelvis to be compressed. The combination of meconium in the liquor plus an abnormal fetal heart rate pattern is sinister not only because it is evidence of fetal asphyxia but it can lead to meconium aspiration at delivery, which is a not uncommon cause of fetal death in CPD.

A further sign of fetal distress in CPD is increasing moulding of the fetal head. This needs to be measured accurately. It usually appears first at the occipitoparietal junction to be followed later by overlap at the parieto-parietal junction. We score the moulding at each junction out of three and add the two together to give a score out of six. The bones will be apart when there is no moulding (0). When they touch the score is one. When they overlap but can be reduced by digital pressure the score is two. If the overlap cannot be reduced the score is three. If there is an increasing moulding score without head descent this is a sign of serious CPD and of developing head compression.

Work done by Wilson et al (1979) has shown that fetal electroencephalographic changes that persist after delivery do not occur unless the fetal pH drops markedly or drops below 7.25 during labour. Everything possible needs to be done to detect early evidence of fetal distress to prevent cerebral birth trauma.

Before making a final decision with regard to fetal condition, and whether or not to intervene, it is important to take into account all the factors of that labour and not to act on one parameter. Each finding must be evaluated carefully. For example, an isolated late fetal heart rate deceleration is of no importance whereas persistent late decelerations that are getting worse, plus meconium staining of the liquor, warrant a fetal scalp blood sample and pH measurement with a view to considering an early delivery of the fetus. The method of delivery will then depend on the cervical dilatation and the degree of CPD.

Assessment of maternal condition

This is not so difficult. Evidence of maternal distress is a pulse rate that is rising above 100 bpm, a rising temperature or blood pressure, or the presence of protein or acetone in the urine. These signs are only meaningful if the mother is being properly managed.

Assessment of labour progress

This is done mainly by recording and interpreting the rate of dilatation of the cervix and the rate of descent of the presenting part. The increasing momentum of the uterine contractions is also of importance but not as easy to measure accurately by clinical means.

The first stage of labour needs to be studied separately in its latent and active phases (Friedman, 1978). By definition the active phase commences when the slower rate of cervical dilation in the latent phase changes to a faster rate of dilatation. This can only be determined in retrospect and varies slightly from one labour to another. In the majority of labours the active

phase commences when the cervix is 3 cm dilated and fully effaced and in practice we use this as our guide for the commencement of the active phase. However, if it is not recognized that this is an arbitrary division, mistakes can be made by diagnosing a delayed active phase when the patient is still in the latent phase. Too early augmentation of the latent phase may cause more problems than it solves.

There is value in recording the changing effacement of the cervix on the cervicograph, in addition to the cervical dilatation. We thicken the vertical line on the cervicograph according to the length of the cervix in centimetres to record effacement. In this way progress in cervical effacement can be seen at a time when there is still minimal progress in cervical dilatation.

We draw guidelines on the labour graph to alert the attendant to delay in labour (see Figure 1). These must only be regarded as guidelines and intelligent flexibility must be allowed, particularly in the latent phase. The normal latent phase has a very wide range of variation. Another problem is the difficulty in determining the onset of labour in a patient who is admitted after being in labour for some while. The pattern of admission in labour in relation to cervical dilatation varies from community to community. In our practice, if a patient has been more than eight hours in the latent phase since admission, this warrants reassessment. Thus, if a patient is admitted at the clinic or hospital and is found to be in the latent phase, we record the dilatation and effacement at zero time on the left-hand side of the labour graph. We re-examine the patient four hours later. If she is still in labour, but there is no change in the cervix, we give 100 mg pethidine to test whether this is false labour. She is then re-examined four hours later (eight hours after admission). If she has gone out of labour we regard this as false labour and await the onset of true labour. If she has progressed to the active phase we transfer her recordings to the active phase section of the graph. Her cervical dilatation recording is then recorded on the appropriate point on the Alert Line and all subsequent recordings follow from there. If at the eight-hour mark she is still in labour, but there has been no progress in cervical dilatation, we regard this as delay in the latent phase.

Delay in the active phase of the first stage of labour is more serious. This is diagnosed by evidence of delay in the progressive dilatation of the cervix and/or failure of descent of the presenting part. In the primigravida the mean rate of cervical dilatation in the active phase is 3 cm per hour and the slowest rate of normal progress can be regarded as 1 cm per hour. It is valuable to draw a reference line on the cervicograph representing this lowest limit of normal progress. We draw a line at 1 cm an hour and call it the Alert Line. If the patient is found to be in the active phase on arrival, or as soon as she is found to have moved from the latent to the active phase, we plot that dilatation on the Alert Line. Any subsequent deviation to the right of that Line alerts the attendant to a potential problem. The Alert Line is of particular help to midwives in peripheral clinics. Depending on the distance from the clinic to a hospital, the midwife re-examines the patient and if two hours later there is still delay, intervention and therefore transfer is indicated. We thus have a second reference line on the cervicograph two hours to the right and parallel to the Alert Line and call this the Action Line.

If the patient is being managed in hospital it is still safe and worth waiting until delay reaches the Action Line as many pick up and progress satisfactorily on their own after crossing the Alert Line and before reaching the Action Line. The use of oxytocin has complications and there is no point in giving the busy midwives more work than necessary.

The rate of descent of the fetal head is also an index of labour progress, particularly in the late active phase. There is minimal descent in the latent phase or even in the active phase until the cervix has reached about 7 cm dilatation. Thereafter, descent is more rapid and is completed in the second stage of labour (Friedman, 1978). The most meaningful method of recording the level of the head is by the number of fifths of head above the pelvic brim (Crichton, 1974), as this, with the degree of head moulding, is the ultimate index of CPD.

Management of a trial of labour

Maternal position in labour does affect the efficiency of uterine activity. The supine position in bed imposed for so long by Western medicine is undoubtedly the worst position. The patient should be encouraged to be ambulant for as long as she is comfortable and, if she does lie down, to lie on her side. She should be given psychological support and encouragement, which really means companionship. This can be provided best by the husband, though in some cultures this is an unfamiliar concept and the grandmother takes his place.

Analgesia needs to be considered, as unrelieved pain can have a deleterious effect on uterine action. This is discussed in Chapter 11. An epidural block can be of particular value in a trial of labour. It should not be given too early as it can cause delay in the latent phase. It is of greatest value at the time of delay when oxytocic augmentation is introduced. Adequate hydration needs to be maintained, particularly in hot climates, when the labour lasts more than eight hours and if there is much vomiting. Then, intravenous dextrose in water is indicated.

Management of delay in the latent phase

Friedman (1978) regards the prolonged latent phase as 'common but innocuous' and that the prognosis for vaginal delivery of an unaffected infant is good. Cardozo et al (1982) practised active management of delay in the latent phase. They ruptured the membranes and augmented labour with oxytocin if progress in cervical dilatation strayed more than two hours to the right of their nomogram. In the group of primigravidas who showed a prolonged latent phase (in which the latent phase from examination on admission to 3 cm dilatation exceeded six hours) they found a 16.7 per cent caesarean section rate (compared with 1.6 per cent in those whose progress was to the left of the nomogram) and the babies had the highest incidence of low Apgar scores at one minute compared with outcome in all the other types of dysfunctional labour. In reviewing their results they felt that they would need to consider a more conservative approach or to monitor intra-

uterine pressure and so determine oxytocic augmentation more accurately. Friedman recommends therapeutic rest in the first instance, using morphine, and only if the condition persists after the period of rest does he advocate oxytocic stimulation.

Our advice to midwives in peripheral clinics is to be conservative in the management of a prolonged latent phase. If the patient has made no progress four hours after admission in the latent phase they give 100 mg pethidine to separate those who are in false labour. If the patient is still in the latent phase at eight hours after admission with no progress in effacement or dilatation of the cervix we advise transfer to hospital. On arrival in hospital, if there is no evidence of CPD we rupture the membranes and give oxytocin.

Management of delay in the active phase

Friedman (1978) differentiates between protraction disorders and arrest disorders. He defines protracted active dilatation as a cervical dilatation rate of less than 1.2 cm per hour in the primigravida or less than 1.5 cm per hour in the multigravida in the active phase of labour. He recognizes a number of contributory factors including CPD, excessive sedation and fetal malposition. He finds that it is not possible to improve the dilatory pattern by any of the modes of treatment known today. After excluding patients with CPD (they have a caesarean section) he advises supportive care for the rest and at the end of their prolonged labour tries to avoid instrumental delivery, as this worsens the outcome.

Cardozo et al (1982) had a very similar group and labelled this group primary dysfunctional labour. This was when the active phase of labour progressed at less than 1 cm per hour when a normal active phase had not been established. Of these, 80 per cent responded to oxytocin but in the second stage of labour the instrumental delivery rate was two times higher than normal. Of those who did not respond to oxytocic augmentation, the majority had CPD and 77.3 per cent of these required caesarean section.

Friedman's second group of patients with delay in the active phase were described as having arrest disorders. Secondary arrest of dilatation occurred when cervical dilatation stopped in the active phase over a two-hour period. CPD was the commonest aetiological factor in these patients and so made the condition particularly ominous. Other factors that often occurred in combination with each other or with CPD were excessive sedation and fetal malpositions. Friedman advised a thorough search for CPD when this abnormal labour pattern was recognized. Those with CPD had an immediate caesarean section and the rest had oxytocic augmentation of labour. If the oxytocic augmentation was adequate the majority of the latter group delivered vaginally without assistance.

Cardozo et al (1982) found that, in their series, secondary arrest of dilatation was more often due to malposition or deflexion of the fetal head which could be corrected by increased uterine efficiency.

We find that frequently it is not possible to differentiate between protraction and arrest patterns of dysfunctional labour and, furthermore, the aetiological factors are the same even if they are seen in different propor-

tions in the two conditions. We are supervising 26 000 deliveries per year, with a large proportion looked after by midwives in satellite clinics, and only the problems referred to the referral hospital. Guide rules need to be as simple as possible, aiming to keep the normal deliveries in the peripheral clinics and transferring the problems to the hospital in sufficient time to ensure a satisfactory outcome for mother and baby. Protocols of management for those with delay in labour need to be clear as the referral hospital in the developing country tends to be extremely busy and short-staffed.

We diagnose delay in the active phase whenever progress in cervical dilatation reaches the Action Line. The midwife in the clinic will prepare to transfer the patient whenever delay has reached the Alert Line so that the patient reaches expert attention in the hospital by the time cervical progress has reached the Action Line. This is a good name for this point in the progress of labour for, apart from fetal or maternal distress, intervention before this time is unwarranted and at this time expert attention is mandatory if there is to be no compromise in fetal and/or maternal condition.

If delay in the active phase is diagnosed, then, before deciding on specific treatment, an accurate and thorough assessment by an experienced observer is absolutely vital. This is one of the most decisive points in a woman's labour. If a mistake in judgement is made at this point then the consequences are fetal damage or fetal death. The labour record thus far must be assessed carefully and this underlines the fundamental importance of good observations and rcordings. The fetal condition must be assessed accurately and if there is clear evidence of fetal asphyxia or CPD at this stage, then a caesarean section is indicated. Fetal distress will be measured clinically by listening to the fetal heart rate in relation to contractions, noting meconium and head moulding. If facilities for cardiotocographic heart rate recording and fetal blood sampling are available these will help in the decision.

The diagnosis of definite CPD at the time of delay is made when the head is still high (three to four-fifths above the brim) with increasing moulding and no progress in the descent over the past few hours. Additional information can be obtained by doing an x-ray pelvimetry if this is available. An erect lateral view is possibly the only view necessary as a good true conjugate diameter is usually accompanied by a good transverse diameter of the brim (Stewart, Cowan and Philpott, 1979). However, radiographic measurements of the pelvis are of less value than the clinical judgement of the relationship of head to pelvis as judged by head level, degree of moulding and the fit of the head in the pelvis.

The maternal condition must be assessed taking note of her emotional response to the delayed progress, hydration, pyrexia, tachycardia and hypertension.

Those primigravidas who do not have evidence of fetal distress or CPD requiring a caesarean section will now have augmentation of what is assessed to be inefficient uterine action. For augmentation to be most effective attention needs to be given to the mother's emotional response to her labour and her hydration and analgesia. Assessments and decisions should be conveyed to the mother in a way that she can understand and if epidural

analgesia is available this should be offered. There is usually some dehydration at this stage of the labour and this should be corrected adequately before giving an epidural block.

The next step is to augment the labour with oxytocin. The aim is to give the least amount of oxytocin necessary to provide physiological uterine action. Rupture of the uterus with oxytocin is very rare in the primigravida and this is not the limiting factor. The real hazards are head compression from contractions that drive the head into the pelvis when the fit is too tight, and reduced placental blood flow from overstimulation of uterine action. It is therefore obvious that oxytocic augmentation should not be embarked upon unless each patient can depend on the sole attention of one experienced midwife who can assess fetal condition and labour progress (including uterine activity) with accuracy and precision.

The amount of oxytocin to be infused is critical. Cowan and Philpott (1982) have measured uterine activity in normal labour, delayed labour and augmented labour in the primigravida. Using a fluid-filled intrauterine catheter, pressure transducer and integrator they found that the mean figure for uterine activity was 1800 kPa per 15 minutes in primigravidas that progressed at 1 cm or more per hour in the active phase of labour. The lower limit of normal progress was 1200 kPa per 15 minutes. When there was delay in labour progress the levels of uterine activity were considerably less. They then gave oxytocin to augment delayed labour. Six units of oxytocin were placed in 1 l of intravenous fluid and an Ivac Drop Counter was used to control the infusion rate. Initially, oxytocin was infused at 2 mu per minute for the first 15 minutes. The infusion rate was increased arithmetically every 15 minutes until there was either progress in labour or 'normal' uterine activity was achieved. Normal uterine activity was regarded as a contraction frequency of five contractions per 15 minutes, when the contractions were of 'good' intensity, and when they lasted 40 to 50 seconds. This judgement was made clinically with a hand on the uterus.

They found that, in those patients who were eventually demonstrated to have no CPD, their delayed progress due to inefficient uterine action quickly increased to uterine activity levels of 1800 to 2000 kPa per 15 minutes with oxytocic augmentation, and cervical dilatation then progressed at 1 cm or more per hour to full cervical dilatation. The rest had increased uterine activity on oxytocin, but often did not achieve levels of 1800 kPa per 15 minutes of uterine activity. They were regarded as having delayed progress on oxytocic augmentation and proceeded to caesarean section. X-ray pelvimetry and measurement of head size showed that these patients had a tighter 'fit' than those who progressed quickly on oxytocic augmentation and delivered vaginally.

In a further study they showed that, by using the uterine activity as measured by the integrator and intrauterine pressure catheter, and using 1800–2000 kPa per 15 minutes as the objective of escalating oxytocic augmentation, they achieved more successful vaginal deliveries in those who had previously shown delay in labour. Furthermore, the 'head fit' expressed as a ratio of head size to pelvic size was closer to 100 per cent (a tighter fit) than in those whose oxytocic augmentation was determined by clinical

judgement of the strength of the contractions. In all labours fetal condition was carefully monitored and no labour was allowed to proceed in the presence of significant fetal distress.

This study shows that, as long as fetal condition is carefully monitored, an oxytocic augmentation for delayed progress in the primigravid trial of labour will quickly reveal the patient who has no CPD and who will, within an hour, change to more efficient uterine action and progress in cervical dilatation of 1 cm per hour or more. When oxytocic dosage is determined by clinical palpation of uterine activity some will not progress and among these will be those with CPD who require caesarean section. A few who do not progress with clinically judged efficient uterine action (and no fetal distress) would progress if the oxytocic dosage could be determined more accurately by intrauterine pressure measurements. However, this technique is not available to many hospitals in those countries where CPD is common, and they will need to depend on clinical judgement of uterine activity. At least this can be safe, if skilfully applied.

Thus, the evidence of a failed trial of labour, and therefore need for immediate delivery by caesarean section (or sometimes symphysiotomy), after commencing oxytocic augmentation will be either significant fetal distress, failure in the progressive dilatation of the cervix or increasing head moulding with no descent of the head. The change from slow dilatation of the cervix prior to delay, to normal progress in dilatation after commencing oxytocin, will commence within two hours of starting the oxytocin in those who are going to deliver safely vaginally.

The method of final delivery

Those patients who progress normally with or without the need for oxytocic augmentation will deliver spontaneously in the second stage of labour or, because of maternal tiredness, may require simple assistance with the vacuum extractor or forceps. If the trial of labour has to be terminated for reasons given above it is important that the final delivery method is easy and non-traumatic for the fetus. If the cervix is not yet fully dilated, this will be by caesarean section, unless symphysiotomy is feasible and part of the range of skills of the doctor or midwife in attendance.

Symphysiotomy has a very important place in the delivery of a patient undergoing a carefully planned and controlled trial of labour. Of critical importance is the timing of the procedure – not too soon and not too late. If done too soon, some unnecessary symphysiotomies will be done. If done too late there will be a high incidence of cerebral birth trauma. We do not do symphysiotomies if the cervix has not reached 7 cm cervical dilatation. If delivery is indicated before that time then a caesarean section is indicated. If there is fetal distress or delayed progress on oxytocin from 7 cm dilatation onwards, symphysiotomy may be considered. If the head is not more than two-fifths above with moulding, symphysiotomy will be successful. If the cervix is 7 cm or more dilated and if the head is three-fifths above but, with a trial push the head can descend to two-fifths, then symphysiotomy will be successful. If the symphysiotomy is done prior to full dilatation, let the

patient lie on her side until full dilatation, when she will usually deliver the baby without assistance. Any fetal distress that was present prior to the symphysiotomy will disappear with the relief of head compression, and delivery need not be hurried.

Vacuum extraction or forceps delivery should only be used once the cervix is fully dilated and there is fetal distress or delayed progress in the second stage. Judgement of the presence of CPD is of extreme importance in the second stage. If, at the time an assisted delivery is indicated, the fetal head is level with or one-fifth above the brim, then an assisted delivery will be safe for the fetus. If the head is more than one-fifth above, with moulding, then delivery must be by either symphysiotomy or caesarean section. Attempts at vacuum extraction or forceps delivery with the head two-fifths above with moulding, at the end of a trial of labour, will bring an unforgivable price in fetal damage.

Recognition of CPD in the multipara

This can be more difficult than in the primigravida. Sometimes there will be normal progress in cervical dilatation (more than 1 cm per hour) to full dilatation in the multigravid in the presence of unexpected CPD. This almost never happens in the primigravida. When that happens in the multigravida the CPD must be diagnosed by the evidence of failure of head descent with increasing moulding. Usually, however, the multigravida with CPD also has delayed progress in cervical dilatation in the active phase. We use the same criteria in diagnosing delay as in the primigravida. The problem lies in what to do at the time of delay. In the primigravida, oxytocic augmentation, even in the presence of unrecognized CPD, will virtually never lead to uterine rupture. This is not necessarily true in the multigravida.

In studies done by Kambaran and Philpott, not yet reported, the mean uterine activity levels in multipara who progress normally is 1458 kPa per 15 minutes with a lower limit of normal of 750 kPa per minute. When there has been delay, and in the absence of fetal distress, oxytocic augmentation to a level of 1800–2000 kPa per 15 minutes has proven safe in the multigravida, as in the primigravida. Translated into clinical terms this means not more than five contractions in 15 minutes, lasting not more than 60 seconds, with good relaxation between contractions. If a safe, easy delivery is to be expected, there will be a change in the rate of cervical dilatation within an hour, proceeding to full dilatation at more than 1 cm per hour, and good head descent. As with the primigravida, it is imperative that there be meticulous control of fetal condition throughout the management of a patient who has delay in labour progress, particularly if oxytocin is used.

Recognition of CPD in the second stage

This will be evidenced by either fetal distress, or slow progress or increasing moulding with failure of head descent. The first and the last have already been defined. Progress in the second stage is determined by time and progressive descent of the head. Among Zulu primigravidas, if there is no

CPD there will be rapid head descent in the first ten minutes of bearing down and delivery within 30 minutes. If there is no head descent in the first ten minutes then it can be expected that the second stage will take longer than 30 minutes. This may or may not be a problem. If the fetal heart rate picks up well between contractions and there is progressive descent of the head, it is all right to wait up to 45 to 60 minutes. If delivery is not achieved in that time the mother will become distressed even if the fetus does not, and intervention is indicated. When reviewing the literature it is noted that many authors are prepared to let the second stage last much longer than an hour, as long as there is progress and no fetal distress. Possibly the Zulu mother knows more about bearing down for, in spite of our policy, our instrumental delivery rate in the second stage has always been well below 10 per cent.

REFERENCES

Bernard, R. M. (1952) The shape and size of the female pelvis. *Edinburgh Medical Journal*, **52**, 1–16.

Briggs, N. D. (1981) Engagement of the fetal head in the Negro primigravida. *British Journal of Obstetrics and Gynaecology*, **82**, 1086–1089.

Cardozo, L. D., Gibb, D. M. F., Studd, J. W. W. et al (1982) Predictive value of cervimetric labour patterns in primigravidae. *British Journal of Obstetrics and Gynaecology*, **89**, 33–38.

Cowan, D. B. & Philpott, R. H. (1982) Intrauterine-pressure studies in African nulliparae: delay, delivery and disproportion. *British Journal of Obstetrics and Gynaecology*, **89**, 370–380.

Crichton, D. (1974) Measurement of the fetal head above the pelvic brim in fifths. *South African Medical Journal*, **48**, 784–785.

Friedman, E. A. (1978) *Labour, Clinical Evaluation and Management*. Second Edition. New York. Appleton-Century-Crofts.

Ince, J. G. H. & Young, M. (1940) The bony pelvis and its influence on labour. *Journal of Obstetrics and Gynaecology of the British Empire*, **47**, 130–196.

Stewart, K. S., Cowan, D. B. & Philpott, R. H. (1979) Pelvic dimensions and the outcome of trial labour in Shona and Zulu primigravidas. *South African Medical Journal*, **55**, 847–851.

Stewart, K. S. & Philpott, R. H. (1980) Fetal response to cephalopelvic disproportion. *South African Medical Journal*, **87**, 641–649.

Wilson, P. C., Philpott, R. H., Spies, S. et al (1979) The effect of fetal head compression and fetal acidaemia during labour on human fetal cerebral function as measured by the fetal electroencephalogram. *British Journal of Obstetrics and Gynaecology*, **86**, 269–277.

THE CERVICOGRAPH IN LABOUR MANAGEMENT IN THE HIGHLAND OF PAPUA NEW GUINEA

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SUMMARY

The use of the cervicograph with the incorporated action and alert lines in labour management in developing country obstetrics is now well established and patients in labour in Port Moresby have been thus managed since 1973. In this study the cervicograph was introduced in hospitals and health centres in Enga Province and the results analysed.

Despite intensive tuition in its use, a large number of cervicographs were incorrectly constructed, especially in health centres, and its introduction made little difference to operative delivery or perinatal mortality rates. The proportion of patients crossing the action line was much higher than in Post Moresby but this difference was probably also largely due to the inaccuracy of many cervicographs.

It is likely that these difficulties will not be overcome until many more nurses with intensive training in the use of the cervicograph are available and until more deliveries take place in health institutions to maintain practice. In the interim a simpler rule of thumb for referral of labour patients may be helpful.

INTRODUCTION

The use of the cervicograph as a visual aid to the progress of labour has become well established since the work of Friedman in 1967[1] and it has become of even more value to developing country obstetrics since the introduction of the alert and action lines by Philpott and Castle[2]. These lines are used to indicate those patients whose labour is not progressing satisfactorily and who require referral to a central unit for augmentation of labour and/or operative delivery. Cervicographs have been in use in Port Moresby General Hospital since 1973 and their use is encouraged throughout Papua New Guinea[3]. However, no assessment of their use and value has been carried out outside of Port Moresby. This paper records the results of an attempt of establish the efficient use of cervicographs (including alert and action lines) in labour patients in health centres and hospitals in a rural Highland Province.

A detailed description of the principles and practice of the use of the cervicograph and the incorporated alert and action lines is not included; the reader is referred to the reports by Philpott[4], Philpott and Castle[2], Studd[5], Studd *at al*[6] and Bird[7].

METHODS

A simple cervicograph based on that used in Port Moresby[3] in which the most important feature was the dilatation of the cervix was designed for use in health centres and hospitals in Enga Province. It was found that only those very few nurses in the Province who had undertaken the Midwifery course at Port Moresby General Hospital were at all familiar with the cervicograph, although its use should be taught in all nursing schools.

Consequently intensive in-service courses for nurses and health extension officers were held at each centre at which the cervicograph was to be used in addition to two in-service courses at the provincial hospital, and frequent visits to each centre throughout the period of the study. Each centre with a doctor was issued with a management flow chart for use with

the cervicograph, based on the notes produced by Bird[8].

Included in the study were two hospitals, Wapenamanda and Sopas and four rural health centres, Laiagam, Pumakos, Kompiam and Kandep staffed by nurses and health extension officers, although Laiagam was intermittently staffed by a doctor. (see map, last page). Labour, delivery and cervicograph records of all patients delivered in these centres during the study period were sent to the author for analysis. Patients included in the study were those meeting the criteria used by Bird in his 1974 Port Moresby study[3], viz; labour not induced, single pregnancy, vertex presentation, no previous Caesarean section, no antepartum haemorrhage, no eclampsia, and birth weight of infant at least 1000g. The period of the study varied from centre to centre because of local difficulties, from a minimum period of 12 months to a maximum of 26 months, all between August 1977 and October 1979.

Analysis was made of the use of the cervicograph and delivery outcomes and the results were compared with the period before the introduction of the cervicograph and with the 1974 Port Moresby study,[3].

RESULTS

No important differences were noted between different centres (although the incidence of operative deliveries was naturally higher at centres with a doctor) and the results from all centres are combined. Throughout, some comparisons are made with the results obtained in Port Moresby by Bird[3]. References to Port Moresby figures all refer to this study.

Cervicograph Reliability

Details of 1154 deliveries were returned, of which 959 (83%) filled the criteria for entry into the study and had acceptable cervicographs. Excluding those patients fully dilated on admission (though these were included in the study) 1004 patients should have had cervicographs which would have entered the study but of these, only 659 (66%) were correctly completed. In 345 cases (34%) there was either no cervicograph at all, or the cervicograph had one or more major faults. A number of the faulty cervicographs were permitted to enter the study as long as the action line appeared reasonably accurately placed. The commonest faults were wrong placement of the alert and action lines and an inadequate number of vaginal examinations. The incidence of faults was much higher in health centres (56%) than in hospitals with medical officer supervision (26%). No assessment could be made of the accuracy of cervical dilatation assessed by vaginal examination but there were occasions where it was obviously inaccurate, usually over-rather than under-estimated, as was Birds'experience[3].

Patient Characteristics

Of the 959 patients studied, there were 390 primigravidae (41%) and 569 multigravidae. The average interval from admission in labour to delivery was 5.3 hours and the average cervical dilatation on admission was 5.6 centimetres. Each patient received an average of 2 vaginal examinations.

Patients were divided into groups identical to those in the Port Moresby study ie.

Group 1: Cervix less than 4cm dilated on admission and at 8 hours, but in labour (33 patients)

Group 2: Cervix less than 4cm dilated on admission but 4cm or more dilated at 8 hours (221 patients)

Group 3: Cervix 4cm or more dilated on admission (705 patients)

Some interesting differences in proportions of patients in the different groups between this study and that in Port Moresby were noted and are shown in table 1. These differences are probably mainly a reflection on the later presentation to hospital in labour of Enga women.

TABLE 1: GROUPS BY PARITY: ENGA AND PORT MORESBY (POM) STUDIES

	PATIENTS		GROUP 1		GROUP 2		GROUP 3	
	Enga	POM	Enga	POM	Enga	POM	Enga	POM
Primigravidae	390 (41%)	1053 (35%)	22 (6%)	93 (9%)	104 (27%)	512 (49%)	264 (68%)	448 (42%)
Multigravidae	569 (59%)	1959 (65%)	11 (2%)	81 (4%)	117 (21%)	732 (37%)	441 (78%)	1146 (59%)
Total	959 (100%)	3012 (100%)	33 (3%)	174 (6%)	221 (23%)	1244 (41%)	705 (74%)	1594 (53%)

Action Line and Method of Delivery

No patients failed to dilate to 4cm or more and they could thus all be divided into those who subsequently did or did not cross the action line. Ninety eight patients (10%) crossed the action line and their method of delivery is shown in table 2.

TABLE 2: METHODS OF DELIVERY, OXYTOCIN USAGE, AND PERINATAL MORTALITY

	ACTION LINE CROSSED		ACTION LINE NOT CROSSED	
	NO.	(%)	NO.	(%)
Caesarean section	16	(16)	5	(0.6)
Symphysiotomy	14	(14)	13	(1.5)
Vacuum extraction	23	(23)	62	(7.0)
Spontaneous	45	(46)	781	(91)
Intravenous oxytocin	13	(13)	10	(1.2)
Perinatal mortality	1	(1)	16	(2.0)
Total deliveries	98	(100)	861	(100)

These results are compared with the Port Moresby figures in table 3. The differences are discussed below.

Proportions of primigravidae and multigravidae and of patients in the three groups crossing the action line were studied. This is shown in table 4 where comparison is again made with the Port Moresby figures.

TABLE 3: METHOD OF DELIVERY IN ENGA AND PORT MORESBY (POM)

	ACTION LINE CROSSED		ACTION LINE NOT CROSSED	
	Enga	POM	Enga	POM
Caesarean section	16 (16%)	7 (18%)	5 (0.6%)	3 (0.1%)
Symphysiotomy	14 (14%)	5 (13%)	13 (1.5%)	1
Vacuum extraction/ forceps	23 (23%)	19 (49%)	62 (7.0%)	259 (9%)
Spontaneous	45 (46%)	8 (20%)	781 (91%)	2710 (91%)
Total	98 (10%)*	39 (1%)	861 (90%)	2973 (00%)

* Percentage crossing or not crossing action line.

TABLE 4: ACTION LINE CROSSED BY PARITY AND GROUP: ENGA AND PORT MORESBY STUDIES

	Primigravidae No. (%)*	Multigravidae No. (%)*	Group 1 No. (%)*	Group 2 No. (%)*	Group 3 No. (%)*
Enga	68 (17)	30 (5)	5 (15)	28 (13)	65 (9)
Port Moresby	20 (2)	19 (1)	11 (16)	11 (1)	17 (1)

* Percentages are of total patients of each parity or group,

Referred Cases

Thirty one (3.2%) of the 959 study cases were referred from health centre to hospital in labour (complications such as antepartum haemorrhage or malpresentation were excluded from the study). Only 15 of the 31 were referred from a health centre in the study (referral rate of 7% for those centres), and of those 15, only 7 had crossed the action line at the time of referral; 13 were primigravidae. The method of delivery of the 15 is shown in table 5.

TABLE 5: METHOD OF DELIVERY IN ENGA AND PORT MORESBY (POM)

	ACTION LINE CROSSED (IN HEALTH CENTRE)	ACTION LINE NOT CROSSED
Caesarean section	1	1
Symphysiotomy	2	2
Vacuum extraction	2	2
Spontaneous	2	3
Total	7	8

The 31 referred cases delivering in hospital were studied together and their method of delivery is shown in table 6 (which includes those cases in table 5); 22 of these were primigravidae.

TABLE 6: METHOD OF DELIVERY OF PATIENTS REFERRED IN LABOUR

	ACTION LINE CROSSED (IN HOSPITAL)	ACTION LINE NOT CROSSED
Caesarean section	2	1
Symphysiotomy	2	5
Vacuum extraction	4	4
Spontaneous	2	11
Total	10	21

Deliveries before the Use of the Cervicograph

The delivery records of all the centres included in the study were analysed for the years immediately preceding the introduction of the cervicograph. The cervicograph was used intermittently but not with any enthusiasm at the Provincial Hospital in 1976, but was not used at any of the other centres until the present study was commenced. Delivery records varied in availability and accuracy, so that the period studied differed in different centres, but all the deliveries analysed took place between 1974 and 1977. Comparisons of methods of delivery and perinatal mortality are shown in table 7.

TABLE 7: DELIVERIES BEFORE AND AFTER INTRODUCTION OF THE CERVICOGRAPH

	Pre-Cervicograph (1974-77)		Post-Cervicograph (1977-79)	
	No.	(%)	No.	(%)
Caesarean section	60	(3.1)	21	(2.2)
Symphysiotomy	39	(2.0)	27	(2.8)
Vacuum extraction/forceps	107	(56)	85	(8.9)
Spontaneous	1719	(89)	826	(86)
Perinatal motality	30	(1.6)	17	(1.8)
Referrals in labour	22	(1.1)	31	(3.2)
Total deliveries	1925	(100)	959	(100)

DISCUSSION

The value of the cervicograph in the management of labour and the significance of crossing the action line has been well established [2,3,7], and it is not the purpose of this paper to confirm or refute this, but merely to review its use in a rural area where it should be most valuable and to compare the findings in this population with the 1974 Port Moresby study[3].

Crossing the action line was confirmed as highly significant in terms of complicated delivery. Caesarean section and symphysiotomy rates in groups crossing and not crossing the action lines were similar in both Enga and Port Moresby although there were more spontaneous deliveries in the Enga group crossing the action line than in Port Moresby (Table 3). There were however, striking difference between the studies in the proportion of patients crossing the action line; 10% in Enga and only 1% in Port Moresby. There are three possible explanations for this-

(1) Different characteristies of Highland and coastal population.

(2) Higher proportion of at risk women in Enga study.

(3) Cervicographs in Enga were not accurate.

It is recognized that there is a higher incidence of disproportion in Highlanders compared to coastal Papua New Guineans and this was confirmed in the Port Moresby study, where the operative delivery rates for Highlanders alone were closer to the rates in Enga, especially for Caesarean section (Table 8). Bird does not indicate whether the proportion of Highlanders crossing the action line was also higher, but Duignan *et al*[9] found no difference in the rate of cervical dilatation among different racial groups. It is of note, however, that the proportion of Rhodesian women crossing the action line in Philpott and Castle's original work[2] was similar (11%) to this study.

Table 8: MAJOR OPERATIVE DELIVERY RATES-PORT MORESBY AND ENGA

	Total Study Group	PORT MORESBY Highlanders Only	ENGA
Caesarean section (rate)	0.3%)	1.8%	2.2%
Symphysiotomy (rate)	0.2%	0.5%	2.8%

There is also no doubt that the proportion of at risk to "normal" women delivering in a health institution in Enga is greater than in Port Moresby where a very large number of "normal" women now deliver in hospital. However, because of the selection of cases for this study, many of the 'at risk' women were excluded (antepartum haemorrhage, malpresentation, previous Caesarean section, etc), and the incidence of spontaneous delivery in the Enga and Port Moresby groups was very similar (86%) and 90% respectively).

The main reason for the different proportion of patients crossing the action line lies probably, then, in the accuracy of the cervicograph. Over one third of the cases studied in Enga had either no cervicograph (these were excluded from the study) or had one or more obvious faults in the cervicograph. This was despite the intensive teaching and supervision in the technique throughout the study period. The major faults were the inaccurate placing of the alert and action lines, failure to perform vaginal examinations at the correct times (particularly failure to perform 2 hourly examinations if the alert line was crossed) and, undoubtedly (although this was not necessarily obvious from studying the cervicographs), inaccurate estimation of the cervical dilatation

on vaginal examination. The early dilatation was obviously overestimated in a number of cases and this led to "false positive" crossing of the action line. Bird also found this a problem and subsequently altered the placement of the alert line for women 4cm dilated to 4 hours later rather than 2 hours, keeping the 2 hour interval for those 5cm or more dilated[7].

Although this would probably have reduced the number of patients in this study crossing the action line, it would certainly also have increased the inaccuracy and unreliability of the cervicographs by adding a further complicating factor for nurses who were already having difficulty fully understanding the method.

Crossing the action line did not seem a major factor in the referral of patients in labour (Table 5) although patients referred from health centres to hospitals did have a higher incidence of operative delivery than average (58%).

Disappointingly, the introduction of the cervicograph has made little difference to the operative delivery or perinatal mortality rates in Enga Province, in contrast to the findings in Port Moresby, where both declined markedly. Indeed the vacuum extraction rate in Enga has increased although this may well be partly a result of changing medical personnel. The threefold increase, however, in the referral rate of patients in labour may be a result of the cervicograph, if only because of an increased awareness among health centre staff of the necessity to refer patients as a result of the attention paid to the matter at in-service teaching. On the other hand, better transport over the years may have been just as important!

As Bird emphasises, it is only possible to use the cervicograph properly if it is thoroughly understood and this only comes with intensive training in a centre with large numbers of deliveries where it is used frequently, and where there are sufficient experienced staff to supervise the vaginal examinations of those in training[7]. This is not true of any centre in Enga and during the period of this study there was rarely more than one midwife in the entire province who had undergone intensive midwifery training at Port Moresby Hospital. The Enga Provincial Hospital averages only some 250 deliveries per year and at one health centre in the study only 30 deliveries took place in 26 months. Even those well trained in the use of the cervicograph and in the assessment of cervical dilatation can become very "rusty" with such infrequent practice.

Although it must be hoped that in time, many of the difficulties will be overcome and that the cervicograph can become a truly useful and effective tool in labour management through out the country, perhaps in the meanwhile some simpler "rule of thumb" may help health centres in their referral of patients.

The outcome of patients who were still undelivered 8 hours after admission in labour

TABLE 9: OUTCOME OF PATIENTS UNDELIVERED AT 8 HOURS AND OF THOSE CROSSING ACTION LINE

	Entire Study Group		Action Line Crossed		Undelivered 8 hours after admission	
	No.	(%)	No.	(%)	No.	(%)
Caesarean section	21	(2.2)	16	(16)	18	(9.6)
Symphysiotomy	27	(2.8)	14	(14)	15	(8.0)
Vacuum extraction	85	(8.9)	23	(23)	36	(19)
Spontaneous	826	(86)	45	(46)	118	(63)
Perinatal mortality	17	(1.8)	1	(1.0)	3	(1.6)
Total deliveries	959	(100)	98	(100)	187	(100)

was studied. This comprised 187 patients (19% of total study group), 125 of whom were primigravidae and 62 multigravidae. This group was compared with those patients who crossed the action line and with the entire study group (Table 9).

Failure to deliver within 8 hours of admission meant a 37% chance of a complicated delivery compared to a 14% chance in the total group and a 54% chance if the action line was crossed. These differences are highly significant. Although this is much less specific than crossing the action line, perhaps, in the absence of a member of staff well-versed in the use of the cervicograph, serious consideration should be given in health centres to the transfer of a patient who is not delivered or nearly delivered 8 hours after admission in labour.

RECERENCES

1. Friedman EA. Labour, clinical evaluation and management. New York: Apple-Century-Crofts: 1967.
2. Philpott RH, Castle WM. Cervicographs in the management of labour in primigravidae. *J Obs Gyn Brit Cwlth* 1972; 79:592, 599.
3. Bird GC. Cervicographs in the management of labour in primigravidae and multigravidae. *Papua New Guinea Med J* 1974; 17:324.
4. Philpott RH. Graphic records in labour. *Br Med J* 1972; 4:163.
5. Studd J. Partograms and nomograms of cervical dilatation in management of primigravid labour. *Br Med J* 1973; 4:451.
6. Studd JWW, Clegg DR, Sanders RR, Hughes AO. Identification of high risk labours by labour nomogram. *Br Med J* 1975; 2:545/
7. Bird GC. Cervicograph management of labour. *Trop Doctor* 1978; 8:78.
8. Bird GC. The cervicograph; mimeographed notes from Port Moresby General Hospital, 1975.
9. Duignan NM, Studd JWW, Hughes AO. Characteristics of normal labour in different racial groups. *Br J Obs Gynae* 1975; 82:593.

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EPIDEMIOLOGICAL FEATURES OF PERINATAL DEATH DUE TO OBSTRUCTED LABOUR IN ADDIS ABABA

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Summary

Obstructed labour was the second most common cause of perinatal death in Addis Ababa, Ethiopia, being responsible for 9·1 perinatal deaths/1000 births. Most obstructed labours were due to cephalopelvic disproportion. There was a ninefold increase in the perinatal death rate when the patients were anaemic but most perinatal deaths were due to delays in seeking available obstetrical care. Formal education of the patients had little influence on the death rates but the informal education that comes with prolonged urban residence had a markedly favourable effect. Use of prenatal medical services and adequate income also had a favourable influence.

PERINATAL deaths due to obstructed labour are most common in Third World nations because maternal pelves are often undersized and obstetric intervention is frequently delayed or unavailable (Sambhi, 1973; Mtimavalye and Maathuis, 1974; Mphahlele and van der Meulen, 1975). Our study was designed to search for reasons why women with obstructed labours in Addis Ababa, Ethiopia, failed to obtain obstetric care in time to save their infants.

PATIENTS

A study of perinatal mortality was undertaken in Addis Ababa, Ethiopia, in 1974 to 1975 in the hospitals and clinics affiliated to the Addis Ababa University Faculty of Medicine where about 40 per cent of births in the city take place. There were 148 perinatal deaths due to obstructed labour, and all the infants had postmortem examinations. The fetal presentations associated with the obstructions are found in Table I. The pregnancies that ended with fatal obstructions were compared with 568 successful pregnancies, selected to be representative of the delivery population. These controls were comprised of the first ten deliveries after 0800 each day that resulted in the birth of infants who survived the neonatal period.

Hospital and clinic records, an interview with the mother and her physical examination on the day after delivery provided 124 medical, demographic and other items of information for analysis in most patients. The information collected included duration of pregnancy based

TABLE I

Perinatal mortality rate due to obstructed labour by type of presentation or delivery. Cephalopelvic disproportion was the cause of the obstructions in those with vertex presentations

Type of presentation or delivery	Frequency of perinatal deaths per 1000 births of type stated	P value compared to normal vertex delivery
Normal vertex	2·1	
Breech	27·7	<0·001
Face	26·1	<0·001
Brow	126·3	<0·001
Forceps	40·1	<0·001
Vacuum extractor	23·2	<0·001
Caesarean section	11·2	<0·001
Ruptured uterus	1000·0	<0·001

on a church calendar well known to most women, mother's education, size and sources of income, specific expenditures for food, water and other items, place and duration of residence, housing density, tribe, religion, details of employment, facilities for excreta disposal, sources of water, age of first marriage and duration and status of marriages.

Data were also collected on maternal age, previous obstetric history, wanted/unwanted status of the pregnancy, efforts at contraception, abortifacients, gestational hypertention, peripheral oedema, vaginal bleeding, polyhydramnios, jaundice, parasites, venereal diseases including serologic tests for syphilis, other specific disorders during gestation, number of visits for prenatal care, blood haemoglobin values, blood groups, leucocyte counts and medications taken during pregnancy. Information was also collected on details of labour and delivery, fetal distress, Apgar scores, infant blood groups and the clinical course of the newborn infant and mother after delivery.

STATISTICAL METHODS

Details have recently been published on the analyses used to determine which of the many variables were primarily related to the perinatal deaths (Naeye *et al*, 1977). Primary variables were judged to be those that had a significant influence on mortality rates without being dependent on other variables. First, the frequency of each variable in the fatal cases was compared with its frequency in the controls using the chi-square test in two-way contingency tables. This resulted in a short list that included both primary and secondary variables. Then a log-linear model analysis of contingency tables was carried out on the short list to distinguish the primary from the secondary variables.

RESULTS

The frequency of perinatal deaths due to obstructed labours was 9·1 per 1000 births. Ninety per cent of mothers were at term. Eighty-two per cent of the infants were stillborn, 54 per cent were male and 6 per cent were twins. Eighty-eight per cent of the labours lasted over 20 hours, many for several days. Thirty-eight per cent of the infants had resultant congenital pneumonia due to bacteria common in the vagina. Twenty-four of the patients had a ruptured uterus, most on arrival at the delivery centres and one mother died.

Duration of residence in the city, use of prenatal medical services, cash income, maternal blood haemoglobin levels and marital status proved the primary factors in the perinatal deaths (Table II). None had significant interrelationships with each other or with other variables in terms of influencing perinatal death rates due to obstruction. Long residence in the city markedly reduced the frequency of the deaths (Table II). A surprising number of rural mothers obtained prenatal medical care and those who obtained such care, whether rural or urban residents, had only one-fifth the perinatal death rate of those who had no prenatal care. Surprisingly, formal education did not significantly reduce the mortality rates. The death rates were high when patients were anaemic. Women who had been divorced and remarried had a lower frequency of perinatal deaths and a higher ratio of prior successful to unsuccessful pregnancies than did women in other marital categories (Table II). This ratio of successful to unsuccessful pregnancies was 7 : 1 in women divorced who remarried and 3 : 1 in both those divorced and not remarried or those married and never divorced ($P<0·05$).

TABLE II

The relationship of primary factors to the frequency of perinatal death due to obstructed labour

	Frequency of perinatal deaths/ 1000 births	P value and comparison
Mother's residence		
Rural, outside Addis Ababa	51·6	<0·001 compared with whole life in Addis
Addis Ababa, 1–12 months	7·7	<0·001 compared with whole life in Addis
1–10 years	6·1	<0·001 compared with whole life in Addis
Over 10 years	5·2	<0·001 compared with whole life in Addis
All life in Addis Ababa	1·8	
Prenatal medical care		
Mother had care	4·4	<0·001 compared with no care
No care	21·2	
Family income, Ethiopian $/month		
None	83·1	<0·001 compared with > $40/month
1–40	15·0	<0·001 compared with > $40/month
41–200	3·7	
Over 200	5·8	
Maternal haemoglobin level		
Less than 10·1 g/dl	63·3	<0·001 compared with >11·7 g/dl
10·1–11·7	13·3	<0·001 compared with >11·7 g/dl
Over 11·7	6·9	
Marital status		
Never married	11·2	<0·001 compared with divorced and remarried
Married	8·7	<0·05 compared with divorced and remarried
Divorced	18·0	<0·001 compared with divorced and remarried
Divorced and remarried	3·7	

None of the following factors had any significant influence on perinatal mortality rates due to obstructed labours: maternal height, maternal weight, specific illnesses during pregnancy, use of oxytocic or anaesthetic agents, vaginal bleeding, tribe, religion or type of work during pregnancy.

DISCUSSION

Obstructed labour due to cephalopelvic disproportion or abnormal fetal presentation was the second most frequent cause of perinatal death in Addis Ababa, Ethiopia, and the number of such perinatal deaths was equivalent to half to two-thirds of *all* perinatal deaths in most European and North American communities (Pharoah, 1976). The pelvic contractions responsible for most of the obstructions were probably due to childhood and adolescent undernutrition which is prevalent in Ethiopia (Clegg *et al*, 1972); rickets may also have played a role. Fetal head sizes in Addis Ababa are not unusually large (Ross, 1975).

Most of the fetuses were dead when the mothers arrived for delivery and were then usually delivered by embryotomy. When the fetus was alive there were often signs of intra-uterine infection and severe fetal distress. Caesarean section was seldom undertaken in such cases because it posed a serious threat of generalized peritonitis and septicaemia in an undernourished patient.

A high proportion of the mothers who arrived too late at delivery centres had received no prenatal care. Surprisingly, the level of formal education did not have much influence on the death rates but the informal education that comes with prolonged urban residence did have a markedly favourable effect. Divorced women who had remarried had both lower

perinatal death rates from obstruction and a higher ratio of prior successful to unsuccessful pregnancies than did women in other marital categories. In Addis Ababa, as in many other third world cities, successful pregnancies make a woman attractive for remarriage.

One surprising finding was that the mother's height had no significant influence on perinatal mortality rates due to obstructed labour. Baird (1949) stated that reproductive performance is best when the patient's height is more than 160 cm and worst when it is less than 152 cm, partly because pelvic shape and size are related much more to height than to ethnic origin. In Addis Ababa, most women have adequate sized and normal shaped pelves, even when they are short in stature (Ross, 1975).

Our study suggests that a greater understanding of the advantages of prenatal medical care and obstetrical services by mothers would reduce the perinatal mortality rate from obstructed labour in Addis Ababa. Some women also need money so that they can obtain prompt transportation to free or low cost delivery services in the city. Maternal anaemia is another factor that increases the risk of perinatal death in obstructed labours. Many of the anaemias would undoubtedly have been corrected if the mothers had attended clinics earlier in pregnancy.

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REFERENCES

Baird, D. (1949): *Lancet*, **1**, 256.
Clegg, E. J., Pawson, E. G., Ashton, E. H., and Flinn, R. M. (1972): *Philosophical Transactions of the Royal Society of London*, **B 264**, 403.
Mphahlele, M., and Van Der Meulen, A. J. (1975): *African Medical Journal*, **49**, 1204.
Mtimavalye, L. A. R., and Maathuis, J. B. (1974): *Journal of Obstetrics and Gynaecology of the British Commonwealth*, **81**, 380.
Naeye, R. L., Tafari, N., Judge, D., Gilmour, D., and Marboe, C. (1977): *Journal of Pediatrics*, **90**, 965.
Pharoah, P. O. (1976): *Proceedings of the Royal Society of Medicine*, **69**, 335.
Ross, S. M. (1975): *Ethiopian Medical Journal*, **13**, 153.
Sambhi, J. S. (1973): *International Journal of Gynecology and Obstetrics*, **11**, 51.

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Clinical and Research Articles

MATERNAL MORTALITY – A TWELVE-YEAR SURVEY AT THE UNIVERSITY OF ILORIN TEACHING HOSPITAL (U.I.T.H.) ILORIN, NIGERIA

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Abstract

Adetoro OO (Department of Obstetrics and Gynaecology, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria). Maternal mortality — a twelve-year survey at the University of Ilorin Teaching Hospital (U.I.T.H.) Ilorin, Nigeria.

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This paper concerns an analysis of maternal death at the University of Ilorin Teaching Hospital (U.I.T.H.) Ilorin over a 12-year period (1972–1983). There were 138,577 births and 624 deaths making a maternal mortality rate of 4.50 per 1000 births. Hemorrhage, ruptured uterus and obstructed labor were the major direct obstetric causes of death. The most important indirect causes were cerebrospinal meningitis, pulmonary infections and fulminating hepatitis. The main avoidable factors were ineffective and cumbersome blood transfusion services; poor management of the third stage of labor; large number of unbooked patients and poor delivery room structure encouraging sepsis. Suggestions are made for a more integrated type of maternity services in our hospital, health education programs for the public and particularly the expectant women and availability of an effective blood bank service within the maternity hospital premises for prompt treatment of patients requiring emergency blood transfusion. The analysis underlines the great problem of maternal mortality in the developing world.

Keywords: Maternal deaths; Hemorrhage; Ruptured uterus; Obstructed labor; Maternal infections.

Introduction

For most developing countries of the world like Nigeria, the desire for many children amongst women is great. Consequently, the birth rate is high. Per capita income is alarmingly low and family planning is often reluctantly accepted because of religious beliefs. Also, in a significant proportion of families in Nigeria women are working and are therefore expected by the polygamous husbands to provide for the children. In view of the multiple role of our women, it is extremely important that we look into the factors responsible for maternal mortality.

Most developing countries do not have accurate statistics on births and deaths. At the present time, Nigeria does not produce periodic statistics on the maternal mortality rate. It also appears that for a long time to come, the only figures or statistics on maternal mortality will come from the few Teaching and Specialist Hospitals which keep data. These figures can not truly reflect the National mortality rate since

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about 80% of deliveries still occur outside the hospital under the supervision of the traditional birth attendants.

Furthermore, a periodic review of the causes of maternal deaths in an obstetric unit is desirable in order to continuously evaluate the effects of the maternal services on the obstetric performances. This was the over-riding reason for the review of the maternal deaths in our hospital over a 12-year period. The objectives of the study were: (1) to determine the trend of maternal mortality at the University of Ilorin Teaching Hospital; (2) to identify the causes of death; (3) to identify ways of minimising the frequency of preventable maternal deaths.

In order to appreciate fully the factors which may affect the results of this study, the following peculiar circumstances of our hospital are noteworthy. (1) The major blood bank is located at the General Hospital Wing of this Teaching Hospital which is 4 km away. This General Hospital Wing accommodates all the other University departments except the Obstetrics and Gynaecologic Department. The Obstetrics and Gynaecologic Department is served by a small blood bank unit which operates from 0800 h to 1600 h daily and thereafter all the emergency blood grouping and crossmatching are carried out at the General Hospital Wing. (2) The delivery suite has a toilet opening directly to the passage between admission room and first stage room. Also the windows of this delivery suite open directly to the outside space. (3) The only Gynaecologic and Obstetric operating theatre leads directly to the outside through a small corridor, and this theatre is served by an inappropriate single unit air conditioning system, which rarely worked well continuously for 24 h. (4) Nurses anesthetists provide most of the anesthetic services.

Materials and methods

The University of Ilorin Teaching Hospital (U.I.T.H.) Maternity Wing is a referral centre in Kwara State of Nigeria. This U.I.T.H. was until 1981, the Kwara State Specialist Hospital for Obstetrical and Gynaecological cases located at the State Capital. Referral to this hospital are from State's district hospitals, rural maternity centers and private maternity homes.

The information on maternal deaths in pregnancy, labor and puerperium was obtained from the case notes. Relevant facts collected from the record include the number of maternal deaths, maternal age, parity and causes of death. The causes of death were examined under two headings: deaths directly related to obstetric complications such as antepartum hemorrhage, eclampsia and ruptured uterus and secondly deaths indirectly related to the obstetric state of the women, for example pulmonary diseases, and diabetes mellitus in pregnancy.

Results

Six hundred twenty four maternal deaths occurred at U.I.T.H. Ilorin, during the period under review. In the same period there were 138,577 births, giving a maternal mortality rate of 4.5 per thousand (Table I). The overall trend in the maternal mortality rate per year suggests an improvement (Table II and Fig. 1). Five hundred one (80.3%) of the maternal deaths were unbooked emergency admissions with 72.5%

Table I. Maternal mortality rate in different centres in Nigeria.

Reference	Year	Center	Maternal mortality rate/1000
11	1973	Eastern State of Nigeria	17.1
6	1975	Western Nigeria	4.7
8	1974	U.C.H., Ibadan	8.2
5	1975	U.I.H.E., Enugu	13.5
7	1976	U.B.T.H., Benin	6.9
4	1977	A.B.U., Zaria	10.0
12	1977	L.U.T.H., Lagos	8.5
Present series	1984	U.I.T.H., Ilorin	4.5

Table II. Maternal mortality per year (1972–1983) At the University of Ilorin Teaching Hospital (U.I.T.H.)

Years	Total deliveries	Total deaths per year	Maternal death/1000
1972	5752	36	6.3
1973	6756	45	6.7
1974	7718	39	5.1
1975	9053	52	5.7
1976	11228	62	5.5
1977	12530	72	5.7
1978	13120	80	6.1
1979	13146	77	5.9
1980	14844	70	4.7
1981	15779	91	5.8
1982	17278	75	4.3
1983	11373	39	3.4

of the total deaths in the age range of 20–34 years.

Hemorrhage (24.2%, consisting of antepartum 8.2%, and postpartum 16.0%), ruptured uterus (13.9%), obstructed labor (11.9%) were the major direct obstetric causes of death (Table III), while cerebrospinal meningitis (5.6%), pulmonary infections (5.0%), and fulminating hepatitis (3.4%) were the leading medical complications of the maternal deaths (Table IV).

The maternal deaths from hemorrhage

Table III. Direct obstetric causes of maternal death (excluding abortions and ectopic pregnancy).

Direct causes	No. of maternal deaths	Percentage deaths (%)
Post partum hemorrhage	100	16.0
Ruptured uterus	87	13.9
Obstructed labor	74	11.9
Eclampsia	70	11.2
Septicemia	52	8.3
Antepartum hemorrhage	51	8.2
Severe anemia	47	7.5
Hemoglobinopathies	7	1.2
Anesthetic death	4	0.6
Total	492	78.8

Fig. 1. Graph showing trend in the maternal mortality rate from 1972 to 1983. Note dramatic decline in mortality rate from 1981.

Table IV. Maternal deaths from associated causes.

Associated causes	No. of cases	Percentage deaths
Fulminating hepatitis	21	3.4
Cerebro-spinal meningitis	35	5.6
Pulmonary infections	31	5.0
Native drug intoxication	18	2.9
Unexplained death	9	1.5
Tetanus	7	1.1
Uremia	7	1.1
Pulmonary embolism	4	0.6
Total	132	21.2

were caused by disseminated intravascular coagulation (DIC) and irreversibly hemmorrhage shock because of lack of prompt adequate blood transfusion in all the cases. Seventy two of the 87 cases of ruptured uteri were in unbooked emergency admissions. All of them were admitted in shock and died in the process of active resuscitation. The remaining cases of ruptured uteri were booked patients with previous cesarean section scars for cephalopelvic disproportion. They defaulted from appointment given for elective cesarean sections only to be seen in advance labor with uterine rupture and collapse. All the patients (74) who died from obstructed labor came in after over 5 days in labor. Forty one of them developed anuria and died of acute renal failure, whilst the remaining 33 died of sepsis. The eclamptic patients (70) in this study arrived late in the hospital, already in pulmonary failure and comatose from overdose of native drugs. Gram negative fulminating septicemia accounted for 50 maternal deaths while severe anemia, complicated by anemic heart failure and cardiac arrest was the cause of the maternal deaths in 47 cases. Hemoglobinopathies caused 7 maternal deaths. 5 of these clinically died of embolism following bone marrow infarction while the remaining two died of acute sequestration of red cells. Two of the four maternal deaths from anesthesia were due to Mendelson syndrome, whilst the remaining two died of cardiac arrest during intubation.

Of the indirect causes of maternal deaths, cerebrospinal meningitis (6.2%), pulmonary infections (5.8%) and fulminating hepatitis (3.8%) ranked highest. They were seen with severe overwhelming infections and failed to respond to all medical treatment available. Native drug intoxication was associated with a 2.9% of the maternal deaths. They all died of acute respiratory arrest. Severe tetanus (1.1%), uremia (1.1%) and pulmonary embolism (0.6%) were the other indirect causes of maternal deaths.

Discussion

This review of maternal mortality rate is based purely on hospital figures and this does not necessarily reflect national figures. However, irrespective of the limitations of our survey it adds to the fact that the maternal mortality rate is very high in Nigeria. The United Kingdom maternal mortality rate published in the report on confidential inquiries into maternal deaths in 1973/75 was 0.11/1000, [10]. In Hongkong, a maternal mortality rate of 0.14/1000, was quoted for 1971 [8]. The present maternal mortality rate of 4.5/1000, in our hospital is unacceptably high and compares with what existed in the United States of America and United Kingdom around the 1930s when their rate was between 6–10/1000 [1].

Hemorrhage was the commonest cause of maternal death in Ilorin, and this finding agrees with Waboso [11] and Oduntan and Odunlami [6]. The high percentage of maternal deaths from postpartum hemorrhage was attributed to unorthodox ways of conducting the third stage of labor, whereby a violent fundal pressure combined with uncontrolled cord traction was employed usually by the midwives. Also ergometrine was administered when available after the delivery of the placenta by the midwives who conducted most of the deliveries. Lack

of adequate quantity of blood for prompt transfusion, with inefficient blood bank facilities in our hospital, in addition to the poor response of the husbands or relations of the patients to donate blood willingly when so requested compounded the problems posed by hemorrhage.

The high incidence of maternal death from ruptured uterus and obstructed labor is in keeping with the findings of Rao [9] and Caffrey [2]. This is attributed to a poor communication system as seen in most developing countries, illiteracy, and booking at wrong places as these cases were referred from far distant rural health centres, and arrived late in moribund condition. It was obvious that most of these deaths could have been prevented if delivery had taken place in a well equipped nearby hospital, where surgical facilities were available.

Eclampsia, as a fourth leading cause of maternal death is attributable to a large number of unbooked cases and this finding agrees with that of Waboso [11] and Oduntan and Odunlami [6] in Nigerian communities. Septicemia at 8.3% of maternal deaths, is in contrast to the findings in Zaria, where it was the commonest cause of maternal death [4]. Severe anemia as a cause of maternal death was seen in 47 (7.5%) out of our 624 cases. This is in contrast to the reports of Fullerton and Watson-William [3], Waboso [11] and Ojo and Savage [8] that anemia was a major significant cause of maternal death in Nigeria. Our finding is probably due to a change in the pattern of anemia as a result of widespread use of antimalarial prophylaxis and a higher proportion of patients receiving hematinics during the antenatal period.

Hemoglobinopathies as a cause of maternal death was seen in 1.2% of our cases. This agrees with the finding of 1.1% by Oduntan and Odunlami [6] but is in contrast to the findings of Ojo and Savage [8] of 4.4% of their cases of maternal deaths in earlier years. Improved medical care in this group of patients over the years have contributed to the reduced fatality. Death from anesthesia accounted for 0.6% of our cases. This figure is perhaps not too bad as most of the anesthetic services were provided by nurses anesthetists. The high incidence (15.8%) of infectious conditions as a cause of maternal death in our study is in contrast to the reports of Ojo and Savage [8] and Oduntan and Odunlami [6] and this is probably due to higher degree of poor environmental sanitation and illiteracy.

The overall maternal mortality rate in the unit continues to improve in recent years from 5.8 per 1000 in 1981, 4.3 per 1000 in 1982 to 3.4 per 1000 in 1983. This improvement is not only due to the recent increase in the medical and midwifery staff strength but also to the quality of the staff in the unit.

Our analysis suggests that the majority of the maternal deaths could have been avoided if the expectant women attended antenatal clinics, accepted medical advice, declined unorthodox interference and reported in hospital in early labor. There is no doubt that we urgently need to reduce drastically our maternal mortality rate. This can be achieved by an improvement in the medical care facilities, health education of the expectant mothers on the value of modern antenatal care and the need for hospital delivery. Also correct management of the third stage of labor and better arrangements to make blood available on a 24-h basis will reduce the maternal mortality rate in the unit. Furthermore, an improvement in the supply of pipeborn water, environmental sanitation, communication and transportation systems as well as improvement of the nutrition and the general standard of living of the population would result in marked decline in our maternal mortality rate.

It is hoped that this analysis shall further stress the immensity of the problem of maternal deaths in third world countries and

stress the need for better planning of the national health services.

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References

1 Ademowore AS: Review of maternal mortality at Wesley Guild Hospital, Ilesa, Nigeria. *In* Obstetrics and Gynaecology in Developing Countries: The proceedings of an International Conference Organised by the Society of Gynaecology and Obstetrics of Nigeria (eds Ojo, Aimakhu, Akinla, Emmanuel and Chukwudebelu) pp 287–294, 1977.

2 Caffrey KT: Maternal mortality – a continuing challenge in tropical medicine – A report from Kaduna, Northern Nigeria. Afr Med J *56:* 274, 1979.

3 Fullerton WT, Watson-Williams EJ: Haemoglobin SC disease and megaloblastic anaemia of pregnancy. J Obstet Gynaecol Br Commonw *69:* 729, 1962.

4 Harrison KA: Child bearing in Zaria. A public lecture in Ahmadu Bello University, Zaria, p 4, 1978.

5 Megafu U: Causes of maternal deaths at the University of Nigeria Teaching Hospital Enugu. West Afr Med *XXIII(2):* 87, 1975.

6 Oduntan SO, Odunlami UB: Maternal mortality in western Nigeria. Trop Georg Med *27:* 313, 1975.

7 Okojie SE: Maternal mortality at the University of Benin Teaching Hospital Benin City, Nigeria. *In* Obstetrics and Gynaecology in Developing Countries; The Proceedings of an International Conference Organised by the Society of Gynaecology and Obstetrics of Nigeria (eds Ojo, Aimakhu, Akinla, Emmanuel and Chukwudebelu) pp 280–286, 1977.

8 Ojo OA, Savage VY: A ten year review of Maternal Mortality rates in the University College Hospital Ibadan, Nigeria. Am J Obstet Gynaecol *118(4):* 517, 1973.

9 Rao KB: Maternal mortality in a Teaching Hospital in Southern India. A 13 year study. Obstet Gynaecol *46:* 397, 1975.

10 Reports of Confidential Enquiries into Maternal Deaths in England and Wales 1973–1975. Reports on Health and Social Subjects London H.M.S.O.

11 Waboso FM: The causes of maternal mortality in the Eastern States of Nigeria. Nig Med J *3(2):* 99, 1973.

12 Wakile EP: Maternal mortality in Lagos, University Teaching Hospital; A three year review. Nig Med Pract *7(5):* 147, 1984.

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Maternal mortality: helping women off the road to death

One of the widest health disparities between rich and poor is in maternal mortality. There are, for example, more maternal deaths in India in the space of a week than there are in all of Europe in a whole year. The estimated half million such deaths that occur every year are all the more intolerable in that they are theoretically preventable with current technology. As part of its long-term programme in this field, with the support of the United Nations Fund for Population Activities, WHO convened an Interregional Meeting on the Prevention of Maternal Mortality in November 1985. The findings and conclusions of the 41 participants—health professionals, researchers and policy-makers from 26 countries and agencies—are already guiding the Organization's joint efforts with countries to help women off the road to maternal death.

Every four hours, day in, day out, a jumbo jet crashes and all on board are killed. The 250 passengers are all women, most in the prime of life, some still in their teens. They are all either pregnant or recently delivered of a baby. Most of them have growing children at home, and families that depend on them.

This shocking scenario, presented by Dr Malcolm Potts at the WHO Interregional Meeting on the Prevention of Maternal Mortality, highlights both the enormity of the problem and the extent to which it has been overlooked. If the 500 000 maternal deaths that are estimated to occur each year took place in such a concentrated and visible way, there would be an international outcry. But maternal deaths take place a few at a time, in poor countries, among poor women, and often in small villages. These deaths do not make headlines, they just leave behind motherless children, bereaved families, and health workers frustrated by their inability to prevent such deaths from happening again and again.

The magnitude of maternal mortality

At the Interregional Meeting, numerous participants presented information from their studies of maternal deaths, defined as deaths among women who are or have been pregnant during the previous 42 days. Maternal mortality rates (MMRs) at the national or local level are shown in Table 1.

Overall, Table 1 makes the point that maternal mortality in developing countries is quite high. With the exception of Cuba, Portugal and China (Shanghai), all the studies found MMRs above 50, and rates over 500 are not uncommon. This means that, *each time they become pregnant,* women in rural Bangladesh, for example, face a risk of dying that is at least 55 times higher than that faced by women in Portugal and 400 times higher than women in Scandinavia.

An obvious feature of this table is that national studies of maternal mortality in developing countries are rare. Few such countries have records of all births and deaths, and special studies of a whole country are difficult and expensive. On the other hand, special studies at the local level provide a great deal of important information. In some cases,

Based on the report of the Interregional Meeting on the Prevention of Maternal Mortality, November 1985, prepared by the Chief Rapporteur, Ms Deborah Maine, Senior Staff Associate, Center for Population and Family Health, Faculty of Medicine of Columbia University, New York, NY, USA. A limited number of copies of the full report and of the papers presented are available to professionally interested persons; please write to the Division of Family Health, World Health Organization, 1211 Geneva 27, Switzerland.

Table 1. Maternal mortality rates*: results of studies presented at the meeting

Continent/country	Maternal mortality rate		Location
	national	local	
AFRICA			
Egypt		190	northern Egypt
		300	southern Egypt
Ethiopia		566	Addis Ababa
United Republic of Tanzania		370	four regions
ASIA			
Bangladesh		566	rural area
		833	rural area
China		13	urban Shanghai
		22	rural Shanghai
India		545	urban Anantapur
		874	rural Anantapur
Indonesia		718	Bali
Malaysia		70	Selangor State
Turkey		119	two rural areas
EUROPE			
Portugal	16		national
LATIN AMERICA			
Colombia		110	Cali
Cuba	31		national
Jamaica	106		national
Peru		73	Callao Province

* Maternal deaths per 100 000 live births.

these studies supply the only data available on maternal deaths in a country, other than official estimates (which are notoriously low).

As Table 1 shows, there is considerable variation in reported maternal mortality rates. While some of this variation may be due to differences in study design, in general the patterns are those that one might expect. Countries with very high crude mortality rates (such as Bangladesh, Ethiopia and India) have higher MMRs than do those with lower crude mortality rates (e.g., China, Colombia, Cuba, Malaysia, Portugal and Turkey). Furthermore, within-country differences conform to other mortality patterns. For example, MMRs in China and India were shown to be lower in urban areas, where health services are more accessible, than in rural areas. Similarly, the MMR reported for a northern region of Egypt is lower than that for a region in the southern, less developed part of the country.

A hospital MMR is the number of maternal deaths taking place in the hospital divided by the number of live births taking place in the same institution during the same period of time. Such rates are not good indicators of the general risk of maternal death in developing countries. One reason is that most births do not take place in hospitals. On the other hand, because women who experience serious complications during delivery are more likely to try to reach a hospital, hospital MMRs are sometimes much higher than the rate in the population at large.

Nevertheless, there is valuable information to be gained from hospital studies. First of all, as described below, they are a major source of information on medical causes of death. Secondly, they tell us something about the functioning of the medical system as a whole. For example, among the hospital MMRs reported at the meeting were the following: Nepal, 398 per 100 000 live births; Nigeria, 1050; Pakistan, 170; Sudan, 305; and Vietnam, 576. In each of these studies, for every thousand women who delivered a live baby in hospital, at least one woman died, and in Nigeria the ratio was more than one for every 100. These rates tell us that something is wrong, because most women can be saved with prompt and adequate medical care.

As distressing as the rates in Table 1 are, some of them are probably still underestimates. Experience in both developed and developing countries has shown that maternal deaths are virtually always underreported.

In industrialized countries, almost all deaths come to the attention of medical and civil authorities. Even so, there is considerable underreporting of maternal deaths because the death certificate may not mention the fact that the woman had recently been pregnant. A recent study in the state of Washington, in the USA, found that maternal deaths were underreported by 100%.

Several of the studies presented at the meeting demonstrated the inadequacy of official statistics. In Jamaica, the official MMR was 48 per 100 000 live births, but a national study uncovered a rate of 102. In Egypt, two separate studies found maternal mortality rates of at least double the official rate of 90. Investigators in Colombia, India, Jamaica and Sudan all discovered substantial underreporting when death certificates were checked against hospital records.

In developing countries, another major reason for underreporting is that many deaths occur outside hospital. In a hospital study in Sudan, for example, the number of cases collected was certainly less than the actual number, as some cases were not reported and some women arrived at the outpatient department either dead or moribund and were immediately taken back by the relatives. Data

from Egypt, India, Indonesia, Malaysia and Turkey showed that large proportions of maternal deaths took place either at home or on the way to the hospital. These proportions ranged from 24% of deaths in Turkey to 82% in rural India. In Bangladesh, hospital staff were aware of only 4% of the maternal deaths discovered by researchers.

In general, the studies presented demonstrated that the larger the number of sources of data employed, the more maternal deaths are discovered. In India it was learned that even schoolchildren can be a valuable source of information on deaths that might otherwise be overlooked.

The causes of maternal mortality

Dr Fathalla,[1] the meeting's Chairman, emphasized in his opening address that the causes of maternal deaths are complex. To do this, he described the case of Mrs X:

> Mrs X died in hospital during labour. The attending physician certified that the death was from haemorrhage due to placenta praevia. The consulting obstetrician said that the haemorrhage might not have been fatal if Mrs X had not been anaemic owing to parasitic infection and malnutrition. There was also concern because Mrs X had only received 500 ml of whole blood, and because she died on the operating table while a caesarean section was being performed by a physician undergoing specialist training. The hospital administrator noted that Mrs X had not arrived at the hospital until four hours after the onset of severe bleeding, and that she had had several episodes of bleeding during the last month for which she did not seek medical attention. The sociologist observed that Mrs X was 39 years old, with seven previous pregnancies and five living children. She had never used contraceptives and the last pregnancy was unwanted. In addition, she was poor, illiterate and lived in a rural area.

Why did Mrs X die, and how could her death have been prevented? Dr Fathalla pointed out that there were a number of points at which Mrs X could have been helped off the road to death. In order to identify these, and to design and implement effective programmes, the various kinds of causes need to be understood.

Medical factors

There is considerable variation in ways of classifying medical causes of death. For example, a woman who bleeds to death when her uterus ruptures may be listed as dying from either haemorrhage or ruptured uterus. Nevertheless, the final "causes" of maternal deaths—those diagnosed and recorded by medical personnel—are remarkably consistent throughout the developing world.

Maternal deaths are usually divided into three categories: "direct" obstetric deaths; "indirect" obstetric deaths; and unrelated deaths. Direct obstetric deaths are those resulting from complications of pregnancy, delivery or their management. Indirect obstetric deaths are the result of the aggravation of some existing condition (such as hepatitis or heart disease) by pregnancy or delivery.

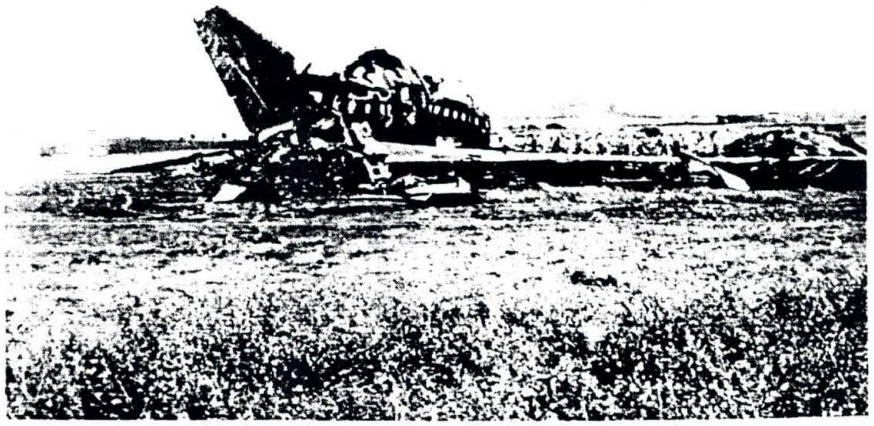
In developing countries, as the studies presented at the meeting confirmed, direct deaths constitute 50–98% of all maternal deaths, and haemorrhage, infection and toxaemia together make up at least half of all maternal deaths in 11 of the 13 countries for which this information was provided. In a few studies, some other condition was listed as one of the three leading causes of death. Most often, this other condition was illegal induced abortion but in two cases it was embolism. Ruptured uterus, hepatitis, anaemia and obstructed labour were each cited once as one of the three leading causes of maternal deaths.

The major medical causes of maternal deaths in developing countries are thus already known, but these diagnoses are usually just the last stretch of the road to death.

Health service factors

The fact that medical causes of death are not the whole story emerged clearly from the meeting's discussions of avoidable maternal deaths. The medical records of women who had died had been analysed in nine countries in order to identify factors that contributed to their deaths. The investigators found that *63–80% of direct maternal deaths, and 88–98% of all maternal deaths, could probably have been avoided with proper handling*. In a number of cases, the researchers specifically stated that they had evaluated the avoidability of deaths not by standards of care under the best of circumstances, but by standards realistic under the circumstances prevailing in that country at the time. For example, in Turkey, 51% of maternal deaths were judged to be avoidable within the existing health system, and another 24% avoidable with an improved health

[1] At the time Dr M.F. Fathalla was Dean, School of Medicine, Assiut University, Egypt. He is now Responsible Officer for Research and Development, Special Programme of Research, Development and Research Training in Human Reproduction, WHO, Geneva, Switzerland.



Imagine a jumbo jet crashing every four hours somewhere in the world. All 250 passengers on board are women in their prime. There are no survivors. This is the magnitude of maternal mortality.

Photo Camera Press©/Len Sirman Press.

system. In most cases, investigators identified more than one avoidable factor that contributed to each death.

Deficient medical treatment of complications was often an important factor. Mistaken or inadequate action by medical personnel was judged to be a contributing factor in between 11% and 47% of maternal deaths in the developing countries studied.

Lack of essential supplies and trained personnel in medical facilities was also mentioned frequently as a contributing factor. In United Republic of Tanzania, lack of blood for transfusions, drugs and equipment was a factor in more than half of the deaths studied. In Jamaica, only 6 of the 18 hospital deaths from haemorrhage took place in hospitals that had a blood bank.

Lack of access to maternity services is another crucial step on the road to death. The studies in Cuba, Egypt, Indonesia, Jamaica, Turkey and United Republic of Tanzania demonstrated that maternal mortality rates are increased in areas where access to a hospital is difficult, and where women are likely to arrive at the hospital, if at all, in a serious condition. In Nepal, for example, 32% of women who died in the hospital arrived in very poor condition, and another 17% arrived unconscious.

Lack of prenatal care was frequently mentioned as a contributing factor. For example, in Portugal, more than half of the women who died had not received prenatal care, compared with one-third of women in the country as a whole. In Nigeria, in all age-parity groups, MMRs were drastically lower among women who had had prenatal care than among those who had not, although "the risks of teenage pregnancy and high parity were still very evident". Some data, however, indicated that more research is needed on the role of prenatal care. For example, in Viet Nam "very few adverse events were found at antenatal visits". Furthermore, the community-based study of maternal mortality in Addis Ababa illustrates the point that "antenatal care and selection of high-risk women are not an end in themselves". All three women in the Ethiopian study who died of haemorrhage had had prenatal care, but had delivered at home. This shows that women must be convinced of the benefit of referral and that, above all, services must be accessible.

Another problem in interpreting data on prenatal care is the difficulty of distinguishing the well-known effects of poverty on maternal health from the effects of lack of prenatal care. In Nepal, for example, only 34% of illiterate women had prenatal care, compared with 91% of women with a college education.

Reproductive factors

For decades it has been known that certain groups of women—very young women, those aged 35 or older, and women who have already borne four or more children—are at especially high risk of dying during pregnancy and delivery. Many of the studies presented at the meeting confirmed this.

Maternal age. Data showing higher MMRs among women aged 35 or older were presented for eight developing countries. In six of the studies

that provided the data to make this comparison, women aged 35–39 were from 85% to 461% more likely to die from a given pregnancy than women aged 20–24 (relative risks, 1.83–5.61). One study, a case/control study in United Republic of Tanzania, did not show this expected relationship.

The same studies that showed an excess of deaths among older women showed an excess among women younger than 20, with the exception of Cuba. Increased risks of death were especially pronounced in Ethiopia, Indonesia and Portugal. Again, the Tanzanian study did not show any differences by age between women who died and those who did not.

Parity. Although information on parity is more difficult to obtain than information on age, several studies also confirmed the increased risk of death associated with having many children. In Jamaica, compared with women having their second child, those having their fifth through ninth births were 43% more likely to die. In Portugal, women having their fifth birth were three times as likely to die as women having their second, while women having their sixth or later birth were at even greater risk.

The importance of these data is that the practice of family planning could prevent a great many deaths of women of unfavourable age or parity.

Unwanted pregnancy. Of course, given the high overall rates of maternal death in poor countries, the impact of family planning would be important if unwanted pregnancies were averted at any age or parity. This point is vividly illustrated by data from the governorate of Menoufia in Egypt and the island of Bali in Indonesia. When similar studies were done in both places, a striking difference was found in maternal mortality rates. In Bali there were 718 deaths per 100 000 live births, compared with 190 in Menoufia: 278% higher. However, when the risk of childbearing was expressed in another way—as maternal deaths per 100 000 married women aged 15–49—the difference was greatly reduced. In Bali, there were 69 deaths per 100 000 women, compared with 45 in Menoufia: an excess of only 53%. The reason for this seeming paradox is that fertility rates are much lower in Bali than in Menoufia, largely owing to the use of family planning.

Illegal induced abortion is a major killer of women, as the studies presented at the meeting amply demonstrated. It was responsible for 7–50% of maternal deaths, the median being 15%. As high as these percentages are, many of them are underestimates because women who have illegal abortions are reluctant to seek formal medical help. In Ethiopia, for example, four of the six women who died on the way to hospital had had an illegal induced abortion. Reluctance or inability to get medical care results in a selective underreporting of abortion deaths. In India, 11% of hospital deaths were due to abortion, compared with 17% of deaths at home in rural areas. Clearly, since induced abortions occur in cases of unwanted pregnancy, family planning could substantially reduce the number of deaths from this cause.

Finally, unwanted pregnancy contributes to maternal deaths in ways which are not yet understood. The Ethiopian study found that women who had an unwanted pregnancy were less likely than other women to seek prenatal care. In addition, two deaths of pregnant women by poisoning were attributed to unwanted pregnancy.

Socioeconomic factors

Socioeconomic factors undoubtedly play a large role in maternal deaths, but how and why are still obscure. What is known is that poverty is clearly a high-risk factor. It is also known that poor women are less likely to have formal education than wealthy women, and are less likely to be in good health and to seek (or receive) medical care. Which of these factors are causes and which are effects, and how can this vicious circle be broken? Much more research needs to be done to answer these questions.

The kinds of questions raised above are also relevant to health problems such as infant mortality. But another (and even less well studied) aspect of socioeconomic status has special importance in maternal deaths, and that is the status of women. As papers presented by the Egyptian and Nigerian participants emphasized, "in almost all societies in the past, and in many societies in the present, women are a socially disadvantaged group . . . The status of women affects their nutrition, reproductive behaviour, utilization of health care services and vulnerability to harmful traditional practices". The ramifications of the status of women are so far-reaching that it may be that "nothing will really change in so far as maternal mortality is concerned until attitudes towards women change and people are sufficiently motivated to improve their living conditions".

Action to prevent maternal deaths

The papers presented and the plenary sessions strongly indicated that a major new initiative to prevent maternal deaths should be mounted—and was in fact overdue. Furthermore, there was agree-

ment that much could be accomplished. The remaining question, then, was how best to begin. Recommendations for action at a number of levels —policy, programme, training and research—had been prepared during two intensive days of working group sessions, and were discussed in the plenary session.

Policy initiatives

In order for there to be a concerted and effective effort to reduce maternal deaths in developing countries, maternal mortality must be given high priority. As with all areas of action, initiatives need to be taken at a number of levels—starting at the global level, with WHO helping to set policy and coordinate actions and resources.

It was strongly recommended that the Member States of WHO should designate maternal mortality as one of the global indicators of "health for all by the year 2000". Furthermore, WHO should help draw the attention of Member States to the greatly elevated risk of death faced by women in high-risk groups if they become pregnant.

While WHO can lead the global effort to reduce maternal deaths, the effectiveness of this effort depends mostly on national governments. To begin with, governments must make maternal mortality a priority public health issue, and should review their policies and programmes with an eye to preventing maternal deaths. Policy reviews should cover such issues as removing obstacles to family planning, e.g., taxes on and other barriers to using or importing contraceptives.

Professional societies too have a role to play. In order to lower maternal mortality in poor countries, services must be spread more widely and innovative programmes must be tried and assessed. This will not be possible without the strong leadership of professional societies such as medical associations, both internationally and nationally.

Programme initiatives

It is clear from the persistence of high rates of maternal mortality and morbidity that current programmes are not adequate. Progress will require bold and determined new thinking and effort. Programmes should rest on the axiom that all services should be provided at the most peripheral level of the health care system consistent with efficacy.

The design of services should be guided by what has been learned from studies such as those presented at the meeting. For example, in many countries most deliveries and many maternal deaths take place outside hospitals. Furthermore, a sizeable proportion of serious complications cannot be predicted beforehand. Therefore, while efforts must be made to upgrade hospital care and to refer high-risk women as early as possible, services need to be designed to reduce the distance between pregnant women and the care they require.

A variety of approaches are possible. Women who are likely to have complications can be sent to maternity waiting homes. These are facilities where pregnant women can come in the last week of pregnancy, stay while they await delivery, and have either a supervised normal delivery or prompt transfer to a medical facility if complications arise. Experience with waiting homes in Colombia, Chile, Cuba, Uganda and Malawi has shown that they can be successful and need not be expensive, as the community can provide much of the labour and supplies.

However, in the large proportion of cases in which complications cannot be predicted, more effective means of treating complications must be made available at the first referral level, including the establishment of more basic obstetric facilities. These need not be new facilities. Health centres could be upgraded to provide essential maternal health services: vacuum extraction deliveries; blood transfusions; simple general and/or local anaesthesia; caesarean section; suction curettage for incomplete abortion; insertion of intrauterine devices; and tubal ligation and vasectomy.

Promising approaches were suggested for each of the major causes of death.

Haemorrhage. Postpartum haemorrhage is difficult to predict and there is often little time or opportunity to transport the woman to a hospital for blood transfusion. Therefore, any trained person who is considered capable of doing a delivery should be trained to handle this life-threatening complication through the use of oxytocic drugs (which contract the uterus and its blood vessels), manual removal of the placenta, and then administration of broad-spectrum antibiotics. In addition, the use of plasma expanders at health centres that cannot provide transfusions should be explored.

Antepartum haemorrhage can be predicted when there is third-trimester bleeding with placenta praevia. In these cases, early referral to a facility where blood transfusion and caesarean section are available is crucial. However, in many cases antepartum haemorrhage cannot be predicted. Therefore, there is an urgent need to shorten the distance between the place of delivery and a facility where emergency care can be provided. In addition to upgrading peripheral health facilities, attention must be paid

to the key role of transportation. An effort should be made to make all kinds of government vehicles available in emergencies, rather than relying on scarce (or non-existent) health department vehicles alone.

Infection. Deaths from infection can be greatly reduced (as they have been in China) through cleanliness during delivery. Providing traditional birth attendants (TBAs) with delivery kits is one way to encourage asepsis. Adding antibiotics to these kits, for use in cases of prolonged labour or premature rupture of the membranes, could prevent many maternal deaths in areas where physicians are scarce.

Toxaemia. Only good prenatal and medical care can prevent the majority of deaths from this cause. However, sedatives for treatment of severe toxaemia should be made available at the primary care level.

Unwanted pregnancy. As the studies presented at the meeting showed, unwanted pregnancy contributes to maternal mortality in a number of ways —e.g., in the number of births to women in high-risk groups and the number of pregnancies per woman. The most dramatic way in which unwanted pregnancies contribute to maternal deaths is through illegal induced abortion. Because these pregnancies are, by definition, unwanted, this is an area in which primary prevention holds great promise.

Family planning is the first line of defence against illegal abortion, and education about avoiding unwanted pregnancies should be provided in schools, at all levels of the health care system, and during all contacts with pregnant and recently delivered women. Special attention should be paid to counselling women who are being treated for complications of abortion, in order to help them avoid repeated unwanted pregnancies and abortions. Furthermore, whatever the accepted indications for legal abortion in a country (and there are usually some), this service should be made widely available, rather than being available only to wealthy women in urban areas.

Obstructed labour. While there are certain groups of women who are at especially high risk of obstructed labour (e.g., women of small stature, women having their first birth, and women having their sixth or later birth), in many cases this complication is not predictable. So, again, access to emergency services is essential. In the case of obstructed labour, much could be accomplished by educating TBAs to be prompt in sending women who are not making satisfactory progress in labour to a facility where they can get medical care, such as a caesarean section.

Anaemia. Depending on the cause of anaemia in a particular region, iron and folate supplements, malaria prophylaxis and/or treatment, and treatment of hookworm disease and schistosomiasis should be provided to pregnant women at the primary care level.

Tetanus. In addition to being a major killer of newborns, tetanus is a common cause of maternal deaths in some areas (Bangladesh, India, Indonesia). The administration of tetanus toxoid to all women, especially pregnant women, should be a high priority.

Training initiatives

To implement programmes successfully, training is crucial. Some of the needs for training are the following.

Traditional birth attendants. TBAs are often the first (if not the only) health care workers with whom pregnant women in poor countries have contact. Therefore, it is essential that they be made as effective as possible through training, supervision and support.

A major role of TBAs should be referral—assuming, of course, that there are health care facilities to which women can be referred. Topics suggested for TBA training in referral include: recognition of risk factors (e.g., age, parity, poor obstetric history, bleeding during pregnancy); detection of anaemia; recognition of infection, prolonged labour and excessive blood loss; and referral to a source of legal abortion.

TBAs should also be given the training and supplies to prevent or treat complications whenever possible. Preventive measures include use of antiseptic techniques in delivery, administration of drugs to reduce anaemia, and provision of contraceptives. Treatment skills could include first aid for treatment of haemorrhage (application of pressure, elevation of limbs, use of oxytocic drugs) and safe removal of retained placenta.

Health centres. If health centres are to fulfil their potential in preventing maternal deaths, centre personnel need the training and supplies to be effective. Suggested areas for training include: recognition of blood pressure abnormalities and anaemia; use of antibiotics, intramuscular iron supplements, oxytocic drugs and plasma expanders; and repair of lacerations. In areas where there is no physician available to perform life-saving caesarean sections, the feasibility of teaching trained midwives to do this operation should be explored.

Referral hospitals. As the studies of avoidable deaths demonstrated, hospital personnel need additional training in treatment of serious complica-

A traditional birth attendant examines a mother-to-be. No matter how good the care at primary health level, a certain proportion of women will die of unforeseeable complications during delivery if the health centre or hospital is too far away.

tions. For example, it was suggested that special teams of health care personnel be established for coping with haemorrhage and eclampsia. Personnel in these facilities need to have banked blood available, and to be able to manage such catastrophic events as uterine rupture.

Research initiatives

Three broad types of research were discussed: research on appropriate technology for preventing maternal deaths; health systems research on innovative programmes; and epidemiological research on the incidence and causes of maternal deaths.

Appropriate technology research. A wide variety of appropriate technology issues were suggested for future research. These included such important topics as: simple, inexpensive methods for detecting and measuring anaemia; durable tubing for vacuum extractors; appropriate plasma expanders for use at health centres; and the content of delivery kits for TBAs.

Health services research. Evaluating service delivery systems, especially innovative ones, is crucial if scarce resources are to be used effectively. Promising topics for health services research include: appropriate therapy for anaemia, such as new iron preparations; the use of prophylactic antibiotics in cases of prolonged labour; the role of maternity villages; and the delegation of basic obstetric functions such as caesarean section and suction curettage to a more peripheral level.

Epidemiological research. Both for shaping policy and for designing programmes, it is important that more research be done on maternal mortality and morbidity rates, and on their causes. It was recommended that all Member States of WHO should, no later than 1995, be able to provide reliable estimates of their MMRs. Also by 1995, Member States should have begun research on the underlying causes of maternal deaths.

Four types of information on maternal mortality should be sought. First is the absolute number of deaths. As the studies presented at the meeting showed, obtaining this information is not easy. Nevertheless, even incomplete counts can sometimes be useful for policy purposes—e.g., when a small developing country is found to have more maternal deaths a year than a very large developed country.

Secondly, countries should collect information on the rate of maternal mortality. As was shown above, hospital studies are not a good method for determining MMRs in developing countries.

The third type of information countries should gather is data on the characteristics of women who die. These are especially valuable when compared with information on women who do not die. Case-control studies are a relatively inexpensive way to accomplish this.

Lastly, data are needed on the causes of maternal deaths: clinical, health services, reproductive, and socioeconomic factors. Priority should be given to research on the risk factors that have the greatest

Table 2. The suitability of data sources and methods for obtaining selected information on maternal mortality (Key: 1=best, 2=satisfactory, 3=poor, 4=not appropriate, UNK=unknown)

Data source/method	Information sought				
	No. of deaths	Maternal mortality rates	Characteristics of the deceased women	Medical causes	Other causes (social, etc.)
Vital statistics					
Routinely classified maternal deaths	2	2	3	3	3
Birth–death record linkage	1	1	2	1	2
Investigate all deaths of women aged 15–49	1+	1	1	1	1
Hospital records					
Maternal deaths in obstetrics/gynaecology service	2	3	1	2	3
Maternal deaths in all services	2	3	1	2	3
Case-control studies	4	4	1	2	2
Obstetrician/gynaecologist peer review	4	4	1	1	2
Health worker interviews					
Obstetricians/gynaecologists	3	3	2	2+	2
All health workers (MCH/family planning)	3	3	2	2+	2
Community studies					
Identify/investigate deaths of women aged 15–49	2	2	1	1–2	1
Prospective monitoring of pregnant women up to 6 weeks after end of pregnancy	1	1	1	1–2	1–2
Household survey	2	2	1	2	1–2
Discussions with groups of knowledgeable/ local people	UNK	4	UNK	UNK	2
Case-control studies	4	4	1	2	1–2
Confidential inquiries					
Vital statistics	3	4	1	1	2
Multiple data sources	1	4	1	1	2
Indirect demographic methods	UNK	UNK	4	4	4

relevance for improving the provision and use of health services.

The participants considered that it would be useful for WHO to draw up a document describing research methods that can provide these kinds of data, and the circumstances under which each method is most and least useful (see Table 2). If necessary, new, low-cost methods for doing research on maternal health should be developed. WHO should also consider providing training courses on study design.

Finally, it was recommended that countries should begin collecting data on maternal morbidity. Most countries have no idea of the magnitude of this problem, although it can be assumed to be large. For example, a study in India found that for each woman who died a maternal death, there were 18 who survived with severe (and sometimes permanent) complications. An effort should be made to take advantage of existing opportunities to gather morbidity data, e.g., during contraceptive prevalence surveys.

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In her closing address, Dr Angèle Petros-Barvazian, Director of WHO's Division of Family Health, said that the meeting should be seen as "the end of the beginning". The actions recommended would now have to be carried out by WHO in its broadest sense—not just headquarters but the regional offices, Member States, and professional and nongovernmental organizations. Only with commitment on the part of all involved could women be helped off the road to maternal death.