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ANAEMIA IN PREGNANCY

Anaemia in pregnancy is a major public health problem in developing countries. While anaemia is directly responsible for 20% of maternal deaths, in another 20% it is a contributing factor (Menon, M.K.K., 1967). Besides, it is also responsible for the high incidence of premature and low weight births thus increasing the perinatal mortality and morbidity. Studies carried out at the National Institute of Nutrition, Hyderabad are highlighted below:

HAEMOGLOBIN SURVEYS:

Haemoglobin surveys carried out in different parts of the country indicate that while 15-20% of women are anaemic at the onset of pregnancy, the incidence of anaemia (Hb. levels less than 11 g%) increases to 60-70% in the last trimester. A survey of 1810 women attending Niloufer Hospital, Hyderabad, indicated that incidence of anaemia was closely related to parity (Table 1).

The incidence seen in the hospital may in fact be an underestimate, since the hospital patients come from a mixed socio-economic group. In rural populations, the incidence of anaemia may be of a much higher order due to associated infestations and infections.

ETIOLOGY:

Anaemia of pregnancy seen in our population is mainly due to iron deficiency. However, associated folic acid and B₁₂ deficiencies also exist.

(1) Dietary factors:

The average Indian diet would appear to be adequate in iron content (20-22 mg) for a non-pregnant adult woman. However, various factors inhibit iron absorption of which phytate is most important. While an absorption of 10% is essential to meet the iron require-

TABLE 1
Incidence of anaemia in pregnancy (%)
*(Total No. investigated - 1810)

Gestational age (weeks)	Over all incidence (Hb/11.0 g%)	Parity			
		I - III		IV & above	
		/11.0 g%	/8.5 g%	/11.0 g%	/8.5 g%
/16	15.5 (265)	12.5 (140)	...	20.0 (125)	2.0
16-28	29.2 (974)	23.0 (666)	2.2	32.5 (308)	6.0
28-40	41.0 (571)	37.0 (371)	3.2	48.5 (200)	8.5

(*) Sample size

ment of a normal adult, studies using whole body counter indicate that only 3-5% of dietary iron is absorbed in an apparently normal healthy individual. The diet is deficient in protein, calcium and vitamin C. The diet is also deficient in other haemopoietic factors like folic acid and B₁₂.

The iron needed during pregnancy is of the order of 4-6 mgs of absorbed iron daily, which cannot be made available through dietary sources. Since most women do not receive any supplements during pregnancy, iron deficiency is a common feature.

(2) Iron stores and Iron loss:

Most of the population in Asian Countries have very poor iron stores as indicated by poor bone marrow haemosiderin and low levels of liver iron. Besides, iron losses through menstruation, to the extent of 15-30 mg every cycle, increases the iron requirement of adult women. Most women enter their first pregnancy with very little iron reserve.

(3) Demands of Pregnancy:

The net iron loss during pregnancy in Indian women is around 350 mg. To meet this additional demand, a woman needs to absorb 2-3 mg of additional iron daily. Besides the increased demands during pregnancy, demands during lactation contribute to reduce iron stores and worsen the deficiency status. Since many women have repeated, closely spaced pregnancies with prolonged periods of lactation, there is progressive depletion of iron stores with increasing number of pregnancies. This results in high incidence of anaemia in women with higher parities.

(4) Infections and Infestations:

Repeated and chronic infections prevent the utilization of iron and are additional contributory factors in causing anaemia. Hookworm infection in some areas aggravates the situation by increasing iron loss.

ABSORPTION STUDIES:

Iron absorption:

Studies carried out on food iron absorption at the National Institute of Nutrition have indicated that during pregnancy, iron absorption from food increased from an average of 10% in the first trimester to 25-30% at term. In addition, iron absorption was of a

much greater order in women in whom the transferrin saturation was less than 15%. On the basis of these data, iron requirement during pregnancy has been computed to be around 40 mg per day. However, the requirement is greater in women who have very poor iron stores and low haemoglobin levels at the onset of pregnancy.

Folic acid absorption:

There is considerable controversy regarding absorption of folic acid in pregnancy. It is believed that folic acid deficiency seen in pregnancy is mainly due to impaired folic acid absorption and partly due to increased renal clearance of folate. Transfer of folate across the placenta to the foetus is also considered as an additional cause.

Studies carried out on folic acid absorption using tritiated folic acid in women undergoing therapeutic termination of pregnancy in the first and second trimester, at the National Institute of Nutrition have indicated that there is no impairment in the absorption of crystalline folate during the first and second trimesters of pregnancy. However, whether this is true of food folate needs to be investigated. These studies also suggest that the folate status of the individual influenced the extent of absorption but this observation needs confirmation.

Serum levels of iron, folic acid and B₁₂:

In spite of normal haemoglobin levels, about 50% of pregnant women have low levels of serum iron, it being less than 60 µg/100 ml in the last trimester. The percentage transferrin saturation is also low in these women.

Determination of serum folic acid and B₁₂ levels have indicated that in about 60% of women, serum folate levels were less than 3 ng/ml indicating folate deficiency and that in 25% levels of serum B₁₂ were below 100 ng/ml in the last trimester.

In a small number of women with severe anaemia, where haemoglobin levels were less than 8.5 gms%, studies on bone marrow indicated that in 60% of them there was megaloblastic erythropoiesis. Folate levels in RBC in these women was below 80 ng/ml. There was no stainable iron in the bone marrow in any of the subjects.

These observations suggest that while in mild and moderate degrees of anaemia in preg-

nancy iron deficiency was the major factor, in the severe forms folate deficiency is clearly present.

EFFECT OF MATERNAL ANAEMIA ON FOETUS AND NEWBORN:

(1) Foetal Stores:

The iron, folate and B₁₂ stores in the livers of infants born to mothers of low socio-economic group was studied. It was observed that iron stores were only 60% of the reported figures from western countries. Similarly, liver stores of folic acid and B₁₂ were far below the reported normal range for newborn in Western countries. The implication of such low stores of these nutrients is obvious. An infant born with poor stores of iron, folate and B₁₂ has greater risk of developing anaemia during very early infancy. Also, the high incidence of infections and infestations in early infancy tended to aggravate and hasten the onset of anaemia.

(2) Infancy anaemia:

In a recent study, it was found that while at birth, haemoglobin levels of infants born to mothers unsupplemented with iron during pregnancy were similar to those born to iron supplement mothers, at 3 and 6 months of age, the incidence of anaemia (Hb. less than 11 gms%) was 45% in infants born to unsupplemented mothers as against 25% in those born to supplemented mothers. This suggests that supplementation of iron during pregnancy not only benefited the mothers but also their infants.

(3) Birth weights:

As indicated earlier, the incidence of prematurity and low birth weight were much higher in infants born to anaemic mothers.

While investigating the iron and folate requirements of pregnant women, it was observed that infants born to mothers, given supplements of folic acid along with iron, were heavier by 200 gm compared to infants born to mothers receiving iron supplements alone. Also the incidence of small-for-date births (weight less than 2500 gm) was 17% and 37% in infants born to folate supplemented and unsupplemented mothers respectively. That such an improvement was brought about by an improvement in placental efficiency has been shown by increased weights of placentae in folate supplemented mothers, which also have a higher DNA and protein content.

TREATMENT AND PREVENTION OF ANAEMIA:

(1) Blood transfusion:

In cases of severe anaemia, during the last trimester of pregnancy, there is very little time to improve the haemoglobin and iron status with oral or parenteral iron. In addition, a greater majority of such women come in a state of anoxia and cardiac failure. In such cases, an initial transfusion of packed cells or exchange transfusion needs to be given, followed by supportive treatment to improve her nutritional status. With the advent of packed cells or exchange transfusion, maternal mortality rate has been brought down to a considerable extent.

(2) Parenteral iron therapy:

In mild and moderate anaemia, in middle or early pregnancy, in cases where regularity of intake of oral iron cannot be ensured and in cases who have intolerance for all forms of iron, parenteral iron is the treatment of choice. However, parenteral iron does not have any greater benefit over the oral iron as far as the rate of haemoglobin regeneration is concerned.

(3) Oral Iron supplements:

Oral iron supplements are useful not only for therapeutic purposes but also for the prevention of anaemia. Two studies conducted at National Institute of Nutrition, Hyderabad using 30 and 60 mgs of elemental iron given daily during the last 12-16 weeks of gestation have indicated that both these levels can, not only maintain but also bring about an increase in haemoglobin levels from the presupplement levels in about 90-92% of women. In 8-10% of the women, haemoglobin levels were still below 11 gms%. Addition of 200-500 µgs of folic acid to the iron supplement resulted in an improvement in RBC folate levels in both the mother and the newborn, but had little if any additional beneficial influence on haemoglobin levels. The same was true for added B₁₂.

However, as indicated earlier, 200-500 µgs of folic acid was found to have beneficial effect on the birth weights of infants to the extent of 200-300 gms and in reducing the incidence of small-for-date births. While 30 mgs of elemental iron as supplement daily is adequate to prevent anaemia in pregnancy in 90% of women, it has been recommended by a study group in Nutritional anaemia that 60 mgs of elemental iron with 500 µgs of folic acid

should be given as a supplement daily in the last 12-16 weeks of pregnancy. This figure has been arrived at on the basis of (a) the estimated additional needs for iron during pregnancy and lactation, (b) the extremely poor iron stores, (c) the variability of the levels of absorption of ingested iron, (d) possible irregularities in supply and intake and (e) losses that may occur due to hookworm infestations.

ANAEMIA PREVENTION PROGRAMME:

The Government of India has accepted an anaemia prevention programme and the proposal has been included in the Fifth Five Year Plan. Tablets containing iron and folic acid are distributed to different MCH and family planning centres to cover at least 50% of pregnant women in their last trimester of pregnancy.

REFERENCE:

Menon, M.K.K. Proc. Soc. India. 2, I, 1967.

ABSTRACTS

Some Research Projects completed in 1974

MICROBIOLOGY

A study of Ps. aeruginosa from clinical material

One thousand strains of *Ps. aeruginosa* were subjected to aeruginocine typing using only 8 indicator strains of Darrell and Wahba and the typing method of Shrinivas. One hundred and eighty three (18.3%) strains could not be typed by this method. Two hundred and fourteen (21.4%) strains could be grouped into Wahba pyocine types. Three hundred and seventy five could be placed into Shrinivas aeruginocine types. Two hundred and twenty eight strains were typeable but could not be given a type status as they produced 93 inhibition patterns; 50 of which were produced by a single strain and 14 by 2 strains, as such they have been grouped as unclassifiable. Shrinivas type 1 was the most commonly encountered type isolated from 13.5% of the cases followed by Wahba type F and A in 8.8% and 6.5% of cases respectively.

A total of 500 strains including 183 non-typeable strains, 113 strains belonging to different Wahba types and 204 strains of different Shrinivas types were further subjected to pyocine typing of Gillies and Govan method. 62 (6.2%) of not typeable strains could not be typed by this method also. One hundred and twenty one (12.1%) strains which could be typed, produced 42 inhibition patterns, 19 of which were produced by a single strain and 11 by 2 strains each. Different Wahba pyocine types and Shrinivas aeruginocine types could be further subdivided by using Gillies and Govan method and 22 of these typeable strains were not typeable by Gillies and Govan method. Most of the inhibition patterns produced by Gillies and Govan typing method could not be grouped into their

37 pyocine types. Hence further typing of un-typeable strains by Gillies and Govan is not useful. Aeruginocine typing using 8 Carrell and Wahba indicator strains and the Shrinivas method of typing is recommended for epidemiological studies of infection with this organism.

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Staphylococcal carrier state and hypersensitivity

The investigation included 1010 individuals. The total carrier-rate was found to be 54.8% and there was no significant difference in different sexes. Among the newborn, 72.7% of the males and 66.6% of the females carried *Staph aureus*.

Nasal carrier rate (44.7%) was the highest, followed by throat (24.9%), intestinal (21.8%) and axillary carriage (8.7%) in that order. Of the 554 carriers 39.1% carried the organism at a single site. About 33.3% of the population studied (60.9% of the carriers) carried *Staph-aureus* at multiple sites. Combined carriage at nose and throat was commonest (9.6%). Intestinal carriage has been found to be more commonly related to nasal carriage.

The carrier rate varied according to age. The highest carrier rate (70.4%) as mentioned above, was observed among newborns examined upto 4th day of age. Thereafter, the rate declined and remained about 60% upto the age of 20 years. Incidence of staphylococcal carriage further declined and remained around

45 per cent in the age group of 26-45 years. There was a further drop in carrier rate to about 40 per cent in the age group about 45 years. These differences were statistically significant.

The same population group was subjected to skin tests in order to determine the extent of delayed hypersensitivity to staphylococcal antigen among carriers and non-carriers. The total incidence of hypersensitivity among the 1010 individuals investigated was 24.9 per cent. Of the 554 carriers, 192 (34.6%) were hypersensitive to staphylococcal antigen. In the non-carrier group only 59 (12.9%) out of 456 were hypersensitive. Not a single case of hypersensitivity was detected in newborn infants.

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Clinicopathological studies on some aspects of mycoplasma infection in man

Large colony mycoplasma could be isolated from the urethra of 9.2 per cent of normal males, 16.4% of cases of gonococcal urethritis and 17.4% of the non specific urthritis cases. This indicates that large colony mycoplasmas are more commonly associated with unhealthy urethras.

Small colony mycoplasmas (T-stain) were more commonly isolated from cases of non-gonococcal urethritis (27.6%) than from gonococcal urethritis (18.9%) in males. Only 10 per cent of healthy males harboured T-strain in their urethra. This indicates that T-strain mycoplasma may be of significance in non-specific male urethritis.

In the female genital tract large colony mycoplasmas may be of etiologic significance in the causation of cervicitis and vaginitis. While only 12.6 per cent ante-natal cases, without any symptoms of vaginitis of cervicitis, harboured mycoplasma a high proportion (34.6%) of the symptomatic patients yielded the organism in the absence of known pathogenic bacteria or monilia. The association of Trichomonas vaginalis with mycoplasma was another significant feature. Mycoplasma were more frequently isolated (43.2%) from patients in whom T.vaginalis was present than from patients who did not harbour this flagellate (27.7%).

Respiratory infections in children caused by Mycoplasma pneumoniae seems to be an infrequent event in Calcutta area. During the present investigation M. Pneumoniae could be isolated only from one case of bronchitis out of 198 cases of respiratory infections in children.

Complement fixing antibody to M. pneumoniae was demonstrable in the sera of 5.5% of 184 healthy children. Of the 110 respiratory cases 17.2 per cent showed presence of CF antibodies. A four-fold rise in titre was observed in 8.2% cases when second serum samples collected 8-10 days later, were examined. This indicates that at least 8% of the acute respiratory infections in children are caused by mycoplasma pneumoniae.

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SUMMARY OF THE WEEKLY SYMPOSIA HELD IN THE COUNCIL, NEW DELHI

Dr.C.R.R.M. Reddy, Professor of Pathology, Andhra Medical College, Visakhapatnam delivered a lecture on October 4, 1975 on "Hydatid disease and Guinea worm".

EPIDEMIOLOGY OF HYDATID DISEASE AT KURNOOL:

At Kurnool Hydatid disease was found to be quite common as every year more than 10 cases were seen in the Department of Patho-

logy, Medical College Kurnool. Among the hydatid disease cases reported in this country during 1933-1967, it was found that 239 of the total 527 cases were from Kurnool, Guntur, Madras and Vellore, and 70 were from Kurnool. One hundred and sixty Casoni tests were done in the Kurnool Hospital in a two-year period, out of which 83 were positive. In 33 operated cases only 25 showed evidence of hydatid cysts. A survey in a nearby village was con-

ducted where almost all the people kept sheep. In a group of 1329 people excluding children below 5 years, the Casoni test was done in 760 people (57.19%) and out of them 167 had a positive reaction (21.98%), showing the wide prevalence of the disease in the area.

One hundred and fifty dogs obtained from the streets of Kurnool town were autopsied and in 50 of them there were adult echinococcus worms. The percentage of the dogs showing the adult worms were much more than was found in other reported series from this country.

Over a two-month period, all the animals slaughtered in the local slaughter house were examined for hydatid cysts. It was found that 7.7% of pigs, 16.96% of goats, 21.75% of sheeps and 60.94% of cattle were infected. The figures are much higher than what are recorded in the country and in endemic foci of hydatid disease in the world.

Fertile cysts were found in 64.6% of cysts of sheep, 66.7% of buffaloes, 54.5% of goats, 41.7% of cows, 31.5% of oxen and 28.5% of pigs. The cysts were more often seen in the lungs of the animals and the lung cysts were more frequently fertile than cysts in other organs.

The studies also showed that the adult worm could be similar to the worm described in New Zealand which is believed to have been introduced into New Zealand by the European colonists. Similarly in India, hydatid infection could have been introduced or reintroduced by the European colonists.

GUINEA-WORM INFECTION AT KURNOOL:

Dracontiasis one of the most easily preventable infections, is common in some parts of this country.

About 10,000 inhabitants of 4 villages in Kurnool District were interviewed in 1967 and the prevalence of guinea-worm infection was found to vary from 11% to 54%. The prevalence increased with the proportion of the people using wells. More than one worm at a time is seen in 40% of the infected persons, more than one infection in a year is seen in 60% of them and infections have occurred in more than one year in 62% of them. Reinfections were common and many people suffered for long periods.

A survey showed that 500 out of 1486 villages had wells and so a population of 0.5 million were at risk.

Dracunculus medinensis can cause three types of lesions in the human being. It can cause a bleb through which the worm comes out, it can become calcified and lastly it can form a sterile abscess called a guinea-worm abscess. All the three types of the above lesions are caused by a mature gravid female. The blebs are present mostly in the lower limbs.

When about 10,000 persons were X-rayed in the local hospital, 4.6% of them showed calcified guinea-worms, the pelvis and abdomen being the commonest sites. Calcified guinea-worms were more often seen in the older age groups and as a rule were symptomless. In 29% of the persons, X-rays revealed calcified worms but the persons denied having had an acute infection.

The least common of the manifestations was the true guineaworm abscess which usually occurred on the scrotum. This was a chemical abscess caused by the contents of the gravid female worm. In the knee joint, the worm often caused acute synovitis.

All persons in a family equally exposed did not get infected. Hyperchlorhydria was one of the factors which was thought to prevent infection.

The infective larvae has to penetrate the wall of the gastrointestinal tract to continue further development. Proteolytic activity could be demonstrated against casein, gelatin, haemoglobin and fibrin in the secretions of the infective guinea-worm larvae, but was absent or present in negligible amounts in the noninfective larvae. Proactivator of the plasminogen also could be demonstrated in the infective guinea worm larvae. The gravid female in its contents had proactivator of the plasminogen. These enzyme activities could be of use for the infective larvae or the worm for their migration.

In a village where only well water was available, it was found that 54% of the persons were found to give history of active infection, 29% of the people had occult infection in the form of calcified guineaworms and only 17% of the people escaped occult or manifest guineaworm infection.

LIST OF TOPICS AND DATES OF WEEKLY SYMPOSIA/LECTURES TO BE
HELD ON SATURDAYS AT 3.30 P.M. IN ICMR OFFICE, NEW DELHI
DURING NOVEMBER, 1975

Date	Topic	Speaker(s)
1.11.1975	The role of hormones in the evolution of Kwashiorkor and marasmus (Dr. V.N. Patwardhan Oration)	Dr. Kamala S. Jaya Rao, Hyderabad
15.11.1975	Hypnosis and its medical applications	Dr. H. Jana, Ahmedabad.
22.11.1975	Thyroid Physiology and Radioimmunoassay	Dr. G.K. Rastogi, Chandigarh.
29.11.1975	Biologically active components of Cobra venom in relation to cancer research (Sandoz Oration)	Dr. B.M. Braganca, Bombay

COUNCIL'S TRAINING PROGRAMMES FOR 1975-76

(A) EXISTING ANNUAL TRAINING COURSES:

Nutrition & Endocrinology:

At the National Institute of Nutrition, Hyderabad.

- (1) Annual Certificate Course in Nutrition; (December 1, 1975 to February 28, 1976)
- (2) Eighth M.Sc. (Applied Nutrition) Course: (June 1, 1975 to February 28, 1976).
- (3) Third Annual Certificate Course in Human Nutrition for Teachers in Agricultural Universities: (August - October, 1975)
- (4) Fourth Annual Training Course in Endocrinological Techniques and their Application: (October - November, 1975).

Reproductive Biology and Fertility Control:

At the Institute for Research in Reproduction, Bombay.

- (1) Sixth Annual Training Course in Reproductive Biology and Fertility Control: (November 1, 1975 to April 30, 1976)
- (2) Fifth Annual Training Course on Hormone Assays: (February - March, 1976)

Haematology:

At the Blood Group Reference Centre, Bombay.

Yearly Training Course in Blood Group Serology and Blood Bank Methodology: (For a period of 5 weeks from 12th May, 1975)

Immunology:

At ICMR/WHO Research and Training Centre in Immunology, Department of Biochemistry, A.I.I.M.S., New Delhi.

Fourth Annual Training Course in Immunology entitled "Cell Mediated Humoral Immune Responses with Special Reference to Parasitic Diseases and Human Reproduction". (From November 3 to November 28, 1975).

Animal Technicians Training:

At the Laboratory Animals Information Service, ICMR Cancer Research Institute, Tata Memorial Centre, Bombay.

*Eighth Annual Animal Technicians Training Course for a period of three months.

Biostatistics:

At the National Institute of Nutrition, Hyderabad.

Second Training Course in Biostatistics for Statisticians and Medical Research Workers to be held in the month of November, 1975.

(B) NEW TRAINING COURSES DURING 1975-76:-

Virology:

At the Virus Research Centre, Poona. Diploma in Virology under Poona University from June, 1975.

Amoebiasis:

At the School of Tropical Medicine, Calcutta.

Technician's Training Course on Amoebiasis. April 1 to June 30, 1975.

Occupational Health:

At the National Institute of Occupational Health, Ahmedabad.

Pneumoconiosis:

- (1) *This course meant for the medical practitioners to be organised in co-operation with Directorate of Mines Safety, Dhanbad.

- (2) *Diploma in Occupational Health for the year 1975-76 under Gujarat University.

Pharmacology and Drug Trials:

*At Dr. U.K. Sheth's Unit, Seth G.S. Medical College, Bombay.

- (1) A short-term course for four weeks' training (November 15 to December 15, 1975).
(2) A long-term course for twelve weeks' training (November 15, 1975 to February 15, 1976).

Cell-Biology and Cyto-Genetics:

*At the Indian Institute of Science, Bangalore.

Clinical Chemistry:

*At the National Institute of Nutrition, Hyderabad.

Haematological Technique:

*At the Department of Haematology, Post-graduate Institute of Medical Education and Research, Chandigarh.

Medical Research Instrumentation:

*At the Biomedical Engineering Division, Indian Institute of Technology, Madras.

*Dates to be announced later

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