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***Theme* : Anemia Free India**

Anemia Mukt Bharat

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Chairman's MESSAGE

Dear Esteemed Members,

Anaemia Mukta Bharat is our dream. 75 year back , when I was born, 75% women were Anaemic and now it stands at 60%. Each member of NIGF including all under graduates, post Graduates & Senior Residents should commit themselves for the noble cause of on Skilling every household for Anaemia Mukta Bharat.

Government is doing its best to give free ration to 80 Crores Indians so no body sleeps hungry. Our collective efforts should bring awareness making significant strides in combating anaemia, particularly among women & children ensuring a healthier & intelligent future for generations to come. By providing education, access to Iron Folic Acid, months & right nutrition, we can make substantial progress in this crucial endeavour to make Anaemia Mukta Bharat as **Jan Jan Ka Abhiyaan.**

From Medical point of view, the road to a developed India is paved with the eradication of impediments like anaemia & kuposhan, which directly impacts the **health, productivity, stamina and well-being of our society**. Your dedication to this cause can be instrumental in driving positive change in your city and your unwavering commitment with school/colleges teachers will be the cornerstone of our success.

As we continue our journey, for developed India of our dreams, let us reaffirm our pledge to leave no stone unturned in our mission to make Anaemia Mukta Bharat a reality ! Each effort, no matter how small, contributes significantly to the larger goal of a healthier and stronger Bharat.

Let's embrace the spirit of unity, innovation and let's continue our noble pursuit, ensuring that our endeavours leaves indelible imprints on the sands of time, benefitting mother and children around the world.

Dr. Sharda Jain
Chairman NIGF

Presidential MESSAGE

It gives us immense pleasure to present second issue of North India Gynaec Forum to our members & readers. Theme of Second issue is Anemia Free India, which is one of important mission of North India Gynaec Forum.

Anemia is not only a clinical condition but also a serious public health issue of our country. According to NFHS 5-53% of non-pregnant women, 50.3% of pregnant women and 58.5% of children in age group of 6-59 months had Anaemia. India carries the largest burden of Anaemia globally

Lack of Anaemia reduction is surprising given India rapid economic growth (GDP growth, 2018). The population most vulnerable include children under 5 years of age & Pregnant women followed by elderly population. World Health Assembly set a target of 50% reduction of anaemia in women of reproductive age by 2025 relative to 2010 levels.

In present issue eminent and experienced author have contributed their articles on diverse aspect of Anemia. Government of India strategies which need implementation by all cadre of health provider will be useful for everyone. Articles by Dr. Meeta Gupta & Dr. Manju Puri will highlight it. Optimizing various drugs oral and parenteral for treatment of Anemia, hemoglobinopathies, holistic approach in various age groups have been taken up by Dr. Mala Srivastava, Dr. Meenakshi B Chauhan, Dr. Monika Gupta, Dr. Preeti Jindal & Dr. Anupama Bahadur.

Dr. Amrit Pal Kaur, NIGF Vice president shared concise Journey & way forward in making Anemia Free India. In her NIGF Diamond Oration. It is our pleasure to have abstract of his oration in present bulletin.

India needs multifactorial and life time approach to make our country citizen Anemia Free. Short term strategy is nutritional supplementation, prevention & treatment for infection & infestation esp. Malaria & Worm, identification of hemoglobinopathies. Medium Term strategies involve Food Fortification. Long term solutions involve genuine change in food security and diet and may require fundamental socioeconomic and dietary change as well commercial approaches–these are ultimate aims of development. A comprehensive approach to Anaemia control would simultaneously encompass short, medium and long-term intervention together with companion strategies.

We heartily thank all the authors for their contribution which is updated and will greatly benefit our readers.

I also congratulate our office bearers esp. President & Secretaries of North India Gynaec Forum who are doing great academic and social activities under aegis of NIGF.

Coming together is a beginning, staying together is progress, and working together is success."

I fully believe that we have come a long way together in fulfilling our mission of unity, excellence & Service among Obs. Gyn. of Northern States of India.

Wishing you a happy reading and clinical practice.

Always yours

Dr. Sadhana Gupta

President NIGF 22-24

President Elect's MESSAGE

Anemia is a silent killer. We are talking of wellness , Exercise, gene therapy, and genome sequencing but still not able to solve the problem of anemia.

Anemia prevention awareness programs should be part of our daily OPD consultation. Never leave any window of opportunity to talk about anemia.

Do you know the baby of an anemic mother may become a loser than a topper. Not only this, in developing fetuses it can change the plasticity of the brain leading to cognitive changes.

Focus every step, correction of anemia in mother to be and pregnant women, delayed cord clamping, iron drops to baby, to nutrition of child. A very important step is adolescent nutrition counseling, school cafeteria food supervision . It is not only about iron, it is about adequate protein , B12, vit D.

So every step is important to take care of anemia .

One CBC reading in the first trimester can open the whole story in front of your eyes.

Anemia ko harana hai to polio ki vaccine ki tarah jagrook banana hai

Dr Ragini Agrawal
President Elect
NIGF

Trajectory to Anemia Free India NIGF Diamond Oration

Dr. Amrit Pal Kaur
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Anemia is a Major Public health Problem in India & a topic of global Concern and is always one of the prime agendas of various development goals of a country. It's a medical condition in which a person's hemoglobin level is less than normal, specific for that age & sex as per WHO cut offs for hemoglobin, as shown below, consequently impairing oxygen transport to tissues.

Age group	No Anaemia	Mild anaemia	Moderate anaemia	Severe anaemia
Children 6-59 months	≥11	10-10.9	7-9.9	<7
Children 5-11 years	≥11.5	11-11.4	8-10.9	<8
Children 12-14 years	≥12	11-11.9	8-10.9	<8
Non-pregnant women (15 yrs of age and above)	≥12	11-11.9	8-10.9	<8
Pregnant women	≥11	10-10.9	7-9.9	<7
Men	≥13	11-12.9	8-10.9	<8

Source: Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. WHO

Anemia affects >50% of population of all age groups in India & has got devastating effects on human health, affecting overall socioeconomic development of our country. The physical & cognitive losses due to Iron deficiency anemia costs developing Countries upto 4.5% loss of GDP which is 1.18% of GDP in India .

Its largely a preventable & easily treatable clinical nutritional deficiency. The causes & types of anemia are many but most common type is Nutritional anemia due to insufficient intake of Iron & vitamins (Global Nutrition Report 2020)

Anemia is important as what we see is the tip of the iceberg i.e. manifested with low Hb. A large part of Iron deficiency is invisible when it has not manifested as low Hb as seen in 1st two stages of development of anemia when Hb & Hematocrit remains normal though a person is deficient in iron.This is called Hidden Hunger. The term "Hidden Hunger" is multiple micronutrient deficiency state. Vitamins & minerals are micronutrients as these are required in microquantities in our body. When we are eating, our stomach gets full, our satiety centre gets satisfied,we stop eating. This does not tell us that our diet is deficient in micronutrients. There is no feedback mechanism in our brain that sends signals for deficiency of micro nutrients in our diet. Hidden Hunger is a global problem affecting more than 2 billion people worldwide. More than 1 million children under five years of age die from micronutrient deficiencies.

India ranks at 170th position among 180 countries for anemia among pregnant women (Global nutrition report, 2016). Anemia impacts all age groups in different ways. In children it leads to impaired cognitive& motor development, stunted growth, increased susceptibility to infections and poor school performance. Among Pregnant ladies it leads to increased maternal & neonatal morbidities and mortality, impaired fetal growth and development. Among adults it reduces work capacity & Productivity & loss of Disability adjusted life years (DALYs)

Anemia remains consistently >50% prevalent in last 4 decades and is the biggest cause of disability in India. The number of years lived with disabilities due to anemia is two times and three times more in India than in Russia and China respectively, among BRICS Nations.

An Another challenge in India is Health Literacy, 8 out of 10 individuals in India have low knowledge of Health. People do not understand their health and there is need to make them aware about their needs. The prevalence of anemia varies from state to state & in different age groups. Some of the studies have given prevalence of Anemia in pregnant women as high as 98.0%

The Prevalence of anemia as shown in NFHS 3 & 4 data has shown a decline in all age groups over the past

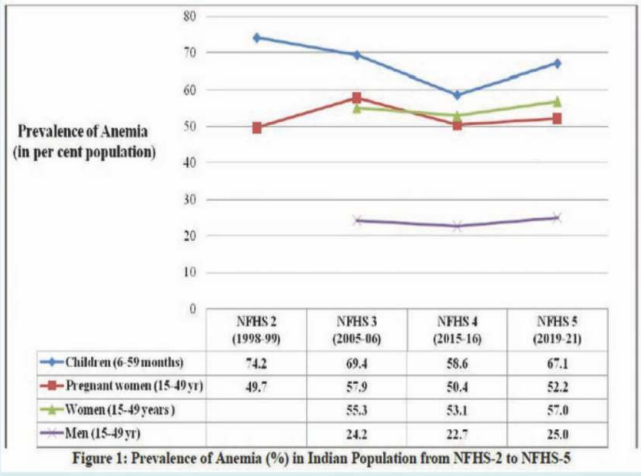
decades but decline is much behind our target of 3% per annum.

Table 5 Shifts in prevalence of Anemia in past decade

Age group	% DECLINE IN 10 YEARS 2006-2016	NFHS-3 (2006)	NFHS-4 (2016)	National Target 2022 (reduce 3 % p.a)*
Children (6–35 months) (Hb<11g/dl),%	--	79	--	--
Children (6–59 months) (Hb<11g/dl),%	11 (1.1% p.a)	69	58	40
Adolescent girls (15–19 years) (Hb<12g/dl),%	2 (0.2% p.a)	56	54	36
Adolescent boys (15–19 years) (Hb<13g/dl),%	1 (0.1% p.a)	30	29	11
Women of reproductive age (Hb<12g/dl),%	2 (0.2% p.a)	55	53	35

The Union Minister of Health & Family Welfare, Dr Bharati Pravin Pawar, stated in a written reply in LOK Sabha on 4th Feb. 2022, showing prevalence of anemia has increased in India, more so in the children of the age of 6 months to 59 months . Some of the states have shown improvement also.

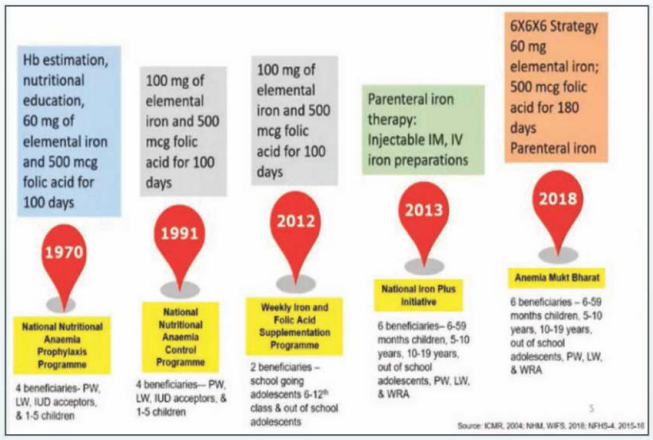
The comparison of prevalence of anemia from NFHS 2 to 5 has been shown in figure.



	NFHS 2 (1998-99)	NFHS 3 (2005-06)	NFHS 4 (2015-16)	NFHS 5 (2019-21)
Children (6-59 months)	74.2	69.4	58.6	67.1
Pregnant women (15-49 yr)	49.7	57.9	50.4	52.2
Women (15-49 years)		55.3	53.1	57.0
Men (15-49 yr)		24.2	22.7	25.0

Figure 1: Prevalence of Anemia (%) in Indian Population from NFHS-2 to NFHS-5

There is a long history of Government run programs for anemia in India. It started with National Nutritional Anemia Prophylaxis program (NNAPP) in 1970, then became National Nutritional Anemia Control program (NNACP) in 1990. The Weekly Iron Folic Acid Supplementation(WIFS) was started in 2012. NNACP & WIFS were integrated into National Iron Plus Initiative in 2013 (NIPI) This was further intensified in 2018 as I-NIPI. Anemia Mukat Bharat(AMB) is a (6x6x6) strategy as one of the objectives under Pradhan Mantri's Holistic Approach to improve nutrition in India as POSHAN Abhiyaan.



There are six beneficiaries, six interventions and six institutional mechanisms under AMB. Over the period, numbers of beneficiaries have changed, composition of iron tablet, color coding and duration of therapy have changed. There are other government run programs also which are related to anemia like National deworming day(NDD), National Vector Borne Disease control program(NVBDCP), National Program for prevention & control of fluorosis, special efforts to reach for Hemoglobinopathies & Behavior change communication program (BCCP).

The new things added are, Point of care approach right at the doorstep of people with faster access to test result, rapid clinical decision making, Immediate start of treatment and no loss to follow up. There is provision of T4 - Anemia room in each facility with 4 T's of Test, Treat, Talk & Track facilities in one room. Repeated behavior change counseling for compliance to Intake of IFA to make it a habit.

The Targets of Anemia Prevalence in India are reduction of 3% per annum But the prevalence of anemia in India is much higher 27.1% higher than global Average (WHO Global Anemia estimates 2021 edition).

Anemia Mukat Bharat Index (AMB Index) 2020-21 Shows only 5 states have performed >50% in key Performance indicators. However for the year of 2022 performance, Andhra Pradesh has topped at 85.9% AMB Index Followed by Maharashtra and Chhattisgarh. Average India AMB Index stands at 50.4%.

Why should we address Anemia?

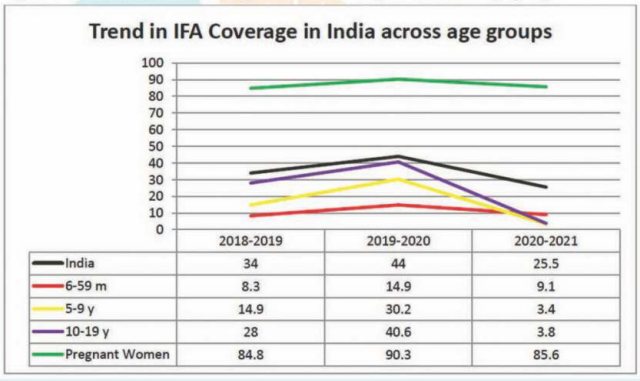
We should address Anemia to achieve short term, long term & intergenerational benefits. A pregnant woman

with IDA gives birth to a baby with IDA & if this baby is not treated in childhood, grows into adolescent with anemia, then gets married, becomes pregnant. This vicious intergenerational cycle has to be broken & this will help to improve other health indices also like maternal, perinatal, neonatal morbidities and mortalities.

To see what all we have done in previous years.

The trend of IFA Coverage in India across diff age groups is Shown in figure.

Figure 1 Trends in Iron Folic Acid Supplementation coverage in India across age groups



	2018-2019	2019-2020	2020-2021
India	34	44	25.5
6-59 m	8.3	14.9	9.1
5-9 y	14.9	30.2	3.4
10-19 y	28	40.6	3.8
Pregnant Women	84.8	90.3	85.6

The only Pregnant women group is showing IFA Coverage near 90%. but in all other groups the IFA coverage is disappointing.

The Nutrition factsheet of Punjab (2022-2023) is showing Prevalence of Anemia among pregnant women as 51.7%. The Pregnant women consuming IFA Tab for 100 days & 180days is 55.4%& 40.5% respectively.

(Source- State Highlights, key findings from HMIS Data 2022-23)

For Child nutrition - Institutional births are 94.3%, Early initiation of Breast feeding within one hour is 53.1%, & Prevalence of Anemia among children of 6 months to 59 months is 71.1%.

The prevalence of anemia among adolescent girls aged 15-19 years and boys is seen as 60.3% and 32.7% respectively. The coverage of biweekly IFA syrup among children aged 6 to 59 months is only 15.93 % and for children aged 6 to 10 years is 29.77%. The coverage of pregnant women with Albendazole is only 42.5 %. With these Figures, the achievements in reduction of prevalence of anemia cannot be expected to improve. We need to introspect.

There is some positive trend in child health and maternal Indicators related to Anemia from NFHS 2-5 in the group of fully vaccinated children, Exclusively Breastfed group & Children breastfed with in 1 hour of birth. The number of women who consumed IFA during pregnancy for 100 days and 180 days and the number of women who used family Planning methods has shown positive trend from NFHS2-5 But still lot more needs to be done.

Probable causes of rising prevalence of anemia from NFHS 4-5

A Study Published in Lancet Global Health 2021, the researchers have interpreted to reexamine WHO cut offs to define anemia (Sachdev HS et al). This CNNS Survey have used venous blood samples and Suggested that Capillary blood samples give lower Hb & thus more prevalence of anemia in India. Other probable causes may be that we have passed through Covid Pandemic in 2019-2020 that has led to economic slowdown, increasing inflation.This might have affected surveyors and surveying methods in the fear of catching the virus infection. Additionally our poor food habits, cooking habits, life style Changes & poor Eating habits of Consuming EMPTY calories has increased over the years might have some contribution.

What can better be done

GOI is taking great steps, AMB is a positive step, ambitious in its goal. Government has started staple food fortification, Behavior change communication, Anemia Room and many more interventions. We at our own level can do GAP analysis in our facility, bridge those GAPS. We can do Quality improvement (PDSA) cycles at our institutions.

The other suggestion is to include other micronutrients like B12 also along with IFA supplementation & the other micronutrients Zinc, Selenium and vitamin C, multivitamins as daily Supplements to overcome Hidden Hunger which is not visible to us. When we are giving IV Iron sucrose, Tablet folic acid should be added, which is often missed. Addition of high protein diet is equally important as Heme needs globin to form Hemoglobin. The locally available diverse foods with high bioavailability of iron should be preferred. Food diversity helps to overcome micronutrient deficiencies. The performance of previous years should be audited each year & focusing on vulnerable groups & geographies. Effective & judicious use of Government released funds is another important aspect to be taken care of.

What is new regarding anemia survey.

Currently anemia has been dropped from NFHS survey. It will be covered under Diet & Biomarker Survey by ICMR and National Institute of Nutrition (DABS-I) DABS-I will map Diet, Nutrition & health status in all age groups, both sexes ,urban and rural population and will use venous samples and autoanalysers.

To conclude, in whatever way anemia is Surveyed, by NFHS or DABS-1, our mission remains the same – ANEMIA MUKAT BHARAT. So the Trajectory to Anemia Mukat Bharat, I compare it with a Hilly road which is a difficult road. Hilly road has rises, at places hilly road goes down or plateaus and then rises again. Similarly our road to AMB has seen rises, plateaus and falls but definitely with our consistent and sincere efforts we are sure to achieve our goal one day.

Let us join our hands to achieve our mission. JAI HIND.

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> Always nourish yourself with a balanced diet.

Anaemia Free India – Government of India approach

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Introduction :

Anaemia is characterized by reduction in red blood cells or their oxygen carrying capacity, and insufficient to meet the body's physiological requirements. The clinical manifestation of anaemia reveal a wide spectrum ranging from weakness, fatigue, drowsiness and dizziness to impaired cognitive development of children, increased morbidity or even congestive cardiac failure in severe cases. Anaemia may lead to many complications of pregnancy and childbirth like neural tube defects, low birth weight, premature births, stillbirths, or even maternal and neonatal death. (1,2).

Burden of Anaemia in India :

Anaemia is a significant public health problem in South-East Asia. High burden of anaemia remains a major public health problem in India. According to National Family Health Survey 5 (NFHS5, 2019-21) the prevalence of anaemia among different age groups is considerably high (44.1% to 67.1%). Comparison with NFHS4 revealed an increase in prevalence of anaemia among different key population in last 5 years. Though there has been evidence that coverage of IFA supply has improved over last 5 years. The Government of India is also committed to the World Health Assembly target of 50 percent reduction of anemia among women of reproductive age by 2025 and the POSHAN Abhiyaan (2018–2020) target to reduce prevalence of anemia among children (6–59 months), adolescents and women of reproductive age (15–49 years) by 3 percentage points per year.(3)

Common aetiology of Anaemia in India :

According to UNICEF and WHO Joint statement, iron deficiency is most common cause of anaemia in India in school children, women of reproductive age-group (50% of all cases), and in children 2–5 years of age (80% of all cases). Other preventable causes anaemia in India include deficiency of vitamin B12, folate and vitamin A, Infectious diseases (malaria, helminth infections, tuberculosis) and haemoglobinopathies. Anaemia is a multi-factorial problem and both distal factors (socio demographic and household factors, environmental factors, health system access and services, and food security) as well as proximal factors (diet, nutrient deficiencies, infection/disease, and genetic factors) contribute to it. Addressing anaemia requires multi-sectoral approach involving medical professionals, policy implementors and community. Nutritional intervention among different key population throughout life cycle is an evidence-based strategy for prevention and control of anaemia in many Low- and Middle-Income Countries including India. (2,4)

Evolution of National Programs addressing anaemia :

Addressing anaemia was a high priority for Government of India, and many interventions have been initiated since 1970s. National Nutritional Anaemia Prophylaxis Program has been launched by Government of India in 1972 targeting nutritional anaemia among mothers and children by providing Iron and Folic Acid supplements for pregnant and lactating mothers and children. (5) In 2013, this program has been merged with RMNCH+A program, in which target groups have been extended to include infant, school children and adolescents. Under the National Iron Plus Initiative (NIPI) a life cycle approach was adopted. (6) In 2018, the Ministry of Health and Family Welfare launched Intensified National

Iron Plus Initiative, popularly known as Anaemia Mukt Bharat (AMB), to strengthen the existing mechanisms and foster newer strategies for tackling anaemia.(2)

Existing Strategies adopted by Government of India under Anaemia Mukt Bharat :

Life cycle approach is adopted to provide preventive and curative mechanisms through a 6X6X6 strategy including six target beneficiaries, six interventions and six institutional mechanisms for all stakeholders. Approximate number of beneficiaries under this strategy is 450 million, i.e. nearly 50% of country's population. The approach includes Life cycle approach: Decentralized Planning, use of information technology and digitalization, focus on addressing social determinants of anaemia and intersectoral coordination.

The key interventions include:(7)

1. Prophylactic Iron and Folic Acid:

Prevention of Iron deficiency through Prophylactic Iron and Folic Acid supplementation (IFA) to children, adolescents, women of reproductive age and pregnant and lactating women: For children 6-59 months, IFA is distributed by ASHA through home visit, for school going children and adolescents through school teachers, for out of school children through ASHA, for out of school adolescent through Anganwadi centres, for women of reproductive age group, pregnant and lactating mothers through village health and nutrition day/ immunization day.

2. Bi-annual De-worming:

To intensify efforts towards Soil transmitted Helminths (STH) control in India, National Deworming Day (NDD) has been implemented under which biannual mass deworming (albendazole tablet) for children and adolescents in the age groups between 1 and 19 years is carried out on designated dates – 10 February and 10 August. Newly married women 20–24 years who are not pregnant or non-lactating are provided biannual deworming during NDD. Deworming of pregnant women is carried out in the second trimester, as per Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) guideline.

3. Behaviour Change Communication:

Intensified year-round Behaviour Change Communication activities are adopted focussing the following key behaviours – appropriate infant and young child feeding practices, ingesting of iron-rich, protein rich and Vitamin C rich foods through dietary diversity (vitamin C as iron absorption enhancer), increasing compliance towards consumption of Iron Folic Acid fortified foods, improving compliance to Iron Folic Acid supplementation and deworming. Considering Millets as effective sources of iron, observation of International Year of millets 2023 by Government of India is also one important step in promoting iron rich diet. Key strategies include individual counselling by front line health care providers, monthly meetings as planned under Mother's Absolute Affection (MAA) programme, group sensitization activities addressing school teachers, administration, faith leaders, panchayat leaders, Village Health Sanitation and Nutrition Committee (VHSNC), mass communication using digital media including social media, special press advertisement on the occasion of important health and nutrition day using national and international celebrities.

4. Iron Fortification:

Iron Fortified food in Public Distribution System and government funded public health programmes is initiated under this program. It is mandatory to use iron fortified salt, wheat flour and oil in foods used in Mid-Day Meal Program and Anganwadi centres under ICDS program, and all health facility based program where food is being provided.

5. Testing and treatment of anaemia:

Screening of anaemia primarily focus on pregnant women and school going adolescents. Government is in the process to replace SAHLI's method by digital haemoglobinometer. Anaemia screening is carried out by ANM at VHND/sub-centre/session site, by RSBK team at AWC/school and by Medical Officer at health facilities. Line listing for all anaemic children (0-5 years) are maintained by the ANM/ASHA/AWW and managed as per Government of India guideline. For school going adolescents, RBSK team visit once a year, identify sick child and refer them to PHC for

haemoglobin testing. Line listing of anaemic child is to be maintained in the school register. It is compulsory for the class teacher/nodal officer of that school to discuss the issue with the parents of anaemic students and counsel on compliance to treatment. The children are also followed up by ANM or Lady Health Visitors.

6. Addressing causes of anaemia other than iron deficiency :

The programmes which address causes of anaemia other than iron deficiency include National Deworming Day (NDD) for prevention of hookworm associated anaemia, National Vector Borne Disease Control Programme (NVBDCP) for malaria and special efforts to reach out to populations affected with haemoglobinopathies and National Programme for Prevention and Control of Fluorosis.

Haemoglobinopathies :

Government of India had released National Guidelines on Prevention and Control of Haemoglobinopathies to ensure uniformity in diagnosis and management of haemoglobinopathies all over India. Existing health facility are utilized for carrying out Pre-marital and pre-conception screening and counselling services in endemic districts. Community based awareness generation on preventive options for preventable haemoglobinopathies has also been focussed using platforms such as Women's Day, World Thalassemia Day, Adolescent Health Days etc. If any Pregnant Women is diagnosed as having severe anaemia, she is referred to higher centres for further investigations and if certain haemoglobinopathies are detected, the husband is to be screened for carrier status. If the couple is found positive, prenatal diagnosis is carried out before twenty weeks of pregnancy. (8)

Fluorosis:

Activities adopted under fluorosis control include identification of fluorosis affected habitation, activities for anaemia control due to fluorosis such as use of safe drinking water, focus on diet corrections (Calcium, Magnesium, Vitamin C) by dietary diversity, etc, training of all public health staff, such as MO in PHC/CHC, field workers.

Other interventions include preventing anaemia among new-born by ensuring delayed cord clamping after delivery (by 3 minutes) in health facilities.(9)

Progress of India towards Anaemia Mukt Bharat:

Comparison of reports of two consecutive rounds of National Family Health Surveys (NFHS4 vs NFHS5), an increase of prevalence of anaemia has been noted among pregnant mothers of 15-49 years (52.2% vs 50.4%), Children age 6- 59 months (67.1% vs 58.6%), Non pregnant women of age 15 49 years (57.2% vs 53.2%) and late adolescent women of 15-19 years age group (59.1% vs 54.1%). However consumption of Iron and Folic Acid during pregnancy and lactation period improved during the five year span. (2)

A considerable variation is noted in performances of different states/UTs considering key performance indicators of Anaemia Mukt Bharat. Based on the report of National Family Health Survey-5 (2019-21), Kerata, Manipur, Goa and Lakshadweep are among the best performing states/UTs, where Bihar, Tripura and Jharkhand and Ladakh are at the bottom of state level ranking. District level analysis revealed that Wayanad and Kozhikode districts of Kerala stood top in the ranking, whereas Leh and Kargil districts of Ladakh at the bottom. Four of the ten poorest-performing districts are from Jammu and Kashmir. Among the key performance indicator, mothers who consumed iron-folic acid for 100 days during pregnancy shows the highest disparities across districts. (10)

Implication of Anaemia Mukt Bharat (AMB) and Way Forward

The performance of AMB is admirable in improving supplies, coverage and consumption of Iron and Folic Acid tablets among pregnant and lactating women. Yet, considering the most commonly indicator for program success, the prevalence of anaemia, we are a long way to go to meet the targets.

- As prevalence of anaemia in pregnant women and children are still considerably high in India, continuum of care approach need to be augmented to cut down the intergenerational cycle of anaemia.
- There has been overall improvement in consumption of IFA tablets by pregnant women

during past five years. Evidence shows this to be a cost-effective strategy which can significantly decrease anaemia among new-borns. Effort needs to be strengthened to increase coverage of 180 or more days of IFA consumption by pregnant and lactating mothers. This will require strengthening availability of IFA across states and districts and effective IEC activities to increase adherence to consumption of IFA tablet.

- Considering the current scenario, it can be commented that emphasis should be given on other preventable non-iron deficiency anaemia, like haemoglobinopathies.
- Policy decision should be consistent with statistical inference of KPIs. Though both survey data (NFHS-4 and NFHS-5) provide reliable estimates, they cannot be directly compared without testing for confidence interval overlaps.
- Wide variation of KPIs among different districts and states indicates the need to identify low performance districts, to analyse the bottlenecks at local context and take interventions accordingly. For that reason, multicentric implementation research could be useful. In those districts, aetiology of anaemia needs to be re-evaluated to identify any non-nutritional cause. Experience sharing with high performance districts could be an effective strategy to find out best practices which could be replicated in other districts.
- A wider heterogeneity has been observed in prevalence of anaemia among adolescent girls, which could indicate the need to provide greater attention on uniformity in service delivery among adolescent girls.

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Iron Deficiency Anaemia

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Anaemia is a major public health problem and a leading cause of maternal mortality and morbidity. It is detrimental to the physical as well as mental health of women, especially during pregnancy and lactation. The global prevalence of anaemia in pregnant women is around 38% and in Low middle-income countries (LMIC), the prevalence of anaemia is estimated to be 45-50%.[1,2,3]

The reasons behind this increased prevalence of anaemia in LMICs may be due to shorter inter-pregnancy intervals, multiple successive pregnancies, pre-pregnancy anaemia, malnutrition, etc. The most common acquired cause of anaemia in pregnancy is iron deficiency anaemia (IDA). The other causes of nutritional anaemia are Vitamin B12 deficiency and folate deficiency anaemia. Other acquired causes of anaemia are haemorrhagic anaemia, anaemia of chronic disease and aplastic anaemia. Thalassemia, haemoglobinopathies, sickle cell anaemia and Hemolytic anaemia comprise the inherited causes of anaemia.

Definition

Anaemia in pregnant women is defined by WHO as haemoglobin (Hb) levels less than 11g/dl. The CDC has defined anaemia as Hb less than 11g/dl in the first and third trimester and below 10.5 g/dl in the second trimester. The severity of anaemia has been classified in Table 1.

Table 1 - Classification of Anaemia based on severity

Severity of Anaemia	Hb (g/dl) ICMR	Hb (g/dl) WHO
Mild	10-10.9	10-10.9
Moderate	7.0-10.0	7.0-9.9
Severe	<7.0	<7.0
Very Severe	<4.0	

Physiology

The physiological changes in the hematologicalsystem in pregnant women are such as to provide adequate blood flow to the placenta and also to compensate for the blood loss at the time of delivery. These changes include- Increased plasma volume by 40-50% and an increase in RBC volume by 20-3%. The disproportionate increase of plasma and RBC volume causes a decrease in Hb by approximately 2g/dl leading to "Physiological anaemia of pregnancy". The decrease in blood viscosity poses a reduced load on the heart and facilitates blood flow through the placenta. The increased blood volume acts as a protective buffer against blood loss in the third stage of labour. This physiological dilution should not be allowed to fall to the level of anaemia and appropriate correction of Hb levels should be done.

Iron requirement in pregnancy

In the first trimester, the iron requirement is negligible around 0.8mg/day and it increases to 7.5mg/day in the third trimester. The total iron requirement in pregnancy is around 1190 mg in a 55kg woman. This is attributed to the requirement of growing fetus (270mg), placenta (90mg), expansion of red cell mass (450mg), obligatory basal losses (230mg) and blood loss at delivery (450mg). however, the net iron requirement is calculated to be only 580-600mg as the iron required for expansion of RBC mass is returned back to the stores(450mg) and amenorrhoea in pregnancy saves about 160mg. The average iron absorption from an Indian diet varies from 0.8-4.5mg/day.[4] The differences in demand and absorption leads to anaemia in pregnancy, if not fulfilled through exogenous sources.

Stages of Iron deficiency

1. Stage I - Depletion of Iron stores

   In this stage, total iron stores (serum ferritin) are depleted but RBC indices and hemoglobin synthesis are not affected
2. Stage II- Iron deficient Erythropoiesis
3. Stage III- Iron Deficiency Anaemia

There is an insufficient supply of Iron to sustain normal haemoglobin concentration in blood and there is a fall in Hb.

Effects of Anaemia on pregnant women and fetus

The maternal complications during antepartum, intrapartum and postpartum duration are enumerated in Table 2. Even in cases of severe anaemia, the fetus can well tolerate the maternal anaemia. This is due to the high oxygen affinity of fetal haemoglobin and the efficiency of the maternal oxygen transport system to deliver an adequate amount of oxygen to the fetal tissues.

Table 2- Maternal and Fetal Complications of Anaemia

Maternal complications of Anaemia		
Antepartum period	Intrapartum complications	Postpartum complications
✓ Increased susceptibility to infections ✓ Asymptomatic bacteriuria ✓ Increased Risk of Preterm premature rupture of membranes ✓ Increase risk of Preterm delivery ✓ Pre-eclampsia ✓ Abruptio placenta ✓ Cardiac failure predominantly in severe anaemia at 28-32 weeks gestation	✓ Uterine inertia ✓ Maternal exhaustion ✓ Postpartum Haemorrhage ✓ Chances of Cardiac failure increased immediately after delivery	✓ Increased Risk of Puerperal sepsis ✓ Increased Risk of Thromboembolic complications ✓ Sub-involution of uterus ✓ Lactation failure ✓ Delayed wound healing ✓ Prolonged hospitalisation ✓ Impaired cognitive ability ✓ Increased risk of postpartum depression
Fetal Complications		
✓ Pre-maturity ✓ Low birth weight		

Evaluation of anaemia in pregnancy

I- Clinical features

Symptoms - Generalised weakness and fatigue, dizziness, loss of appetite, irritability, pedal oedema, skin and nail changes, dyspnoea on exertion, palpitations, worsening of pre-existing angina. Apart from symptoms, the following points in history should be taken

- History of passage of worms in stools
- History of bleeding from any other site like bleeding per rectum, bleeding from gums, haematuria
- Features of Malabsorption- chronic diarrhoea
- Chronic illnesses like Tuberculosis. Chronic malaria, bleeding diathesis, chronic kidney disease
- History of recurrent infections
- Maternal complications of Anaemia
- Obstetric history about history of post-partum haemorrhage
- Menstrual history to elicit if there is history of heavy menstrual bleeding
- Previous history of anaemia, blood transfusions and Jaundice.
- Dietary History- detailed history regarding the history of dietary intake of iron-rich foods and vegetables. The history of pica with ice (Pagophagia) is specific to Iron deficiency anaemia.
- Drug history- history of haematinics, drugs causing bone marrow suppression (Quinidine, chloramphenicol, trimethoprim-sulphadiazine etc)

Signs-

- Look for evidence of pallor in the lower palpebral conjunctiva, tongue, mucous membranes, palm of hand, and nail beds.
- Presence of koilonychia or platynychia, brittle nails, cheilosis and glossitis.
- The signs of cardiac decompensation like tachycardia, tachypnoea, raised JVP, varying degrees of oedema over the body, heart murmurs, etc should be checked.

II- Laboratory evaluation

A) Haemoglobin Estimation- should be done at the first antenatal visit, at 28 weeks and 36 weeks.

B) RBC indices- MCV, MCH and MCHC should be done to find the aetiology of anaemia (Table 3)

C) Peripheral blood smear- for typing of anaemia (Table 3)

Table 3- RBC Indices and Peripheral smear interpretation

Type of anaemia	MCV (Mean Corpuscular volume- average volume of a red cell; normal 80-95fl)	MCH (Mean corpuscular haemoglobin Average Hb content in a red cell; normal 27-32pg)	MCHC (Mean corpuscular haemoglobin concentrationratio of the weight of Hb to the volume in which it is contained; Normal 34-37g/dl)	Peripheral blood smear
Iron Deficiency anaemia	Decreased	Decreased	Decreased	Microcytic Hypochromic
Vitamin B12 or Folate deficiency	Increased	Increased	Decreased	Macrocytic

D) Stool examination to rule out ova, cyst and occult blood.

E) Urine complete examination- to rule out Urinary tract infections and asymptomatic bacteriuria.

F) Renal function tests- Blood urea, serum creatinine

G) Serum proteins, bilirubin levels

H) Specific investigations

1. Serum Ferritin- normal value= 20-200mcg/l

Low serum ferritin is considered the most sensitive and specific marker for the diagnosis of Iron deficiency anaemia. Ferritin levels above 100ng/ml suggest adequate iron stores. False positive high serum ferritin levels may be seen in the presence of any infection, inflammation, malignancy and post-partum period and it may mask the existing iron deficiency anaemia.[5]

2. Serum Iron levels- Normal Value= 33-150mcg/dl

It tells us about the total iron in circulation which is bound to its transport protein transferrin. The amount of iron absorbed through diet and by the breakdown of macrophages contributes to serum iron levels. Serum iron is decreased in all the stages of Iron deficiency.

3. Total Iron binding capacity(TIBC)- Normal Value= 325-400mcg/dl

It is the measure of total serum transferrin. It is increased in Iron deficiency anaemia.

4. Transferrin Saturation- Normal Value= 25-50%

This represents the ratio of Serum Iron with TIBC. In Iron deficiency anaemia, serum iron levels are reduced, so transferrin saturation is also reduced.

In cases when the diagnosis of IDA is not made with routine testing or there is an inadequate response to Iron therapy, some advanced tests can be done which are enumerated below-

- Free Erythrocyte Protoporphyrin (FEP)- FEP is the substrate used for heme synthesis and rises when there is inadequate iron supply.
- Soluble serum transferrin receptor (sTfR)- It is measured by ELISA and used to assess cellular iron status. It is an expensive but reliable test to diagnose IDA. It is the only test to accurately reflect the iron deficit between the point of storage iron depletion (serum ferritin <20mcg/l) and the development of anaemia. As soon as the cellular iron deficiency is established, the sTfR rises in proportion to the magnitude of iron deficiency, preceding reduction in MCV or rise in FEP. There is 3-5 fold increase in concentration of these receptors in IDA.
- Zinc Protoporphyrin (ZPP)- In the last step of Hemoglobin synthesis, ferrous protoporphyrin is combined with globin to make Hb. In the case of iron deficiency, zinc replaces iron to produce ZPP. The normal ratio of iron to zinc in protoporphyrin is approximately 30000:1 but ZPP will increase to measurable concentration in Iron deficiency anaemia. The levels of ZPP are not affected by infection, inflammation and pregnancy-associated hemodilution.
- Bone marrow biopsy- It is the last resort and is only indicated when there is no response to therapy or to rule out other conditions. The absence of stainable iron is the gold standard for the diagnosis of IDA.

Mentzer Index -used to differentiate beta-thalassaemia from IDA. It is the quotient of MCV (fl) and RBC count (millions/microlitre). The calculated index less than 13

indicates thalassaemia and more than 13 makes the likely diagnosis of IDA.

Management

Prevention-

The WHO recommends a daily intake of 60mg of elemental iron and 400 mcg of folic acid in pregnant women for the prevention of anaemia. The Anaemia Mukt Bharat Programme has aimed to achieve 50% reduction of anaemia in women of reproductive age by 2025. Another initiative by the government of India, POSHAN Abhiyan (2018-22) had been designed to reduce the prevalence of anaemia in children, adolescents and women of reproductive age group by 3% every year. The MoHFW has advised prophylactic Iron and folic acid tablets (one tablet containing 60 mg of elemental iron and 500mcg of folic acid) to all pregnant women for a duration of 180 days in pregnancy, to be started from 16 weeks onwards andcontinued after delivery for another 180 days.7 Deworming with 400mg of Albendazole has been recommended by WHO and MoHFW in pregnant women with IDA.

Treatment of iron deficiency anaemia (IDA)

The treatment of IDA in pregnancy depends on the severity of anaemia and the period of gestation at the time of diagnosis.

Oral Iron Therapy - Oral iron therapy is indicated in pregnant women with mild to moderate anaemia in the second trimester up to 30-32 weeks. Various iron formulations are available – Ferrous sulphate, Ferrous fumarate, Ferrous succinate, Ferrous Gluconate, Ferrous ascorbate, carbonyl iron, sodium feredate, Ferric ammonium citrate, etc. The Iron tablets (IFA) supplied by the Government of India contain Ferrous sulphate 333mg containing 100mg of elemental iron and 0.5mg of folic acid. The Ferrous sulphate salts are the cheapest, safe and well-absorbed form of iron. The ferrous salts are three times more readily absorbed than the ferric salts and are thus always preferred. For the treatment of IDA, the daily elemental iron dose should be from 100-200mg/day.

Prescription of Iron Tablets

- Iron tablets are prescribed daily or twice daily depending on the severity of the anaemia. If the woman cannot tolerate higher doses of elemental iron, then, we can start with the lower doses and increase the dose gradually as it reduces side effects and improves compliance. Intermittent Iron therapy also improves compliance and it is as effective as daily Iron therapy.
- In case of side effects, the ferrous sulphate salt can be replaced with ferrous fumarate, succinate or gluconate salt as these cause fewer side effects.
- Tablet should be taken on an empty stomach or one hour after meals. In the case of gastric intolerance, it may be taken with meals, although absorption may be reduced.
- Avoid Tea/coffee for at least two hours after taking Iron tablets.
- Antacids and Calcium salts should not be taken along with iron tablets. Patients should be specifically told not to take iron and calcium tablets together and should keep a gap of at least 2 hours between the two.
- Anaemic women who cannot take oral tablets can be prescribed liquid preparations of Iron.

Side effects of Oral Iron-

- Gastrointestinal discomfort like nausea, vomiting, sour eructations, epigastric pain
- Constipation, Diarrhoea, flatulence.
- Staining of teeth with Liquid preparations

Response –

- Reticulocyte count increases by 7-10 days
- Haemoglobin starts rising after two weeks and rise of 1gm/dl is expected after two weeks. A repeat hemoglobin test is recommended after 4 weeks of oral iron therapy. If there is no response, then, the other causes of anaemia should be ruled out. One of the reasons of poor response to oral iron is that patient may not be taking the tablets at all. This can be confirmed by asking about the colour of stools from the patient. If the patient is taking the iron tablets, the colour of stools should be black.

Parenteral Iron Therapy

Indications –

- Intolerance and poor compliance to oral iron
- Poor absorption of oral iron
- No response to oral iron after 4 weeks in cases of confirmed IDA

Preparations

Intravenous preparations are safer, well tolerated and widely used than intra-muscular preparations. Iron sucrose and iron carboxy-maltose are the I/V preparations which are approved for use in the second and third trimesters of pregnancy. The dose calculation of parenteral iron is by Ganzoni"s formula (Total Iron= 2.4 weight in Kg (pre-pregnancy)×Hb deficit + 1000mg for replenishment of stores

	Iron sucrose	Iron carboxy-maltose
	Second generation Intravenous iron	Third generation Intra-venous iron
Dosage schedule	Maximum 200mg per dose is given; 200mg diluted in 200ml Normal saline, given over 30 minutes repeated up to three times a week	1000mg can be given in single setting; 1000mg in 100ml Normal saline, given over 15 minutes if repeat dose is required, should be repeated after 1 week
Test Dose	Not recommended	Not recommended
Vial	100mg/5ml	50mg/ml in 10 ml vial
Side effects	Metallic taste, nausea, fever, shivering, hypotension, anaphylactoid reactions rarely	Headache, dizziness, nausea, abdominal pain, constipation, rash, injection site reactions

Precautions

- Iron deficiency should be confirmed
- Any history of anaphylactoid reactions should be elicited
- Infusion should be carried out only in a health facility with adequate supervision and availability for the management of anaphylaxis. Emergency tray (adrenaline, dexamethasone, injection avil) should always be kept ready bedside of the patient receiving injectable iron.
- Oral iron should be stopped at least 24 hours before injectable iron therapy; otherwise receptor sites are choked leading to increased risk of toxicity from free circulating iron.

Blood Transfusion

Indications

- Severe anaemia in the last trimester with/without signs of heart failure
- Hb 5-7gm/dl with signs of impending heart failure
- Intra-partum and post-partum severe anaemia
- Acute haemorhage

Dietary Modifications

- Motivate women to increase the quantity of iron rich food and practices that increase the absorption of iron like intake of lemon (ascorbic acid) with meals enhances absorption of iron.
- Foods rich in iron are Bengal gram, whole wheat flour, ragi, jaggery, green leafy vegetables, beetroot, beans, nuts, eggs, mutton, etc
- Consumption of phytate rich food (whole grains, lentils, nuts) should be discouraged with meals as phytate is a known iron absorption inhibitor. Other food items that need to be eluded are tannins present in coffee, cocoa and tea; calcium, particularly in milk and milk products; phosphates in egg yolk; and oxalates in vegetables.
- Cooking in Iron utensils has also been found to be useful in increasing the iron content in the meals.
- Bio-fortification is a recent approach in iron fortification of wheat, bean, cassava, maize, rice, and yam. Sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) and Micronized ground ferric pyrophosphate are the iron salts which are commonly used for food fortification in India.

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Multiple Micronutrient Deficiency & Diet in Anemia Management

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On 24 November 2021, when reports of the National Family Health Survey (NFHS) 5 were declared, it was an alarm for all of us. The report shows an increased prevalence of anemia across children, women, men, and pregnant women of all age by 2% to 9%. As we all know, an increase in anemia is synonymous with an increase in maternal and fetal morbidity. So, anemia still remains a major global health concern.

According to the level of public health significance, India is at a severe stage of anemia and malnutrition. Globally, around 1 billion women and children are anemic, and India is a major contributor. In mild form, anemia affects work performance, child development, school performance, and in moderate to severe form, it can lead to death. Various factors contribute to its prevalence. A significant aspect often overlooked is the role of multiple micronutrient deficiencies and its role in development and progression of anemia. This article aims to shed light on the intricate relationship between anemia and nutrition and the importance of a well-balanced diet to manage and prevent anemia effectively.

WHO defines anemia as hemoglobin concentration less than 12 g/dl in children, girls, and women. According to WHO, anemia in pregnancy is a hemoglobin concentration below 11 g/dl and hematocrit less than 33%. The magnitude of the problem is huge, as 52% of Indian pregnant women are anemic, and 20% of maternal mortality is due to anemia. It causes morbidity beyond imagination. For every maternal death, there are around 30 near-missed cases.

Severity of anemia	Level of hemoglobin concentration
Mild	10 – 10.9 g/dl
Moderate	7 – 9.9 g/dl
Severe	4 – 7 g/dl
Very Severe	< 4 g/dl

The prevalence of anemia varies across populations. Regional variations are influenced by nutritional, genetic, and socioeconomic status.

Prevalence of anemia

Age Group	Anemia Incidence in NFHS-4	Anemia Incidence in NFHS-5
6-5 years children	58.6%	67.1%
15-19 years adolescent girl	54%	59%
15-49 years women	53.1%	57%
15-49 years pregnant women	50.4%	52.2%
15-49 years men	22.7%	25.5%
15-19 years adolescent boys	29.2%	31%

Common symptoms of anemia are fatigue, weakness, malaise, dyspnea, chest pain, and palpitation.Anemia affects the quality of life of individuals. To address anemia comprehensively, it is crucial to explore the role of multiple micronutrients in maintaining a healthy blood profile.

Micronutrients include iron, vitamin B-12, folic acid, vitamin C, vitamin D, A & K, and vitamin B complex. Trace elements like zinc, magnesium, selenium, molybdenum, nickel, copper, magnesium, and calcium play a pivotal role in the synthesis and functioning of RBC. Deficiencies in these micronutrients can lead to various types of anemia, exacerbating the symptoms and hindering effective management.

The primary causes of most micronutrient malnutrition are inadequate intake of micronutrient-rich food and impaired absorption or utilization of nutrients from these foods, partially due to infection and parasitic infestation. Poverty, lack of access to a variety of food, lack of knowledge of optimal dietary nutrition, and a high incidence of infectious diseases are some of the factors that lead to micronutrient malnutrition. Let's delve into each micronutrient's role in anemia and how dietary intervention can make a difference.

1. **Iron -** Iron deficiency anemia is the most common form of anemia globally. Iron is a key component of hemoglobin. The iron assimilated by the developing red cell is either converted to heme or temporarily or permanently stored as a non-heme fraction within the erythrocytes. Storage iron may be demonstrated as specific granules within the developing RBCs. A balance in iron concentration is extremely important to maintain cellular homeostasis in both normal hematopoiesis and erythropoiesis. Iron deficiency or iron overload can impact hematopoiesis and is associated with many hematological diseases. Hemoglobin is primarily involved in the transfer of oxygen from the lungs to tissues. However, iron also plays a role in metabolism as a component of various proteins and enzymes. Iron is toxic to the body in its free state. Incorporating both heme and nonheme iron sources in the diet is beneficial. But dairy products, although rich in calcium and protein, lack iron. Vitamin C increases the absorption of both heme and nonheme iron. Four ounces of orange juice are enough to increase iron absorption. Iron absorption is inhibited by phytates, a compound found in plant-based diets that demonstrate a dose-dependent effect on iron absorption. Polyphenols are found in black and herbal tea, coffee, wine, legumes, cereals, fruits, and vegetables and have been demonstrated to inhibit iron absorption. Food fortification is being implemented in many countries and is found to be successful in reducing the incidence of iron deficiency anemia.

2. **Vitamin B12-** Deficiency of vitamin B12 leads to megaloblastic anemia. It is characterized by the production of abnormally large and dysfunctional RBCs. Vitamin B12 is essential for DNA synthesis and normal RBC maturation. Dietary sources of vitamin B12 are primarily animal meat, fish, eggs, and dairy products. Vegetarians, pregnant and breastfeeding mothers who are at risk of deficiency may need to take supplements. The reference daily intake is about 2.4 micrograms but slightly higher for those who are pregnant and breastfeeding. Vitamin B12 is absorbed in the stomach with the help of a protein called Intrinsic factor. Intrinsic factor binds to vitamin B12 and helps in absorption from the intestine. Excess vitamin B12 is stored in the liver. Deficiency of vitamin B12 develops in intrinsic factor deficiency and people on vegan and vegetarian diets. For them, fortified foods are good sources of vitamin B12. Vitamin B12 supplements are recommended for people who are at risk of vitamin B12 deficiency, such as older adults, pregnant and breastfeeding women, vegetarians, vegans, patients with intestinal diseases, or those having stomach surgeries.

3. **Folic acid -** Its role is in DNA synthesis and cell division. Folate is essential for DNA synthesis and cell division, particularly in rapidly dividing cells like bone marrow. Its deficiency can lead to megaloblastic anemia characterized by larger than normal RBCs. Folic acid-rich sources are green leafy vegetables, legumes, fortified cereals, eggs, and beef. Folic acid is found in both plant and animal sources. The recommended daily amount of folate for adults is 400 µg, and women planning for pregnancy need up to 1000 micrograms. If dietary intake is insufficient, supplements of folic acid are necessary.

4. **Vitamin C -** It enhances the absorption of non-heme iron found in plant-based foods and can aid in preventing iron deficiency anemia. It is present in fruits like oranges and strawberries and vegetables like bell peppers, broccoli, and amla.

5. **Vitamin D -** It decreases inflammatory cytokines and supports erythropoiesis by increasing burst-forming units, erythroid proliferation, and having a synergistic effect with erythropoietin to further enhance erythroid progenitor cell proliferation. Vitamin D also potentially affects circulating iron status by promoting erythropoiesis and by suppressing hepcidin expression. Lower levels of pro-inflammatory cytokines and hepcidin increase iron bioavailability for erythropoiesis and hemoglobin synthesis by preventing iron sequestration in macrophages. Commercially sold

mushrooms have a high amount of vitamin D2 due to intentional exposure to a high amount of ultraviolet light. Many foods and supplements are fortified with vitamin D, like dairy products and cereals.

6. **Vitamin A -** It is essential for normal erythropoiesis, contributing to the differentiation and maturation of RBCs. It plays a crucial role in maintaining the integrity of epithelial tissues, especially the lining of the GIT. A well-balanced diet that includes these foods ensures adequate intake of vitamin A to support erythropoiesis.
7. **Vitamin K -** Vitamin K2 modulates differentiation and apoptosis of both myeloid and erythroid lineages. There are two sources of vitamin K, including vitamin K1 or phylloquinone, which is primarily found in green leafy vegetables, and vitamin K2 or menaquinone, which is synthesized by certain intestinal bacteria.
8. **Vitamin B complex -** It prevents infections, supports and promotes cell health, and the growth of RBCs. As the building block of a healthy body, Vitamin B complex has a direct impact on energy levels, brain function, and cell metabolism. Certain diseases prevent vitamin B complex absorption, such as celiac disease, HIV, Crohn's disease, alcohol use disorder, kidney disease, rheumatoid arthritis, ulcerative colitis, and inflammatory bowel disease. Most people get enough vitamin B complex by eating a balanced diet. It is deficient in strict vegans, vegetarians, or patients on proton pump inhibitors for a long period of time.

Vitamin	Sources	Doses
Vitamin B12	animal meat, fish, eggs and dairy product	2.4 microgram per day
Folic acid	green leafy vegetables legumes, fortified cereals, eggs and beef	adult dose is 400 µg & pregnancy & lactation 1000 micrograms
Vitamin C	oranges and strawberry and vegetables like bell pepers, broccoli and amla	90 mg/day Pregnancy 120 mg/day
Vitamin D	fatty fish, fish liver oil, small amounts is present in egg yolks, cheese and beef liver	600 IU/day
Vitamin A	are Liver, sweet potatoes, carrots, spinach, and kale	3000 mcg/day
Vitamin K	green leafy vegetables & synthesized by intentional bacteria	5 -10 mg/day
Vitamin B Complex	milk, cheese, egg, liver, kidney, meat, fish, dark green vegetable such as spinach & kale, vegetables like beetroot, avocado, potatoes, whole grains, cereal and citrus fruit	400mcg/ day Pregnant 600 mcg/day Lactating 500 mcg/day

9. **Zinc -** Zinc is redistributed from plasma and bones to the bone marrow to produce new RBCs. Zinc induces iron uptake and transcellular transport in intestinal cells via the induction of DMT1 and FPN1 expression. Zinc appears to be a key modulator of intestinal iron absorption, tissue iron distribution. Zinc is a catalyst for many enzymes that are needed for RBC production.
10. **Magnesium -** It is a cofactor of a large number of enzymes that play an important role in the synthesis of hemoglobin. Magnesium deficiency can interrupt hemoglobin synthesis and erythrocytes' energy metabolism.
11. **Selenium -** It is linked to anemia through the modulation of inflammation via the interleukin 6 pathway. Selenium is an important component of glutathione peroxidase. Its concentration in erythrocytes shows its protective effect on RBCs against oxidative damage. Increasing oxidative stress could be another contributing factor to the development of anemia due to selenium deficiency.
12. **Molybdenum -** Dietary molybdenum has shown to treat iron deficiency anemia by increasing the activity of one or more molybdenum enzymes.
13. **Nickel -** It is considered synergistic to iron by promoting intestinal absorption of iron. Nickel deficiency can lead to iron deficiency anemia.
14. **Copper -** Copper is essential for absorbing iron from the gut. Low copper levels lead to less iron absorption. It is a crucial micronutrient needed for hemoglobin synthesis through the action of cytochrome oxidase. It is required for iron transfer from cells to blood, ensuring dietary iron absorption, and systematic iron distribution

15. **Manganese -** It is an essential mineral that plays a role in the maintenance of human homeostasis. It protects against free radicals.
16. **Cobalt -** It induces an increase in the secretion of erythropoietin, thus causing increased erythropoiesis. It results in increased utilisation and absorption of iron and a parallel increase in the erythrocytes and hemoglobin level in circulating blood.
17. **Calcium -** It prevents anemia when the zinc-copper ratio is high. Calcium acts before its absorption in the intestinal tract by interfering with zinc absorption.

Vitamin	Sources	Doses
Iron	heme iron is meat, fish and poultry non heme iron are fortified breads and breakfast cereals, nuts, seeds, dry fruits, legumes such as mixed beans and backed beans, lentils and chickpea, dark leafy green vegetables such as spinach, silver beet, broccoli & tofu., In Fruits prunes, raisins and apricot	70 to 175 µg/dl for man 50 to 170 µg/dl for woman
Zinc	oysters, red meat, poultry, seafood, nuts, whole grain, breakfast cereals, and dairy products	11 mg/day for man and 8 mg/day for women
Magnesium	green vegetables, nuts, seeds, dried beans, whole grains, wheat, germs, wheat and oat bran	is 400 to 420 mg per day and for woman is 310 to 320 mg per day
Selenium	pork, beef, turkey, chicken, fish, shellfish eggs, beans and nuts	400 µg per day
Molybdenum	whole grains, nuts, beef, liver legumes, cereals grains, green leafy vegetables, milk and cheese	45 µg per day.
Nickel	legumes, nuts seeds, chocolate oats & soya bean	1 mg/day
Copper	oysters, shellfish, whole grains, beans, nuts, potatoes, meat like kidney & liver, dark leafy greens and dry fruits	10 mg/day
Manganese	are green vegetables, tea, fruits, legumes, grains and rice	1 -10 mg/day
Cobalt	Fish nuts green leafy vegetables, such as broccoli and spinach cereals such as oats	1 mg/ day
Calcium	milk, cheese and other dairy products 2500mg/day	2500 mg/day

Dietary strategies for anemia management:

1. **Diversification of diet:** Encouraging a diverse and well-balanced diet is the cornerstone of anemia management. Including a variety of foods from different food groups ensures a broad spectrum of essential micronutrients. Nowadays, the concept of a colorful thali is there, where we incorporate food items of different colors into the diet. A diet rich in whole grains, lean proteins, fruits, vegetables, and dairy products or dairy alternatives can provide the necessary nutrients to support RBC protection.\
2. **Emphasis on iron-rich food:** For those at risk of or diagnosed with iron deficiency anemia, increasing the intake of iron-rich food is essential. Incorporating lean meats, poultry, fish, beans, lentils, and fortified cereals can boost iron levels. Additionally, adding vitamin C-rich food with iron-rich food can enhance iron absorption.
3. **Consider supplementation:** In cases where dietary interventions may not be sufficient, supplementation should be considered under the guidance of healthcare professionals. Iron, vitamin B-12, and folic acid supplements may be prescribed to address specific deficiencies. However, it is essential to note that supplementation should be tailored to individual needs and monitored regularly.
4. **Cooking methods matter:** Certain cooking methods can impact the bioavailability of nutrients. For instance, soaking, fermenting, and sprouting grains and legumes can reduce anti-nutrients that hinder iron absorption. Cooking food in cast iron pans can also contribute to increased iron intake.

Healthcare professionals play a crucial role in providing dietary counseling for managing anemia. Dietician help can be sought. They can assess patients' nutritional status, educate them on iron-rich food requirements, recommend supplementation when needed, and

monitor progress to ensure an effective and balanced approach to anemia management.

Challenges exist in implementing dietary interventions, such as individual variability in response, adherence issues, and the need for long-term behavioral changes. However, there are opportunities for a personalized approach, leveraging technical support, and promoting education to empower individuals in making healthier choices. Adjustments can be made according to their religious and cultural habits, and local products familiar to the patient can be prioritized.

Researchers are increasingly recognizing the interconnectedness of various micronutrients in the context of anemia. They are studying how different micronutrients interact with each other and contribute synergistically or antagonistically to erythropoiesis. This is a growing area of interest in emerging research, focusing on understanding how genetic factors influence an individual's susceptibility to anemia in the presence of micronutrient deficiencies. Genetic variations may impact absorption, metabolism, and utilization of micronutrients, leading to a personalized approach to anemia management.

Epigenetic studies are exploring how environmental factors, including nutrition, can influence gene expression and contribute to anemia. Understanding the epigenetic mechanisms involved in micronutrientrelated anemia could provide new avenues for targeted interventions. The role of gut microbiota in nutrient absorption and metabolism is gaining the attention of researchers. Research is exploring how the composition of the gut microbiome can affect the bioavailability of micronutrients critical for erythropoiesis and consequently impact anemia risk. Studies are assessing the efficacy of micronutrient supplementation and fortification strategies in managing and preventing anemia, especially in vulnerable populations of young children and pregnant women. This includes exploring optimal dosages, formulations, and delivery methods. The role of trace elements, beyond well-studied micronutrients like iron, vitamin B12, folic acid, vitamin C, and vitamin A, is gaining interest. Researchers are investigating their impact on iron metabolism and erythropoiesis.

Nutrigenomic and nutrigenetics are fields that explain how nutrition interacts with an individual's genetic makeup. Research in the area is shedding light on how specific dietary patterns and micronutrient intake can affect gene expression related to anemia. Advances in diagnostic techniques are allowing researchers to assess micronutrient status more accurately. This includes the use of novel biomarkers and imaging technology to evaluate micronutrient levels and their functional impact on erythropoiesis.

Large-scale epidemiological studies are being conducted to understand the prevalence of micronutrient deficiencies and their association with anemia on a global scale. Identifying geographical and demographic patterns informs targeted public health interventions. Research is focused on developing and evaluating cost-effective interventions for anemia in resource-limited settings. This includes community-based programs, educational initiatives, and sustainable agricultural practices to improve the availability of nutrient-rich food.

Addressing anemia requires a multifaceted approach, and nutrition plays a pivotal role in its management. By understanding the intricate relationship between multiple micronutrient deficiencies and anemia, healthcare professionals and individuals can adopt proactive measures to optimize nutrition and enhance overall well-being. A comprehensive, well-balanced diet that meets individuals' nutritional needs is key to preventing and managing anemia effectively.

> "अन्नं ब्रह्मा रसं विष्णु भोक्ता देवो जनार्दनम्।
> एवं ध्यात्वा तथा ज्ञात्वा अन्न दोषो न लिप्यते।"

Parenteral Iron In Anemia Management – Selection, Scope & Safety

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Introduction

Iron is an essential mineral that plays a crucial role in various physiological functions within the human body. Its importance spans across all age groups, from infants to the elderly. Iron is primarily involved in the formation of hemoglobin, a protein in red blood cells responsible for transporting oxygen from the lungs to the rest of the body. Additionally, iron is essential for proper cell function and the production of energy. Iron supplementation can be used as medication in the management of iron deficiency anemia.

Iron metabolism in human body

Iron is a critical component of the body. Its primary role is to store and transport iron (as myoglobin and hemoglobin) throughout the body. In an iron-deficient state, hemoglobin cannot be synthesized, with resultant microcytic anemia due to the formation of small erythrocytes.

Iron metabolism is a complex and tightly regulated physiological process crucial for maintaining optimal levels of this essential micronutrient in the body.

- Dietary Iron Absorption: Iron exists in two forms in the diet: heme iron from animal sources and non-heme iron from plant-based sources. In the stomach, gastric acid facilitates the conversion of non-heme iron to a more absorbable form that is ferric ion(Fe^{3+}) . In the duodenum, the primary site of iron absorption, various proteins and transporters facilitate the uptake of iron into enterocytes.
- Intracellular Iron Processing: Once absorbed, iron is transported across the basolateral membrane into the bloodstream by ferroportin. In the bloodstream, iron binds to transferrin, a carrier protein that ensures its safe transport to various tissues and cells for use. The extra iron is stored as ferritin within enterocytes
- Iron Utilization in Tissues: Iron delivered to tissues is utilized for crucial cellular processes, including the synthesis of hemoglobin in red blood cells, myoglobin in muscles, and various enzymes involved in energy metabolism.
- Hepcidin Regulation: Central to iron homeostasis is hepcidin, a hormone produced by the liver. Hepcidin regulates the concentration of iron in the blood by modulating the activity of ferroportin. Increased hepcidin levels lead to decreased iron absorption and increased iron sequestration within cells, while low hepcidin levels enhance iron absorption.
- Recycling and Macrophage Iron: Iron from senescent red blood cells is recycled by macrophages in the spleen and liver. Heme iron is converted into non-heme iron and released into circulation for reuse. This recycling mechanism is vital for sustaining iron levels and minimizing dietary iron requirements. [4]

The mechanism of iron excretion is an unregulated process arrived through loss in sweat, menstruation, shedding of hair and skin cells, and rapid turnover and excretion of enterocytes.

Requirement in Pubertal, Adolescent, Lactation, Pregnancy:

Pubertal and Adolescent Requirements: During puberty and adolescence iron requirement is – 15.1 mg/day of elemental iron

Menstrual loss per day of iron – Average loss of 1.6 mg of iron with blood loss of 40 ml. Requirement of Iron during menstruation is 14.8 mg/ day of elemental iron.

Pregnancy- During pregnancy iron requirement is between 40 mg to 60 mg per day (elemental iron).

Lactation Requirements: Per day dose during lactation is 40mg to 60 mg. Lactation is a physiologically demanding phase for mothers, necessitating increased iron intake. Breast milk is naturally low in iron, and the nutritional demands of both the mother and the growing infant .Adequate iron levels support optimal lactation and contribute to the iron content of breast milk, ensuring the infant receives sufficient iron during this critical developmental stage.

Indications of Iron supplementation

Iron supplementation is indicated for iron-deficient states secondary to conditions such as iron deficiency anemia, iron deficiency without anemia, nutritional deficiency, malabsorption, chronic inflammatory state, blood loss, or an increase in the body's need for iron. Iron is an essential mineral needed for general health. Depleted iron stores lead to decreased production of hemoglobin and circulating erythrocytes in the body, resulting in anemia. Symptoms of iron deficiency can present as fatigue, weakness, shortness of breath, pica and pagophagia, tachycardia, altered mental status, hypothermia, and increased risk of infection.[1]

Treatment primarily aims at replenishing the body's iron stores and providing symptomatic relief. If left untreated, this may lead to adverse events such as neurodevelopmental delay in developing children and poor pregnancy outcomes for expectant mothers. At-risk populations are women of child-bearing age, where monthly menses and pregnancy are a common cause for anemia.[2] The elderly are more likely to have iron-poor diets and indolent GI blood loss from gastritis or nderlying malignancy. Patients with chronic kidney disease or on hemodialysis often have iron deficiency and cannot stimulate their kidneys to produce erythropoietin, further exacerbating the anemia.Some people may have malabsorptive states (such as Whipple disease, small intestinal bacterial overgrowth (SIBO), celiac disease, pernicious anemia) where they cannot effectively digest the iron in their diets.

Iron supplementation through various routes such as oral or IV and iron fortification of foods can help manage and treat iron deficiency.[3]

Diagnosis of iron deficiency anemia

Diagnosis of iron deficiency anemia requires laboratory-confirmed evidence of anemia, as well as evidence of low iron stores.16 Anemia is defined as a hemoglobin level two standard deviations below normal for age and sex (TABLE).17

Table 1. Age-Related Variations in Hemoglobin Level and MCV

	Hemoglobin level (g per dL [g per L])		MCV (μm³ [fL])	
Age	Mean	Diagnostic of anemia	Mean	Diagnostic of microcytosis
3 to 6 months	11.5 (115)	9.5 (95)	91 (91)	74 (74)
6 months to 2 years	12.0 (120)	10.5 (105)	78 (78)	70 (70)
2 to 6 years	12.5 (125)	11.5 (115)	81 (81)	75 (75)
6 to 12 years	13.5 (135)	11.5 (115)	86 (86)	77 (77)
12 to 18 years (female)	14.0 (140)	12.0 (120)	90 (90)	78 (78)
12 to 18 years (male)	14.5 (145)	13.0 (130)	88 (88)	78 (78)
20 to 59 years (white men)	NA	13.7 (137)	90 (90)	80 (80)
60 years and older (white men)	NA	13.2 (132)	90	80
20 years and older (white women)	NA	12.2 (122)	90	80
20 to 59 years (black men)	NA	12.9 (129)	90	80
60 years and older (black men)	NA	12.7 (127)	90	80
20 years and older (black women)	NA	11.5 (115)	90	80

MCV = mean corpuscular volume; NA = not available.

Adapted with permission from Van Vranken M. Evaluation of microcytosis. Am Fam Physician. 2010;82(9):1118.

Basic investigations for iron deficiency anemia

1. **Complete blood count (CBC):**
   - o Includes hemoglobin, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC).
2. **Iron profile:**
   - o Includes serum iron, ferritin and total iron-binding content (TIBC).
3. **Hemoglobin electrophoresis**

Administration

Oral Iron Supplementation

- Oral iron replacement therapy is the most cost-effective and readily available for the general public

as ferrous sulfate hydrated (64 mg, 20% elemental iron), ferrous gluconate (39 mg,12% elemental iron), carbonyl iron and ferrous fumarate (99mg, 33% elemental iron).

- For best absorption, the recommendation is to take iron at least 30 minutes before a meal or 2 hours before taking other medications.
- If the patient cannot tolerate the gastrointestinal side effects, they may take it with small amounts of food.
- Avoid taking it with milk, calcium, and antacids, high fiber foods, or caffeine.
- Some studies have suggested taking iron with orange juice or with vitamin C supplementation to help improve absorption.

Role Of Parenteral Iron Therapy

An alternative to oral iron supplementation is via IV infusion; this may be preferable in patients who:

- Cannot tolerate oral iron due to side effects
- Pregnant women who already have significant nausea and vomiting
- Those who have had a gastric bypass, where reduced gastric secretion impairs iron absorption
- Those who have malabsorption conditions that prevent adequate absorption into the body (such as Whipple's disease, SIBO, celiac disease, pernicious anemia)
- Those with chronic inflammatory states, such as SLE or rheumatoid arthritis have elevated hepcidin levels that reduce oral iron absorption[7]

Parenteral Iron therapy formulations and dosing:

Different forms of IV iron

Iron Sucrose : Iron sucrose is a complex form of iron with sucrose, a type of sugar. Iron sucrose injection is an iron replacement product that is used to treat iron deficiency anemia (not enough iron in the blood) in patients with chronic kidney disease (CKD) including those who are undergoing dialysis (hemodialysis or peritoneal) and those who do not require dialysis. Iron sucrose is a sterile aqueous complex of polynuclear iron (III)-hydroxide in sucrose for intravenous use. Following intravenous administration, iron sucrose is dissociated by the reticuloendothelial system into iron and sucrose; the sucrose component is eliminated mainly by urinary excretion. Iron sucrose can be administered with or without erythropoietin to raise hemoglobin levels and may be used in cases of oral iron therapy intolerance or ineffectiveness. Hypersensitivity reactions are less common with iron sucrose compared to other parenteral iron products, such as iron dextran. It has a lower risk of causing severe allergic reactions or anaphylaxis, low risk of hypophosphatemia (low levels of phosphate in the blood), High blood pressure, light headed feeling.

Dose of Iron Sucrose :

10 mL (200 mg elemental iron) diluted in a maximum of 100 mL of 0.9% sodium chloride IV over at least 15 minutes.

5 ml (200 mg elemental iron) in a maximum of 100 mL of 0.9% sodium chloride IV over at least 15 minutes for patient with dialysis within 1st hour of dialysis.

Total treatment course dose: 1000 mg.

Administer on 5 different occasions within a 14 day period to achieve a total cumulative dose of 1000 mg within the 14- day period. Administering 25 mL (500 mg elemental iron), diluted in a maximum of 250 mL of 0.9% sodium chloride, IV over 3.5 to 4 hours on days 1 and 14. The largest increase in Hb from baseline to any time from week 1 to week 5 (mean [SD]) was 2.34 (1.22) g/dL in the iron sucrose group. Once treatment with iron is started, it is important to repeat a CBC and iron panel in 2-3 months to assess response to treatment.

Iron (III) Isomaltoside : Iron isomaltoside 1000 solution for injection formulation containes iron in a strongly bound complex that enables a controlled and slow release of bioavailability iron to iron- binding proteins with little risk of free iron. It is rapidly taken up by the cells in the reticuloendothelial (RES) , particularly in the liver and spleen from where iron is slowly released following intravenous administration.The plasma life is 5 hours for circulating iron and 20 hours for total iron (bounding and circulating). The dose is expressed in mg of elemental iron. It may be administered either as an intravenous bolus injection up to 500 mg up to three times a week at an administration rate of upto 250 mg iron/minute. It should be added to maximum 500 ml sterile 0.9% sodium chloride. The administration of 200 mg iron isomaltoside 1000 solution for injection/ infusion results in an increase of haemoglobin which is equivalent to 1 unit blood. Iron isomaltoside lead to a

significantly more rapid and increased Hb response in the first 2 weeks. A faster and greater response with iron isomaltoside was also observed for s-ferritin and transferrin saturation. It i administered as 1000 mg in a single visit resulted in a faster and more pronounced hematological response and improvement in fatigue compared to iron sucrose which requires multiple visits. The safety profile was similar with a low frequency of hypersensitivity reactions, cardiovascular events, and serious ADRs. The largest increase in Hb from baseline to any time from week 1 to week 5 (mean [SD]) was 2.83 (1.33) g/dL in the iron isomaltoside group.

Ferric Carboxymaltose (FCM): Ferric carboxymaltose is another intravenous formulation known for its rapid infusion rate. Ferric carboxymaltose injection is used to treat iron-deficiency anemia (a lower than normal number of red blood cells due to too little iron) in adults and children 1 year of age and older and anemia in adults with chronic kidney disease who are not on dialysis. It improves the ability to exercise in certain adults with congestive heart failure . It works by replenishing iron stores so that the body can make more red blood cells. It may cause severe or life-threatening reactions during and shortly after you receive the medication like shortness of breath, difficulty swallowing or breathing ,swelling of the face, throat, tongue, lips, or eyes , hives ,rash, itching ,weak pulse ,chest pain ,or loss of consciousness. It is particularly useful when larger doses are required. There is increase of Hb by 2 g/dL within 7 days and 3 g/dL in 2–4 weeks in patients receiving FCM.It is usually given as a total of 2 doses, spaced at least 7 days apart. It may also be given as a single dose in adults. For patients with congestive heart failure it is usually given once every 6 weeks for no more than a total of 5 doses.

For patients weighing 50 kg or more, the recommended dosage is 750 mg intravenously in two doses separated by at least 7 days for a total cumulative dose of 1,500 mg of iron per course.

In adult patients 15 mg/kg body weight up to a maximum of 1,000 mg intravenously may be administered as a single-dose per course.

For patients weighing less than 50 kg, the recommended dosage is 15 mg/kg body weight intravenously in two doses separated by at least 7 days per course. Each mL of this drug contains 50 mg of elemental iron. The dosage is expressed in mg of elemental iron.

Dose calculation :

Ganzoni formula : Body weight in kg x (Target Hb – Actual Hb in g/dl) x 2.4

IV Iron solution should be added to maximum 500 ml sterile 0.9% sodium chloride. Doses upto 1000mg must be administer over more than 15 minutes. Doses exceeding 1000 mg must be administer over 30 minutes or more. During administration patient should be observed for adverse effects for at least 30 minutes following injection for severe reactions & complications

Complications:

- **Anaphylactic Reactions:** While rare, anaphylactic reactions can occur in response to parenteral iron administration. These severe allergic reactions demand immediate medical attention and may include symptoms such as difficulty breathing, swelling, and a drop in blood pressure.
- **Iron Overload:** Excessive or rapid administration of parenteral iron may lead to iron overload, a condition where iron accumulates in the body beyond its capacity for utilization. This can result in organ damage, particularly affecting the liver, heart, and pancreas.
- **Infections at the Injection Site:** Infections at the injection site can occur, emphasizing the importance of maintaining sterile conditions during parenteral iron administration. Proper hygiene and aseptic techniques are crucial to prevent this complication.
- **Hypophosphatemia:** Ferric carboxymaltose, in particular, has been associated with transient decreases in serum phosphate levels. Monitoring phosphate levels during and after infusion is essential, especially in patients with underlying phosphate imbalances.
- **Hypotension :** Rapid infusion of parenteral iron, especially with certain formulations, may lead to hypotension or low blood pressure. Administering iron at a controlled rate and monitoring vital signs can help prevent this complication.
- **Delayed Hypersensitivity Reactions:** Some individuals may experience delayed hypersensitivity reactions, presenting as skin rashes or itching. While less common than immediate allergic reactions, these manifestations necessitate careful observation and may require medical attention. Understanding

these potential side effects and complications is crucial for healthcare providers overseeing parenteral iron therapy. Patient education, careful monitoring, and adherence to established protocols can minimize the risks associated with this form of treatment, ensuring its safety and efficacy in addressing iron deficiency anemia.

Conclusion :

In conclusion, the landscape of anemia management has evolved significantly with the integration of parenteral iron therapy.

The incidence of anemia in India remains a pressing concern, intricately woven into the fabric of societal, economic, and individual factors. Parenteral iron therapy stands as a vital tool in addressing this challenge.

As healthcare providers continue to refine their understanding and application of parenteral iron therapy, one aspect remains paramount – the importance of personalized care. Tailoring interventions to individual needs, considering the broader context of health, and ensuring vigilant monitoring are the cornerstones of effective and safe parenteral iron therapy.

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Hemoglobinopathies in India – Obstetrician's Perspective

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Abstract :

Hemoglobinopathies, including thalassemias and sickle cell disease is a group of inherited blood disorders affecting hemoglobin structure and function, pose a significant public health challenge in India, with the highest prevalence globally. In India, where consanguineous marriages are not uncommon, the prevalence of hemoglobinopathies is notably higher. From an obstetric perspective, these disorders present unique challenges to maternal and fetal health throughout pregnancy and childbirth. Antenatal care in hemoglobinopathy-affected pregnancies in India involves a combination of clinical monitoring, specialized fetal imaging, and the administration of appropriate interventions. Challenges such as anemia, increased susceptibility to infections, and the risk of complications during labor necessitate a thorough understanding of the unique healthcare landscape in India

Keywords: Hemoglobinopathies, thalassemia, sickle cell disease, anemia, Fetal health, maternal health.

Introduction

India, a land of diverse landscapes and cultures, also carries a unique burden of genetic disorders. Among these, hemoglobinopathies, primarily beta-thalassemia and sickle cell disease, hold a significant place, impacting millions of lives and posing intricate challenges for obstetricians[1]. Hemoglobinopathies, a group of genetic disorders affecting the structure and production of hemoglobin, pose a significant health challenge in India. As an obstetrician, it is crucial to understand and address the implications of hemoglobinopathies in the context of maternal and fetal health[2]. This article explores the impact of hemoglobinopathies on pregnancy, the challenges faced by pregnant women, and the strategies employed by obstetricians in managing these conditions.

Thalassemias are clinically divided into Thalassemia Major (TM), Thalassemia Intermedia (TI) and Thalassemia Minor or Trait according to severity. Thalassemia Major (TM) and the severe form of Thalassemia Intermedia (TI) constitute the major burden of disease as management of both requires lifelong blood transfusions and iron chelation[3]. While Thalassemia minor is the carrier state in which the person is clinically normal and is commonly referred to as β (beta) Thalassemia Trait (BTT). The thalassemia syndromes (TM, TI) are caused by inheritance of abnormal β thalassemia genes from both carrier parents, or abnormal β Thalassemia gene from one parent and an abnormal variant hemoglobin gene (HbE, HbS) from the other parent[4].

Sickle Cell Disease (SCD) is another hemoglobin disorder that requires lifelong management and contributes to infant and childhood morbidity and mortality. SCD is caused by inheritance of two abnormal HbS genes, one from each parent or Hb S gene from one parent and HbE or β thalassemia gene from the other[5]. Sickle cell syndromes include Sickle Cell Disease (SCD, HbSS), also called Sickle Cell Anemia (SCA), as well as disorders due to sickle cell gene combined with another hemoglobinopathy such as Hb C, E, or β thalassemia. Persons carrying only one of these genes are called 'carriers' as they do not suffer from any disease but carry the abnormal gene and transmit it to the next

generation[6]. Carriers cannot be recognized clinically but only by performing special blood tests. Where both mother and father are 'carriers', there is a chance that their children may inherit the abnormal gene from both parents and thus suffer from a severe thalassemia syndrome or a Sickle Cell syndrome or may be normal without any abnormal gene or carriers like their parents[6].

Epidemiology and Burden

India bears the brunt of the beta-thalassemia burden, accounting for nearly 25% of affected individual's worldwide[7]. Thalassemias and sickle cell disease, the two major categories of hemoglobinopathies, are particularly prevalent in certain states, emphasizing the need for a region-specific approach to management[7]. The carrier rate for beta-thalassemia genes ranges from 2% to 14% across different regions, with states like Punjab, Haryana, and Maharashtra exhibiting exceptionally high prevalence. Sickle cell disease, though less common, affects millions as well, particularly in tribal populations of central India. This high prevalence presents obstetricians with a constant need to be vigilant and knowledgeable about these conditions[8].

It is estimated that about 10000-15000 babies with Thalassemia Major (TM) are born every year. The only cure available for these children with thalassemia major is bone marrow transplantation (BMT) more appropriately called hematopoietic stem cell transplant (HSCT). However, this can help only a few patients because of cost, paucity of BMT centers, or non-availability of a suitable HLA matched donor[9]. Therefore, the mainstay of treatment is a regimen of regular blood transfusions followed by adequately monitored iron chelation therapy to remove the excessive iron overload-as a consequence of the multiple blood transfusions. Thus it is a transfusion dependent disorder and places a great burden on healthcare services[9].

Clinical Manifestations in Pregnancy

Pregnancy, a state of physiological hypervolemia and increased oxygen demand, can exacerbate underlying hemoglobinopathies. Pregnant women with thalassemia intermedia or major may experience anemia, fatigue, dyspnea, bone deformities, and even heart failure[10]. Sickle cell disease can lead to recurrent acute episodes of pain, vaso-occlusive crisis, and potentially life-threatening complications like pre-eclampsia and eclampsia. Early diagnosis and meticulous management become crucial to ensuring maternal and fetal wellbeing[11].

Impact on Pregnancy

Increased Risk of Anemia: Pregnant women with hemoglobinopathies, especially thalassemias, are at an increased risk of developing severe anemia. This can lead to complications such as fatigue, shortness of breath, and an increased risk of preterm birth[12].

Maternal Health Complications: Women with hemoglobinopathies may experience complications such as hypertension and gestational diabetes, which can further complicate the pregnancy. Obstetricians need to closely monitor and manage these conditions to ensure the well-being of both the mother and the baby[13].

Fetal Complications: Fetuses of mothers with hemoglobinopathies may face intrauterine growth restriction and a higher risk of stillbirth. Regular monitoring and early intervention become paramount to mitigate these risks[14].

Management Strategies

Preconception Counseling: Obstetricians play a crucial role in preconception counseling, educating couples about the genetic basis of hemoglobinopathies and the importance of carrier testing before planning a pregnancy[15].

First antenatal visit thalassemia is important. Areas which are endemic screening for all hemoglobinopathies are important by HPLC.

HbE is common in the North Eastern states, and has a carrier frequency as high as 50%, in some areas. It is found in lower frequencies in the Eastern states of West Bengal, Bihar and Uttar Pradesh6.The sickle cell gene is now known to be widespread among people of the Deccan plateau of central India with a smaller focus in the north of Kerala and Tamil Nadu21. In India, the prevalence of Beta thalassemia varies by region, with the highest rates found in the northern states of Punjab, Haryana, and Delhi and the western states of Maharashtra and Gujarat[7].

Early Diagnosis and Screening: Routine screening for hemoglobinopathies during prenatal care is essential. Obstetricians employ advanced diagnostic techniques, including genetic testing, to identify carriers and affected individuals early in the pregnancy[16].

Carrier screening for hemoglobinopathies is done with a blood test. There are two options for how the blood sample is tested:

Hemoglobin electrophoresis— This is a test that looks at the different types of hemoglobin in your blood. It can show if the blood is abnormal.

Molecular genetic testing— This is a test of the genes in your blood. It checks for hemoglobinopathies and many other genetic disorders at the same time. This is also called expanded carrier screening.

Collaboration with Hematology Specialists: Collaborative efforts with hematologists are crucial for managing pregnant women with hemoglobinopathies. Hematology specialists provide expertise in optimizing iron levels, managing blood transfusions, and ensuring proper iron chelation therapy[17].

Fetal Monitoring: Continuous fetal monitoring through ultrasound and other techniques helps obstetricians assess the growth and well-being of the fetus. This allows for timely interventions if any complications are detected[18].

Multidisciplinary Approach: A multidisciplinary approach involving obstetricians, hematologists, genetic counselors, and neonatologists is essential for comprehensive care. This approach ensures that all aspects of maternal and fetal health are addressed[19].

Prenatal Diagnosis and Counseling: Preconception counseling and carrier screening for thalassemia and sickle cell disease are vital measures in preventing the birth of severely affected children. Amniocentesis and chorionic villus sampling can confirm fetal diagnosis in the first or second trimester, allowing couples to make informed decisions. Obstetricians play a key role in guiding couples through this complex process, providing emotional support and accurate information[6].

Management Strategies: The management of hemoglobinopathies in pregnancy requires a multidisciplinary approach involving obstetricians, hematologists, and genetic counselors. Regular blood transfusions, folic acid supplementation, iron chelation therapy for thalassemia, and pain management for sickle cell disease are crucial components of care. Close monitoring of maternal and fetal parameters, timely interventions for complications, and judicious use of blood products are essential for a successful pregnancy outcome[20].

Challenges and Future Directions: Despite significant advancements in diagnosis and management, several challenges remain. Accessibility to specialized care, particularly in rural areas, limited resources, and inadequate awareness about carrier screening pose significant hurdles. The future lies in expanding prenatal screening programs, establishing dedicated thalassemia and sickle cell centers, and promoting research into potential curative therapies like gene therapy. Public education campaigns aimed at increasing awareness and encouraging carrier screening are also crucial in reducing the burden of these diseases.

Conclusion

Hemoglobinopathies pose unique challenges in the field of obstetrics in India. Obstetricians play a pivotal role in the prevention, early diagnosis, and management of these conditions to optimize outcomes for both the mother and the baby. As medical knowledge and technology advance, ongoing research and collaborative efforts will continue to shape the landscape of obstetric care for women affected by hemoglobinopathies in India.

Additional Points to Consider:

- Impact of maternal malnutrition on pregnancy outcomes in women with hemoglobinopathies.
- Psychosocial challenges faced by families affected by hemoglobinopathies.
- Ethical considerations in prenatal diagnosis and reproductive choices.
- Role of non-governmental organizations in providing support and advocacy for affected families.

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Anaemia in Elderly Age Group: A Holistic Approach

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Introduction :

Anaemia affects the size, quantity, and concentration of haemoglobin in erythrocytes, which impairs oxygen and carbon dioxide exchange between blood and tissues. It is more common as people age, with a frequency of almost 17% in the cohort of older adults over 65 years of age (1). WHO criteria for anaemia was established in 1968 and is defined as haemoglobin (Hb) concentration <130 g/L in men, and <120 g/L in women. There is a J-shaped correlation of anaemia with mortality. It is widely acknowledged that anemia has detrimental effects such as diminished physical performance, a rise in falls, frailty, diminished cognitive function, an increase in dementia, a rise in hospitalisation, and an increase in mortality, all been linked to anaemia (2).

Iron, vitamin B12 and folate deficiency are among the curable subgroups of nutritional deficiencies. The prevalence of various causes of anaemia are unexplained anaemia of the elderly (34%–44%); iron deficiency (12%–25%); CKD (4%–8%); MDS (9%–16%); malignant hematologic (e.g., chronic lymphocytic leukemia) disorder (2%); or inflammation (6%–20%) (2).

In a Cohort study by Joosten et al, 732 elderly patients were evaluated and found that the two most common causes of anaemia in the elderly are chronic disease and iron deficiency (3).

Diagnosis & Treatment:

Anaemia is commonly identified when elderly patients are scheduled for elective surgical procedures and is independently associated with increased perioperative mortality. Initial laboratory assessment should include a complete blood count, red blood cell indices, reticulocyte count, and peripheral blood smear in individuals without indications of an underlying illness (Table 1).

Table 1

Test	*Finding*	*Possible aetiology*
Complete blood count		
RBC indices	*MCV < 80 µm3 per cell (80 fL)*	Iron deficiency anaemia
		Anaemia of chronic disease
	MCV > 100 µm3 per cell (100 fL)	Vitamin B12 deficiency; folate deficiency
	MCV normal	Renal, liver and thyroid diseases as well as those above
WBC and platelet counts	*Abnormal*	Primary marrow production problem
Peripheral smear	*Burr cells*	Chronic renal failure
	Spherocytes, fragments	Hemolytic diseases
	Dysplastic changes	Myelodysplasia
Reticulocyte count	*< 1%*	Inadequate production in the presence of anaemia
	≥1%	Increased production but unclear whether it is of appropriate magnitude; reticulocyte index helpful for clarification
Reticulocyte index*	*≥2*	Reticulocyte release appropriate for anaemia
	< 2	Inadequate response to anaemia

Usually, the mean corpuscular volume (MCV) is the initial index and then biochemical analysis. It has been

demonstrated that the red cell distribution width (RDW), which is used to assess macrocytosis, is enhanced by the MCV. MCV, however, is less useful for microcytic anaemias, especially in individuals with comorbidities.

The classical cut-off value of ferritin < 15-20 ng/ml, which defines iron deficiency in young adults is considered too strict in elderly patients. A threshold of at least 45 ng/ml, if not 100 ng/ml for ferritin, could be reasonable, mainly when specific comorbidities occur, like advanced CKD or CHF. Transferrin saturation (TSAT), which reflects circulating iron available for erythropoiesis rather than tissue iron stores like ferritin, has been proven useful (4).

Anaemia of inflammation is often diagnosed when the ferritin level is high (>200 ng/mL) and the transferrin saturation is low (<16%). The TIBC is more than 400 µg per dL (72 µmol/L) in cases of typical iron-deficient anaemia. Because of higher iron reserves and decreased transferrin, an acute-phase reactant in the presence of acute and chronic stress, the TIBC is often below normal in anaemia of chronic illness. The response to an oral iron therapy trial indicates that there is an iron deficit. However, because hepcidin impairs iron absorption from the intestinal tract, a trial of intravenous (IV) iron therapy may be necessary if oral iron therapy fails to produce the desired results.

Evaluation should also consider potential underlying conditions, such as chronic kidney disease (CKD) or occult malignancy. In elderly postmenopausal individuals with absolute iron deficiency, ruling out gastrointestinal pathology, including malignancy, is crucial due to potential chronic blood loss hence, referral to a gastroenterologist is often necessary for further investigation.

Serum creatinine and glomerular filtration rate (GFR) assessment is essential to evaluate for CKD in anaemia cases. The suggested GFR cutoff of <60 mL/min indicates consideration for anaemia secondary to end-stage renal disease (ESRD). Between 30 and 60 mL/min GFR, anaemia may have causes other than ESRD. Precise evaluation and consideration of various causes are vital for effective management and targeted interventions in anaemic individuals.

In patients with anaemia of inflammation or UA, iron treatment is not effective. At this time, measurements of CRP, fibrinogen, erythrocyte sedimentation rate (ESR), IL6 and hepcidin levels (if clinically accessible) may be helpful in addition to clinical examination for inflammatory disorders. If abnormal, management of the underlying condition supplemented with an erythropoiesis-stimulating agent (ESA) may be appropriate for further management. History of alcohol or drug abuse may have MCV >100 by contributing either to poor marrow reserve or folate deficiency in the elderly (2) (5).

Management :

Therapy aims to treat the underlying condition as well as correct anaemia and restore iron reserves. For adults, oral iron supplementation is the first-line treatment. The recommended daily intake of elemental iron is 60–200 mg. Ferrous sulphate, gluconate and fumarate, are the most often used formulas. Thus far, there isn't any convincing proof that one formulation over another has a different influence on haematological effectiveness or adverse effects. However, formulations containing divalent iron, including ferrous sulphate and gluconate, have demonstrated superior absorption. An empty stomach helps the body absorb iron, although iron oral treatment frequently causes dyspepsia and epigastric discomfort. hence patient would prefer to take iron supplements with their major meals. Additional potential side effects of iron oral treatment include diarrhoea, constipation, nausea and vomiting, and melena, which affect 10–40% of individuals. The other strategies to reduce side effects and enhance patient compliance include altering the iron formulation (ferrous gluconate tablets contain less iron), lowering the dose of iron, or using carbonyl iron. Over 1/4 of patients discontinue taking iron therapy, primarily as a result of side effects, which is one of the primary causes of therapy failure. An additional cause for therapy inefficacy might be malabsorption. Helicobacter pylori stomach infection, proton pump inhibitor medication, and gastric hypochloridria leading to atrophic gastritis can result in malabsorption. After the anaemia has been corrected, treatment should be continued for a minimum of two to three months to restore iron storage. Over 100 µg/L of serum ferritin may be regarded as a therapeutic goal. Intravenous iron replacement is appropriate in cases of severe iron insufficiency, erythropoietin administration, poor gastrointestinal iron absorption, intolerance or inadequate compliance to oral medication, and persistent blood loss. The frequently used formulations

include iron sucrose, ferric carboxy-maltose, and iron dextran (6). Oral or parenteral vitamin B12 supplementation is used to treat vitamin B12 deficiency. In patients with CKD, erythropoietin derivatives can be used with iron supplementation (7).

Recombinant human erythropoietin and darbepoetin alfa are commonly used in managing anaemia in chronic kidney disease (CKD), with similar efficacy and side effect profiles. Darbepoetin alfa has a longer half-life, allowing for less frequent dosing compared to erythropoietin. KIDGO guidelines recommend considering erythropoiesis-stimulating agents (ESAs) in non-dialysis CKD patients when haemoglobin drops below 10 g/dl, individualized based on various factors. Regardless of dialysis status, the goal haemoglobin using ESAs in all CKD patients is less than 11.5 g/dL (8). There is no consensus opinion for optimal therapy for UAE as no single targetable deficit has been characterised. Erythropoietin stimulating agents such as epoetin alfa and darbepoetin alfa are used to treat anaemia in patients with chronic kidney disease (CKD), or in patients with nonmyeloid malignancies where anaemia is due to the effect of concomitant myelosuppressive chemotherapy. In a study by Gowanlock et al, erythropoietin was lower in chronic kidney disease, anaemia of chronic disease and anaemia of unknown aetiology by 48%, 46% and 27% after adjusting haemoglobin, eGFR and comorbidities (9).

Blood Transfusion: Transfusion is certainly recommended for symptomatic anaemia and severe anaemia with Hb values less than 6 g/dl as compensatory systems are overwhelmed. Transfusions should not be utilised for mild anaemia with haemoglobin levels above 10 g/dl as it is rarely symptomatic. The risk-to-benefit ratio must be assessed between these, and rather than using a general Hb threshold, this evaluation should be dependent on each person's health situation and anaemia tolerance.

Conclusion :

Anaemia in the elderly population envisages challenges and burden to both the patient and health care worker. Anaemia further adds to the comorbidities of the patient and thus complicating the management. The three most common cause of the anaemia in elderly includes nutritional deficiency, anaemia of chronic diseases, and, unexplained anaemia. They are mainly treated by supplementation with iron, folic acid and vitamin B12 in cases of nutritional deficiencies; erythropoietin and erythropoiesis-stimulating agents in CKD, myelodysplastic syndrome and unexplained anaemia. It is important to recognise anaemia in elderly as it affects the functional decline, morbidity and mortality of the patient.

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Role of Paramedical People in Anemia Free India - An innovative experience

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Introduction

Anaemia is a silent epidemic that adversely affects the health and economic growth of low- and middle-income countries. The physical and cognitive losses due to anaemia cost the developing countries up to 4% loss of GDP. Government of India has been struggling to reduce the prevalence of anaemia since 1970's when the first National Nutritional Anaemia Prophylaxis Programme (NNAPP) was rolled out. It was later replaced by the National Iron Plus Initiative (NIPI) in 2013 and then Anaemia Mukt Bharat programme in 2018. The mainstay of all these programmes was Iron and folic acid supplementation following a life cycle approach. It was provided free of cost. It is more than 50 yrs. but the problem of anaemia remains unabated.

India ranked 170 out of 180 countries with respect to prevalence of anaemia in women as per global nutrition survey in 2016. Despite the roll out of Anaemia Mukt Bharat Programme in 2018 the prevalence of anaemia as per National Family Health Survey NFHS 5 (2019-2021) has increased compared to NFHS 4 across almost all age groups. The reported prevalence as per NFHS 5 in nonpregnant women and pregnant women of reproductive age group is 52.2% and 57.2% respectively and 67.1% in children 6-59 months old.

It is time we pause, and think, are we missing something? Do we need to do some course correction? The fact is if we keep doing the same thing again and again, we are bound to get the same results. The problem of anemia prevention is multidimensional. We need to be more inclusive, think differently and plan different interventions to reach our goal. The AMB programme perse is good but there are issues with the implementation related health care providers, beneficiaries, facilities, and policy. All these years our approach has been top bottom, that is policies are made by the center and disseminated down to the frontline workers. It is time we take a bottom-up approach that is reach out to frontline workers identify the barriers on ground by interacting with them doing focused group discussions (FGDs) and in-depth interviews (IDIs) and train them in quality improvement methodology to analyze and solve their problems by suggesting and implementing change ideas to resolve them. The policies need to be tweaked according to the input received from the ground. Health care providers need to be encouraged to own up the programme rather than feeling forced to implement it. This can be a gamechanger.

Obstetricians and Gynaecologists, paediatricians and neonatologists, medical officers, ANMs and ASHAs are the health care providers (HCP) who meet this vulnerable population frequently and for significantly long periods of time during pregnancy, childbirth, postpartum and childhood. So, both medical and paramedics need to team up to make a difference. The term paramedics generally encompasses nurses, therapists, technicians, and other ancillary personnel like ANMs ASHAs etc. involved in medical care but is frequently applied specifically to highly trained persons who share with physicians the direct responsibility for patient care. Somewhere the focus is lacking, doctors remain preoccupied with other more emergent health related issues and paramedics are usually not entrusted with responsibility and accountability.

Moreover, anaemia is mostly asymptomatic, and it is only when it becomes symptomatic that patient seeks help. Involvement and inclusion of paramedical HCPs in vital in promoting preventing, screening, and treating anaemia to make India Anaemia Mukt. In this chapter

the role of paramedics in making India anaemia mukt will be discussed.

Honing up their knowledge about correct definition of anaemia and adverse effects of anaemia

It is important that each one of us including paramedics is aware of the exact cut off level of Hb for making the diagnosis of anaemia and disseminate the same to all those around us at our workplace and the community we live in. Anaemia is defined as a Hb level of <11 gm/dl in pregnant women and <12 gm/dl in nonpregnant women. Most HCPs get concerned when Hb level is < 10 gm/dl. Levels between 10-12 gm /dl in nonpregnant and between 10-11gm/dl in pregnant women are passed off as normal.

The accurate knowledge of the adverse effects of anaemia on adolescent girls, mothers, newborns, and children is essential for the paramedical persons. They can further disseminate that in community and motivate public to get their haemoglobin tested and take treatment if diagnosed with anaemia. Increase the awareness of beneficiaries on the impact of anaemia and vitamin B12 deficiency on the babies born to anaemic mothers in the form of lower cognitive growth, lower IQ, lower resistance to infections, predisposition to noncommunicable diseases like diabetes mellitus, hypertension, etc later in life. Anaemia also leads to poor school performance and lack of concentration in adolescents. Hence the importance of being anaemia free.

Taking ownership and motivate others for screening and treatment.

As anaemia is mostly asymptomatic, we all need to promote active screening for early diagnosis and treatment. We can start by getting our own Hb tested and if it is < 12 gm% in females and < 14 gm/dl in males, a complete blood count (CBC) with peripheral smear is done and start treatment to make ourselves anaemia mukt. This must be followed by increasing our circle of influence by making our family and extended family anaemia free. Next in line is our workplace, our neighbourhood, our city and so on. It is important to take ownership and passionately expand our circle of influence and onboard more and more champions to spread the movement further. Both medical and paramedical staff need to work as a team for eradication of anaemia

Ensuring all vulnerable groups are tested and treated.

The next important step is to ensure that all our mothers are anaemia free at the time of childbirth. It requires perseverance and persistence by frontline health workers. All HCPs must ensure that the Hb of each pregnant woman is tested at registration antenatal visit and then at 28 weeks and 36 weeks as per the guidelines of Government of India irrespective of whether she is anaemic at registration or not. Any mother found anaemic must have her Hb tested every month to track the improvement till it is > 11 gm/dl. Screening and treating adolescent girls and postnatal mothers are equally important.

The Hb levels of mothers who do not take IFA supplements during antenatal period falls by 2 gm/dl at the time of childbirth. Hence it is essential that all doctors and paramedics be sensitized that all mothers must be advised to take 1 tablet of IFA for 180 days during antenatal and for 180 days in postnatal period. In women who are anaemic instead of one tablet two tablets per day are advised.

Empowerment to provide correct dietary advice.

All paramedics should emphasize on dietary advice to public specifically vulnerable groups not only on diet which is rich in iron but also on the enhancers and inhibitors of iron absorption. It is important to counsel on not to take tea and coffee with food and that taking vitamin rich food like lemon juice amla orange etc can increase iron absorption. They must use every opportunity to discuss about diet with beneficiaries. Lab technicians while doing haemoglobin can talk about this and even hand over pictorial dietary charts with dos and don'ts to those who are detected as anaemics.

Empowerment to provide correct advice on intake of Iron folic acid supplements.

Most of the mothers are prescribed iron and calcium together so the paramedic pharmacist or the nursing officer while dispensing the tablets must use this opportunity to counsel the beneficiary that these tablets must not be taken together as calcium hinders the absorption of iron tablets. Beneficiaries must be counselled to take calcium tablets with food and iron 1-2 hrs after the food.

Empowerment to notice the clinical signs of vitamin B12 deficiency.

All paramedics must be trained to suspect vitamin B12 deficiency in beneficiaries with facial pallor and hyperpigmentation of knuckles. They need to be informed that vit B12 deficiency is common and is an important cause of anaemia especially in the late trimester as the requirement of the foetus markedly increase as the pregnancy advances. They need to know that the source of vit B12 is foods from animal origin hence vegetarians are more prone for this deficiency. Even those from poor socioeconomic status are unable to afford milk and milk products or nonvegetarian food and are at risk of vitamin B12 deficiency They must know that tablets and injections are available to correct this deficiency.

Education regarding counselling for managing side effects of oral iron intake.

All paramedics must be informed that they can encourage beneficiaries to take iron tablets either once a day or on alternate day or twice a week or even once a week in case the beneficiary has side effects like gastritis, constipation etc. They can then gradually increase the dose. It is important that they counsel the beneficiaries on the need for and importance of taking supplements and that iron rich food alone cannot fulfil the increased iron requirement especially during adolescence and pregnancy. They must also know that changing the iron salt can also improve tolerance and that safe parenteral iron therapy is available for those who are unable to tolerate oral preparations.

Empowerment to bust myths.

Through focused group discussions with the frontline workers, we can identify the myths and barriers and provide them with requisite knowledge to handle those. They can be encouraged to identify champions amongst the beneficiaries especially those with good compliance and ask them to share their experiences with those who are afraid of or reluctant to take IFA supplements.

Train all paramedics in the point of care quality improvement methodology

All paramedics must be trained in point of care quality improvement methodology. This is a four-step approach to fix complex problems effectively in the available resources. This includes:

1. Identification and line listing the gaps and barriers, prioritization of problems, making an aim statement and a team to solve the problem.
2. Analysis of the problem by the team and suggestion of change ideas to resolve each reason. Identify outcome measures.
3. Run multiple plan- do- study- and act- (PDSA) cycles to test the change ideas and then based on the results either accept, adapt, or abandon the ides and run the next PDSA cycle.
4. Sustainability or hard wiring the change ideas and monitor the progress by plotting the outcome on times series charts.

With the help of this methodology the frontline health care providers/paramedics will be empowered to identify and solve the barriers at their own level independently.

Conclusion

Any complex problem can be solved by a team approach involving all those who are related to problem both providers and beneficiaries. Paramedics/ frontline health care providers have a vital role to play in making India anaemia free. Government has very good programmes but to make them effective we must follow a combined top-down and bottom-up approach to get more insights from HCPs at ground level on the difficulties they face in implementation of the programme and empower them to fix their own problems. They must be encouraged to track their outcomes measures like proportion of adolescent girls with anaemia, proportion of antenatal mothers with anaemia, proportion of postnatal mothers with anaemia etc at regular intervals and display it in their centre and share it on monthly basis with their MO at PHC. Those with good results must be appreciated and rewarded. This will generate competition and stimulate them to keep their areas free of anaemia and sustain the progress made.

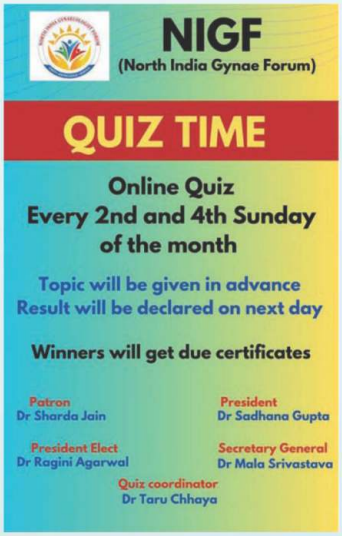
Everyone must be encouraged to start with making themselves anaemia free, then their families, their extended families, workplace, neighbourhood, village/city, and state anaemia free. With passion, patience and perseverance we all can work together and make India anaemia free.

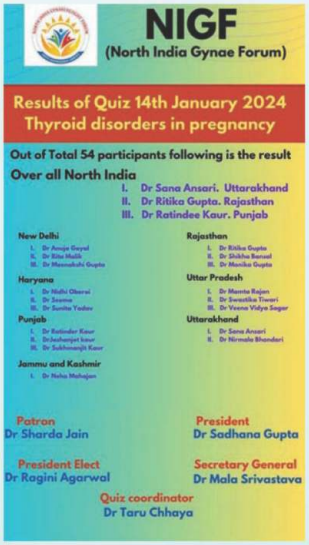
Barriers concerning healthcare providers relate to lack of knowledge, attitude, and priorities. This requires reaching out, interacting, sensitizing, and motivating the ASHAs, ANMs, NOs, MOs, and Specialists.

North India Gynae Forum Quiz – A new Beginning

Dr. Taru Chhaya
Quiz Coordinator

- NIGF has started Quiz on pertinent & common health issues. Our quiz coordinator is Dr Taru Chhaya along with her team Dr Pooja Dadwal, Dr Ridhi Kathuria, Dr Mandeep Kaur on every 2nd & 4th Sunday of the month.
- Our first quiz was floated on 14 January on Thyroid Disorders in Pregnancy. First best markers were given winner certificate.





NIGF Quiz on Thyroid Disorders In Pregnancy

1. Hyperthyroidism in pregnancy accounts for...which statement is true
   A. Need not to treat severe Hyperthyroidism during pregnancy
   B. Graves' disease does not affect a baby's thyroid
   C. antithyroid medicine should be stopped if patient develops jaundice, dull pain in your abdomen, constant sore throat
   D. Antithyroid medicine, methimazole is easier to take during first trimester and has fewer side effects
2. Which statement of the following is not correct
   A. Thyroid hormones are crucial for normal development of your baby's brain and nervous system.
   B. Two pregnancy-related hormones—human chorionic gonadotropin (hCG) and estrogen—cause higher measured thyroid hormone levels in your blood.
   C. The thyroid shrinks slightly in healthy women during pregnancy
   D. Thyroid problems can be hard to diagnose in pregnancy due to higher levels of thyroid hormones and other symptoms that occur in both pregnancy and thyroid disorders.
3. Untreated hyperthyroidism during pregnancy can lead to one of the following except
   A. Polyhydramnios
   B. Miscarriage
   C. Still birth
   D. IUGR
4. In OPD a patient is seen with enlarged Thyroid gland during first trimester of pregnancy with resting pulse rate 110/mt.. ... Which test will you perform?
   A. Serum free T3 levels
   B. Serum TSH levels
   C. Iodine uptake test
   D. Sonography Thyroid
5. Which statement is correct about Gestational Transient Hyperthyroidism .....

A. Presence of serum markers of Thyroid autoimmunity

B. Occurs due to excessive production of HCG in H.Mole, Twin pregnancy, H.Gravidarum

C. Active management of the condition is required

D. None of the above

6. According to recent American Thyroid Association (ATA) guidelines, the recommended reference ranges for TSH are (0.1-2.5) mIU/L in the first trimester,.(0.2- 3.0) mIU/L the second trimester, and (0.3-3.0) mIU/L in the third trimester. True or False

7. All of the following is true except one

A. Maternal T3, T4, TSH, TRH, Iodine, Thyroid stimulating Immunoglobins cross the placenta readily.

B. T3 is the active hormone interacting with the nuclear receptors and regulating gene expression.T4 is predominantly a prohormoneas a precurser of T3 in tissues.

C. In Fetal brain T4 and T3 are low before the onset of fetal thyroid function.

D. Maternal Thyroid Hormones are crucial for key maturational processes during early brain development of fetus.

8. Hashimoto"s disease occurs in 2 to 3 out of every 100 pregnancies. Hashimoto's disease is a pregnancy induced disorder. In Hashimoto's disease pregnancy stimulates the immune system to make antibodies that attack the thyroid, causing inflammation and damage that make it less able to make thyroid hormones. True or False

9. Which of the following is incorrect

A. It is safe to breastfeed while taking beta-blockers, thyroid hormone, or antithyroid medicines?

B. Postpartum thyroiditis is an autoimmune condition similar to Hashimoto's disease.

C. More iodine is required during pregnancy—about 450 micrograms a day. Good sources of iodine are dairy foods, seafood, eggs, meat, poultry, and iodized salt—salt with added iodine.

D. Levothyroxin is the drug of choice for hypothyroidism during pregnancy.

10. Serum Free T4 and TSH level should be first measured after 3 months of pregnancy. The overall purpose is acquiring and keeping normal free T4 and TSH values throughout pregnancy and for achieving this, levothyroxine treatment should be titrated to achieve a serum TSH value of less than 2.5 mIU/L. The statement is true or false

Check your correct answers

1. C	2. C	3. A	4. B
5. B	6. True	7. A	8. False
9. C	10. False		

> A healthy outside starts from the inside.
>
> **- Robert Urich**

NIGF Activities Oct. 2023 to Jan. 2024

Kanoon ki Pathshala

- NIGF Kannon ki Pathshala every month is open on Virtual Platform, hearty Congratulations to Dr. Sangita Gupta & Key faculties – Dr. Sangita Gupta, Dr. Ashok Chanana, Dr. Richa Sharma, Dr. Sadhana Gupta, Dr. Babita Shukla, Dr. Gaurav Agrawal, Dr. Getendra Sharma, Dr. MC Patel, Dr. Raj Bokaria, Dr. Sharda Jain Is guiding force behind it.
- Successfully accomplished all 5 series with great audience – 1 What is considered as negligence 2. Consent 3. How to respond to legal notice 4. MTP 5 Birth Injuries
- Recording link of all program is available on NIGF face book page

NIGF Haryana Chapter Webinar 20 Oct 2023

- Hearty congratulations Dr Ruby Bhatia, Dr. Meenakshi for 2 academia series on HDP by Haryana chapter of NIGF. Excellent Academic Program on Hypertensive Disorders in Pregnancy & Prevention of Birth Defect

Punjab Chapter NIGF 6 Dec.

- The inaugural webinar of Punjab Chapter NIGF was held on 6th December 2023 on Diabetes in Pregnancy. The chief guests for the occasion were respected Dr Sharda Jain and Dr Sadhana Gupta. Guest of honour Dr Amrit Pal Kaur. The speakers were Dr Manjit Mohi who gave a lecture on Antenatal screening of Diabetes and Dr Ragini Aggarwal who spoke on Medical Nutritional Therapy. The panel on Hyperglycemia in Pregnancy was moderated by Dr Suparna Grover with Dr Seema Bhatti, Dr Parneet Kaur, Dr Poonam Goyal, Dr. Nishi Garg and Dr Vineeta Munjal as our esteemed panelists. The webinar was attended by around 70 participants and was well appreciated.

  Convenor for the virtual academic program was **Dr. Kavita M Bhatti.**

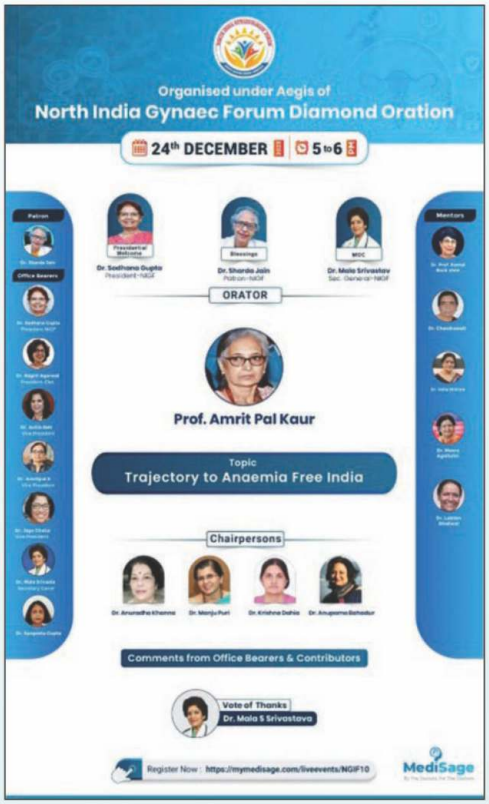
  Dr Madhu Nagpal, President, Punjab Chapter NIGF

  Dr. Sushma Chawla, Vice President, Punjab Chapter NIGF

  Dr. Kavita M. Bhatti, Secretary, Punjab Chapter NIGF

Diamond Oration 24 Dec.

- Classic & classy oration by Prof Amrit Pal Kaur, pearls of wisdom from chair persons & leaders, let's pledge for Anemia Free India



SOCIAL ACTIVITIES

Cervical cancer screening camp with free paps smear was held at Pathankot by CMC Hospital Ludhiana in association with Rotary Club Pathankot under the aegis of NIGF on 21/1/24. Thankful to CMC authorities and Rotary club Pathankot for the promotion of cervical cancer screening program. Dr. Kavita M. Bhatti Professor & Head, Department of OBGYN, CMC Hospital, Ludhiana

Education on menstrual health and hygiene with distribution of sanitary pad to rural ladies of alwar by Dr. Monika Gupta, Secretary Rajasthan NIGF Chapter

SOCIAL ACTIVITIES

Dr. Hema Jai Shobhane, Secretory UP Chapter of NIGF, organized Social & Academic Program at MLB Medical College Jhansi, with Dignitaries & large attendance. The event was highlighted by media.

Dr. Deepti Chaturvedi is doing great work on prevention of women cancer & sensitizing people & doctors through community & academic work.

भगवान श्रीराम की जन्मभूमि अयोध्या धाम में

भव्य मंदिर का लोकार्पण और जगत के पालनहार

प्रभु श्रीराम जी के **प्रतिमा की नवीन विग्रह प्राण प्रतिष्ठा**

एवं

गणतंत्र दिवस

की

हार्दिक शुभकामनाएं