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Key Words

Anaemia, iron deficiency anaemia (IDA), children, iron deficiency, clinical spectrum

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Received: 20 November 2023

Accepted: 1 January 2024

Published: 10 January 2024

Citation: Bhupender Singh, S.N. Panda, Ankit Kumar and Ajay Bajpai, 2024. Clinical Spectrum of Iron Deficiency Anaemia in Children between 6 Months to 5 Years of Age. Int. J. Trop. Med., 19: 45-49, doi:10.59218/makijtm.2024.1.45.49

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Clinical Spectrum of Iron Deficiency Anaemia in Children between 6 Months to 5 Years of Age

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ABSTRACT

Anemia especially Iron deficiency (IDA) anemia has significant impact in the development children. There is paucity of data on clinical spectrum of IDA of children of age group 6 months to 5 years. Hence this study was planned to analyze the clinical spectrum of iron deficiency anaemia in children between 6 months to 5 years of age. A cross sectional study was conducted with a total of 421 patients between 6 months to 5 years of age at a tertiary care hospital of central India who were diagnosed as having anaemia due to iron deficiency. All subjects were subjected to a detailed clinical history and necessary laboratory investigation. We found that anemia was prevalent in 72.5% of the total hospital admissions with IDA being the commonest anemia in 70% cases. The age group most commonly affected by IDA was 6 months to 1 year. Moderate anemia was prevalent amongst 60% of the cases. Most common presentation was respiratory symptoms like cough and nasal obstruction amongst 41% of the cases followed by Gastrointestinal symptoms. Fatigue and pallor were the prominent features of severe anemia of age group 6 months to 5 years. Iron deficiency anaemia was more prevalent in children less than 1 year of age and affected males more than females. Most of the children had moderate anaemia and presented with respiratory symptoms followed by GI symptoms. Fatigue, irritability, loss of appetite and pica were associated with severe IDA. Laboratory investigations revealed decreased serum ferritin and serum iron. Hence there is need of early

INTRODUCTION

Anaemia is defined as a haemoglobin concentration more than two standard deviations below the reference mean value for child's age and sex. Iron deficiency Anaemia (IDA) develops when body iron is not able to meet the normal red blood cell production. WHO has defined cut off for anaemia for children of age group of 6 months to 5 years as less than 11 g dL^{-1} ^[1]. The cut off of IDA for ferritin level for this age group is $<12 \text{ mg L}^{-1}$. The highest prevalence of IDA is found in children younger than 5 years of age. In developing countries like India, the prevalence of IDA amongst children of age group 0-4 years is 47.4%^[2].

Healthy infants have enough body iron for the first 5-6 months of life^[3]. As the age progress there is rise in the prevalence of IDA. The cause of IDA is multifactorial. At birth maternal iron deficiency, prematurity, administration of erythropoietin for anaemia of prematurity, foetal-maternal haemorrhage, twin-twin transfusion syndrome, other perinatal haemorrhagic events, and insufficient intake of dietary iron during early infancy are the cause of IDA. It is a well-known fact that delayed clamping of the umbilical cord (approximately 120-180 seconds after delivery) can improve the amount of iron and significantly reduce the risk of IDA in future^[4]. In developing countries like India the dietary factors like poor iron intake, decreased iron absorption, consumption of unmodified cow's milk before 12 months of age, and occult intestinal blood loss due to cow's milk protein-induced colitis are the prominent cause of IDA^[5]. Gastrointestinal malabsorption of iron occurs in diseases like celiac disease, Crohn disease, giardiasis, resection of the proximal small intestine, PICA Chronic diarrhoea. Conditions that cause gastrointestinal blood loss like inflammatory bowel disease, duodenal or gastric ulcers, and chronic use of nonsteroidal anti-inflammatory drugs or aspirin are also associated with iron deficiency in post infancy period.

IDA has significant impact on the develop of children especially the growing age group of 06 month to 5 years. Apart from symptoms of anaemia like easy fatigability, neuro-cognitive disorders due to decreased expression of dopamine receptors, disrupted myelinization or disrupted the function of various enzymes involved in the nerve tissue are also associated with IDA^[6]. Also there is a strong correlation of febrile convulsions with IDA^[7].

Keeping in view of the strong impact of IDA in development of children and paucity of data on clinical spectrum of IDA among children of age group 6m to 5 years this study was carried out to find out the clinical spectrum of iron deficiency anaemia in children of this age group. Hence this study was undertaken with the objectives to estimate the incidence, Clinical spectrum of IDA, to study the correlation of birth weight and anaemia and to correlate the laboratory findings with severity of anaemia.

MATERIALS AND METHODS

This was a cross sectional study done for a period of 1 ½ years between January 2021 and May 2022. 830 children between ages of 6 months to 5 years who were admitted to department of Pediatrics, of tertiary care hospital in central India were screened for anaemia. Among these children 602 were found to be anemic ($\text{Hb} < 11 \text{ g dL}^{-1}$) who were then further screened for iron deficiency anaemia (serum ferritin and serum iron levels estimated). Among these 602 children, 421 children with serum ferritin $< 12 \text{ } \mu\text{g dL}^{-1}$ and serum iron $< 40 \text{ } \mu\text{g dL}^{-1}$ were taken up for the study.

The Children of age less than 6 months of age and more than 5 years of age, those with hemolytic anaemia, bleeding diathesis, aplastic anaemia, anaemia secondary to leukemia and anaemia due to malaria were excluded from the study. All the patients were evaluated using detailed history, clinical examination and laboratory investigations and recorded on a predetermined proforma.

Statistical analysis: At the end of the study data was analyzed using standard statistical analysis like percentage for categorical variables. Chi square test and p value was applied to test the significant difference. Due Institutional ethical clearance was taken prior to starting the study and written informed consent of the NOK/parents was also taken before enrolling patients for the study.

RESULTS

A total of 830 children admitted in Pediatric ward of a tertiary care hospital of central India were screened for anaemia and 72.5% of the children had $\text{Hb} < 11 \text{ g dL}^{-1}$. Out of these 421 (70%) of them had iron deficiency anaemia (serum ferritin and serum iron levels estimated) (Table 1). A total of 421 children between 6 months to 5 years of age were included in the study. They were divided into three groups based on their age (6mon-1yr, 1yr-3yrs, 3yrs-5yrs). Maximum number of children were in the 6 months to 1-year age group (42%) (Table 2). There was a slight male predominance (52% v/s 48%) but it was not statistically significant (Table 3). Table D shows number of cases according to severity of anaemia. 252 children had moderate anaemia while only 13 of them had severe anaemia. Presenting symptoms in children were gastro-intestinal disturbances like vomiting, diarrhea and abdominal pain (20%), cough and nasal obstruction in 41% of them, irritability in 14% and fever in 9% (Table 4). Table 5 shows 295 children had normal weight at birth and only 126 of them had low birth weight.

In children with mild to moderate anaemia fatigue, pallor and loss of appetite were the most common signs and symptoms. In children with severe anaemia tachycardia, breathlessness and malnutrition was seen

Table 1: Proportion of anaemia among screened children

	No. of cases	Percentage
Patients screened for anaemia	830	100
Patients with Hb <11g dL ⁻¹	602 out of 830	72.5
Patients with S. ferritin <12 µg dL ⁻¹ and S. iron <40 µg dL ⁻¹	421 out of 602	70

Table 2: Distribution of cases according to age groups

Age	No. of cases	Percentage
6month-1yr	178	42
1yr-3yrs	146	35
3yrs-5yrs	97	23
Total	421	100

Table 3: Distribution of cases according to gender

Age groups	Male		Female		Total
	No. of cases	Percentage	No. of cases	Percentage	
6month-1yr	95	53.3	83	46.7	178
1yr-3yrs	74	50.7	72	49.3	146
3-5yrs	50	51.5	47	48.5	97
Total	219	52	202	48	421

Chi square = 0.2 p value = 0.8 (p>0.05, not significant)

Table 4: Distribution of cases according to severity of anaemia

Severity of anaemia	No. of cases	Percentage
Mild Anaemia (Hb 10-10.9g dL ⁻¹)	156	37
Moderate anaemia (Hb 7-9.9g dL ⁻¹)	252	60
Severe anaemia (Hb <7g dL ⁻¹)	13	3
Total	421	100

Table 5: Distribution of cases according to presenting complaints

Presenting complaints	No. of cases	Percentage
Respiratory symptoms (cough, nasal obstruction)	173	41
Gastrointestinal symptoms (vomiting, diarrhoea, abdominal pain)	84	20
Symptoms of anaemia (Pallor, irritability, pica)	59	14
Urinary tract infection	29	7
Fever	38	9
Rash	13	3
Seizure	21	5
Bleeding (epistaxis, melena, hematuria)	4	1

Table 6: Distribution of cases according to birth weight

Birth weight	No. of cases	Percentage
Normal	295	70
Low (<2.5kg)	126	30

Table 7: Distribution of cases according to signs and symptoms

Signs and symptoms	Mild anaemia		Moderate anaemia		Severe anaemia	
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Fatigue	39	25	91	36	9	69
Pallor	16	10	86	34	8	61
Irritability	23	15	50	20	7	50
Loss of appetite	47	30	101	40	11	82
Pica	12	8	28	11	4	30
Breathless-ness	5	3	15	6	10	75
Hepato- megaly	3	2	5	2	4	32
Tachy- cardia	8	5	38	15	9	68
Mal- nutrition	78	50	151	60	13	100

Table 8: Mean hematological values in children with iron deficiency anaemia

Type of anaemia	Hemoglobin (g dL ⁻¹)	Serum ferritin (µg dL ⁻¹)	Serum iron (µg dL ⁻¹)	Total iron binding capacity (µg dL ⁻¹)	Mean corpuscular Volume (fl)	Iron saturation (%)
Mild	10.4	11.7	37.3	405.7	68.6	9
Moderate	8.5	10.2	35.9	423.1	60.4	8.2
Severe	6.2	9.832.6	450.5	55.2	7.5	

(Table 6). In all cases Hb was $<11\text{g dL}^{-1}$ with a mean value of 6.2 dL^{-1} in patients with severe anaemia. MCV was reduced in all types of anaemia. Serum ferritin, serum iron and iron saturation were all reduced and the mean values are depicted in (Table 7 and 8).

DISCUSSIONS

Iron deficiency anaemia is most common worldwide and an important public health problem, especially in developing countries. Appropriate screening and subsequent diagnostic testing must be done to prevent complication of anaemia at level of primary care itself.

In the present study out of 830 children, 602 (72.5%) were found to be anemic. These children further underwent investigations for estimation of levels of serum ferritin and serum iron. The occurrence of iron deficiency anaemia was in 421 children (70%) which is similarly to a study by Behera *et al.*^[8] where they found Anemia amongst 62% of the children (N = 313 children). Number of male children affected were more than number of female children (52% v/s 48%) in our study. The difference between frequency of anaemia among male and female children was non-significant ($p = 0.20$). These figures are almost similar to a study conducted by Saba *et al.*^[9]. However, in a study by Maria *et al.*^[10] prevalence of Anemia in males was slightly lesser (48.3%) when compared to that of females (51.7%).

We found that children in the age group of 6 months to 1 year were the most affected (178 out of 421) followed by 146 children in the age group of 3-5 years. Kotecha *et al.*^[11] found anaemia prevalence in Vadodara to be 91% amongst children under 3 years of age, however they have not specifically subdivided further into further subgroups. Our study depicts that most children suffered from moderate anaemia (60%) and only 3% of them had severe anaemia which was consistent with study by Eun Young *et al.*^[12] and found the proportion of mild, moderate and severe anaemia to be 36.9%, 59.3-3.8% respectively amongst infants and toddlers.

Presenting symptoms of majority of children were not typical of anaemia. In our study majority of children complained of cough, vomiting and diarrhea which was not the case in the study by Madhusudan *et al.* where majority of children with anaemia presented with gastrointestinal disturbances (54%)^[13]. Only 14% of them had symptoms of anaemia like pallor, irritability and PICA. A study by Amieeleena showed that all cases that presented with pica had iron deficiency anaemia^[14], 9% of the children presented with fever and 5% of them with seizure which was consistent with our study.

Low birth weight infants (especially preterm) are a high-risk group for iron deficiency anaemia due to low iron stores at birth. These infants should receive iron supplements of $2\text{mg kg}^{-1}\text{ day}$ from 1 month 12 months of age^[15]. In our study 30% of the children had low birth weight. Hence the higher prevalence of anemia.

In the present study, pallor and fatigue were the most common signs and symptoms as found by Sreenivas *et al.*^[16] Other rare features like fever and hepatomegaly was also found as Calis *et al.*^[17] found in their study. Under iron deficiency conditions, formation of hemoglobin is reduced resulting in reduction of mean cell hemoglobin. In the present study the mean hemoglobin in patients with severe anaemia was 6.2 g dL^{-1} . Study by Nodoshan *et al.*^[18] showed that children from 6-60 months of age who were having malnutrition had significantly low Hb, MCV and MCH.

The serum ferritin level is the best indicator of the iron stores in the body and the first biochemical variable to change in iron deficiency. A serum ferritin level below $10\text{-}12\text{ }\mu\text{g L}^{-1}$ strongly supports iron deficiency. Total iron binding capacity increased as serum iron decreases. The value obtained by dividing the serum iron value to total iron binding capacity shows transferrin saturation and is reduced in iron deficiency^[19]. In our study serum ferritin and serum iron levels were below normal whereas total iron binding capacity was more than $400\text{ }\mu\text{g dL}^{-1}$. Ferritin level was below normal in 83.4% of children in a study conducted by Mirza *et al.*^[20] which also the case in our study.

CONCLUSION

We found that anemia was prevalent in 72.5% of the total hospital admissions with IDA being the commonest anemia in 70 % cases. The age group most commonly affected by IDA was 6 months to 1 year. Moderate anemia was prevalent amongst 60% of the cases the most common presentation was respiratory symptoms like cough and nasal obstruction amongst 41% of the cases followed by Gastrointestinal symptoms which was different from the classical signs and symptoms of anemia. Malnutrition. Low birth weight was evident in cases of severe anaemia. Fatigue and pallor were the prominent features of severe anemia of age group 6 months to 5 years.

Implication of the study: The study emphasizes on the high prevalence of anemia and IDA amongst children of age group 6 months to 5 years especially 6 months to 1 year with varied presentation. And accidental detection of IDA. Hence there is need to address

the problem of anemia especially IDA by early identification, diagnosis and early management through proper supplements of IDA to ensure good neurocognitive development and growth of the children of this age group.

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