



A STUDY OF ANEMIA IN HOSPITALISED INFANTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Anemia is a significant public health problem that occurs worldwide with higher prevalence noted in children less than 3 years. Objective of the study was to determine the occurrence, pattern and severity of anemia among hospitalized infants and the risk factors for development of anemia.

Methods: This is a prospective study of hospitalized infants between 6-12 months of age admitted at a tertiary care teaching hospital, Mangalore, Karnataka. between December 2013 to November 2014.

Results: Out of total 260 admissions during the study period 147 (56%) infants were found to be anemic with the mean age group of 9.6 months and majority of them (66%) were admitted for Respiratory tract infections. Preterm delivery was seen 34.7% of cases, maternal anemia 55.8% , low SES in 60% , not exclusively breast fed in 78.2% , cow's milk in 76.2%, top up formula feed in 59.9%, improper weaning in 51%, LBW in 40%. 39% of infants had PEM. 52% of infants had moderate to severe anemia . 69.4% had microcytic and hypochromic anaemia.

Conclusion: The Prevalence of anemia was 56% in the current study with more than 69% of anemic infants having microcytic hypochromic anaemia suggesting iron deficiency still as the major cause for nutritional anemia in infants. Improper Weaning techniques, Consumption of cow's milk, top-up formula feeding, Pre-term Gestation and low birth weight are important Risk factors Associated with development of Moderate to Severe Anemia in infants as noted in our study.

Key words: anemia, infants, risk factors, weaning technique, iron deficiency

INTRODUCTION

Anemia is a significant public health problem that occurs worldwide in both developed and developing countries. The WHO Global Database on Anemia for 1993–2005, estimated the prevalence of anemia worldwide at 25 % with higher percentage noted in developing countries

(43%)¹. In absolute numbers anemia affects 293 million children, out of which 89 million live in India. India is one of the countries with very high prevalence of nutritional anemia in the world (1). According to NFHS-3 data, 79% of infants in the age group between 6-35 months of age are anemic in India. ²

Causes of anemia vary by age. During infancy it is due to increased iron requirements related to rapid growth and development but other factors such as preterm delivery, low birth weight, faulty feeding techniques, not starting right type of complementary food at the right time and failure of exclusive breast feeding. In India weaning food is predominantly cereal based which is a poor resource of iron and not including pulses/vegetables/fruits for a prolonged period can lead to iron deficiency.

Most infants with anemia are asymptomatic but they can have nonspecific symptoms like irritability and anorexia. Further, anemia in infancy and early childhood is associated with behavioral and cognitive delays, including impaired learning, decreased social achievement, and lower scores on tests of mental and motor development. The Neurological complications once established are irreversible. The sparse literature available regarding anemia in hospitalized children necessitated the need for the present study and early screening and detection of anemia will in turn help in early and better management. The present study was undertaken with an aim to find the occurrence of anemia, the patterns of anemia, its distribution in different age groups distribution in sex, feeding history, nutritional history, and its severity among the hospitalized children aged 6 months-12 months.

METHODS

The present prospective, hospital based study was carried out in the Department of Pediatrics of Yenepoya Medical College hospital; a tertiary health care referral centre in Mangalore, Karnataka over a period of 1 year from December 2013 to November 2014. All the infants between 6 months - 12 months, who were hospitalized for any other illness but found to have anemia on routine blood investigations (complete hemogram) were included in the study and further investigations were carried out to ascertain the cause of the anemia. Infants who were known cases of Thalassemia, bleeding disorders and who had h/o blood transfusions were excluded from the study. Age, sex, birth weight, maternal anemia, h/o preterm delivery, h/o blood loss during delivery, h/o exclusive breast feeding, weaning history, h/o cow's milk supplementation, h/o giving top feeds (formula) and the current diagnosis for which the infant was admitted were noted down in the predesigned Performa along with relevant clinical examination find-

ings. Two ml of venous blood anti-coagulated with EDTA was collected from the infants and various hematological parameters were studied. These included hemoglobin, total and differential counts, platelet count, red cell indices like PCV, MCV, MCH, MCHC were estimated using automated cell counter method using SYSMEX KX-21 automated hematology analyser B2584 08/2007 Japan. Peripheral blood smears were prepared using Leishman stain and the results were interpreted and certified by a Pathologist. The WHO criterion (hemoglobin < 11 g/dL) was used to diagnose anemia³. To categorize the degree of anemia, the following cut-off points were used: 10.0-10.9 g/dL - mild anemia; 7.0-9.9 g/dl - moderate anemia; < 7 g/dl - severe anemia. Ethical clearance was taken as per the norms of the hospital and an informed consent was taken from the parents/guardian of the children. Data statistically analyzed using statistical tools like SPSS version 20 and Chi-square test was applied to test the association of the various variables to the severity of Anemia. To compare between the variables p value < 0.050 was considered as significance level.

RESULTS

A total of 260 infants of age group 6m- 12 m were admitted during the study period, among which 147 infants were selected who fulfilled the inclusion criteria. Among the study group, there were 27 (18%) males and 120 (81%) females. The mean age was 9.6 months. Out of 147 infants who were included in the study 66% were diagnosed to have respiratory tract infections, 17% with acute gastro enteritis and the other 17% with global developmental delay, UTI, pyoderma. 40% (59 infants) were born with low birth weight. Lowest birth weight noted was 1.7kg and the mean birth weight was 2.46kg. 34.7% (51 infants) had a history of prematurity. 42.9% (63 infants) were born through caesarian section. 55.8% (82 cases) had a history of maternal anemia during pregnancy. 9.5% (14 infants) had h/o maternal blood loss during labour. 50.3% (74 infants) hailed from nuclear families, while 49.7% (73 infants) hailed from joint families. 21.8% (32 cases) gave history of exclusive breast feeding till 6 months of age. 76.2% (112 infants/147 infants) had history of cow's milk supplementation starting at 2-3 months of age and 59.9% (88/147 infants) had history of top up feed diet like commercially available baby formulae, which was started at an average age of 2-3. 3% of

the infants had a history of worm infestation Table 1 shows frequency of risk factors present in the study group.

Improper weaning technique was observed in 51% of cases. Common faulty technique noted were late weaning which is seen in 25% of cases, prolonged cereal based weaning technique in 18% and usage of commercially available weaning food in 8%.

Only 4-5% infants had inclusion of non-vegetarian diet (chicken/ fish, mixed with rice/pulses) before 12 m of age. Most of the weaning foods observed were rice products (predominantly cereal based for a prolonged period, from which the iron absorption is only 5%). Overall weaning food given to infants was deficient in iron.

39% of infants had PEM. 16% of each having grade 1 and grade 2 PEM. Grade 3 PEM is observed in 7% but there was no case of grade 4 PEM according to IAP classification. Clinical signs of pallor was present in 56% of cases.

Mean hb calculated was 9.61gm/dl, the lowest value being 4.6gm/dl .Mild anemia according to WHO classification was seen in 48% and moderate anemia in 49% and severe anemia was noted only in 3% of cases.

Microcytic hypochromic anemia was observed in majority of cases (69.4%) of cases followed by normocytic normochromic anemia in 27.2% of cases. Dimorphic anemia was seen in only 3.4% of cases. Table 2 shows the hematological parameters noted in infants with anemia.

On comparison between preterm and term babies, moderate and severe degree of anaemia was seen more commonly in preterm babies(66%) where as only 22% of term babies had severe anaemia which was statistically significant. Similarly majority of low birth weight babies(75%) when compared to normal birth weight babies(35%) had severe anaemia. Similar results were seen in cow's milk and top up formula fed group with severe anaemia noted in 60.5% and 60% respectively. Improper weaning also contributed as one of important risk factor for the development of severe anaemia with more than 75% of babies with improper weaning having moderate to severe anaemia . Only 16% with proper weaning technique were detected with severe anaemia.

So, improper Weaning techniques, consumption of cow's milk , top-up formula feeding , pre-term

Gestation and low birth weight are important risk factors associated with development of Moderate to Severe Anemia in infants as noted in our study. Table 3 shows the association between the severity of anemia and the risk factors.

Table 1: The frequency of the Variables Present in Infants with Anaemia.

Variables	Frequency (%)
Pre-term	51 (34.7%)
Maternal anemia	82 (55.8%)
Low socio economic strata	88 (60%)
Not exclusively breast-fed	115(78.2%)
Cows milk given	112(76.2%)
Top up feeds given	88(59.9%)
Improper weaning	75 (51%)
Perinatal blood loss	14 (9.5%)
Low birth weight	59 (40%)

Table 2: Haematological parameters (n=147)

Parameter	Minimum	Maximum	Mean ±SD
Hb	4.60	10.90	9.61 ± 1.26
PCV	19.90	45.10	30.08 ± 3.61
RBC	2.46	5.90	4.33 ± .57
MCV	20.00	101.00	68.33 ± 12.94
MCH	12.80	35.70	23.68 ± 4.18
MCHC	23.10	35.90	32.48 ± 2.61
Platelet	1.35	6.28	1.87 ± 0.69

Table 3: The association between the severity of anaemia and risk factors

Variable	Mild	Moderate	Severe	P-value
Term				
Preterm	17(33.5%)	31 (60.7%)	3 (5.8%)	<0.001
Full term	75(78%)	20(21%)	1(1%)	
Birth weight				
LBW	15 (25%)	42 (70%)	3 (5%)	<0.001
NBW	56(64.3%)	29 (33%)	2 (2.3%)	
Cows milk				
Given	44 (40%)	63 (56%)	5 (4.5%)	<0.001
Not given	27(77.1%)	8 (23%)	0 (0%)	
Weaning				
Improper	9 (24.3%)	24 (65%)	4(10.9%)	<0.001
Proper	92(83%)	17(15%)	1 (0.9%)	
Top up formula				
Given	35 (40%)	49 (55.6%)	4 (4.5%)	<0.05
Not given	36(61.3%)	22 (37.2%)	1 (1.7%)	

Footnote- For calculating chi-square test and p values moderate and severe category values are clubbed together (mild vs moderate+severe compared in term and preterm babies.)

DISCUSSION

Out of the 260 infants who were admitted in our hospital during the study period more than 50%

(147) of them were found to be anemic. Saba F et al had conducted a study in children between 6 months to 12 years at Bangalore, Karnataka and found out that children between 6 Months between to 1 year was the most affected group with anemia(33%)⁴. Similarly in a study done by F Akin et al. in Turkey it was found that Hb and Hct of the patients >24 months were significantly higher than those of the patients with the age of 6-12 months making this age group most vulnerable for the development of anemia⁵. In contrast to our study where female sex is dominant among anemic infants (81%), there was no difference noted between the gender with anemia affecting 55.4% of boys and 58.8% of girls in study done by Dos santhos et al⁶. This may be due to the fact that the studies were done in two different countries.

The relationship between anemia and infection remains controversial. However, it is generally accepted that excess or deficiency of iron result in changes in immune response.⁶Anemia to a certain extent, is associated with the reason for hospitalization. Anemia is most common in children suffering from respiratory tract diseases, followed by gastrointestinal diseases Respiratory tract diseases possibly require greater utilization of hemoglobin both due to the infectious process and increased respiratory effort, whereas gastrointestinal diseases lead to blood loss in feces and vomit or by degradation by parasites⁶. Lima et al. reported a higher prevalence of anemia in infants with infectious diarrhea. Where as in our study respiratory tract infections was found to be predominant (66%)⁷. Ramkrishna K et al studied Hemoglobin Level as a risk Factor for Lower Respiratory Tract Infections and concluded that anemic children were 5.75 times more susceptible to LRTI compared to the control group. Prevention of anemia due to whatever etiology will reduce the incidence of LRTI⁸.

Zlotkin s also mentions that occurrence of anemia is dependent on time and type of complementary feeds given and frequency of infections apart from other factors⁹. The choice of complementary foods at this stage will markedly influence the risk of iron deficiency and anemia. Unfortunately, typical grain-based complementary foods are poor sources of iron and contain phytic acid, which is a potent inhibitor of iron absorption. For example, per 100 g, rice-based complementary foods contain 1 mg of iron and maize and wheat-based complementary foods contain 0.8 mg of iron. Though iron deficiency continue to be the important cause of nutritional anemia

the incidence of anemia due to vitamin b12 is also increasing.¹⁰

IAP recommendations on infant and young child feeding guidelines advises balanced diet consisting of various food groups in different combinations for complementary feeding like seasonal fruits, leafy vegetables, pulses, legumes, sugar/jiggery and animal foods which is not happening adequately in our current weaning practice¹¹ In a study done by Kambli s regarding mother knowledge about weaning practices it was found that majority of mothers are having wrong concept about weaning and are not knowledgeable about current weaning recommendations.¹²

In a study done by Spinelli MG et al it was found that on multiple regression analysis maternal age less than twenty years, birth weight less than 2.5 kgs, not being breast fed and male gender were important risk factors found to be associated with anemia¹³. In a study done by Sirdaha M M, et al it was found that low educational level of parents was significantly associated with anemia and they have also stressed upon the necessity of national intervention programs to improve the health status of developing countries¹⁴. In a study done by Jain s et al it was found that exclusive breast feeding, weaning at the correct age, nutritional status and more importantly receiving iron supplements were found to be significant in lowering the incidence of anemia¹⁵.

In an Indian study it was noted that there is an association between anemia and malnutrition with lower mean hemoglobin levels in underweight and stunted children¹⁶. Siegal EH et have noted that stunting (30.8%) and wasting (18.1%) were prevalent in anemic children studied between 4-17 months where as in our study 39% had PEM with majority having grade 1-2 PEM.¹⁷

In a study done by Kapur D et al it was found that only 7.8*% of children had severe anemia which is slightly higher than our observation and they also concluded that parasitic infections were not related to prevalence or to severity of anaemia but nutritional deficiency was the main cause. 45% of the babies were found to be taking the diet which was low in iron¹⁸. In our study mild to moderate anemia was noted in majority of cases which is in accordance with study done by sabA F et al.³

In a study done by Ratna S et on morphological pattern of anemia it was found that normocytic normochromic anemia was more common (55%)

which is in contrast to our study observation where microcytic anemia was predominantly seen (69%)¹⁹.

Aap recommends routine universal screening program for infants at 1 year of age along with assessment of risk factors for development of anemia. It also recommends that at 4 months of age, breastfed infants should be supplemented with 1 mg/kg per day of oral iron beginning at 4 months of age until appropriate iron-containing complementary foods (including iron-fortified cereals) are introduced in the diet²⁰. Similarly in a study done by Kazal LA jr apart from the correct feeding practices it is also suggested that routine screening of infants between 9 months to 12 months of age by using erythrocyte protoporphyrin level or red-cell distribution width which will help to identify the earlier stages of iron deficiency²¹. Overall continuous monitoring of infant feeding practices in community is essential for timely interventions to ensure optimal growth and development.

This Study notes down the Existence of predominant Asymptomatic, mild to moderate anemia among Hospitalized infants (96%), thus emphasizing the importance of nutritional anemia in these infants. Detail assessment of birth history, feeding history and nutritional status of all admitted infants should be done, so that early intervention can be done. Maternal education regarding Maternal Anemia, breast feeding and complementary feeds along with proper explanation of the nutritive value of weaning foods is essential and is of prime importance.

Measures directed at the prevention and control of anemia, including increased coverage of supplementation programs as suggested by NRHM-national iron initiative 2013²² that all children between 6-60 months should receive iron and folic acid supplements (containing 20mg of iron, and 100 mcg of folic acid), bi-weekly for 100 doses in a year are strongly recommended. To conclude, the Prevalence of anemia was 56% in the current study with more than 69% of anemic infants having microcytic hypochromic anemia suggesting iron deficiency still as the major cause for nutritional anemia in infants. Improper Weaning techniques, Consumption of cow's milk, top-up formula feeding, Pre-term Gestation and low birth weight are important Risk factors Associated with development of Moderate to Severe Anemia in infants as noted in our study.

Key messages- This Study notes down the Existence of predominant asymptomatic, mild to

moderate anemia among Hospitalized infants (96%), thus emphasizing the importance of nutritional anemia in these infants. Maternal education regarding breast feeding and complementary feeding is of prime importance.

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