Original Research Article

Prevalence Of Anemia And Its Characteristic Among Children Between Age Of 6 Months To 12 Years: Report From A Tertiary Care Center Of Bihar

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Abstract

Introduction: Anemia is a widespread public health problem associated with an increased risk of morbidity and mortality, especially in pregnant women and young children. Approximately 50% of the population suffers from nutritional anemia as known in countries where meat consumption is low. In the present study, an attempt has been made to assess the magnitude of anemia. **Methodology:** The current cross-sectional study was conducted by the Department of pediatrics, Patna Medical College & Hospital, Bihar. The study encompasses 100 pediatric patients admitted during the study period from August 2012 to January 2013 between the ages of 6 months to 12 years. All children and their parents were informed about the purpose and the method of the research and the voluntary nature of participation in the study verbally and in written form. A total of 2 mL of venous blood was drawn under aseptic precautions in an ethylene diamine tetra acetate containing vacutainer. Peripheral blood smear after staining with Leishman's stain was examined under binocular microscope for count and morphology of RBC, WBC, platelets. Special investigations like electrophoresis, sickling test, bone marrow aspiration were done wherever needed. **Results:** Out of the 100 hemograms analyzed, 69 depicted anemic status. Infants (6 months-1 year) were found to be most commonly affected constituting to one-third, followed by school-going children (6 years-12 years), toddlers (2 years-3 years), and preschool children (4 years-5 years). Out of 69 anemic patients, majority had nonhemoglobinopathies and only 2 had hemoglobinopathies. Bone marrow examination could be done on 10 anemic children. Out of which, five children showed micronormoblastic maturation followed by three children had megaloblastic maturation, one child had normoblastic maturation, and another child had hypoproliferative bone marrow. Both the children with hemoglobinopathies were diagnosed with Thalassemia major. **Conclusion:** There is an urgent need to initiate specific public health action to prevent anemia considering the grave consequences of anemia and iron deficiency on the physical and mental growth and development of these children and on their long-term health.

Key Words: Anemia, Children

Introduction

Anemia is a widespread public health problem associated with an increased risk of morbidity and mortality, especially in pregnant women and young children[1]. Globally 1.62 billion people are anemic, while among the preschool children the prevalence of anemia is 47.4%. Nutritional anemia in South Asia accounts for nearly half of global cases of anemia. In India, anemia continues to be the major health problem in young children, adolescent girls, and pregnant women. Approximately 50% of the population suffers from nutritional anemia as known in countries where meat consumption is low[2].

In India, about 89 million children are anemic. The prevalence of anemia was 70% in children aged 6–59 months[3]. The highest prevalence of anemia was seen in children <10 years, especially in those <5 years[4]. Iron deficiency is one of the most common causes of anemia[5]. Besides iron, other nutrients such as vitamins A, E, and C also play key role in formation and protection of red blood cell (RBC) by stimulating stem cells as well as by activating a number of antioxidant enzymes[6]. Therefore inadequacy of any of these micronutrients may lead to anemia in the vulnerable sections of population. Studies have shown that preschool children are more vulnerable to the risk of iron deficiency anemia. The prevalence of iron deficiency anemia is the highest among preschool children. In this age group (6–59 months), body grows rapidly and requires high-iron-rich and nutritious food that may not be fulfilled by their normal diet. Low economic status, less education, and poor health of mothers due to meager dietary intake are the main causes of anemia. Anemia is the most predominant factor for morbidity and child mortality, and, hence, it is a critical health issue for children in India. Iron deficiency affects cognitive and motor development and increases susceptibility to infections. The prevention as well as timely management of anemia is essential to attain Sustainable Development Goal-3 (SDG) on ensuring healthy lives and promoting wellbeing for all at all ages. Further actions are required to reach the World Health Assembly target of a 50% reduction of anemia in women of reproductive age by 2025.

Bihar is one of eight empowered action group (EAG) states of India with poor demographic and socioeconomic indicators including maternal and child health. The Clinical, Anthropometric, and Biochemical (CAB) survey conducted recently in 2014 shows that 70.6% and 81.2% of children aged 6–59 months and 5–9-year-old children are suffering from anemia. Hence, information regarding young children is inadequate on factors affecting anemia. In the present study, an attempt has been made to assess the magnitude of anemia.

Methodology

The current cross-sectional study was conducted by the Department of pediatrics, Patna Medical College & Hospital, Bihar. The study encompasses 100 pediatric patients admitted during the study period from August 2012 to January 2013 between the ages of 6 months to 12 years. Children having medication in the past fortnight prior to data collection and unwilling individuals were excluded from the study. All children and their parents were informed about the purpose and the method of the research and the voluntary nature of

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participation in the study verbally and in written form. Informed written consent was obtained from the parents of each child after the study objective was explained. The study protocol was approved by the Institutional Ethical Committee.

A total of 2 mL of venous blood was drawn under aseptic precautions in an ethylene diamine tetra acetate containing vacutainer. The hematological details like Hb, red blood cell (RBC) count, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), red cell distribution width (RDW), platelet count, white blood cell (WBC) count were recorded by using Sysmex KX-21N, 3 part differential analyzer. Peripheral blood smear after staining with Leishman's stain was examined under binocular microscope for count and morphology of RBC, WBC, platelets. Special investigations like electrophoresis, sickling test, bone marrow aspiration were done wherever needed. Bone marrow aspiration was done using Salah's needle at the posterior superior iliac spine. Slides were stained with Leishman's stain (for studying morphology), Pearls Prussian blue (for detecting iron stores), and studied under oil immersion using a binocular microscope.

Data obtained were compiled, tabulated, and analyzed. Descriptive statistics were computed with percentages, mean, standard deviation, and Chi-square test was applied to test the association of age with occurrence of anemia (nonhemoglobinopathies and hemoglobinopathies) using SPSS version 21.0. $P < 0.05$ was considered statistically significant.

Results

Out of the 100 hemograms analyzed 69 depicted anemic status. Of these 69 children, more than half 41 were male. Thus, male to female ratio was found to be 1.46:1. Infants (6 months-1 year) were found to be most commonly affected constituting to one-third, followed by school-going children (6 years-12 years), toddlers (2 years-3 years), and preschool children (4 years-5 years).

Out of 69 anemic patients, majority had nonhemoglobinopathies and only 2 had hemoglobinopathies. The two children with hemoglobinopathies, one child was 7 years and another one was 9 years old. Test of association could not be done due to less number in one of the cells.

Bone marrow examination could be done on 10 anemic children. Out of which, five children showed micronormoblastic maturation followed by three children had megaloblastic maturation, one child had normoblastic maturation, and another child had hypoproliferative bone marrow. Both the children with hemoglobinopathies were diagnosed with Thalassemia major.

Majority of the anemic children had moderate anemia. Table 1 shows themorphologic types of nonhemoglobinopathies in different age groups and it depicts that microcytic hypochromic anemia (MCHA) was commonest among children of age group 6 months to 1 year. Macrocytic anemia was the least common morphological type of anemia in all the age groups.

Table 1: Table showing morphological types of nonhemoglobinopathies in different age groups

Age group	Type (number)			
	MCHC	Macrocytic	Dimorphic	NNA
≤ 1 year	14	3	7	5
2-3 years	9	1	5	2
4-5 years	4	-	4	1
≥ 6 years	7	1	3	3
Total	34	5	19	11

Among nonhemoglobinopathies parameters, Hb ranged from 3.9 g/dL to 12.1 g/dL and a mean Hb of8.2 g/dL, with a standard deviation of 2.6. RDW ranged from 11.9 to 18.1 and had a mean of 18.2, with a standard deviation of 1.9. MCV ranged from 103fL to 53 fL and had a mean of 74.1 fl, with a standard deviation of 9.9. Among hemoglobinopathies, Hb ranged from 3.2 g/dL to 11.8 g/dL and a mean Hb of6.7 g/dL, with a standard deviation of 2.1. RDW ranged from 19.9 to 26.3 and had a mean of 25.7, with a standard deviation of 3.3. MCV ranged from 81 fL to 52 fL and had a mean of 67.1 fl, with a standard deviation of 10.3. Mean reticulocyte count was 0.17×10^{12} with a standard deviation of 0.9. Mean HbF was 32.7 with a standard deviation of 24.5.

Discussion

One of the major areas for improvement in primary care is prevention of nutritional deficiency like anaemia, because it has been associated with visual and auditory dysfunctioning, cognitive, behavioural abnormalities, and delay in psychomotor development. Appropriate screening and subsequent diagnostic testing will allow most cases of anemia to be diagnosed at the earliest. This should happen at the level of primary care physicians to choose screen and treat approach to prevent complications of anemia at level of primary care itself. The children with suspected nutritional deficiency can be screened, treated, and followed-up at the primary care level, so that the complications such as cognitive and behavioral effects of anemia can be prevented. Anaemia has multifactorial causes involving complex interaction between nutrition and other factors like infectious diseases, and this complexity presents a challenge to effectively address the population determinants of anaemia. Reduction of knowledge gaps in research and policy and improvement of the implementation of effective population-level strategies will help to alleviate the anaemia burden in low-resource settings[7-9].

In the present study, occurrence of anemia among the study population was found to be 69% out of which2.9% were hemglobinopathies and rest had non hemglobinopathies.

Nonhemoglobinopathies

In the present study, infants were found to be most affected followed by school-going children toddlers and least among preschool children. The occurrence of anemia was 50% in infants < 2 years of age and varied between 14% and 22% in 6-11-year-old children[10]. According to the NFHS 1998-99, 74% of the children in the age group of 6-35 months were anemic[11]. In the study conducted by Gomber et al., 76% of children were anemic in the age group of 3 months-3 years[12]. Osσrio et al., have noticed the incidence of anemia to be 40.9% in the age group of 6-59 months[13].

Majority of the anemic children were males. A similar sex distribution was noted in the study conducted by Gomber et al.[14], in which out of the 95 children studied for etiology of anemia, 51 were boys and 44 were girls. There was no difference in sex distribution in the study conducted by Kapoor et al[15].

Our study depicted that most children in all the age groups suffered from moderate anemia. In comparison, the study conducted by Gomber et al.[14], among children aged 5-5.9 years, mild anemia was found in 28.9% and moderate anemia in 2.9% of children[14]. In another study conducted by Vishwanath et al.[16], it was found that of the 100 children evaluated 89 children had iron deficiency anemia and 48% had mild, 42% had moderate, and 10% had severe anemia.

In the present study, MCHA followed by dimorphic. This is in comparison to Kapoor et al.,'s[15] study in which MCHA was most common (43.2%) followed by equal incidence of NNA and dimorphic anemia (27%), while the least common was macrocytic anemia (2.7%). Gomber et al.[14], have adopted an etiological classification of anemia rather than morphological classification. They found iron deficiency anemia to be the most common (41%) and folate deficiency to be least common (2.2%).

In the present study, mean Hb, MCV, RDW were comparable with results of study conducted by Geibel Herbert N which had a mean Hb, MCV, RDW of 9.78 g/dL, 64.34 fl, 17.20, respectively[17]. In the study conducted by Osorio, mean hemoglobin was found to be 11 g/dL.[13] In another study conducted by Aulakh et al.[18], among the iron deficiency anemia group, the mean RDW value among children with mild, moderate, and severe anemia was 16.60 ± 1.78%, 17.95 ± 1.91%, and 20.55 ± 1.32%, respectively.

Hemoglobinopathies

Patients with hemoglobinopathy syndrome are commonly encountered in hematology clinic. Of these, the commonest disorder of hemoglobinopathy syndrome in India is thalassemia[19]. Both these two children were male and in the age group of 6-12 years. Both had thalassemia major. In a study conducted by Mitra[19], HbE was found to be the most common, followed by homozygous thalassemia and least common was HbDE disease. According to study conducted by Roberts and El Badawi, in β thalassemia-mean Hb, mean MCV, mean RDW, mean reticulocyte count, and Mean HbF-were 12.5 ± 1.9, 63.3 ± 4.7, 14 ± 1.5, 0.178 ± 0.09 × 1012 , 5.1 ± 3.6, respectively, in sickle cell anemia-Mean Hb, mean MCV, mean RDW, mean reticulocyte count, and mean HbF were 8.5 ± 1.3 g/dL, 89.4 ± 8.4 fl, 16.8 ± 3.4, 0.353 ± 0.132 × 1012 and 33.3 ± 17.6, respectively and in sickle thalassemia-Mean Hb, mean MCV, mean RDW, mean retic, and mean HbF were 9.4 ± 2, 68.4 ± 5.3, 16.4 ± 2.2, 0.37 ± 0.290 × 1012 and 24.9 ± 11.2, respectively. Further, it was found that RDW was highest in sickle cell anemia followed by in sickle thalassemia and β thalassemia and was least in iron deficiency anemia[20], which is similar to that seen in present study. A study conducted by Madan et al.[21], showed mean Hb in iron deficiency to be 8.1 g/dL, in thalassemia trait with iron deficiency to be 10.7 g/dL and thalassemia trait without iron deficiency to be 11.6 g/dL. Another study showed increased RBC count with mild anemia and marked reduction in MCV, MCH, to be a reliable indicator of thalassemia trait[22].

Conclusion

There is an urgent need to initiate specific public health action to prevent anemia considering the grave consequences of anemia and iron deficiency on the physical and mental growth and development of these children and on their long-term health. Appropriate diagnostic tests will allow most cases of anemia to be diagnosed. There must be a uniform definition of screening criteria. As anemia in infants is common, screening should be done in this age group.

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