Original Research Article

Hematological Profile of Anemias in Children in a Tertiary Hospital

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Abstract

Background: Anemia is an important health problem worldwide and particularly in children. It affects their growth and social performance and may lead to morbidity and mortality. The main objective of the study was to determine the morphological types of anemia and to assess their etiological factors by necessary investigations. *Material and Methods:* Duration of study period was two years from July 2013 to June 2015. The first 100 cases in this period were taken for study. Children within age group from 6 months to 13 years attending NRIGH pediatric and oncology department who were clinically diagnosed as anemic were selected for study. A detailed history was recorded and necessary investigations were done. *Results:* The maximum number of patients were in the age group of 1 year to 5 years (50%). There was a male preponderance (56%) as compared to females (44%). Moderate degree of anemia was found in maximum number of cases and in preschool children, while severe and mild degrees of anemia were seen in school going children. Microcytic hypochromic anemia (61%) was the most common morphological type of anemia and macrocytic anemia (4%) was least common. Iron deficiency anemia (56%) was the common etiological type among nutritional anemias and in hemolytic anemias, β thalassemia major (63.6%) was common. *Conclusion:* Study of patterns of anemia is essential to direct the investigation since it reflects the underlying etiopathological factors. This aids in better management and treatment of the anemia which goes a long way in improving quality of life.

Keywords: Anemia; Hemoglobin; Microcytic Hypochromic.

Introduction

Anemia is considered as a worldwide problem, affecting all age groups. The prevalence of anemia among children under 5 years of age is estimated to be about 20% in industrialized countries and 39% in non-industrialized countries [1].

The causes of anemia vary by age. Anemia should not be considered as a diagnosis, but a finding that needs further investigation.

Most children with anemia are asymptomatic and have abnormal hemoglobin or hematocrit levels on routine screening. Thorough elicitation of history and physical examination can reveal the underlying cause of anemia [2].

In hematological evaluation of anemia only hemoglobin level is usually verified. If anemia is encountered then complete blood count is obtained and anemia work up is done.

The main objective of the present study is to determine the morphological types, patterns of anemia and also to assess their etiological factors by necessary investigations.

Materials and Methods

The present study was conducted in the hematology section of the Department of Pathology of NRI Medical College, Chinakakani for the period of 2 years from July 2013 to June 2015.

The first 100 cases in this period were taken for the study.

Source of Data

All patients in the age group of 6 months to 13 years, who were admitted in pediatric and oncology units of NRI Hospital and diagnosed with anemia.

Inclusion Criteria

Children between 6 months to 13 years of age with anemia and also those who presented with other complaints and were incidentally found to have anemia were included in the study.

Exclusion Criteria

Children less than 6 months and more than 13 years with anemia were excluded from the present study.

A detailed history was elicited, thorough clinical examination was done and the data recorded in the proforma. The required quantity of venous blood was collected in EDTA vials. The collected blood was analysed using fully automated analyser, SIEMENS ADVIA 2120/2120i having five part differentials from which the following parameters were obtained Hb%, PCV, RBC count, RBC indices-MCV, MCH, MCHC, RDW, total WBC including differential count and platelet count.

The peripheral smears were prepared on glass slides and stained with Leishman's stain. The reticulocyte count was done by Supravital staining technique using brilliant cresyl blue.

Tests such as serum ferritin, serum B 12 & folate estimation, bone marrow aspiration and biopsy, Hemoglobin electrophoresis, osmotic fragility and Coomb's test were done depending on specific requirement.

Other ancillary tests including stool examination, ultrasonography and x-ray were done whenever required

Observation & Results

The present study was carried out on 100 anemic pediatric patients in the age group of 6 months to 13 years. These 100 patients were categorized into three age groups infants, preschool children and school going children.

In the present study, preschool children were found to be most affected thus constituting 50%, followed by school going children 31% and infants being 19%. The male to female ratio being 1.27:1. These findings are depicted in Table 1.

Infants and school going children presented with severe anemia whereas preschool children presented with moderate anemia. These findings are depicted in Table 2.

Table 1: Sex distribution of pediatric anemias in different age groups

Age Groups	Males		Females		Total
	No.	%	No.	%	
6M – 1 Year	14	25%	5	11.4%	19
1 – 5 Years	30	53.6%	20	45.4%	50
5 – 13 Years	12	21.4%	19	43.2%	31
Total	56		44		100

Table 2: Age wise gradation of pediatric anemias

Degree Of Anemia	6M – 1 Year	1 – 5 Years	5 – 13 Years
Mild	2	3	1
Moderate	8	33	9
Severe	9	14	21
Total	19	50	31

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The most common presenting symptom was fever (45%) followed by gastrointestinal symptoms (33%) and respiratory symptoms (21%). Pallor was seen in all the patients, followed by organomegaly (45%) in which 16% of patients had splenomegaly and 29% had hepatomegaly. In 5% of patients frontal bossing was seen and cervical lymphadenopathy in 1%.

Peripheral blood smear showed anemia in all the patients, 18% showed thrombocytosis, 14% showed thrombocytopenia, leucopenia in 10%, leucocytosis in 13%, eosinophilia in 5%, bicytopenia in 6% and pancytopenia in 8 %of patients.

The most common morphological type of anemia was microcytic hypochromic (60%), followed by normocytic hypochromic (17%), normocytic normochromic (14%) and dimorphic (5%). The least common morphological type of anemia was macrocytic anemia (4%).

The most common etiology of anemia was iron deficiency anemia constituting 55% followed by anemia in leukemias and megaloblastic anemias each constituting 8%, thalassemia major 7%, anemia of chronic disease 4%, aplastic anemia 3%, thalassemia trait 2%, hereditary spherocytosis, anemia due to blood loss and sickle cell anemia each constituting 1% and anemias of unknown etiology constituting 9%. The prevalence of morphological and etiological types is depicted in Table 3.

Discussion

Anemia is a global health issue, particularly in pediatric age group where it continues to remain over 70% in most parts of India. Anemia poses a greatest challenge to country's development since it retards physical, mental growth and development especially in young children [3].

The most common cause for anemia is malnutrition and iron deficiency makes up the bulk of it. Nutritional anemia can usually be prevented at a low cost [3].

Hereditary hemolytic anemias constitute an important cause of mortality and morbidity in developing countries next only to infection and malnutrition [4].

The prospective study of anemia in children involving 100 patients was undertaken during the period from July 2013 to June 2015. The observations were compiled, results analysed and discussed with other groups.

Preschool children were maximally affected in our studywhich is in concurrence with a study done by G. Suba et al. [5] and Stellinga-Boelan et al. [6] whereas in a study done by Susan et al. [12] infants were maximally affected. The probable causes due to which preschool children are most commonly affected may be poverty, improper complimentary diet.

In our study males were more anemic than females which is in accordance to a study done by Rathna et al. [3], Amieleena Chhabra et al. [7] whereas in a study done by Neeraj Jain et al. [8] higher incidence of anemia was in girls. In a study done by Venkatesh et al. [11] there was no difference between both sexes.

The most common presenting complaintwas fever constituting 45% andpallor was found in all cases (100%). Hepatomegaly was found in 29%

Table 3: Table showing prevalence of morphological and etiological types of anemia

Etiological type	Microcytic hypochromic	Normocytic hypochromic	Normocytic normochromic	Dimorphic anemia	Macrocytic anemia	Total
Iron deficiency anemia	51	5	-	-	-	56
Anemia in leukemias	3	2	3	-	-	8
Megaloblastic anemia	-	-	-	4	4	8
βThalassemia major	4	3	-	-	-	7
Anemia of chronic disease	2	3	-	-	-	5
Aplastic anemia	-	-	3	-	-	3
βThalassemia trait	1	1	-	-	-	2
Hereditary spherocytosis	-	-	1	-	-	1
Sickle cell anemia	-	-	1	-	-	1
Anemia of unkown etiology	-	3	5	1	-	9
Total	61	17	13	5	4	100

cases and splenomegaly was found in 16% cases. These complaints were similar to a study done by Amieleena Chhabra et al. [7].

A moderate degree of anemia was found in maximum number of cases which is in concordance with a study done by S. Jain et al. [9], where as Amieleena Chhabra et al. [7] reported severe anemia in maximum number of cases (54.2%). Several studies have indicated that even moderate anemia is associated with depressed mental and motor development in children, which may not be reversible [13].

Regarding morphological type microcytic hypochromic anemia was the most common (60%) which was similar to a study done by G. Suba et al. [5] (table 4) and Kapur et al. [10] and was in contrast to a study done by Rathna s et al [3] (Table 4) where normocytic normochromic anemia was most common.

In etiological types iron deficiency anemia was the most common (56%) followed by malignancies (8%) and megaloblastic anemia (8%) which was similar to a study done by Amieleena Chhabra et al. [7] (Table 5). Venkatesh et al. [11] reported iron deficiency anemia as the most common type followed by megaloblastic anemia.

In our study the other etiologies included anemia of chronic disease 4%, aplastic anemia 3%, thalassemia trait each 2% and 1% each of hereditary spherocytosis, sickle cell anemia and bleeding disorders.

In a detailed study of our 56 patients of Iron deficiency anemia microcytic hypochromic picture (Fig. 1, A) was seen in majority of patients (91.1%) and normocytic hypochromic picture was seen in 8.9% patients. Among themthrombocytosis was also seen in 20 patients with one patient showing platelet count of 13 lakhs. In this patient in view of severe thrombocytosis a hematological malignancy was suspected initially. However bone marrow smear examination did not support the diagnosis of essential thrombocythemia or other myeloproliferative disorders.

Iron deficiency anemia is shown to be associated with reactive thrombocytosis but platelet count rarely exceeds 7 lakhs as was depicted by Sanchez and Ewton [14]. Platelet counts exceeding 10 lakhs was observed in few reports only [14].

Eight cases of Megaloblastic anemia were diagnosed in which blood picture was macrocytic (Fig. 1, C) in 4 patients (50%), dimorphic (Fig. 1,B) in 4 patients (50%), pancytopenia was seen in 5 patients (62.5%) and bicytopenia in 3 patients (37.5%).

Hypersegmented neutrophils (Fig. 1,C) were seen in all blood pictures but association was highest with macrocytic picture, similar to Amileena Chhabra et al. [15] study.

Bone marrow examination showed megaloblastic picture (Fig. 1,D) in 6 patients (75%) and dimorphic picture in 2 patients (25%) whereas in a study done by Sunil Gomber et al. [16] all cases of bone marrow showed megaloblastic maturation.

Table 4: Comparative study of morphological types of anemia

Type of anemia	G.Suba et al [5] (Karnataka) (2015)	Rathna S et al [3] (Pondicherry) (2014)	Present study (2016)
Microcytic hypochromic	63%	27%	61%
Normocytic normochromic	23%	55%	13%
Normocytic hypochromic	09%	11%	17%
Dimorphic anemia	04%	3%	5%
Macrocytic anemia	01%	4%	4%

Table 5: Comparative study of etiology of anemia

Type of anemia	Amieleena Chhabra et al [7] (2014) (Northern India)	Present study (2016)
Iron deficiency anemia	65%	56%
Malignancies	16%	8%
Megaloblastic anemia	11%	8%
Thalassemia major	4%	7%
Anemia of chronic diseases	11%	4%
Aplastic anemia	8%	3%
Bleeding disorders	3%	1%

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Incidence of hereditary hemolytic anemias in India is 0.1 to 0.2% [17]. In our study out of 100 patients studied 11 were diagnosed as hereditary hemolytic anemia constituting 0.1% and were between 1-10 years age group, males being commonly affected. This was similar to studies done by Shivashankara et al. [18] and RS Balgir et al. [19].

A history of consanguineous marriage was seen in 81% of cases of hereditary hemolytic anemia and was similar to a study done by Preethi BP et al. [4] where consanguinous marriage was seen in 55% of patients. This suggests the possibility of individual spontaneous mutations and requirement of further genetic studies for evaluation of the same [4].

Among the hemolytic anemias, 63.6% of patients had beta thalassemia major, 18.2% had beta thalassemia minor and 9.1% each of hereditary spherocytosis and sickle cell anemia.

All the patients of beta thalassemia major and beta thalassemia trait showed progressive pallor with peripheral smear showing anisopoikilocytosis,target cells, (Fig. 2, A)polychromatophils (Fig. 2, B) and an increased reticulocyte count (Fig. 2,D)

A single case of hereditary spherocytosis was seen in the present study. The patient was 10 years of age, presented with predominant symptoms of pallor, fever and jaundice which were similar to a study done by Das et al. [20]. There was a family history of splenectomy for mother and maternal uncle. According to a study done by Das et al. [20] a family history of one first degree relative was seen in 35% of patients.

In the hematological workup of the same patient, he had a mild degree of anemia and mild to moderate splenomegaly. Peripheral smear showed normocytic picture with spherocytes (Fig. 2, C) forming 60 to 70% of red cells. Reticulocyte count was 10% and osmotic fragility test was abnormal.

A single case of sickle cell anemia was seen in our study. The patient presented with pallor and cough. Peripheral smear examination showed sickle cells (Fig. 3, A) and was confirmed by positive sickle cell test (Fig. 3, B). The Hb S in the present study was 70.6%, whereas in a study done by RS Balgir [19] it was in the range of 75-95%. Hb F was absent in our study and in a study done by RS Balgir et al. [19] it was in the range of 1-20%.
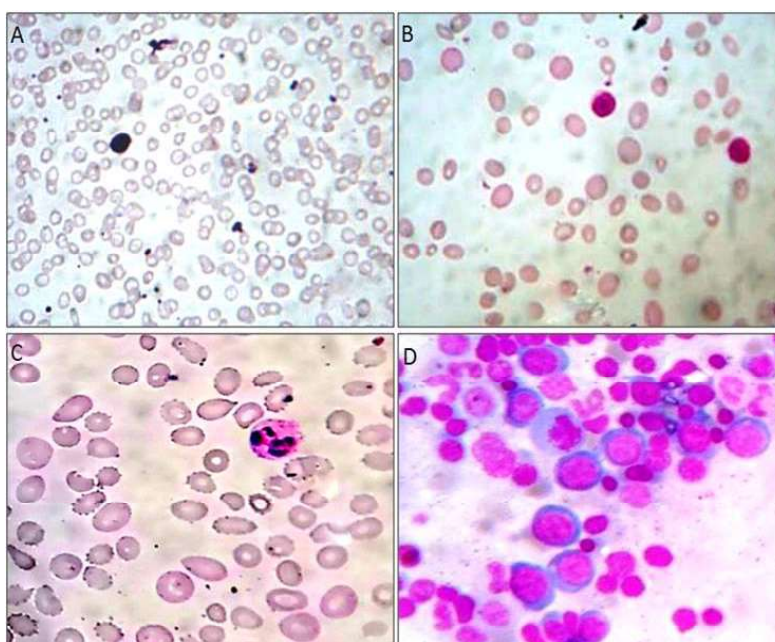

Fig. 1:

A: Iron deficiency anemia: Peripheral smear showing microcytic hypochromic RBC (Leishman's stain 400 X)

B: Megaloblastic anemia: Peripheral smear showing dimorphic picture (Leishman's stain 400 X)

C: Megaloblastic anemia: Peripheral smear showing macrocytes,macroovalocytes and hypersegmented neutrophil (Leishman's stain 400 X)

D: Megaloblastic anemia: Bone marrow aspiration smear showing megaloblasts with sieve-like chromatin (Leishman's stain 400 X)
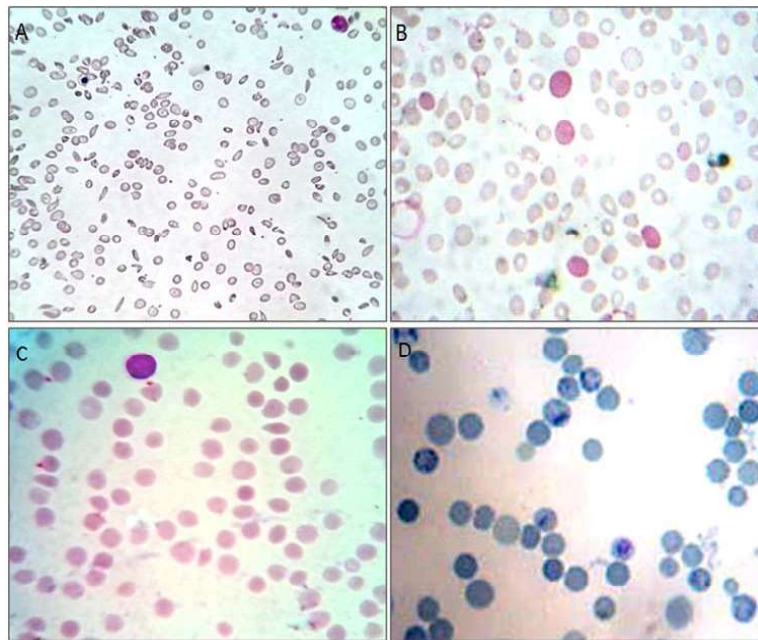
Fig. 2:

A: Hemolytic anemia: Peripheral smear showing anisopoikilocytosis, target cells and occasional nRBC (Leishman's stain 100 X)

B: Hemolytic anemia: Peripheral smear showing polychromatophils(Leishman's stain 400 X)

C: Hereditory spherocytosis: Peripheral smear showing spherocytes (Leishman's stain 400 X)

D: Hemolytic anemia: Supravital stain showing increased reticulocytes (400 X)
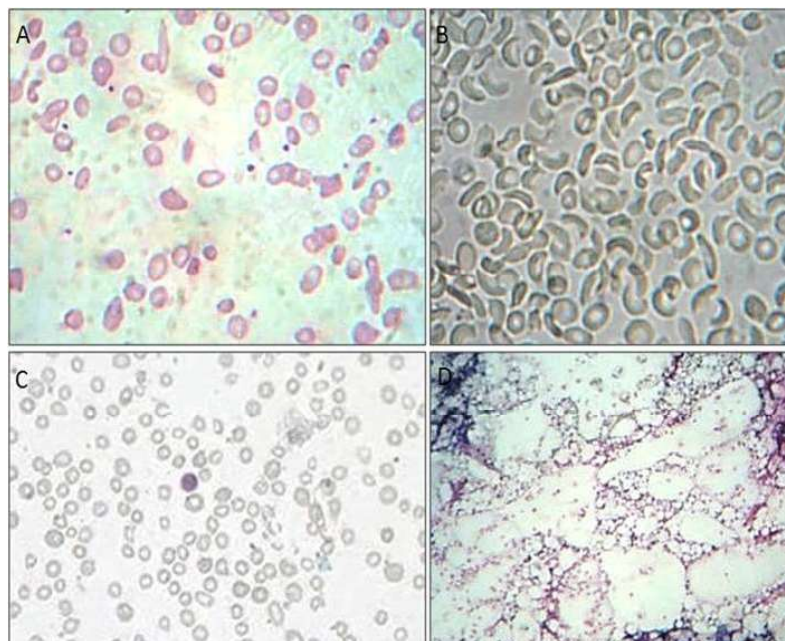
Fig. 3:

A: Sickle cell anemia: Peripheral smear showing irreversibly sickled cells (Leishman's stain 400 X)

B: Sickle cell anemia: Sickle test - showing sickling of red blood cells (400 X)

C: Aplastic anemia: Peripheral smear showing pancytopenia (Leishman's stain 400 X)

D: Aplastic anemia: Bone marrow aspiration smear showing hypocellular marrow with fat (Leishman's stain 100 X)

Aplastic anemia is being considered as a rare disease with varied incidence worldwide. In referral hospitals, aplastic anemia accounts for 20-40% of all pancytopenic patients [22].

We diagnosed 3 cases of aplastic anemia; the incidence among pancytopenic patients being 37%. The mean age was 12 yrs which was similar to the study done by M Mahapatra et al. 21 where the disease was common in the age group of 11 – 20 years. The peripheral smear in all the 3 patients showed pancytopenia (Fig. 3, C) and bone marrow examination revealed aplastic marrow (Fig. 3, D).

We noted that the most common cause of anemia of chronic disease was infections constituting 80% followed by chronic kidney disease 20%. Guenter Weiss et al. [22] stated that the estimated prevalence of underlying causes of anemia of chronic disease is 18-95% for Infections and 23-50% for chronic kidney disease and inflammation.

Neoplastic conditions also contributed to being the cause of anemia in our study. There were 8 cases of leukemia, 7 cases being acute lymphoblastic leukemia and 1 case was acute myeloid leukemia. These patients had ages ranging from 3 –13 years and was similar to a study done by Khalid et al. [23] where median age of presentation was 6±4.7 years. In these cases of leukemia 3 were microcytic hypochromic, 2 were normocytic hypochromic and 3 were normocytic normochromic.

Conclusion

To conclude among 100 patients studied, anemia was common in preschool children with a male preponderance. Infants and preschool children presented with severe anemia whereas moderate anemia was seen in school going children andthe most common complaints were fever and pallor. The common etiological type was iron deficiency anemia and morphological type was microcytic hypochromic. Among hemolytic anemias beta thalassemia major was the most predominant type.

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