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Haematological and biochemical profile of anemia in pediatric age group

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Abstract
Aim: The aim of present study was to know the spectrum of anemia in pediatric age group using different haematological and biochemical investigations.
Material and Method: The present study was conducted in the Department of Pathology at SMS Medical College among patients with anemia in the age group of 0 to 18 years. Various haematological (CBC, GBP, Bone marrow aspiration, HPLC) and biochemical (Serum ferritin, Serum iron, TIBC, Vitamin B12 and Folic acid) investigations were done on the blood samples received. Data so collected was tabulated in an excel sheet and was analyzed using SPSS software version 22.
Results: Maximum 104 (41.6%) patients were diagnosed with iron deficiency anemia. 71(68.2%) IDA patients were found in age group 1-6 years. 34 patients were diagnosed with vitamin deficiency anemia (Vit. B12, Foloc acid or both). Maximum (17.6%) number of Folic acid deficiency were found in 7-12 years.
Conclusion: Haematological and biochemical tests can be used for early detection of anemia. Preventive programme for control of anemia in children should be made accompanied by measures of providing appropriate nutritional requirements.

Keywords: IDA, Anemia, CBC

Introduction

Anemia is one of the chief significant conditions of blood in the children early stages of the life. It lead to morbidity and mortality in children and establish a public health problem of substantialimportance [1]. Anemia in children differs from those of adults as they tend to be more pronounced and develop rapidly. As much as 51% children in 0-4 years and 46% children 5-12 years are anemic in developing regions [2, 3].

The common belief that iron deficiency (ID) is the main cause of anemia worldwide mainlycomes from estimates which used Hb as a proxy to estimate the prevalence of IDA (Stoltzfus 2001) [4]. Nevertheless, anaemia is multifactorial. Indeed, anemia can result from other nutritional deficiencies such as folate, vitamin B12 or vitamin A (Suharno *et al* [5]; Savage *et al* [6], or from parasitic diseases such as malaria (Menendez *et al*) [7] and helminthiases (Brooker *et al*) [8], as a consequence from chronic inflammatory diseases (Yip and Dallman [9]) or from genetic disorders such as haemoglobinopathies (Stuart and Nagel [10]; Rundand Rachmilewitz [11]), or glucose-6-phosphate dehydrogenase deficiency (Cappellini and Fiorelli) [12]. Anaemia can be the consequence of a decreased production of RBC, an increased destruction of RBC and/or direct blood loss.

Most infants and children with mild anemia do not exhibit overt clinical signs and symptoms. A complete blood count is the most common initial diagnostic test used to evaluate for anemia, as it allows differentiating microcytic, normocytic, and macrocytic anemia based on the mean corpuscular volume [13]. Since the hematological parameters are interrelated with each other as well as with the age and gender, relevant intervention strategy is required. Constant monitoring is needed while providing public health nutrition programs to eradicate anemia. Different biochemical and haematological tests are done to evaluate anaemia in children. Hence the present study was conducted to find out the clinicohaematological & biochemical profile of anaemia in pediatric age group.

Materials and methods

The present study was conducted in the Department of Pathology at SMS Medical College, Jaipur. It was a prospective study on 250 patients from a period of Oct 2019 to June 2020. Children with severe pallor aged 0 to 18 years admitted in the pediatric wards were enrolled. The subjects were selected according to the following inclusion and exclusion criteria:

Inclusion criteria

All the children presenting with anemia in age group 0-18 years of age with adequate clinical details and the children with clinical evidence of Anemia.

Exclusion criteria

Patients more than 18 years of age, patients having anemia due to malaria, children already on iron/ multivitamin supplements, patients suffering from any chronic illnesses and children having known history of coagulation and bleeding disorders.

Sample handling

Blood samples (2 ml each) were taken in EDTA vacutainers and plain vials Morphological study was carried out manually as well as cell counter (Automated Haematology Analyzer) includes red cell indices (MCV,MCH,MCHC,PCV,RBC,RDW) platelet count (by automated analyzer) and peripheral Blood Examination (by Leishman stained smears). Biochemical study (wherever

necessary) was done which includes Serum iron, Serum ferritin, Vit B12, TIBC & Folic acid. Bone Marrow Examination (wherever necessary) and HPLC (High performance liquid chromatography) - by D-10 method.

Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using chi square test and the level of significance was set at $p < 0.05$.

Results

The present study comprised of 250 subjects, out of which 58% were males and 42% were females (table 1).

Dimorphic, Macrocytic, Microcytic Hypochromic, Normocytic Hypochromic and NormocyticNormochromic Anaemia were reported in 11.2%, 3.2%, 47.2%, 2.4% and 36% of the subjects respectively. Maximum ceses were of Microcytic Hypochromic type as shown in table 2.

Table 3 shows the distribution of anemia according to Vit. B12 and Folic acid.

Total 36 patients were studied. 8 cases of macrocytic anemia, 8 had Vitamin deficiency (5 with reduced Vit B12, 2 with reduced Folic acid and in 1 case both were reduced) i.e 22.2%. In 28 cases of dimorphic anemia, 26 had Vitamin deficiency (11 with reduced Vit. B12, 13 with reduced folic acid and in 2 cases both were reduced) i.e 72.2% as shown in Table 3. Therefore 34 cases were diagnosed with Vitamin deficiency Anemia. In 2 cases, no vitamin deficiency was found.

Total 250 patients were studied. IDA was diagnosed when serum iron was decreased, TIBC increased and serum ferritin decreased, which was 41.6%. Total 11 patients were studied, out of which 7(63.6%) were diagnosed as Nutritional deficiency anemia, 2 (18.1%) were diagnosed as megaloblastic anemia, 1(9.0%) was diagnosed as ITP and 1(9%) was diagnosed as Aplastic anemia as shown in table 4.

Table 1: Gender distribution of the study population (N=250)

Gender	Number	Percentage
Male	145	58
Female	105	42
Total	250	100

Table 2: Distribution according to the types of Anaemia based upon the morphology

Type	Number	Percentage
Dimorphic anaemia	28	11.2
Macrocytic anaemia	8	3.2
Microcytic Hypochromic Anaemia	118	47.2
Normocytic Hypochromic Anaemia	6	2.4
NormocyticNormochromic Anaemia	90	36.0
Total	250	100.0

Table 3: Distribution of anemia according to Vit. B12 and Folic acid (N=36)

Anemia type	Only Vit. B12 ↓	Only Folic acid ↓	Both ↓	Total	Percentage
Macrocytic (N=8)	5	2	1	8	22.2
Dimorphic (N=28)	11	13	2	26	72.2

Table 4: Distribution of Anemia according to Iron profile and comparison of bone marrow findings with peripheral blood smear

Type of Anemia	S.Iron	TIBC	S. Ferritin	Total	Percentage
IDA	↓	↑	↓	104	41.6
	Peripheral blood picture				
Type of Anemia on bone marrow	Microcytic hypochromic	Macrocytic	Dimorphic	Total (%)	
Nutritional Deficiency	6	Nil	1	7 (63.6%)	
Megaloblastic anemia	nil	2	nil	2 (18.1%)	
ITP	1	Nil	nil	1 (9.0%)	
Aplastic	1	Nil	nil	1 (9.0%)	

Discussion

The present study comprised of 250 subjects, out of which 58% were males and 42% were females. These results were in accordance with study done by Taskesen *et al* [14], Jain *et al* [15] and Gupta S *et al* [16]. Taskesen *et al* [14] in his study found 57% boys and 43%were girls. Jain *et al* [15] have also reported increased incidence in males (71%) compared to girls (29%).

In the present study, Dimorphic, Macrocytic, Microcytic Hypochromic, Normocytic Hypochromic and Normocytic Normochromic Anaemia were reported in 11.2%, 3.2%, 47.2%, 2.4% and 36% of the subjects. Sastry C.P.V [17] in his study found that peripheral smear examination showed Microcytic hypochromic anemia in 81.8% (90/110). Dimorphic anemia was seen in 9.09 %. Normocytic Normochromic anemia was seen in 9.09 % of patients. Venkatesh G [18] observed Microcytic hypochromic anemia in 54.4%, macrocytic hypochromic anemiais seen in 11.8% and dimorphic anemia is seen in 36.6% of patients.

In the present study, Vitamin B12 and Folic acid deficiency was found in 6.4% and 6% of the nutrition deficient subjects. Sastry C.P.V [17] reported Vitamin B12 deficiency anemia in 5% of the subjects. Madoori *et al* [19] also found that 5% (16) cases had megaloblastic anemia. Venkatesh G *et al* [18] reported iron deficiency anemia the most common followed by dimorphic anemia and megaloblastic anemia. Early diagnosis and treatment is important in cases of vitamin B12 deficiency to prevent neurological and haematological complications. Diet rich in vitamin B12 and vitamin B supplements are important in the prevention and treatment of nutritional vitamin B12 deficiency. Strategies to improve vitamin B12 status in children should be developed such as creating awareness regarding intake of proper diet and vitamin B supplements by pregnant and lactating mothers, proper method of weaning and timely introduction of adequate complementary feeding in infants and introducing a modified meal plan in Anganwadis and schools to incorporate vitamin B rich food to children. In the

National Nutritional Anemia Prophylaxis Programme, vitamin B supplementation should be given along with iron and folic acid to prevent vitamin B12 deficiency in children. In the present study, iron deficiency anemia was found in 104 patients i.e. 41.6%. Ferritin is the intracellular storage form of iron found chiefly in the cytoplasm of the cells of the reticuloendothelial system. It can be quantitated in serum using immunoenzymatic assays. Serum ferritin concentrations have been documented to give an accurate indication of the amount of storage iron in healthy individuals and in patients with iron deficiency or iron overload [20]. Ali *et al* [20] in his study of 248 patients found lack of iron stores in 69 patients. Of these, the serum ferritin was elevated in 20 patients (29%) despite lack of demonstrable iron in the marrow specimen. They concluded that a low serum ferritin value probably indicates iron depletion, while an elevated value does not exclude that possibility.

Conclusion

It can be concluded from the study findings that one of the major areas for improvement in primary health care is prevention and early diagnosis of anemia because it has been associated with delay in psychomotor development especially in preschool age. Need for urgent community participation strategies is recommended in the form of counselling the parents for proper child feeding practices, immunization and sickness recognition from the first year of life. Preventive measures for control of anemia in children must be accompanied by measures of providing appropriate nutritional requirements.

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