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Clinicohaematological and Biochemical Profile of Anemia in Pediatric Age Group

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ABSTRACT

Introduction: Anemia is universal health issue, particularly in emerging nations like India. The etiology of anemia is multifactorial but iron deficiency anemia is considered to be the most common cause of anemia in developing nations like India. 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 Subharti Medical College on blood samples received from 250 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, Vit. 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: 145(58%) males had anemia whereas it was found in 105(42%) females. 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 (26.4%) number of Vit. B12 deficiency anemia patients were from 13- 18 age group whereas 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.

Key words: IDA, Anemia, CBC

INTRODUCTION

Anemia is a universal health issue, particularly in emerging nations like India, in spite of the point that this can be mainly avoidable & painlessly treatable[1]. Anemia originates from prehistoric Greek "ἀναιμία", which means "without blood". The biomedical definition of anemia is a reduction in the number of red blood cells (RBC) or the haemoglobin(Hb) content of blood, or a decreased ability of Hb to bind oxygen (Schnall, 2000)[2].

Anemia is one of the chief significant conditions of blood in the children early stages of the life. It leads to morbidity and mortality in children and establish a public health problem of substantialimportance[3]. 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[3-5.]

The common belief that iron deficiency (ID) is the main cause of anemia worldwide mainly comes from estimates which used Hb as a proxy to estimate the prevalence of IDA (Stoltzfus2001)[6]. Nevertheless, anaemia is multifactorial. Indeed, anemia can result from other nutritional deficiencies such as folate, vitamin B12 or vitamin A (Suharno et al[7],1993; Savage et al[8], 1994), or from parasitic diseases such as malaria(Menendez et al[9], 2000) and helminthiases (Brooker et

al[10], 2004), as a consequence from chronic inflammatory diseases (Yip and Dallman[11],1988) or from genetic disorders such as haemoglobinopathies (Stuart and Nagel[12], 2004; Rund and Rachmilewitz[13], 2005), or glucose-6-phosphate dehydrogenase deficiency (Cappellini andFiorelli[14], 2008). 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. Initial evaluation should include a thorough history, such as questions to determine prematurity, low birth weight, diet, chronic diseases, family history of anemia, and ethnic background. 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[15].

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[21]. 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 Subharti Medical College and associated Chhatrapati Shivaji Hospital, Meerut. It was a 2 year prospective study on 250 patients from a period of Oct 2017 to June 2019. The participants of the present study were children who were admitted in pediatric ward of N.S.C.B Subharti Medical College and associated Chatrapati Shivaji Hospital, Meerut. 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 studies (wherever necessary) were 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).

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 Normocytic Normochromic Anaemia were reported in 11.2%, 3.2%, 47.2%, 2.4% and 36% of the subjects respectively. Maximum cases 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.

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 (N=250)

Type of Anemia	S.Iron	TIBC	S. Ferritin	Total	Percentage
IDA	↓	↑	↓	104	41.6

Table 5: Comparison of bone marrow findings with peripheral blood smear(N=11)

	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%)

Total 250 patients were studied. IDA was diagnosed when serum iron was decreased, TIBC increased and serum ferritin decreased, which was 41.6% (Table 4).

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 5.

DISCUSSION

The present study comprised of 250 subjects, out of which 58% were males and42% were females. These results were in accordance with study done by Taskesen et al[16], Jain et Al[17] and Gupta S et al[18]. Taskesen et al[16] in his study found 57% boys and43%were girls. Jain et al[17] have also reported increased incidence in males (71%) compared to girls (29%). Chauhan et al[19] reported dissimilar results who reported44.2% boys and 55.8% girls in their study. Sastry CPV et al[1] also found female preponderance in their study (males 40/110 (36.3%).

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[1] in his study found that peripheral smear examination showed Microcytichypochromic 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[20] observed Microcytic hypochromic anemia in 54.4%, macrocytic hypochromic anemia is seen in 11.8% and dimorphic anemia is seen in36.6% of patients[5].

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[1] reported Vitamin B12deficiency anemia in 5% of the subjects. Madoori[21] et al also found that 5% (16) cases had megaloblastic anemia. Venkatesh G[20], et al 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 B12and vitamin B supplements are important in the prevention and treatment of nutritional vitamin B12deficiency. 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[19].

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[22]. It is the most specific biochemical test for iron deficiency anemia (IDA) because it correlates with total body iron stores. Low serum ferritin concentration reflects depleted iron stores. When compared with other iron status parameter, serum ferritin is one of the lowest biologically varying iron status markers, thus making it one of the most useful parameters. Ali et al[22] in his study of 248 patients found lack of ironstores 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[22].

In the present study, 7 cases were diagnosed as nutritional deficiency anemia on bone marrow and 7 (77.7%) were diagnosed as Iron deficiency anemia with iron stores (Perl stain) ranging from 0 to 2. Approximately similar results were reported by Tabassum et al[23,] Pujara et al[2] and Bableshwar et al[25.]

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. Appropriate screening and subsequent preliminary diagnostic modalities will allow most cases of anemia to be diagnosed at the earliest. Basic blood parameters are mandatory before treating children with anemia to avoid unwanted side effects. Anemia in association with malnutrition is widely prevalent in our country. 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. Spectrum of measures including child feeding, health and environmental core measures will provide complete congenial environment for healthy growth of children.

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