Original Research Article

Clinical and hematological profile of anemia in children aged 6 months to 12 years at tertiary care hospital in central India

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ABSTRACT

Background: Anemia is a major global health problem. It results in significant morbidity and mortality among children.
Methods: It is a retrospective study carried out with the help of medical records of Chirayu Medical College and Hospital Bhopal, from January 2017 to December 2019. Total number of 138 cases were taken in study as per inclusion criteria. Anemia was diagnosed on the basis of hemoglobin level and age of presentation. Anemia was classified into different types as per different hematological parameters and other relevant investigations.
Results: Out of 138 children, 96 were found to be anemic. Majority of children were of age group 1 year to 5 years. There was male preponderance. It was found that 57% of children were anemic due to iron deficiency anemia, 16% were having thalassemia, 11% were having megaloblastic anemia, 5% with sickle cell anemia and 2% with aplastic anemia.
Conclusions: Iron deficiency anemia is a major cause of morbidity worldwide. Anemia control is a global priority. Strategies to combat anemia by forging public private partnership, iron supplementation program, iron fortification of food items (point of care and at the level of manufacturing) and dissemination of awareness regarding anemia and treatment should be implemented. Special care should be taken to diagnose and counsel other major causes of anemia like thalassemia depending on the endemicity.

Keywords: Anemia, Iron deficiency anemia, Sickle cell anemia, Vitamin B12 deficiency, Microcytic, Nutritional anemia

INTRODUCTION

Anemia is the most common nutritional deficiency disorder globally, affecting a quarter of the world population, especially children and women of reproductive age group, resulting in public health problem of paramount importance.[1] Globally, anaemia affects 1.62 billion people (95% CI: 1.50–1.74 billion), which corresponds to 24.8% of the population (95% CI: 22.9–26.7%). Estimated 447 million persons with anaemia, causes India to contribute almost one quarter to the global burden as calculated by the global burden of disease in 2016.[2] The highest prevalence is in preschool-age children (47.4%, 95% CI: 45.7–49.1) The prevalence of anaemia among children under 5 years of age is estimated to be about 20% in industrialized countries and 39% in non-industrialized countries.[3]

Anaemia is defined as a condition in which there is less than the normal haemoglobin (Hb) level in the body, which decreases oxygen-carrying capacity. Anaemia is diagnosed on the basis of Hb level according to age, gender, and condition (Table 1). Globally, the most significant contributor to the onset of anaemia is iron deficiency.[4,5,16] Approximately 50% of anaemia cases are caused by iron deficiency.[6] Iron deficiency generally develops slowly and is not clinically apparent until anaemia is severe, even though functional consequences

already exist.[7] Iron deficiency impairs the cognitive development of children from infancy through adolescence. In India, the national program for prevention and control of anaemia focuses on pregnant women and young children less than 5 years.

Anaemia control is also a global economic priority, productivity losses arising from poor endurance in physically demanding occupations leads to lower wages, but cognitive effects that persist from childhood exceeds physical productivity effects on adult productivity, cognitive losses becomes a key economic issue.[8]

Table 1: Haemoglobin levels to diagnose anaemia at sea level (g/l).

Population	Non-anaemia	Anaemia		
		Mild	**Moderate**	**Severe**
Children 6-59 months of age	110 or higher	100-109	70-99	Lower than 70
Children 5-11 years of age	115 or higher	110-114	80-109	Lower than 80
Children 12-14 years of age	120 or higher	110-119	80-109	Lower than 80
Non-pregnant women (15 years of age and above)	120 or higher	110-119	80-109	Lower than 80
Pregnant women	110 or higher	100-109	70-99	Lower than 70
Men (15 years of age and above)	130 or higher	110-129	80-109	Lower than 80

Aim

Aim of the study was to determine the prevalence of anaemia, and clinico-hematological profile in children of age group 6 months to 12 years at Chirayu Medical College and Hospital, Bhopal, Madhya Pradesh.

METHODS

A prospective study, for a period of 3 years from January 2017 to December 2019 at Department of Paediatrics Chirayu medical college, Bhopal was conducted after obtaining ethical committee clearance of the institute. The children who were admitted in the hospital with sign of Pallor were selected as per inclusion criteria into the study. An informed consent was taken from parents, detailed history was recorded with particular emphasis on symptoms suggestive of anaemia such as weakness and easy fatiguability, breathlessness on exertion, pica. A thorough clinical examination of every child was done.

Routine Investigations for anaemia and its causes were done. Anaemia was classified morphologically based on peripheral smear findings. Packed-cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and red cell distribution width (RDW) were determined by automated cell counter. Hemoglobin was estimated by Sahli's method and expressed in gm%, peripheral smear was stained by Leishman's stain. Reticulocyte count was done by brilliant crystal stain method, serum iron determination was done by Ramany's dipyridyl method, Total iron binding capacity was determined by Ramsay's method, serum vitamin B12 and folic acid was determined by architect method.

Inclusion criteria used in the study was children of age group 6 months to 12 years with pallor, admitted in Chirayu Medical College and Hospital, while exclusion criteria was infants less than 6 months of age and teenagers more than 12 years old, out patients who were not admitted in the hospital, patients who collapsed due to congestive cardiac failure within 12 hours of admission and patients with communicable diseases like human-immunodeficiency virus (HIV), tuberculosis and hepatitis were excluded.

Data were entered in Microsoft excel 2007 and all statistical analyses were performed. Statistical package for the social sciences (SPSS) for Windows version 17.0, Chicago, USA, was also used for data analysis. Descriptive characteristics (mean and standard deviation) and percentage were performed for each parameter separately. Chi-square and independent - test were used for proportions and mean comparisons between groups, respectively.

RESULTS

A total of 138 cases aged between 6 months to 12 years were included in the study of which 46 (33.33%) were female and 92 were male (66.7%) (Table 3 and Figure 2). Anemias was recorded in 96 patients (69.5%) (Table 2 and Figure 1). The most commonly affected age group was 1 year to 5 years with 37.7% cases (Table 3). The mean haemoglobin was found to be 9.58±2.91 gm/dl. The mean haemoglobin of females in our study was 9.45 gm/dl. The mean haemoglobin of male was 9.65 gm/dl. Out of 138 children 118 were Hindus and 20 were Muslims.

Weakness and fatigability were the most common presenting symptom observed in 83.33% of children. On general examination Pallor was seen in 100% of patients, knuckle pigmentation in 18.1%, and koilonychia in 10.41% (Table 6).

About 13 cases presented with the clinical findings of pallor and splenomegaly. Hepatomegaly was seen in 18.75% cases (Figure 4).

Table 2: Total number of patients with anemia.

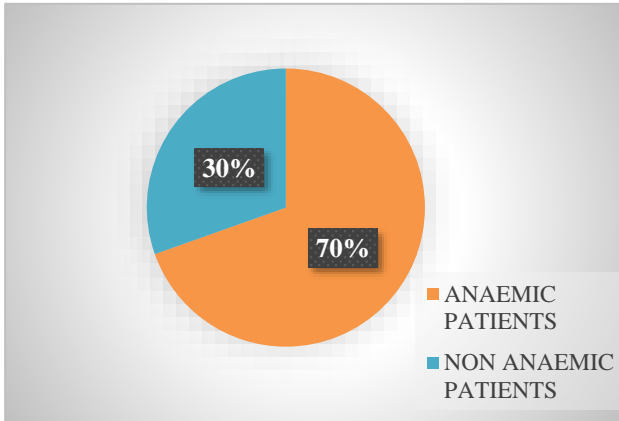| Parameter	Total number of patients	Percentage
Anemic patients	96	69.6
Non-anemic patients	42	30.4
Total	138	100

Figure 1: Number of patients with anaemia.

Table 3: Gender wise distribution of anaemia.

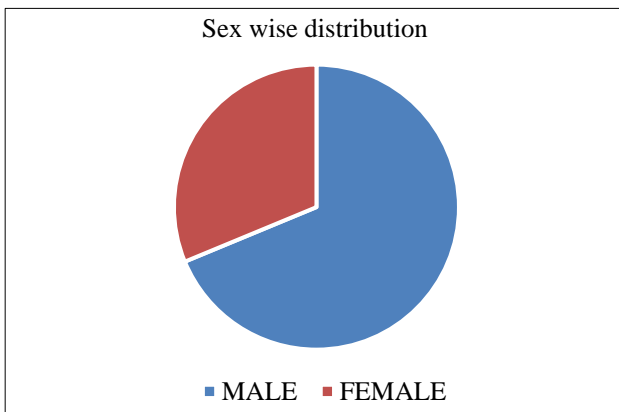| Gender	Anaemic (%)	Total	%
Male	66 (71.7)	92	66.7
Females	30 (65.2)	46	33.3
Total	96 (69.6)	138	100

Figure 2: Sex wise distribution.

About 30 (31.2%) had severe anemia, 43 (44.8%) had moderate anemia and 23 (24%) had mild anemia (Table 7). Among different types of anemia studied, iron deficiency was reported predominantly 55/138 (57.3%) followed by thalassemia 15/138 (15.6%), and megaloblastic anaemia 10/138 (10.4%), least were aplastic anemia and sickle cell anemia with 2 and 5 cases each respectively (Table 5 and Figure 3). Incidence of iron deficiency anemia in females is 42.4% and males is 34.8% while for megaloblastic anemia incidence in males is 6.5% and females is 8.7%.

Table 4: Age wise distribution of anaemia.

Age in years	Number of cases	%
6 months to 1 year	16/20	80.0
1 to 5	38/52	73.1
5 to 10	30/40	75.0
10 to 12	12/26	46.2

Table 5: Prevalence of different types of anaemia.

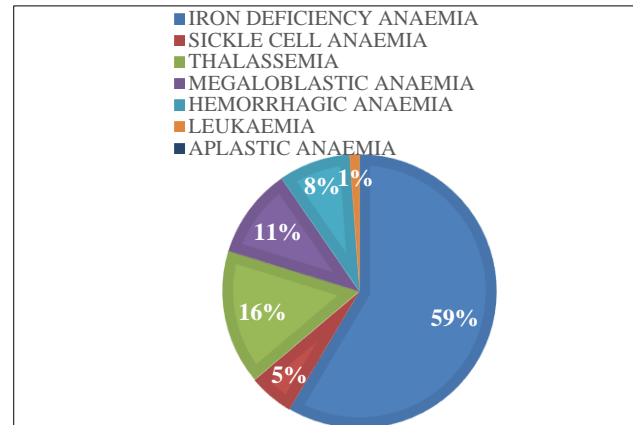| Disease	No.	%
Iron deficiency anemia	55	57.3
Thalassemia	15	15.6
Megaloblastic anaemia	10	10.4
Anaemia of acute hemorrhage	8	8.3
Sickel cell anemia	5	5.2
Aplastic anemia	2	2.1
Leukaemia	1	1.1
Total	96	100

Figure 3: Prevalence of different types of anaemia.

Table 6: Clinical profile of patients' anaemia.

Clinical signs and symptoms	No. of cases	%
Pallor	96	100
Weakness and fatigability	80	83.33
Fever	38	39.6
Icterus	28	29.2
Shortness of breath	20	20.83
Hepatomegaly	18	18.75
Cough	17	17.7
History of pica	15	10.41
Splenomegaly	13	13.5
Petechiae	11	11.45
Vomiting	10	10.41
Koilonychia	10	10.41
Hyperpigmentation	6	6.2
Tremors	6	6.2

In iron deficiency anemia PCV, MCV, MCHC, MCH are decreased and RDW is increased. In megaloblastic anemia

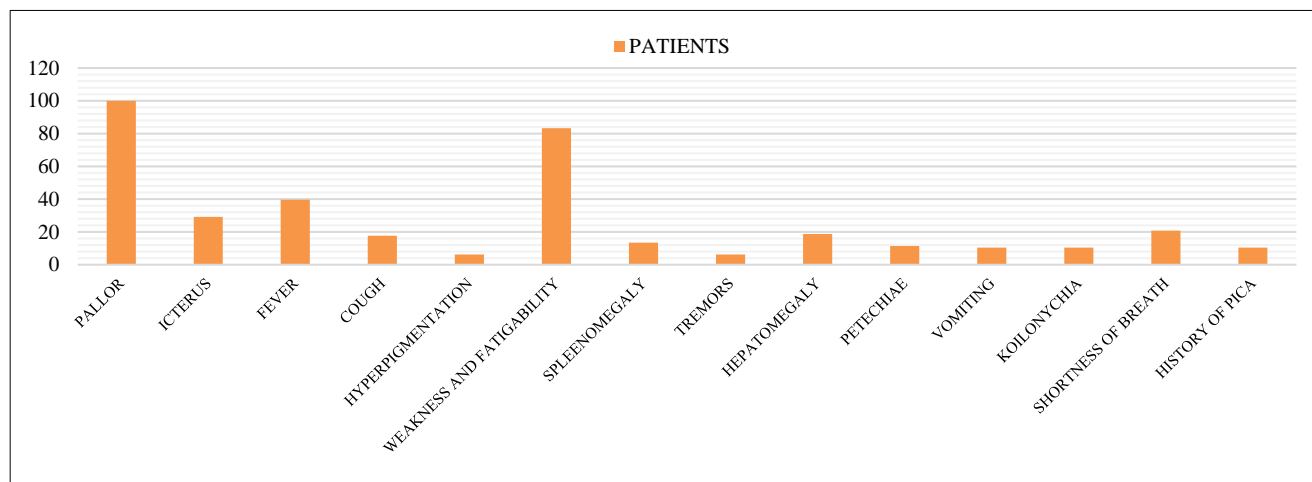PCV decreased, MCV and MCH are increased, and MCHC are normal.

Figure 4: Percentage of clinical features of anaemia.

Table 7: Severity of anemias on the basis of hemoglobin.

Grade of anaemia	Males	Females	Total	%
Mild	16	7	23	24
Moderate	31	12	43	44.8
Severe	19	11	30	31.2
Total	66	30	96	100

DISCUSSION

In the present study, 138 patients were enrolled in the study out of which 96 children were found to be anemic (69.5%). Globally, the mean blood haemoglobin concentration is 11.1 g/dl.[15]

In our study anemia was found to be more in age group of 1 to 5 years, consistent with findings of national poshan abhiyaan in which anemia was most prevalent among children under 2 years of age.[2]

The common cause found in the study is iron deficiency anemia (57.3%) while thalassemia 15.6%, 10.4% cases had megaloblastic anemia and 5.2 % had aplastic anemia. In a similar study done by Madoori et al, 58% of children were found to be anemic due to Iron deficiency anaemia, 27% because of sickle cell anaemia, 9% due to thalassemia, 5% due to megaloblastic anaemia and 2% due to aplastic anemia.[9]

The increased prevalence of thalassemia in our study population is due to our hospital being a referral centre for Shujalpur and Sehore, Madhya Pradesh, India. Prevalence of thalassemia disorder in overall population is very high amongst tribal population. In central India, the incidence of β-thalassaemia has been mainly attributed to its high prevalence in the migrant population of Sindhi origin.

Estimates indicate that there would be around 100,000 patients with a beta thalassemia syndrome.

It is observed from our study that all types of anemia were due to poverty, maternal anemia, continued exclusive breast feeding beyond 6 months and improper complimentary diet. Males with high percentage of 55% and females with 45% were found in our study. Rationale reason for the cause of anemia more in male as compared to females can be because of expression of anemia due to sickle cell disorder or thalassemia in males as compared to females.[10]

Majority of the patients who are anaemic were Hindu as there is majority of Hindu population in surrounding areas.

Maximum number of patients were of moderate anaemia which was led by nutritional anaemia. The severely anaemic category was also led by nutritional anaemia.

Peripheral smear examination showed microcytic hypochromic anemia in 74.0%. Dimorphic anemia was seen in 10.4%. Normocytic normochromic anemia is seen in 15.6% of patients. A study by Venkatesh observed microcytic hypochromic anemia in 54.4%, macrocytic hypochromic anemia is seen in 11.8% and dimorphic anemia is seen in 36.6% of patients.[11]

In iron deficiency anemia PCV, MCV, MCHC, MCH are decreased and RDW is increased.[12] Under iron deficiency condition, formation of Hb is reduced resulting in a reduction of MCH.[13] The transmembrane protein (ferroportin) is responsible for the transfer of iron from enterocytes and monocytes/macrophages to the circulation. It was found that ferroportin mRNA expression was significantly reduced in monocytes of anemic subjects compared with controls.[14]

Limitations of our study was the small study population, so a study in future should be planned with longer duration for a larger sample size in order to corroborate the evidence found in this research and to eliminate random error.

CONCLUSION

In the present study nutritional deficiency anemia is found to be the most common cause of anemia among children (6 months-12 years). In nutritional deficiency, Iron deficiency anemia was the most common followed by megaloblastic anemia. Appropriate screening and subsequent diagnostic testing will allow most cases of anemia to be diagnosed at the earliest. Basal blood parameters are mandatory before treating children with anemia to avoid unwanted side effects. Combating iron deficiency anemia should be a priority making every endeavor towards implementing adequate public policies, strengthening community actions, promoting people's involvement and reformulating healthcare services. As our study showed high prevalence of thalassemia patients, feasible option for its prevention is to promote education and awareness programs and intensify screening in all the state with micro mapping to assess the true burden.

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