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Original Research Article

Study of severe anemia in hospitalized children in Ahmedabad (Gujarat), India

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ABSTRACT

Background: Anemia is a major nutritional problem worldwide especially in developing countries. This research was conducted to find the incidence of severe anemia, to identify the common clinical features and etiology of it and to assess the requirement of packed red cell transfusion.
Methods: All patients having severe anemia (hemoglobin <7 gm/dl in 6-59 months and <8 gm/dl in 5-14 years as per WHO definition) between 6-14 years were included in this study. Detailed medical history, anthropometric measurements and clinical examination were done. Complete blood count, peripheral smear, reticulocyte count and stool microscopy were done in all patients. Then anemia classified morphologically into microcytic, normocytic, macrocytic and dimorphic. Further investigations were done according to the peripheral smear to identify the etiology of severe anemia.
Results: During the study period, 84 patients of severe anemia were hospitalized with incidence of 2.57%. It was more common in male in 6 months to 5 years and in female in 10-14 years age. 67% patients had microcytic, 28% had dimorphic and 2.5% each had normocytic and macrocytic anemia. The most common anemia was iron deficiency (82%) followed by anemia of chronic disease (17%), hemolytic anemia (12%), megaloblastic anemia (7%) and blood loss anemia (1%). Packed red cell transfusion was required in 16 (19%) patients with severe anemia.
Conclusions: Good clinical examination with peripheral smear is helpful in classifying the anemia morphologically. Following this, the use of investigations as per the standard flow charts, helps in identification of etiology.

Keywords: Anemia, Iron deficiency, Hemolytic, Megaloblastic

INTRODUCTION

Anemia is defined as reduction in the concentration of hemoglobin or red blood cell volume in peripheral blood below normal for age and sex.[1] Anemia is a major nutritional problem worldwide especially in developing countries. In India, according to national family health survey 4 (NFHS 4), incidence of anemia in urban and rural children is 56% and 59.5% respectively and severe anemia is 1.6% and 1.5% respectively.[2] The incidence of anemia in children in Gujarat between 6 months to 5 years is quite high and has increased from 62.6% to 79.7% from NFHS 4 (2015-16) to NFHS 5 (2019-20).[3] Anemia is a serious concern for children because it can impair cognitive development, decrease growth and increase morbidity from infectious disease. Most common presentation of children with severe anemia is either for associated infection or disease. Only sometimes, severe anemia alone is a reason of hospitalization. Various causes of anemia are iron deficiency, malaria, hookworm and helminthic infections, other nutritional deficiencies, chronic infections, hemolytic causes and genetic conditions. Among all the causes, iron deficiency is estimated to be responsible for half of all the causes of anemia. Due to associated disease or infection, many times, the history and examination may not give a clue to severe anemia. Pallor may also be missed sometimes because of dark skin pigmentation in

our country. Severe anemia needs to be identified, assessed and treated efficiently as it can lead to heart failure and death. Hence, this study was done with the aim to find the incidence of severe anemia in hospitalized children, to identify the common clinical features and etiology of severe anemia and assess the requirement of packed RBC transfusion.

METHODS

This study was a prospective observational study, which was conducted in department of paediatrics, in a tertiary care hospital, over the period of 2 years from 1st August 2018 to 31st July 2020. After taking written informed consent of parent/guardian, 84 patients were included in this study. Inclusion criteria were: All hospitalized children having severe anemia between the age of 6 months to 14 years. Severe anemia as per WHO definition was taken (Children between 6-59 months: Hb <7.0 gm/dl and Children between 5-14 years: Hb<8.0 gm/dl). Detailed medical history, anthropometric measurements and clinical examination were done. Complete blood count by auto analyser SYSMEX, thick and thin smear by using Neubauer's counting chamber, reticulocyte count by using supravital staining and stool microscopy were done in all patients. Anemia was classified morphologically by peripheral smear in 4 types: microcytic, normocytic, macrocytic and dimorphic. Investigations were done according to the peripheral smear to identify the etiology of anemia: S. iron, S. ferritin, S. total iron binding capacity (if smear is microcytic or normocytic or dimorphic) and S. vitamin B12 and S. folate (if smear is macrocytic, normocytic or dimorphic). Special investigations like erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), renal function test (LFT), liver function test, thyroid profile, hemoglobin electrophoresis, bone marrow examination was done wherever needed.

RESULTS

During the study period of August 2018 to July 2020, total 3261 patients between the age group of 6 months to 14 years were hospitalized. Out of these, 84 patients had severe anemia. So, incidence of severe anemia in hospitalized patients was 2.57%.

Severe anemia was most common in 6 months to 5 years age group. Table 1 is showing age and gender wise distribution of severe anemia in our study population. Ratio of male: female was 1.1:1. It was more common in lower socioeconomic class. Though, majority of the mothers were literate, still their children developed severe anemia.

On anthropometry examination, 65.07% children of severe anemia between 6 months to 5 years had associated malnutrition and 52.38% children from 5 to 14 years had associated undernutrition. Table 2 is showing classification of study population as per nutritional status. Figure 1 and 2 are showing symptoms and signs of severe anemia respectively.

Most common associated disease was infectious diseases (73.80%), followed by gastrointestinal diseases (2.38%), malignant diseases (2.38%) and renal disease (1.1%). In 6 months to 5 years age group, 75% patients had Hb between 5 to 7 gm/dl and 25% patients had Hb <5 gm/dl. In 5 years to 14 years age group, 62% patients had Hb between 5 to 8 gm/dl and 38% patients had Hb <5 gm/dl. Lowest Hb noted was 1.7 gm/dl. As per morphological classification, 67% patients had microcytic, 28% patients had dimorphic and 2.5% patients each had normocytic and macrocytic anemia. Figure 3 is showing Classification of severe anemia in study population based on morphology.

As per etiological classification, the most common anemia was iron deficiency (82%) followed by anemia of chronic disease (17%), hemolytic anemia (12%), megaloblastic anemia (7%) and blood loss anemia (1%). Figure 4 is showing classification of study population based on etiology. Table 3 is showing classification of anemia based on etiology.

Predisposing factors for iron deficiency anemia: Bottle feeding with animal milk was common predisposing factor in infants seen in 23.18%, followed by predominant breastfeeding with lack of complementary feeding (11.59%) and h/o pica (8.69%). One patient had history roundworm infestation, 2 patients had history of chronic blood loss and 1 patient had h/o acute blood loss.

In the patient with microcytic anemia, the mean S. iron, S. ferritin and TIBC was 34.58±22.10 µg/dl, 23.64±25.83 ng/ml and 352.05±79.17 µg/dl respectively. In the patient with dimorphic anemia, mean vitamin B12 and folate levels were 322±410.7 pg/ml and 8.7±5.66 ng/ml respectively. In the patient with macrocytic anemia, mean vitamin B12 and folate levels were 144.5 pg/ml and 10.7 ng/ml.

In patient with hemolytic anemia, 3 patients were diagnosed with G6PD deficiency, 2 patients with malaria, 2 patients with beta thalassemia trait, 1 patient each with thalassemia intermedia, sickle beta thalassemia trait and sickle cell disease.

Anemia of chronic disease was seen in total 14 patients. Out of which, most common causative chronic disease was liver abscess in 5 patients, followed by 2 patients of inflammatory bowel disease (1 patient of Crohn's disease and 1 of ulcerative colitis), 2 patients of giardiasis, 2 patients of malignancy (ALL both), 1 patient of HIV, 1 patient of extrapulmonary tuberculosis and 1 patient of celiac disease.

Anemia of blood loss was seen in one patient, who was an adolescent female with menorrhagia.

Packed RBC transfusion was required in only 16 patients (19.04%) out of total 84 patients who presented with severe anemia. Ten patients presented with congestive cardiac failure and needed transfusion. Remaining patients had very low Hb. Rest of patients treated with drugs, supplementation and nutritional advice.

Table 1: Age and gender wise distribution of study population.

Age (Years)	Male, n (%)	Female, n (%)	Total
6 months-5	36 (57.14)	27 (42.85)	63
5-10	5 (62.5)	3 (35.71)	8
10-14	3 (23.07)	10 (76.93)	13
Total	44 (52.38)	40 (47.62)	84

Table 2: Classification of study population as per nutritional status.

Age group (Years)	N (%)
6 months-5 (PEM grading as per (IAP), (n=63)	41 (65.07)
5-10 (as per BMI), (n=8)	4 (50)
10-14 (as per BMI), (n=13)	7 (53.84)
Total	52 (61.90)

Table 3: Classification of anemia based on etiology.

Types of anemia, (n)	Predisposing factors/ etiology of anemia	N
Iron deficiency anemia (69)	Poor dietary intake	35
	Bottle feeding with animal milk	16
	Predominant breastfeeding with lack of complementary feeding	8
	Pica	6
	Worm infestation	1
	Blood loss	1
Megaloblastic anemia (6)	B12 deficiency	5
	Folic acid deficiency	1
Hemolytic anemia (10)	G6PD deficiency	3
	Malaria	2
	Beta thalassemia trait	2
	Thalassemia intermedia	1
	Sickle beta thalassemia trait	1
	Sickle cell anemia	1
Anemia of chronic disease (14)	HIV	1
	Liver abscess	5
	Extrapulmonary TB	1
	Giardia	2
	Ulcerative colitis	1
	Crohn's disease	1
	Leukemia (ALL)	2
	Celiac disease	1
Blood loss anemia (1)	Blood loss-acute (menorrhagia)	1

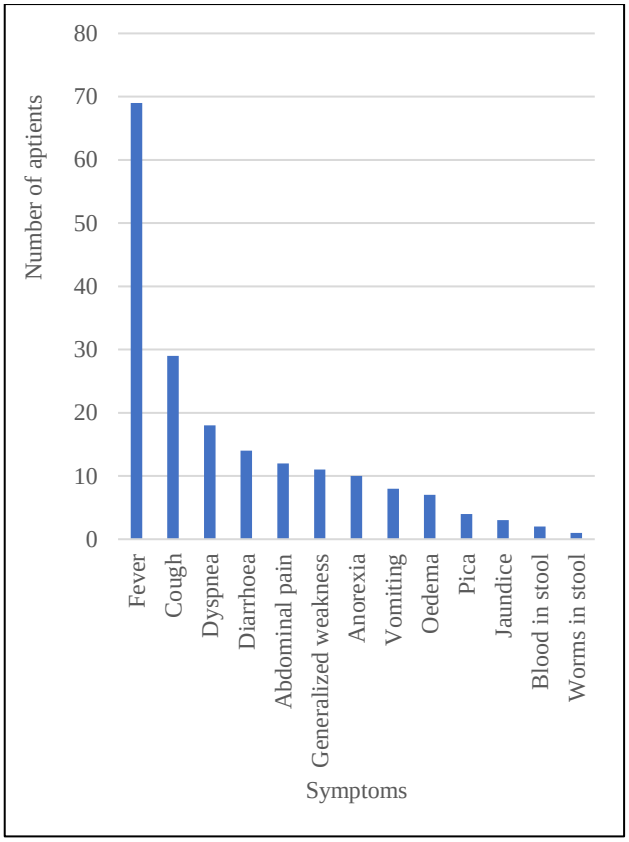

Figure 1: Symptoms in patients with the severe anemia.

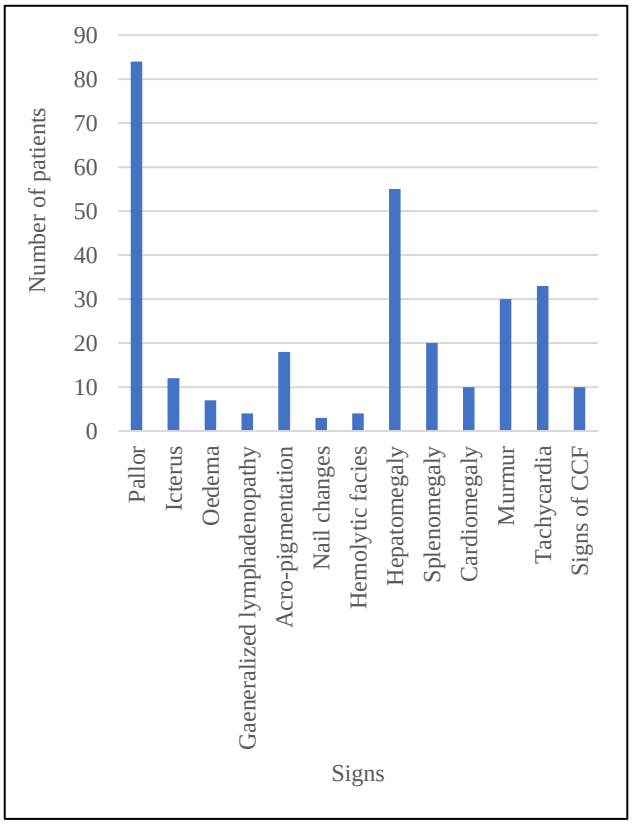

Figure 2: Signs in patients with the severe anemia.

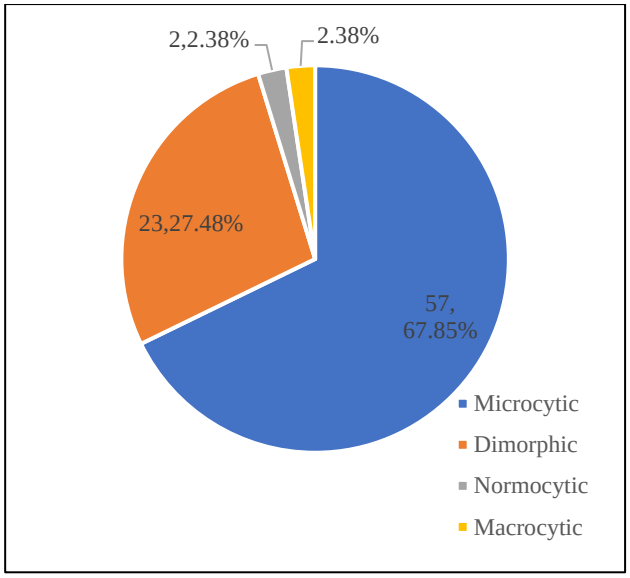

Figure 3: Classification of severe anemia in study population based on morphology.

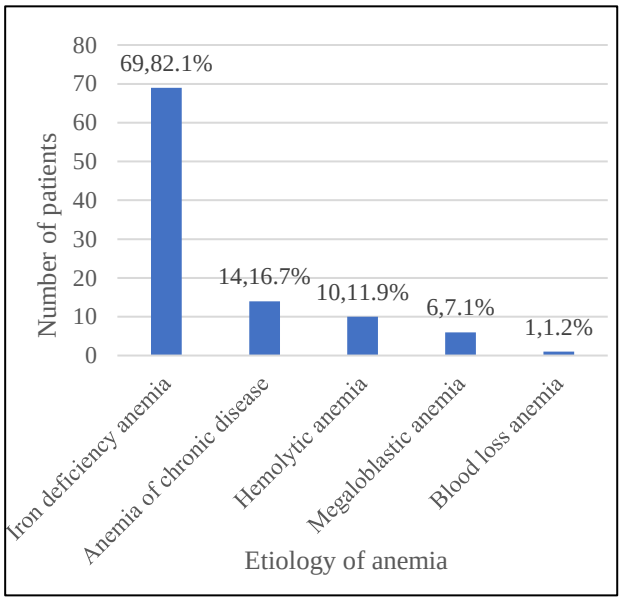

Figure 4: Classification of study population based on etiology.

DISCUSSION

In our study, severe anemia was most common between 6 months to 5 years age group. This observation was similar to the study done by Abhishek Janjale et al, Saroja et al and Deeksha Kapoor et al.[4-6] The high prevalence in this age group may be because of the high iron requirement for rapid growth and low content of bioavailable iron in the child's diet. Also in early age group, it is more prevalent due to maternal micronutrient deficiencies.[7] This could also be due to a fact that most mothers continue breastfeeding till late age and do not start complementary feeding timely.[8] There is also high incidence of bacterial infections, parasitic infestations and certain factors like first diagnosis of hereditary anemia in this age group, which may be associated with increased incidence of severe anemia in this age group.[9]

The next common age group for severe anemia was adolescent age group. The contributory factors for development of severe anemia can be pubertal growth spurt, increased blood loss during menstruation, poor personal hygiene and intake of junk foods during day.[10,11] Adolescence is a significant period of human growth and maturation. In developing countries like India, higher incidence of worm infestation and micronutrient deficiencies like vitamin B12, Folic acid and iron can be additional factors contributing to severe anemia.[12] In our study, there were more numbers of male patients with severe anemia than female patients. Male: female ratio was 1.1:1. It was comparable to the studies, Janjale et al, Saroja et al and Madoori et al.[4,5,13]

In our study, most common type of anemia found was microcytic anemia, which was similar with other studies done by Abhishek et al, Aduamankwaah et al and Saba et al. Dimorphic anemia was the 2nd most common type of anemia in our study, which was also 2nd most common type in study done by Saba et al and Amankwaah et al, while it was the third most common type of anemia in Janjale et al. Normocytic anemia was seen in very few (2.4%) patients in our study, whereas it was seen in more number (38.9%) of patients in study done by Abhishek et al and Saba et al (22%). Macrocytic anemia was seen in very few patients (2.4%) patients in our study as well as other above studies.[4,13,14]

Iron deficiency anemia was the most common type of anemia according to the etiology in our study. Iron deficiency anemia was seen in 82%patients in our study. It was the most common type of anemia, as per other studies conducted in India. It has been reported by WHO that prevalence of iron deficiency anemia in 0-4 years age group is 20% and 39% in industrialized and non-industrialized countries respectively. In 5-14 years, it is 5.9% and 48.1% in industrialized and non-industrialized countries.[15]

There are certain factors, which increase the risk of development of iron deficiency anemia. These factors are: preterm or low birth weight, excessive consumption of cow's milk in infants, infections with helicobacter pylori, hookworm infestation, malaria, pica, inflammatory bowel disease, peptic ulcer, menstrual blood loss in adolescent girls etc. Study of anemia with special reference to risk factors was done in 206 hospitalized infants by Patel et al. It was suggestive that preterm, low birth weight, maternal anemia, excessive breastfeeding, consumption of cow's milk and improper complementary feeding

practices were most common risk factors associated with development of anemia.[16]

Worm infestation was present in 1.4% patients in our study. India is one of the developing tropical countries with increasing population, poor socioeconomic conditions and poor sanitation. Because of the above problem there are higher chances for parasitic infestations. These infestations lead to intestinal bleeding, loss of appetite, diarrhea and reduction in the absorption of micronutrients leading to development of anemia.[17] In our study, 23% of patients were given cow's milk. It is known that iron is deficient in cow's milk. When it is given without any iron supplementation, it leads to increased risk of iron deficiency anemia. Bottle feeding with either animal milk or formula is associated with increased risk of infections and hospitalization.[17]

Pica was seen in 8.6% patients in our study. Pica is a manifestation of iron deficiency, and is also considered to be a predisposing factor as it may lead to worm infestation and lead poisoning. It is both effect and cause of iron deficiency anemia.[14]

Anemia of chronic disease was the 2nd most common type of anemia seen in our study; however, it was seen as the 3rd most common type in different studies done in India. In our study, 73% patients presented with various infections like pneumonia, UTI, enteric fever, liver abscess, dengue fever, diarrheal diseases, viral hepatitis, bronchiolitis, malaria, tuberculosis, worm infestations, HIV etc.[4,14]

Hemolytic anemia was the 3rd most common type of anemia in our study. However, it was seen as the most common anemia in study done by Antony Jenifer et al and second most common type of anemia in study done by Wahab et al and Reddy et al. [14]

CONCLUSION

The study concludes that severe anemia is more common in 6 months to 5 years children and adolescents. It is significantly associated with malnutrition and infectious diseases. Morphologically most common anemia is microcytic followed by dimorphic. MCV, MCH, MCHC, Serum ferritin and serum iron are important markers of iron deficiency anemia. Peripheral smear is also an important marker for identification of megaloblastic anemia. Majority of the patients with megaloblastic anemia had low serum vitamin B12 and /or folate levels. The most common anemia in hospitalized patients with severe anemia was iron deficiency anemia. Only very few patients of severe anemia needed packed red cell transfusion and could be managed by identifying the appropriate etiology and treating it. A good analysis of peripheral smear after thorough clinical examination and an approach as per standard flow charts can lead to identification of etiology of severe anemia.

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