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Clinical profile and etiology of severe anemia in hospitalized children aged 6 months to 5 years

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ABSTRACT

Anemia is a major global health problem, especially in developing countries. This problem is largely preventable & easily treatable. In India prevalence is approximately 51%. The NFHS 2005-2006 revealed that at least 80% of Indian children aged 12-23 months are anemic. Most children with anemia are asymptomatic and have abnormal Hb or hematocrit level on routine screening. Anemia in infancy and early childhood is associated with behavioral and cognitive delays, and lower scores on test of mental and motor development.

Aims & Objectives : To study clinical profile and factors associated with severe anemia.

Materials and Methods: This study was conducted in the Department of Pediatrics, Pt. B.D.S. PGIMS, Rohtak. The patients of age group 6 months to 59 months having severe anemia (Hb <7 gm/dl) were taken as subjects.

Results: Out of 100 patients 51 belonged to iron def anemia (51%), 15 belongsed to megaloblastic anemia (15%). The mean hemoglobin was 5.22 that ranged from 2 to 7 gm//dl with standard deviation of 1.389. mean MCV was 76, whereas MCH, MCHC were 20 and 26 respectively. Most of anemic children belonged to grade 3 and 4 degree of malnutrition (76%).

Conclusions: Prevalence of anemia in children admitted at PGIMS was high. Characteristics strongly associated with severe anemia included unemployment among caregivers and malnutrition. Iron deficiency anemia and megaloblastic anemia were the common types.

1. Introduction

Anemia is one of major global health problem, especially in developing countries like India. Despite the fact that this problem is largely preventable & easily treatable, the disease is quite prevalent in preschool children, pregnant and lactating women.[1] About 30% or nearly one third of world's population is suffering from anemia due to various causes.[2–4] The World Health Organization (WHO) has estimated that globally 1.62 billion people are anemic, with the highest prevalence of anemia (47.4%) among pre-school children. The fourth National Family Health Survey (NFHS) 2015-2016 revealed prevalence of anemia in children aged 6-59 months to be 58.6%, of which rural population is afftected more than urban.[5] Estimates in high-risk Indian populations suggested that total anemia prevalence may be as high as 50% to 80%, with as many as 10% to 20% having moderate to severe anemia.[6]

The risk factors of anemia most often cited in the literature are low family income and low maternal level of education, lack of access to healthcare services, inadequate sanitary conditions, and a diet with poor quantities of iron.[7,8] Among infants, the following characteristics conferred special risks: low socioeconomic status, consumption of cow's milk before 6 months of age, low birth weight, and prematurity.

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Most common type of anemia in developing countries is nutritional anemia. Nutritional anemia can be due to iron deficiency (most common cause), folic acid deficiency, and Vitamin B_{12} deficiency or may be combination of these. Other types include hemolytic anemia, which can be either congenital or acquired. Congenital causes include membrane defect, haemoglobin defects and enzyme defect while acquired causes can be immune or non- immune. Aplastic anemia, anemia due to blood loss and anemia of chronic disease are the some other types of anemia.[9,10]

Global cause-specific analysis have tended to focus only on tracking iron deficiency or on single country or region.[11–14]

In view of magnitude and consequences of severe anemia, this study was planned with the aim to identify the significant socio-economic, demographic risk factors and etiology of severe anemia in Indian children of 6-59 months age by means of statistical modeling.

2. Materials and Methods

This observational cross sectional study was conducted at a tertiary care hospital from north India during the period from March 2016 to September 2017. Ethical clearance was obtained from the Institutional Ethics Committee (IEC).

The patients of age group 6 months to 59 months admitted in pediatric ward having severe anemia (Hb <7 gm/dl) as per WHO criteria were subjects of our study.[15] An apprpopriate sample size of 100 was considered for study. Consecutive sampling was done amongst admitted children in hospital. An informed consent was obtained from the parents of enrolled children. Child with Hb>7 gm/dl, age <6 or >59 months, lack of parental consent, history of recent surgery or blood transfusion and children with known cause of anemia or active bleeding were excluded from the study.

2 mL of venous blood was drawn under aseptic precautions in an ethylene diamine tetra acetate (EDTA) containing vacutainer and sent immediately to the laboratory for hematological testing. Automated Blood Cell Counter (MS-9-3-S), Digital Photochlorimeter/ Hemoglobinometer hematology analyzer was used to evaluate parameters: Hemoglobin concentration (Hb), RBC indices [mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC)], Hematocrit (PCV), RBC count, Total leucocyte count (TLC), Differential leucocyte count (DLC), and Platelet Count (PC). Slides were stained with Leishman's stain for morphological study and for malarial parasites. Reticulocytes count was done using brilliant cresyl blue stain. Bone marrow aspiration in children was done preferably in posterior superior iliac crest because it mostly contains cellular marrow and there are no vital organs in close proximity, in children younger than 18 months of age ANTEROMEDIAL surface of tibia was preferred. Diagnosis of hemoglobinopathies and thalassemias were made using High Performance Liquid Chromatography (HPLC). Other investigations like serum ferritin level, Vitamin B 12 levels, folic acid level, Total iron binding capacity (TIBC) were performed using direct Chemiluminescence technology method.

The reference range of MCV was taken as 80- 100fl, MCH 27-32pg, while MCHC 32-36g/dl. Microcytic anemia was taken when MCV value read less than 80fl and MCH less than 27. Macrocytic when MCV was greater than 100fl.Normocytic normochromic was taken when all hematological indices were within normal range.

The data was collected as per the performa and entered in Excel spreadsheet and appropriate statistical methods were applied to get necessary outcome.

3. Results

3.1. Clinical and demographic profile

Record of 100 children were finally analyzed (Patients enrolled: 108; 8 patients were excluded as per exclusion criteria) (Table 1). There was a slight female preponderance [n=55(55%)] in our study. The age for presentation ranged from 7 months to 59 months [mean 29.4(13.8)]. 30 children were delivered prematurely (gestational age <37 weeks). 64 children were breastfed exclusively for first 6 months of life however only 21 children received adequate complementary feeding as per infant and young child feeding practice. Maternal anemia was present 37 children. As per modified kuppuswami scale, 37 children belonged to upper middle, 51 to lower middle and 12 to upper lower class however there was no patient in upper and lower socioeconomic status. As per indian academy of pediatrics (IAP) classification for malnutrition, 21 children had grade 1, 55 had grade 2, 21 had grade 3 and 3 had grade 4 malnutrition.

On clinical examination all children were visibly pale, 10 children had icterus, 4 had hepatosplenomegaly and 3 were having lymphadenopathy.

3.2. Hematological Parameters

A. Hemoglobin: Mean hemoglobin was (5.219 ±1.40) g/dl, maximum hemoglobin was 7g/dl and minimum was 2g/dl. 12% patients had hemoglobin level <3g/dl, 24% patients had hemoglobin 3-4.9g/dl, while 64% patient had hemoglobin level 5-7g/dl,

B. RBC Indices: Among 100 patients of anemia in children (6-59 months) mean MCV, MCH and MCHC were (76.88±31.92) fL, (20.87±7.41) pg/dL and (26.15 ±3.91) g/dl respectively.

3.3. Etiology of severe anemia

Most common morphological variant of anemia was found to be microcytic hypochromic (42), followed by macrocytic (23), dimorphic (18) and normocytic normochromic (17) (Table 2). Nutritional anemia was the single most common cause of severe anemia (n=80). In nutritional anemia 51 children had iron deficiency, 15 children had vitamin B12 deficiency, 11 children had combined vitamin B12 and folic acid deficiency and 3 children had isolated folic acid deficiency. Other causes of anemia were thallassemia (9), hereditary spherocytosis (3), malignancy (3), malaria (2), aplastic anemia (2) and bleeding diathesis (1) (Table 3).

Table 1: Baseline clinical profile of children with severe anemia (n=100)

Variables	Groups	Frequency (Percentage)
Sex	Male	45
	Female	55
Age	<2 Years	37
	>2 Years	63
Delivery status	Preterm	30
	Term	70
Exclusive breastfeeding till 6 months	Yes	64
	No	36
Adequate complementary feeding after 6 months	Yes	21
	No	79
Maternal anemia	Present	37
	Absent	63
Socioeconomic status (As per modified kuppuswami scale)	Upper	0
	Upper middle	37
	Lower middle	51
	Upper lower	12
	Lower	0
Caregiver education	Illiterate	23
	Primary	65
	Secondary	11
	College	1
Nutritional status (As per IAP classification)	No malnutrition	2
	Grade 1 malnutrition	21
	Grade II malnutrition	55
	Grade III malnutrition	21
	Grade IV malnutrition	1
Clinical examination	Pallor	100
	Icterus	10
	Hepatosplenomegaly	4
	Lymphadenopathy	3

Table 2: Classification on the basis of RBC morphology

Morphology	Frequency (Percentage)
Normocytic normochromic anemia	17
Microcytic hypochromic anemia	42
Macrocytic anemia	23
Dimorphic anemia	18

Table 3: Etiology of severe anemia in children

Etiology	Frequency (Percentage)
Iron def. anemia	51
Megaloblastic anemia (Vitamin B_{12} deficiency)	15
Combined megaloblastic anemia (Vitamin B_{12} and Folic acid deficiency)	11
Thalassemia	9
Megaloblastic anemia (folic acid deficiency)	3
Hereditary spherocytosis	3
Malignancy	3
Malaria	2
Aplastic anemia	2
Bleeding diathesis	1
Total	100

4. Discussion

The present study was undertaken due to a limited literature on etiology and predisposing factors associated with severe anemia in the children admitted to the hospitals so that preventive measures can be applied for targeted high-risk population. Anemia is a very common accompaniment of patients admitted for various reasons to the hospital and presence of severe anemia may alter the presentation of many conditions as well as affect the management decisions in certain settings.

The results of this study emphasize the role of nutrition in prevention of severe anemia as approximately 80% of patients had anemia secondary to nutritional deficiency. But the study also discourage sole use of hemoglobin values for treatment of severe anemic children with hematinic as only half of patients in our study were found to be iron deficient. They must be investigated further to find out the cause and type of anemia before starting treatment. Like previous studies iron deficiency was found to be the most common cause of severe anemia but approximately half the patients had anemia due to causes other than iron deficiency. We found high prevalence of anemia due to nutritional deficiencies other than iron including folic acid and vitamin B12. 29 out of 100 patients had either vitamin B12 or folic acid deficiency or both, which was significantly higher than other studies.

In our study we observed high prevalence of exclusive breastfeeding compared to national data. As per NFHS- 4, 54.9% of children under-6 months are exclusively breastfed while in our study 64% children were exclusively breastfed. This study also suggested the importance of adequate complementary feeding for prevention of severe anemia as 79% of children in our study did not receive adequate

complementary feeding as per infant and young child feeding practices.

5. Conclusion

It has become a common observation among practising physicians to start iron, folic acid therapy on presumption of iron deficiency which should be discouraged also there is no need to transfuse blood in all severely anemic children(not in congestive heart failure) without doing bone marrow testing. In future large community based trials cum effective interventional programmes are needed to eliminate route cause of anemia in children under 5 years of age group in our country.

6. Source of Funding

None.

7. Conflict of Interest

None.

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