

# Severe Nutritional Anemia Among Hospitalized Children in Central India

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**Abstract:** Despite numerous efforts, pediatric nutritional anemia remains one of the most serious health issues in developing countries. Severe nutritional anemia is associated with a number of modifiable risk factors, which can be overcome if the risk factors are accurately identified and addressed for different population groups. The purpose of this descriptive study is to focus on severe nutritional anemia in hospitalized children aged 1–5 years in a tertiary care center in Central India. Hospitalized children were enrolled in the study, and demographic, socioeconomic, clinical, and laboratory data, as well as clinical and laboratory images, were reviewed. For defining severe anemia, the World Health Organization cutoff value was used. Out of total 9850 children of 1–5 years of age group admitted in hospital for 2 years, 197 children had severe nutritional anemia, indicated the incidence of 2%. Lower socioeconomic status and malnutrition were significantly correlated to severe nutritional anemia.

**Keywords:** severe anemia, nutrition, children, socioeconomic status.

## 1. Introduction

Nutritional anemia is one of the major global health problems, especially in pediatric age group [1]. Studies in high-risk Indian populations suggest that total anemia prevalence ranges from 50% to 80%, among them 10–20% children suffer from moderate to severe anemia [2].

The fourth National Family Health Survey (NFHS) 2015–2016 found that anemia was prevalent in 58.6% of children aged 6–59 months. Rural children have a higher prevalence than urban children [3,4]. Non-hemoglobinopathies, such as nutritional anemia, are far more common in developing countries and can be caused by iron deficiency (the most common cause), folic acid deficiency, or a combination of these. Increased food availability, better resource utilization, and improved living conditions all contribute to more balanced nutrition. Children with long-term iron deficiency anemia are at risk of developmental delays, particularly in the cognitive and motor domains [5,6]. Childhood nutritional anemia leads to poor school performance, more dropout rates, repeated hospitalization, as well as increased morbidity and mortality [7]. The present study is to view the description of severe nutritional anemia in children aged 1–5 years with respect to multiple relatable factors and outcome.

## 2. Methods

This is cross-sectional health facility-based observational descriptive study conducted in tertiary center hospital in central India for 2 years. Ethical clearance was obtained from the Institutional Ethics Committee. All the children admitted in hospital between 1 and 5 years of age group, using the WHO cutoff value of hemoglobin <7 g/dL were identified as having severe anemia and included. Consent was taken from the caregivers. Children with severe anemia secondary to non-nutritional causes, with history of blood transfusion in the past 4 weeks or surgery in the past 3 months were excluded from the study.

A detailed history including demographic data such as residency and socioeconomic status (according to Modified Kuppaswamy classification), thorough anthropometric and physical examination was carried out along with laboratory investigations. The test variables were compared using Chi-square test for qualitative variables and Student's test for quantitative variables.  $p < 0.05$  was considered significant.

## 3. Results

Total 9850 patients of age group 1–5 years of age were admitted over 2 years study period including pediatric wards and pediatric intensive care unit. Among them 4826 patients had nutritional anemia and 197 children had severe nutritional anemia indicating 2% incidence of severe nutritional anemia. Out of 197 children, 164 were from 1 to 3 years (toddler age group); 33 were from 3 to 5 years (preschool age group) (according to Centre for disease control) (Table 1).

One hundred and four (52.8%) were male and 93 (47.2%) were female. One hundred and forty-nine (75.6%) patients belonged to the upper lower class and 30 (15.2%) were from lower middle class (Table 2).

We could see statistically significant association between incidence of severe nutritional anemia and lower socioeconomic class ( $p = 0.001$ ). One hundred and thirty (66%) of the patients hailed from rural areas, while 67 (34%) were from an urban

**Table 1.** Demographic data

Variables	Groups	No.	%
Age	1–<2	126	63.95
	2–<3	38	19.28
	3–<4	10	5.07
	4–≤5	23	11.67
Gender	Male	104	52.8
	Female	93	47.2
Nutritional status (WHO)	Normal	94	47.7
	Moderate acute malnutrition	63	32
	Severe acute malnutrition	40	20.3
Development	Normal	109	55.32

	Delay at least in one domain	88	44.67
Immunization	Complete	160	81.2
	Partial	32	16.2
	Unimmunized	5	2.5
Birth weight	<1.5 kg	16	12.69
	1.5–2.5 kg	85	67.46
	>2.5 kg	25	19.84

**Table 2.** Socioeconomic data

Variables	Groups	No.	%
Socioeconomic status	Lower class (V)	8	4.1
	Upper lower class (IV)	149	75.6
	Lower middle class (III)	30	15.2
	Upper middle class (II)	10	5.1
	Upper class (I)	0	0
Residence	Urban	12	6.1
	Urban slum	55	27.9
	Rural	130	66
Source of drinking water	Safe	114	57.9
	Unsafe	83	41.6
Toilet	Available	115	58.4
	Not available	82	41.6
Literacy	Illiterate	36	18.3
	Primary education	114	57.9
	Higher secondary	47	23.9

area. Fifty-five (27.9%) were found to be living in urban slums. Caregivers of 36 (18.3%) children were illiterate; while that of 114 (57.9%) had primary education level and 47 (23.9%) of them had higher secondary level.

In this study, 114 (57.9%) children had access to a safe and an improved water source while 83 (42.1%) had unsafe drinking water sources. One hundred and fifteen (58.4%) of the patients were able to avail toilet facilities, while 82 (41.6%) had no toilet facilities. One hundred and eighty-four (93.4%) of the enrolled children were weaned between the ages of 6–12 months.

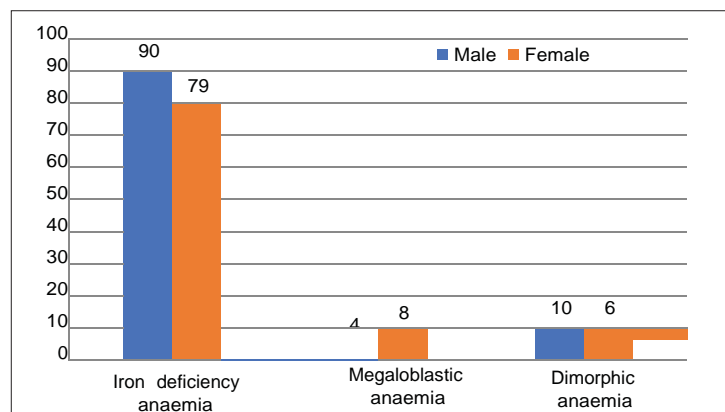
In this study, 103 (52.28%) were malnourished, out of which 63 (32%) had moderate acute malnutrition while 40 (20.3%) of them had severe acute malnutrition. Ninety-four (47.7%) of the enrolled cases had normal weight for length/height. There is a significant statistical association between malnutrition and incidence of severe nutritional anemia ( $p=0.0001$ ).

One hundred and sixty (81.2%) children were completely immunized, while 32 (16.2%) were partially immunized. Five (2.5%) of them had not received any immunization. Unfortunately, 88 (44.67%) children had developmental delay in at least domain, most commonly in social followed by gross motor. Fever (61.4%) was the commonest complaint observed followed by irritability (43.1%), vomiting (28.9%), cold and cough (25.9%), feeding difficulties (25.9%), and abdominal pain (24.9%) pallor was invariably seen in all enrolled patients (100%). Knuckle pigmentation was seen in 141 patients (71.6%), tachycardia was seen in 72 cases (36.5%), and glossitis in 58 (29.4%). Septicemia being seen in 121 (61.4%) was the most common comorbidity among, followed by respiratory tract infections – 83 cases (42.1%), central nervous system infections – 34 cases (17.3%) and worm infestation – 34 cases (17.3%). Hematological parameters confirmed iron deficiency anemia in 169 (85.78%) children followed by dimorphic anemia in 16 cases (8.12%). Megaloblastic anemia was least common seen in 12 (6.09%) of the patients. Children were treated according. Majority of the patients 162 (82.23%) had a hospital stay of 4–7 days. Eighty-five (93.9%) of them were discharged, 8 (4.1%) took discharge against medical advice, and 4 (2%) of the enrolled patients died during the hospitalization period.

#### 4. Discussion

Anemia burden is like a iceberg in society, it is always a hidden entity, and its manifestation is not as disease per se. Anemia is highly impacted by socioeconomic, biological, environmental, and nutritional factors. In India, anemia is the most common nutritional problem affecting more than half of the total population, particularly the children. Iron deficiency anemia is the most common form of nutritional deficiency in the world responsible for a staggering amount of ill-health, cost productivity, increased mortality, and morbidity. Although central region of India is commonly known for sickle cell anemia, childhood nutritional anemia of all types should also be addressed with same aggression. We could see 2% incidence of severe nutritional anemia in 1–5 years of age group of children admitting to hospital. It was observed that toddlers (1–3 years) were maximally affected (83.43%), which is in concurrence with the study by Shah *et al.* (71.25%) [8]. This is in contrast to the study done by Singh *et al.* [9] who found that the children of age group between 2 and 5 years were most affected. The more severity of the problem in toddlers is likely to be due to increased iron requirements, rapid growth, late weaning, and low availability of foods rich in iron and mismanaged feeding. In the present study, males (52.82%) were more affected than females (47.2%). Here, we could see that 75.6% of the patients belonged to the upper lower class with a significant p value of 0.001. After that, lower middle class had the second highest number of cases. Sixty-three (32%) had moderate acute malnutrition while 40 (20.3%) of them had severe acute malnutrition. About 44.16% children had delay in at least one of the developmental domains which are a worrisome thing holding impact on later period of life as well. This finding warrants targeted measures in this high-risk vulnerable group for anemia correction. We could see that children present with wide range of clinical features, pallor, knuckle pigmentation being very commonly seen. Vaidya *et al.* have shown similar presentation of children [10]. In the present study, 151 patients (76.6%) presented with microcytic hypochromic anemia, iron deficiency anemia 85.78% (169 patients) was the most common cause observed for

severe nutritional anemia, followed by dimorphic anemia (8.12%) and megaloblastic anemia(6.09%) (Fig. 1). Majority of the children had hospital stay of 4–7 days, but it is difficult to interpret the correlation between anemia and the length of hospitalization as many other factors may play a significant role in this context, such as the underlying medical condition, different medical care, and the effect of the sample randomization. Out of the 197 patients enrolled in the study, majority of the patients 185 (93.9%) got discharged. Anemia in childhood is commonly associated with growth failure and malnutrition and adversely affects the development of children and there is a need for effective strategy such as improving nutrition of mother and increasing the consumption of iron rich foods in children. Children being the most vulnerable group for nutritional deficiency anemia require early screening and treatment. Study being done in a tertiary care center and government health facility, we could see multiple causative variables associated with severe nutritional anemia. Most of study population belonged to upper lower class, rural, and slum area. We could study few children with partial immunization and various degrees of malnutrition. This study has some limitations as well. The small sample size of 195 children may limit the accuracy of the results and their ability to be generalized to the entire population. Investigations such as total iron binding capacity and serum ferritin could not be obtained for every patient, resulting in incorrect anemia classification. Long-term monitoring of this cohort’s growth, cognition, neurobehavior, and academic performance is also recommended.



**Figure 1.** Types of severe nutritional anemia

## 5. Conclusion

This 2 years cross-sectional hospital-based study stresses on multiple modifiable risk factors and features of severe nutritional anemia in 1–5 years of age group children. It was observed that severe nutritional anemia was significantly associated with lower socioeconomic class and malnutrition. In a resource limited country like India, the etiology of anemia can be diagnosed with history, clinical examination, and laboratory investigations. Strict policies should be implemented to reduce the burden of childhood nutritional anemia through all levels of health-care system.

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