Indian Journal of Youth and Adolescent Health
Volume 10, Issue 1 - 2023, Pg. No. 16-20
Peer Reviewed & Open Access Journal

Research Article

Clinico-aetiological Profile of Severe Anaemia in Hospitalised Adolescents in a Tertiary Care Centre of Bundelkhand Region, Central India

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DOI: https://doi.org/10.24321/2349.2880.202304

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How to cite this article:
Kankane A, Gautam A, Pandey N, Chaurasia OS. Clinico-aetiological Profile of Severe Anaemia in Hospitalised Adolescents in a Tertiary Care Centre of Bundelkhand Region, Central India. Ind J Youth Adol Health. 2023;10(1):16-20.

Date of Submission: 2023-02-27
Date of Acceptance: 2023-03-28

A B S T R A C T

Background: Anaemia is a worldwide public health issue and developing countries are burdened with it because of malnutrition, iron deficiency, vit. B_{12} deficiency, folic acid deficiency, and infectious diseases. It affects 1.6 billion people (24.8%) globally.

Objective: To study the clinico-aetiological profile of severe anaemia in adolescent patients admitted to the paediatrics department of a tertiary care centre in the Bundelkhand region of Central India.

Methods: The study design of the present study was cross-sectional observational. The study included 100 cases of severe anaemia aged 10-19 years fulfilling the inclusion and exclusion criteria. It was conducted from September 2021 to August 2022. Adolescents with haemoglobin levels less than 8 gm/dl are considered severely anaemic according to WHO. SPSS version 23 was used to perform statistical analysis.

Result: Out of 100, most of the patients were from rural areas (55%). The commonest affected age group was the early adolescent (10-12 years) group with a female preponderance (67%) over male. Pallor (100%) was the most common physical finding, the second most common being icterus followed by pedal oedema. Results of the present study showed that nutritional anaemia was the most common aetiology, out of which iron deficiency anaemia (IDA) was found in 36% of cases followed by vit. B_{12} deficiency anaemia (24%) and iron + vit. B_{12} deficiency anaemia (8%). Predominant RBC morphology observed on peripheral blood smear was microcytic hypochromic (50%).

Conclusion: The study shows that nutritional deficiencies, i.e. iron and vit. B_{12}, constitute the commonest cause of severe anaemia in hospitalised adolescents.

Keywords: Adolescent, Severe Anaemia, Clinical Profile, Aetiology, Bundelkhand Region

Introduction

Anaemia is a condition in which there is a decrease in the haemoglobin level of blood below the lowermost value of the normal range for that particular age and gender.[1] Adolescents with a haemoglobin level of less than 8 gm/dl are considered severely anaemic according to World Health Organization (WHO) criteria.[2] Anaemia limits the development of boys and girls, their learning ability, reduces concentration, increases the risk of infections and rate of school dropouts, and reduces fitness and work productivity.[3] World Health Organization (WHO) has defined the adolescent stage as a time in life when a person is between the ages of 10 and 19 years.[4] Adolescence is divided into three stages: early stage (10 to 13 years), middle stage (14 to 16 years), and late stage (17 to 19 years).[5] 1.2 billion of the global population is constituted of adolescents between the age group of 10-19 years and more than 253 million of this population live in India.[6] For this age group, there is limited national representative nutrition survey data. NFHS (2019-21) has covered the age group of 15-19 years and has estimated that anaemia prevalence among girls has decreased from 53.7% to 52.9% and among boys, it has reduced from 31.5% to 28.2%.[7] A study from Uttar Pradesh and Bihar shows that the prevalence of mild anaemia is 23.7% among adolescent boys and 42% among girls. A study conducted among adolescent girls from the Madhya Pradesh region showed the prevalence of anaemia as 52.06%, out of which mild anaemia was found in 70.5%, moderate anaemia in 28.06% and severe anaemia in 1.44% of the participants.[8,9] On search, no data was found on severe anaemia from the Bundelkhand region. Thus, with the purpose of filling this lacuna, the current study was conducted with the objective to identify the clinico-aetiological profile of severe anaemia in adolescents.

Material and Methods

After getting clearance from the Institutional Ethics Board and taking informed consent from parents and assent from patients, this hospital-based cross-sectional observational study was conducted from September 2021 to August 2022 including 100 patients between 10 and 19 years of age admitted with severe anaemia in the Paediatrics Department of Maharani Laxmi Bai Medical College, Jhansi (Uttar Pradesh). Inclusion criteria were all children between 10 and 19 years of age with severe anaemia, haemoglobin level less than the expected value or gender-specific cutoff values for severe anaemia (male < 8 gm/dL and female < 8 gm/dL), and history of recurrent blood transfusions. Exclusion criteria were patients aged less than 10 years or more than 19 years, patients having mild to moderate anaemia, patients who succumbed to death within 12 hours of admission, patients who did not give consent, adolescents with congenital anomalies, post-traumatic cases, recent surgical cases, and history of recent blood transfusion.

A detailed history of illness was taken from all patients fulfilling the inclusion criteria consisting of treatment history, dietary history, family history, history of any substance intake and exposure to radiation, demographic profile, worm infestation, menstrual history, history of bleeding, trauma, and blood transfusion. A head-to-toe examination was performed for significant physical signs such as pallor, icterus, glossitis, lymphadenopathy, pedal oedema, nail changes, knuckle hyper-pigmentation, ascites, altered sensorium, bleeding manifestation (petechiae, purpura, bleeding from any site) etc. Systemic examination was done thoroughly. A battery of investigations was done to reach the clinico-aetiological diagnosis of severe anaemia including a complete haemogram, general blood picture, iron profile, serum vit. B_{12}, serum folate levels, renal function test, liver enzymes, blood and urine culture, radio-imaging (ultra-sonography, brain scan, chest x-ray) etc. Wherever required, invasive procedures such as lumbar puncture and bone marrow aspiration were also done.

Statistical Package for Social Sciences (SPSS) version 23 IBM (USA) was used to perform statistical analysis. Initially, data were processed on MS Excel and then coding was performed. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to check normality of data. Data were found to be non-normally distributed. For categorical variables, frequency and proportions were used in descriptive analysis while mean and SD were used for continuous variables.

Results

The present study included 100 patients of ages 10-19 years, out of which maximum cases (48%) belonged to 10-12 years of age, followed by 40% of cases of 13-15 years and 12% of cases of 16-19 years. 33% of participants were male and 67% were female. Socio-economic status was evaluated using the modified Kuppuswamy scale,[10] according to which most of the patients belonged to the lower class (57%), out of which 29% belonged to the upper-lower class and 28% belonged to the lower-lower class. This was followed by lower-middle class (21%), upper-middle class (15%) and upper class (7%) (Table 1).

The commonly encountered symptoms were easy fatigue (84%), fever (61%), and yellowish discolouration of skin (58%), followed by anorexia (30.0%), breathlessness (20.0%), cough (15.0%), vomiting (14.0%), abdominal pain (12.0%), convulsions (7.0%), bony pain (5.0%), and bleeding (5.0%). In physical signs, pallor was present in all cases followed by icterus (58%), pedal oedema (56%), knuckle hyperpigmentation (53%), glossitis (17%), lymphadenopathy (10%), purpuric spots (10%), and altered sensorium (3%). Splenomegaly was found in 18% of cases, hepatomegaly

ISSN: 2349-2880
DOI: https://doi.org/10.24321/2349.2880.202304

in 16% of cases and ascites in 3% of cases (Table 2). The majority of adolescents enrolled in this study were found to have IDA comprising 36% of cases. Vit. B_{12} deficiency was found to be the second-most common cause of anaemia comprising 24% of cases, while 8% of adolescents had mixed type of anaemia (iron + vit. B_{12}). Following aetiologies of severe anaemia were found in the rest of the adolescents: acute viral hepatitis (8%), tubercular meningitis (4%), hepatic encephalopathy (4%), thalassemia (4%), malaria (3%), pulmonary tuberculosis (2%), HIV (2%), aplastic anaemia (2%), chronic kidney disease (2%), and leukaemia (1%) (Table 3). Pertaining to haemoglobin levels, 59% of patients had a haemoglobin level between 6.1 and 8 g/dL and 41% had a haemoglobin level of less than or equal to 6 g/dL. The majority of patients had a microcytic hypochromic picture (50%) followed by a dimorphic picture (35%), macrocytic hypochromic picture (8%) and normocytic normochromic picture (7%).

Table 1.Distribution of Study Participants based on Demographic Profile (N = 100)

Variables	No. of Cases	Percentage
Age group (years)		
10-12	48	48.0
13-15	40	40.0
16-19	12	12.0
Total	100	100.0
Gender		
Female	67	67.0
Male	33	33.0
Total	100	100.0
Area		
Urban	45	45.0
Rural	55	55.0
Total	100	100.0
Socioeconomic class		
Upper (I)	7	7.0
Upper-middle (II)	15	15.0
Lower-middle (III)	21	21.0
Upper-lower (IV)	29	29.0
Lower-lower (V)	28	28.0
Total	100	100.0

The present study showed that a reduction in RBC count was the only cytopenia in 36% of cases followed by pancytopenia (26%), thrombocytopenia with anaemia (20%), and leukopenia with anaemia (14%). Only 4% of cases had leukocytosis. In this study, in IDA, Red Cell Distribution Width (RDW) was increased and Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC) were decreased in RBC indices. In megaloblastic anaemia, MCHC was found within range and MCV and MCH were increased. Patients with IDA showed a serum ferritin level of less than 10 µg/l. Majority of patients with vit. B_{12} deficiency had S. B_{12} levels less than 83 pg/ml while few of them had S. vit. B_{12} levels between 110 and 130 pg/ml. Among all 100 patients, 50 had a reticulocyte production index (RPI) of 0.2% while the other half had an RPI of 0.5%.

Table 2.Sign and Symptoms of Study Participants (N = 100)

Presenting Symptoms	No. of Cases	Percentage
Easy fatigue	84	84.0
Fever	61	61.0
Yellowish discolouration of skin	58	58.0
Anorexia	30	30.0
Breathlessness	20	20.0
Cough	15	15.0
Vomiting	14	14.0
Abdominal pain	12	12.0
Convulsions	7	7.0
Bony pain	5	5.0
Bleeding	5	5.0
Physical findings		
Pallor	100	100.0
Icterus	58	58.0
Pedal oedema	56	56.0
Knuckle hyperpigmentation	53	53.0
Splenomegaly	18	18.0
Glossitis	17	17.0
Hepatomegaly	16	16.0
Lymphadenopathy	10	10.0
Purpuric spots	10	10.0
Ascites	3	3.0
Altered sensorium	3	3.0

Table 3.Aetiological Diagnosis of the Study Population (N = 100)

Diagnosis	No. of Cases	Percentage
Iron deficiency anaemia	36	36.0
Vit. B_{12} deficiency anaemia	24	24.0

ISSN: 2349-2880
DOI: https://doi.org/10.24321/2349.2880.202304

Acute viral hepatitis	8	8.0
Iron + vit. B_{12} deficiency	8	8.0
Tubercular meningitis	4	4.0
Hepatic encephalopathy	4	4.0
Thalassemia	4	4.0
Malaria	3	3.0
Pulmonary tuberculosis	2	2.0
HIV	2	2.0
Aplastic anaemia	2	2.0
Chronic kidney disease	2	2.0
Leukaemia	1	1.0

Discussion

Adolescence is a vital developmental stage in which the majority of physical, psychological and behavioural changes take place. The present hospital-based study was carried out among 100 adolescents admitted with severe anaemia, to know their clinico-aetiological profile. The study shows female preponderance with a 1:2 male-female ratio. In studies by Kumar et al.[11] and Dashratham and Reddy[1], similar findings were observed, i.e. male:female ratio of 0.6:1 and 2:3 respectively. However, in a study conducted by Reddy et al.,[12] more participants were male (55.7%).

Regarding aetiology, nutritional anaemia was observed to be the commonest cause of severe anaemia accounting for about 68% of cases in the present study. Amongst these, 36% of cases had IDA while 24% had vit. B_{12} deficiency anaemia and 8% had iron + vit. B_{12} deficiency. This was in accordance with a study conducted by Venkatesh et al.[13] in which the most common cause was IDA, with dimorphic anaemia being the second commonest cause. Ramya et al.[14] also reported IDA as the most common cause of nutritional anaemia followed by malignancies with megaloblastic anaemia. Madoori et al.[15] found IDA to be responsible for 58% of cases while 27% had sickle cell disorder, 5% presented with megaloblastic anaemia, and 2% with aplastic anaemia. Sastry[16] also found IDA to be the commonest cause of anaemia followed by sickle cell disorder (27%). Nutritional anaemia came out to be the first cause of severe anaemia but the second cause varied in other studies as well as in the current study which can be explained by differences in social and geographical regions in various studies.

In the present study, easy fatigability (84.62%), fever (61%), and yellowish discolouration of skin (58.97%) were the most common symptoms. The most common finding was pallor (100%) followed by icterus (58%), pedal oedema (56%), and knuckle hyperpigmentation (53%). These clinical features were similar to earlier studies. In a study conducted by Reddy et al.,[12] common presenting symptoms were easy fatigability (82.9%) and pica (9.5%) while the most common sign was pallor constituting 47.6% of respondents. Sastry[16] found weakness and fatigability as the most common presenting symptoms (81.8%). Pallor (100%) was found in all patients, koilonychia in 36.3% and knuckle hyper-pigmentation in 18.1% of participants. Similarly, Kumar et al.[11] reported the main presenting complaint as weakness and easy fatigability (91%) with severe pallor (54.9%) as the sign in a majority of patients (54.9%).

In the present study, in peripheral blood smear, a microcytic hypochromic picture was found in 50% of cases, and a dimorphic picture was observed in 35% of cases. Similarly, Prakash et al.[17] observed that 98.7% of cases had microcytic hypochromic anaemia while only two cases had macrocytic anaemia. Also, Dasharatham and Reddy[1] reported a dimorphic picture in 30% of respondents while the majority presented with a microcytic hypochromic picture. Sastry[16] found dimorphic anaemia in 9.09% and microcytic hypochromic anaemia in 81.8% of participants.

The majority of cases in the current study belonged to the upper-lower class (29%), 28% belonged to the lower-lower class, 21% were from the lower-middle class and 15% were from the upper-middle class. These findings were similar to earlier reported studies. Reddy et al.[12] found that the majority of patients with severe anaemia belonged to the upper-lower class (45.2%) followed by middle-lower class (44.8%) and lower class (14%). Venkatesh et al.[13] reported that the majority of patients were from the lower class.

With reference to cytopenias, the present study showed anaemia as the only cytopenia in 36% of cases followed by pancytopenia in 26% of cases. Among these cases of pancytopenia, the majority of patients suffered from megaloblastic anaemia. Similarly, in studies by Khunger et al.[18] and Gayatri and Rao,[19] the most common cause of pancytopenia was megaloblastic anaemia.

Pertaining to RBC indices in our study, MCV, MCH, and MCHC were decreased and RDW was raised in all patients with IDA, while MCHC was normal, and MCV and MCH were elevated in megaloblastic anaemia. Variations in these red cell indices were seen in dimorphic anaemia. In a study conducted by Sastry,[16] it was observed that in IDA, RDW was increased and PCV, MCV, MCHC, and MCH were decreased while in megaloblastic anaemia, MCHC was within range, PCV was decreased and MCV and MCH were increased.

Conclusion

The present study shows nutritional anaemia as the commonest aetiology of severe anaemia among girls in the age group of 10-12 years. This reflects the poor nutritional status of adolescents in this region. As nutritional anaemia is

ISSN: 2349-2880
DOI: https://doi.org/10.24321/2349.2880.202304

a preventable cause, the current study warrants a need for adolescents-oriented government-run community health programmes to uplift their nutrition which in turn will decrease the burden of severe anaemia.

Acknowledgement

All authors contributed to the conceptualisation of the study design and preparation of the manuscript. Special acknowledgement is due to Dr Ajay Arya (Statistician, MLB Medical College, Jhansi) for helping in statistical analysis.

Financial Support and Sponsorship: None

Conflicts of Interest: None

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