Original research article

Evaluation of Anemia in Dependent Age Groups of Society (Pediatric and Geriatric population) - A Hospital Based Cross Sectional Study

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Abstract

Background: Anemia is a major public health concern globally and in India despite numerous health programme organized across the country for decades the national prevalence rates of anemia are reaching new heights as is evident from the national family health survey (NFHS 5).

World Health Organization (WHO), defines anemia as having hemoglobin (Hb) levels lower than 12.0 and 13.0 g/dL in females and males, respectively. The "Dependent Population" defined as People, below 15 years of age group and 65 years and above. Thus, in age group below 15 years and above 65 years, it is indeed necessary to identify anemia, stratify the type and its severity and search for etiology accordingly.

Aim: To evaluate etiology, morphological types and grading patters of anemia in pediatrics and geriatric patients.

Material and methods: The present study was two-months hospital based prospective study of all diagnosed cases of anemia to access the etiology, morphological type and associated grading pattern of anemias in pediatric and geriatric age group from September 2022 to October 2022, which included 56 cases.

Result: During a period of 02 months, out of the 56 patients, 20 belonged to the pediatric age group (upto 15 years) and 36 belonged to the geriatric age group (65 years and above) were evaluated for anemia. Male to female ratio, out of 20 pediatric patients, was of 3:1. Majority of our patients (55 %) belonged to age group of 06-10 years. Similarly, out of 36 geriatric patients, 17 patients were female (47.3%) and 19 patients were male (52.7%) with male to female ratio of 1.1:1. Majority of our patients (77.78 %) belonged to age group of 65-75 years. Clinically, majority of pediatric patients presented with nutritional deficiency (30%) and majority of geriatric patients presented with generalized weakness and fatigue (20%). Majority of pediatric age group showed moderate degree of anemia (50%) and in geriatric age group for 36 blood samples were evaluated out of which majority of them showed moderate degree of anemia (47.2%) and severe (47.2%) equally. Morphologically out of 20 blood samples of pediatric age group displayed Microcytic anemia (50 %) with most common etiology being, iron deficiency anemia was observed in 06 cases (30%) with serum ferritin levels below 15 ng/ml and out of 36 geriatric patients' anemia of chronic disease was observed in 13 cases (36.11%) with most common, etiology being, renal disorder.

Conclusion: Anemia remains a major health concern in both dependent age groups**.** Early detection of anemia and definite characterization for the underlying etiology should be taken

in consideration for the overall improvement in the quality of life in both dependent age groups.

Keywords: Anemia, Di-morphic anemia, Iron deficiency, Anemia of chronic disease, Geriatric, Pediatric

Introduction

Anemia is a major public health concern globally and in India despite numerous health programs organized across the country for decades. The National Prevalence rates of anemia are reaching new heights as is evident from the National Family Health Survey 5(NFHS 5).

According to the World Health Organization (WHO), anemia is defined as having hemoglobin (Hb) levels lower than 12.0 and 13.0 g/dL in females and males, respectively. [1]

In any community, the children and elderly constitute the priority group as they require special care and attention. The "Dependent Population" is defined as People in the following age groups: - [2]

a) upto15 years of age

b) 65 years and above

Although anemia has various etiologies based on its underlying pathophysiology, nutritional deficiencies and chronic diseases are the most common etiologies of anemia in children and older adults. [3-4]

*Burden in Pediatric age group:

Anemia in children is a major public health threat that is associated with increased risk of infections, mortality and serious consequences on development of child. A major bulk of Anemia cases is prevalent among the children. Estimates suggest that, Anemia in children have increased from 58.6% (NFHS 4) to 67.1% (NFHS 5). [5]

The Centre has an ongoing programme called **AnemiaMukt Bharat** to reduce the proportion of Anemia among children to 40% by the year 2022.The current NFHS 5 data thus shows a lack of progress towards these goals.

*Burden in Geriatric age group:

In Elderly patients, Anemia contributes significantly to morbidity, mortality and also hampers the quality of life. Despite the Modern diagnostic advances, geriatric anemia still remains under reported and inadequately investigated, thereby necessitating evaluation of even mild anemia in this vulnerable population. [6]

Anemia is a major health problem in Geriatric age group and its prevalence significantly increases with age. [7]

In India, although the percentage of elderly to total population is low in comparison to developed countries, however, the absolute size of aged population is considerable. [8]

Anemia in geriatric age group is often overlooked and remains undiagnosed due to presenting symptoms (fatigue, weakness and shortness of breath) that are similar and attributable to the aging process itself. [7]

Currently there are nearly 138 million elderly persons in India. As per the reports of the Technical Group on Population Projections for India, an increase of nearly 34 million elderly persons was seen in 2021 and is further expected to increase by around 56 million in 2031. [9]

Anemia in elderly, is thus an emerging global health problem of 21st century.

Most common cause include nutritional deficiency anemia and anemia of chronic disease is responsible for two third cases of anemia in pediatric and geriatric age group, while unexplained anemia covers the rest one third cases. [10,11,12]

There is scarcity of data and health statistics when it comes to geriatric population of our country. The limited literature on Anemia among elderly prompted us include the Geriatric population in our study. A majority of studies done previously have examined Anemia and its parameters, in Pediatric and Geriatric Patients separately, BUT NEVER TOGETHER.

Besides, the Pediatric and Geriatric population seem to be the most ignored group of population when it comes to screening and treatment of anemia.

The current study, is thus unique, and proposes to study the Parameters of Anemia in both the dependent age groups together.

METHODOLOGY:
*STUDY DESIGN –
This is a hospital based prospective cross-sectional study to assess the Etiology, Morphological type and associated grading pattern of Anemia in Pediatric and Geriatric age groups.

*STUDY POPULATION-
The study population will comprise of all the patients in the Pediatric (upto 15 years) and Geriatric (65 years and above) age groups

*SELECTION CRITERIA:
1) Diagnostic   criteria: The WHO recommended cut off for hemoglobin level will be used to diagnose as well as categories Anemia: - [13]

For elderly males (65 years and above): diagnosis of Anemia will be considered Hemoglobin<13g/dL

For elderly females (65 years and above): diagnosis of Anemia will be considered as Hemoglobin<12g/dL

For the Pediatric age groups the diagnosis of Anemia will be considered as: -

Pediatric population	Hemoglobin level for anemia diagnosis
Children (6 to 59 months)	<11 g/dL
Children (5 to 11 years)	<11.5 g/dL
Children (12 to 15 years)	<12 g/dL

INCLUSION CRITERIA:
1. The Pediatric (upto 15 years) and the Geriatric (65 years and above) patients fulfilling the diagnostic criteria as stated above will Constitute the Study Sample.
2. Patients in the same age intervals (i.e., upto 15 years; and, 65 years and above) with the normal hemoglobin levels – Constitute the Control Sample.

EXCLUSION CRITERIA:
    a. Patients in the age group of 16 years to 64 years.
    b. Patients requiring frequent blood transfusions
    c. History of surgery within past 2 months
    d.

*STUDY METHOD:

On admission, a detailed history with emphasis on the present and past symptoms was obtained, followed by hematological work-up including hemogram, peripheral blood smear and red blood cell indices. Further work up such as iron profile and vitamin B12 was done as and when required.

All the venous blood samples were sent and reported in the Medical College and Hospital during the two-month interval. The blood samples was processed in Automated Hematology Analyzer: iCount5 Hematology Analyzer.

Ascertaining the Grading of Anemia: -

The results as displayed by the hematologyanalyzer was analyzed and co related with the grading pattern of anemia as per WHO: -

Hemoglobin levels to diagnose anemia at sea level(g/dL): - [13]

Population	Non anemia	Anemia mild	Anemia moderate	Anemia severe
Children (6 to 59 months)	11 or higher	10 to 10.9	7 to 9.9	<7
Children (5 to 11 years)	11.5 or higher	11 to 11.4	8 to 10.9	<8
Children (12 to 15 years)	12 or higher	11 to 11.9	8 to 10.9	<8
Elderly female (65 years and above)	12 or higher	11 to 11.9	8 to 10.9	<8
Elderly male (65 years and above)	13 or higher	11 to 12.9	8 to 10.9	<8

Ascertaining the Morphological type of Anemia: -

The results obtained from automated hematologyanalyzer that is the Hemoglobin and red blood cell indices was correlated with red cell morphology on peripheral blood smear slide. Subsequently the Morphological pattern of Anemia was ascertained.

The patients with confirmed cases of anemia were approached. The patients were explained the details of the study and detailed history of the patient was recorded and subsequently documented.

The common findings that are often found in patients of anemia were looked for and documented as follows:

Example 1 (For the Pediatric population)

HISTORY ASKED: PRESENT (yes/no)   ABSENT (yes/no)

o   History of Low birth weight
o   History of Stunting
o   History of developmental delay
o   Dietary History:
    1)   Use of low iron formula
    2)   Introduction of unmodified cow's Milk before the age of 1 year
    3)   Excessive milk intake (more than Or equal to 24 ounces/day)
    4)   Poor intake of iron rich foods

- Family history:

Whether any History of jaundice, Gall stone or splenomegaly present.

o Drug exposure:
1) Exposure to Paint, home renovations or Use of imposted or glazed ceramics suggest Lead toxicity.
2) Anemia following exposure to oxidant drugs or fava beans suggest G6PD deficiency

o Underlying medical conditions:Any underlying renal disease, or Malignancy or inflammatory condition.

Any autoimmune disease present or not.

Example 2 (For the geriatric age group)

HISTORY ASKED: PRESENT (yes/no)   ABSENT (yes/no)
1. History of Fatigue
2. History of weakness
3. History of prescription of Any hematinic
4. History of abdominal pain
5. History of gastrectomy and Malabsorption.
6. History of any chronic illness
   (Like hypothyroidism, hypoadrenalism renal disease, hypopituitarism, etc.)
7. Family History of Anemia
8. Dietary Habits:
(Inadequate iron or protein intake; Strict vegetarian; diet lacking fruits and vegetables)

After detailed study of the clinical history and findings, the most likely Etiology associated with Anemia in Patient were ascertained.
Relevant clinical investigations pertaining to answers obtained using pre-structured questionnaire format was done.

The following clinical investigations was considered to be done as and when required: -
1) Serum Iron Profile Assay
2) Vitamin B12 Assay

DATA ANALYSIS:
The collected data was transformed into variables, coded and entered into the statistical package of social sciences (SPSS) Software. For statistical analysis, Chi Square test was used.
RESULT:
During a period of 02 months, out of the 56 blood samples, 20 belonged to the pediatric age group (upto 15 years) and 36 belonged to the geriatric age group (65 years and above).

TABLE 1: Age wise distribution 0f cases:

Pediatric Age group	Total	Percentage
0 -5 years	04	35.7
6 -10 years	11	
11-15 years	05	
Geriatric age group	Total	Percentage

65 – 75 years	28	64.3
76 – 85 years	07	
86 – 100 years	01	

Out of 20 pediatric patients, 05 patients were female (25%) and 15 patients were male (75%) with male to female ratio of 3:1. Majority of our patients (55 %) belonged to age group of 06-10 years, followed by 5 cases (25%) in the age group 11-15 years and 4 cases (20%) in the age group between 0-5 years. The age of our cases ranged from 0-15 years with mean age of patient being 7.26 years. The mean age of male patients was 7.95, while the mean age of female patients was 9.6 years.

Similarly, out of 36 geriatric patients, 17 patients were female (47.3%) and 19 patients were male (52.7%) with male to female ratio of 1.1:1. Majority of our patients (77.78 %) belonged to age group of 65-75 years, followed by 7 cases (19.44%) in the age group 76-85 years and 1 case (2.78%) in the age group between 86-1oo years. The age of our cases ranged from 65-100 years with mean age of patient being 96.66 years. The mean age of male patients was 72.36, while the mean age of female patients was 66.47 years.

Table 2: Clinical presentation of Pediatric patients:

HISTORY / SYMPTOMS	No. of Patients
Low birth weight/ developmental delay	04 (20%)
Nutritional deficiency / low iron formula	06 (30%)
Generalized weakness/ fatigue	04 (20%)
Fever	02 (10%)
Pain Abdomen	01 (5%)
Diarrhea	01 (5%)
Loss of appetite	01 (5%)
Yellowness of eye	01 (5%)

Clinically, majority of pediatric patients presented with nutritional deficiency (30%), followed by low birth weight with developmental delay (20%) and generalized weakness and fatigue (20%), fever (10%), Pain abdomen (5%), Diarrhea (5%), Loss of appetite (5%) and Yellowness of eye (5%).

Table 3. Clinical presentation of Geriatric patients:

HISTORY/ SYMPTOMS	No. of patients
Generalized weakness / Fatigue	26 (72.2%)
Dyspnea	03 (8.33%)
Nausea / vomiting	01 (2.7%)
Fever	01(2.7%)
Palpitations	01(2.7%)
Pain abdomen polyuria	01(2.7%)
Constipation	01(2.7%)
Diarrhea	01(2.7%)
Loss of appetite	01(2.7%)

Clinically, majority of geriatric patients presented with generalized weakness and fatigue (20%), fever (10%), Pain abdomen (5%), Diarrhea (5%), Loss of appetite (5%) and Yellowness of eye (5%).

Using the WHO Hemoglobin concentration for diagnosis of anemia and assessment of the severity, the following conclusions were drawn as far as the grading of anemia is concerned.

Table 4: Grading of anemia in pediatric age group:

GRADE	TOTAL	PERCENTAGE
MILD	02	10%
MODERATE	10	50%
SEVERE	08	40%

Complete blood counts for the 20 blood samples of pediatric age group were evaluated out of that majority of them showed moderate degree of anemia (50%), severe (40%) and mild degree (10%) patterns were observed.

TABLE 5: Grading of anemia in geriatric age group:

GRADE	TOTAL	PERCENTAGE
MILD	02	5.6 %
MODERATE	17	47.2%
SEVERE	17	47.2%

Complete blood counts for the 36 blood samples of geriatric age group were evaluated out of that majority of them showed moderate degree of anemia (47.2%) and severe (47.2%) equally and mild degree (5.6%) patterns were observed.

TABLE 6: Peripheral blood smear pattern in Geriatric age group

PBS FINDINGS	TOTAL	PERCENTAGE
NORMOCYTIC NORMOCHROMIC	08	22.3%
MICROCYTIC HYPOCHROMIC	07	19.4%
MACROCYTIC NORMOCHROMIC	07	19.4%
DIMORPHIC	14	38.9 %

Peripheral Blood Smear (PBS) examination for the 36 blood samples of geriatric age group was made and out of that majority of them displayed Di-morphic anemia (38.9%), followed by normocytic and normochromic (22.3%) and both microcytic with macrocytic morphology (19.4%) patterns were observed.

TABLE 7: Peripheral blood smear pattern in Pediatric age group

PBS FINDINGS	TOTAL	PERCENTAGE
NORMOCYTIC NORMOCHROMIC	04	20%
MICROCYTIC HYPOCHROMIC	10	50%
MACROCYTIC NORMOCHROMIC	04	20%
DIMORPHIC	02	10%

Peripheral Blood Smear (PBS) examination for the 20 blood samples of pediatric age group was made and out of that majority of them displayed Microcytic anemia (50 %), followed by normocytic normochromic and macrocytic (22.3%) and Di-morphic morphology (10.0%) patterns were observed.

TABLE 8: Etiology of Pediatric age group:

S. NO	TOTAL	NUTRITIONAL	PARASITIC	RENAL DISORDER	LIVER DISORDER
Microcytic	10	6	2	1	1
Macrocytic	3	3	-	-	-
Anemia of Chronic Disease	2	1	-	1	-
Anemia of Inflammatory Etiology	3	1	1		1
Dimorphic Anemia	2	2	-	-	-

Etiologically, iron deficiency anemia was observed in 06 cases (30%) of microcytic anemia with serum ferritin levels below 15 ng/ml and 02 (10%) with parasitic etiology with 01 cases each of renal and liver disorders. Followed with macrocytic anemia in 03 cases (15%) and anemia of inflammatory etiology in 03 cases (15%). 02 cases (10%) had anemia of chronic disease and Di-morphic anemia respectively.

TABLE 9. Etiology of geriatric age group:

S.No	Total	Nutritional	Parasitic	Renal Disorder	Liver Disorder
Microcytic	8	5	1		2
Macrocytic	6	6	-	-	-
Anemia of Chronic Disease	13	1	-	12	-
Anemia of Inflammatory Etiology	6	-	2	-	4
DI-MORPHIC ANEMIA	3	2	1	-	-

Etiologically, renal disorder was observed in 13 cases (36.11%) of anemia of chronic disease followed by iron deficiency anemia 08 cases (22.22%) with serum ferritin levels below 15 ng/ml suggesting nutritional deficiency along with parasitic infestation and 06 cases (16.66%) with macrocytic and anemia of inflammatory etiology equally. 03 cases (8.3%) had Di-morphic anemia.

Discussion:

The current study estimated the burden of anemia in pediatrics and geriatric age group, attending the medical college and hospital who were evaluated for presence of anemia according to WHO criteria i.e., for pediatric age group is Hb < 11 and for elderly age group, Hb < 13 accordingly. In pediatric age group, out of 20 pediatric patients, 05 patients were female (25%) and 15 patients were male (75%) with male to female ratio of 3:1 with more prominent in age group of 6 to 10 years. Kanchana et al, carried out the study showed higher number of anemic children in age group of 2 to 5 years. 14 Studies by singh and Parihar 15

and Gebreweld et al 16 done in Jammu and Kashmir, showed a higher proportion of children anemic below 2 years of age. These findings were observed due to inadequate iron intake in the diet and the weaning practices which is undertaken while in our study the most common cause of anemia was nutritional deficiency as well as followed by low birth weight and developmental delay.   In present study, anemia was graded as mild in 10%, moderate 50% and severe 40% along with microcytic hypochromic blood picture in 50% and macrocytic normochromic with normocytic normochromic being 20% along with Di-morphic blood picture in 10%. In the study conducted by Kanchana et al 14 showed, higher proportion of moderate anemia was seen in 46.8% along with 26.6% have mild anemia with 3.6% with severe anemia with peripheral blood picture having 45% of normocytic anemia, 37% with microcytic anemia and 18% with Di-morphic blood picture.   In our study, on examination of peripheral blood picture, microcytic hypochromic blood picture being prevalent which is suggestive of iron deficiency anemia with etiology of nutritional iron deficiency and low birth weight with developmental delay. Out of 20 pediatric cases 2(10%) have dimorphic anemia blood picture which is due to nutritional vitamin B12 and folic acid deficiency.   In geriatric age group, most common age group presenting with anemia is 65 to 75 age group, out of 36 geriatric patients, 17 patients were female (47.3%) and 19 patients were male (52.7%) with male to female ratio of 1.1:1. This finding was in accordance with Shrivastava et al 16, while Ghosh et al 17 found a higher prevalence of anemia in his study.   In present study, anemia was graded as mild 5.6%, while moderate and severe grade was found in 47.2% and the most common peripheral blood smear finding was Di-morphic anemia blood picture, incorporating both microcytic and macrocytic Rbc's (38.9%) morphology, followed by normocytic and normochromic (22.3%), whereas microcytic and macrocytic individually (19.4%).   In our study, most common cause of Di-morphic anemia is nutritional deficiency, followed by macrocytic anemia and microcytic anemia having common etiology of nutritional and parasitic infestation.   Anemia of chronic disease have underlying etiology of renal disease. Anemia of inflammatory etiology is mostly associated with liver disease.

Conclusion:
The present study was conclusive of -   Nutritional deficiency is the most common etiology of anemia in the age group of below 15 years as iron stores present at birth, gets utilized upto 9 months and afterwards deficiency of iron can lead to microcytic anemia. Low socio-economic living status is also the cause of delayed or low iron supplementation. Along with children under 15 years of age, it was found that majority have complaints of gastro-intestinal symptoms on presentation. Hence it was found that mild to early moderate degree of anemia was not noticed and child being asymptomatic.   In age group, above 65 years it was found that Di-morphic anemia is the most common finding, incorporating microcytic and macrocytic morphology followed with anemia of chronic disease having underlying etiology of renal disorder.   So, it is indeed necessary, to identify anemia, stratify the type and its severity, search for the underlying cause, and address the identified cause subsequently in both dependent age groups for early detection that can significantly contribute to the overall improvement in the quality of life in both dependent age groups.

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