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Original Research Article

A Study of Clinico-Haematological and Biochemical Profile of Anaemia on Children

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Abstract:

Introduction: Patients of the paediatric age range who have cytopenia (bicytopenia / pancytopenia) present with a range of clinical signs, including organomegaly, pallor, and fever. The causes range from megaloblastic anaemia to leukaemias that are deadly. The study's objective was to assess young children with bicytopenia: aetiology, clinico-haematological profile, and pancytopenia.

Method: The current study was carried out in the upgraded Department of Paediatrics, Patna Medical College and Hospital, Patna among young patients who had been admitted to the paediatric ward. The automated haematology analyzer Pentra xlr from Horiba was used to estimate haemoglobin, and a skilled lab worker simultaneously created a peripheral blood smear. In order to determine the severity of anaemia, WHO criteria were applied. Anaemia was defined as Hb <11g/dL in children between 6 months to 59 months in children between the ages of 5 years and 11 years and <12 g/dL in kids between the ages of 12 and 14years. Analyses and records of red cell indices were made.

Result: Microcytic hypochromic instances predominated. 106 instances (96.3%) of the 110 individuals with microcytic hypochromic blood pictures had lowered red cell indices. Red cell indices and the macrocytic blood image correlated perfectly.

Conclusion: With concentrating on integrated child nutrition, health, and environmental core measures, preventative efforts for the management of anaemia in children must be supplemented with steps to avoid underweight and stunting.

Keyword: Anemia, Iron Deciency, Pediatric.

Introduction

Anaemia is characterised by a drop in blood haemoglobin levels. It is a disorder in which there are not enough red blood cells or that they cannot carry enough oxygen for the body's needs, which vary with age, sex, altitude, smoking habits, and pregnancy [1-3]. Pallor, drowsiness, irritability, and a diminished capacity for exercise are all clinical signs of anaemia. If ignored, anaemia can also cause tachypnea, tachycardia, shortness of breath when exerting oneself, weakness, heart dilatation, and cardiac failure [3].

Due to the widespread socioeconomic inadequacies, poor dietary practises, a high incidence of malnutrition, and parasitic infestations, nutritional anaemias are a serious public health concern in developing nations like India. In developing regions, anaemia affects up to 51% of children aged 0 to 4 years and 46% of children aged 5 to 12 years. [4,5]

Cytopenia is not a diagnosis; rather, it is a symptom of a main or general medical haematological problem.[6] Pancytopenia and bicytopenia are both characterised by a drop in the blood's total number of all three cell lineages and two cell lines below the normal reference values, respectively. The causes and methods used to diagnose bicytopenia and pancytopenia share a great deal in common.[6]

Due to differences in geographic distribution and genetic abnormalities, many illnesses that cause cytopenia have different incidences.[7] In the paediatric population, cytopenia frequently causes changes in peripheral blood counts. Pancytopenia is typically a sign of either an acute malignancy or a bone marrow failure condition, especially when it coexists with organomegaly or lymphadenopathy.[8]

Estimates that used Hb as a [9] proxy to estimate the prevalence of Iron Deficiency are the main source of the widely held idea that iron deficiency

(ID) is the primary cause of anaemia worldwide. Anaemia is multifactorial, though. Anaemia can result from decreased RBC production, increased RBC oxidation, and/or direct blood loss. The most frequent cause is iron deficiency, which is typically related to food, but infectious illnesses including malaria, helminth infections, HIV, and tuberculosis are also significant [10] in developing countries.

The majority of newborns and kids with moderate anaemia don't have overt clinical symptoms. A suitable intervention plan is needed because the haematological parameters are correlated to one another, to age and gender, as well as to each other. In order to reduce anaemia, public health nutrition programmes must be continuously monitored. To assess [11] anaemia in children, various biochemical and haematological assays are performed. In order to determine the clinicohaematological & biochemical role of anaemia in the paediatric age group, the current investigation was carried out.

Materials and Methods:

The present study was carried out in the upgraded Department of Paediatrics, Patna Medical College and Hospital, Patna among young patients who were admitted to the paediatric ward. A one-year prospective research from 28th August 2021 to 27th August 2022 was conducted. Those admitted to the paediatric wards with severe pallor between the ages of 1 year and 18 year were included.

After obtaining parental agreement and ethical approval from the institute's ethics committee, the subjects were chosen.

Guardians of children were questioned about their demographics, socioeconomic standing, medical histories, and previous use of any prescription drugs and dietary supplements. Age, sex, height and weight, as well as body mass index, were the demographic data collected from the patient. The following inclusion and exclusion criteria were used to choose the subjects:

Inclusion Criteria:

- All of the kids in the 1 to 15-year-old age range who present with severe anaemia as per WHO classification and have complete clinical information.
- Children 1 to 15 years who showed signs of anaemia medically.

Exclusion Criteria:

- Patients with mild to moderate anaemia, those with severe malaria-related anaemia,
- Children who have already taken doses of iron and/or vitamins
- Patients with any kind of chronic sickness.
- Children with a known history of bleeding or clotting disorder.
- Children who received previous blood or blood product transfusion.

Venous blood samples were obtained, and blood was immediately transferred to a tube containing ethylenediaminetetraacetic acid (EDTA) after blood sampling. Four hours later, a wholeblood count was carried out using an automatic cell counter. Blood samples were noted as being excluded from the study if clots were found in them or if there was significantly insufficient blood in the tube to prevent an excessively high EDTA concentration. The automated haematology analyzer Pentra xlr from Horiba was used to estimate haemoglobin, and a skilled lab worker simultaneously created a peripheral blood smear. In order to determine the severity of anaemia, WHO criteria were applied.

Anaemia was defined as Hb<11g/dL in children between 6 months to 59 months in kids between the ages of 5 and 11 years [9] and <12 g/dL in kids between the ages of 12 and 14years. Analyses and records of red cell indices were made.

Six millilitres of fasting blood were drawn and placed in a simple vial in order to evaluate biochemical parameters. The sample was centrifuged at 3000 rpm for 6 minutes after it had fully clotted. Serum from the supernatant was collected. It was employed to calculate serum levels of folate, iron, ferritin, and total iron binding capacity (TIBC). A semi-automatic equipment was used to estimate serum B12, folate, and ferritin using the chemiluminescence method and TIBC using the Ferene method.

Statistical Analysis:

Statistical analysis was performed using SPSS 22.00 for Windows (SPSS Inc., Chicago, USA) using the means and standard deviations of the measurements for each group. The level of significance for the chi square test was set at p 0.05 to identify the difference between the two groups.

Results:

225 participants made up the study's subject population, with 42% of females and 58% of males. Minimum subjects were in the age range of 12 to 15 years, while maximum subjects were in the 1-6 year age range. The percentages of participants who had dimorphic, macrocytic, microcytic hypochromic, normocytic hypochromic, and normocytic Normochromic anaemia, respectively: 8.8%, 4.44%, 48.8%, 2.22%, and 35.5% (Table 1).

Table 1: Distribution according to the types of Anaemia based upon the morphology

Type	Number	%
Microcytic Hypochromic Anaemia	110	48.8%
Normocytic Normochromic Anaemia	80	35.5%
Normocytic Hypochromic Anaemia	5	2.22%
Macrocytic anaemia	10	4.44%
Dimorphic anaemia	20	8.8%

Between red cell indices and peripheral blood images, 130 cases out of 225 had significant correlations, according to Table 2 (Table 2). 110 examples of microcytic hypochromic blood are depicted in Table 1 with the following results: 106 cases (96.3%) had lower indices of red cells than in the same image. Out of 80, 71 (88.75%) of the cases had blood tests that indicated normocytic, normochromic morphology on peripheral blood smear (PBS). The association between the macrocytic blood profile and red cell indices was exact (100%).

Table 2: Red cell indices and peripheral blood smear correlation (N=185)

Types of Anemia	Red cell indices	No. of cases	Percentage (%)
Microcytic Hypochromic	MCV<80 MCHC<27 MCH<27	106	96.3%
Macrocytic	MCV >100 MCHC- N/↓ MCH- ↑/ ↓/N	10	100%
Normocytic Normochromic	MCV- 80-100 MCHC- 32-36 MCH- 27-32	71	88.75%

Discussion

Due to the interdependence of haematological parameters with one another, age, and gender, an appropriate intervention plan is needed. In order to reduce anaemia, public health nutrition programmes must be continuously monitored. To assess anaemia among pediatric population, many biochemical and haematological tests are performed. In order to determine the clinicohaematological & biochemical role of anaemia in the paediatric age group, the current investigation was conducted.

225 participants made up the study's subject population, with 42% females and 58% males. These findings were in line with a study carried out in 2010–2011–2012 by Taskesen et al. [12], Jain et al. [13], and Gupta S et al. [4] In their study, Chauhan et al. [14] obtained different results: 44.2% boys and 55.8% 14 girls. In their investigation, Sastry CPV et al. [15] discovered a female preponderance (males made up 36.3%).

According to our research, younger children—those under the age of six—were more likely to be anaemic than their older counterparts. This was consistent with earlier findings that young children have a high demand for 15 nutrients to sustain their rapid physical development, which also raises their need for iron. When complementary foods were first given, children were more likely to be anaemic. Complementary foods are started when the infants are 6 months old. Children over 2 years old can eat a wider variety of foods, which reduces their risk of anaemia by 17 percent.

Dimorphic, Macrocytic, Microcytic Hypochromic, Normocytic Hypochromic, and Normocytic Normochromic Anaemia were found in 11.2%, 3.2%, 47.2%, 2.4%, 14 and 36% of the participants in the current study, respectively. In his study, Sastry C.P.V. [15] discovered that 81.8% (90/110) of patients with peripheral smear examinations had Microcytic hypochromic anaemia. Microcytic hypochromic anaemia was identified in 54.4%, macrocytic hypochromic anaemia was seen in 11.8%, and dimorphic anaemia was seen in 36.6% of patients, according to Venkatesh G. [16]

Iron deficiency anaemia was the most prevalent kind of anaemia in the current study, occurring in 41.6% of the participants. 70% of the world's malnourished youngsters are from Asia. Of the 64% malnourished children in Bangladesh and 16% in China, 50% of preschoolers are underweight. [17]

40–50% of preschoolers are affected by IDA because of vitamin deficiency [19] and protein energy malnutrition. IDA accounts for 83% of all cases of anaemia in Pakistan and is a significant nutritional issue. Anaemia prevalence was reported to be 55% in India and 42% in Nepal in studies on the nutritional condition of boys and girls in 11 different nations. In poor nations, it is mostly an issue for babies, adolescent girls, and women who are close to childbearing age. In a study done in 2

areas of India, children between the ages of 12 and 23 months showed low ferritin levels in 72% of them. Children under the age of 10 years had the highest prevalence of anaemia, particularly those under the age of five. [17]

In the current study, 104 patients, or 41.6% of the population, had iron deficiency anaemia. Serum ferritin is one of the least physiologically variable iron status markers when compared to other iron status parameters, making it one of the most helpful metrics. In their investigation of 248 individuals, Ali et al. [18] discovered that 69 patients had insufficient iron reserves. Although there was no discernible iron in the bone marrow material in 20 of these patients (29%) the blood ferritin level was increased. They came to the conclusion that while an increased number does not rule out the potential of iron depletion, a low serum ferritin levels likely suggests it.

This study's limitation stems from the fact that it is a prospective study that reported the prevalence and severity of anaemia globally.

Conclusion:

The study's findings suggest that one of the main areas for improvement in primary healthcare is anaemia prevention because anaemia has been linked to a delay in psychomotor development, particularly in preschool age. In our country, anaemia and malnutrition are both very common. Therefore, there is an urgent need for community involvement programmes that involve counselling parents about infant eating habits, immunisations, and illness recognition from the kid's first year of life. with concentrating on integrated child nutrition, health, and environmental core measures, preventive measures for the management of anaemia in children must be accompanied with steps to avoid underweight and stunting.

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