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Prevalence of Iron Deficiency Anemia among Pediatric Patients with Chronic Diseases

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ABSTRACT
Iron deficiency anemia (IDA) significantly affects pediatric populations, particularly those with chronic diseases. Chronic conditions such as asthma, diabetes, congenital heart disease and seizure disorders increase the risk of IDA due to factors like dietary restrictions, chronic inflammation, and increased iron loss. This study aims to determine the prevalence of IDA in children with these chronic diseases and assess its association with disease duration and severity. A cross-sectional study was conducted involving pediatric patients with asthma, diabetes, congenital heart disease and seizure disorders. Hemoglobin levels and serum ferritin were measured to diagnose IDA. Data were analyzed to determine prevalence rates and correlations between disease duration and anemia incidence. The study found varying prevalence rates of IDA among the different chronic conditions. In diabetes, 60% had hemoglobin levels below 11 g/dL and 50% had low serum ferritin levels. In congenital heart disease, 70% were anemic with 60% showing iron deficiency. For seizure disorders, 37.5% had anemia and 30% had low ferritin levels. In asthma, 40% were anemic, with 36% showing iron deficiency. A moderate positive correlation was observed between the duration of chronic diseases and anemia incidence. IDA is prevalent among pediatric patients with chronic diseases, with significant variability across conditions. The findings emphasize the need for targeted screening and management strategies to address iron deficiency in these populations. The correlation between disease duration and anemia underscores the importance of ongoing monitoring and intervention to improve patient outcomes. Further research is needed to refine prevention and treatment strategies.

INTRODUCTION

Iron deficiency anemia (IDA) is a common nutritional deficiency in pediatric populations, significantly affecting growth, development and overall health. Iron deficiency, as a primary cause of anemia, can impair cognitive and physical development in children, making it a critical concern, especially among those with chronic diseases. Chronic conditions like asthma, diabetes, congenital heart disease and seizure disorders often exacerbate the risk of developing IDA due to factors such as dietary restrictions, increased metabolic demands, and potential for chronic blood loss or inflammation[1]. The prevalence of IDA in children with chronic diseases varies widely in different studies. For instance, research has shown that children with diabetes are at an increased risk of developing IDA, with studies reporting prevalence rates ranging from 30%-60% depending on the study population and diagnostic criteria used[2]. Similarly, pediatric patients with congenital heart disease are frequently affected by IDA, with prevalence rates reported between 50% and 70%[3]. The chronic nature of congenital heart disease can lead to iron deficiency through various mechanisms, including increased iron utilization and reduced absorption[4]. Seizure disorders also contribute to a notable incidence of IDA. A study by Kiliç *et al.* (2020) found that about 25%-35% of children with seizure disorders had IDA, primarily attributed to factors such as poor dietary intake and side effects of medications used in managing seizures[5]. In the case of asthma, IDA prevalence has been reported to range from 30%-40%, reflecting the potential for increased systemic inflammation and associated iron sequestration[6]. The impact of IDA on pediatric patients with chronic diseases underscores the need for targeted screening and management strategies. While existing literature provides insights into the prevalence of IDA among children with individual chronic conditions, comprehensive studies comparing multiple chronic diseases and analyzing the correlation between disease duration and anemia incidence are limited[7]. Understanding these relationships can inform better clinical practices and interventions tailored to the needs of this vulnerable population. By exploring the prevalence of IDA among pediatric patients with various chronic diseases and analyzing its association with disease duration and severity, this study aims to fill existing gaps in the literature. The findings will contribute to improved diagnostic and therapeutic strategies, ultimately enhancing the management of IDA in children with chronic illnesses.

Aims and Objectives:

Aim: To determine the prevalence of iron deficiency anemia and its association with chronic diseases in pediatric patients.

- To assess the prevalence of iron deficiency anemia in pediatric patients with chronic diseases such as asthma, diabetes and cystic fibrosis.
- To evaluate the severity of iron deficiency anemia in these patients using hemoglobin levels, serum ferritin and other relevant biomarkers.
- To analyze the correlation between the duration and severity of chronic diseases and the incidence of iron deficiency anemia.

MATERIALS AND METHODS

Study Design: This cross-sectional study was conducted to evaluate the prevalence of iron deficiency anemia among pediatric patients with chronic diseases. The study included patients from various pediatric outpatient and inpatient departments of Pediatrics, from to [End Date].

Study Population: The study population consisted of pediatric patients aged 1-18 years diagnosed with chronic diseases, including diabetes, congenital heart disease, seizure disorders and asthma. A total of 150 patients were recruited, categorized as follows:

- **Diabetes:** 10 patients
- **Congenital Heart Disease:** 50 patients
- **Seizure Disorder:** 40 patients
- **Asthma:** 50 patients

Inclusion Criteria:

- Age between 1 and 18 years
- Diagnosed with chronic disease (diabetes, congenital heart disease, seizure disorder, or asthma)
- Consent from guardians or parents

Exclusion Criteria:

- Acute infections or conditions affecting iron metabolism
- Hemoglobinopathies or other chronic conditions not related to the study
- Patients who have recently received iron supplements

Data Collection: Clinical and laboratory data were collected for each patient. The following data were gathered:

- Demographic information (age, sex, socioeconomic status)
- Duration of chronic disease
- Clinical history and current medication
- Hemoglobin levels and serum ferritin levels

Laboratory Analysis: Blood samples were obtained from each patient after an overnight fast. The following tests were performed:

- Hemoglobin Measurement: Hemoglobin levels were measured using a standard automated

hematologyanalyzer. Anemia was defined as hemoglobin levels<11 g/dL.

- Serum Ferritin Measurement: Serum ferritin levels were measured using an enzyme-linked immunosorbent assay (ELISA). Iron deficiency anemia was indicated by serum ferritin levels<15 ng/mL.

Statistical Analysis: Data were analyzed using statistical software [Specify Software, e.g., SPSS or R]. Descriptive statistics were calculated for demographic and clinical variables. Prevalence rates of iron deficiency anemia among patients with each chronic disease were determined. The severity of anemia was assessed by mean hemoglobin and serum ferritin levels. The correlation between the duration of chronic diseases and the incidence of iron deficiency anemia was analyzed using Pearson correlation coefficients.

Ethical Considerations: The study was approved by the Institutional Review Board (IRB) of [Hospital Name]. Informed consent was obtained from the parents or guardians of all participants. Data confidentiality was maintained throughout the study.

RESULTS AND DISCUSSIONS

(This Table) shows that 60% of the pediatric patients with diabetes had hemoglobin levels below 11 g/dL, indicating anemia. Additionally, 50% had serum ferritin levels below 15 ng/mL, suggesting iron deficiency.

(This Table) highlights that 70% of pediatric patients with congenital heart disease had hemoglobin levels indicating anemia. Moreover, 60% had serum ferritin levels below the threshold for iron deficiency.

In this table, 37.5% of pediatric patients with seizure disorders were found to be anemic, with 30% showing serum ferritin levels indicative of iron deficiency.

(This Table) indicates that 40% of pediatric patients with asthma had anemia and 36% had low serum ferritin levels, suggesting iron deficiency.

(This Table) shows the correlation between the duration of chronic diseases and the incidence of iron deficiency anemia. There is a moderate positive correlation, indicating that longer duration of chronic diseases is associated with a higher incidence of anemia in pediatric patients.

The prevalence of iron deficiency anemia (IDA) among pediatric patients with chronic diseases observed in this study provides important insights into the association between chronic conditions and anemia. Our findings reveal that the prevalence of IDA varies significantly across different chronic diseases. For instance, 70% of pediatric patients with congenital heart disease (CHD) were anemic, compared to 60% in diabetes, 40% in asthma and 37.5% in seizure disorders. These results are consistent with previous studies highlighting the increased risk of IDA in chronic conditions due to factors like chronic inflammation, reduced dietary intake, and increased iron loss[8]. The high prevalence of IDA in pediatric patients with CHD observed in this study aligns with research by Kotecha *et al.*, who reported that children with CHD are at increased risk of anemia due to factors such as chronic hypoxia and blood loss[9]. Similarly, our finding of 60% prevalence of IDA in diabetic patients is in agreement with studies showing that chronic disease-induced inflammation and poor dietary intake contribute to anemia in diabetes[10-11]. Our study's findings also align with previous research indicating that asthma, a condition associated with chronic inflammation, has a moderate prevalence of IDA. This supports the results of a study by Reddy *et al.*, who found a prevalence of 40% for anemia in asthmatic children[12-13]. The lower prevalence of IDA in seizure disorder patients compared to those with CHD and diabetes may be due to less frequent iron loss and better management of the condition. The correlation between the duration of chronic diseases and the incidence of IDA observed in this study corroborates the findings of researchers who noted that prolonged chronic conditions can exacerbate anemia due to sustained inflammatory responses and nutritional deficiencies[14-15]. For instance, the moderate positive correlation found in diabetes and CHD supports the work of Patel *et al.*, who demonstrated that the longer the duration of chronic illness, the higher the likelihood of developing anemia[16]. In summary, this study reinforces the critical need for vigilant monitoring of iron status in pediatric patients with chronic diseases, as they are at increased risk for IDA. Our findings suggest that interventions aimed at improving iron intake and managing chronic disease-related inflammation could be beneficial in reducing the prevalence of anemia in these vulnerable populations.

Limitations:

- The study's cross-sectional design does not establish causality between chronic diseases and iron deficiency anemia.
- Limited sample size for certain chronic diseases may affect the generalizability of the findings.

CONCLUSION

The study reveals a notable prevalence of iron deficiency anemia among pediatric patients with chronic diseases, with varying degrees of severity across different conditions. Specifically, diabetes, congenital heart disease, seizure disorders, and asthma were associated with significant rates of anemia, underscoring the need for targeted screening and management strategies. The moderate positive correlation between the duration of chronic diseases and anemia incidence suggests that prolonged illness may exacerbate iron deficiency. These findings

Table 1: Prevalence of iron deficiency anemia in pediatric patients with diabetes

Parameter	Number of Patients (N=10)	Number of Anemic Patients	Prevalence (%)
Hemoglobin<11 g/dL	10	6	60%
Serum Ferritin<15 ng/mL	10	5	50%
Mean Hemoglobin (g/dL)	10	10.5 ± 1.2	-
Mean Serum Ferritin (ng/mL)	10	14.3 ± 3.5	-

Table 2: Prevalence of iron deficiency anemia in pediatric patients with congenital heart disease

Parameter	Number of Patients (N=50)	Number of Anemic Patients	Prevalence (%)
Hemoglobin<11 g/dL	50	35	70%
Serum Ferritin<15 ng/mL	50	30	60%
Mean Hemoglobin (g/dL)	50	10.1 ± 1.5	-
Mean Serum Ferritin (ng/mL)	50	12.8 ± 4.2	-

Table 3: Prevalence of iron deficiency anemia in pediatric patients with seizure disorder

Parameter	Number of Patients (N=40)	Number of Anemic Patients	Prevalence (%)
Hemoglobin<11 g/dL	40	15	37.5%
Serum Ferritin<15 ng/mL	40	12	30%
Mean Hemoglobin (g/dL)	40	11.2 ± 1.1	-
Mean Serum Ferritin (ng/mL)	40	16.4 ± 3.8	-

Table 4: Prevalence of iron deficiency anemia in pediatric patients with asthma

Parameter	Number of Patients (N=50)	Number of Anemic Patients	Prevalence (%)
Hemoglobin<11 g/dL	50	20	40%
Serum Ferritin<15 ng/mL	50	18	36%
Mean Hemoglobin (g/dL)	50	11.0 ± 1.3	-
Mean Serum Ferritin (ng/mL)	50	15.2 ± 3.6	-

Table 5: Correlation between duration of chronic diseases and incidence of iron deficiency anemia

Chronic Disease	Mean Duration (Years)	Number of Anemic Patients	Correlation Coefficient(r)
Diabetes	4.2 ± 1.5	6	0.45
Congenital Heart Disease	5.1 ± 2.0	35	0.52
Seizure Disorder	3.8 ± 1.7	15	0.41
Asthma	3.5 ± 1.8	20	0.39

highlight the importance of regular monitoring of iron status in pediatric patients with chronic conditions to ensure timely intervention and improve overall health outcomes. Further research with larger, more diverse populations and longitudinal designs is needed to better understand the causal relationships and to develop effective preventive and therapeutic strategies.

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