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A follow up study of clinical and biochemical outcome in Pediatric patients of iron deficiency anemia

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Abstract

Background: Iron deficiency anaemia (IDA) is a type of anaemia that occurs when the body does not have enough iron to produce red blood cells. Red blood cells contain a protein called hemoglobin, which binds to oxygen in the lungs and carries it to the body's tissues. Without enough iron, the body cannot produce enough hemoglobin, leading to a decrease in the number of red blood cells and a condition called anaemia. It can have a number of clinical and biochemical consequences. The present study was done to study clinical profile of Iron deficiency anaemia in children and through laboratory investigations, enlighten and find ways of predicting the aetiology, diagnosis, association of other nutritional deficiency with iron deficiency anaemia and severity of the condition that will help us take urgent and curative steps for a better treatment and outcome in these patients.

Methods: The study was carried out over a period of 2 years from March 2020 to April 2022. This is a prospective observational study is conducted in SMIMER Medical College and Hospital, Surat, a tertiary care institute in Gujarat state of India. All the paediatricpatients with age of 6 months to 5 years,

presenting with anemia (Hb<11 g %) and admitted in paediatric ward were included in study. Known case of hemolytic anemias, known case of bleeding disorders and patients with past history of blood transfusion were excluded from this study. Data collection was done using a pretested questionnaire including socio-demographic factors. WHO Criteria used for diagnosis of anemia. Routine Investigations i.e. HB, S. Iron, MCV, MCH, MCHC, Reticulocyte Count, RBC Count and RDW for anemia and its causes was done. After discharge follow up visits were advised at 2-week, 1 month and 3 months. Data was analysed using statistical package for social sciences and excel and p<0.05 was considered as statistically significant.

Results: The prevalence of anaemia is 62.31% in patients admitted during study period. Mild to moderate anaemia is observed in 75% and severe anaemia in 25% patients. In present study, 62% patients are in age group of 6 months to 2 years and 38% patients are >2 years to 5 years. After treatment, laboratory parameters of patientsi.e. HB, S.Iron, MCV, MCHC, MCH, RBC are increased. Reticulocyte Count and RDW are decreased. All patients showed positive weight gain after 3 month of iron therapy.

Conclusion: Though anaemia is common, most patients are stable and present with mild to moderate anaemia. Only a fraction of patients presenting with congestive cardiac failure require packed red blood cells transfusion. Oral iron therapy for three months is the mainstay of treatment for iron deficiency anaemia. Vitamin B12 therapy is also needed in patients with dimorphic anaemia.After treatment, laboratory parameters of patientsi.e. HB, S.Iron, MCV, MCHC, MCH, RBC are increased. Reticulocyte Count and RDW are decreased and all patients showed positive weight gain.

Keywords: Iron deficiency, Anaemia, Hemoglobin, Iron

Introduction

Iron is vital for all living organisms as it is essential for multiple metabolic processes including oxygen transport, DNA synthesis and electron transport. More than 30% of the world's population is suffering from anemia. According to UNICEF based statistics, the estimated prevalence of IDA in children under 5 years of age is 75%.[1]Variousstudies in India have reported the prevalence of anaemia in infants and children varying from 60% to 80%.[2]

Iron deficiency is a condition in which the body lacks sufficient iron to produce red blood cells. It is the most common nutrient deficiency in the world and is particularly common in women of childbearing age, children, and people with diets that are low in iron.[3] Symptoms of iron deficiency include fatigue, weakness, pale skin, and difficulty maintaining body temperature. In severe cases, iron deficiency can lead to anaemia, which is a condition in which the body does not have enough red blood cells to deliver oxygen to the body's tissues. It is important to see a healthcare provider for a diagnosis and treatment.[4]Iron deficiency anaemia, a more severe stage of iron deficiency (defined as a low hemoglobin in combination with iron deficiency), was found in 3.3 million females. Red blood cells contain a protein called hemoglobin, which binds to oxygen in the lungs and carries it to the body's tissues. Without enough iron, the body cannot produce enough hemoglobin, leading to a decrease in the number of red blood cells and a condition called anaemia.[5]

Iron deficiency anaemia is usually diagnosed through a blood test. Treatment may involve taking iron

supplements, making dietary changes to increase your intake of iron-rich foods, and treating any underlying conditions that may be causing the iron deficiency. It is important to see a healthcare provider for a proper diagnosis and treatment plan. It can have a number of clinical and biochemical consequences, including physical symptoms and Laboratory abnormalities.[6]

The present study was done to study clinical profile of Iron deficiency anaemia in children and through laboratory investigations, enlighten and find ways of predicting the aetiology, diagnosis, association of other nutritional deficiency with iron deficiency anaemia and severity of the condition that will help us take urgent and curative steps for a better outcome in these patients.

Materials & Methods

Study area and duration

This is a prospective observational study is conducted in SMIMER Medical College and Hospital, Surat, a tertiary care institute Gujarat state of India and was carried out over a period of 2 years from March 2020 to April 2022.

Inclusion criteria

- Patient with age of 6 months to 5 years.
- Presenting anaemia (Hb<11 g %) as per WHO criteria for diagnosis of anaemia were included.
- Children meeting inclusion criteria with parents giving valid consent

WHO Criteria for diagnosis of anemia

Anemia Severity	Hemoglobin(gm/dl)
Mild	10 to 11gm/dl
Moderate	7 to 10gm/dl
Severe	< 7gm/dl

Exclusion criteria

- Known case of hemolytic anemia's
- Known case of bleeding disorders
- Past history of blood transfusion

Sample size

Out of 2112 admissions during the study period, 1316 patients were having variable degree of anemia. This was 62.31%. Anemia is frequently seen in admitted patients. Out of that 100 patients were randomly enrolled for the study.

Study method

- Written and informed consent was obtained from parents /guardian for utilization of data. Patients were managed according to the underlying condition and standard protocol. Details were filled in case report files and proforma were filled from case report files.
- Routine Investigations for anemia and its causes was done. HB, S. Iron, MCV, MCH, MCHC, Reticulocyte Count, RBC Count and RDW were determined by automated cell counter. Normal values were taken as follows: HB 12-18 g/dL, S IRON (50-150 ug/dl), MCV 83-101 fl/ red cell, MCH 27-32 pg./ red cell, MCHC 31.5-34.5 ug /dL, RETICULOCYTE COUNT 0.5% - 2.5%, RBC COUNT (4.5-5.5million cells/ Ul and RDW 11.5%-14.5%.
- After discharge follow up visits were advised at 2-week, 1 month and 3 months.
- On 1st follow up (i.e., after 2 week) patients were advised for complete blood count and reticulocyte count. On 2nd follow up (i.e., after 1 month) patients were reinforced to take regular iron supplementation and iron rich food. On 3rd follow up (i.e., after 3 month) patients were examined and anthropometry were recorded and submitted following investigations complete blood count, serum iron, serum B.12, serum ferritin level. These details were filled up in the proforma of the respective patients. Data was analyzed and Statistical conclusion was derived.

Data analysis

The data was analysed using Statistical package for social sciences (SPSS) trial version and Microsoft excel 2013. Descriptive statistics were performed for various variables. The chi-square test for association was used and $p<0.05$ was considered as statistically significant.

Results

In present study total, 100 patients were enrolled by simple random sampling method (Table 1). All patients underwent for a hemoglobin levels blood test on admission. Out of total 100 patients, 42% patients have mild anemia, 33% have moderate anemia and 25% have severe anemia. 62% patients belong to age group of 6 months to 2 years and 38% patients belong to age group of >2 years to 5 years.In age group 6 months to 2 years; mild, moderate and severe anemia is seen in 35.48%, 38.70% and 25.80% respectively; while in age group of >2 to 5 years mild, moderate and severe anemia is seen in 52.63%, 23.68% and 23.68% respectively. Severity of anemia does not differ in various age group. p=0.071 is statistically insignificant.

55 are male and 45 are female. Male patients having mild, moderate and severe anemia are 38.18%, 38.18% and 23.64% respectively; while female patients having mild, moderate and severe anemia are 46.67%, 26.67% and 26.67% respectively. p=0.151 is statistically insignificant.

Maximum number of children had history of consumption of mixed food habit. Nonvegetarian particularly red meat has greater content of heme iron. In the present study though most of the patients had dietary habit of mixed food but it was in form of egg rather than meat. So, the non-vegetarian food habit had no significant impact in frequency of anemia.

Table 1: Demographic data and severity of anaemia (IDA).

	No. of pts	Mild	Moderate	Severe	p value
Mean Hemoglobin and Anemia		10.55	8.163	6.03	
Gender		42	33	25	
Male	55	38.18%	38.18%	23.64%	p=0.151
Female	45	46.67%	26.67%	26.67%	
Age Group					
6 months to 2 years	62	35.48%,	38.70%	25.80%	p=0.071
>2 to 5 years	38	52.63%,	23.68%	23.68%	
Diet					
Vegetarian	28	9 (32.14%)	9 (32.14%)	10 (35.71%)	p=0.0717
Mix	72	33 (45.83%)	24 (33.33%)	15 (20.83%)	

Presenting complaints were fever (86%), increased frequency of stool and vomiting (47%), cough and cold (43%), seizure (26%), difficulty in breathing (23%), irritability (21%), pica (11%) and others (3%). (Table 2)

In present study, pallor as a presenting sign was seen in 89 patients, signs of other nutritional deficiencies seen in 42 patients, hepatosplenomegaly in 40 patients, hair changes seen in 16 patients, edema seen in 5 patients, nail changes seen in 4 patients, others (poor oral hygiene, superficial skin infection, signs of dehydration, lymphadenopathy, ear discharge) seen in 47 patients.

Out of 100 patients, 40 presented with respiratory complaints 29 had LRTI and 11 had URTI; seizures seen in 22 patients, ADD seen in 15 patients, SAM seen in 9 patients, Others (UTI, enteric fever, hepatitis, measles, PUO, fluid refractory shock, obstructive cholestatic jaundice, acute metabolic encephalopathy) were also seen. Only one patient of malaria (p.vivax) was seen.

In the present study, total mean hemoglobin seen was 8.34gm/dl. While mean hemoglobin seen was 10.55gm/dl in mild anemia, 8.16gm/dl in moderate anemia and 6.03gm/dl in severe anemia. Lowest hemoglobin level observed in our study at admission was 3.42 g/dl seen in patient of acute diarrheal disease with severe acute malnutrition.

Table 2: Signs & Symptoms, Risk Factors.

Presenting Symptoms	No. of Patients
• Fever	86
• Increased Frequency of Stool and Vomiting	47
• Cough and Cold	43
• Seizure	26
• Difficulty In Breathing	23
• Irritability	21
• Pica	11
• Others (Failure to Thrive, Weight Loss)	3
Presenting Signs and Anemia	
• Pallor	89
• Signs of Other Nutritional Deficiencies (Glossitis, Stomatitis, Cheilitis)	42
• Hepatosplenomegaly	40
• Hair Changes	16
• Oedema	5
• Nail Changes	4
Presenting Illnesses and Anemia	
• Respiratory illnesses - LRTI - URTI	40 29 11
• SEIZURE	22
• ADD	15
• SAM	9
• OTHERS	13
• P vivax malaria	1

Patients of mild anemia (42) were discharged on iron rich diet and 2 patients required B12 therapy. Patients of mild anemia did not require iron therapy on discharge or even on follow up. (Table 3) Patients with moderate anemia (33); initially 4 patients required packed RBC transfusion, because they were having signs of Lower Respiratory Tract Infection; then they were discharged with oral iron therapy. Rest 29 patients were discharged on oral iron therapy and 2 patients required B12 therapy also. Patients with severe anemia (25); initially12 patients required Packed RBC transfusion during hospital stay (3 patients of SAM, 5 patients of CCF, 4 patients of LRTI). 22 patients were discharged with oral iron therapy and patient with SAM (3) started oral iron therapy 2 weeks after discharged. B12 therapy was required in 3 patients with severe anemia.

7 % patients having dimorphic anemia were given injection Vitamin B 12 according to protocol.Oral iron therapy was given with Syrup containing ferrous fumarate. All patients were advised iron rich diet on discharge.

Table 3: Treatment given.

Anemia	Packed RBC	Inject able iron	Oral iron therapy	Iron rich diet	B12 therapy
	N (%)		N (%)	N (%)	N (%)
Mild (n=42)	0 (0)	-	0 (0)	42 (100)	2 (4.76)
Moderate (n=33)	4 (12.12)	-	29 (87.87)	33 (100)	2 (6.06)
Severe (n=25)	12 (48)	-	22 (88)	25 (100)	3 (12)
Total	16 (15)	-	50 (50)	100 (100)	7 (7)

All 100 patients enrolled at the time of study attended the first follow up at 2 weeks. 15 patients did not come for next visit so 85 patients attended 1st month follow up. Further 9 patients dropped during the 3rd visit, hence 76 patients completed all follow up visits.

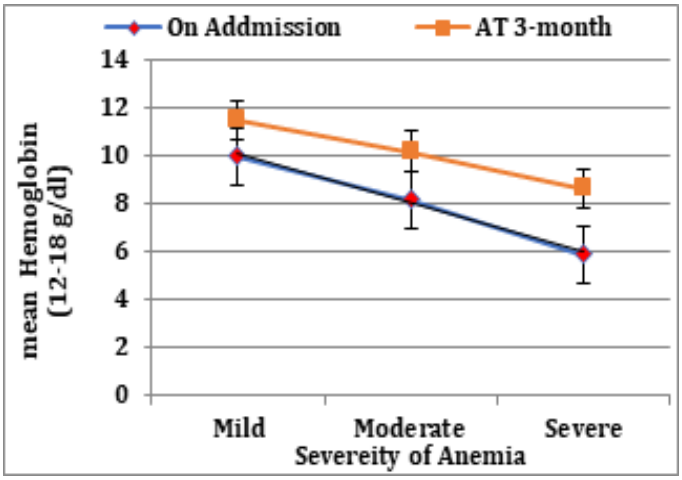
Table 4 shows comparative figures of laboratory parameters of patients at the starting and end of the study. Patients with mild anemia were advised iron rich diet only. At 3-month they showed near normal improvement in Hb, S. iron and RBC indices. Patients with moderate anemia were advised oral iron therapy along with iron rich diet. Packed RBC was transfused when indicated. At 3-month Hb value improved but still qualified for mild anemia, similarly S. iron and RBC indices improved. Patients of severe anemia were advised oral iron therapy along with iron rich diet. Packed RBC was transfused when indicated. At 3-month Hb level improved till moderate anemia. Improvement in s. iron as well as RBC indices were also partial only. A longer treatment and follow up is advocated, especially for patients with moderate to severe anemia. Patients with dimorphic anemia had mean S.B12 level was 31.36ng/ml and after treatment improved to 312.98ng/ml falling in the range of normalcy. Patients with dimorphic anemia completely improved after appropriate B12 therapy.

Table 4: Laboratory parameters on admission and on discharge.

Mean	Mild		Moderate		Severe	
	On admission (n=42)	At3 months (n=32)	On admission (n=33)	At 3 months (n=23)	On admission (n=25)	At 3 months (n=21)
Hemoglobin (12-18 g/dl)	9.96	11.45	8.16	10.15	5.87	8.6
Serum iron (50-150 ug/dl)	53.27	82.26	32.78	72.30	25.14	66.24
Mean corpuscular volume (MCV) (83-101 Fl/red cell)	71.80	78.31	68.83	80.30	61.41	75.23
Mean corpuscular hemoglobin (MCH) (27-32 pg./red cell)	21.85	27.60	20.16	27.17	15.77	26.44
Mean corpuscular hemoglobin concentration (MCHC) (31.5-34.5 ug /dl)	30.6	34.19	28.25	32.92	25.18	31.86
Reticulocyte count (0.5%-2.5%)	1.14	0.82	1	0.9	1.4	1.28

Red cell distribution width (RDW) (11.5-14.5%)	16.07	14.78	16.53	14.93	18.18	15.81
RBC count (4.5-5.5 million cells/ul)	4.58	4.87	4.50	4.94	4.52	5.04

Figure 1:



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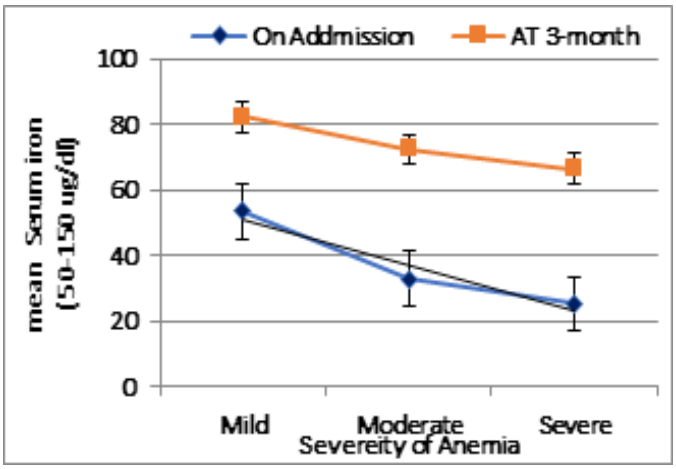

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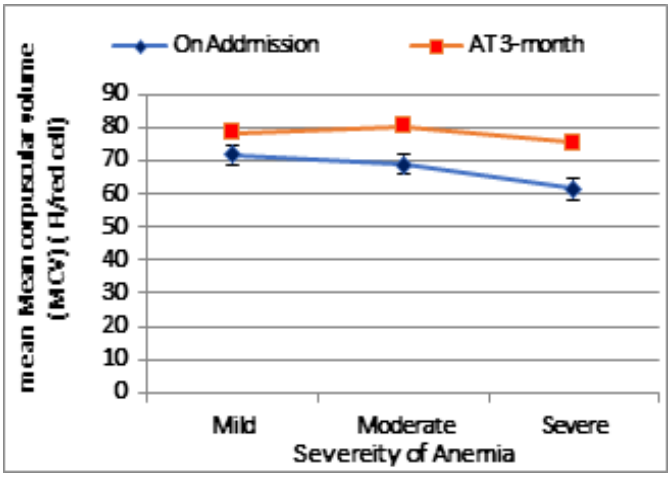

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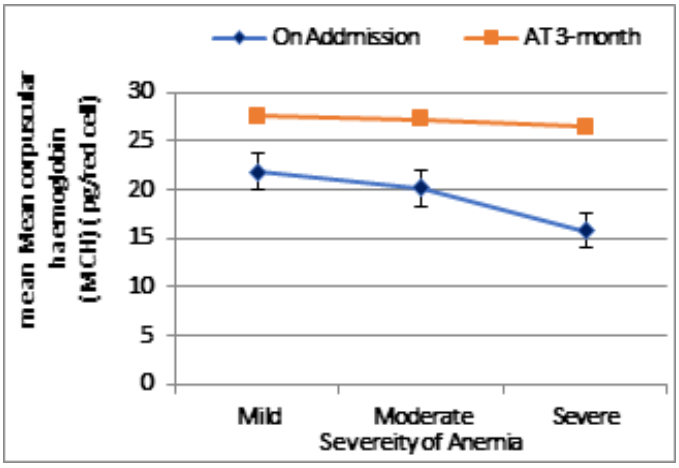

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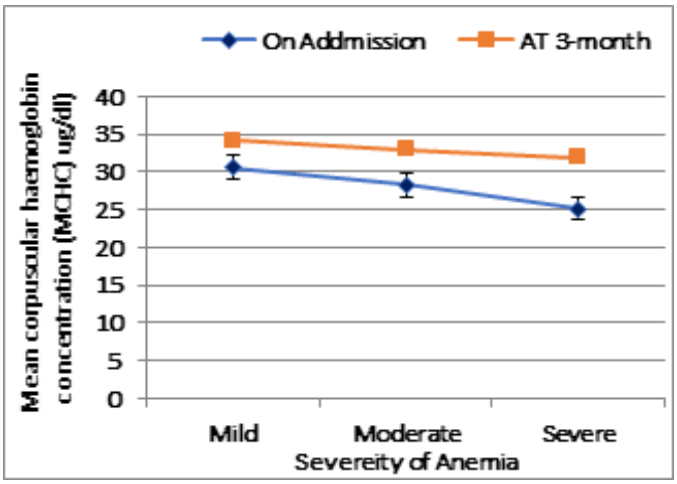

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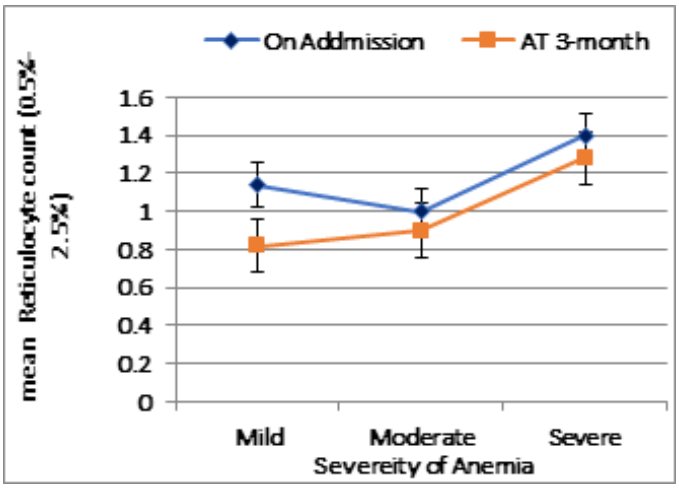

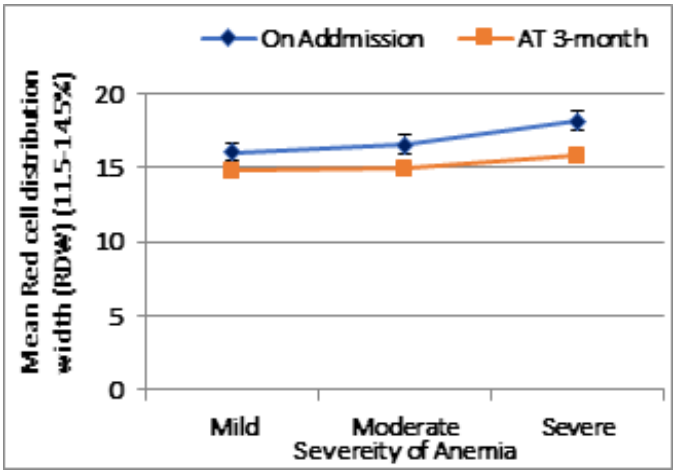

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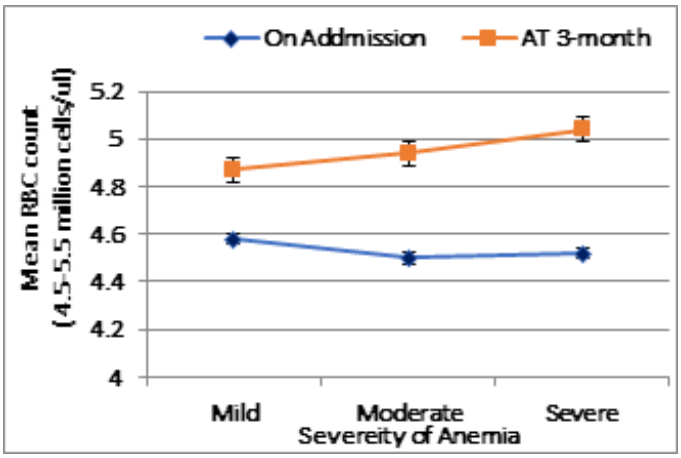


Figure 8:

Fig.1-8: Changes in Laboratory parameters: Hemoglobin, Serum iron, Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), Reticulocyte count, Red cell distribution width (RDW) and RBC count: For mild, moderate and severe patients.

Table 5: Mean weight gain and anemia.

Anemia	Weight gain (gm/kg) at completion of 3 month follow up (n=76)
Mild	6.43
Moderate	5.68
Severe	6.06

Table 6: Gain in mean serum iron and severity of anemia.

Anemia	Mean serum iron at admission	Mean serum iron at 3 months	Improvement of iron
Mild	53.27	82.26	+28.99
Moderate	32.78	72.30	+39.5
Severe	24.93	66.20	+41.27
Total	39.48	74.82	+35.34

Figure 9: Weight gain

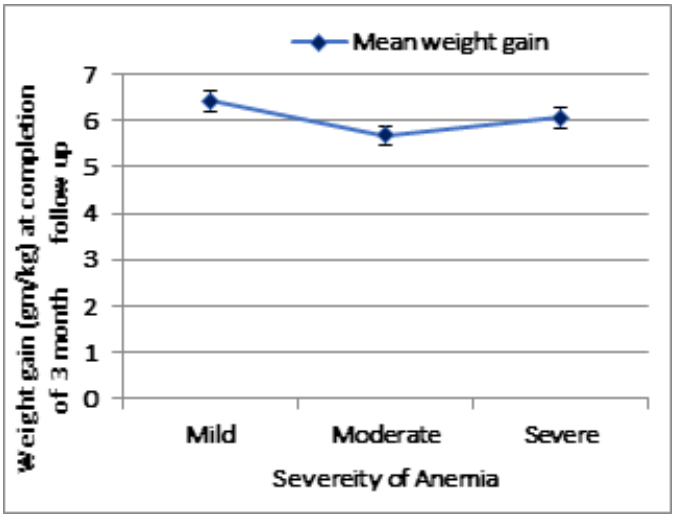
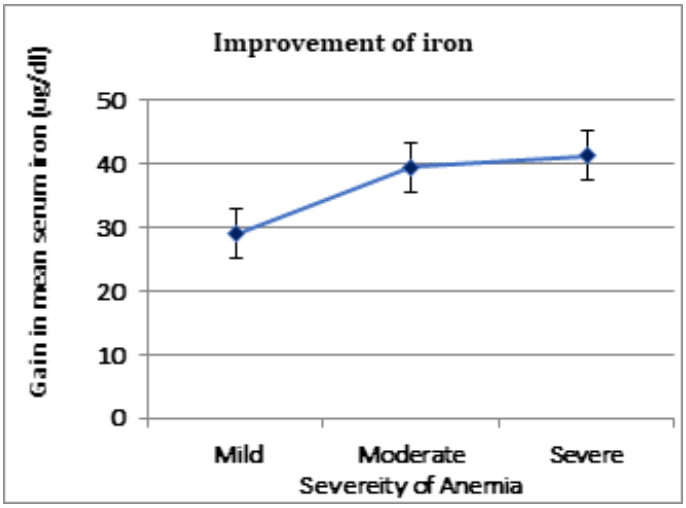


Figure 10:Improvement of iron



All patients showed positive weight gain after 3 month of Iron therapy. The weight gain was similar in all the degrees of anemia. In mild, moderate and severe anemia

weight gain seen was 6.43gm/kg, 5.68gm/kg and 6.06gm/kg respectively. (Table 5)

Mean S.iron level for total patients was 39.48ug/dl on admission which improved to 74.82 ug/dl at 3 months that shows deficiency was corrected. Mean S. iron level for patients in the mild, moderate and severe group were 53.27 ug/dl, 32.78ug/dl and 24.95ug/dl on admission. It was in the normal range for mild anemia, decreasing significantly with increasing severity of anemia. This corrected to 82.26 ug/dl, 72.30ug/dl and 66.20 ug/dl respectively after 3months of treatment. All categories showed S. Iron level in the range of normalcy at 3 months of treatment. The gain in S. iron was 28.99ug/dl, 39.50ug/dl and 41.27ug/dl in the 3 groups respectively suggesting that as the severity of anemia increases gain of iron also increases with the treatment. This reflects improved absorption of iron with increasing deficiency. p value 0.009 which is highly significant. In present study lowest S. iron level at admission was observed was 4.8ug/dl and was seen in a patient of acute diarrheal disease with severe acute malnutrition. (Table 6)

Discussion

South East Asia has the largest number of anaemic persons, both as an absolute number and also in proportion to its population, including children. Sixty percent women, 36% men, and 66% of the children in this region are anaemic. This contributes to 324,000 deaths and 12,500,000 Disability Adjusted Life-Years (DALYs) in this region, which is the highest in the world.[7]Anaemia has been a big problem in India and the National Family Health Survey (NFHS) III data showed the prevalence of anaemia among children less than five years of age to be around 70%. [8]The study found that in India in 2019–21, 67.1% of children of specified age 6-59 months were anaemic, an increase of 8.5% points since the NFHS-4 study conducted in 2015–16 i.e., 67.1% and as compared with NFHS-4 (58.6%), despite of the significant increase in the consumption of iron-folic acid (IFA) tablets under INIPI.[9]

In this study the prevalence of anemia is 62.31% in patients admitted during study period. Mild to moderate anemia is observed in 75% patients. Out of 100 patients, 55 are male and 45 are female. It shows male preponderance. Taskesen et al in his study found 57% boys and 43% were girls.[10]Jain et al have also reported increased incidence in males (71%) compared to girls (29%).[11] Chauhan et al reported dissimilar results who reported 44.2% boys and 55.8% girls in their study.[12] Sastry CPV also found female preponderance in their study (males 40/110 (36.3%).[13]

In present study, 62% patients are in age group of 6 months to 2 years and 38% patients are >2 years to 5 years. The most common age group affected is in between 6 months to 2 years of age. Ramana Sastry C.P.V in his study which states that the majority of children were among followed by 5- 6 years.[13] A study by James et al documented that iron deficiency was commonest in 2nd year of life, which is comparable with our study.[14] The severity of anemia does not differ in various age group. Gender is not a significant attributing factor for iron deficiency anaemia in children under 5 years. Kotecha and Kotecha studied anaemia prevalence in children under three years of age in Vadodara urban slum and found anaemia prevalence to be as high as 91%.[15]

In this study presenting complaints were fever (86%), increased frequency of stool and vomiting (47%), cough and cold (43%), seizure (26%), difficulty in breathing (23%), irritability (21%), pica (11%) and others (3%).

Pallor as a presenting sign was seen in 89 patients, signs of other nutritional deficiencies seen in 42 patients, hepatosplenomegaly in 40 patients, hair changes seen in 16 patients, oedema seen in 5 patients, nail changes seen in 4 patients, others (poor oral hygiene, superficial skin infection, signs of dehydration, lymphadenopathy, ear discharge) seen in 47 patients. Out of 100 patients, 40 presented with respiratory complaints 29 had LRTI and 11 had URTI; seizures seen in 22 patients, ADD seen in 15 patients, SAM seen in 9 patients, Others (UTI, enteric fever, hepatitis, measles, PUO, fluid refractory shock, obstructive cholestatic jaundice, acute metabolic encephalopathy) were also seen. Only one patient of malaria (p.vivax) was seen.

Sastry CPV found Weakness &fatigue ability were the most common presenting symptom observed in 81.8% of children. On General examination Pallor was seen in 100% of patients, knuckle pigmentation in 18.1%, and koilonychia in 36.3%.[13]

The finding which is mostly emphasized in iron deficiencyanaemia is its effects on the neurocognitive system. Many well-designed prospective studies have shown that motor and cognitive retardation and mood disorders may be observed in children with iron deficiency.[16] Lozoff et al. showed that children with iron deficiency got tired more easily, played less and were more hesitant compared to completely healthy children.[17] More importantly, these effects persisted 10 years after treatment.[18] ID which has progressed to iron deficiency anaemia may cause to disruption in mental and motor functions and these effects may be permanent. The mechanism of action by which iron deficiency causes to neurocognitive disorders is not fully understood. In some studies, it was shown that ID decreased expression of dopamine receptors, disrupted myelinization or disrupted the function of various enzymes involved in the nerve tissue.[19] Again, another important yet controversial clinical effect of iron deficiency is its effects on the immune system.[20]In addition, it was shown that IDA was strongly related with febrile convulsions in some recent studies and in a meta-analysis performed in 2010.[21]

The study shows 28 out of 100 patients with iron deficiency anemia are consuming vegetarian diet, whereas72 were on mixed diet. Patients having mixed food predominantly had mild anemia, though this was statistically insignificant (p=0.075), this may be due to high iron content of nonvegetarian food. Maximum numbers of children have history of consumption of mixed food. Nonvegetarians particularly red meat has greater content of heme iron. In the present study though most of the patients have dietary habit of mixed food but it is in form of egg rather than meat. So, the mixed food habit has no significant impact in frequency of anemia.

Most of the patients are fully immunized suggesting effective immunization program. Study done by Kapur D et al detected pica in 31% of patients. In present study 11% patients showed pica.[22]International study done by Aukett et al suggest that there is a direct relation between iron deficiency and delayed psychomotor development, but such parameter is not studied in present study.[23]

Out of 25 patients with severe anemia; 3 with SAM, 5 with Congestive cardiac failure (CCF) and 4 with LRTI (total 12 patients- 48%) and 4 (12.12%) out of 33 patients with moderate anemia with LRTI received packed RBCs during hospitalization. All patients with moderate to severe anemia are treated with 3 months oral iron whereas patients with mild anemia are treated with

dietary iron. 7 patients with dimorphic anemia received vitamin B12 therapy also.

In this study comparative figures of laboratory parameters of patients at the starting and after treatment end of the study showed improvements. In Iron deficiency anaemia MCV, MCHC, MCH are decreased and RDW is increased. After treatment HB, S.Iron, MCV, MCHC, MCH, RBC are increased. Reticulocyte Count and RDW are decreased.

Iron status is a continuum. At one end of the spectrum is IDA, and at the other end is iron overload. ID and IDA are attributable to an imbalance between iron needs and available iron that results in a deficiency of mobilizable iron stores and is accompanied by changes in laboratory measurements that include Hb concentration, mean corpuscular Hb concentration, mean corpuscular volume, reticulocyte Hb concentration (abbreviated in the literature as CHr) content, total iron-binding capacity, transferrin saturation, zinc protoporphyrin, SF concentration, and serum transferrin receptor 1 (TfR1) concentration. Measurements that are used to describe iron status.[24]

All patients showed positive weight gain after 3 month of iron therapy; it was similar in all grades of anemia. As shown in table 3, all categories showed serum iron level in the range of normalcy at 3 months of treatment. As the severity of anemia increases gain of iron also increases with treatment. This reflects improved absorption of iron with increasing deficiency. p=0.009 is highly significant.

Patients with mild anemia are advised iron rich diet only. At 3 months they showed near normal improvement in hemoglobin, serum iron and RBC indices. Patients with moderate anemia are advised oral iron therapy along with iron rich diet. Packed RBCs are transfused when indicated. At 3 months hemoglobin value improved but still qualified for mild anemia, similarly serum iron and RBC indices improved. Patients of severe anemia are advised oral iron therapy along with iron rich diet. Packed RBCs are transfused when indicated. At 3-month hemoglobin level improved till moderate anemia. Improvement in serum iron as well as RBC indices are also partial only. A longer treatment and follow up is advocated, especially for patients with moderate to severe anemia. Patients with dimorphic anemia completely improved after appropriate B12 therapy.

Limitation of study

Out of 100 cases enrolled in the study, 15 were lost at 1 month follow up visit and another 9 cases at 3 months follow up visit. Thus only 76 cases were available for final analysis.

Conclusions

Anemia is frequently seen in admitted patients. Children under 2 years age are more commonly anemic than older children. No gender discrepancy is seen in anemia in children under 5 years. Though anemia is common, most patients are stable and present with mild to moderate anemia. Only a fraction of patients presenting with congestive cardiac failure require packed RBC transfusion. Oral iron therapy for three months is the mainstay of treatment for iron deficiency anemia. Vitamin B12 therapy is also needed in patients with dimorphic anemia.

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