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Efficacy Of Intravenous Therapy In Children With Iron Deficiency Anaemia Having Poor Response To Oral Iron Therapy

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Abstract

Objective: Iron deficiency is the most common nutritional deficiency worldwide. Common causes of iron deficiency anaemia (IDA) in children are excessive consumption of cow's milk and prolonged breastfeeding with delayed and poor weaning. The objective of this study is to assess the effectiveness of intravenous iron in children with IDA, with poor compliance to oral iron therapy. This study aims to determine the mean levels of Hb after IV iron therapy in children with iron deficiency anaemia having a poor response to oral iron therapy.

Methods: It was a descriptive study. The study was conducted at the Department of Paediatric Medicine, Fatima Memorial Hospital, Lahore. A Total of 119 children fulfilling the selection criteria were enrolled in the study. The absolute dosage of iron was divided into 2 doses administered over two consecutive days. Each IV iron dose was diluted in 100 ml of normal saline in a micro-burette and infused over two hours. Patients were followed up at four weeks to check for haemoglobin levels. All the collected data were entered and analysed by using SPSS v25.0.

Results: A total 119 patients with Iron deficiency anemia (IDA) were enrolled in this study. There were 61(51.3%) males and 58(48.7%) females. Age range in this study was from 6 months to 12 years with a mean age of 7.5±1.5 years. Mean duration of IDA was 8.5±2.3 months. Mean Hb level at baseline was 8.16±0.911 g/dl and 10.76±1.023 g/dl after 4 weeks of treatment and the difference was statistically significant with p-value of 0.001.

Conclusion: Intravenous iron therapy is effective and safe to raise the haemoglobin levels in children with IDA who showed poor compliance to oral iron therapy.

Keywords: Anaemia, Iron-Deficiency, Pediatric, Haemoglobins, Iron, Intravenous

Introduction

Anaemia is defined as a haemoglobin level of less than the 5th percentile for a particular age group.[1] Anaemia is a major health problem throughout the world, and children under 5 years of age are at the highest risk.[2] Nutritional deficiency is the most common cause of anaemia in children under two years of age due to the high growth rate and increased demand for iron, Vitamin B12, and folic acid.[3] Iron deficiency is the most common nutritional deficiency in childhood worldwide, particularly in developing countries. According to a study conducted in Sindh, anaemia is the most common micronutrient deficiency in malnourished children of Pakistan.[4]

About 1.62 billion people worldwide have iron deficiency anaemia. Children between 6 months and 2 years of age are more prone to it, and the most common cause is the late introduction of solid foods.[5] However, recurrent episodes of upper respiratory tract infection, diarrhoea, trauma, and surgery are also associated with the severity of anaemia.[6]

Children with iron deficiency anaemia present with pallor, irritability, anorexia, and lethargy. As haemoglobin level falls further, tachycardia and even high-output cardiac failure may occur. Some children may present with pica and pagophagia. Iron deficiency anaemia can result in fatigue, affect. Exercise tolerance and work capacity reduce neurotransmitter functions and diminish

Contributions:
M.H.R, M.U, M., M.M - Conception of study - Experimentation/Study Conduction
M.H.R, M.U, M., M.M - Analysis/Interpretation/Discussion
M.H.R, M.U, M., M.M - Manuscript Writing
M.H.R, M.U, M., M.M - Critical Review

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immunological and inflammatory defences.[7] Iron deficiency may increase the risk of psychiatric illness in later life.[8]

Various oral iron preparations were traditionally used in the treatment of IDA in the form of ferrous gluconate, ferrous fumarate, ferrous ascorbate and ferrous sulphate.[9] Oral iron therapy is the first-line treatment for children with IDA.[10] Intravenous (IV) iron therapy can be used in situations where the anaemic child is poorly compliant with oral iron therapy. Failure to respond to oral iron therapy can be due to malabsorption or lower compliance rates as a result of lack of commitment, poverty, prolonged treatment, decreased tolerability, or gastrointestinal upsets.[11]

In a study, the mean ferritin level before IV iron therapy was 3.75±2.53 ng/ml, and the mean haemoglobin was 5.9±1.3g/dl. After IV iron therapy, the haemoglobin level was raised to 8.38±1.09 g/dl and 9.74±0.88 g/dl at 2 and 4 weeks, respectively, which was statistically significant ($p<0.05$)(9). In another study, mean Hb levels (g/dl) calculated at baseline (before therapy) were 7.12±0.59 Hb g/dl, while haemoglobin level After therapy (4 weeks) were recorded as 9.33±0.50 g/dl.[12]

In another study, mean Hb levels (g/dl) calculated at baseline (before therapy) were 7.43±1.21 g/dl, while these findings after therapy (2 weeks) were recorded as 9.27±1.23 g/dl.[13] Although a lot of literature is available on oral iron therapy, material on intravenous iron therapy in children, especially in local settings, is scarce. So, the objective of our study is to assess the effectiveness of intravenous iron therapy in children with IDA refractory to oral iron and to determine the mean levels of Hb after IV iron therapy in children with iron deficiency anaemia having a poor response to oral iron therapy.

Materials And Methods

The study was a descriptive case series. It was conducted at the Department of Paediatric Medicine, Fatima Memorial Hospital, Lahore. The study duration was from August 3, 2023, to February 2, 2024. By using a non-probability consecutive sampling technique, the sample collection of 119 children was done.

Children of either gender presenting with iron deficiency anaemia (as per operational definition) between 6 months and 12 years, with poor/no response to oral iron therapy (as per operational definition), were included in the study.

Children with mixed deficiency anaemia having Hb <7mg/dl and with severe malnutrition (-2SD as per WHO definitions), with diabetes (BS>200g/dl), renal failure (creatinine >2mg/dl), and liver dysfunction (ALT& AST> 40 IU), were excluded from the study. After getting approval from the ethical committee of the hospital, a total of 119 children fulfilling the selection criteria were enrolled in the study from the OPD of Fatima Memorial Hospital, Lahore. Written consent was taken from parents before enrolment. Demographic details (name, age, gender, and duration of IDA) were noted. The total and absolute dosage of iron was calculated by using this formula:

Total dosage of iron = (required Hb - observed Hb) x 80 ml x body weight x 0.034

Absolute dosage = Total iron + 20% of total iron dosage

A blood volume of 80 ml/kg was used with a correction factor of 0.034 to build the iron stores. The absolute dosage of iron was divided into 2 doses administered over two consecutive days. Each IV iron dose was diluted in 100 ml of normal saline in a microburette and infused over two hours.

All the collected data were entered and analysed by using SPSS v25.0. Quantitative variables like age, duration of IDA, haemoglobin level at baseline and after 4 weeks were calculated as Mean and SD. Qualitative variables like gender, residence and socio-economic status were calculated as frequency and percentage. A paired t-test was applied to compare Hb levels before and after the treatment. A p-value ≤0.05 was considered significant. Stratification was done for age, gender, duration of IDA, residence, socio-economic status and baseline haemoglobin level. Post-stratification, a t-test was applied. A p-value ≤0.05 was considered significant.

Results

A total of 119 patients with Iron Deficiency anaemia (IDA) were enrolled in this study. There were 61 (51.3%) males and 58 (48.7%) females. The age range was 6 months to 12 years, with a mean age of 7.5±1.5 years. According to age distribution, 62 (52.1%) children were <6 years and 57 (47.9%) were ≥6 years. The mean duration of IDA was 8.5±2.3 months. 76 (63.9%) children had IDA for <6 months, and 43 (36.1%) for ≥6 months. Regarding residence, 72 (60.5%) were rural and 47 (39.5%) were urban. Socio-economically, 52 (43.7%) were of low income, 35 (29.4%) middle income, and 32 (26.9%) high income.

The mean haemoglobin (Hb) level at baseline was 8.16±0.911 g/dl. After 4 weeks of treatment, the mean Hb level increased to 10.76±1.023 g/dl, and this rise was statistically significant (p=0.001). Out of 119 children, **112 children (94.1%)** showed an increase in Hb levels after 4 weeks of treatment, while 7 children (5.9%) did not show significant improvement.

When stratified according to baseline Hb levels:

- Among 29 children with baseline Hb <8 g/dl, **26 children (89.7%)** showed a rise in Hb.
- Among 90 children with baseline Hb ≥8 g/dl, **86 children (95.6%)** showed a rise in Hb.

Detailed stratification of mean Hb levels after 4 weeks with respect to gender, age, duration of IDA, residence, socio-economic status, and baseline Hb is shown in Tables 1 and 2.

Table 1: Stratification of Mean Hb levels after 4 weeks of treatment by gender, age, IDA, residence, socio-economic status and Hb at baseline.

Stratification of Mean Hb levels after 4 weeks of treatment		Mean	Std. Deviation	*p*-value
Gender	**Male**	10.92	1.021	0.094
	Female	10.60	1.008	
Age Group	**<6 years**	10.66	1.023	0.252
	≥6 years	10.88	1.019	
Duration of IDA	**<6 Months**	10.78	0.988	0.870
	≥6 Months	10.74	1.093	
Residence	**Rural**	10.67	0.979	0.197
	Urban	10.91	1.080	
Socio-Economic Status	**Low**	10.52	0.896	0.068
	Middle	10.94	1.056	
	High	10.97	1.121	
Hb at Baseline	**<8 g/dl**	10.21	1.146	0.001
	≥8 g/dl	10.94	0.916	

Table 2: Rise in Hb After 4 Weeks According to Baseline Hb Levels

Baseline Hb Group	Number of Children	Children with Hb Rise	Percentage with Hb Rise
<8 g/dl	29	26	89.7%
≥8 g/dl	90	86	95.6%
Total	119	112	94.1%

Discussion

The role of intravenous (IV) iron therapy in the pediatric population is debatable, with limited data available regarding its safety and efficacy in children with iron deficiency anaemia (IDA). In our study, we used an FDA-approved IV iron sucrose preparation, which is associated with reduced risks of hypersensitivity reactions.[18] A significant improvement in anaemia was observed, with 94.1% (112 out of 119) of children showing a measurable rise in haemoglobin levels within 4 weeks of IV iron therapy. Notably, 89.7% of children with a baseline Hb <8 g/dl and 95.6% with Hb ≥8 g/dl showed improvement, highlighting the effectiveness of this intervention across varying severity levels of anaemia.[15,16]

The mean baseline Hb of our patients was 8.16±0.911 g/dl, which rose to 10.76±1.023 g/dl after four weeks of treatment, with a mean rise of 2.5 g/dl. These results are consistent with those of MMA Baig et al., who reported a mean rise of 1.84 g/dl in Hb at 2 weeks (from 7.43 g/dl to 9.27 g/dl),[9] and Akin M et al., who noted a rise from 7.9±1.2 to 10.6±1.5 g/dl after 4 weeks of therapy.[16] Sabe et al. observed similar improvements in children with inflammatory bowel disease after 12 weeks of IV iron therapy, with a mean Hb increase from 9.1±1.4 to 11.9±1.8 g/dl,[14,17] while our findings demonstrate a comparable Hb rise within a shorter duration (4 weeks), indicating early effectiveness. Nazir et al. also reported a significant rise in Hb (from 7.37±0.44 to 9.47±0.47 g/dl) in malnourished children over 6 weeks [15,18]. Additionally, our findings correlate with outcomes in pregnant women with IDA in a study by Onken JE et al., who reported a 1.76 g/dl rise at 4 weeks of IV iron.[19]

Other studies also affirm the efficacy of IV iron, showing statistically significant improvements in Hb levels at 2 and 4 weeks, such as increases from 5.9±1.3 to 9.74±0.88 g/dl,[10] and 7.12±0.59 to 9.33±0.50 g/dl,[11] among others. Another study reported Hb increase from 7.43±1.21 to 9.27±1.23 g/dl after 2 weeks.[12] Safety remains a major concern, but we observed no serious adverse effects. Previous studies reported only mild side effects such as rash and shivering,[20] cough and wheezing,[21] consistent with the safe profile of IV iron sucrose in our cohort.

Conclusions

Intravenous iron, a method of administering iron directly into the bloodstream, has been proven to be both safe and effective in efficiently raising the levels of haemoglobin in children who suffer from iron deficiency anaemia, particularly those who exhibit poor adherence to oral iron therapy, which involves taking iron supplements orally.

References

1. Braat S, Fielding KL, Han J, Jackson VE, Zaloumis S, Xu JXH, et al. Haemoglobin thresholds to define anaemia from age 6 months to 65 years: estimates from international data sources. Lancet Haematol. 2024;11(4):e253–64. https://doi.org/10.1016/S2352-3026(24)00030-9
2. Simanjuntak SPP, Saragih JRP. Relationship between anaemia and pneumonia severity in children aged 29 days to 5 years. Int J Health Med Sci. 2024;7(2):30–4.
3. Dessie G, Li J, Nghiem S, Doan T. Prevalence and determinants of stunting-anemia and wasting-anemia comorbidities and micronutrient deficiencies in children under 5 in the least-developed countries: a systematic review and meta-analysis. Nutr Rev. 2024;00(0):1–17. https://doi.org/10.1093/nutrit/nuae017
4. Kapoor A, Baig F, Channa NA, Othman SS, Abualhamael SA, Baig M. Estimation of calories intake, iron, zinc, and selenium among children of the underprivileged area in Sindh, Pakistan. PLoS One. 2024;19(6):e0304277. https://doi.org/10.1371/journal.pone.0304277
5. Dehghani A, Molani-Gol R, Rafraf M, Mohammadi-Nasrabadi F, Khodayari-Zarnaq R. Iron deficiency anemia status in Iranian pregnant women and children: an umbrella systematic review and meta-analysis. BMC Pregnancy Childbirth. 2024;24(1):1–12. https://doi.org/10.1186/s12884-024-06342-3
6. Iolascon A, Andolfo I, Russo R, Sanchez M, Busti F, Swinkels D, et al. Recommendations for diagnosis, treatment, and prevention of iron deficiency and iron deficiency anemia. HemaSphere. 2024;8(7):e1087. https://doi.org/10.1097/HS9.0000000000001087
7. Abramowitz BR, Saba H, Meier RR, Binyamin A, Md RA, Md HS, et al. Iron deficiency anemia as a potential risk factor for poor outcomes in acute pancreatitis. [Preprint]. 2024;0–18.
8. Li J, Wang L, Wang Z, Zhao F, Sun Y, Lu Y, et al. Association between suicide attempts and anemia in late-life depression inpatients. BMC Geriatr. 2024;24(1):1–7. https://doi.org/10.1186/s12877-024-04631-y
9. Baig MMA, Batool S, Aslam T, Rafique M, Batool S, Anwaar O, et al. Efficacy and safety of intravenous iron in children with iron deficiency anaemia poorly compliant to oral iron therapy. J Ayub Med Coll. 2022;34(2):317–20.
10. Boucher AA, Bedel A, Jones S, Lenahan SF, Geer R, McGann PT. A retrospective study of the safety and efficacy of low molecular weight iron dextran for children with iron deficiency anemia. Pediatr Blood Cancer. 2021;68(7):e29024. https://doi.org/10.1002/pbc.29024.
11. Onyeneho NG, Anzaku SA, Okeke TC, Ohayi SAR, Okeke OF. Comparative effectiveness of intravenous iron sucrose and oral iron therapy in the treatment of iron deficiency anemia in pregnancy in a Nigerian tertiary hospital: A randomized clinical trial. PLOS ONE. 2023;18(7):e0287567. https://doi.org/10.1371/journal.pone.0287567
12. Boynito WG, Diongue O, Temesgen K, Yeshitila YG, Tessema GY, De Souza M, et al. Effectiveness of video-based health education on breastfeeding practices among infants aged 0–6 months in Dirashe District, South Ethiopia: a cluster randomized controlled trial. Hum Behav Emerg Technol. 2024;2024. https://doi.org/10.1155/2024/6678912
13. Ragab SM, Kamal TM, Badr MA, Taha R, Al-Haggar MS. Efficacy and safety of intravenous ferric carboxymaltose in children with iron deficiency anemia unresponsive to oral iron. Pediatr Hematol Oncol. 2021;38(7–8):599–608. https://doi.org/10.1080/08880018.2021.1925381
14. Sabe R, Vatsayan A, Mahran A, Khalili AS, Ahuja S, Sferra TJ. Safety and efficacy of intravenous iron sucrose for iron-deficiency anemia in children and adolescents with inflammatory bowel disease. Glob Pediatr Health. 2019;6:1–7. https://doi.org/10.1177/2333794X19867947
15. Nazir F, Khurshid A, Talib MA. Intravenous iron sucrose in malnourished children with iron deficiency anemia. Prof Med J. 2020;27(09):1867–71.
16. Kaur R, Kant S, Subramanian M, Kamble BD, Malhotra S, Haldar P. Effectiveness of intravenous iron sucrose therapy in routine antenatal care for the treatment of moderate to severe anemia among pregnant women attending a secondary care hospital in North India: a retrospective analysis. Cureus. 2022;14(3):e23179. https://doi.org/10.7759/cureus.23179
17. Zaman S, Shah SA, Jehanzeb K, Sabir S, Rashid HU. Effect of intravenous iron therapy on serum ferritin and haemoglobin levels in children reporting with iron deficiency anaemia. J Pak Med Assoc. 2020;70(5):1344–8.
18. Caimmi S, Crisafulli G, Franceschini F, Liotti L, Bianchi A, Bottau P, et al. Hypersensitivity to intravenous iron preparations. Children (Basel). 2022;9(10):1–10. https://doi.org/10.3390/children9101565
19. Onken JE, Bregman DB, Harrington RA, Morris D, Acs P. Safety and efficacy of ferric derisomaltose for iron deficiency anemia: A pooled analysis of randomized controlled trials. Clin Hematol Int. 2021;3(2):76–85. https://doi.org/10.2991/chi.k.210118.001.
20. Kalra PA, Bhandari S, Angulo E, Gaillard C, Abdel-Gadir A, Macdougall IC. A systematic literature review of intravenous iron therapy and infections. Clin Kidney J. 2020;13(6):1044–59. https://doi.org/10.1093/ckj/sfaa016.
21. Kazancı EG, Korkmaz MF, Orhaner B. Efficacy and safety of intravenous iron sucrose treatment in children with iron deficiency anemia. Med Sci Discov. 2020;7(9):317–21.