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Original Research Article

Comparative study of oral iron and intravenous iron sucrose in the management of iron deficiency anemia during pregnancy

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ABSTRACT

Background: Iron deficiency anemia (IDA) is the most common nutritional disorder during pregnancy and has been identified as an indirect cause of 20-40% of maternal deaths. The objective of the study to compare the efficacy of oral iron (OI) and intravenous iron sucrose in the management of IDA in pregnant women between 24 and 36 weeks of gestation.

Methods: A prospective observational study was conducted at the Antenatal Clinic of Ballari Medical College and Research Centre, Ballari, between June 2024 and November 2024. Sixty pregnant women between 24 and 34 weeks of gestation, with hemoglobin (Hb) levels between 7 and 10 g/dL and peripheral smear findings suggestive of IDA, were enrolled and randomized into two groups of 30 each. Group A (OI): Received ferrous ascorbate tablets containing 100 mg of elemental iron, administered twice daily throughout pregnancy. Group B (Intravenous iron): Received iron sucrose complex containing 200 mg of elemental iron diluted in 100 ml of 0.9% normal saline, infused intravenously over 15-20 minutes on alternate days. OI was withheld during this period. Both groups were monitored clinically for adverse reactions. Laboratory investigations, including Hb percentage, complete blood count, peripheral smear, and urine analysis, were performed on day 1 and at designated follow-up visits. Data were tabulated and analysed using an unpaired t test. A $p<0.05$ was considered statistically significant.

Results: The increase in Hb and other hematological parameters from baseline was significantly greater in the intravenous iron group compared to the OI group at all time points.

Conclusions: Intravenous iron sucrose was found to be more effective and produced a faster correction of IDA in pregnancy compared to OI therapy.

Keywords: Iron sucrose, Hemoglobin, Anemia

INTRODUCTION

Iron deficiency anemia (IDA) is the most common nutritional disorder affecting pregnant women and remains one of the world's most significant public health challenges. The World Health Organization (WHO) defines anemia in pregnancy as a Hb level of less than 11 g/dl. IDA affects approximately 35-75% of individuals in developing countries, with 65-75% of these cases occurring in India.[1,2] Contributing factors include poor dietary intake, malaria, helminthic infestations, HIV infection, and hemoglobinopathies.[3] One of the major consequences of anemia is poor obstetric outcomes, and it is responsible for approximately 20% of maternal deaths. Anemia is reported to be an indirect cause of maternal mortality in 20-40% of cases.[4,5] Management of anemia depends on its severity and includes OI supplementation, parenteral iron therapy, or blood transfusion.[6] While blood transfusion can be life-saving in severe cases, it carries risks such as allergic reactions, transfusion-related complications, and potential transmission of infections,

including CMV, HIV, and hepatitis B. OI is generally preferred due to its low cost, good safety profile, and proven efficacy. However, its use may be limited by gastrointestinal side effects, leading to poor compliance.[7] Intravenous iron formulations, such as the newer iron sucrose complex, have emerged as effective alternatives for treating IDA.[8]

This study aims to compare the efficacy of intravenous iron sucrose versus OI supplementation in the management of iron deficiency anemia among pregnant women between 24 and 36 weeks of gestation.

METHODS

Study design

A prospective observational study was conducted at the Department of Obstetrics and Gynaecology, Ballari Medical College and Research Centre, from June 2024 to November 2024.

Participants

Pregnant women attending the antenatal clinic between 24 and 36 weeks of gestation were screened. Inclusion criteria were: singleton, uncomplicated pregnancy; gestational age between 24 and 36 weeks; Hb levels between 7 and 10 g/dL; and age between 18 and 40 years.

Exclusion criteria included hemoglobinopathies, bleeding disorders, acute or chronic infections, obstetric complications, recent blood transfusion, and known allergy to parenteral iron.

Randomization and intervention

A total of 60 eligible women were enrolled and divided into two groups (A and B) based on the treatment prescribed by the attending obstetrician.

Group A (OI)

The 30 women received ferrous ascorbate tablets, each containing 100 mg of elemental iron, taken twice daily for 4 weeks. Tablets were to be consumed on an empty stomach, avoiding milk, tea, or coffee around the time of ingestion.

Group B (Intravenous iron)

The 30 women received iron sucrose infusion at a dose of 200 mg elemental iron in 100 ml of 0.9% normal saline, administered intravenously over 15-20 minutes on alternate days.

Total dosage was calculated using:

Total dose=weight (kg) × (target Hb-actual Hb) × 0.24+500 mg.

OI was discontinued during this period. All participants received folic acid supplementation.

Outcome measures

The primary outcome was Hb improvement at 2, 4, and 6 weeks. Secondary outcomes included changes in CBC, peripheral smear, urine analysis, and monitoring of adverse effects to evaluate treatment safety and response.

Statistical analysis

Data were expressed as mean±standard deviation. Intergroup comparisons were made using the unpaired Student's t test. A $p<0.05$ was considered statistically significant.

RESULTS

Baseline characteristics

The 60 pregnant women were enrolled. The baseline clinical and demographic characteristics were comparable between both groups, as presented in Tables 1 and 2.

Primary outcomes

The primary outcome-Hb improvement-was assessed following treatment. Both groups showed an increase in Hb levels, with a notably greater rise observed in the IVI group.

Table 1: Comparison of demographic characteristics in the two groups.

Variables	Group 1 (n=30)	Group 2 (n=30)
Age (in years), mean±SD	28.1±3.24	27.8±3.06
Body mass index (kg/m²), mean±SD	22.8±2.74	23.1±2.58
Gravidity, N (%)		
Primigravida	18 (60.0)	20 (66.7)
Multigravida	12 (40.0)	10 (33.3)
Trimester, N (%)		
Second trimester	21 (70.0)	22 (73.3)
Third trimester	9 (30.0)	8 (26.7)

Table 2: Pre and post treatment comparison between two groups.

Parameters	Pre-treatment oral (Mean±SD)	Pre-treatment IV (Mean±SD)	P value	Post-treatment Oral (Mean±SD)	Post-treatment IV (Mean±SD)	P value
Hb (g/dl)	8.62±0.47	8.58±0.44	0.74	10.12±0.56	11.18±0.51	<0.001
PCV (%)	29.64±2.18	29.27±2.09	0.51	34.16±1.34	36.82±1.29	<0.001
MCV (fl)	76.84±2.76	77.12±2.58	0.69	81.58±2.11	84.76±2.05	<0.001
MCH (pg)	23.84±1.06	23.69±1.12	0.61	27.36±0.81	30.12±0.74	<0.001

Table 3: Adverse reaction with oral and intravenous iron.

Adverse reactions	Oral (n=30)	Intravenous (n=30)
Nausea/vomiting	4	0
Fever/chills	0	2
Rashes	2	1
Constipation	5	0
Dizziness	1	2
Thrombophlebitis	0	1
Diarrhea	2	0
Injection site pain	0	3
Total	14	9

Secondary outcomes

Adverse effects were reported in 46.6% of participants in the OI group, while only 30% of those in the IVI group experienced adverse reactions. Importantly, no significant anaphylactic reactions were noted in participants receiving iron sucrose (Table 3).

DISCUSSION

IDA is among the most prevalent nutritional deficiencies affecting pregnant women worldwide. In the present study, the safety, efficacy, and tolerability of OI (ferrous ascorbate) were compared with intravenous (IV) iron sucrose for the treatment of IDA during pregnancy. The results showed that IV iron sucrose produced a faster rise in Hb levels and more effectively replenished iron stores than oral ferrous ascorbate. Similar findings have been reported by Bayoumeu et al.[6-9] and other investigators, supporting the superior efficacy of IV iron sucrose in the management of IDA during pregnancy.

IV iron sucrose produces a more rapid rise in Hb levels than OI, making it an appropriate therapeutic option for pregnant women, particularly during the third trimester when timely correction of anemia is crucial. Although OI (ferrous ascorbate) is an effective, safe, and economical treatment, its long-term use is often compromised by gastrointestinal adverse effects, leading to reduced patient compliance. Gastrointestinal symptoms such as nausea, constipation, diarrhea, abdominal discomfort, and severe abdominal pain have been reported in 30-35% of patients receiving OI therapy.[10] In the present study, adverse effects were observed in 46.6% of participants treated with OI.

Parenteral iron formulations are also associated with specific adverse effects. Intramuscular iron dextran may cause injection-site pain, skin discoloration, and arthralgia and should be avoided in patients with rheumatoid arthritis because of its potential to trigger disease exacerbations.[11] Likewise, iron sorbitol citric acid complex administered intramuscularly has been associated with nausea, vomiting, injection-site pain, and a metallic taste. In addition, ferric citrate and ferric gluconate have been reported to cause severe and prolonged hepatic necrosis.[12]

Iron sucrose is an intravenous iron preparation with a medium molecular weight ranging from 30,000 to 100,000 Daltons. Owing to its rapid distribution and plasma half-life of approximately 5-6 hours, it effectively replenishes iron stores and supports erythropoiesis.[13] Several studies have reported that IV iron sucrose produces a more rapid improvement in Hb levels than OI therapy or intramuscular (IM) iron dextran. Consistent with these findings, the present study demonstrated that IV iron sucrose was well tolerated, with only few of participants experiencing adverse effects.

CONCLUSION

Both treatment groups demonstrated an increase in Hb levels following therapy; however, the rise was significantly greater in the IV iron sucrose group. Improvements in other hematological and iron-related biochemical parameters were also significantly more pronounced among participants receiving IV iron sucrose than those treated with OI. Furthermore, IV iron sucrose was not associated with any serious adverse events. These findings indicate that IV iron sucrose is a more effective and well-tolerated treatment than OI for the management of iron deficiency anemia during pregnancy.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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