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A Comparative Evaluation of Oral and Intravenous Iron Therapy in Pregnant Women with Iron Deficiency Anemia

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Abstract

Objective:
The prevalence of anemia during pregnancy is reported to be as high as 80% in certain sections of the Indian population. Iron therapy in various forms has been shown to correct anemia and improve fetomaternal outcomes. This study aimed to evaluate the efficacy of intravenous iron sucrose (IVIS) versus oral iron therapy in the treatment of iron deficiency anemia among antenatal mothers attending a tertiary care center. **Materials and Methods:** This prospective comparative study included 80 pregnant women between 18 and 28 weeks of gestation diagnosed with iron deficiency anemia (hemoglobin 7–10.9 g/dL). Participants were allocated to receive either oral ferrous sulfate 200 mg twice daily or a calculated dose of intravenous iron sucrose (100 mg in 100 mL normal saline administered on alternate days). Hemoglobin (Hb) and hematocrit (PCV) levels were measured at baseline, at 4 weeks, and at 8 weeks of therapy. Drug acceptability was assessed based on patient feedback. Adverse drug reactions, gestational age at delivery, and neonatal birth weight were also recorded. Statistical analysis was performed using Student's t-test and Chi-square test. **Results:** Both groups showed a significant increase in hemoglobin and hematocrit levels at 4 and 8 weeks compared to baseline. However, the increase was significantly greater in the IVIS group at 4 weeks ($p = 0.01$) and at 8 weeks ($p < 0.001$). At 4 weeks, 32 (80%) participants in the oral iron group and 35 (87.5%) in the IVIS group achieved the target hemoglobin level of ≥11 g/dL, though the difference was not statistically significant. No serious adverse effects were observed in the IVIS group, indicating good safety. Drug acceptability and neonatal birth weight were higher in the IVIS group. **Conclusion:**Intravenous iron sucrose is more effective than oral iron therapy in the treatment of iron deficiency anemia during pregnancy, with faster improvement in hematological parameters, better tolerability, and no serious adverse effects.

Keywords:
Iron deficiency anemia, Iron sucrose, Oral iron therapy, Pregnancy

Introduction
Iron deficiency anemia (IDA) is the most common nutritional disorder encountered during pregnancy and remains a major public health problem worldwide. According

to the World Health Organization, anemia in pregnancy is defined as a hemoglobin (Hb) level of less than 11 g/dL. The prevalence of anemia in developing countries ranges from 35% to 75%, with India contributing a significant proportion, where nearly 65–75% of pregnant women are affected.

The etiology of anemia in pregnancy is multifactorial and includes poor nutritional intake, iron deficiency, parasitic infestations such as worm infections, malaria, chronic infections like HIV, and inherited hemoglobinopathies. Anemia during pregnancy is associated with several adverse maternal and fetal outcomes, including preterm delivery, low birth weight, and increased perinatal morbidity and mortality. It is also responsible for approximately 20% of maternal deaths and acts as an indirect contributing factor in nearly 20–40% of maternal mortality cases.

Data from the National Family Health Survey **(NFHS-II, 1998–1999)** revealed that anemia was prevalent in 54% of rural women of reproductive age compared to 46% in urban women. Regional variations have also been observed, with states like Kerala reporting a lower prevalence (~23%), while northeastern states of India report rates as high as 62%. The higher burden in northeastern regions is often attributed to difficult geographical terrain, limited access to healthcare services, and delayed antenatal care, leading to late presentation with moderate to severe anemia.

Management of iron deficiency anemia in pregnancy depends on its severity and includes oral iron therapy, parenteral iron administration, and blood transfusion in severe cases. Although blood transfusion provides rapid correction, it is associated with risks such as transfusion reactions, anaphylaxis, and transmission of infections including hepatitis B and HIV. Oral iron therapy is widely used due to its affordability, safety, and ease of administration; however, its effectiveness is often limited by gastrointestinal side effects such as nausea, vomiting, constipation, and poor compliance.

Intravenous iron preparations, particularly iron sucrose, have emerged as an effective alternative for the treatment of IDA in pregnancy. They allow rapid replenishment of iron stores, improved hemoglobin levels, and better patient compliance, especially in cases where oral iron is poorly tolerated or ineffective. Parenteral iron therapy also reduces the need for blood transfusion in the antenatal period. Given these considerations, the present study was undertaken to compare the efficacy and safety of intravenous iron sucrose with oral iron therapy in the management of iron deficiency anemia in pregnancy. Additionally, the study aims to assess patient acceptability of both treatment modalities based on their tolerability and preference.

Materials and Methods

This prospective comparative study was conducted in the Department of Obstetrics and Gynecology at Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, after obtaining approval from the Institutional Ethics Committee.

A total of 80 pregnant women with singleton gestation between 18 and 28 weeks, diagnosed with iron deficiency anemia (hemoglobin 7–10.9 g/dL) confirmed by peripheral smear, were included in the study. Written informed consent was obtained from all participants.

Inclusion Criteria

- Pregnant women with singleton pregnancy
- Gestational age between 18–28 weeks
- Hemoglobin level between 7–10.9 g/dL
- Confirmed iron deficiency anemia

Exclusion Criteria

- Hematological disorders other than iron deficiency anemia
- History of hypersensitivity to iron preparations
- Prior blood transfusion in current pregnancy
- Multiple pregnancy
- Obstetric complications or systemic illness

Study Design

Participants were randomly allocated into two groups (n = 40 each):

- **Group I (IVIS group):** Received intravenous iron sucrose
- **Group II (Oral group):** Received oral iron therapy

Intervention

Intravenous Iron Sucrose Group (IVIS):
Patients received 100 mg iron sucrose diluted in 100 mL normal saline on alternate days. The total required dose was calculated using the formula:

Total iron dose (mg) = Body weight (kg) × (Target Hb – Actual Hb) × 2.4 + 500 mg

The target hemoglobin was taken as 11 g/dL. A test dose was administered, and patients were observed for 15 minutes for any hypersensitivity reactions before full infusion.

Oral Iron Group:
Patients received 200 mg ferrous sulfate tablets twice daily (each containing 60 mg elemental iron). Both groups received equal supplementation of folic acid.

Follow-up and Outcome Measures

Patients were followed up at:

- Baseline
- 4 weeks
- 8 weeks

The following parameters were assessed:

- Hemoglobin (Hb)

- Packed Cell Volume (PCV)
- Adverse drug reactions
- Drug acceptability (based on patient feedback)
- Gestational age at delivery
- Neonatal birth weight

Adverse effects were categorized as:

- **Mild:** No intervention required
- **Moderate:** Required medical treatment
- **Severe:** Required intensive care

Statistical Analysis

Data were analyzed using:

- **Unpaired Student's t-test** for continuous variables
- **Chi-square test** for categorical variables

A p-value <0.05 was considered statistically significant.

Results

The demographic characteristics of the study participants are presented in **Table 1**. Both groups were comparable with respect to gestational age, parity, and maternal weight ($p > 0.05$). However, the baseline hemoglobin level was significantly lower in the intravenous iron sucrose (IVIS) group compared to the oral iron group ($p = 0.02$). The packed cell volume (PCV) values were comparable between the two groups.

Table 1: Demographic Profile of the Study Participants

Parameters	Oral Iron Group (Mean ± SD)	IVIS Group (Mean ± SD)	P-value
Gestational age (weeks)	26.2 ± 4.5	27.1 ± 4.2	0.36
Parity (%)			0.62
Primi	26 (65%)	24 (60%)	
G2	9 (22.5%)	7 (17.5%)	
G3	5 (12.5%)	9 (22.5%)	
Maternal weight (kg)	51.6 ± 7.3	53.6 ± 7.6	0.24
Hemoglobin (g/dL)	9.8 ± 1.4	9.2 ± 0.86	0.02*
PCV (%)	29.3 ± 4.7	29.7 ± 4.8	0.71

*Statistically significant ($p < 0.05$)

Both groups showed improvement in hematological parameters over time. As shown in **Table 2**, the rise in hemoglobin was significantly higher in the IVIS group at 4 weeks ($p = 0.01$), while at 8 weeks the difference was not statistically significant ($p =$

0.26). PCV values increased in both groups, but differences between groups were not statistically significant.

Table 2: Comparison of Pre- and Post-treatment Hemoglobin and PCV

Parameters	Oral Iron Group (Mean ± SD)	IVIS Group (Mean ± SD)	P-value
Pretreatment Hb (g/dL)	9.8 ± 1.4	9.2 ± 0.86	0.02*
Hb at 4 weeks (g/dL)	10.5 ± 1.1	11.2 ± 1.3	0.01*
Hb at 8 weeks (g/dL)	12.1 ± 1.5	12.5 ± 1.6	0.26
Pretreatment PCV (%)	30.4 ± 2.8	30.7 ± 2.9	0.64
PCV at 4 weeks (%)	33.4 ± 4.2	34.6 ± 3.6	0.18
PCV at 8 weeks (%)	36.8 ± 4.6	38.2 ± 3.4	0.12
Achieved target Hb ≥11 g/dL at 4 weeks	32 (80%)	35 (87.5%)	0.37

*Statistically significant ($p < 0.05$)

At 4 weeks, 80% of participants in the oral group and 87.5% in the IVIS group achieved the target hemoglobin level, but this difference was not statistically significant ($p = 0.37$). Adverse effects were observed only in the oral iron group, whereas no adverse reactions were reported in the IVIS group. Drug acceptability was higher in the IVIS group (87.5%) compared to the oral group (75%), although the difference was not statistically significant. The mean gestational age at delivery was significantly higher in the IVIS group (37.81 ± 0.69 weeks) compared to the oral group (37.45 ± 0.71 weeks) ($p < 0.001$). Similarly, the mean neonatal birth weight was higher in the IVIS group (2.91 ± 0.74 kg) compared to the oral group (2.84 ± 0.5 kg), and this difference was statistically significant ($p < 0.001$).

Discussion

Anemia remains one of the most prevalent nutritional deficiencies affecting pregnant women worldwide and continues to be a major public health concern. Iron supplementation during pregnancy is essential due to the increased physiological demand for iron required for maternal erythropoiesis and fetal development. The total additional iron requirement during pregnancy is estimated to be approximately 800 mg, of which nearly 300 mg is utilized for fetal and placental development, while the remaining is required for expansion of maternal hemoglobin mass. This increased demand cannot be met by dietary intake alone, thereby necessitating iron supplementation even in non-anemic pregnant women.

Oral iron therapy is widely used as a first-line treatment because of its low cost, ease of administration, and general safety. However, its effectiveness is often limited by poor bioavailability and gastrointestinal side effects such as nausea, vomiting, constipation, and metallic taste, which significantly reduce patient compliance. Furthermore, dietary inhibitors such as phytates and oxalates can further impair iron absorption.

Parenteral iron therapy, particularly intravenous iron sucrose, has emerged as an effective alternative, especially in patients who are intolerant to oral iron, noncompliant, or present with moderate to severe anemia in later stages of pregnancy. Although blood transfusion offers rapid correction of anemia, it carries risks such as transfusion reactions and transmission of infections including hepatitis B, hepatitis C, and HIV, and hence is reserved for severe cases.

In the present study, intravenous iron sucrose demonstrated a greater and faster improvement in hematological parameters compared to oral iron therapy. The rise in hemoglobin levels was significantly higher in the IVIS group at both 4 weeks and 8 weeks of therapy. Similarly, the increase in packed cell volume was more pronounced in the IVIS group, indicating better replenishment of iron stores.

These findings are consistent with previous studies. Tripathi and Pradhan reported a significantly higher increase in hemoglobin and serum iron levels in patients receiving intravenous iron sucrose compared to oral iron therapy. Likewise, Parmar et al. observed that parenteral iron therapy led to faster correction of anemia and reduced the need for blood transfusion. Other studies by Dubey et al. and Gupta et al. also reported minimal to no adverse effects with intravenous iron therapy, supporting its safety profile.

In the present study, adverse effects were observed only in the oral iron group, predominantly gastrointestinal in nature, while no adverse reactions were reported in the IVIS group. This contributed to better patient compliance and higher acceptability in the intravenous group. Although the difference in acceptability between the two groups was not statistically significant, a greater proportion of women preferred intravenous therapy.

Another important observation was the improved neonatal outcome in the IVIS group, as reflected by a higher mean birth weight. This suggests that effective correction of maternal anemia has a positive impact on fetal growth and development.

Conclusion

The present study demonstrates that intravenous iron sucrose is more effective than oral iron therapy in the management of iron deficiency anemia during pregnancy. It provides a faster and greater improvement in hemoglobin and packed cell volume, with better tolerability and minimal adverse effects. Intravenous iron therapy also showed improved maternal and neonatal outcomes, including higher birth weight. Therefore, it can be considered a preferable option, particularly in cases of moderate to severe anemia, intolerance to oral iron, or when rapid correction of anemia is required. This is especially relevant in regions with limited access to healthcare services, where delayed presentation of pregnant women often necessitates rapid and effective treatment.

Conflicts of Interest

There are no conflicts of interest

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