Tzu Chi Medical Journal 2020; 32(3): 258–261

Original Article

A comparative study to evaluate oral iron and intravenous iron sucrose for treatment of anemia in pregnancy in a poor socioeconomic region of Northeast India

Maureen P. Tigga, Amulya P. Debbarma*

Department of Obstetrics and Gynaecology, Agartala Government Medical College and G B Pant Hospital, Agartala, Tripura, India

Abstract

Objective: The prevalence of anemia during pregnancy is as high as 80% in some sections of the Indian population. Iron therapy in different forms has been found to alleviate anemia and yield good fetomaternal outcome. This study aims to evaluate the efficacy of intravenous iron sucrose (IVIS) versus oral iron in treating anemia among the antenatal mothers attending a tertiary care center of Northeast India. **Materials and Methods:** One hundred women between 18 and 28 weeks of gestation with diagnosed iron-deficiency anemia and hemoglobin (Hb) of 7–10.9 g/dL were enrolled to be administered either oral ferrous sulfate 200 mg twice daily or requisite dose of IVIS 100 mg in 100 ml normal saline on alternate days. Hb and hematocrit were measured at the time of enrollment, 4th week, and 8th week of therapy. Acceptability of both the drugs based on like and dislike after interviewing the study participants was recorded. Adverse drug reactions, gestational age at delivery, and neonatal birth weight were also noted in both the groups. The results were analyzed by Student's *t*-test and Chi-square test. **Results:** Hb and hematocrit values were found to be increased in both the groups at 4th and 8th weeks. When both the groups were compared, the rise in the values was higher in the iron sucrose group (at 4th week $P = 0.01$ and at 8th week $P = 0.00$). The number of participants who reached target Hb levels at 4 weeks was 41 (82%) with oral iron and 48 (96%) with iron sucrose. In the iron sucrose group, no adverse effects were observed, suggesting its safety, and the acceptability and newborn birth weight were noted to be higher. **Conclusion:** IVIS was found to be more effective than oral iron therapy in treating antenatal anemia with no serious adverse drug reactions.

Keywords: *Iron-deficiency anemia, Iron sucrose, Oral iron therapy*

Submission : 22-Apr-2019
Revision : 09-May-2019
Acceptance : 12-Jun-2019
Web Publication : 24-Jul-2019

Introduction

Anemia is the most common medical disorder in pregnancy, being more rampant in the developing countries with varied incidence, etiology, and severity [1]. In India, more than 90% of anemia cases are estimated to be due to iron deficiency, because of vegetarian dietary patterns [2]. The high frequency of iron-deficiency anemia during pregnancy in the developing world has substantial health and economic costs and is of concern and a cause of considerable morbidity and mortality [3].

The second National Family Health Survey-11 in 1998–1999 showed that 54% of rural women of childbearing age were anemic compared with 46% in urban areas [4]. Kerala had only 23% prevalence of anemia compared with 62% in many northeastern states of India [4]. The high prevalence of anemia in Northeastern India is attributed to the difficult hilly terrains of this region which hampers the timely access of antenatal mothers to health services. This results in large number of them reaching the hospitals with moderate to severe anemia at a latter gestation, thereby precluding the time for its correction.

On the other front, treating nutritional anemia in pregnancy with oral iron is staggering due to its associated side effects, resulting in noncompliance for the same. Parenteral iron therapy is therefore considered an alternative for oral iron

Access this article online

Quick Response Code:

Website: www.tcmjmed.com

DOI: 10.4103/tcmj.tcmj_99_19

**Address for correspondence:*
Dr. Maureen P. Tigga,
Department of Obstetrics and Gynaecology, Agartala Government Medical College and G B Pant Hospital, Agartala, Tripura, India.
E-mail: maureentigga@gmail.com

How to cite this article: Tigga MP, Debbarma AP. A comparative study to evaluate oral iron and intravenous iron sucrose for the treatment of anemia in pregnancy in a poor socioeconomic region of Northeast India. Tzu Chi Med J 2020; 32(3): 258-61.

defaulters, which can also reduce the need for blood transfusion in antenatal period. The present study was aimed at comparing the efficacy and safety of iron sucrose and oral iron for the treatment of iron-deficiency anemia in pregnancy and to know the acceptability of both the therapies among patients in terms of their like and dislike.

Materials and methods

This study was carried out at Agartala Government Medical College and G B Pant Hospital, Tripura, in the Department of Obstetrics and Gynaecology from August 2014 to July 2016 after the institutional ethical committee approval. One hundred consenting women with singleton pregnancy and gestational age between 18 and 28 weeks, with iron-deficiency anemia confirmed by a peripheral smear and Hb of 7–10.9 g/dL, were included in the study. Patients with hematological disease other than iron-deficiency anemia, hypersensitivity to iron, prior blood transfusion in current pregnancy, and anemia in failure and those with multiple pregnancy and obstetrical complications were excluded from the study.

A meticulous clinical examination along with laboratory investigations, i.e., hemoglobin (Hb), packed cell volume (PCV), and peripheral smear, was carried out before recruitment of the patients.

Patients included in the study were randomized into two groups of 50 each. The first group (intravenous iron sucrose [IVIS] group) comprised of patients who were given IVIS 100 mg in 100 mL of normal saline on alternate days after a test dose. A minimum dose of 100 mg iron sucrose/day and up to a maximum of 300 mg/week was administered. The following formula was used for the calculation of requisite dose of iron sucrose: Body weight in kg × (target Hb – initial Hb) × 2.4 plus 500 mg [5]. The target Hb was 11 g/dL. A test dose of 15 ml of iron sucrose infusion was administered slowly and followed by a 15 min halt during which the patient was observed for anaphylactic reactions. If no reactions occurred, the rest of the infusion was administered. The second group (oral group) comprised of patients who were given 200 mg oral ferrous sulfate tablets twice daily each containing 60 mg elemental iron. Both the groups received equal amount of folic acid. The patients were asked to report after 4 and 8 weeks for estimation of Hb and PCV and to inquire about any side effect. Pre- and posttreatment mean values of Hb and PCV were compared individually and between the two groups.

The acceptability of both the drugs was assessed based on "like" and "dislike" after interviewing the study participants during follow-up. Adverse effects such as gastrointestinal (nausea, vomiting, constipation, and diarrhea), pruritis, fever, myalgia, hypotension, local extravasation, metallic taste, and anaphylactic reactions were noted. The severity of the adverse reactions was graded based on patient's response as following: mild defined as adverse effect that did not require medical intervention; moderate defined as adverse effect that required medical intervention; and severe defined as adverse effect that required medical intervention and intensive care unit admission.

The patients were followed up to their delivery, and the gestational age at the time of delivery and the newborn birth weight were recorded and compared between the two groups. Statistical analysis was carried out using unpaired *t*-test to compare nonnominal parameters (hemoglobin and PCV) between the two groups. Chi-square test was used for binominal variables (side effects), and $P < 0.05$ was considered statistically significant.

Ethics

Approval from the Ethics Committee, Agartala Government Medical College, was obtained with Ref No. F4 (12–41)/AGMC/Academic/PG/Thesis/2011. Written informed consent was duly obtained from all participants.

Results

The demographic data for both the groups are presented in Table 1. The gestational age, parity, and maternal weight between the two groups were comparable.

The mean Hb level (g/dL) and PCV (%) in the two study groups were as follows: Hb: 9.6 ± 0.74 (oral) versus 8.84 ± 0.66 (IVIS) and PCV: 29.56 ± 1.36 (oral) versus 29.73 ± 1.36 (IVIS).

As demonstrated in Table 2, there was statistical significance of difference in the mean Hb levels between the two groups at 4 and 8 weeks of treatment. The mean Hb (g/dL) after treatment at 4 weeks was 10.96 ± 0.46 (oral) versus 11.20 ± 0.51 (IVIS) and at 8 weeks it was 12.51 ± 0.47 (oral) versus 12.87 ± 0.41 (IVIS).

A statistically significant difference was observed between the two groups after 4 weeks ($P = 0.01$) and 8 weeks ($P = 0.00$) of iron therapy. The mean differences of

Table 1: Demographic profile of the study cases

Parameters	Oral iron group	IVIS group
Mean gestational age (weeks)	25.40±3.73	27.88±1.30
Parity (%)		
Primi	33 (66)	32 (64)
G2	13 (26)	11 (22)
G3	4 (8)	7 (14)
Mean maternal weight (kg)	51.25±0.85	52.93±1.06
Mean hemoglobin (g %)	9.6±0.74	8.84±0.66
Mean PCV (%)	29.56±1.36	29.73±1.36

PCV: Packed cell volume

Table 2: Comparison of pre- and posttreatment levels of hemoglobin and packed cell volume

Parameter	Oral iron group	IVIS group
Mean pretreatment Hb (g %)	9.6±0.74	8.84±0.66
Mean Hb at 4 weeks (g %)	10.96±0.46	11.20±0.51
Mean Hb at 8 weeks (g %)	12.51±0.47	12.87±0.41
Mean pretreatment PCV (%)	29.56±1.36	29.73±1.36
Mean PCV at 4 weeks (%)	33±0.9	34±0.6
Mean PCV at 8 weeks (%)	36.69±0.66	38.32±0.85
Number of women achieving target Hb (11 g %) at 4 weeks	41 (82)	48 (96)

Hb: Hemoglobin, PCV: Packed cell volume

rise of Hb level (g/dL) in the oral group after 4 and 8 weeks of therapy were 1.6 g/dL and 2.91 g/dL, respectively. However, in the IVIS group, after 4 weeks, Hb rise was 2.12 g/dL; after 8 weeks, it was 4.03 g/dL. The mean difference of rise in PCV (%) after 4 weeks was 3.44% (oral) versus 4.27% (IVIS). After 8 weeks, it was 7.13% (oral) versus 8.59% (IV), thereby demonstrating statistical significance of difference between the two groups with respect to rise in PCV as well.

In the present study, it was observed that the number of cases who attained the target Hb level at the end of 4 weeks was 41 (oral) versus 48 (IVIS).

It was also observed that side effects occurred only in cases on oral therapy, whereas no adverse reaction was seen in the IVIS group. Among the oral therapy group, 28% of cases had no side effects, whereas the remaining had the following: nausea 16%, vomiting 8%, dyspepsia 16%, constipation 6%, diarrhea 6%, metallic taste 16%, myalgia 2%, and pruritus 2%. Of 36 cases who experienced adverse effects in the oral group, 26 had mild, 10 had moderate, and none had severe adverse effects.

It was observed that acceptability for IV therapy was higher than oral therapy based on like and dislike of cases after interviewing them at 4 and 8 weeks. It was noted that 78% of cases who were on oral iron liked the therapy, whereas 86% of cases on IVIS liked the same. However, this difference was not statistically significant as the *P* value observed was 0.298.

The mean gestational age (in weeks) at delivery in the oral group was 37.40 ± 0.65 versus 37.95 ± 0.70 in the IVIS group ($P = 0.000$). The mean neonatal birth weight (in kg) was 2.67 ± 0.05 (oral) versus 2.79 ± 0.89 (IVIS), thereby demonstrating statistical significance of difference between oral therapy and intravenous therapy based on neonatal outcome ($P = 0.00$).

Discussion

Anemia is one of the most prevalent nutritional deficiencies affecting pregnant women [6]. Iron supplementation during pregnancy is of paramount importance because the demand for iron by the mother and the fetus increases. The total maternal need for extra iron averages close to 800 mg (elemental iron), of which about 300 mg is for the fetus and the placenta and the rest is for maternal hemoglobin mass expansion [7]. This increased demand cannot be met without iron supplementation. Overall, a pregnant woman needs about 2–4.8 mg of iron per day [7]. The woman must consume 20–48 mg of dietary iron to absorb this quantity of iron daily [7]. Therefore, iron supplementation during pregnancy is recommended universally even in nonanemic women. Supplementation of iron can be done through various methods such as oral iron therapy, parenteral therapy, or blood transfusion.

Oral iron is an easy and cost-effective method of iron replenishment; however, it has certain disadvantages [8]. Bioavailability of different oral iron preparations is variable and severely affected by the presence of phytates and oxalates in food. Metallic taste and gastrointestinal adverse effects associated with oral iron preparation decrease patient compliance which turns out to be a major hindrance in the success of oral iron therapy. On the other hand, parenteral iron presents as a useful therapeutic option, especially in patients who do not tolerate oral iron, patients who are noncompliant, or patients with proven malabsorption [9]. Blood transfusion, although an effective and rapid method of iron replenishment, is associated with the risk of transmission of infectious agents such as HBV, HCV, and HIV [10].

In the present study, a comparative analysis on the efficacy of oral versus parenteral iron supplementation in treating anemia was carried out. It was found that there was a greater rise in Hb and PCV levels in the parenteral group as compared to the oral group at the end of 4 and 8 weeks of therapy, respectively. The pretreatment mean Hb level in the oral group was 9.6 ± 0.74 g/dL, whereas it was 8.84 ± 0.66 g/dL in the IVIS group. The mean differences of rise of Hb level (g/dL) in the oral group after 4 and 8 weeks of therapy were 1.6 g/dL and 2.91 g/dL, respectively. However, in the IVIS group, after 4 weeks, Hb rise was 2.12 g/dL and after 8 weeks it was 4.03 g/dL. A statistically significant difference was observed between the two groups after 4 ($P = 0.01$) and 8 weeks ($P = 0.00$). The mean difference of rise in PCV after 4 weeks in oral was 3.44% and in IVIS was 4.27%. After 8 weeks, rise in PCV was 7.13% (oral) and 8.59% (IVIS), showing a statistical significance of difference between the two groups with respect to rise in PCV percentage among study cases. These findings were similar to that reported by Tripathi and Pradhan, who in their study showed a higher rise in Hb in women receiving parenteral iron sucrose [11]. They demonstrated that the mean increase in total serum iron following iron sucrose was 40.20 ± 5.11 μg/dL compared to an increase of 33.56 ± 3.39 μg/dL with oral ferrous sulfate, which was statistically highly significant ($P < 0.0001$).

It was also noted that the target Hb taken as 11 mg/dL was achieved by a larger proportion of women belonging to the parenteral iron group. A total of 41 (82%) women in the oral versus 48 (98%) women in the parenteral group reached target Hb level at the end of 4 weeks of therapy. Similar findings were reported by Parmar *et al*., showing that parenterally administered iron sucrose elevated hemoglobin and restored iron stores earlier and also led to the reduction in the rate of blood transfusion rate [12].

Our study also elucidated that side effects occurred only in cases on oral therapy, whereas no adverse reaction was seen in the parenteral group. A similar picture was seen in the studies conducted by Dubey *et al*. and Gupta *et al*., where no side effects were reported in the women who received parenteral iron therapy [13,14].

It was observed that acceptability for IV therapy was higher than oral therapy based on like and dislike of cases after interviewing them at 4 and 8 weeks. It was noted that 78% of cases who were on oral iron liked the therapy, whereas 86% of cases on IVIS liked the same. Similarly, Neeru *et al*. reported better tolerability for parenteral iron in their study [15].

Another noteworthy finding of our study was the favorable neonatal outcome in terms of birth weight, which was

found to be higher in the parenteral therapy group. The mean neonatal birth weight (in kg) was 2.67 ± 0.05 (oral) versus 2.79 ± 0.89 (IVIS), thereby demonstrating statistical significance of difference between oral therapy and intravenous therapy based on neonatal outcome ($P = 0.00$).

Conclusion

The present study reveals that parenteral iron therapy is superior in terms of tolerability and correction of anemia when compared to its oral counterpart. It also yields a quicker rise in Hb as well as a higher neonatal birth weight with no adverse effects. This makes parenteral iron a better option to administer to the pregnant women, especially in the difficult hilly terrains of Northeast India, where antenatal mothers do not have easy access to the health services, resulting in large number of them reaching hospitals with moderate-to-severe anemia at later gestation, thereby precluding the time for its correction.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Diejomaoh FM, Abdulaziz A, Adekile AD. Anemia in pregnancy. Int J Gynaecol Obstet 1999;65:299-301.
2. Sharma JB, Soni D, Murthy NS, Malhotra M. Effect of dietary habits on prevalence of anemia in pregnant women of Delhi. J Obstet Gynaecol Res 2003;29:73-8.
3. Cutner A, Bead R, Harding J. Failed response to treat anaemia in pregnancy: Reasons and evaluation. J Obstet Gynaecol 1999;suppl 1: S23-7.
4. International Population Studies. National Family Health Survey. 1998-1999 NFHS-11. Vol. 98. Mumbai, India: International Population Studies; 2000. p. 250-60.
5. Baird-Gunning J, Bromley J. Correcting iron deficiency. Aust Prescr 2016;39:193-9.
6. Thangaleela T, Vijayalakshmi P. Prevalence of anaemia in pregnancy. Indian J Nutr Diet 1994;31:26-32.
7. Mukherji J. Iron deficiency anemia in pregnancy. Rational Drug Bull 2002;12:2-5.
8. Hollands JM, Foote EF, Rodriguez A, Rothschild J, Young S. Safety of high-dose iron sucrose infusion in hospitalized patients with chronic kidney disease. Am J Health Syst Pharm 2006;63:731-4.
9. Pavord S, Myers B, Robinson S, Allard S, Strong J, Oppenheimer C. UK guidelines on the management of iron deficiency in pregnancy. Br J Haematol 2012;156:588-600.
10. Yohanes T, Zerdo Z, Chufamo N. Seroprevalence and predictors of hepatitis B virus infection among pregnant women attending routine antenatal care in Arba Minch hospital, South Ethiopia. Hepat Res Treat 2016;2016:9290163.
11. Tripathi S, Pradhan A. Intravenous iron versus oral iron in antenatal women with iron deficiency anemia in Sub-Himalayan settings. J Evid Based Med Healthc 2015;2:5832-8.
12. Parmar M, Vaghela H, Shah PT, Thakar RV, Deliwala KJ. Evaluation of effectiveness of intravenous iron sucrose in antenatal patients of iron deficiency anemia. Int J Med Sci Public Health 2014;3:173-6.
13. Dubey S, Suri V, Aggarawal N, Das R. Is it safe to use intravenous iron sucrose during pregnancy? A randomized controlled trial. Int J Reprod Contracept Obstet Gynecol 2013;2:544-9.
14. Gupta A, Manaktala U, Rathore AM. A randomised controlled trial to compare intravenous iron sucrose and oral iron in treatment of iron deficiency anemia in pregnancy. Indian J Hematol Blood Transfus 2014;30:120-5.
15. Neeru S, Nair NS, Rai L. Iron sucrose versus oral iron therapy in pregnancy anemia. Indian J Community Med 2012;37:214-8.