e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15 (09); 1664-1668

Original Research Article

A Comparative Study of Injection Ferric Carboxymaltose and Iron Sucrose in Anaemia Complicating Pregnancy

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Received: 25-06-2023 / Revised: 28-07-2023 / Accepted: 30-08-2023

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Conflict of interest: Nil

Abstract:

Background: Iron deficiency anemia is the most common cause of anemia during pregnancy. It may have detrimental effects on the growing fetus as well as the mother. The purpose of the study was to evaluate the safety and effectiveness of intravenous ferric carboxy maltose (FCM) versus iron sucrose in the treatment of anemia in pregnancy.

Methods: This investigation is a prospective observational study that included all pregnant women treated for anemia during pregnancy with iron sucrose and FCM at the Obstetrics and Gynecology Department of DMCH from May 2022 and April 2023. 110 women in all were selected. There were 55 women in group B who received FCM and 55 women in group A who received injection iron sucrose between weeks 30 and 36 of pregnancy. After four weeks of therapy, serum ferritin levels and hemoglobin levels were measured again to evaluate the efficacy of the treatment. Analyzing adverse medication reactions that occurred during and two hours after infusion allowed for the assessment of safety.

Results: Hemoglobin levels were considerably raised by intravenous ferric carboxymaltose infusion as opposed to intravenous ferrous sucrose. In the FCM group, none of the ladies experienced significant adverse reactions.

Conclusion: When pregnancy becomes more difficult due to iron deficiency anemia, ferric carboxymaltose can be utilized safely.

Keywords: Anemia, Ferric Carboxymaltose, Hemoglobin, Iron Sucrose, Serum Ferritin.

Introduction

In underdeveloped nations, iron deficiency anemia is the most prevalent medical issue that affects pregnant women. Anemia is a common condition among pregnant women; 41.8% of them have it. In developing nations, anemia during pregnancy is far more common. [1]

It is an international public health issue that accounts for 40% of maternal mortality in underdeveloped nations, of which 25% are direct maternal deaths. In India, the percentage of pregnant women with iron deficiency anemia (IDA) varies from 23.6% to 61.4%. [2] In addition to increasing mortality, it also raises perinatal mortality and morbidity, yet it is still a significant, avoidable source of poor outcomes for both mothers and perinatals.

Anemia during pregnancy is defined by the World Health Organization (WHO) as hemoglobin (Hb) levels less than 11g/dl. Due to the increased need for iron during pregnancy (about 1000 mg), which is necessary to sustain the expanding hemoglobin mass of the mother as well as the growing fetus and placenta, progression from iron deficiency to IDA in pregnancy is typical. [3] Hemodilution is another physiological cause of anemia.

Pregnancy-related iron deficiency (IDA) can result in a number of gestational problems, as well as higher rates of morbidity and mortality for both mothers and babies. [4,5] Cardiovascular symptoms, lowered immunological, mental, and physical functioning, and decreased peripartum iron stores are among the effects on mothers [6,7]. Due to its low bioavailability, diet alone is unable to provide such elevated levels of iron [8]. Because of all of this, iron supplements are essential for all expectant mothers.

The cornerstone of care for iron deficient anemia is oral or parenteral iron supplementation. Parenteral iron therapy is indicated for patients who require a quick restoration of their iron stores as well as those who are intolerant to oral iron and do not follow oral iron guidelines. Ferric gluconate, iron

sucrose, iron polymaltose, and most recently ferric carboxymaltose [9] are examples of intravenous iron formulations now in use. Their structures are similar, but they vary in terms of the size of the surrounding carbohydrate and the core. Other dextran-free intravenous options include iron sucrose and ferric carboxymaltose. Because iron sucrose has a better safety profile and is more bio-available for erythropoiesis than iron dextran, it is utilized extensively [10]. However, it needs to be administered frequently and at lower doses than that.

A new iron complex called ferric carboxy maltose is made up of an iron-hydroxide core that has been chelated within a carbohydrate shell. When macrophages absorb this complex in its entirety, very little non-transferrin bound iron is produced, preventing both oxidative stress and iron toxicity [11]. Because of its physiological osmolarity, near-neutral pH of 5-7, and enhanced bioavailability, (FCM) enables the administration of large single doses over brief periods of time (up to 1000 mg in a single dosage infused in 15 minutes). FCM does not require the administration of a test dosage and does not cross react with dextran antibodies [12,13] since it is free of dextran and its derivatives. With its modest immunogenic potential, it does not predispose to anaphylactic responses. The purpose of the study was to evaluate the safety and effectiveness of intravenous ferric carboxy maltose (FCM) versus iron sucrose in the treatment of anemia in pregnancy.

Material and Methods

From May 2022 to April 2023, the study was carried out in the obstetrics and gynecology department of Darbhanga Medical College and Hospital, Laheriasarai, Bihar. 110 women between the ages of 30 - 36 were selected, and 55 of them were randomly assigned to one group and given iron sucrose, while the other 55 received ferric carboxymaltose. The study addressed patients with moderate anemia (Hb 7-9.9gm and S. ferritin levels <30mcg) and gestational age more than 30 weeks. Exclusions from the study included thalassemia or hemochromatosis, hypersensitivity reaction to any iron preparation, hemoglobin overload disorders, hemolytic tendencies, chronic renal failure, cardiovascular disease, tuberculosis, hepatitis B/C, or HIV infection.

The levels of S. ferritin, PBF, and CBC were assessed in these patients. The following formulas were used to determine the intravenous iron dose: Total iron requirement: 500 mg (iron reserves) + 2.4 × body weight (in kg)×hb deficiency. The hemoglobin shortfall was computed by deducting 11 grams per milliliter. Every woman was worm-free. Diabetic women were prescribed 500□g of folic acid and B12 tablets per day.

IV iron sucrose was administered to Group A patients in several doses of 200 mg/day on Days 0, 2, 4, 6, and 8, for a total of 1000 mg (200 mg of iron sucrose diluted in 100 milliliters of 0.9% normal saline, delivered over 20 to 30 minutes). IV ferric carboxy maltose 1000 mg single dose (carboxymaltose 1000 mg diluted in 100 ml of 0.9% NS given in 15 min) was administered to individuals in Group B.

Serum ferritin and Hb% were measured in both groups on days 0 and 30 following the last parentral iron dosage. During the process, side effects such as headache, nausea, myalgia, arthalgia, nausea, vomiting, discomfort in the epigastrium, and anaphylactic reactions were monitored. After receiving infusion, the patients were monitored for an hour. A follow-up call was made one month later, and a clinical examination and other investigations were conducted for comparison.

Results

In all, 110 pregnant women were involved in the research. who were mostly in the 20–29 age range. In both groups, the majority of them were multigravida (tables 1 and 2).

Table 1: Distribution of patients according to age

Age (in years)	Group A No. (%)	Group B No. (%)
15-19	02(3.6)	01(1.8)
20-24	25(45.0)	19(34.0)
25-29	24(43.0)	24(43.0)
30-34	3(5.4)	11(20.0)
35-39	1(1.8)	0
Total	55	55
Mean±SD (years)	24.56±3.53	25.58±3.70
Statistical inference	t=1.4792, p=0.142 (Not significant)	

Table 2: Gravidity of patients

Gravidity	Group A No. (%)	Group B No. (%)
Primigravida	25(45.0)	22(40.0)
Multigravida	30(54.5)	33(60.0)
Total	55	55
Statistical inference, chi-square value – 0.15, p-value =0.698 (not significant)		

The majority of patients in Groups A (45%) and B (45%) had pre-treatment hemoglobin levels between 8 and 8.9 g/dl (table 3).

Table 3: Pre-treatment haemoglobin (gm/dl) of the patients

Pre-treatment Hb (gm/dl)	Group A No. (%)	Group B No. (%)
7.0-7.9	12(21.0)	16(29.0)
8.0-8.9	25(45.0)	25(45.0)
9.0-9.9	18(32.7)	14(25.0)
Total	55	55
Statistical inference, chi-square value – 1.07, p-value =0.899 (not significant)		

Patients whose serum ferritin level was less than 30 mcg/dl were chosen; most patients in both groups had serum ferritin levels between 10 and 19.9 mcg/l prior to therapy (table 4).

Table 4: Pre-treatment Serum ferritin (mcg/l) of the patients

Pre-treatment Hb (gm/dl)	No of patients Group A	No. of patients Group B
0-9.9	16	16
10.0-19.9	27	27
20.0-29.9	12	12
Total	55	55
Statistical inference, chi-square value – 0.00, p-value =1.000 (not significant)		

Group B (FCM) experienced a greater increase in mean Hb level at 4 weeks post-treatment compared to Group B (iron sucrose). According to statistics, the increase was substantial (table 5).

Table 5: Rise in mean Haemoglobin (gm/dl) level at 2 weeks post treatment

Variable	Haemoglobin (gm/dl)		Statistical inference (unpaired t Test)
	Group A Mean±SD	Group B Mean±SD	
Rise in haemoglobin (gm/dl) at 4 weeks post treatment	1.06±0.47	1.79±0.47	t=11.21 p<0.001 Highly significant

Four weeks after starting therapy, Group A (iron sucrose) had an increase in mean blood ferritin of 84.78 ± 10.53, while Group B (FCM) had a statically significant increase of 123.80 ± 16.03 (table 6).

Table 6: Rise in mean Serum ferritin (mcg/L) level at 2 weeks post treatment

Variable	Haemoglobin (gm/dl)		Statistical inference (unpaired t Test)
	Group A Mean±SD	Group B Mean±SD	
Rise in serum ferritin (mcg/L) at 4 weeks post treatment	84.78±10.53	123.80±16.03	t=15.08 p<0.001 Highly significant

In all groups, no significant adverse effects were reported. Of the patients in Group A, 52% experienced mild adverse symptoms such as nausea, vomiting, diarrhea, constipation, etc., whereas 34% experienced mild adverse effects (table-7, 8).

Table 7: Adverse drug reactions

Adverse drug reactions	Group A No. (%)	Group B No. (%)
Diarrhoea	6(12%)	2(4%)
Nausea	2(4%)	1(2%)
Constipation	6(12%)	3(6%)
Abdominal pain	2(4%)	0
Injection site reactions	4(8%)	1(2%)
Headache	6(12%)	3(6%)
Dysguesia	2(4%)	0
Skin discoloration	2(4%)	6(12%)
Vomiting	3(6%)	1(2%)
Hypertensivity reaction	0	0
Hypertension	0	0
Hot flushing	0	0
Hypotension	0	0
Total	26(52%)	17(34%)
Chi square value – 3.3048; p=0.69; not significant		

Table 8: Comparison of two groups a/c to the results obtained

Variable	Group A Mean±SD	Group B Mean±SD	p-value
Baseline Hb (gm%)	8.40±0.64	8.45±0.64	P=0.682 (NS)*
Hb rise at 4 weeks (gm%)	1.06±0.11	1.79±0.47	P<0.001 (HS)**
Baseline serum ferritin (mcg/L)	14.74±5.82	14.09±6.05	P=0.567 (NS)*
Serum ferritin rise at 4 weeks (mcg/L)	84.78±10.53	123.80±16.03	P<0.001 (HS)**
Adverse drug reactions (%)	52%	34%	P<0.001 (HS)**

*NS = Not significant, **HS = Highly significant

Discussion

The study compared the safety and effectiveness of iron sucrose and ferric carboxymaltose in pregnant women with iron deficient anemia. One of the main causes of maternal and newborn morbidity in both industrialized and developing nations is iron deficiency anemia. Therefore, it is crucial to diagnose IDA and treat anemia in all pregnant women before to birth. Another significant indirect cause of maternal death is IDA.

Our findings are consistent with a number of randomized control trials that demonstrate the effectiveness and safety of ferric carboxy maltose. Age-related demographic information was similar between the two groups. Ferritin and Hb baseline values were clinically negligible in both groups. In primi, the prevalence of IDA was 40–45%, whereas in multi, it was 60%. Frequently occurring pregnancies may be the cause of the high prevalence in multiples.

Insufficient time between two births, which causes the iron reserves to be depleted. Hb increased in the FCM group statistically significantly more than that of iron sucrose (1.79 vs. 1.06 g/dl). In the FCM group, serum ferritin was likewise significantly higher (123.80 vs. 84.78 mcg/L), and there were also proportionally less side effects (34% vs. 52%), all of which were minor. The current study's findings about the safety and effectiveness of FCM compared to iron sucrose are in line with those of previous investigations by Joshi SD et al. [15], Garg R et al. [14], and Maheshwari B et al. [16]. While the mean increase in Hb was 1.79 g/dl in our investigation, the Hb rise in a trial by Van Wyck et al. [17] was greater than 3 g/dl in patients receiving FCM over a 4-week period. In patients treated with iron sucrose, the increase in hemoglobin was found to be 4-6 g/dl in a study by Giannoulis et al. [18], while in our investigation, the increase in hemoglobin was 1.09 g/d during a 4-week period. In our investigation, we found that the mean ferritin level in the FCM group grew from 14.09 to 123.80 mcg/l in 4 weeks. Breymann et al. [19] reported an increase in ferritin levels from 39.9 to 150 mcg/l in 4 weeks. Iron sucrose can cause adverse reactions, with GI side effects being the most frequent. None of the trial participants needed an extended stay in the hospital; all of them recovered without any problems. Iftikar et al. [22], David et al. [20], and Evstatiev et al. [21] demonstrated that FCM had superior compliance and was well tolerated compared to other preparations. Our study findings were in line with the studies mentioned above.

Conclusion

Our study suggests that FCM, with its lower side effects and better patient adherence, is a potentially safe and successful therapy option for IDA correction in the third trimester of pregnancy. The present study has also shown that IDA could be significantly rectified with a single large dosage of FCM.

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