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Original Research Article

A Comparative Study of Injection Ferric Carboxy Maltose and Injection Iron Sucrose for Treatment of Iron Deficiency Anaemia in Pregnancy at Kamla Raja Hospital, Gwalior

Megha Bandil[1], Renu Jain[2], Yashodra Gaur[3], Vrunda Joshi[4]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, G.R. Medical College, Gwalior, Madhya Pradesh, India

[2]Professor, Department of Obstetrics and Gynaecology, G.R. Medical College, Gwalior, Madhya Pradesh, India

[3]Professor, Department of Obstetrics and Gynaecology, G.R. Medical College, Gwalior, Madhya Pradesh, India

[4]Professor & HOD, Department of Obstetrics and Gynaecology, G.R. Medical College, Gwalior, Madhya Pradesh, India

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Corresponding author: Dr. Megha Bandil

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Abstract

Background: Iron deficiency anaemia is the most common form of anaemia during pregnancy. It may have detrimental effects on the mother and growing foetus. There is need to study the effectiveness and safety of injection ferric carboxy maltose and injection iron sucrose in pregnant women havinganaemia.

Aim: To carry out a comparative study of injection ferric carboxy maltose and injection iron sucrose for treatment of iron deficiency anaemia in pregnancy at Kamla Raja Hospital, Gwalior.

Methods and Materials: A total of 100 pregnant women with microcytic hypochromic anaemia (iron deficiency anaemia) as determined by peripheral smear were included. The total dose will be determined using the formula. While women in Group B (n=50) received injections of iron sucrose, women in Group A (n=50) received injections of ferric carboxy maltose.

Results: Most patients in Group A (46%) and in Group B (46%) had their pre-treatment Hb in range of 8-8.9 g/dl. Majority of patients in both groups had their pre-treatment serum ferritin in range of 10-19.9 mcg/l. At 2 weeks and three week post treatment, the rise in mean Hb level was more in Group A as compared to Group B. Statistically the rise was highly significant.

Conclusion: From our study we concluded that injection Ferrous carboxy maltose appears to be safe and efficient for correction of iron deficiency anaemia in third trimester of pregnancy with lesser adverse effects and better patient compliance.

Keywords: Injection Ferric carboxy maltose, injection iron sucrose, iron deficiency anaemia, pregnant woman

Introduction

In developing nations, iron deficiency anaemia is the most prevalent medical problem during pregnancy. Anemia is a common condition in pregnancy, affecting

41.8% of all pregnant women. In developing nations, anaemia during pregnancy is far more common. It is a concern of global public health and is to blame for 25% of all direct maternal deaths, accounting for 40% of all maternal mortality in developing nations. Iron deficiency anaemia (IDA) in pregnancy affects anywhere from 23.6 percent to 61.4 percent of pregnant women in India. It also increases perinatal mortality rate and morbidity rate in addition to mortality, yet it continues to be a significant avoidable factor in adverse perinatal and maternal outcomes [1,2].

Anemia is described by the World Health Organization (WHO) as haemoglobin (Hb) less than 11 g/dl during pregnancy. Due to the increased need for iron during pregnancy (about 1000 mg), which is necessary to support both the expanding haemoglobin mass in the mother and the growing foetus and placenta, progression from iron deficiency to IDA in pregnancy is common. The physiological cause of anaemia is haemodilution. Pregnancy-related iron deficiency anaemia (IDA) can result in a variety of prenatal problems as well as higher rates of mother and newborn morbidity and mortality. Cardiovascular symptoms, lowered physical, mental, and immunological function, as well as low peripartum iron reserves, are the maternal effects [3].

Due to limited bioavailability, diet alone cannot provide such high levels of iron. Due to all of this, iron supplements are essential for all pregnant women. Parenteral or oral iron supplements are the mainstay of treatment for iron deficiency anaemia. The need for rapid restoration of iron stores in patients as well as intolerance to oral iron are the indications for parenteral iron therapy. Ferric gluconate, iron sucrose, iron polymaltose, and most recently ferric carboxymaltose are some of the current intravenous iron formulations. They are structurally identical, however they differ in terms of the size of the core and the surrounding carbohydrate. Dextran free intravenous options include iron sucrose and ferric carboxymaltose. Because iron sucrose has a better safety profile than iron dextran and has a higher bioavailability for erythropoiesis, it has been utilised extensively [4].

However, it cannot be administered in higher doses and must be administered in small doses frequently. The iron-hydroxide core of ferric carboxy maltose is chelated in a carbohydrate shell, and the entire complex is absorbed by macrophages, resulting in very low levels of non-transferrin-bound iron and preventing iron toxicity and oxidative stress. Ferric carboxy maltose (FCM) has a physiological osmolarity, near-neutral pH (5-7), and enhanced bioavailability, which enables the administration of high single dosages over shorter time periods (up to 1000mg in a single dose infused in 15 minutes) [5]. FCM does not require the administration of a test dosage because it is free of dextran and its derivatives and does not cross react with dextran antibodies. Due to its low immunogenic potential, it does not put people at risk for anaphylactic reactions [6]. In this study, the effectiveness and safety of injection iron sucrose versus injection ferric carboxy maltose (FCM) in treating anaemia in pregnant women were compared.

Aims

1. To determine the effectiveness of injection FCM in treatment of iron deficiency anaemia in pregnant woman and to compare it with Injection iron sucrose.
2. To determine the safety of injection FCM in treatment of iron deficiency anaemia in pregnant woman and to compare it with injection sucrose

Methods

Study Design

This prospective comparative study was carried out in the department of OBGY, G.R. Medical College, Gwalior, (MP) for a duration of six months from September 2021 to February 2022

Study Population[0]

Pregnant woman between 20 to 34 weeks of gestation with moderate anaemia admitted in the Kamla Raja Hospital for the treatment of anaemia.

Sample size: This study included 100 pregnant woman.

Inclusion criteria

- Gestational age between 20 to 34 weeks
- With Moderate anaemia (Hb 7-9.9 gm/dl)
- Not in labor
- With no signs and symptoms of congestive heart failure.

Exclusion criteria

- Gestational age less than 20 weeks and greater than 34 weeks.
- Pregnant woman who need urgent termination of pregnancy.
- Anemia due to acute blood loss.
- Pregnant woman in labor.
- History of blood transfusions; history of bleeding tendencies; history of illnesses associated with iron overload; hypersensitivity reaction to any iron preparation;
- The study excluded people with thalassemia, hemochromatosis, or medical conditions such chronic renal failure, cardiovascular disease, tuberculosis, hepatitis B/C, or HIV infection.

Pregnant woman who fulfilled inclusion criteria were enrolled in the study. A detailed history was taken including demographic characteristics, history of menstrual cycle, history of family, past medical and personal history. Period of gestation was calculated from LMP or by 1st trimester USG if LMP is not known. Detailed general, systemic and obstetric examination was carried out. Samples of the study participants were send to assess CBC, PBF, and S. ferritin levels.

Study participants were divided into two groups

Group A: Injection Ferric Carboxy Maltose was administered

Group B: Injection sucrose was administered

Participants were alternatively allocated to either group till we reached our target number of 50 in each group over the period of study.

Methodology

The following formulas were used to determine the intravenous iron dosage: overall iron Requirement: 2.4 x body weight (kg) x the blood-brain-barrier deficiency + 500 milligrammes (iron stores). In order to compute the haemoglobin shortfall, 11gm percent was subtracted. Dimorphicanaemia in women was treated with 500ug folic acid and B12 pills daily. Group B individuals received a total of 1000 mg of 200 mg/day of iron sucrose IV over the course of eight days at 0 day, 2nd day, 4^{th} day, 6^{th} day and 8^{th}day (iron sucrose 200mg diluted in 100ml of 0.9 percent normal saline and given over 20 to 30min).

Group A participants received one dosage of 1000 mg of injection ferric carboxy maltose intravenously (Inj carboxymaltose 1000 mg diluted in 100ml of 0.9 percent NS given in 20 to 30mins).

Follow up

At0 week, second week and third week following the final parenteral iron dose, Hb percent and ferritin were evaluated in both groups. During the procedure, it was examined for if there were any side effects such as headache, nausea, myalgia, arthalgia, nausea, vomiting, epigastric discomfort, and

anaphylactic reactions. After the injection, the patients were monitored for an hour.

Statistical Analysis

With SPSS version 20, statistical analysis was carried out. The results are shown as a mean and a standard deviation. One way ANOVA, student- t test, chi square test was used to analyse the mean difference between the two groups, and a p-value of ≤ 0.05 was regarded as statistically significant.

Results

A total of 100 antenatal women were included in the study. Most of them were aged between 20-29 years. Majority of them were multigravida in both groups. Most patients in Group A (46%) and in Group B (46%) had their pre-treatment Hb in range of 8-8.9 g/dl (table-1). Majority of patients in both groups had their pre-treatment serum ferritin in range of 10-19.9 mcg/l (table-2). At 2 week and three week post treatment, the rise in mean Hb level was more in Group A (FCM) as compared to Group B (iron sucrose). Statistically the rise was highly significant (table-3). At 2 weeks post treatment, the rise in mean serum ferritin was 85.89 ± 11.64 in Group B (iron sucrose), whereas it was 134.91 ± 17.14 in Group A (FCM), which is statically highly significant (table 4). No serious side effects were reported in any group. Mild adverse effects like nausea, vomiting, diarrhea, constipation etc were observed in 52% patients in Group B, and 34% patients in Group A.

Table 1: Pre- treatment haemoglobin (gm/dl) of the patients

Pre- treatment Hb (gm/dl)	Group A (%)	Group B (%)
7-7.9	22	30
8-8.9	46	46
9-9.9	32	24
Statistical inference, chi -square value – 0.00, p –value = 0.899 (not significant)		

Table 2: Pre-treatment serum ferritin (mcg/l) of the patients

Pre- treatment serum ferritin (gm/dl)	Group A (%)	Group B (%)
0-9.9	27	28
10-19.9	48	47
20-29.9	25	25
Statistical inference, chi square value – 0.00, p –value = 1.000 (not significant)		

Table 3: Rise in mean Haemoglobin (gm/dl) level at 2 weeks and 3rd week post treatment

	Hemoglobin (gm/dl)		Statistical inference (Unpaired t Test)
	Group A Mean ± S.D	Group B Mean ± S.D	
Rise in haemoglobin (gm/dl) at 2 week and third week post treatment	1.80 ± 0.58	1.07 ± 0.58	t= 11.42 P < 0.001 Highly significant

Table 4: Rise in mean serum ferritin (mcg/L) at 2 week and 3rd week post treatment

Variable			Statistical inference (unpaired t Test)
	Group A Mean ± S.D	Group B Mean ± S.D	
Rise in serum ferritin (mcg/dl) at 2 week and 3rd week post treatment	134.91 ± 17.14	85.89 ± 11.64	t= 15.19 P < 0.001 Highly significant

Discussion

The World Health Organization (WHO) defines anaemia as having haemoglobin (Hb) less than 11 g/dl while pregnant. The development from iron deficiency to IDA in pregnancy is common due to the increased requirement for iron during pregnancy (approximately 1000 mg), which is required to sustain both the increasing mass in the mother and the growing baby and placenta. Hemodilution is the physiological cause of anaemia. IDA during pregnancy can lead to a number of prenatal issues as well as greater risks of morbidity and mortality for both the mother and the infant. The maternal effects include cardiovascular symptoms, decreased physical, mental, and immune function, as well as reduced peripartum iron reserves [7,8].

In pregnant women with iron deficiency anaemia, the study's objective was to compare the efficacy and safety of ferric carboxymaltose with iron sucrose. In both industrialised and developing nations, iron deficiency anaemia is one of the most significant causes of maternal and newborn morbidity. Therefore, IDA diagnosis is crucial, and all pregnant women should have their anaemia treated before giving birth. IDA is a significant indirect factor in maternal fatalities. Our findings are consistent with other randomised control studies that have demonstrated the efficacy and safety of ferric carboxy maltose. Age-related demographic information was comparable across the two groups. Clinically insignificant baseline values of Hb and ferritin were found in both groups. In primi, IDA prevalence ranged between 40 and 45 percent, while it was 60 percent in multi. Pregnancies occurring frequently may be the cause of the high prevalence of multi [9,10].

Diet alone cannot supply such large levels of iron due to the low bioavailability of iron. All pregnant women must take iron supplements as a result of the above. The mainstay of treatment for iron deficiency anaemia is iron supplementation administered intravenously or orally. Parenteral iron therapy is indicated when a patient's iron stores need to be restored quickly and when they are unable to tolerate oral iron. Some of the current intravenous iron formulations include ferric gluconate, iron sucrose, ferric polymaltose, and most recently ferric carboxymaltose. Although they are fundamentally the same, the size of the core and the surrounding carbohydrate varies [11-13].

Iron sucrose and ferric carboxymaltose are two intravenous alternatives that are dextran free. Iron sucrose has been used a lot because it is safer than iron dextran and has a higher bioavailability for erythropoiesis.

Having too many children too soon causes the body's iron reserves to be depleted. Hb increased in the FCM group statistically significantly more than it did in the Iron Sucrose group. The FCM group also had considerably greater serum ferritin levels with relatively fewer adverse effects, all of which were moderate in nature. The current study's findings regarding the effectiveness

and safety of FCM in comparison to Iron Sucrose were consistent with those of the other studies carried out by Garg R et al. [14] and Joshi SD et al. [15] and Maheshwari B et al. [16].

In a research by Van Wyck *et al* [17], patients treated with FCM over 4 weeks experienced an increase in haemoglobin of >3 g/dl, whereas in our study, the average increase was 1.79 g/dl. In a study by Giannoulis *et al* [18]., patients receiving iron sucrose experienced an increase in haemoglobin of 4-6 g/dl over 4 weeks, but in our study, the Hb levels increased by 1.09 g/d over 3weeks period of time. According to Breymann et al. [19], ferritin levels climbed from 39.9 to 150 mcg/l in 4 weeks. However, in our investigation, we found that the mean ferritin level increased in the FCM group from 14.09 to 137.80 mcg/l in 3 weeks. Iron sucrose can cause negative reactions, with GI issues being the most prevalent. None of the patients in our study needed to stay in the hospital for a lengthy time, and their rehabilitation went well. In comparison to previous preparations, FCM had better compliance and was well tolerated, as demonstrated by David *et al* [20]., Evstatiev *et al* [21]., and Iftikar *et al* [22]. The findings of our investigation were in agreement with the studies mentioned above.

Conclusion

From our study we concluded that injection Ferrous carboxy maltose appears to be safe and efficient for correction of iron deficiency anaemia in third trimester of pregnancy with lesser adverse effects and better patient compliance.

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