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

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(2); 129-134

Original Research Article

Comparison of Effectiveness between Intravenous Ferric-Carboxy Maltose and Iron Sucrose in Treatment of Anemia Complicating Pregnancy

Purnima Saxena[1], Somya Saxena[2]

[1]Assistant Professor, Department of Obstetrics and Gynecology, Dr Baba Saheb Ambedkar Medical College, Delhi

[2]Assistant Professor, Department of Obstetrics and Gynecology, M L N Medical College, Allahabad

Received: 19-12-2022 / Revised: 21-01-2023 / Accepted: 05-02-2023

Corresponding author: Dr Purnima Saxena

Conflict of interest: Nil

Abstract

Introduction: Anemia during pregnancy is most frequently caused by iron deficiency. Both the mother and the growing foetus may suffer negative effects. The goal of the current study was to examine the effectiveness of iron sucrose and intravenous ferric carboxy maltose (FCM) in treating anemia in pregnant women.

Material and Methods: In this prospective observational study, 100 pregnant women between the ages of 14 and 35 weeks who had been diagnosed with iron deficiency anemia received either FCM or iron sucrose treatment for the condition during the months of August 2021 and August 2022. By measuring serum ferritin and hemoglobin levels again two weeks and six weeks after medication ended, the effectiveness of the treatment was evaluated.

Results: The level of hemoglobin and S. Ferritin were more increased in FCM group compared to Iron Sucrose group in the duration of 6 weeks after completion of treatment.

Conclusion: Compared to iron sucrose, ferric carboxymaltose is more effective at treating iron deficiency anaemia, which can complicate pregnancy.

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

Introduction

One of the main health concerns during pregnancy is anemia. According to the WHO, iron deficiency anemia is responsible for between 35% and 70% of anemic pregnant women in developing nations [1] and approximately 591,000 perinatal deaths and 115,000 maternal deaths worldwide. All age groups, from puberty and adolescence to perimenopause, are affected by anemia. Low dietary iron intake, poor bioavailability of iron, an Indian diet strong in phytates, poor eating habits, chronic blood loss during menstruation, and a high prevalence of illnesses like malaria and hookworm infestations are all contributing factors to India's high incidence of anemia [2]. Due to the fetus's increased demands throughout pregnancy, the condition worsens. To fulfil the increased need during the prenatal period, prophylactic oral iron is advised during

pregnancy. Due to gastrointestinal side effects such bloating, diarrhea, heartburn, nausea, constipation, and black faeces, the biggest problem with oral iron therapy is compliance. Parenteral treatment can prevent the requirement for blood transfusions throughout the prenatal and postpartum periods in these individuals and promises a better response [3]. Iron sucrose complex (ISC) is the most frequently used iron preparation for anemia in pregnancy, although it requires multiple injections to treat anemia because only a little dosage is allowed per session. Given that it necessitates numerous sessions, this raises the overall expense of therapy. The most recent development in i.v. iron preparations is Ferric Carboxymaltose (FCM), a type I iron complex devoid of dextran. The goal of the current study was to compare FCM with ISC for the treatment of moderate to severe iron deficiency anemia in pregnant women in terms of effectiveness, safety, and cost effectiveness.

Material & Methods

Study design, settings and participants:

A tertiary care teaching hospital in Uttar Pradesh, India, conducted the prospective observational study over the course of a year, from August 2021 to July 2022. The study comprised 100 pregnant women with gestational ages ranging from 14 to 35 weeks, established iron deficiency anemia, Hb levels between 6 and 10 g/dl, and peripheral smear characteristics indicative of iron deficiency anemia. The study excluded participants with anemia brought on by other hematological conditions, iron hypersensitivity, a history of blood transfusion during the current pregnancy, anemic patients who presented with congestive heart failure, and participants with liver or renal disease.

Study procedure

This study was approved by institutional ethical committee. Patients were recruited for the study after obtaining consent. 100 pregnant women fulfilling inclusion criteria were randomized into two groups in 1:1 ratio. On enrollment detailed clinical history (menstrual, obstetric, personal, family, dietary) and patient's symptoms such as fatigability, dyspnea, loss of appetite, loss of weight etc. and also compliance with oral iron and chronic medical illness were recorded. Detailed general and obstetrical examination was done. Blood sent for routine antenatal investigations. Hemogram, reticulocyte count, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, mean corpuscular distribution width, Hb electrophoresis, serum ferritin levels, serum iron, total iron binding capacity, and transferrin saturation were among the anemia-specific investigations carried out.

50 patients each were divided into two groups from the enrolled patients. Patients in Group A were given ferric-carboxy maltose (FCM), whereas those in Group B were given iron sucrose.

The Ganzoni formula was used to determine the patient's iron needs to make up the deficiency and replace the iron stores to raise the haemoglobin level to 11 g/dL. Body weight in kg x (goal Hb - starting Hb) x 2.4 plus 500 mg. Patients in the FCM group received i.v. FCM after determining their total iron shortage. The highest dose per session was 1000 mg, which was given as an IV infusion over a 15-minute period after being diluted in 200 cc of 0.9% normal saline.

The next dosages, if necessary, were scheduled for days 7 and 14. Following a test dosage that lasted for 20 minutes, patients in the iron sucrose group received 200 mg of iron sucrose diluted in 200 ml of normal

saline intravenously. When the whole iron requirement was not met, iron sucrose was provided on alternate days. The dosage ranged from 200 mg per day at the minimum to 600 mg per week at the most. After administering a test dose of 20 ml of iron sucrose infusion, there was a 10-minute window during which no more infusion was given and the patient was monitored for anaphylactic reactions. The remaining infusion was given if there were no negative reactions. The trial participants experienced no negative medication reactions.

At the second, fourth, and 37th weeks of gestation, haematological markers like haemoglobin and PCV were checked again. Response of the bone marrow to the total amount of iron necessary to treat iron deficiency The reticulocyte count was used to interpret anaemia. Symptomatic clinical improvement was evaluated. Hemoglobin and serum ferritin levels were checked on patients after two and six weeks. After one week after finishing intravenous iron, patients were encouraged to remain on oral iron once the desired level was reached.

Statistical Analyses

Data were analyzed and statistically evaluated using SPSS software, version 17 (Chicago II, USA). Quantitative data was expressed in mean, standard deviation and difference between two comparable groups were tested by Unpaired t test. 'P' value less than 0.05 was considered statistically significant.

Results

Demographic details and baseline hematological characteristics are mentioned in the Table 1. Both groups were comparable in demographic details and hematological characteristics ($p>0.05$). Mean requirement of iron in intra venous ferric carboxy maltose group was 1057 mg and in the intravenous iron sucrose group it was 1059 mg. The mean requirement of iron in both the groups was almost similar and the difference was statistically non-significant.

Table 1: Baseline characteristics of study participants in both groups

Characteristics	FCM Group (n=50)	Iron sucrose group (n=50)	p value
Age (years)	26.3±2.8	27.1±2.4	0.06
Weight (kg)	50.3±3.1	50.1±4.1	0.39
BMI (Kg/m^2)	21.1±0.5	21.4±0.4	0.25
Red Blood Cell Count (million/ul)	3.6 ±0.23	3.7±0.45	0.08
Packed cell volume (%)	22.80±1.26	23.19±1.22	0.06
Mean corpuscular hemoglobin (pg)	21.65±2.16	21.77±0.3	0.38
Mean corpuscular hemoglobin concentration (g/dl)	26±3.11	27.23±7.2	0.13
Mean corpuscular volume (fL)	71.04±0.6	70.23±7.6	0.22
Reticulocyte count (%)	1.5±0.11	1.46±0.28	0.17
S. ferritin(µg/ml)	14.32±0.22	13.86±6.21	0.30

The hemoglobin and serum ferritin levels at 2 weeks and 6 weeks after iron therapy were significantly higher compared to baseline in both the groups (Table 2). In FCM group significant increase was seen in hemoglobin levels (1.47± .01 g/dl at 2 weeks, 3.95± 0.01g/dl at 6 weeks) as well as in serum ferritin levels (27.76± 0.24µg/L at 2 weeks and 84.02± 05 µg/L). Similarly in iron sucrose group, significant increase in

hemoglobin levels (1.06±0.03 g/dl at 2 weeks, 3.22± 0.04 g/dl at 6 weeks) and in serum ferritin levels (22.37±3.11 µg/L at 2 weeks and 52.18±7.1µg/L) was also noticed. The level of hemoglobin and S. Ferritin were more increased in FCM group compared to Iron Sucrose group in the duration of 6 weeks after completion of treatment (p<.001) (table-2)

Table 2: Hemoglobin and s. ferritin level (mean value± standard deviation) at baseline, 2 weeks and 6 weeks interval

Hemoglobin level (g/ dl)	**Timeline**	**FCM Group**	**Iron sucrose group**	**p value**
	At baseline	6.89±0.6	7.02±0.3	0.08
	At 2 weeks	8.36±0.2	9.12±0.12	.0002
	P value from baseline to 2 weeks	<0.001	<0.001	
	Change from baseline to 2 weeks	1.47± .01	1.06±0.03	.004
	At 6 weeks	10.84±0.42	10.24±.03	<.001
	P value from baseline to 6 weeks	<0.001	<0.001	
	Change from baseline to 6 weeks	3.95± 0.01	3.22± 0.04	<.001
S. FERRITIN (µg/L)	At baseline	14.32±0.22	13.86±6.21	0.29
	At 2 weeks	42.08±6.32	36.23±5.13	<.001
	P value from baseline to 2 weeks	<0.001	<0.001	
	Change from baseline to 2 weeks	27.76± 0.24	22.37±3.11	<.001
	At 6 weeks	98.34±8.32	66.04±4.13	<.001
	P value from baseline to 6 weeks	<0.001	<0.001	
	Change from baseline to 6 weeks	84.02± 05	52.18±7.1	<.001

Discussion

Anemia is a serious problem for maternal health because anemia is amongst one of the five problems that that becomes the target of solving the World Health Organization (WHO) in 2025. The most common cause of anemia worldwide was iron deficiency anemia which was estimated to be around 50% of cases (WHO, 2014).

In order to treat iron deficiency anaemia in pregnancy, two intravenous iron formulations were examined in the current study. FCM was found to be more effective than ISC at treating anaemia, and it resulted in a noticeably higher and faster rise in haemoglobin than the ISC group.

Iron sucrose is the gold standard of care for parenteral iron therapy used to treat anaemia in pregnant women. The main drawback of iron sucrose, on the other hand, is that there is only a restricted maximum allowable dose each week, necessitating numerous visits from the patient in order to acquire the necessary iron dose, as opposed to FCM, which can be given in greater doses all at once.

Our findings are consistent with several randomised control studies that have demonstrated ferric carboxy-safety maltose's and effectiveness. Age, weight, BMI, RBC count, PCV, MCV, MCH, and MCHC demographic characteristics were comparable across the two groups. Hb and ferritin baseline levels were nearly equal in both groups at the beginning of the trial.

Christoph P. *et al*. presented one of the early studies on the use of FCM for treating IDA

during pregnancy [4]. The study came to the conclusion that FCM and ISC were equally safe and tolerable, and that FCM has the advantage of delivering a much higher dose of iron at once, which reduces the need for repeated applications and improves patient comfort. However, the authors also noted a comparable increase in Hb levels at the conclusion of the study. In contrast, the results of the current study showed that after 6 weeks, the Hb levels in the FCM group were substantially higher (3.95 0.01) than in the ISC group (3.22 0.04) (p value.001, which is significant).

FCM and oral iron therapy were also examined in a different trial by Breymann C *et al* for the treatment of iron deficient anaemia in pregnancy. Hb levels rose in both groups at roughly the same rates. In the FCM group, more patients accomplished Hb> 11.0 g/L in a shorter amount of time. The authors came to the conclusion that FCM should be used as the first line of treatment for IDA correction, particularly in the third trimester of pregnancy [5].

Serum ferritin levels are a major determinant of the body's ability to store iron. Patients with anaemia and women with iron deficiency but not anaemia had significantly higher ferritin levels after receiving FCM, according to research by Froessler *et al*. [6,7]. Serum ferritin levels in the two groups in the current study were comparable at baseline and six weeks later. Although FCM (84.02ug/dl) provides an immediate increase in iron storage, it is superior to iron sucrose (52.18ug/dl) in terms of obtaining a greater value at the conclusion of six weeks.

The findings of the current investigation, which compared the efficacy of FCM to iron sucrose, were in line with those of studies carried out by Joshi SD *et al*. [8], Maheshwari B *et al*. [9] and Garg R *et al*. [7].

There have been studies that compared the cost of therapy for FCM and ISC treatment and found that the FCM group had a much lower cost [10,11]. In our study, the Ministry of Family Welfare's JSSK (Janani Shishu Suraksha Karyakram) programme for expectant mothers covered the cost of the medication for the patients. In the current study, the total cost of the medication was computed and compared for both groups, and it was shown that the FCM group had a considerably higher cost (difference INR 306.1). However, as there were much more hospital visits in the ISC group, the research did not account for travel expenses or the amount of working days lost due to travel. Due to the fact that the ISC group required many visits in order to acquire the full dosage, the overall cost of therapy would have been higher.

Conclusion

From our study we concluded that both drugs show improvement in Hb in iron deficiency anemia. Multiple doses of iron sucrose are needed for the same iron requirement as large dose of FCM (1000) can be given in one sitting in contrast to iron sucrose in which only limited dose is permissible (200 mg) therefore patient compliance is much better and hospital expenditure is much reduced as compared to iron sucrose for correction of IDA in second and early third trimester of pregnancy. Achievement of same Hb level and S. ferritin at lesser time duration by FCM administration as compared to iron-sucrose. Hence the correction of anemia is more rapid in fixed duration of time FCM provides more promising results than iron sucrose.

References

1. WHO. Topics: Anemia in women and children. World Health Organization. [cited 2022 Nov 12].Availablefrom:https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children
2. Singh P, Toteja GS. Micronutrient profile of Indian children and women: summary

of available data for iron and vitamin a. Indian Pediatr. 2003;40(5):477–9.
3. Jose A, Mahey R, Sharma JB, Bhatla N, Saxena R, Kalaivani M, Kriplani A. Comparison of ferric Carboxymaltose and iron sucrose complex for treatment of iron deficiency anemia in pregnancy-randomised controlled trial. BMC Pregnancy Childbirth. 2019 Feb 4;19(1):54.
4. Christoph P, Schuller C, Studer H, Irion O, De Tejada BM, Surbek D. Intravenous iron treatment in pregnancy: comparison of high-dose ferric carboxymaltose vs. iron sucrose. J Perinat Med. 2012; 40(5): 469-7.
5. Froessler B, Collingwood J, Hodyl NA, Dekker G. Intravenous ferric carboxymaltose for anaemia in pregnancy. BMC Pregnancy Childbirth. 2014 Mar 25; 14:115.
6. Froessler B, Gajic T, Dekker G, Hodyl NA. Treatment of iron deficiency and iron deficiency anemia with intravenous ferric carboxymaltose in pregnancy. Arch Gynecol Obstet. 2018 Jul;298(1):75-82.
7. Garg R, Nigam A, Agrawal P, Nigam A, Agrawal R. Iron Carboxymaltose: A Safe and Effective Molecule to Combat Anaemia in Pregnancy. Int J Curr Res Aca Rev 2016;4:124-30.
8. Joshi SD, Chikkagowdra S, Kumar V. Comparative study of efficacy and safety of intravenous ferric carboxymaltose versus iron sucrose in treatment of postpartum iron deficiency anaemia. Int J Reprod Contracept Obstet Gynecol. 2016; 5:2566-70.
9. Maheshwari B, Mahtab V, Tyagi S, Tyagi P. Evaluation of efficacy, safety and cost effectiveness of oral iron and injectable iron sucrose and ferric carboxy maltose in pregnant women in 2nd and 3rd trimester in anaemia. Ind J Obstet Gynecol Res. 2017;4:96-100.
10. Mahey R, Kriplani A, Mogili KD, Bhatla N, Kachhawa G, Saxena R. Randomized controlled trial comparing ferric carboxymaltose and iron sucrose for treatment of iron deficiency anemia due to abnormal uterine bleeding. Int J Gynaecol Obstet. 2016 Apr;133(1):43-8.
11. Evstatiev R, Marteau P, Iqbal T, Khalif IL, Stein J, Bokemeyer B, Chopey IV, Gutzwiller FS, Riopel L, Gasche C; FERGI Study Group. FERGIcor, a randomized controlled trial on ferric carboxymaltose for iron deficiency anemia in inflammatory bowel disease. Gastroenterology. 2011 Sep;141(3):846-853.e1-2.