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Original Research Article

Comparison of efficacy of injection ferric carboxymaltose and iron sucrose in moderate anaemia in pregnancy

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ABSTRACT

Background: Prevalence of anaemia in pregnant women is 14% in developed and 58-89.6% in pregnant Indian women. Parenteral iron is seems to be an option in the treatment of moderate iron deficiency anaemia which allow high doses of iron to be administered rapidly, in those who are intolerant to oral iron, have poor compliance to oral iron or gastrointestinal disorder. The objective was to compare the efficacy of newer drug, intravenous ferric carboxymaltose (FCM) with intravenous iron sucrose.

Methods: Group A were given injection FCM and group B were given injection iron sucrose. FCM was given in one or two sittings depending on iron requirement and iron sucrose was given in divided doses. Haemogram was done at baseline and on day 3 and 21 and at 12 weeks. All the observations were tabulated and analysed.

Results: The mean rise in haemoglobin values from baseline in the FCM group was 0.20 ± 0.06 at 3rd day, 2.03 ± 0.47 at 3 weeks, 3.86 ± 0.53 at 12 weeks compared to iron sucrose group, which was 0.11 ± 0.08 at 3rd day, 1.51 ± 0.39 at 3 weeks, and 3.22 ± 0.54 at 12 weeks, which was statistically significant and showed that the haemoglobin levels were increased more in FCM group. Target haemoglobin was achieved in 92% women in FCM group and 78% women in iron sucrose group.

Conclusions: Women in the FCM group achieved significantly higher haemoglobin level than in iron sucrose group. It was given in fewer sittings, hence was more convenient with better efficacy.

Keywords: Anaemia, Ferric carboxymaltose, Iron sucrose complex, Parenteral

INTRODUCTION

World Health Organization (WHO) has estimated that prevalence of anaemia in pregnant women is 14% in developed and 51% in developing countries. It is estimated that majority of women do not have adequate iron stores for pregnancy.¹ Among pregnant Indian women, 58-89.6% prevalence of anaemia has been documented.²

The first choice for prophylaxis and for treatment of mild iron deficiency anaemia in pregnancy is oral iron therapy. Effectiveness of oral iron is largely compromised by lack of absorption, poor compliance, increased adverse effects (up to 56%) and discontinuation of treatment (up to 20%).¹

Blood transfusion has its own hazards including transfusion of wrong blood, deadly infections and anaphylaxis.

Women with moderate anaemia can be treated also with parenteral iron therapy depending upon individual basis (degree of anaemia, period of gestation and tolerance of therapy chosen etc.). Parenteral iron is seems to be an attractive option in the treatment of iron deficiency anaemia, likely to be more popular due to the introduction of new intravenous iron preparations, which allow high doses of iron to be administered rapidly. Indications of parenteral iron therapy are intolerance to oral iron, poor

compliance to oral iron, gastrointestinal disorder, malabsorption syndrome.³

Various parenteral iron preparations are now available. Intravenous iron sucrose complex (IVIS) is given in multiple doses which requires women to come frequently. Newer drug, intravenous ferric carboxymaltose (FCM), can be infused in one or two doses, so they are more patient friendly.³ The objective was to compare the efficacy of intravenous ferric carboxymaltose and intravenous iron sucrose complex in pregnant women with moderate anaemia.

METHODS

This randomized comparative hospital-based longitudinal study was conducted in the Department of Obstetrics and Gynecology, SMS Medical College and Attached Group of Hospitals, Jaipur from July 2020 till December 2020.

Institutional review board and ethical committee approval was taken prior to the study.

Inclusion criteria

Women with singleton live pregnancy, 24-26 weeks period of gestation, >18 years of age with Hb level between 7-10 gm/dl, MCV <100 fl and ferritin level <50 µg were selected for the study from the antenatal clinic.

Exclusion criteria

Women with medical disorders, suspected acute infection, prior parental iron treatment or blood transfusion, intolerance to iron derivatives, known haemoglobinopathies or women with transport difficulties were excluded.

Written informed consent was taken from all women who were participating in the study.

Sample size was calculated at 80% study power and α error of 0.05% assuming SD 0.51 gm/dl raise at four weeks in haemoglobin after Ferric carboxymaltose supplement as found in study of Mahajan et al.⁴ For a minimum detectable mean differences of 0.3 gm/dl in haemoglobin between two groups, 46 patients were required as sample size which were rounded off to 50 patients in each group as final sample at present study expecting 10% dropouts or attrition.

Group allocation was done by coin tossing method to allocate the first woman to group A. After that, they were allocated alternately in both groups. Group A were given injection FCM and group B were given injection iron sucrose. FCM was given in one or two sittings depending on iron requirement and iron sucrose was given in divided

doses. The dose for IV iron in both groups was calculated from the following formula: $\text{Weight} \times (\text{target haemoglobin} - \text{actual haemoglobin}) \times 0.24 + 1000 \text{ mg}$. The weight was the patient's weight before pregnancy (in kilograms). Target haemoglobin was set as 11 gm/dl and 0.24 is a correction factor that takes into account the patient's blood volume, estimated at 7% of body weight and haemoglobin iron content; 1000 mg is the quantity of stored iron in adults. Haemogram was done at baseline and on day 3 and 21 and at 12 weeks. All the observations were recorded, statistical analysis done and conclusions drawn.

Statistical analysis

Continuous variables (quantitative data) were summarized as mean and standard deviation while nominal/categorical variables (qualitative data) were expressed as percentages and proportions. Unpaired t test and Pearson correlation coefficient was used for analysis of continuous variables while chi-square test and Fischer Exact test were used for nominal/categorical variables. Paired t test was used for analysis of paired data. P value <0.05 was taken as significant. Statistical analysis was done using computer software (Microsoft excel 2007). Statistics was calculated using NCSS 2020 software.

RESULTS

The mean age of the anaemic women was 24.74±4.176 years with range of 19-34 years. Majority of the women in both the groups belonged to lower middle class (IV) and lower class (V) (62%) and were educated upto high secondary, 54%. Majority of women were second and third gravidae (56%) and mean gestational age in the study was 24.99±0.943 weeks with range of 24-26 weeks.

Mean basal Hb was 8.58±0.87 gm/dl, 8.53±0.75 gm/dl and mean values of serum ferritin, serum iron, transferrin saturation and TIBC were 7.17±3.56 µg/l, 12.49±4.87 µg/dl, 3.55±2.10 and 543.37±62.10 µg/dl. All the parameters in the two groups were comparable with no significant difference before iron supplementation.

At 3rd day post-treatment, mean rise in haemoglobin was more in FCM group than iron sucrose group (0.1997 gm/dl versus 0.1141 gm/dl), the rise being statistically significant (p<0.05).

At 21 days post-treatment, overall mean haemoglobin was higher (from 8.53±0.75 to 10.53±0.69 gm/dl) in FCM group as compared to that of iron sucrose group (8.63±0.98 to 10.15±0.95 gm/dl), which was statistically significant (p=0.02). Mean rise in haemoglobin was also more in FCM group as compared to iron sucrose group (2.03 gm/dl versus 1.51 gm/dl) and this difference too was statistically significant (p=0.003) (Table 1).

Table 1: Haemoglobin level at different time in the study.

Parameter		FCM group	Iron sucrose group	P value	
Hb	Baseline	Mean Hb±SD	8.53±0.75	8.63±0.98	P=0.568, NS
	3 rd day	Mean total Hb±SD	8.73±0.75 pair t=22.91 p<0.05, sig	8.75±0.97 pair t=22.91 p<0.05, sig	P=0.908, NS
		Rise mean Hb±SD	0.20±0.06	0.11±0.08	P<0.05, sig
	3 weeks	Mean total Hb±SD	10.53±0.69 pair t=28.69 p<0.001, sig	10.15±0.95 pair t=31.37 p<0.001, sig	P=0.02, sig
		Rise mean Hb±SD	2.03±0.47	1.51±0.39	P=0.003, sig
	12 weeks	Mean total Hb±SD	12.38±0.90 pair t=50.73 p<0.001, sig	11.86±0.91 pair t=41.87 p<0.001, sig	P<0.01, sig
Rise mean Hb±SD		3.86±0.53	3.22±0.54	P<0.001, sig	

Table 2: Rise in haemoglobin at 12 weeks post treatment.

Pre-treatment Hb (gm/dl)	FCM group (n=50)				Iron sucrose group (n=50)			
	No	Rise in haemoglobin			No	Rise in haemoglobin		
		2.0-3.0	3.1-4.0	4.1-5.0		2.0-3.0	3.1-4.0	4.1-5.0
7-7.9	15	1	10	4	14	3	9	2
8-8.9	18	3	9	6	17	6	10	1
9-10	17	1	11	5	19	10	9	0
Total	50	5	30	15	50	19	28	3

At 12 weeks post-treatment also, overall mean haemoglobin was higher (from 8.53±0.75 to 12.38±0.90 gm/dl) in FCM group as compared to that in iron sucrose group (8.63±0.98 to 11.86±0.91 gm/dl), which was statistically significant (p<0.01). Mean rise in haemoglobin was more in FCM group as compare to iron sucrose group (3.86 gm/dl versus 3.22 gm/dl). This difference was statistically highly significant (p<0.001) (Table 1).

12 weeks after treatment, all women had rise in haemoglobin in both group, A rise in haemoglobin of 4.1 to 5.0 gm/dl in FCM group was seen in 30% women but in iron sucrose group in only 6% women. The rise was more in 7.0-7.9 gm/dl as compared to higher haemoglobin levels in both the groups (Table 2).

It was observed that in the both groups all the other hematological parameters also changed significantly after 12 weeks treatment in both the groups from the baseline. Mean changes in mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and red cell distribution width (RDW) were slightly higher in FCM group than in iron sucrose group but the difference was not statistically significant (Table 3).

Table 3: Mean rise in various haematological parameters in both the groups after 12 weeks.

Parameters	FCM group (N=50)	Iron sucrose group (N=50)	P value
	Mean rise±SD	Mean rise±SD	
MCV	14.87±8.11	14.80±6.05	t =0.048 p=0.961, NS
MCH	7.87±2.43	7.69±2.83	t =0.341 p=0.733, NS
MCHC	2.53±1.54	2.30±1.89	t =0.667 p=0.506, NS
RDW	-4.37±2.46	-4.32±2.21	t =-0.106 p=0.915, NS

In the present study, target haemoglobin was achieved in 92% women in FCM group and 78% women in iron sucrose group. This difference was significant (p=0.04) (Table 4).

Table 4: Correction of anaemia in the two groups.

Hb level	FCM group (N=50)		Iron sucrose group (N=50)		Total	
	No.	%	No.	%	No.	%
<11 gm/dl	4	8	11	22	15	15
≥11 gm/dl*	46	92	39	78	85	85
Total	50	100	50	100	100	100

$\chi^2=3.84$, $df=1$, $p=0.04$ sig

DISCUSSION

Ferric carboxymaltose consists of a ferric hydroxide core stabilized by a carbohydrate shell and has very high stability and half-life (16 hours). On administering, it allows for controlled delivery of iron within the cells of the reticuloendothelial system and subsequent delivery to the iron-binding proteins ferritin and transferrin, with minimal risk of release of large amounts of ionic iron in the serum thus allows rapid administration of high doses of iron in a single sitting.⁵

We observed higher increase in haemoglobin in FCM group than iron sucrose group at each point of measurement. The mean rise in haemoglobin values from baseline in the FCM group was 0.20 ± 0.06 at 3rd day, 2.03 ± 0.47 at 3 weeks, 3.86 ± 0.53 at 12 weeks compared to iron sucrose group, which was 0.11 ± 0.08 at 3rd day, 1.51 ± 0.39 at 3 weeks, and 3.22 ± 0.54 at 12 weeks, which was statistically significant and showed that the haemoglobin levels were increased more in FCM group.

Similar to the present study, Jose et al also observed that the FCM group achieved significantly higher haemoglobin level than iron sucrose group (10.6 ± 1.21 versus 10.01 ± 0.71 p value ≤ 0.003) in three weeks and (11.53 ± 0.46 versus 10.8 ± 0.44 gm/dl) at 12 weeks. Total rise in mean haemoglobin level was also more in FCM group as compared to iron sucrose group (2.96 versus 2.21 gm/dl), the rise being highly significant statistically ($p < 0.001$).³

In a comparative study, Mahajan et al also found that in both the groups there was a significant increase in haemoglobin level. At four weeks post-treatment, mean total Hb level was significantly higher in FCM group as compared to that of iron sucrose group (10.29 versus 9.57 gm/dl; $p < 0.0001$). At 4 weeks post treatment, rise in mean haemoglobin level was more in FCM group as compared to iron sucrose group (1.80 versus 1.09 gm/dl), the rise being highly significant statistically ($p < 0.001$).⁴

Other authors, Swetha et al, Khan et al also found increase in haemoglobin from baseline to 4 weeks in each group, but the increase in haemoglobin in FCM group was more than iron sucrose group at each point of measurement.^{6,7}

Comparison with other studies is difficult because of different criteria of inclusion, different method and different cut-offs used for lab parameters.

Jose et al observed mean change in MCV, MCH, MCHC and RDW was slightly higher in FCM group than iron sucrose at 12 weeks post treatment.³ Mahajan et al also found significant improvement of all parameters in both the groups but the difference between the groups was insignificant with other parameters.⁴ This study was similar to the present study. Swetha et al also found mean rise in MCV, MCH and MCHC to be higher in FCM group than iron sucrose at 2 weeks post treatment. There was no significant difference in all rise in both the groups.⁶

Jose et al also observed that, 82% of women in FCM and only 70% in Iron sucrose group had Hb > 11 gm% respectively after 12 weeks. In attaining the target haemoglobin levels, the difference between the two groups was statistically significant.³ Lunagariya et al reported that target haemoglobin of 11 gm/dl was attained by 14% of the patients in the FCM group after 2 week of treatment as compared with 6% of patients in the iron sucrose group, which was statistically significant. This study compared levels after 2 weeks only.⁸

Verma et al, reported that 100% cases achieved target haemoglobin at 12 weeks after FCM therapy while in 98% cases achieved target haemoglobin at 12 weeks after iron sucrose therapy.⁹ This study was similar but achieved better correction than the present study.

There are some limitations of the study. Although FCM and iron sucrose replenishes stores, women were not followed upto term to determine whether Hb and serum ferritin level were maintained till delivery and lactation. Only i.v. routes were compared. The oral and i.m. route was not compared in the study.

CONCLUSION

Women in the FCM group achieved significantly higher haemoglobin level than in iron sucrose group. It was given in fewer sittings, hence was more convenient with better efficacy. Hence, it may be recommended as a treatment option in women with iron deficiency anaemia, non-responding to oral therapy even at peripheral health centre.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organisation. The Prevalence of anemia in women. WHO: Geneva, Switzerland; 2017.
2. National Health Policy 2017. New Delhi: Ministry of Health and Family Welfare, Government of India; 2017. Available from:

- https://www.nhp.gov.in/nhpfiles/national_health_policy_2017.pdf. Accessed on 15 January 2018.
3. Jose A, Mahey R, Sharma JB, Bhatla N, Saxena R, Kalaivani M, et al. Comparison of ferric Carboxymaltose and iron sucrose complex for treatment of iron deficiency anemia in pregnancy-randomised controlled trial. *BMC Pregnancy Childbirth.* 2019;19(1):1-8.
 4. Geisser P. The pharmacology and safety profile of ferric carboxymaltose (Ferinject): structure/reactivity relationships of iron preparations. *Portuguese J Nephrol Hypertens.* 2009;23(1):11-6.
 5. Mahajan A, Bhagat BR, Gupta S, Mahajan B, Verma M. A comparative study of efficacy and safety of intravenous ferric carboxymaltose versus iron sucrose in the treatment of iron deficiency anaemia of pregnancy in a tertiary care hospital. *Int J Reprod Contracept Obstet Gynecol.* 2018;7:1938-42.
 6. Swetha T, Yasodha S, Prabhu R. Comparative study of efficacy and safety of anaemia correction between iron sucrose versus ferric carboxymaltose in pregnancy. *IOSR J Dent Med Sci.* 2019;18(6):45-8.
 7. Khan S, Gupta S. A comparative study of injection ferric carboxymaltose and iron sucrose in anaemia complicating pregnancy. *Int J Contemp Med Res.* 2019;6(8):H6-9.
 8. Lunagariya M, Nakum KD, Vithal A, Patel J, Patel M. Iron sucrose versus ferric carboxymaltose: in search of better treatment option in cases of post partum iron deficiency anemia. *Int J Contemp Med Res.* 2018;5(1):12-6.
 9. Verma U, Singh S, Chandra M, Chandra M, Garg R, Singh S, et al. To evaluate the efficacy and safety of single dose intravenous iron carboxymaltose verses multidose iron sucrose in postpartum cases of severe iron deficiency anemia. *Int J Reprod Contracept Obstet Gynecol.* 2015;4:442-6.

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