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Original Research Paper

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INTRAVENOUS IRON SUCROSE COMPARED TO ORAL IRON IN CORRECTION OF IRON DEFICIENCY ANEMIA DURING PREGNANCY.

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ABSTRACT

AIMS AND OBJECTIVES: 1.To compare the efficacy of intravenous sucrose over oral iron in treatment of iron deficiency anemia.

2. To study the adverse effects of intravenous iron sucrose over oral iron.

MATERIALS AND METHODS: The study was conducted over a period of 2 years from 2015 January to 2016 December in the antenatal clinic of Government General Hospital, ACSR Medical college Nellore .

This is a prospective comparative study involving two groups of patients. 100 women around 26 weeks of Gestational age were selected in each group. I choose mild to moderate anaemia in 2nd trimester since it may worsen severe anemia in 3rd trimester and its associated complications.

SUMMARY: In my study I studied 200 women with mild to moderate iron deficiency anemia with> Hb 7gm/dl around 24 weeks of gestation of which 100 women were given intravenous iron sucrose as per the formula weight at first visit (Kgs) (11-Hb%) X 2.4+500mg). The patients were given 200 mg of elemental iron in 100ml of normal saline on alternate days. No testing dose was given. For all the women in the study group deworming was done by albendazole 400mg stat and iron deficiency was confirmed by peripheral smear. Hb and PCV are calculated. Oral group received 333mg (100mg elemental iron) twice a day for 100 days. Hb% and PCV were calculated at the time of recruitment.

The mean Hb and PCV level in the intravenous group before treatment is 8.026g/dL and 23.58% and after treatment it was 10.84g/dL and 31.96% after two weeks respectively after administration of 766.8gms of elemental iron. There is a significant rise in the Hb % level before and after treatment ($p<0.001$) was calculated by 'Paired t test'. The man Hb and PCV level in the oral group before treatment is 8.39g/dL and 24.9% and after treatment it was 9.76g/dL and 28.01% after 100days respectively. There is also a rise in the Hb level in the oral iron group but the mean rise in the Hb level is significantly higher in the Intravenous group than oral group($p<0.001$) calculated by 'student t test'.

CONCLUSION: Intra venous route is the preferred mode of improving Hb significantly in mild to moderate iron deficiency anemia in pregnancy.

The iron sucrose complex has minimal side effects and no test dose is required and can be given on a OP basis. This drug can be used where rare blood groups like negative blood group and are safely administered where the blood is not available in the blood bank. Patient has better compliance and less side effects.

In oral iron therapy compliance is less and gastro intestinal side effects are more and duration of therapy is more than 3months. In these 3months patients can be develop both maternal and fetal complications of anemia. Further in India iron absorption is very low because of worm infestations and many other reasons, mentioned early. Intravenous iron absorption is high because of its low molecular weight.

I conclude that Iron sucrose complex is more effective in improving the Hb levels with minimal side effects in a shorter period. This makes it convenient and effective in pregnant iron deficient women, who are unable to obtain an adequate amount of iron rapidly by oral route.

KEYWORDS : Assess, Quality of Life, Elderly, Old Age Homes.

INTRODUCTION

Anaemia is a common medical disorder that contributes significantly to maternal morbidity and mortality, intrauterine growth restriction, preterm delivery and prenatal morbidity and mortality. In India its prevalence may be as high as 88% in some parts[1]. Anaemia especially if severe is directly or indirectly responsible for 40% of maternal deaths[2].

In India >90% of anaemia cases are estimated to be due to iron deficiency, because high iron requirements during pregnancy are not easily fulfilled by dietary intake, especially when iron bio-availability is poor[3]. Because of religious reasons, poverty or both the Indian population observes dietary patterns that are largely vegetarian[4] which has low iron.

The demands for iron in pregnancy come to a total of about 900 mg[5] of which about 500mg to 600mg goes to the uterus and 150 to 200 is lost at delivery and another 150 to 200 mg is expended in lactation. In addition there is an increased maternal hemoglobin mass which consumes about 500 mg. this leaves a deficit 600 to 700mg. In terms of daily needs, this approximates 4-6mg/day in the second trimester and 6-8mg for day in the third trimester.

Multiparty, previous menorrhagic cycles, infections, worm infestations and malnutrition contribute to this condition. Apart from dietary insufficiency, inadequate absorption of iron is an important cause of iron deficiency. As most of our women start their pregnancy with deficient iron stores, pregnancy causes worsening of anaemia and causes unwanted complications.

Oral iron is the treatment of choice and most of the pregnant women can be treated effectively with oral preparations.

However parenteral administration of iron is necessary under certain circumstances like inability to tolerate the side effects of orally administered iron, inflammatory bowel disease, peptic ulcer, noncompliance with oral regimens and pregnancies after 34 weeks with moderate degree of anaemia.

Parenteral administration of iron provides quick and certain correction of total iron deficit because it not only corrects the anaemia but also builds up iron stores. It can be achieved by either intramuscular or intravenous route. Intramuscular iron can cause major reactions like acute anaphylactic reaction characterized by respiratory difficulty and cardiovascular collapse. Minor adverse effects include arthralgia, backache, chills, dizziness, fever, headache, malaise, myalgia, nausea and vomiting and discoloration of the overlying skin.

Intravenous iron sucrose effectively corrects anaemia and side effects are less, can be administered to mild to moderate anaemia woman before 36 weeks especially in Rh-ve mothers where procuring blood is difficult and rare blood groups like AB+ve when blood is not available in blood banks.

The Government of India in the national nutritional anaemia control program has recommended a daily prophylactic intake of 100mg elemental iron with 500µg of folic acid in the second half of pregnancy for 100days. Oral iron therapy has poor patient compliance either due to side effects or forgetfulness and lack of knowledge and it is not effective in practice due to poor absorption.

Al-Momen etal studied 119 pregnant women with iron deficiency anaemia. The study group received total calculated dose of Iron Sucrose complex (ISC) [Hb deficit (gm/l) x body weight (kg)x 0.3] in divided doses (200 mg elemental iron in nomal saline intravenously over 1 hour daily) followed by 10mg/kg to replenish iron stores. Control group received 300mg (60mg of elemental iron) orally three times a day. ISC group achieved a significantly higher Hb level of 128.5 +/- 6.6 gm/l vs 111.4 +/- 12.4 gm/l in the control group (p< or = 0.001) and in a shorter period (6.9 +/- 1.8weeks vs 14.9 +/- 3.1) in control group (p< or = 0.001).

Bhandal N. Russell R. in oxford UK study intravenous versus oral iron therapy for postpartum anaemia. Conclusions: Intravenous iron sucrose increases the Hb level more rapidly than oral ferrous sulphate in women with postpartum IDA. It also appears to replenish iron stores more rapidly.

Ragip A, Al, MD, Eylem MD, form Division of Maternal – Fetal Medicine, Ankara Etlik Maternity Hospital, Turkey, Conducted a Randomized Trial. Conclusion: Intravenous iron sucrose treated iron-deficiency anaemia of pregnancy ,it has restored iron stores faster and more effectively than oral iron, with no serious adverse reactions.

The objective of the present study was to compare the efficacy of intravenous iron sucrose with oral ferrous sulphate from 24 weeks of gestation in patients with Hb >7g/dl.

In the present study I studied the Hb rise in two groups. In addition I attempted to assess the safety and compliance of the two methods

STUDY DRUG

Pharmacology & Pharmacokinetics of iron sucrose

Composition:

Iron sucrose

Each ml contains
Ferric Hydroxide in complex with Sucrose
Equivalent to elemental iron 20mg

DESCRIPTION:

Iron sucrose a brown, sterile, aqueous, complex of polynuclear iron (III)- hydroxide in sucrose (Iron sucrose) for intravenous use. Iron sucrose injection has a molecular weight of approximately 34,000-60,000 Daltons.

Each ml contains 20mg elemental iron as iron sucrose in water for injection. The product contains approximately 30% sucrose w/v (300 mg/ml) and has a pH of 10.5-11.1 at 20°C. The product contains no preservatives. The osmolarity is not less than 1150 and not more than 1350 mOsoml/L, when tested by diluting the injection 1 in 10.

CLINICAL PHARMACOLOGY

Pharmacodynamics: Following intravenous administration, iron sucrose is dissociated by the reticuloendothelial system into iron and sucrose.

Pharmacokinetics: Following intravenous doses of iron sucrose, the iron component exhibits first order kinetics with an elimination half-life of 6 h, total clearance of 1.2 L/h, Since iron disappearance from serum depends on the need for iron in the iron stores and iron utilizing tissues of the body, serum clearance of iron is expected to be more roped in iron deficient patients treated with Iron sucrose as compared to healthy individuals. The effects of age and gender on the pharmacokinetics of iron sucrose have not been studied.

Distribution:

Following intravenous administration of Iron sucrose, the iron component appears to distribute mainly in blood and to some extent in extra vascular fluid. Significant amount of administered iron is distributed in the liver, spleen and bone marrow.

Metabolism and Elimination:

Following intravenous administration, Iron sucrose dissociates into iron and sucrose in the reticuloendothelial system.

The sucrose component is eliminated mainly by urinary excretion.

SPECIAL INDICATIONS AND USAGE:

1. Hemodialysis Dependent Chronic Kidney Diseases (HDD-CKD) patients receiving an Erythropoietin.
2. Peritoneal Dialysis Dependent Chronic Kidney Disease (PDD-CKD) patients receiving an Erythropoietin.
3 On-Dialysis Dependent Chronic Kidney Disease (NDD-CKD) patients receiving or not receiving an Erythropoietin.

DOSAGE AND ADMINSTRATION:

The dosage of Iron sucrose is expressed in terms of mg of elemental iron. Each ml contains 20mg of elemental iron.

Administration: Iron sucrose must only be administration intravenously either by slow injection or by infusion

Indications for iron sucrose complex

Hemodialysis Dependent Chronic Kidney Diseases Patients (HD-CKD):

The recommended dose of Iron sucrose is 100mg (5ml) administered one to three times per week; most patients will require a minimum cumulative dose of 100mg over 10 sequential dialysis sessions. Patients may continue to require therapy with Iron sucrose at the lowest dose necessary to maintain target levels of hemoglobin, hematocrit and laboratory parameters of iron storage within acceptable limits. Iron sucrose can be administered as slow intravenous injection or as an intravenous infusion.

Slow intravenous injection: Iron Sucrose may be administrated undiluted by slow intravenous injection into the dialysis line over 2 to 5 minutes.

Infusion:

Iron Sucrose my be administered by infusion (into the dialysis line for hemodialysis patients) as every 5ml iron sucrose diluted exclusively in a maximum of 100ml of 0.9% NaCL, immediately prior to infusion.

The solution must be infused at a rate of 100mg of iron over a period at least 15minutes.

Unused diluted solution must be discarded.

Non-Dialysis Dependent Chronic Kidney Disease Patients (NDD-CKD):

Iron Sucrose is administered as a total cumulative dose of 1,000mg over a 14days period as a 200mg slow IV injection undiluted over 2to5 minutes on 5different occasions within the 14 day period. There is limited experience with administration of an infusion of 500mg of iron Sucrose, diluted in a maximum o f250ml of 0.9%Nacl, over a period of 3.5-4 hours on day 1and day14.

Peritoneal Dialysis Dependent Chronic Kidney Disease Patients (PDD-CKD):

Iron sucrose in infused intravenously in three divided doses for a total doses of 1000mg during a 28-day period: two infusions of 300mg over 1.5hours 14days apart, followed by one 400mg infusion over 2.5hours 14days later.

NOTE: Do not mix ISC with other medications or add to parenteral

nutrition solutions for intravenous. Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration.

SIDE EFFECTS:
Side effects include major side effects like hypotension, chest pain, hypertension, hypovolemia, CHF.Minor side effects like cramps, musculoskeletal pain, diarrhea, nausea, vomiting, pain, elevated liver enzymes, skin irritation, pruritus, application site reaction, dizziness, dyspnea, pneumonia, cough headache, fever, asthenia, malaise.

DRUG INTERACTIONS:
Iron sucrose should not be administered concomitantly with oral iron preparation since the absorption of iron is reduced.

WARNINGS:
Hypersensitivity reactions have been reported with injectable iron products.

PRECAUTIONS:
General: Because body iron excretion is limited and excess tissue iron can be hazardous, caution should be exercised to withhold iron administration in the presence of evidence of tissue iron overload. Patients receiving iron sucrose require periodic monitoring of hematological parameters. Iron therapy should be withheld in patients with evidence of iron overload. Transferrin saturation values increase rapidly after IV administration of iron sucrose; thus serum iron values may be reliably obtained 48hours after IV dosing.

Hypersensitivity Reactions: Serious hypersensitivity reactions have been rarely reported in patients receiving iron sucrose.

Hypotension: Hypotension has been reported in chronic kidney disease patients receiving intravenous iron. Hypotension following administration of iron sucrose may be related to rate of administration and total dose administered. Caution should be taken to administer iron sucrose according to recommended guidelines.

Carcinogenesis, Mutagenesis, and impairment of Fertility: No long-term studies in animals have been performed to evaluate the carcinogenic potential of iron sucrose.

OVERDOSE:
Dosages of iron sucrose in excess of iron needs may lead to accumulation of iron in storage sites leading to hemosiderosis. Periodic monitoring of iron parameters such as serum ferritin and transferrin saturation may assist in recognizing iron accumulation. Iron sucrose should not be administered to patients with iron overload and should be discontinued when serum ferritin levels equal or exceed established guidelines. Particular caution should be exercised to avoid iron overload where anemia unresponsive to treatment has been incorrectly diagnosed as iron deficiency anemia.

Symptoms associated with overdosage of infusing iron sucrose too rapidly included hypotension, dyspnoea, headache, vomiting, nausea,, dizziness, joint aches, parenthesis, abdominal and muscle pain, edema, and cardiovascular collapse, Most symptoms have been successfully treated with IV fluids, hydrocortisone, and/ or antihistamines. Infusing the solution as recommended or at a slower rate may also alleviate symptoms.

CONTRAINDICATIONS:
The use of iron sucrose is contraindicated in patients with evidence of iron overload, in patients with known hypersensitivity to it or any of its inactive components, and in patients with anemia not caused by iron deficiency.

STORAGE: Store at controlled room temperature. Do not freeze.

PRESENTATION:
Iron sucrose_.1ml contains 20mg of elemental iron

PROFORMA

Name: O.P.NO/I.PNO.
Age: Literacy:
Address:
Socio economic status:
Obstetric formula:
Complaints: C/o weakness, lassitude, and easy fatigability
C/o palpitations, breathlessness on exertion.
C/o bleeding from any other site.
H/o passage of worms in stools.
Menstrual H/o:
Obstetric H/o:
Personal H/o: H/o APD.
Malabsorption syndrome.
Hypersensitivity to iron preparations.
DM, HTN, TB, bleeding gums and piles.
Family history: Thalassemia / sickle cells anaemia.
General examination: Height, Weight, Pallor, and Pedal edema
Tem:
PR:
BP:
CVS:
RS :
P/A:

Investigations:

Hb%	peripheral smear
PCV	stool for ova and cyst
Blood grouping and Rh typing	BT and CT

Study group	Hb		PCV	
	Recruitment	After treatment	Recruitment	After treatment
Oral iron group				
Intravenous iron Group				

Side effects to the drugs.

MATERIALS AND METHODS
The study was conducted over a period of 2 years from 2015 January to 2016 December in the antenatal clinic of Government General Hospital, ACSR Medical college Nellore .

This is a prospective comparative study involving two groups of patients. 100 women around 26 weeks of Gestational age were selected in each group. I choose mild to moderate anaemia in 2nd trimester since it may worsen severe anemia in 3rd trimester and its associated complications.

Inclusion criteria:
1. Women with mild to moderate anaemia i.e., Hemoglobin>7 gms.
2. Women from 24 weeks of gestation onwards.
3. Women with iron deficiency anaemia.

Exclusion Criteria:
1. Anaemia other than iron deficiency.
2. Women > 36 weeks
3. Women with severe anaemia Hb <7gms.
4. Anaemia due to renal diseases and inflammatory bowel diseases.

Group-A:- This group received intravenous iron sucrose. The total amount of iron to be given was calculated by formula, weight at first visit (Kgs) (11-Hb% X 2.4)+500mg and administered as an infusion of 200 mg in 100ml normal saline over ½ hr every alternate day as per company recommendations.

Group-B: - This group includes cases that were given 100 mg elemental iron orally for 100 days twice a day.

Data Collected:

1) Age
2) Literacy
3) Parity
4) Gestation at start of treatment
5) Hb g/dl and PCV% in the two groups before and after treatment
6) Side effects to the drugs.

Study protocol:

After selection, Women are randomly divided into two groups. All women with Hb <11gms are taken and deworming is done by albendazole. Iron deficiency anaemia is confirmed by peripheral smear. 242 antenatal women randomly allocated to receive either intravenous iron sucrose or oral ferrous sulphate. For intravenous group, the total amount of iron to be given was calculated by formula, weight at first visit (Kgs) (11-Hb% X 2.4+500mg) and administered as an infusion of 200 mg in 100ml normal saline every alternate day. The controls receive ferrous sulphate 333mg (100mg of elemental iron) two times a day for 100 days and thereafter all patients are monitored for clinical response and adverse effects.

A detailed history was taken from all the women and a complete physical examination and an obstetric examination were performed at the time of recruitment. Hemoglobin, PCV and peripheral smear were done at the time of recruitment.

Intravenous group received iron sucrose in divided doses as 200 mg in 100ml of normal saline on alternate days upto 2 weeks.

They also received 0.5mgfolic acid supplementation daily. Most of the patients were admitted in hospital to ensure compliance for a short time as they came from far off places and remaining treated on O.Pbasis who belonged to local. The 200 mg infusion was slowly started at the rate of 5 drops/for 10mts. If no reactions are observed, the rest of dose in run over 20 mts.

Oral group received 100mg of elemental iron twice a day for 100days therapeutic iron according to the ICMR recommendations. After one week I assessed the improvement in the form of reticulocyte count and sense of well being. I found satisfactory increase and continued the treatment. Among the 142 oral iron group patients 30 patients were non compliant and 12 patients discontinued the treatment due to severe gastritis.

The women in the oral iron group were given daily oral doses of 100mg elemental iron two times a day and 500µg folic acid. The women were asked to take 2 tablets per day i.e 100 mg of elemental iron starting from 24- 26weeks of gestational age for 100 days. They were asked to come every two weeks and had to bring back empty packs and were also asked about the intake of their tablets and the color of their stools to ensure that they had consumed the tablets. Hb g/dl and PCV% are calculated every2weeks. I have taken Hb gm/dL and PCV % after 100days since ICMR recommended 100mg of elemental iron twice a day for 100days for correction of anemia.

COMPARISION OF RESULTS IN BOTH GROUPS

TABLE-1

Characteristics	Group-A	Group-B
Age (years)	22.4	21.8
Literacy		
<10th Grade	78	80
>10th Grade	22	20
Parity		
1	40	40
≥2	60	60
Gestation at start of Rx(wk)	25.4	25.2

There were no statistically significant differences between two groups.

TABLE-2 Distribution of Hb% in the two groups before and after treatment

Hb(g/dl)	Group-A		Group-B	
	Before Rx	After Rx	Before Rx	After Rx
7-7.9	49	-	22	-
8-8.9	37	-	53	8
9-99	12	3	23	49
10-10.9	2	56	2	43
11-11.9	-	41	-	-

There was significant difference between 2 groups in the no. of women with Hb concentration>11g/dl after treatment.

Women with Hb concentration > 11g/dl at recruitment were excluded.

TABLE-3 Mean values before treatment and after treatment in two groups.

Variable	Group-A			Group-B
	Before Rx	After Rx	Before Rx	After Rx
Hb g/dl(Mean)	8.26	10.84	8.39	9.76
PCV%(Mean)	23.50	31.96	24.9	28.1

There was no significant difference in Hb&PCV between 2 groups at the time of recruitment (P>0.05).

There was significant rise in Hb&PCV after treatment in Group-A (P<0.001) in two weeks calculated by paired t test.

Hb and PCV in the ISC and control group after treatment

Variable	ISC Group	Oral Group	'P' value 't' test
Hb g/dL(Mean)	10.8	9.76	<0.001
PCV (Mean)	31.9	28.1	<0.001

p value <0.001highly significant.

The mean Hb PCV in Group-A, significantly higher in Group-A, compared to Group-B, after treatment calculated by't' test.

TABLE-4 No. Of women in two groups who experienced side effects from medication

Side effects	Group-A	Group-B
Dyspepsia	-	10%
Constipation	-	8%
Diarrhoea	-	4%
Vomiting	-	12%
Rash itching	-	-
Fever with chills	3%	-
Hypotension	1%	-
Rash with Itching	1%	-
Arthralgia	1%	-
Headache	-	-

There were no major side effects noted in 2 groups.
Fever with chills observed in group A could be because of normal saline.

DISCUSSION

Our study clearly illustrates that intravenous iron sucrose complex is safe, convenient and effective in pregnant women with iron deficiency anaemia as compared with ferrous sulphate. It has been recognized for decades that oral iron is not adequate for pregnant women with iron deficiency anaemia, mainly because of augmented demand for iron to meet the demands of pregnancy (500-1000 mg), in the form of maternal red cell mass expansion (400-600mg), placenta (250mg), umbilical cord (50mg), fetus (200mg) and the expected blood loss at delivery (200-500mg).

Therefore a pregnant woman without anemia may require at least 1000mg of elemental iron to be delivered while an anemic one may need more than 2600 mg. This requirement cannot be met by oral route because of limited absorption, bioavailability and compliance. In addition, oral iron therapies are further complicated by the adverse effects of pregnancy on the gastro intestinal tract.

Intramuscular iron therapies need to be discouraged because of its adverse effects which include pain, irregular, absorption, staining and malignancies.25,26,27 There are several intravenous iron preparations beside iron sucrose complex such as iron dextrin which has been extensively used over last 30 years. Upto 30% of patients suffer from adverse effects which include arthritis, fever, urticaria and anaphylaxis.25-31 .It is contraindicated in rheumatoid arthritis because of its association with arthritis flare up.

On the other hand, Iron Sucrose Complex (ISC) seems to be safe with fewer and milder side effects even in patients with rheumatoid arthritis.32-35 Anaphylaxis is very rare because of its small molecular weight.

Although ISC therapy may appear invasive, expensive it is highly and rapidly effective without major side effects.

1.Comparison of different studies depending on mean age of recruitment group (yrs)

Name of the study	Name of the study			
	Bay moeu	Al momen	Alra Ragip	Present study
1)ISC Group	25	28.4	24.9	22.4
2) Oral Group	26	27.6	26.5	21.8

2.Comparison of different studies depending on mean gestational age at recruitment(weeks)

Name of the study	Name of the study			
	Bay moeu	Al momen	Alra Ragip	Present study
1)ISC Group	25	21.7	29.7	25.4
2) Oral Group	26	21.9	28.9	25.2

The mean gestational age at recruitment is almost similar in all studies. In Alra Ragip, study gestational age at recruitment is little higher.

3. Comparison of different studies regarding before treatment and after treatment Hb levels gm/dL.

Name of the study (Target Hb in g/dL)	Calculation of dosage of iron	Intravenous Iron		Oral Iron	
		Before	After	Before	After
Almomen etal (13g/dL)	IV-Hb deficit(g/l)×body wt×0.3 followed by 10mg/kg Oral-60mg thrice a day for 100 days	7.58±0.9	12.8±0.6	7.6 ±7.8	11.4 ±1.2g/dl
Baymoeu etal (12g/dL)	IV-wt before pregnancy kg x [12-Hb(g/dl)] x 2.4 +500 Oral-240 mg of Ferrous sulphate perday for 4wks on day 30 results	9.6 ±0.79	11.1± 1.3g/dl	9.7± 0.5	11± 1.2g/dl
Ragip Alra et al(11g/dL)	IV –weight beforpregnancy (kg)x(11-g/dL-actual hemoglobin g/dL) x 2.4 + 500mg Oral-300mg of elemental iron per day After 2 weeks results were	9.8±0.6	10.4± 0.6	9.9±0.5	10.1±0.5
Present study(11g/dL)	IV-wt at first visit kg[(11-Hb) g/dl] x 2.4 + 500 Oral- 100mg of elemental iron BD 100 Days	8.02 ±0.77	10.8± 0.51	8.3± 0.66	9.7± 0.63

From above table iron sucrose preparation is proved to be very efficient in correcting anemia in early gestation, whatever may be the pretreatment hemoglobin. 97% of the people in the present study were having Hb value of >10g/dL by the time they were in 3rd trimester.

The authors differed in the dosage calculation and target Hb. The study carried out by Ragip alra followed the protocol of dosage of calculation and nearly achieved target Hb after two weeks of treatment and his study correlates well with the present study.

4. Comparison of different studies with regard to time interval (weeks)

Name of the study	Name of the study			
	Bay moeu	Al momen	Alra Ragip	Present study
1)ISC Group	4weeks	6.9weeks	2weeks	2weeks
2) Oral Group	4weeks	14.9weeks	2weeks	14.3weeks

The author al momen used a formula and target Hb was 13g/dL and this was achieved 6.9weeks time in ISA group and in my study target Hb was 11gm/dL this was almost achieved in two weeks.

5. Comparision of different studies with regard to side effects

Group	Side effects	Name of the study			
		Bay moue	Al momen	Ragip alra	Present study
1.ISC Group	a)Unpleasant taste	+ (4.16%)			
	b)Tightness of chest		+(1.9%)		
	c)Fever				+(3%)
	d)Hypotension				+(1%)
	e)Rash with itching				+(1%)
	f)Arthralgia			+(2.7%)	+(1%)
2.Oral Group	Gastro intestinal side effects	+ (4.34%)	+(30%)	+(31.1%)	+(34%)

From the above table, it is evident that ISC group is superior to oral iron group as side effects were observed in almost 30% of oral group where as ISC group an average of 5% of people had negligible side effects. Hence ISC group is superior to oral iron in correction of anemia.

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