

Comparison of Efficacy of Ferrous Sulfate and Carbonyl Iron on the Blood Film of Iron Deficiency Anemia in Pregnant Women

Ahmed TN¹, Shahriar I², Iqbal JU³, Rowshan MM⁴, Nahar S⁵, Akhter S⁶

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Iron deficiency anemia, haemoglobin, carbonyl iron, ferrous sulfate.

Abstract

Background: Iron deficiency anemia is the most common and important public health problem all over the world in the risk group of antenatal women. Research is going on to improve the iron status of the pregnant women with different forms of iron available. In this regard Carbonyl Iron is showing promising result in improving the red cell mass with better compliance.

Objective: The purpose of present study was to compare the efficacy of Ferrous Sulfate and Carbonyl Iron in the blood film of iron deficiency anemia in pregnant women.

Methodology: An observational prospective study in obstetric and gynae out – patient department of Sir Salimullah Medical College and Mitford Hospital. Women between 16 – 28 weeks of pregnancy with haemoglobin level 7 – 10 gm/dl and with microcytic hypochromic blood film were included in this study. Pregnant women in 1st and 3rd trimester of pregnancy were excluded from the study. Among the study population one group was given tablet Ferrous Sulfate and another group was given capsule Carbonyl Iron.

Results: At the end of study (after 12 weeks) MCV, MCH, MCHC level were more increased in case of Carbonyl Iron group than Ferrous Sulfate group which is statistically significant.

Conclusion: Carbonyl Iron is more effective than Ferrous Sulfate in the treatment of iron deficiency anemia in pregnancy.

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Introduction

As per World Health Organization (WHO), anemia in pregnancy is defined as haemoglobin concentration less than 11 g/dl. It is responsible directly or indirectly for 40 – 60% of maternal deaths from cardiac failure, hemorrhage,

infection and pre-eclampsia. It also increases perinatal mortality and morbidity rates consequent of preterm deliveries, intra-uterine growth restriction, low iron stores iron deficiency anemia, cognitive and affective dysfunction in infant (Singhal et al. 2015).

1. Dr. Taslima Nasreen Ahmed, Assistant Professor, Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.
2. Professor Dr. Iram Shahriar, Professor (Retd.), Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.
3. Professor Dr. Jalal Uddin Iqbal, Professor & Head, Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.
4. Dr. Mahfuza Mazeda Rowshan, Associate Professor, Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.
5. Dr. Sharmin Nahar, Lecturer, Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.
6. Dr. Shakila Akhter, Assistant Professor, Department of Pharmacology, National Institute of Cardio Vascular Disease (NICVD)

Correspondence to: Dr. Taslima Nasreen Ahmed, Assistant Professor, Department of Pharmacology and Therapeutics, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh. Mobile: 01711229204, Email: shormee01@gmail.com

Incidence of iron deficiency anemia (IDA) is being particularly high in many underdeveloped tropical countries where it remains a major contributing factor to maternal morbidity and mortality and also high perinatal mortality. Iron deficiency is the commonest cause of anemia in pregnant women (Pyarelal 2015).

A recent estimate based on World Health Organization (WHO) criteria indicated that around 600 – 700 million people worldwide have marked Iron deficiency anemia (IDA) and the bulk of these people live in developing countries like Bangladesh. In developed countries, prevalence of Iron deficiency anemia is much lower and usually varies between and 2% to 8%. In developing countries upto 20% to 40% of infants and pregnant women may be affected. It results from an inadequate dietary intake of iron, inadequate iron absorption or blood loss (Chaudhury et al. 2012). The requirement of iron increase

during pregnancy, especially in the third trimester. A pregnant woman needs six times more iron than a nonpregnant woman. Increased iron requirements to supply the expanding blood volume of the mother and the rapidly growing fetus and placenta can cause Iron Deficiency Anemia (Pyarelal 2015).

Maternal Iron Deficiency Anemia early in pregnancy can result in low birth weight subsequent to preterm delivery as well as association exists between maternal anemia and lower infant apgar score. Therefore, iron supplementation is mandatory to improve or maintain the iron status of the mother during pregnancy. (Pyarelal 2015).

The increased need of iron during pregnancy makes the iron supplementation mandatory. All most all cases of iron deficiency anemia respond readily to treatment with iron supplementation. The most common iron salt used for oral administration is Ferrous Sulfate. But it is known to produce gastrointestinal side effects like nausea, constipation, black stool, metallic taste, vomiting, diarrhea and abdominal pain etc.

Among the possible alternatives to control iron deficiency Carbonyl Iron is now being prescribed for the patients with iron deficiency anemia Carbonyl iron is highly purified small metallic iron particle. It describes the process of manufacture of the iron particles, not their composition. Heating gaseous iron pentacarbonyl $[\text{Fe}(\text{CO})_5]$, deposits metallic iron as submicroscopic crystals that forms spheres of less than 5μ in diameter. Solubilization of Carbonyl

Iron particles acidity of stomach is a pre requisite for absorption of Carbonyl Iron supplement. The slow rate of solubilization leads to more prolonged absorption for low toxicity.

A mild deficiency should not affect baby while pregnancy. But if mild iron deficiency anemia goes untreated and becomes more severe during pregnancy is linked to an increased risk of a baby being born with a low birth weight. Having severe iron deficiency anemia may even increase the risk of still birth and newborn death. It is responsible directly or indirectly for 40% - 60% of maternal deaths from cardiac failure, hemorrhage, infection and preeclampsia (Singhal et al. 2015).

The present study is performed to find out the efficacy of Ferrous Sulfate and Carbonyl Iron, in the blood film of iron deficiency anemia in pregnant women.

Methodology

Study Design and Place: This observational prospective study was conducted in the department of pharmacology and therapeutics in Sir Salimullah Medical College, Dhaka with the study period from July 2016 – June 2017.

Study Population: All pregnant women with Iron deficiency anemia attending the obstetric and gynae outpatient department of Sir Salimullah Medical College and Mitford Hospital those were prescribed Ferrous Sulfate and Carbonyl Iron were included in the study population. They were selected on the basis of inclusion and exclusion criteria. Women between 16 – 28 weeks of pregnancy with haemoglobin level of 7 – 10 gm/dl and with microcytic hypochromic blood film were included in the study while pregnant women in 1st and 3rd trimesters of pregnancy were excluded from the study.

Study Procedure: An observational prospective study was conducted in a tertiary care hospital in Bangladesh. New patient according to the selection criteria attending the outpatient department of obstetrics and gynae in Sir Salimullah Medical College and Mitford Hospital during the study period were considered for analysis. After proper counseling, the aim, objectives, risk and the procedure of the study were explained in details to the subjects. Only positive respondent was recruited as study subjects and were allowed to withdraw themselves from the study even after participation. Informed consent was obtained from all participants. The study subjects were divided in two groups, Group A taking tablet Ferrous Sulfate (150 mg twice or thrice daily) and Group B taking capsule Carbonyl Iron (50 mg twice or thrice daily). MCV, MCH, MCHC were observed on the day of enrollment and at 12th week. Tablet Ferrous Sulfate was given three times daily for the patient whose haemoglobin level was between 7.0 to 8.0 gm/dl and two times daily for the patient whose haemoglobin level was between 8.1 – 10 g/dl. Capsule Carbonyl Iron was given three times daily for the patient whose haemoglobin level was between 7.0 – 8.0 gm/dl and two times daily for the patient whose haemoglobin level was between 8.1 – 10 gm/dl.

Statistical Analysis: All the findings were recorded, compiled, tabulated and analyzed. The data was expressed as mean \pm SD for windows version 21. Unpaired 't' tests, paired 't' tests,

Chi-Square tests were done as the test of significance and p value <0.05 was significantly considered as significant. Statistical analysis was done by using Statistical Package of Social Service (SPSS). The summarized data were presented in the form of tables.

Results:

The research work was conducted in the Department of Pharmacology and Therapeutics, Sir Salimullah Medical College using a prospective observational study design.

A total of 160 study subjects were enrolled from Sir Salimullah Medical College and Mitford Hospital and followed up at 12th week of therapy. Group A comprised of 80 patients who received Ferrous Sulfate and Group B comprised of 80 patients who received Carbonyl Iron. MCV, MCH and MCHC level were calculate before therapy and after the completion of 12th weeks therapy. At the end of the study, after 12th week the MCV value with Carbonyl Iron was 72.28 ± 2.28 while the MCV value with Ferrous Sulfate was 71.06 ± 2.62 , the MCH value with Carbonyl Iron group was 25.13 ± 2.68 and MCH value with Ferrous Sulfate group was 23.69 ± 2.84 , MCHC value with Carbonyl Iron group was 30.89 ± 2.86 while the MCHC value with Ferrous Sulfate group was 29.36 ± 3.38 .

Table-I

MCV, MCH and MCHC level of the study subjects at baseline and after treatment at different follow ups in both groups (n = 160)

	Group		p-value
	Day 0 [Mean \pm SD]	Week 12 [Mean \pm SD]	
MCV			
FS	69.66 \pm 2.77	71.06 \pm 2.62	0.001**
CI	69.41 \pm 2.92	72.28 \pm 2.28	<0.001***
MCH			
FS	22.63 \pm 2.87	23.69 \pm 2.84	0.001**
CI	22.06 \pm 2.88	25.13 \pm 2.68	<0.001***
MCHC			
FS	27.91 \pm 3.74	29.36 \pm 3.38	0.001**
CI	27.44 \pm 3.60	30.89 \pm 2.86	<0.001***

Paired t test was done to measure the level of significance. P value < 0.05 was accepted as level of significance.

ns = non-significant; */**/** = significant

* 0.049 – 0.010

** 0.009 – 0.001

*** < 0.001

Table I showed that at the end of the study (after 12 weeks) MCV, MCH, MCHC level were more significantly increased in case of Carbonyl Iron group than Ferrous Sulfate Group.

Discussion

As we know iron deficiency anemia is very common worldwide. A recent estimate based on WHO criteria indicated that around 600 – 700 million people world wide

have marked Iron deficiency anemia (IDA) and the bulk of these people live in developing countries like Bangladesh. Pregnancy with anemia has a significant impact on the health of fetus as well as that of the mother. The treatment of Iron deficiency anemia (IDA) is given to replenish Hb and restore iron stores by supplying sufficient iron.

Routine iron supplementation with iron salts shows low efficacy for the control of Iron deficiency anemia (IDA) due to poor compliance with the treatment, because of its disagreeable flavor and adverse effects. Among the possible alternatives to control iron deficiency Carbonyl iron is formulated in such a way that it has remarkably low toxicity when compared with ionized form of iron such as Ferrous Sulfate.

The present study compared the therapeutic efficacy and tolerability of Ferrous Sulfate and Carbonyl iron. 160 patients were enrolled for the study and followed up at 2nd, 4th, 8th, and 12th week of therapy. Group-A comprised of 80 patients, who received Ferrous Sulfate and Group B comprised of 80 patients, who received Carbonyl iron.

MCV, MCH, MCHC were observed on the day of enrollment and after 12th weeks of therapy. At the end of the study MCV, MCH, MCHC level were more significantly increased in case of Carbonyl Iron group than Ferrous Sulfate group. Similar result was reported by Gordeuk VR et al.

Conclusion

The study shows that individual efficacy of both compounds was good and they were effective in the treatment of iron deficiency anemia in pregnancy. Efficacy of Carbonyl Iron was higher than Ferrous Sulfate. The result of the present study suggest that Carbonyl Iron can be considered as a useful alternative formulation for the treatment of iron deficiency anemia in patients due to its better efficacy.

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