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INTRAVENOUS IRON SUCROSE IN ANTIOXIDANT STATUS AND OXIDATIVE STRESS IN ANEMIC PREGNANT FEMALES

Dr. Mudiliar Vidyarani S,[1] Dr. V. Lakshmi Narasimha Sai Kiran,[2] Dr. Anis Siddiqui[3*]

[1]Associate professor, Department of Pharmacology, Maheshwara Medical College, Hyderabad, Telangana

[2]Assistant professor, Department of Pharmacology, Kamineni Institute of Medical sciences, Narketpally, Telangana

[3*]Assistant professor, Department of General Medicine, Raipur institute of medical sciences RIMS, Raipur Chhattisgarh

Corresponding address

Email id: dranis4444@gmail.com

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ABSTRACT

Background: The most prevalent nutritional deficiency among pregnant Indian women is iron deficiency anemia (IDA), which can be treated orally or intravenously. Because free iron is known to produce the free radicals that contribute to oxidative stress, intravenous iron supplementation may increase the chance of free iron entering the bloodstream.

Aim: The purpose of this study was to investigate the effects of intravenous iron sucrose on oxidative stress and antioxidant state in pregnant women with iron deficient anemia.

Methods: Forty pregnant women with a confirmed diagnosis of moderate iron deficiency anemia with hemoglobin levels between 7 and 9.9 g/dl were evaluated in this study. Intravenous blood samples were taken from each female both before and after intravenous iron sucrose treatment in order to measure antioxidants such as reduced glutathione. superoxide dismutase and catalase, and lipid peroxidation markers as malondialdehyde. The results were developed through statistical analysis of the collected data.

Results: Following intravenous iron sucrose therapy, the levels of malondialdehyde significantly increased, according to the current study's findings. The study's findings also revealed that following the treatment of iron deficiency anemia in the participants, there were no appreciable changes in the levels of reduced glutathione or the activities of superoxide dismutase and catalase.

Conclusions: Based on an increase in lipid peroxidation in pregnant females with iron deficiency anemia, the current study shows that intravenous iron sucrose infusion is linked to oxidative stress. Antioxidant therapy might therefore be taken into consideration during iron treatment.

Keywords: anemia, antioxidants, intravenous iron sucrose, oxidative stress, pregnant females

INTRODUCTION

Iron deficiency anemia, or IDA, is one of the most prevalent nutritional deficits among pregnant women worldwide, with a high prevalence in underdeveloped countries like India. According to the WHO, the prevalence of iron deficiency anemia is approximately 38% worldwide, with pregnant Indian women having an 84% prevalence. In South Asian regions, anemia accounts for about half of maternal deaths worldwide, with India accounting for nearly 80% of these deaths.[1]

Low bioavailability and inadequate iron intake are the primary causes of iron insufficiency in pregnant women.1 Hemoglobin values of 10-10.9 g%, 7-9.9 g%, and 4-6.9 g%, respectively, are used to classify iron deficiency anemia as mild, moderate, or severe. Oral iron therapy is the primary line of treatment for mild IDA during pregnancy. However, the course of treatment is lengthier and is linked to a number of compliance problems in females with moderate and severe iron deficiency anemia. Parenteral iron therapy is a preferable treatment option for patients with mild anemia.[2]

Iron citrate, iron sorbitol, and iron dextran are among the commercial parenteral iron formulations that can be administered intramuscularly or intravenously. Among these, sucrose has been shown to be both effective and safe for usage in expectant mothers. Since total iron stores may be administered in a short amount of time, intravenous iron-sucrose appears to be the preferred treatment with no significant adverse effects. It is recommended for the quick correction of anemia in pregnant women and the restoration of the mother's iron stores. Therefore, intravenous iron sucrose transfusion is a successful treatment method for expectant mothers with severe anemia in late pregnancy and in subjects that are non-compliant with oral therapy.[3]

Iron overload and iron shortage both have the potential to cause cellular harm by producing free radicals. To prevent free iron from being available for catalyzing the production of free radicals and OH ions, transferrin and the iron-transporting protein are typically maintained at approximately 30% of iron saturation. It has been observed that the presence of non-transferrin-bound, perhaps redox-active iron is linked to a high transferrin saturation percentage. Hemodialysis patients receiving intravenous iron sucrose treatment have higher amounts of powerful pro-oxidants and redox-active iron. Although intravenous iron is effective in treating pregnancy anemia, it is unclear how it affects pregnant women's oxidative stress levels.[4]

Therefore, the goal of the current study was to investigate the effects of intravenous iron sucrose on oxidative stress and antioxidant state in pregnant women with iron deficiency anemia.

MATERIALS AND METHODS

The goal of the current prospective clinical investigation was to investigate the effects of intravenous iron sucrose on oxidative stress and antioxidant state in pregnant women with iron deficient anemia. The Institute's Department of Medicine provided the study participants. Prior to their involvement in the study, all participants provided written and verbal informed consent.

Forty pregnant women who were willing to participate in the trial and had verified diagnoses of moderate anemia with hemoglobin levels between 7 and 9.9 g/dl were included.

Participants with anemia from causes other than iron deficiency anemia, inflammation, asthma, allergies, peptic ulcers, liver and kidney illnesses, heart conditions, and gestational diabetes mellitus were excluded from the study for the iron sucrose dosage. After computation, it was rounded to the closest multiple of 100 mg. 0.24 + 500 mg × total dosage weight in kg × (target Hb in g/L–Actual Hb in g/L). Over the course of 20 to 30 minutes, 200 mg of iron sucrose were given in 100 milliliters of 0.9% intravenous sodium citrate. A maximum of 600 mg of the total dose per week was administered on alternate days. Oral iron supplementation was not included. After the 2016 trial, the goal hemoglobin level was 120 g/L.[5]

Before and after intravenous iron sucrose administration, two milliliters of intravenous blood were drawn under stringent aseptic and sterile conditions in a test tube containing EDTA as an anticoagulant. Biochemical examination was carried out on the blood that was taken. An ERBA H 360 cell count analyzer was used to determine the hemoglobin content. Malondialdehyde, superoxide dismutase, catalase, and reduced glutathione were among the other characteristics that were evaluated using conventional methods. SPSS software was used to statistically analyze the collected data in order to evaluate descriptive measures, student's t-paired test, and chi-square test. The mean, standard deviation, frequency, and percentages were used to express the results. A p-value of less than 0.05 was deemed statistically significant.

RESULTS

The goal of the current prospective clinical investigation was to examine the effects of intravenous iron sucrose on oxidative stress and antioxidant status in pregnant women with iron deficient anemia. Forty pregnant women with a confirmed diagnosis of moderate iron deficiency anemia and hemoglobin levels between 7 and 9.9 g/dl were evaluated in this study. Intravenous blood samples were taken from each female both before and after intravenous iron sucrose therapy in order to measure lipid peroxidation markers such malondialdehyde and antioxidants like reduced glutathione, superoxide dismutase, and catalase. According to baseline demographic data, the mean age of the 40 pregnant females with mild anemia evaluated in this study was 26.2±4.1 years. The study participants' mean gestational age was 28.3±4.3 weeks. The mean hemoglobin level in study subjects was 9.2±0.7 g/dl (Table 1).

The study results showed that for Malondialdehyde was 8.84±1.87 nmol/ml in study individuals before to treatment, which substantially rose to 10.47±3.22 moles/ml with $p<0.05$ when antioxidant status and oxidative stress were compared. Superoxide dismutase (SOD) increased from 9487±1022 to 9179±995 before and after therapy (Table 2).

Catalase was found to be 15.01±4.62 U/ml in study individuals prior to therapy and increased to 15.56±4.98 U/ml following treatment, according to other antioxidant status and oxidative stress data. With a $p>0.05$, this rise was not statistically significant. Glutathione, which was 1.47±0.35 mg/g Hb prior to therapy and dropped to 1.42±0.34 mg/g Hb following treatment, showed similar outcomes. Nevertheless, with $p>0.05$, this decline was not statistically significant (Table 2).

DISCUSSION

Forty pregnant women with a confirmed diagnosis of moderate iron deficiency anemia and hemoglobin levels between 7 and 9.9 g/dl were evaluated in this study. Intravenous blood samples were taken from each female both before and after intravenous iron sucrose therapy in order to measure lipid peroxidation markers such malondialdehyde and antioxidants like reduced glutathione, superoxide dismutase, and catalase. The current study's design was consistent with studies by Maruyama Y et al. (2007) and Schümann K, Ettle T et al. (2007) that evaluated subjects with similar demographics and study designs in pregnant women with iron deficiency anemia treated with iron sucrose.

The mean age of the 40 pregnant females with mild anemia evaluated in this study was 26.2±4.1 years, according to baseline demographic data. The study participants' mean gestational age was 28.3±4.3 weeks. The study participants' mean hemoglobin level was 9.2±0.7 g/dl. These demographics were similar to those of the research conducted by Lachili B et al. (2001) and Eiselt J et al. (2006), in which the authors evaluated participants with anemia and demographic information equivalent to that of the subjects evaluated in this investigation.

Malondialdehyde (MDA) was 8.84±1.87 nmol/ml in study participants prior to treatment, which substantially increased to 10.47±3.22 moles/ml with $p<0.05$ when antioxidant status and oxidative stress were compared between study subjects before and after treatment.

Based on baseline demographic data, the mean age of 40 pregnant females with mild anemia assessed in this study was 26.2±4.1 years. The average gestational age of research participants was 28.3±4.3 weeks. The mean hemoglobin level of research participants was 9.2±0.7 g/dl. These demographics were comparable to those found in studies by Lachili B et al. (2001) and Eiselt J et al. (2006), where the authors assessed individuals with anemia and similar demographic data to those examined in this study.

Prior to treatment, study participants' levels of malondialdehyde (MDA) were 8.84±1.87 nmol/ml. This significantly rose to 10.47±3.22 moles/ml with $p<0.05$ when antioxidant status and oxidative stress were compared between study subjects before and after therapy.

However, with $p>0.05$, this decline was not statistically significant. These results were consistent with the antioxidant state and oxidative stress reported by the authors of Roob JM et al. (2000) and Toxqui L et al. (2010).

CONCLUSIONS

The current study concludes, taking into account its limitations, that intravenous iron sucrose infusion is linked to oxidative stress, as seen by an increase in lipid peroxidation in pregnant women with iron deficiency anemia. Antioxidant therapy might therefore be taken into consideration during iron treatment. To draw a firm conclusion, more longitudinal research with a larger sample size, a longer follow-up period, and a control group will be required in the future.

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S. No	Characteristics	Mean
1.	**Mean age (years)**	26.2±4.1
2.	**Gestational age (weeks)**	28.3±4.3
3.	**Hemoglobin (g/dl)**	9.2±0.7

Table 1: Demographic data of the study subjects at baseline

S. No	Parameters	Before treatment	After treatment
1.	**MDA (nmoles/ml)**	8.84±1.87	10.47±3.22
2.	**SOD (U/ml)**	9487±1022	9179±995
3.	**Catalase (U/ml)**	15.01±4.62	15.56±4.98
4.	**Glutathione (mg/g Hb)**	1.47±0.35	1.42±0.34

Table 2: Comparison of antioxidant status and oxidative stress in study subjects before and after the treatment