Comparative Study of Total Dose Infusion of Iron and Intramuscular Iron Administration in Treatment of Iron Deficiency Anemia During Pregnancy

Thesis

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By:

Samira Ali Mufetah

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Resident of Obstetric and Gynecology
In Ibnsina Hospital- Sirt - Libya

Supervised by

Dr. Hazem Fadel El Shahawy

Professor of Obstetric and Gynecology
Faculty of Medicine - Ain Shams University

Dr. Nashwa El Said Hassan

Lecturer in Obstetric and Gynecology
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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بسم الله الرحمن الرحيم
قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ
أَنتَ الْعَلِيمُ الْحَكِيمُ
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Samira Ali Mufetah

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List of Abbreviations

ACE	:	Angiotensin converting enzyme
AIP	:	Anaemia in pregnancy
AT	:	Antithrombin
CBC	:	Complete blood count
EPCR	:	Endothelial protein C receptor
HIV	:	Human immunodeficiency virus
HLA	:	Human lymphocyte antigens
IDA	:	Iron deficiency anemia
MCV	:	Mean corpuscular volume
PPI	:	Proton Pump Inhibitors
RDW	:	Red cell distribution width
RES	:	Reticulo-endothelial system
SF	:	Serum ferritin
sTfR	:	Serum transferrin-receptors
TIBC	:	Total iron-binding capacity
TM	:	Thrombomodulin
t-PA	:	Tissue plasminogen activator
TSAT	:	Transferrin saturation
WHO	:	World Health Organization

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Introduction

Anemia is the reduction in the normal number of red blood cells and quantity of hemoglobin in the blood. Anemia in pregnancy is defined by the world health organization as a hemoglobin value below 11g/dL **(WHO, 1992)**.

Iron deficiency anemia being the most common cause of anemia in pregnancy world wide **(Williams et al., 1992).**

During pregnancy there is an increase in both red cell mass and plasma volume to accommodate the needs of the growing uterus and fetus. The plasma volume increase more than the red cell mass leading to a fall in the concentration of hemoglobin in the blood despite the increase in the total number of red cells. This drop in hemoglobin concentration decrease the blood viscosity and it is thought this enhances the placental perfusion providing a better maternal fetal gas and nutrient exchange **(Mani, 1995)**.

Anemia has been associated with general weakness, tiredness and dizziness but the level of hemoglobin associated with these symptoms in pregnancy is un known. Its suggested that the iron stores of the woman's body become reduced during pregnancy (as a result of the increased red cell mass and the demands of fetus exceeding iron intake **(Steer, 1995)**.

Knowledge of different hemoglobin cut off levels during pregnancy to differentiate between hydraemia and anemia is important in the first diagnosis. According to the center of disease control data from 1989, lower hemoglobin cut off is 11.0g/dL in the first and last trimester and 10.5g/dL

in the second trimester. Therefore any level below 10.5g/dL should be regarded as anemia and consequently checked **(CDC, 1989)**.

Anemia during pregnancy is a well known and considerable risk factor for both mother and fetus. Fetal consequences are an increased risk of growth retardation, prematurity, intrauterine death, amnion rupture and infection. Maternal consequences of anemia are also well known and include cardiovascular symptoms, reduced physical and mental performance, reduced immune function tiredness, reduced peripheral blood reserves and finally increase risk for blood transfusion in the postpartum period **(Breymman, 2002)**.

In addition to clinical assessment, laboratory parameters are of major importance for differential diagnosis of anaemia, more than 100 years ago first tests including blood smear, red cell indices and serum iron have been introduced. Later bone marrow stain and most important serum ferritin test have been introduced, ferritin being the actual gold standard for iron status testing. During pregnancy, ferritin shows also week correlations to other iron parameters and the severity of anaemia, there fore additional tests are helpful **(Broek, et al., 2000)**.

The increased iron requirement in pregnancy and the pureiperium carry with it an increased susceptibility to iron deficiency and iron deficiency anemia and preoperative blood transfusion **(Breymann, 2002)**.

Iron replacement can be given by mouth, intramuscular and intravenous administration. It is also possible to give iron

by giving a blood transfusion and recombinant erythropoietin conjunction with iron is a further possibility **(Mahomed, 2000)**.

Oral iron intake is the treatment of choice, and almost all women can be treated effectively with oral preparations. However, parentral administration of iron is necessary under certain circumstances and may be suitable under following situations: inability to tolerate the effect of orally administered iron, inflammatory bowel disease, peptic ulcer, non compliance with oral regiments **(Singh et al., 1998).**

Parentral administration of iron provides quick and certain correction of the total iron deficit because it not only corrects the anemia but also builds up iron stores. Parentral administration of iron can be achieved by either an intramuscular or an intravenous route. Intravenous administered iron can cause anaphylactic shock and all safe guards, such as hospital admission with resuscitation equipment available by the bed side **(Singh, et al., 1998).**

Intramuscular administration of iron is usually achieved by repeated injections of small doses of iron **(Sood et al. 1979)**.

Intramuscular administration can be cause discomfort and pain at the injection site and associated with other local complications such as staining of skin, bleeding, formation of sterile abscesses, tissue necrosis or atrophy and sarcoma formation **(Benito et al., 1988)**.

Aim of Work

To determine the efficacy of total dose infusion of iron dextran in comparison to intramuscular administration in treatment of iron deficiency anemia during pregnancy.

Hematological Changes with Pregnancy

The major hemodynamic changes induced by pregnancy include an incease in cardiac output, sodium and water retention leading to blood volume expansion, and reduction in systemic vascular resistance and systemic blood pressure. These changes begin early in pregnancy **(Chapman et al., 1998)**.

Blood Volume:

The maternal blood volume increases markedly during pregnancy. In studies of normal women, the blood volumes at or very near term are averaged about 40 to 45 percent above their non pregnant levels**.** The degree of expansion varies considerably. In some women only a modest increase occurs, whereas in others the blood volume nearly doubles. A fetus is not essential for the development of hypervolemia during pregnancy, as increases in blood volume have been demonstrated in some women with hydatidiform mole **(Whittaker et al., 1996).** Pregnancy-induced hypervolemia has several important functions to meet the demands of the enlarged uterus with its greatly hypertrophied vascular system,to protect the mother and in turn the fetus against the deleterious effects of impaired venous return in the supine and

erect positions and to safeguard the mother against the adverse effects of blood loss associated with parturition **(Cunningham et al., 2004).**

Maternal blood volume begins to increase during the first trimester. In fact, by 12 menstrual weeks, the plasma volume expands by approximately 15% as compared with that of prepregnancy. It expands most rapidly during the second trimester, and then rises at a much slower rate during the third trimester to plateau during the last several weeks of pregnancy **(Bernstein et al., 2001).** Blood volume expansion results from an increase in both plasma and erythrocytes. Although more plasma than erythrocytes is usually added to the maternal circulation, the increase in the volume of erythrocytes is considerable, averaging about 450 mL. Moderate erythroid hyperplasia is present in the bone marrow, and the reticulocyte count is elevated slightly during normal pregnancy. This change is almost certainly related to the increase in maternal plasma erythropoietin levels, which peak early during the third trimester and correspond to maximal erythrocyte production **(Clapp et al., 2003).**

Red blood cells mass:

The circulating red cell mass increases by 20-30% during pregnancy, with rises in both cell number and size. It

rises more in women with multiple pregnancies, and substantially more with iron supplementation (29% compared with 17%). In a normal pregnancy the serum iron concentration falls, the absorption of iron from the gut rises and iron-binding capacity rises, since there is increased synthesis of the β1-globulin transferrin. Plasma folate concentration halves by term, because of greater renal clearance, although red cell folate concentrations fall less. Erythropoietin rises in pregnancy, more if iron supplementation is not taken (55% compared with 25%) but the changes in red cell mass compensate this. Human placental lactogen may be also stimulate haematopoiesis **(Scholl, 2005).**

The Red cell distribution width (RDW) increased significantly between 34 weeks of gestation and labor. No significant changes in RDW occurred between 16 and 34 weeks of gestation, or during the 7 days postpartum **(Shehata, 1998).**

Change in plasma:

The plasma volume increases more than the red cell mass, which leads to a fall in the various concentration measures which include the plasma volume, such as the haematocrit, the haemoglobin concentration and the red cell count. The fall in packed cell volume from 36% in early