MATERNAL AND FETAL OUTCOME IN PREGNANCIES COMPLICATED BY IRON DEFICIENCY ANEMIA

Thesis

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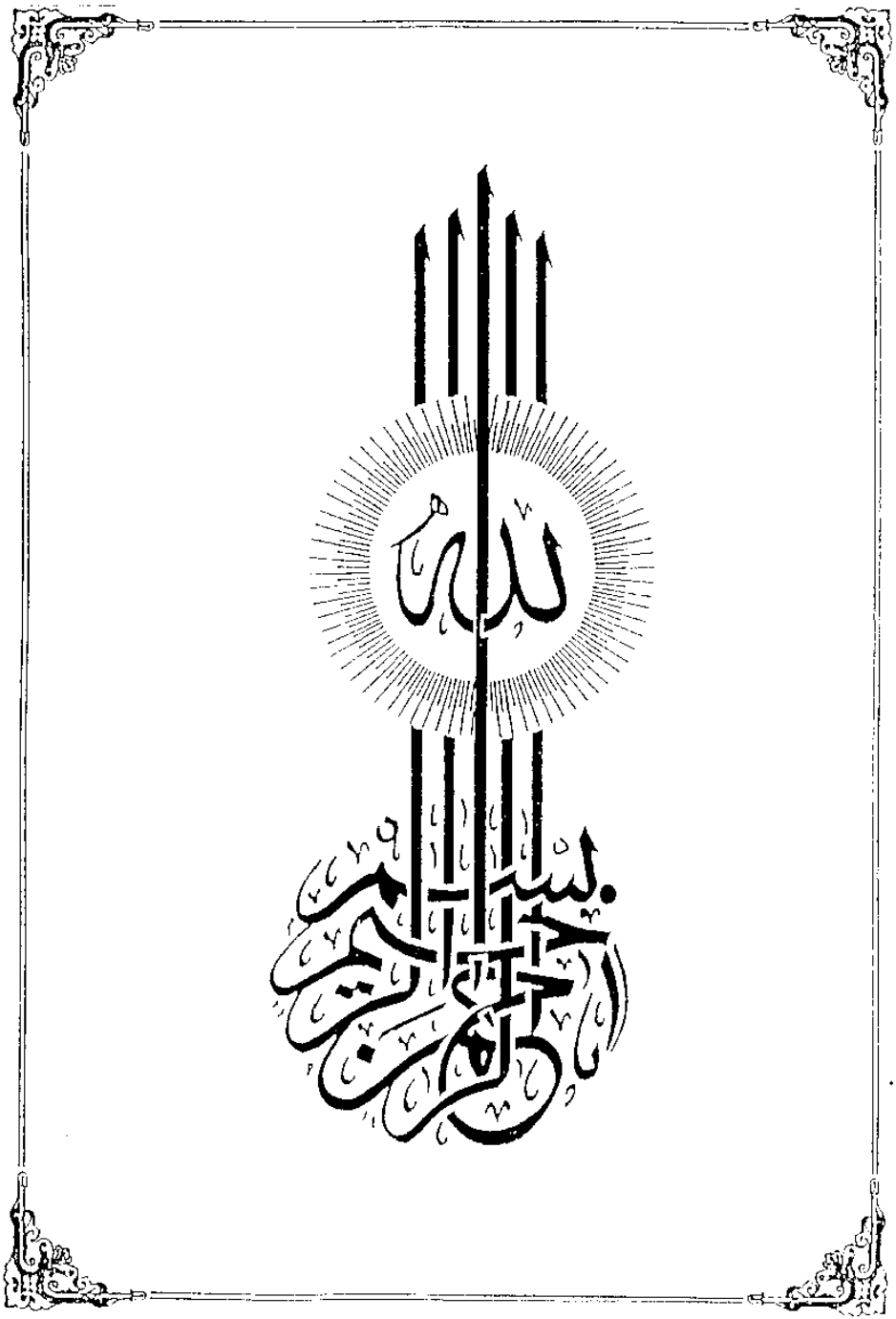
بِسْمِ ٱللَّهِ ٱلرَّحمَنِ ٱلرَّحِيـــمِ

﴿ قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَآ إِلاَّ مَا
عَلَّمْتَنَآ إِنَّكَ أَنتَ ٱلعَلِيمُ ٱلْحَكِيمُ ﴾

صدق الله العظيم

﴿سورة البقرة – الآية ٣٢﴾



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CONTENTS

Introduction

INTRODUCTION

- Anemia was defined by ***WHO;1975*** , as a reduction of the hemoglobin concentration, the hematocrit, or the number of red blood cells, to level below that which is normal for a given individual.

- The hypochromic, microcytic anemias are the most frequently encountered anemias on a world wide scale, with the iron deficiency anemia ranking as the commonest. ***Lam-SI. :Quah-Tc; 1991.***

- There is a high incidence of iron deficiency anemia in pregnancy because many women in childbearing age are in precarious iron balance and because the fetal iron requirements are justified before maternal iron needs. ***Prithard J.K, MacDonald JS;1980.***

- Iron deficiency anemia is associated with an increased incidence of complications of pregnancy, there is an increase in premature births and fetal distress, perinatal fetal mortality is increased, toxemia of pregnancy is more frequent and in severe anemias, maternal deaths become significant. ***Mc. Fee; 1973 .***

Aim of the work

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The purpose of this study, was to find out the effects of iron deficiency anemia on the outcome of pregnancy including both maternal outcome (regarding method of delivery and immediate postpartum complications), and fetal outcome (regarding Apgar score, fetal weight, placental weight and cord hemoglobin).

Review of literature

IRON HOMEOSTASIS

Iron deficiency anemia accounts for 75% of all anemias diagnosed in pregnancy. Hemoglobin values < 11 g/dl occur in as many as 80% of normal pregnant women at term if no iron supplementation is used *(Meeks et al; 1987)* .

Increased utilization of iron , even during a normal pregnancy, dictates the need for supplementation, whether it be nutritional or exogenous. This need may be further enhanced in the presence of multiple gestations , adolescent pregnancy , chronic blood loss , successive gestations less than two years apart , or poor iron absorption *(Meeks et al; 1987).*

In order to predict the pathophysiologic effects of inadequate iron , one must first understand the mechanism of iron distribution , absorption , loss , and metabolism *(Gookin and Morrison; 1986).*

IRON COMPARTMENTS :

Body iron is incorporated into numerous proteins of critical importance including , (1) the heme proteins , (2) iron flavoproteins , (3) various enzymes , and (4) cofactors of the krebs tricarboxylic acid cycle *(Meek et al; 1987).*

Body iron can be separated into that which is essential for normal function and that which is contained in reserve stores. Multiple iron compartments may be described using anatomic distribution , chemical characteristics , and function .

Table (I) summarizes the iron content in each compartment in males and iron sufficient , non - pregnant females ,who ordinarily have 70 % as much total body iron as their male counterparts .

Table (I) : Iron compartments in iron sufficient individuals :

Iron compartments	Iron content (mg)		
	male	non-pregnant female	%
Hemoglobin iron	2.500	1700	67
Storage iron	1.000	700	27
Myoglobin iron	130	130	3.5
Labile pool	80	80	2.2
Other tissue iron	8	8	0.2
Transport iron	3	3	0.08

Iron compartments include hemoglobin iron , storage iron, myoglobin iron , labile pool iron , transport iron. The dispersion of iron in each compartment can be affected by concurrent disease processes as well as by nutritional status ***(Gookin and Morrison;1986)*** .

Hemoglobin iron. Constitutes over 60 % of total body iron and during pregnancy is increased by 20 % in association with the concomitant increase in total blood volume (red cell mass) ***(Letsky; 1991)*** .

It is the largest single compartment of iron and is found in erythrocytes and serves as oxygen transport. Hemoglobins contains 0.34 % iron by weight. Ordinarily one mg of iron is found in every milliliter of red cell mass ***(Finch & Huebers; 1982)*** .

Laboratory indices , such as packed cell volume (PCV) or hemoglobin (Hb) , are generally reflective of hemoglobin iron. However , storage iron compartments must be depleted before these laboratory values begin to decrease ***(Gookin and Morrison; 1986)*** .

Although the average non-pregnant women have approximately 1700 mg of iron contained in hemoglobin, this value is altered by pregnancy, anemia, and polycythemia. In the iron sufficient pregnant women, the hemoglobin iron compartment grows by approximately 500 mg as red cell mass expands to meet the metabolic demands of pregnancy ***(Morrison; 1983)*** .

Storage iron. Comprises about 30% of total body iron ***(Worwood; 1980)*** . These stores are equally divided between ferritin (found in plasma and virtually all cells of the body) and hemosiderin (found only in the cells of reticulo - endothelial system) ***(Gookin and Morrison;1986)*** .

Ferritin contains approximately 20% iron by weight and is insoluble in water. Ferritin iron is a complex of ferric hydroxide, with a small amount of phosphate and oxygen molecules dispersed in a lattice-like crystalline frame work. The life span of ferritin is a few days and degeneration and re-synthesis provide an available intracellular iron pool. ***(Alfrey et al; 1967)***

Ferritin is normally found in plasma and in most cells; however, tissue specific isoferritins have been identified in different organs. The concentration of ferric iron in or near the cell regulates the synthesis of ferritin. The protein carrier apoferritin (ferritin without iron) seems to exhibit enzymatic properties in the oxidation of ferrous to ferric iron, thereby, facilitating the incorporation of iron into the ferritin lattice ***(Meeks et al; 1987).***

At maximum saturation, the ferritin molecule is 30% iron by weight. Ferritin has the ability to release and attach iron rapidly and therefore plays a direct role in iron absorption. Even though plasma levels of ferritin are low, these levels correlates with body's iron stores and may be a useful measurement of iron

stores when bone marrow aspiration is not advised, as in pregnancy ***(Gookin and Morrison; 1986)*** .

Hemosiderin, the other major source of iron storage, is found in the cells of the reticulo endothelial system of the bone marrow, as well as the kupffer's cells of the liver and spleen. It is antigenically similar to ferritin, and may represent denatured ferritin protein and iron ***(Schafer and Bunn; 1987)*** .

The amorphous hemosiderin protein is 25% to 30% iron by weight, contains ferritin granules as demonstrated in electron microscopy, and is water soluble ***(Wixom et al; 1979)***.

The size of this storage compartment varies greatly. Menstrual aged women usually have less than 300 mg of iron in the storage compartment. The total iron store can be determined by the amount of iron mobilized following phlebotomy, although a more practical method is measurement of serum ferritin and determination of bone marrow hemosiderin. In general, measurement of ferritin assesses iron absorption, and hemosiderin measures iron balance. ***(Finch and Huebers; 1982)***.

Storage iron is primarily utilized for blood cell replacement and may be mobilized at a rate of 80 mg per day. Depletion of iron stores results when iron losses exceed that absorbed, and deficiency occurs after bone marrow hemosiderin has been exhausted. The iron demands of pregnancy far exceeds the amount of iron found in the stores of most women. Even in those women who take supplemental iron, iron stores are often reduced to zero following delivery ***(Fairbanks and beulter; 1977)*** .

Myoglobin. Myoglobin (muscle protein) has a structure very similar to hemoglobin. Each molecule consists of heme surrounded by a peptide chain of 150 amino acids residues, and

is 0.34% iron by weight. The myoglobin system serves as an oxygen reservoir to protect muscle against cellular damage during periods of oxygen deprivation, and is relatively constant in both women and men. Pregnancy does not significantly alter this compartment ***(Meeks et al; 1987)*** .

Labile pool. The labile pool is that iron which is constantly moving from plasma to interstitial and intracellular fluid. It is bound to cellular membranes and intracellular proteins by "acetate extractable protein" for very brief periods of time before forming heme or entering storage compartments. The labile pool allows for the study of iron clearance rates, incorporation mechanisms, and daily turnover ***(Meeks et al; 1987)*** .

Parenchymal iron. Parenchymal iron is essential for cellular function and enzymatic reactions, and is found in the cytochrome systems as well as a variety of oxidize enzymes, including acyl-COA. Parenchymal iron deficiency reduces the efficiency of the mitochondrial systems and may alter or modify protein synthesis and steroidogenesis. Fortunately, it is the last iron compartment to be depleted during deficiency states ***(Wriggles worth and Baum; 1980)***.

Transport compartment. The transport compartment is the smallest iron compartment, although it is kinetically the most active-turning over as rapidly as ten times every day ***(Wriggles worth and Baum; 1980)***.

It forms the common pathway for iron exchange between all compartments. Transport iron is bound to the specific protein transferrin, which is an elongated beta globulin with two glycoprotein moieties. Because each molecule has two ferric iron binding sites, three types of transferrin may exist: apoferric, monoferric, and diferric. The percentage of these forms are predictable based on total body iron, and