Maternal anemia during and after labor and its effect on maternal well being and fetal outcome

A thesis
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By

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Introduction

Introduction:

The physiological adaptations to pregnancy are profound and can alter the criteria for diagnosis and treatment of diseases. The understanding of these adaptations to pregnancy remains a major goal of obstetrics, and without such knowledge, it is almost impossible to understand the disease process that can threaten women during pregnancy and the puerpurium. Many of these physiological adaptations can be perceived as abnormal in the non-pregnant women and misinterpreted as pathological *(F. Cunningham et al, 2005).*

Hemoglobin level changes during pregnancy are good example to the physiological adaptations and changes that occur during normal pregnancy and can be misinterpreted as pathological. During normal pregnancy the average expansion of blood volume is 40 to 50 percent. The increase in blood volume results from a combined expansion of both plasma volume and red blood cell mass though the increase in plasma volume is greater than red blood cell mass leading to hemodultion and a state of physiological anemia which may be interpreted as abnormal *(F. Cunningham et al, 2005).*

Accordingly **Anemia during pregnancy** is defined according to WHO guidelines as hemoglobin level below 11g/dl at any time during pregnancy, but many clinicians use the figure of 10.5 gm/dl as recommended by the centers for Disease Control of North America *(David Luesley et al, 2004).*

The incidence of anemia in general and gestational anemia in a community is influenced by dietary habits, socioeconomic factors, educational factors, agricultural practices, environmental sanitation standards and reproductive patterns such as maternal age, family size, and interbirth intervals. **The incidence of anemia during pregnancy** is 2 - 20% in developed countries and 40-80% in developing countries. Nutritional anemia is the most important cause of maternal anemia; iron deficiency responsible in more than 90 per cent of cases. The incidence of folate deficiency is around 5 Percent (though it is often undiagnosed); this is usually the cause of megaloblastic anemia in pregnancy, with vitamin B12 deficiency being rare during pregnancy *(Ray Yi, 2000).*

Sufficient evidence shows that moderate to severe anemia can produce undesirable health consequences. From the perspective of reproductive health outcomes, only very severe anemia (hemoglobin level below 5gm/dl) has clearly been shown to result in maternal mortality. In the less severe range, however, the evidence that anemia is a direct cause of poor reproductive outcomes is not clear *(Ray Yi, 2000).*

Aim of Work

Aim of work:

The aim of this preliminary study is to investigate:

1. Prevalence of anemia in laboring women attending the casualty of Kasr El-Aini hospital from the period from September 2008 to January 2009.

2. The adverse effects of anemia on maternal well being and fetal outcome.

3. Relation of severe anemia to the various adverse effects on maternal well being and fetal outcome.

Review of Literature

Chapter One

Blood physiology of females at reproductive age

Blood physiology in non-pregnant females:

The cellular elements of blood, white blood cells, red blood cells and platelets are suspended in the plasma. The normal total circulating blood volume is about 8% of the body weight (5600ml in a 70 kg person). About 55% of this volume is plasma. Plasma is the fluid portion of blood. It contains immense number of ions, inorganic molecules, and organic molecule. The normal plasma volume is about 5% of the body weight or roughly 3500 ml in a 70 kg adult *(William Ganon, 1995).*

The formation of red blood cells is subjected to a feedback control. It is inhibited by a rise in the circulating red cell level to supernormal values and is stimulated by **anemia** and **hypoxia.** The red blood cells are manufactured in the bone marrow; they lose their nuclei before entering the circulation. In humans, they survive in the circulations for an average 120 days. The average normal red blood cell count is 5.4 million/µl in men and 4.8 million/µl in women. Each human red blood cell is biconcave disk, about 7.5 µm in diameter and 2 µm thick, and each contains approximately 29 pg of hemoglobin. There are thus about $3x10^{13}$ red blood cells and about 900 g of Hb in the circulating blood of an adult man *(William Ganon, 1995).*

Hemoglobin is the red, oxygen carrying pigment in the red blood cells. The average normal Hb content of blood is 16gm/dl in men and 14 gm/dl in women. Hb is a globular molecule made up of 4 subunits having molecular weight of 64,450. Each subunit contains a **heme** moiety conjugated to a polypeptide. Heme is an iron containing porphorin derivative. The polypeptides are referred to collectively as the **globin** portion of the Hb molecule. There are two pairs of polypeptides in each Hb molecule, in normal adult human Hb (Hb A) the two polypeptide types are called the ∝ chains, each contains 141 amino acid residues, and the β chains, each of which contains 146 amino acid residues *(William Ganon, 1995).*

Hematological changes during pregnancy:

Maternal blood volume begins to increase at about 6 weeks' gestation. Thereafter, it increases progressively until 30 to 34 weeks and then plateaus until delivery. The average expansion of blood volume is 40 to 50 percent, although individual increases range from 20 to 100 percent *(Pritchard, 1965).* Women with multiple pregnancies have a larger increase in blood volume than those with singletons. The increase in blood volume results from a combined expansion of both plasma volume and red blood cell (RBC) mass. The plasma volume begins to increase by 6 weeks and expands at a steady pace until it plateaus at 30 weeks' gestation; the overall increase is approximately 50 percent (1,200 to 1,300 ml) *(Kaufman, 2000).*

Erythrocyte mass also begins to increase at about 10 weeks' gestation. Although the initial slope of this increase is slower than that of the plasma volume, erythrocyte mass continues to increase progressively until term without plateauing. Without iron supplementation, RBC mass increases about 18 percent by term, from a mean non-pregnant level of 1,400 ml up to 1,650 ml. Supplemental iron increases RBC mass accumulation to 400 to 450 ml or 30 percent *(Pritchard, 1965).* Because plasma volume increases more than the RBC mass, maternal hematocrit falls. This so-called physiologic anemia of pregnancy reaches a nadir at

30 to 34 weeks. Because the RBC mass continues to increase after 30 weeks when the plasma volume expansion has plateaued, the hematocrit may rise somewhat after 30 weeks (Figure i) *(Scott, 1972).*

In pregnancy, erythropoietin levels increase two to three fold, starting at 16 weeks and may be responsible for the moderate erythroid hyperplasia found in the bone marrow, and mild elevations in the reticulocyte count. The increased blood volume is protective given the possibility of hemorrhage during pregnancy or at delivery. The larger blood volume also helps fill the expanded vascular system created by vasodilatation and the large low-resistance vascular pool within the uteroplacental unit preventing hypotension *(Steven Gabbe et al, 2007).*

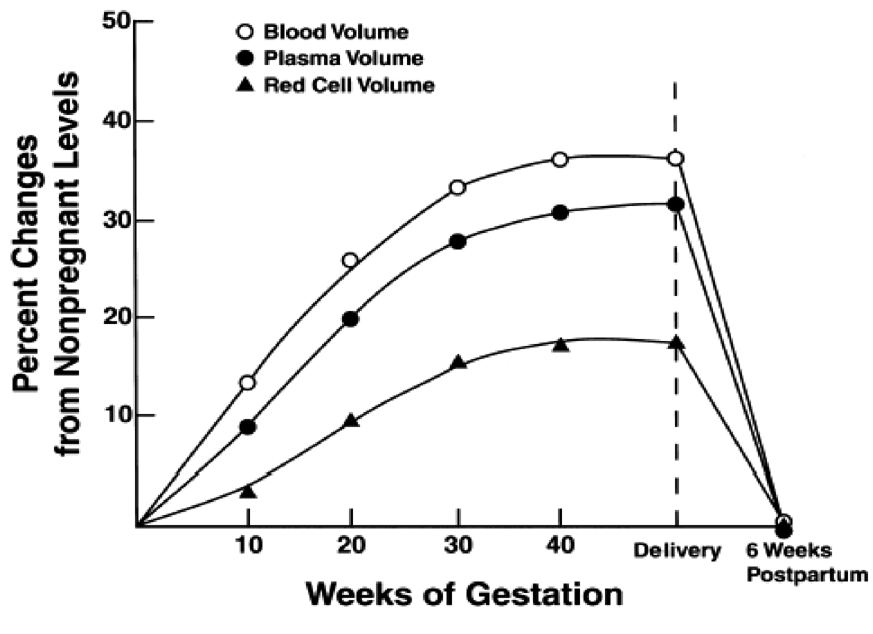

Figure i: Changes in total blood volume and its components (plasma and red cell volumes) during pregnancy and postpartum (Peck and Arias, 1979).