Assessment of the optimal time for hemoglobin level measurement after cesarean section

Thesis

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List of Abbreviations

ALT	Alanine aminotransferase
aPTT	Activated partial thromboplastin time
ARDS	Acute respiratory distress syndrome
AST	Aspartate aminotransferase
ATPase	Adenosine triphosphatase
BDNF	Brain-derived neurotrophic factor
CBC	Complete Blood Count
CCL5	Chemokine (C-C motif) ligand 5
CD4	Cluster of differentiation 4
CMV	Cytomegalo virus
dc	Delta change
dl	Deciliter
ECG	Electrocardiogram
FDPs	Fibrinogen degradation products
FFP	Fresh frozen plasma
fl	Femtoliter
FNHTR	Febrile non hemolytic transfusion reaction
g	Gram
Hb	Hemoglobin
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
HLA	Human leucocyte antigen

List of Abbreviations (Cont.)

HRQOL	Health related quality of life
HTLV	Human T lymphotropic virus
ICH GCP	International Conference on Harmonisation and Good Clinical Practice
ICU	Intensive care unit
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IL	Interleukin
IRB	Institutional review board
IV	Intravenous administration
IVC	Inferior vena cava
JW	Jehovah's witnesses
MCV	Mean corpuscular volume
mg	Milligram
microl	Microliter
ml	Milliliter
mmHg	Millimeter mercury
N	Number
Nacl	Sodium chloride
nvCJD	new variant of Creutzfeldt–Jakob disease
PAI	Plasminogen activator inhibitors
PGE2	Prostaglandin E 2

List of Abbreviations (Cont.)

PPH	Post partum hemorrhage
PRBCs	Packed red blood cells
PT	Prothrombin time
r-HuEPO	recombinant human erythropoietin
RANTES	Regulated on activation, normal T cell expressed and secreted
RBCs	Red blood cells
SHOT	Serious hazards of transfusion
Spp.	Staphylococcus Saprophyticus
TACO	Transfusion associated cardiac overload
TAFI	Thrombin- activatable fibrinolysis inhibitors
TAGVHD	Transfusion associated graft versus host disease
TAT	Thrombin- Anti Thrombin complex
TNFa	Tumor necrosis factor alpha
tPA	Tissue plasminogen activator
TRALI	Transfusion related acute lung injury
TRICC	Transfusion requirement in critical care
TT	Thrombin time
UTRs	Urticarial transfusion reactions
vWF	Von Willebrand factor
WBCs	White blood cells
WHO	World Health Organization

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INTRODUCTION

Delivery by cesarean section (CS) is by far one of the most commonly performed obstetric operations all over the world. Nevertheless, it exposes women to the inherent risk of abdominal surgery; injury to the pelvic structures, infection and the need for blood transfusion ***(Ramadani, 2004; Murphy et al., 2009).***

It was reported that, uterine blood flow increases from 50 to 60 milliliter/minute in the late first trimester, whereas at term, the blood flow increases up to 750 milliliter/minute. Moreover, the cardiac output and uterine artery diameter also increase with advancing gestation. In early pregnancy, the uterus receives 3 to 6 percent of cardiac output; at term, the proportion is about 12 percent ***(Flo et al., 2010)***.

This massive hyper-perfusion results in an average blood loss -based on objective data- of approximately 1000 ml during CS **(*Stafford et al., 2008).***

Many factors would be implicated to affect intra-operative blood loss during CS, e.g., maternal causes; weight, parity, previous CS, fetal causes; multiple gestation, polyhydramnious, malpresentation, technical causes; operative time, type of incision, placental separation technique, placental position and the type of anesthesia. Consequently, judicious

estimation of operative blood loss during CS is crucially important in terms of decreased peri-operative morbidity and avoidance of the risks associated with unnecessary blood transfusion and avoidance of stress (on doctors, patient) ***(Vimala et al., 2005).***

The challenge to estimate the quantity of blood lost continues to be a difficult task to all practitioners especially, the recognition of large volumes of blood loss ***(Schorn, 2010)***.

This challenge is a must, as the inaccurate estimation of blood loss may result in significant adverse outcomes. While, underestimation leads to delayed treatment and overestimation leads to unnecessary and costly interventions ***(Kodkany and Derman, 2006).***

Concerning underestimation that may lead to anemia if the treatment was delayed, many women have a troublesome life due to postpartum anemia causing various symptoms including; fatigue, physical disability, cognitive problems, and psychiatric disorders. Nevertheless, the conditions for mother and child in the postpartum, nursing and lactation period should be as favorable as possible ***(Milman, 2012)***.

Also postpartum anemia is associated with negative surgical outcomes, including a more need for postoperative respiratory and cardiovascular support, delayed or impaired

wound healing, difficult mobilization; and increased incidence of infection, including wound, genitourinary, and respiratory infections. As regards wound infections, it is thought that healing is impaired by other conditions associated with anemia, including malnutrition, abnormal circulation of blood and decreased tissue oxygenation ***(Lagoo et al., 2012)***.

Additionally, in the most severe cases, hemorrhagic shock may lead to anterior pituitary ischemia with delay or failure of lactation (i. e. post-partum pituitary necrosis). Occult myocardial ischemia, dilutional coagulopathy, and death also may occur (***Milman, 2011).***

On the other hand, each unit of blood or any component is associated with risk of exposure to blood-borne infections. During the past several decades, substantial advances have been achieved in blood transfusion safety. Currently, the most serious known risks are administrative error leading to ABO-incompatible blood transfusion, transfusion-related acute lung injury (TRALI), and bacterial and viral transmission ***(Shander and Goodnough 2009).***

AIM OF THE WORK

The purpose of this study is to detect the optimal time for implementation of hemoglobin level measurement after cesarean section in order to avoid exaggerated actions based on over and underestimation of blood loss (intraoperative and post operative).

RESEARCH QUESTION

What is the optimal time of hemoglobin level measurement after cesarean section?

RESEARCH RATIONALE

Hemoglobin level changes from day to day after cesarean section due to fluid infusion, diuresis and blood loss. Also comparison of surgical blood loss from one institution to another, or from one obstetrician to another is a difficult task.

OUTCOME

Assessment of the pattern of hemoglobin level fluctuation after cesarean section in comparison to intra or post operative blood loss.

Determination of the optimal time of hemoglobin level measurement after cesarean section after studying the fluctuation in hemoglobin level in one week duration.

Chapter (1)

PHYSIOLOGICAL BLOOD CHANGES DURING PREGNANCY

Normal pregnancy is characterized by profound changes in almost every organ system to accommodate the demands of the feto-placental unit. One of these changes is the hematological changes, which may appear to be pathological in the non-pregnant state ***(Chandra et al., 2012)***.

Plasma Volume

It was found that during pregnancy, the total blood volume increases by about one and half liters. This increase aids in supplying the demands of the new vascular bed and compensating for blood loss occurring at delivery. Of this, around one liter of blood is contained within the uterus and maternal blood spaces of the placenta. For this reason we can see that the increase in blood volume is more marked in multiple pregnancies and in iron deficient states ***(Ramsay, 2010)***.

Expansion of plasma volume occurs by 10–15 % at six to twelve weeks of gestation. It expands rapidly until 30 to 34 weeks. After which there is only a modest rise. The total gain at

term averages 1100 to 1600 milliliter and results in a plasma volume of 4700 to 5200 milliliter ***(Bernstein et al., 2001)***.

Also it was found that there is a slight increase in plasma renin activity and slight reduction in atrial natriuretic peptide levels during pregnancy. These changes will lead to systemic vasodilatation and increase in vascular capacitance. So that the elevation in plasma volume will be in response to the resultant underfilled vascular system ***(Almeida et al., 2009)***.

While during Postpartum period, plasma volume decreases immediately after delivery as a result of diuresis. However, it increases again two to five days later, possibly because of a rise in aldosterone secretion, which occurs at this time. At three weeks postpartum, plasma volume is still elevated by 10 to 15% above non-pregnant levels, but is usually at normal non-pregnant levels at six weeks postpartum ***(Saha et al, 2009)***.

Red Blood Cells

Red blood cell mass begins to increase at eight to ten weeks of gestation. Among women not on iron supplements, the red cell mass may only increase by 15 to 20 percent. However, in women taking iron supplements, it may rise by 20 to 30 percent (250 to 450 milliliter) above non pregnant levels by the end of pregnancy ***(Ramsay, 2010).***