CBC Changes on Repeated Blood Donors

Thesis

Submitted for partial fulfillment of Master Degree in Clinical Hematology

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2013


بسم الله الرحمن الرحيم
قالوا
سبحانك
لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم
صدق الله العظيم

ACKNOWLEDGEMENT

In the name of **ALLAH**, the Most gracious and the Most Merciful Alhamdulillah, all praises and glory to **ALLAH** for the strengths and His blessing in completing this thesis.

In the first place I would like to record my gratitude to **Prof. Dr. Maha Tawfiek El Zimaity,** Professor of clinical hematology, Faculty of Medicine, Ain shams University, for her continuous encouragement, endless support and precious advice, which made her a backbone of this thesis.

Special appreciation goes to my supervisor, **Prof. Dr. Mohammed Moussa,** Professor of clinical hematology, Faculty of Medicine, Ain shams University, for his advice and crucial contribution. His involvement with his originality has triggered and nourished my intellectual maturity that I will benefit from, for a long time to come.

Many thanks go in particular to **Dr. Rasha Ibrahem,** lecturer of clinical hematology, Faculty of Medicine, Ain shams University, I am much indebted to her for her valuable advice in supervision and furthermore, using her precious times to read this thesis and gave her critical comments about it.

Last but not least, my deepest gratitude goes to my beloved husband, my father, my mother, and to all persons who helped me for their constant prayers, continuing support and encouragement.

Rania Rostom

CONTENTS

LIST OF ABBREVIATIONS

2,3 DPG	**2,3 di phospho glyceride**
ADPase	Adenosine di phosphate
ATP	Adenosine tri phosphate
BM	Bone marrow
Ca	Calcium
dl	Deciliter
Fe	Iron
FFP	Fresh frozen plasma
Fl	Femto litter
FLT3	F ms-like tyrosine kinase 3
GM-CSF	Granylocyte macrophage colony stimulating factor
Hb	Hemoglobin
HBsAg	Hepatitis B surface antigen
HCV	Hepatitis C virus
HIF-1α	Hypoxia- inducible factor 1 α
HIV	Hepatitis immunodeficiency virus
HLA	Human leucocytic antigen
HSCs	Hematopoietic stem cells
MCH	Main corpuscular hemoglobin
MCHC	Main corpuscular hemoglobin concentration
Mg	Magnesium
mmol	Melli mole

Na	Sodium
PCV	Packed cell volume
PRBCS	Packed red blood cells
prp	Platelet rich plasma
PTP	Post transfusion purpura
RBCs	Red blood cells
RDW	Red cell distribution width
Rh	Rhesus factor
TRALI	Trans fusion related acute lung injury
TTP	Thrombotic thrombocytopenic purpura
uv	Ultra violet
vWF	Von willebrand factor
WBCs	White blood cells

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INTRODUCTION

The need for blood products is constant and unremitting. Only a small percentage of eligible individuals answer the appeal to donate **(France, 2007).**

However, there is a subgroup of people who donate blood repeatedly. High demand for blood may have led to a bias towards investigations analyzing and reporting beneficial effects of blood donation, such as reduced risk of myocardial infarction, (Salonen et al.,1998) and blood lipid-lowering effects **(Kumar,1994).**

In most countries, strict regulations have been established for the selection of blood donors that incorporate criteria that serve to protect both the donor and recipient **(Mahinda et al. ,2008).**

An acceptable frequency of donation is normally two or three times a year or every 12 weeks **(Djalali et al. ,2006).**

Chronic iron deficiency is a well-recognized complication of regular blood donation. With each donation men lose 242 ± 17 mg and women lose 217 ±11 mg of iron **(Simon, 2002).**

A healthy individual can donate blood up to four times a year, *i.e.,* at three monthly intervals as iron stores get repleted within this time period **(Boulton et al.,2000).**

All Government are screened for anemia and cut of value of haemoglobine is 12.5g/dl **(Malik,2003).**

AIM OF WORK

Besides iron deficiency, our work aimed at addressing the question if frequent blood donors experience changes in their blood counts that may affect their immunity.

REVIEW OF LITERATURE

Chapter 1: Blood & Blood Components

Blood

Is composed of blood cells suspended in a liquid called plasma. Plasma, which constitutes 55% of blood fluid, is mostly water (92% by volume), and contains dissipated proteins, glucose, mineral ions, hormones, carbon dioxide (plasma being the main medium for excretory product transportation), and blood cells themselves. Albumin is the main protein in plasma, and it functions to regulate the colloidal osmotic pressure of blood. The blood cells are mainly red blood cells (also called RBCs or erythrocytes) and white blood cells, including leukocytes and platelets. The most abundant cells in vertebrate blood are red blood cells. These contain hemoglobin, an iron-containing protein, which facilitates transportation of oxygen by reversibly binding to this respiratory gas and greatly increasing its solubility in blood. In contrast, carbon dioxide is almost entirely transported extracellular dissolved in plasma as bicarbonate ion **(Maton et al., 1993).**

Blood accounts for 8% of the human body weight with an average density of approximately 1060 kg/m^3, very close to pure

water's density of 1000 kg/m^3. The average adult has a blood volume of roughly 5 liters (1.3 gal), composed of plasma and several kinds of cells (occasionally called corpuscles); these formed elements of the blood are erythrocytes (red blood cells, RBCs), leukocytes (white blood cells), and thrombocytes (platelets). By volume, the red blood cells constitute about 45% of whole blood, the plasma about 54.3%, and white cells about 0.7**% (Albert and Bruce,2005).**

Whole blood (plasma and cells) exhibits Newtonian fluid; its flow properties are adapted to flow effectively through tiny capillary blood vessels with less resistance than plasma by itself. In addition, if all human hemoglobin were free in the plasma rather than being contained in RBCs, the circulatory fluid would be too viscous for the cardiovascular system to function effectively **(Shunkle and Micheal, 2004).**

Cells

One micro liter of blood contains:

Red Blood Cell

A typical human erythrocyte has a disk diameter of approximately 6.2-8.2 µm and a thickness at the thickest point of 2-2.5 µm and a minimum thickness in the center of 0.8-1 µm, being much smaller than most other human cells. These cells have

an average volume of about 90 fL with a surface of about 136 μm^2, and can swell up to a sphere shape containing 150 FL, without membrane distension (**Mary, 2004) .**

Adult humans have roughly $2–3 \times 10^{13}$ (20-30 trillion) red blood cells at any given time, comprising approximately one quarter of the total human body cell number (women have about 4 to 5 million erythrocytes per micro liter (cubic millimeter) of blood and men about 5 to 6 million; people living at high altitudes with low oxygen tension will have more). Red blood cells are thus much more common than the other blood particles **(Mary, 2004)**.

Human red blood cells take on average 20 seconds to complete one cycle of circulation **(Hillman et al. , 2005**).

As red blood cells contain no nucleus, protein biosynthesis is currently assumed to be absent in these cells, although a recent study indicates the presence of all the necessary biomachinery in the cells to do so **(Kabanova et al., 2009)**.

The blood's red color is due to the spectral properties of the hemicironions in hemoglobin. Each human red blood cell contains approximately 270 million of these hemoglobin biomolecules, each carrying four heme groups; hemoglobin comprises about a third of the total cell volume. This protein is responsible for the transport of more than 98% of the oxygen (the