Viral infections among volunteer blood donors in the national blood transfusion centre in Egypt

Thesis

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By

Hossam El-Din Fikry Ahmed Sabaa

M. B. B. Ch Faculty of medicine

Cairo University

Supervised by

Prof.Dr.: Naglaa Gamal Mady Abo-El-azaem

Professor of clinical pathology

Faculty of medicine, Al- Azhar University

Prof.Dr.: Wael Refaat Abd-El-Hamid Hablas

Professor of clinical pathology

Faculty of medicine, Al- Azhar University

Dr.: Abd-El-Raouf Abd-El-Raouf Abo-Nar

Lecturer of clinical pathology

Faculty of medicine, Al- Azhar University

Faculty of medicine

Al- Azhar University

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(و علمك ما لم تكن تعلم و كان فضل الله عليك عظيما)

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LIST OF ABBREVIATIONS

AE	Acridinium ester
AIDS	Acquired immunodeficiency syndrome
anti-HBc IgM	IgM antibodies to the hepatitis B core antigen
cccDNA	Covalently closed circular Deoxyribonucleic acid
CDC	Centers for Disease Control and Prevention
cDNA	Complementary DNA
CMV	Cytomegalovirus
DNA	Deoxyribonucleic acid
EIAs	Enzyme immunoassay
ELISA	Enzyme-linked immunosorbent assay
HAART	High active antiretroviral therapy
HBV	Hepatitis B virus
HBcAg	Hepatitis B core antigen
HBe Ab (anti-HBe)	Hepatitis B envelope antibody
HBeAg	Hepatitis B envelope antigen
HBIG	Hepatitis B immunoglobulin
HBs Ab (anti-HBs)	Antibody to the hepatitis B surface antigen
HBsAg	Hepatitis B surface antigen
HCV	Hepatitis C virus
HDV	Hepatitis D virus
HIV	Human immunodeficiency virus
HPA	Hybridization Protection Assay
HTLV	Human T-Lymphotropic virus
IDT	Individual donor testing
IDU	Intravenous drug use

MGN	Membranous glomerulonephritis
mRNAs	Messenger ribonucleic acid
MTCT	Vertical Transmission from mother to child
MTUs	Loading Multi-Tube Units
NAT	Nucleic Acid Testing
NBTC	National blood transfusion centre
OBIs	Occult HBV infections
OD	Optical density
PCR	Polymerase chain reaction
RNA	Ribonucleic acid
STDs	Sexually transmitted diseases
TCR	Target Capture Reagent
TMA	Transcription mediated amplification
TTIs	Transfusion transmissible infections
VNRD	Voluntary non remunerated repeat donations
WHO	World Health Organization
WNV	West Nile virus

I.INTRODUCTION

Blood transfusion is one of the life saving interventions but carries the risk of acute and delayed complications such as transfusion transmissible infections (TTIs). Blood donors are the cornerstone of a safe and adequate supply of blood and blood products and the safest blood donors are voluntary, non remunerated blood donors from low risk populations (**Anjali et al., 2012).**

Hepatitis B is one of most common infectious diseases of the world infecting two billion people including an estimated 400 million chronically infected cases. Individuals with chronic infection have a high risk of developing liver cirrhosis and hepatocellular carcinoma. Hepatitis C virus infection is another common chronic blood borne infection with an estimated 3.9 million persons infected with the virus and it has a high rate of development of liver cirrhosis. Infection by Hepatitis B virus (HBV) and Hepatitis C virus (HCV) cause serious mortality, morbidity and financial burden and are thus a major global health problem, so predonation screening of blood donors or screening of donated blood for HBV and HCV are thus a routine practice **(Nkrumah et al., 2011)**.

Although blood transfusion safety has greatly improved over the last 15 years, the transfusion risk of HBV remains high in developing countries. The development of quality practice for blood donation based on the use of the most sensitive techniques for the detection of infectious risk of blood donation should be a priority of health authorities **(Noah et al., 2011) .**

The current use of nucleic acid testing for detection of the human immunodeficiency virus (HIV) and hepatitis C virus (HCV) RNA and HBV DNA in a single triplex assay may provide additional safety **(Stramer et al., 2011).**

The availability of hepatitis B virus (HBV) nucleic acid testing (NAT) for donor blood screening led to its implementation in low prevalence and high prevalence countries. Genomic detection was a substantial addition to HBV surface protein (HBsAg) screening by detecting window period infections and occult HBV infections (OBIs) which is characterized by undetectable HBsAg, low viral load and presence of serological markers (anti-HBc and/or anti-HBs). OBIs are the result of multiple, poorly understood mechanisms including incomplete immune control mutations of the HBsAg antigenic determinants, abnormal expression of S gene, and inhibition of genome transcription. Infectivity for the recipient is high for window period blood and relatively low for OBIs **(Williams & Wilkins., 2011).**

II.AIM OF THE STUDY

This study aims to screen HCV, HBV, and HIV in blood donors in the national blood transfusion centre (NBTC) in Egypt for detection of prevalence of viral infections among volunteer blood donors.

III.REVIEW OF LITERATURE

1.Blood donation

A blood donation occurs when a person voluntarily has blood drawn and used for transfusions or made into medications by a process called fractionation **(Goldman et al., 2007).**

In the developed world, most blood donors are unpaid volunteers (voluntary non remunerated repeat donations, VNRD) who donate blood for a community supply. In the poorer countries, most blood donors are directed donors. Many donors donate as an act of charity, but some are paid and in some cases there are incentives other than money such as paid time off from work. Donation is relatively safe, but some donors have bruising where the needle is inserted or may feel faint **(Goldman et al., 2007).**

Potential donors are evaluated for anything that might make their blood unsafe to use. The screening includes testing for diseases that can be transmitted by the blood transfusion including HIV and viral hepatitis. The donor must also answer questions about medical history and take a short physical examination to make sure the donation is not hazardous to his or her health. How often a donor can give varies from days to months based on what he or she donates and the laws of the country where the donation takes place. For example in the United States, donors must wait eight weeks (56 days) between whole blood donations but only three days between platelet pheresis donations **(Riley et al., 2007).**

Types of blood donation

Blood donations are divided into groups based on who will receive the collected blood. An allogeneic (also called homologous) donation is when a donor gives blood for storage at a blood bank for transfusion to an unknown recipient. A directed donation is when a person, often a family member, donates blood for transfusion to a specific individual**.** Directed donations are relatively rare when an established supply exists. A replacement donation is a hybrid of the two and is common in developing countries such as Ghana. In this case, a friend or family member of the recipient donates blood to replace the stored blood used in a transfusion, ensuring a consistent supply. When a person has blood stored that will be transfused back to the donor at a later date, usually after surgery, that is called an autologous donation**.** Blood that is used to make medications can be made from allogeneic donations or from donations exclusively used for manufacturing **(Riley et al., 2007).**

Blood is sometimes collected using similar methods for therapeutic phlebotomy, which is used to treat conditions such as hereditary hemochromatosis or polycythemia vera. This blood is sometimes treated as a blood donation, but may be immediately discarded if it cannot be used for transfusion or further manufacturing **(Goldman et al., 2007).**

The actual process varies according to the laws of the country, and recommendations to donors vary according to the collecting organization. The World Health Organization gives recommendations for blood donation policies, but in developing countries many of these are not followed. For example, the recommended testing requires laboratory facilities, trained staff, and specialized

reagents, all of which may not be available or too expensive in developing countries **(WHO., 2008)**.

An event where donors come to donate allogeneic blood is sometimes called a blood drive or a blood donor session. These can occur at a blood bank, but they are often set up at a location in the community such as a shopping center, work place, or school **(Gómez-Simón et al., 2007).**

Donor safety

The donor is also examined and asked specific questions about their medical history to make sure that donating blood is not hazardous to their health. The donor's hematocrit or hemoglobin level is tested to make sure that the loss of blood will not make them anemic and this check is the most common reason that a donor is ineligible **(Gómez-Simón et al., 2007)**.

Pulse, blood pressure and body temperature are evaluated before donation. Elderly donors are sometimes also deferred on age alone because of health concerns. The safety of donating blood during pregnancy has not been studied thoroughly and pregnant women are usually deferred **(Goldman et al., 2007).**

Methods of blood donation

There are two main methods of obtaining blood from a donor. The most frequent is to simply take the blood from a vein as whole blood. This blood is typically separated into parts, usually red blood cells and plasma, since most recipients need only a specific component for transfusions. A typical donation is 450 millilitres of whole blood, though 500 millilitre donations are also common. The blood is usually stored in a flexible plastic bag that also contains sodium