Screening of Human Cytomegalo Virus among Voluntary Blood Donors

Thesis

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By

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Nagwa Basyouni

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List of Abbreviations

Abbr.	Full-term
ab	: Antibody
ACD	: Acid-citrate-dextrose
AIDS	: Acquired immunodeficiency syndrome
ANOVA	: One-way analysis of variance
BMT	: Bone marrow transplantation
BPAC	: Blood products advisory committee
BT	: Blood Transfusion
BTC	: Blood transfusion Center
CD34+	: Cluster of differentiation 34
CD4+	: Cluster of differentiation 4
CD45RA	: Cluster of differentiation 45 Receptor A
CD8+	: Cluster of differentiation 8
CID	: Cytomegalic inclusion disease
CLIAs	: Chemiluminescent immunoassays
CMI	: Cell-mediated immunity
CMV	: Cytomegalovirus
CNS	: Central nervous system
CPE	: Cytopathic effect
DC	: Dendritic cells
DNA	: Deoxyribonucleic acid
EBV	: Epstein-Barr virus
EDTA	: Ethylenediaminetetraacetic acid
EIAs	: Enzyme immunoassays
ELISA	: Enzyme-linked immunosorbent assay
FDA	: Food and Drug Administration

FFP : Fresh Frozen Plasma
gB : Glycoprotein B
G-CSF : Granulocyte Colony Stimulating Factor
gH : Glycoprotein H
gM : Glycoprotein M
gN : Glycoprotein N
gO : Glycoprotein O
GVHD : Graft-versus-host disease
HAV : Hepatitis A virus
HBsAg : Hepatitis B surface antigen
HBV : Hepatitis B virus
HCMV : Human cytomegalovirus
HCV : Hepatitis C virus
HEV : Hepatitis E virus
HIV : Human immunodeficiency virus
HTLV : Human T cell lymphotropic virus
IE : Immediate early (CMV protein)
IFN-γ : Interferon γ
IFRC : International Federation of Red Cross and Red Crescent societies.
Ig : Immunoglobulin
IgG : Immunoglobulin Gamma
IgM : Immunoglobulin Mu
L phase : Late phase (gene expression)
LDLs : Low-density lipoproteins
MB : Methylene blue
MHC : Major histocompatibility molecules
mRNA : messenger ribonucleic acid

NAT : Nucleic acid testing
NK : Natural killer
PBL : Peripheral blood leukocytes
PBL : Peripheral blood leukocytes
PCR : Polymerase-chain reaction
PI : Pathogen inactivation
PLT : Platelet
RBCs : Red blood cells
RNA : Ribonucleic acid
S/D : Solvent/detergent
SD : Standard deviation
spp. : Species
ta-GVHD : Transfusion-associated graft-versus-host disease
TTBI : Transfusion transmitted bacterial infections
TT-CMV : Transfusion-transmitted CMV
TTIs : Transfusion transmitted infections
TTP : Thrombotic Thrombocytopenic Purpura
TTPI : Transfusion-Transmitted Parasitic Infections
UL : Unique long (gene product)
UV light : Ultra Violet light
VCJD : Variant Creutzfeldt-Jakob disease
WBC : White blood cell
WHO : World Health Organization
WNV : West Nile Virus

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Abstract

Background: Blood transfusion represents a potentially life-saving intervention with well-known benefits & risks. Transfusion transmitted infections (TTI) are a great concern of safety for patients. **Aim of the Work:** The aim of this study is to determining the prevalence of CMV infection among voluntary blood donors using PCR technique to guarantee that the blood bank would offer the safest blood units attainable. **Subjects and Methods:** This study carried out between the months of June and November in 2013 at blood bank of Ain Shams University hospitals on 50 voluntary blood donors. The study population consisted of 50 consecutive voluntary blood donors of different blood groups with different social classes. They were 25 males (13 from them under 40 years and 12 above 40 years) and 25 females (13 from them under 40 years and 12 above 40 years). Their ages ranged from 18 years to 55 years with a mean of 31.35±9.09 SD years. Results: The current study showed a statistically significant difference between CMV cytomegalovirus according to social class. Conclusion: Despite a high incidence rate of HCMV infection was reported in this study among voluntary eligible blood donors, the routine screening of blood donors for HCMV infection in such a resource limited environment not feasible. However, the HCMV free blood could be a source of the needed blood for immunosuppressed patients. Recommendations: An inventory CMV DNA negative blood should be kept in blood bank as a source of needed blood for immunocompromised patients.

Key words: blood donors, blood transfusion, transfusion transmitted infections, CMV

Introduction

Blood transfusion represents a potentially life-saving intervention with well-known benefits & risks. The safety especially with regard to the risk of transfusion transmissible infection is an issue of utmost concern especially in the developing countries ***(Nowgoh Benedict et al., 2012).***

Transfusion-transmissible infections (TTIs) are caused by the microbial agents that are transmissible by blood transfusion and can cause morbidity and mortality in recipients. In order to be transmissible by blood, the infectious agent or infection usually has the following characteristics: ***(Bennett-Guerrero et al., 2010)***.

- Presence in the blood for long periods, sometimes in high titres.
- Stability in blood stored at 4°C or lower.
- Long incubation period before the appearance of clinical signs.
- Asymptomatic phase or only mild symptoms in the blood donor, hence not identifiable during the blood donor selection process which through this process blood donors generally are healthy individuals who are pre-screened for risk factors for communicable disease during the donor interview; individuals with identified risk factors don't proceed to donation and testing ***(Contreras , et al., 1998; FDA blood products advisory committee (BPAC) meeting Rockville, MD, 2012).***

According to general recommendations of World Health Organization (WHO) to minimize the risk of TTIs, screening of all blood donations should be mandatory for the following infections and using the following markers:

- HIV-1 and HIV-2: screening for either a combination of HIV antigen-antibody or HIV antibodies.
- Hepatitis B: screening for hepatitis B surface antigen (HBsAg)
- Hepatitis C: screening for either a combination of HCV antigen-antibody or HCV antibodies.
- Syphilis (Treponema pallidum): screening for specific treponemal antibodies ***(World Health Organization WHO, 2010).***

The transfusion-associated transmission of human herpes viruses have been described and can pose significant threats, especially to immunocompromised subjects. They are cell-associated pathogens and cellular components are thus the main compartment for their transmission by transfused blood products. Human cytomegalovirus (CMV) is a member of the human herpes family of viruses, transmissible through blood component transfusions and, accordingly, transmission by blood transfusion, transplacental route or by transplantation of hematopoietic stem cells and solid organs from infected donors were described as means of transmission of the virus ***(Chakravarti et al., 2009).***