Updates on Optimal Transfusion Therapy

Essay

For partial fulfillment of Master Degree in Anesthesiology

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John Emil Riad

الأحدث عن النقل المثالي للدم

رســـــالة

توطئة للحصول على درجة الماجستير في علم التخدير

مقدمة من

الطبيب / جون إميل رياض مينا

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٢٠١٥

List of Content

List of Content

List of Abbreviations

AABB	**: American Association of Blood Banks**
ADP	: Adenosine Diphosphate
APC	: Activated Protein C
aPTT	: activated partial thromboplastin time
ATP	: Adenosine Triphosphate
bFGF	: Basic fibroblast growth factor
BPG	: Bisphosphoglycerate
CMV	: Cytomegalovirus
EDTA	: Ethylenediaminetetraacetic acid
ENA	: Extractable Nuclear Antigen
FDA	: Food and Drug Administration
FDP	: Fibrinogen Degradation Product
FNHTR	: Febrile Non Hemolytic Transfusion Reaction
GM-CSF	: Granulocyte Macrophage Colony Stimulating Factor
GP	: Glycerate 3-phosphate
HbA1c	: Hemoglobin A1c
HBOC	: Hemoglobin-based oxygen carriers
HBP	: Hyperbranched polymer
Hct	: Hematocrit
HIV	: Human Immunodeficiency Virus
HLA	: Human leukocyte antigen
HPA	: Human platelet antigens

List of Abbreviations

HSC	: Hematopoietic Stem Cell
HTD	: Hard to Treat Diseases
HTLV	**: human T-cell lymphotropic virus**
IGF	: Insulin Growth Factor
IIT Madras	: Indian Institute of Teechnology at Madras
IL	: Interleukin
INR	: International Normalized Ratio
LEH	: Liposome-encapsulated hemoglobin
MCD	: Mean Corpuscular Diameter
MCH	: Mean Corpuscular Hemoglobin
MCHC	: Mean Corpuscular Hemoglobin Concentration
MCV	: Mean Corpuscular Volume
MIP	: Macrophage Inflammatory Protein
NADH	: Dihydronicotiamide Adenine Dinucleotide
PAI	: Plasminogen activator inhibitor
PAR	: Protease Activated Receptor
PDGF	: Platelet Derived Growth Factor
PECAM	: Platelet endothelial cell adhesion molecule
PEG	: polyethylene glycol
PF	: Platelet Factor
PFBOC	: Perfluorocarbon-based oxygen carriers
PT	: Prothrombin Time

List of Abbreviations

RANTES	: Regulated on Activation, Normal T Expressed and Secreted
RBC	: Red Blood Cell
Rh	: Rhesus
SCF	: Stem cell Factor
SOD	**: Super Oxide Dismutase**
t- PA	: Tissue type Plasminogen Activator
TA- GVHD	: Transfusion-Associated Graft Versus Host Disease
TGF	: Tissue Growth Factor
TRALI	: Transfusion Related Acute Lung Injury
TRICC	: Transfusion requirements in critical care
u- PA	: urokinase type Plasminogen Activator
VEGF	: Vasoactive Endothelial Growth Factor
vWF	: Von Willebrand Factor
WBC	: White Blood Cell

List of Tables

List of Figures

List of Figures

INTRODUCTION

Blood transfusion is a life saving intervention. Every second, in every country of the world, someone needs blood.Surgery, trauma, severe anemia and complications of pregnancy are among the clinical conditions that demand blood transfusion. Whatever the degree of development of a health care system, transfusion is the only option for survival of many patients ***(Malar, 2013)***.

From donor to recipient, raw blood will undergo a succession of processing events before eventually becoming a qualified, recipient-adapted finished product ***(Beauplet, 2001)***.

Shortages may arise from a fall in supply, a lack of national blood transfusion services, policies, appropriate infrastructure, trained personnel, or financial resources to support the running of a voluntary non remunerated donor transfusion service. There is an urgent need to develop innovative ways to recruit and retain voluntary low-risk blood donors ***(Osaro and Charles, 2011)***.

Blood banks screen donors for risk factors and test donated blood to reduce the risk of transfusion-related infections, but they occasionally still occur. Blood is a port of transmitting hepatitis B, hepatitis C, HIV, syphilis, malaria ***(Sharma and Tyler, 2011)***.

Unnecessary blood transfusion when the availability of simpler, less expensive strategies that could provide equal or greater benefit not only does expose patients needlessly to the risk of potentially fatal transfusion reactions and infections, it also worsens the gap between supply and demand and contributes to shortages of blood and blood products for patients who are really in need ***(Osaro and Charles, 2011)***.

These strategies should include the correction of anemia using pharmacological measures as the use of antifibrinolytics to prevent bleeding and the use of erythropoietin and oral and intravenous iron and use of nonpharmacologic measures as preoperative autologous blood transfusion, perioperative red blood cell salvage and normothermia ***(Osaro and Charles, 2011).***

The demand for more blood substitutes began during the Vietnam War as wounded soldiers were unable to be treated at hospitals due to blood shortage. These worldwide blood shortages have led scientists to synthesize and test what is called "Artificial blood"to bridge the gap between demand and supply ***(Sarkar, 2008)***.

These efforts have essentially focused on the ability of red blood cells to carry oxygen. Hence, most of the products that are in advanced-phase clinical trials are derivatives of hemoglobin and are known as hemoglobin-based oxygen carriers. However, to date, no oxygen-carrying blood

substitutes are approved for use by the US Food and Drug Administration ***(Grethlein, 2012).***

Hopefully, as better blood substitutes are developed and enter routine clinical use, the need for blood transfusions in the operative and trauma settings will decrease. Large-scale production of blood substitutes would also help to meet the anticipated increase in demand for blood as the population increases and the blood donor pool diminishes.

Aim of the Essay

The goal of this work is to focus on blood and blood products as regard preparation, storage, indications for transfusion, complications and methods to avoid such complications by optimal use of each product. Also, the recent solution "Oxygen carrying blood substitutes" or what is called "Artificial blood" as a new method to overcome many of these complications.