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لم ترد بالأصل

RECENT ADVANCES IN ARTIFICIAL BLOOD SUBSTITUTES AND OXYGEN CARRIERS

Essay

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ABSTRACT

Blood substitutes are oxygen-carrying, volume expanding solutions. they include; perfluorocarbons and hemoglobin- based solutions. They are used as alternatives to natural human blood transfusion to decrease the incidence of complications that may result from homologous blood transfusion and to face the probable coming shortness of blood donation.

Keywords:

Oxygen; Carrying; Volume expanding; Perfluorocarbons; Hemoglobin-based; Complications; Donation

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ABBREVIATIONS

AIDS	: Acquired Immune Deficiency Virus
ARDS	: Acute Respiratory Distress Syndrome
CABG	: Coronary Artery Bypass Graft
CAT	: Catalase
CFR	: Code of Federal Regulations
DCLH	: Diaspirin cross-linked hemoglobin
DIC	: Dissiminated Intravascular Coagulopathy
DPG	: Diphosphoglycerate
FDA	: Food and Drug Administration
GVHD	: Graft-versus-host disease
Hb or Hgb	: Hemoglobin
HBOC	: Hemoglobin-based oxygen carrier
HIV	: Human Immune deficiency virus
HLA	: Human Leukocyte Antigen
HLK	: Hemolink
HNA	: Human Neutrophil Antigen
LAIR	: Leukocyte-associated immunoglobulin-like receptor
MP4	: Malemide-activated polyethylene glycol-modified haemoglobin
PFCs	: Perfluorocarbons
RBCs	: Red Blood Cells
rHb1.1	: Human recombinant hemoglobin
RSR13	: Allosteric modifier
SARS	: Severe Acute Respiratory Syndrome
SOD	: Super Oxide Dismutase
TRALI	: Transfusion Related Acute Lung Injury

INTRODUCTION

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The need for human blood for blood transfusion is steadily increasing due to an increase in ageing population, and decreased allogenic donations. However, donated human blood has many problems[1].

The maintenance of intravascular volume is essential and resuscitation with isotonic crystalloid or volume expanders such as gelofusin or pentastarch is fundamental in the management of shock, with the addition of packed red cells when available, to restore oxygen carrying capacity and oxygen delivery to reinstate tissue perfusion[2].

There are two main indications for the transfusion of red cells:

1. Severe haemorrhage.
2. Chronic symptomatic anaemia for which no specific therapy exist[3].

Although of its great benefits, donated blood may exert an immunosuppressive effect on the recipient, making them more susceptible to infections, and may lead to various metabolic conditions, such as, Hyperkalemia, Hypocalcemia and Alkalosis[4].

The development of artificial oxygen carriers began in 1933,and include:

1. Perflurocarbons: they are synthetic oxygen carriers composed of eight to ten hydrocarbon molecules where the hydrogen atom has been replaced by fluorine, they are biologically and chemically inert. They possess high gas dissolving properties. They are not miscible with water and therefore have to be brought into an

emulsion prior to use. Perflurocarbons have short intravascular half-life of 12-18 hours, but are only cleared from the body weeks later, preventing multiple doses in a short time span[5].

2. Haemoglobin-based solution: they would seem to be a natural substitute for red cells that need some chemical modification to form a stable, functional tetramer of hemoglobin which would not dissociate into dimers upon infusion. They are derived from three principal sources: human, bovine and genetically engineered hemoglobin[6].

The requisites for artificial oxygen carriers that develop should be not only effectiveness for tissue oxygenation, but also the following:

1. No blood type antigen and no infection.
2. Stability for long-term storage at room temperature.
3. Low toxicity and prompt metabolism, even after massive infusion.
4. Physicochemical properties that are adjustable to resemble those of human blood.
5. Reasonable production expense and cost performance[7].