

BLOOD PRODUCTS IN BLOOD BANKING: PREPARATION AND CLINICAL IMPORTANCE

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ABSTRACT

Blood transfusion is a common procedure in which donated blood or components are given through an intravenous line, it is administered to replace blood and components that may be too low. Blood transfusion provides blood or components to people who has lost them due to injury, surgery or have certain medical conditions that affect blood or its components. Blood comes from donors, blood banks and health care providers ensure transfusions are safe, low risk treatment. Whole blood and many blood products transfusion is the cornerstone of therapy for many serious and common diseases like Anaemia, coagulopathies, thrombocytopenia, prolonged neutropenia

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Both in the past and present, transfusion of blood and its products has been a lifesaving procedure especially its ability to increase oxygen carrying capacity and till date there hasn't been any replacement for blood.

Keywords: *Blood products, blood banking, preparation of blood products, relevance of blood transfusion*

INTRODUCTION

Blood is a body fluid that carries necessary substances such as nutrients, oxygen and transports metabolic wastes in the body (Singhal *et al.*, 2013). Blood is made of the Plasma; liquid component of blood, in which the red blood cells, white blood cells, and platelets are suspended (Obeagu *et al.*, 2020; Ogar *et al.*, 2021; Ravindra 2021). A blood product is any component of the blood which is collected from a donor for therapeutic use in blood transfusion (JPAC 2014).

Blood banking involves screening, collection, preparation, storage, and issue of blood and blood components after compatibility testing (Christopher 2007). Screening for HIV, Hepatitis B, Hepatitis C and Syphilis should be mandatory prior to use (WHO 2020).

BLOOD PRODUCTS AND TRANSFUSION

Blood transfusion is a common procedure in which donated blood or components are given through an intravenous line, it is administered to replace blood and components that may be too low. Blood transfusion provides blood or components to people who have lost them due to injury, surgery or have certain medical conditions that affect blood or its components. Blood comes from donors, blood banks and health care providers ensure transfusions are safe, low risk treatment. Well-coordinated blood and blood product systems can increase the act's lifesaving impacts by ensuring that safe, high quality blood products are available to all people in all times (Sharma *et al.*, 2011).

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With roughly 200 million population, the global health body says Nigeria needs an average of 1.8 million pints of blood annually but the country's agency in charge of blood donation-Nigeria's National Blood transfusion Service says it collects only 500,000 pints of blood every year, leaving a shortfall of about 73.3%. According to the American Association of Blood banks as of 2013. One unit of blood, once it is separated, may be transfused to several patients, each with different need.

TYPES OF BLOOD PRODUCTS

Whole blood

Packed red cells (red blood cell concentrate)

Washed red blood cells

Granulocytes

Fresh frozen plasma (FFP)

Cryoprecipitate

Platelet concentrate (JPAC 2014).

PREPARATION OF BLOOD PRODUCTS

There are two blood donation collection procedure. Single whole blood donation. Apheresis: leucapheresis, plasmapheresis, plateletpheresis and Erythropheresis (Dayyal 2019).

Whole Blood

Whole blood contains all the blood components, 450 ml blood is collected from the donor which is added to 63ml of CPD or CPDA-1 anticoagulant. It can be stored at 1°-6°C for 21-35 days. 1 unit increases Hgb 1g/dL and Hct 3%. ABO and Rh compatibility, risk of volume overload must be borne in mind (Basu *et al.*, 2014).

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Packed Red Blood Cells

Also known as Red cell concentrate. It is prepared from whole blood, separated from the plasma after centrifugation. 100ml of an additional solution is added for long term storage, most common being CPD, this extends storage time to 42 days at 1-6° C. One unit increases hematocrit 3% (Sharma *et al.*, 2011).

Washed Red Blood Cells

Whole blood is centrifuged at 3000rpm for 5min, the plasma and buffy coat is removed and the red cells is resuspended in normal saline and washed to remove most of the plasma, platelets and white cells. Once red cells have been washed they can only be kept for up to a day. (Lu *et al.*, 2019)

Granulocytes

There are two main granulocyte-rich components available: buffy coats derived from whole blood donations (PGC): after centrifugation of whole blood, the buffy coat is collected and later softly spun to collect residual granulocytes. Granulocytes collected by apheresis from individual donors (leucapheresis). 20–24°C and must be transfused within 24 hours from collection (Strauss *et al.*, 2011).

Fresh Frozen Plasma (FFP)

Plasma can be prepared by separation from whole blood or via plasmapheresis. Plasma separated from donated whole blood after undergoing centrifugation of 2600-3000rpm for 10min at 22°C , frozen ≤ 8 hours of collection. Stored at -18°C or colder for 1 year. FFP is a rich source of plasma protein & coagulation factors (Khawar *et al.*, 2018).

Cryoprecipitate

This is the cold insoluble fraction of Fresh Frozen Plasma, it is obtained by thawing FFP at 0-4°C and stored at < - 18°C for a year. Each unit from separate donor is suspended in 15–20

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mL plasma. It contains fibrinogen, Von Willebrand factor, factor VIII (AHF), fibronectin (Stubbs *et al.*, 2019).

Platelet Concentrate

Requires light spin that separates RBCs and WBCs from plasma and platelets, the heavy spin separates platelets in platelet rich plasma (PRP) to settle at the bottom of a satellite bag. Platelets concentrate also contain about 50–60 mL plasma. Platelet units must be maintained at 22°C and agitated during storage and must be used within 6days (Aubron *et al.*, 2018).

CLINICAL IMPORTANCE

Whole Blood- Acute blood loss with hypovolaemia, Exchange blood transfusion, Trauma

- Packed red cells – severe anaemia
- Washed red blood cells- recurrence of severe allergic reactions, chronic lung disease in neonates.
- Granulocyte- life-threatening soft tissue or organ infection with bacteria or fungi and low neutrophil counts, prolonged neutropenia
- Fresh frozen plasma- Thrombotic thrombocytopenic purpura. Multiple coagulation factor deficiencies where specific concentrate is unavailable, hypovolemia (JPAC 2014).
- Plasma derivatives are manufactured by fractionation of large volumes of pooled human plasma e.g. Human albumin solutions, F VIII concentrate, F IX concentrate
- Cryoprecipitate- von Willebrand Factor (von Willebrand's disease). Factor VIII deficiency (hemophilia A). As a source of fibrinogen in acquired coagulopathies; e.g. DIC.
- Platelet concentrate- Thrombocytopenia, Platelet function defects. Prevention of bleeding due to thrombocytopenia as in bone marrow failure (JPAC 2014).

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CONCLUSION

Whole blood and many blood products transfusion is the cornerstone of therapy for many serious and common diseases like Anaemia, coagulopathies, thrombocytopenia, prolonged neutropenia

Both in the past and present, transfusion of blood and its products has been a lifesaving procedure especially its ability to increase oxygen carrying capacity and till date there hasn't been any replacement for blood.

RECOMMENDATION

Training on blood products and its preparation should be encouraged to avoid cardiac overload and wastage. All health care practitioners who administer blood and its products must complete specific training for safe transfusion practices. Government should help provide facilities for the preparation and storage of blood products e.g. platelet concentrate to enhance continuous preparation of these products. There should be adequate power supply as the need for constant electricity in blood banking cannot be overemphasized

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