

## Guidelines on the Clinical Use of Whole Blood and Components of Blood

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### Abstract

Blood transfusion is an essential part of modern health care .Used correctly ,it can save life and improve health. But transfusion carries the risk of adverse reactions and transfusion transmissible infection, and the clinician should be aware of it.(1)

The appropriate use of blood and blood components means the transfusion of safe blood components only to treat a condition leading to significant morbidity or mortality that cannot be prevented or managed effectively by other means.(1)

**KEY WORDS:** Components, FFP, Platelet concentrates, Intravenous fluid resuscitation

### INTRODUCTION

Blood transfusion plays an important role in comprehensive patient care in modern medicine. The aim of blood transfusion services should be to provide effective blood and blood products ,which are as safe as possible and adequate to meet patient need.(4) But many times un necessary transfusions are received by the patients or simple alternatives to transfusion like intravenous fluid resuscitation is not effectively commenced. The outcome becomes giving risks of transfusion to the patient without much benefit and its actual cost .So efforts should be made

- 1 .To motivate use of simple alternatives to transfusion wherever possible
2. To understand in brief about whole blood and components (indications ,contraindications ,complications and benefits )
3. To understand precautions while transfusion at all levels
4. To avoid unnecessary transfusions at all levels of health care system

### INTRAVENOUS FLUID RESUSCITATION (2)

Intravenous fluids are the first line treatment for hypovolemia. Initial treatment with these fluids is life saving and provide some time to control bleeding and obtain blood for transfusion.

Among available intravenous fluids Normal Saline or balanced salt solutions like Ringer Lactate are effective as replacement fluids. Dextrose solutions do not contain sodium and are poor replacement fluids.

All colloid solutions (albumin, dextrans, hydroxyethyl starch solutions) are replacement fluids. But they have not been shown to be superior to crystalloids in resuscitation.

Plasma should never be used as a replacement fluid.

Plain water should never be infused intravenously as it will cause hemolysis and will probably be fatal.

In addition to intravenous route , other routes can be used e.g. oral, rectal

#### **WHOLE BLOOD AND COMPONENT PATHWAY (4)**

Whole blood is separated in to 1. RBCs ( Red Blood Cells/PCV ) and

2. Platelet Rich Plasma by light spin Centrifugation

Platelet Rich Plasma is further separated by high spin Centrifugation in to

1)Platelet poor plasma and 2) Platelet concentrate

Platelet poor plasma is stored as Fresh Frozen Plasma(F.F.P.)

#### **SOME KEY POINTS ABOUT WHOLE BLOOD AND COMPONENTS**

It is needless to enumerate the list of indications and contraindications as all clinicians are well known about it. Hence some important key points are picked up for the rational use of particular component for particular patient.

##### Whole Blood

It is collected from voluntary and eligible blood donors as 350 ml or 450 ml of blood in anticoagulant-preservative solution.

It is stored in approved blood bank refrigerator at temperature between +2° C to +6° C

#### **INDICATIONS FOR WHOLE BLOOD**

The only indications for whole blood in modern medicine are (4)

- 1) Exchange transfusion
- 2) Open heart surgery
- 3) Acute, moderate to severe blood loss with hypovolemic shock.

**Disadvantage of transfusion of stored whole blood should be considered as it contains.**

- 1) No functional platelets.
- 2) No labile coagulation factors.
- 3) Leukocytes with antigenic property
- 4) High potassium content.(3)
- 5) Transfusion transmissible infections including HIV I, HIV II, Hepatitis B & C, Malaria and Chagas disease& Syphilis. Any of these infectious agents can be present in cells or plasma which has not been detected by routine screening tests.

P.C.V. – Packed cells, Red cell concentrate

Whenever blood transfusion is indicated P.C.V. should be preferred to Whole blood.

Unnecessary transfusion of plasma in stored whole blood should be avoided to reduce the incidence of

- 1) Transfusion reaction
- 2) Electrolyte imbalance
- 3) Circulatory overload

#### INDICATIONS FOR PCV

##### **General Indications for red cell transfusion-**

- 1) Acute blood loss with > 30% loss of blood volume.
- 2) Severe anemia with Hb less than 6 gm% (Nutritional, Hemolytic or other)(4)
- 3) Anemia due to recurrent haemorrhage (e.g. haematemesis, PR bleeding etc.)
- 4) Premature infants.
- 5) Immune hemolytic anemia due to
  - Allo immune hemolytic disease of newborn
  - Auto immune hemolysis

##### **Contraindications for blood transfusion (4)**

- 1) Well compensated anemia with chronic renal failure
  - 2) Nutritional anemia due to iron /B12/folic acid deficiency unless patient shows signs of decompensation.
  - 3) To correct protein/coagulation factor deficiency
  - 4) Preoperative transfusion to increase hemoglobin above 10 gm %
  - 5) To enhance general well being, promote wound healing ,prevent infection ,expand blood volume.
- **Washed Red Cells (WRC)**

Washed Red Cells are practically devoid of plasma, leucocytes and platelets. These can be prepared by manual or automated techniques. Their use minimizes the risk of post transfusion hepatitis and formation of HLA-antibodies.
  - **Leuco depleted Red Cells**

These are obtained by using special filters. The procedure should be carried out according to the need of the patient. The procedure can be done at the time of blood collection by using in-line filter or filtration procedure can be done in laboratory or Blood Bank within 7 days of blood collection.

#### F.F.P. (Fresh Frozen Plasma)

Plasma separated from whole blood within 6 hours of collection and rapidly frozen to -25 degree centigrade

It can be stored at -25<sup>0</sup>C for up to 1 year

Before use it should be thawed in the blood bank in water bath at 30<sup>0</sup>C to 37<sup>0</sup>C .

#### INDICATIONS FOR FFP

There are very few clinical indications for FFP transfusions.

Often the risks outweigh any possible benefit in case of plasma transfusion.

FFP transfusion is indicated for replacement of coagulation factor deficiencies in

- 1) Liver disease
- 2) Warfarin overdose
- 3) DIC
- 4) TTP

**Contraindications-** Plasma should not be given in

- 1) Coagulopathy in massive transfusion.
- 2) As a blood Volume expander in hypoproteinemia
- 3) To treat hypoproteinemia
- 4) As a source of immunoglobulins.

#### **Complications of FFP transfusions**

- 1) Plasma can transmit most of the infections present in blood especially- Hepatitis B, C, , HIV etc.
- 2) Plasma also can cause transfusion reactions like allergic and anaphylactoid reaction.

#### **Cryoprecipitate**

It is prepared from fresh frozen plasma by collecting the precipitate formed during controlled thawing at +4<sup>0</sup>C and re suspending it in 10 -20 ml plasma.

Cryoprecipitate is rich in factor VIII & Fibrinogen. It is indicated in

- 1) Haemophilia-A
- 2) Van Willebrand's disease
- 3) Deficiency of fibrinogen & Factor XIII

#### **Platelet Concentrates**

Platelet preparations are of two types

- 1) Random Donor Platelets (5.5 x 10<sup>10</sup> Platelets/unit from 450ml. & 3.5 x 10<sup>10</sup> /Unit from 350 ml. of blood) in volume of resp. 50 to 70 ml. and 50 to 55 ml. of Plasma.
- 2) Single Donor Platelet by Aphaeresis procedure contains 5 to 6 times more platelets than random donor platelets.(4)

#### • **Random donor Platelet transfusion:-**

Platelet transfusions are indicated in thrombocytopenia patients who are actively bleeding or are at risk of haemorrhage. The factors that determine the need and dosage of platelet transfusion are : Clinical severity of bleeding, platelet count, platelet function, bleeding time, underlying disorder, drug intake, splenomegaly, platelet and HLA immunization and response to previous therapy.

- **Single donor Platelet transfusion :-**

Single donor platelets are obtained by platelet aphaeresis using a cell separator. Usually 3.0 to 8.0x 10<sup>11</sup> platelets are obtained in plasma volume of about 180-200ml. If more than 3 to 4 Platelet Concentrates are required, Platelet Aphaeresis should be preferred to avoid exposure of the patient to multiple donors.

**Indications-**

- 1) Treatment of Bleeding due to Thrombocytopenia, Impaired Platelet function
- 2) Prevention of bleeding due to Thrombocytopenia such as in bone marrow failure.

**Contraindications-**

- 1) Autoimmune ITP
- 2) T T P
- 3) Heparin induced thrombocytopenia
- 4) Thrombocytopenia associated with Septicemia, Hypersplenism until treatment has commenced.

Platelet transfusion also can cause febrile non-hemolytic and allergic urticarial reactions. Prescribe whenever really required.

**COMPLICATIONS OF TRANSFUSION (6)**

1. Reactions
  - A. Febrile non hemolytic
  - B. Allergic
  - C. Delayed hemolytic
  - D. TRALI ( Transfusion Related Acute Lung Injury )
  - E. Acute hemolytic
  - F. Fatal hemolytic
  - G. Anaphylactic
2. Infections
  - A. Hepatitis B
  - B. Hepatitis C
  - C. H.I.V.1,2
  - D. H. T. L. V. 1 ,2
  - E. Malaria
  - F. Cytomegalovirus
  - G. Syphilis
3. Other Complications
  - A. RBC allosensitisation
  - B. HLA allosensitisation
  - C. Graft Versus Host Disease
4. Non Immunological Reaction
  - A. Fluid over load

- B. Hypothermia
- C. Electrolyte Toxicity
- D. Iron over load
- E. Hypotensive Reaction
- F. Immuno modulation

#### 5 .Bacterial Infection Secondary to contamination of unit

To avoid any of these complications following alternatives to blood Transfusion are recommended (6)

1. Intra venous fluid resuscitation
2. Autologous blood transfusion
3. Erythropoietin in patients with anemia of chronic renal failure
4. Intra operative salvage and reuse of blood

#### SOMETHING ABOUT CHOICE OF COMPONENT

##### **Whole Blood and P. C. V.**

Should be of specific group & ABO compatible.

When specific group unit is not available ABO compatibility is sufficient in case of rare blood groups

##### **Emergency transfusion**

Patients who are rapidly or uncontrollably bleeding may require immediate transfusion. In such situations when we cannot wait until determination of the ABO group and Rh type of the patient or cross matching, group O negative RBCs can be given for females of child bearing age. If group O negative units are few or not available and patient is a male or older female ,group O positive RBCs can be given.(3)

##### **F. F. P. / Cryo.**

- 1) ABO compatible unit should be chosen.
- 2) No compatibility testing is required.
- 3) Should be used as soon as possible after thawing because labile coagulation factors start degrading after 6 hrs.

##### **Platelet Concentrates**

- 1) Choose ABO compatible unit whenever possible.
- 2) If it is not available, Platelets of another group can be used in adults.
- 3) Administration of ABO incompatible Platelets is an acceptable transfusion practice.
- 4) Platelet from Rh (D) positive donors should not be transfused to Rh negative recipient due to risk of Rh immunization from contaminating red cells.

- 5) If Rh. negative Platelets are not available, Rh. (D) immunoglobulin Rh Ig should be given in doses of 20 microgram/ unit of RH positive Platelet concentrate.(4)
- 6) Should not be kept in refrigerator as it reduces platelet function

### RESPONSE TO TRANSFUSION OF COMPONENTS (6)

One unit of PCV (around 200 ml ) increases hemoglobin by one gm/dl

One unit of RDP (50 to 70 ml ) increases platelet count by 5000 to 10000/ micro l.

One unit of SDP (200 To 400 ml ) results in platelet increment by  $>10 \times 10^9/l$  within 1 hour and  $>7.5 \times 10^9/l$ . within 24 hours of transfusion

One unit of FFP (200 To 250 ml ) increases coagulation factors about 2%

One unit of Cryoprecipitate (10-15 ml ) increases factor VIII – 80 IU

### : A. B. O. COMPATIBILITY :-(1)

<b>RED CELL COMPONENTS</b>
In red cell transfusion, there must be ABO and RhD compatibility between the donor's red cells and the recipient's plasma.
1. Group O individuals can receive blood from group O donors only
2. Group A individuals can receive blood from group A and O donors
3. Group B individuals can receive blood from group B and O donors
4. Group AB individuals can receive blood from AB donors, and also from group A,B and O donors

<b>PLASMA AND COMPONENTS CONTAINING PLASMA</b>
In plasma transfusion, group AB plasma can be given to a patient of any ABO group because it contains neither anti-A nor anti-B antibody.
1. Group AB plasma (no antibodies) can be given to any ABO group patients
2. Group A plasma (anti-B) can be given to group O and A patients
3. Group B plasma (anti-A) can be given to group O and B patients
4. Group O plasma (anti-A + anti-B) can be given to group O patients only

### GENERAL PRECAUTIONS

Following general precautions while transfusing blood and components of blood must be taken.

#### While Prescribing

1. Each hospital should have standard operating procedure for transfusing blood or components and for each stage of transfusion process concerned staff should be trained to follow them.
2. Requisition form and sample label should be correctly completed including the reason for transfusion, investigation reports, diagnosis and exact date and time

when the unit is required etc. and should be signed by the concerned responsible doctor. It will help the blood bank personnel to choose the right unit for your patient.

3. All the request forms should not be labeled as “Urgent”, when it is real emergency, contact blood bank by telephone.

#### **Before Transfusion**

1. When two or more units are prescribed, patient’s relative should be advised to bring the unit necessary for transfusion. Two or more units at a time should not be asked for, to avoid deterioration of the contents due to temperature fluctuations.
2. Accurate, unique identification of the patient and the blood unit is necessary to ensure the administration of the right blood to the right patient ( e.g. Name of the patient, Reg. no. , blood group, ward, dept. etc.)
3. Check the temperature of the unit which should be nearer to room temperature, Also check recipient and donor’s blood group, bag no., collection date, expiry date etc.
4. Blood should never be warmed in a hot water as this could lead to hemolysis of red cells.

#### **During Transfusion**

1. Patients general condition before transfusion, during transfusion and after transfusion should be recorded on case paper sheet.
2. Exact time when transfusion is started and when transfusion is completed should be mentioned.
3. Never use DNS or D5 through same IV line. Use only 0.9% NS if needed. Co-administration of dextrose may result in chemical hemolysis.(3)
4. Red Cells/ Platelets are at higher risk of bacterial proliferation, so should be transfused as early as possible.
5. If the Patient is unconscious or anaesthetized, observe for

Rigors, Hypotension, Rash, Fall in Hb%

6.If patient requires massive blood transfusions ,clinician should be aware about life threatening load of potassium released into the plasma and consequent signs of hyperkalemia particularly arrhythmias.(4)

7. Patient should be closely monitored by responsible nurse and doctor during transfusion

#### **TIME LIMITS FOR TRANSFUSION (1)**

1. Whole blood or PCV – Infusion should be started within 30 minutes of removing pack from refrigerator and completed within 4 hours
2. Platelet concentrate/ FFP / Cryoprecipitate – infused as soon as possible (immediately) and completed within 20 minutes

#### **.After Transfusion**

1. Observe for transfusion reaction immediately and upto one week (delayed transfusion reaction may occur).



2. When repeated transfusions are required for a particular patient, please send fresh sample and requisition form for cross matching every time to avoid interaction with newly formed irregular antibodies.

## SUMMARY

Before prescribing blood or components of blood, to re-emphasize some points,

- 1) The patient with acute blood loss should receive effective resuscitation (IV, fluids, crystalloids, colloids, oxygen etc.) while the need for transfusion is being assessed. These measures are more safer, less expensive and equally effective.
- 2) The patient's haemoglobin value although is important, it should not be the sole deciding factor in starting transfusion. (Other supporting factors like clinical signs and symptoms are equally important).
- 3) The clinician should be aware of the risks of transfusion transmissible diseases in the blood products.
- 4) Transfusion of only required components for individual patient should be considered.
- 5) Transfusion should be prescribed only when the benefits to the patient are likely to outweigh the risks (1).
- 6) The reason for transfusion should be clear and recorded accordingly.(1)
- 7) A trained person should monitor the patient to see and respond if any adverse reaction occur.(1)

Active collaboration between the Blood Transfusion Services and Clinicians throughout the management of patients who may require transfusion is very important for better outcome regarding patient's benefit.

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