Guidelines for Handling Blood and Blood Components

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Essentials for Transfusion

- Transfusion should only be used when the benefits outweigh the risks and there are no appropriate alternatives.
- The results of laboratory tests are not the sole deciding factor for transfusion.
- Transfusion decisions should be based on clinical assessment based on evidence-based clinical guidelines.
- Not all anaemic patients need a transfusion (there is no universal 'transfusion trigger').
- Discuss the risks, benefits and alternatives to transfusion with the patient and take their consent.
- The reason for transfusion should be documented in the patient's clinical record.
- Timely provision of blood component support in major haemorrhages can improve outcomes – good communication and teamwork are essential.
- Failure to check patient identity can be fatal.

"Blood and blood products are categorised as drugs under the Drugs and Cosmetics Act, Government of India and hence the processing, issue and transfusion should be in compliance with the rules therein"

CONTENT

1. REQUISITION FOR BLOOD AND BLOOD COMPONENTS

Pre-transfusion Sample collection

A. Patient Identification:

- Even if you know your patient, check your patient's identification on the patient file to make sure it is correct.

B. Sample:

- If blood is required for any patient, a 3-5 ml sample in an EDTA vial should be sent. Smaller blood volume may be sent for neonates requiring transfusions.
- From neonates (age < 4 months) send EDTA samples of the mother and newborn
- For double volume exchange transfusion (DVET), send 3 ml mother's sample along with a neonatal EDTA sample is required.
- In case the mother is not available, please mention the same on the request form.
- After drawing the sample(s), label the tubes before leaving the patient.
- Labelling samples away from the patient greatly increases the risk of mislabelling.
- Document in the file that you have drawn the blood sample.
- Never sign for anyone else's work!

"Errors in sample labelling and patient identification are the leading cause of Acute Hemolytic Transfusion Reactions – a potentially fatal complication of transfusions."

Instructions for Requisition

a. The requisition form should be filled properly with clinical diagnosis, indication for transfusion, pre-transfusion Hb. (platelet count, APTT/PT in case of blood components), time and date of sending as well as when transfusion is scheduled.

b. The nurse and doctor's signature along with full name and designation should be clearly written.

c. In case there is a history of previous transfusion, mention the blood group on the form and the unit numbers of blood transfused before.

d. Tick the appropriate option for compatibility testing whether routine cross-matching including AHG testing is required or an urgent cross-matching including immediate spin cross-matching.

e. All samples for routine compatibility testing should be sent 24 hours in advance and for rare blood groups please communicate with the blood bank resident at least 48 hours prior to the planned surgery.

f. For all routine cases, blood donation cards are to be sent along with the requisition form. In case no donors are available, please inform us well in advance.

g. Only cases where transfusion is required immediately should be marked "URGENT" or "IMMEDIATE".

Process flow from Transfusion Requestion till the issue of blood

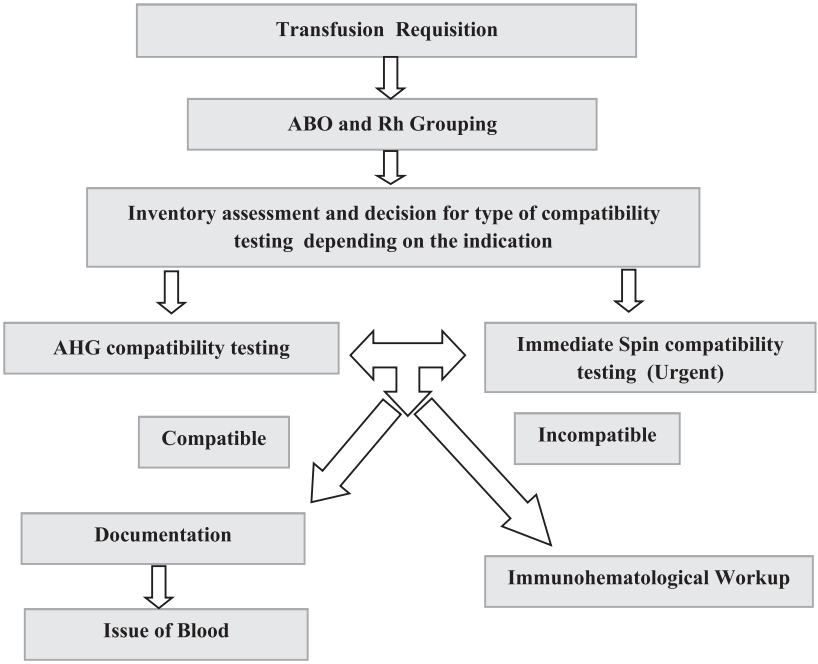


Table 1: AHG compatibility testing (routine) vs Immediate spin compatibility testing (Urgent)

AHG compatibility testing (Routine)	Immediate spin cross-matching (Urgent)
Designed to detect compatibility of *IgM type and IgG type* of antibodies in patient's serum against antigen on donor's red cells in saline and AHG Phase testing.	Designed to detect compatibility of *IgM type* of antibodies in patient's serum against antigen on donor's red cells in saline phase i.e., ABO compatibility testing
AHG testing detects anti-D, -C, -E, -c, -e, -K, -Jk, -Fy, -S, -s, - Le^a and Le^b hence most of the clinically significant antibodies are detected.	Also detect anti-A/B, -Le^a , - Le^b, -I, -P1, -M and N but not some other clinically significant antibodies.

2. INFORMED CONSENT

- The patient/guardian (in the case of a child) should be informed about his/her need for blood, alternatives available, as well as risks involved in transfusion and non-transfusion.
- His/ her written consent should be taken in the language he/she understands best only after providing information.
- For minors and unconscious patients, the legal guardian should sign the informed consent.

Guidelines for the person obtaining consent:

a) Describe the blood product to be transfused.

b) Inform the patient or alternate decision maker of the material risks and benefits of the transfusion and any alternatives.

c) Give the patient the opportunity to ask questions.

d) The document that consent was obtained by completing a transfusion consent form.

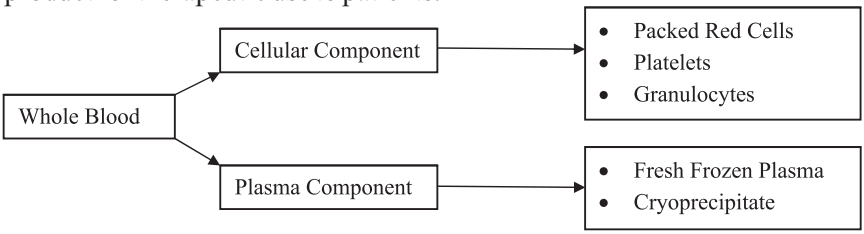
e) Clearly document the reason for transfusion in the patient's chart.

f) Whenever possible, consent for transfusion should be discussed early enough to allow for blood alternatives to be considered

Reference standards issued by the Blood Safety Division, National AIDS Control Organization Ministry of Health and Family Welfare Government of India

3. TYPE OF BLOOD COMPONENTS

Whole blood is an essential source of therapeutic products, having both cellular and protein components, with humans as their exclusive source. The sources of these products have a special interest as products of autologous origin (self) offer a greater safety index than an allogenic product for therapeutic use to patients.



With advancements in types of blood bags and component preparation techniques, whole blood from a single blood donor can be divided into three or four blood components preserving the function of the individual component by storing them at the desired temperature and issuing specific components as per patient's need. Following are the types of blood Products available in the Department of Transfusion Medicine.

- Whole Blood (WB)
- Packed Red blood cells (PRBC) in CPDA-1
- SAGM-PRBC (Packed Red Cells in additive solution)
- Paediatric PRBC units (Volume 80-100ml)*
- Random Platelet Concentrate (RD-PC)
- Fresh Frozen Plasma (FFP)
- Cryo-poor Plasma (CPP)
- Cryoprecipitates (Cryo)
- Apheresis Platelets (SDAP)
- Granulocyte concentrates

* Paediatric PRBC units are prepared by dividing adult PRBC units into three parts using sterile connecting devices and transfer bags.

Description of each component about its volume, content, storage conditions, indications, their administration guidelines are given in Tables 1, 2 and 3.

Table 1: Specification for Red Blood Cell component of whole blood

Parameter	Whole Blood (WB)	PRBC (CPDA-1)	PRBC-SAGM
Description	Whole blood collected from blood donor in CPDA-1 Solution	Red blood cell concentrate from which most of plasma has been removed	Red cell concentrate from which major part of the plasma and the buffy coat layer has been removed with subsequent addition of a nutrient Solution (SAGM).
Volume	399 ml (350 + 49 ml CPDA-1); 513 ml (450 + 63 ml CPDA-1)	200 to 300 ml	250 to 350 ml
Hemoglobin	12 g /100ml	20 g/ 100 ml (≥45g /bag)	≥45g /bag
Haematocrit	30-40%	65-75%	55-65%
Storage Condition	+2 to +6°C in approved blood bank refrigerator, with fitted temperature chart and alarm		
Shelf Life	35 days	35 days	42 days
Indications	▪ Red cell replacement in acute blood loss ▪ Exchange transfusion* ▪ Patient needing red cell transfusions where PRBCs are not available	▪ Replacement of red cells in anaemic patients ▪ In acute blood loss along with crystalloids and colloids	▪ Replacement of red cells in anaemic patients ▪ Patients who have experienced febrile reactions to previous red cell transfusion.
Administration	▪ Transfuse using standard blood transfusion set with 170µm filter. ▪ Transfusion should be started within 30 minutes of issue. ▪ Complete transfusion within 4 hours of commencement ▪ (*) Reconstituted whole blood use is recommended.		

Table 2: Specification for Platelet component of whole blood

Parameter	Platelet Concentrates (PC)	Apheresis Platelets (SDAP)
Description	Platelet concentrates are prepared from either 350 ml or 450 ml of whole blood. They are also called Random donor platelets (RDP)	Platelet concentrate derived from blood donor using an apheresis machine and disposable kit. It is also called single donor apheresis platelets (SDAP)
Volume	50 to 90 ml	200-300ml
Platelet Content	3.5 to 4.5 X 10^{10} /unit	3 to 7 X 10^{11} /unit
Dosage	One unit of platelet concentrate/10 kg body weight: 60 or 70 kg adult needs 4–6 RDP	One pack of platelet concentrate collected from a single donor by apheresis is usually equivalent to one adult therapeutic dose
Storage and Shelf Life	5 days at 20°C to 24°C (with agitation)	5 days at 20°C to 24°C (with agitation)
Indications	▪ Thrombocytopenia ▪ Platelet function defects ▪ Prevention of bleeding due to thrombocytopenia, such as in bone marrow failure	▪ Same as for RDPs ▪ Patients experiencing frequent febrile reactions with platelet concentrate ▪ SDAP should be considered when more RDPs are required
Administration	▪ Transfuse using standard blood transfusion set with 170µm filter. ▪ Initiate transfusion slowly for first 15 minutes unless massive blood loss.	▪ Same as Random donor platelets, but ▪ ABO compatibility is more important as plasma volume is large
Do not store at 2°C to 6°C in Refrigerators as it makes them non-functional **Caution:** Platelets are prone to develop bacterial contamination; Transfusion should be started immediately after receiving the units in the ward and should be completed over a period of about 30 minutes. **There is no need to warm any unit issued from blood bank.**		

Table 3: Specification for Plasma component of whole blood

Parameter	Fresh Frozen Plasma (FFP)	Cryoprecipitate
Description	Plasma separated from one whole blood donation within 6 hours of collection and then rapidly frozen to –30°C to -80°C	Prepared from fresh frozen plasma by collecting the precipitate formed during controlled thawing at +4°C.
Volume	150–220 ml	15 to 20 ml
Content	▪ Contains normal plasma levels of stable clotting factors, albumin and immunoglobulins. ▪ Factor VIII level at least 70% of normal fresh plasma levels.	▪ Factor VIII: 80–100 IU/ bag; ▪ Fibrinogen: 150–300 mg/bag
Dosage	Initial dose of 15 ml/kg	1 bag / 10 kg body weight
Storage and Shelf Life	At –30°C to -80°C for up to 1 year; Use preferably within 6 hrs after thawing at 37°C	
Indications	Replacement of multiple coagulation factor deficiencies: e.g. ▪ Liver disease ▪ Warfarin (anticoagulant) overdose ▪ Depletion of coagulation factors in patient receiving large volume transfusions ▪ Disseminated intravascular coagulation (DIC) ▪ Thrombotic thrombocytopenic purpura (TTP)	▪ As an alternative to Factor VIII concentrate in the treatment of inherited deficiencies of: • von Willebrand Factor (von Willebrand's disease) • Factor VIII (haemophilia A) ▪ Factor XIII ▪ As a source of fibrinogen in acquired coagulopathies: e.g. disseminated intravascular coagulation (DIC)
Administration	▪ Must normally be ABO compatible to avoid risk of haemolysis in recipient. ▪ Infuse using a standard blood administration set (with 170µm filter) as soon as possible after thawing. ▪ Labile coagulation factors rapidly degrade; use within 6 hours of thawing	▪ Can be transfused across ABO barrier. ▪ After thawing, infuse as soon as possible through a standard blood administration set. ▪ Must be infused within 6 hours of thawing.

1. PRODUCT MODIFICATIONS

A. Leukoreduction

Leukoreduction (LR) is a technical term for the removal of leucocytes (white blood cells) from blood components using special filters. This can be performed during the manufacturing of blood components via pre-storage LR at the time of or soon after collection as well as before transfusion through a special filter through the transfusion set.

The leucocytes present in donated blood play no therapeutic role in transfusion and may be a cause several adverse transfusion reactions. Removal of leucocytes may therefore have a number of potential benefits for transfusion recipients, including:

- Reduced risk of platelet refractoriness
- Reduced risk of febrile non-haemolytic transfusion reactions (FNHTR)
- Reduced risk of CMV transmission
- Reduction in storage lesion effect
- Reduction in the incidence of bacterial contamination of blood components
- Possible reduced risk of transfusion-associated graft vs host disease (TA-GVHD)
- Possible reduction in transfusion-related immunomodulatory (TRIM) effects, including cancer recurrence, mortality, non-transfusion transmitted infection
- Possible reduced risk of transmitting variant Creutzfeldt-Jakob Disease (vCJD)

  Pre-storage LR has been shown majorly to reduce FNHTR. Two mechanisms thought to cause FNHTR are:

  a. Cytokines released into stored components from contaminating white blood cells;
  b. The reaction of recipient antibodies with 'foreign' donor white blood cell antigens

Therefore removal of white blood cells from blood components by leukoreduction provides a preventive measure against these two possible underlying causes of FNHTR.

B. Washed Unit

Washing of red cells removes unwanted plasma proteins, includingantibodies. Washed red cells are given to patients who require red cells with a low-protein supernatant. There will be some loss of red cells with washing itself. The following groups of patients should receive washed components:

- patients with reactions to transfused plasma proteins (eg, IgA deficiency)
- patients with severe allergic reactions of unknown cause
- patients with severe reactions despite leucocyte depletion
- patients with paroxysmal nocturnal haemoglobinuria who experience reactions despite group-specific leucocyte-depleted fresh red cells.

C. Phenotype matched blood unit

Apart from ABO and Rh, there are 41 more known blood groups are there in red cells (a total of 43 blood group systems). Repeated transfusion makes the recipients more prone to develop alloantibody against various blood groups; therefore, blood group-matched (phenotyped) red cells are transfused. This strategy is *indicated* for patients prone to receive multiple units such as:

- Thalassemias
- Patients on dialysis therapy
- Hematology- Oncology patients

Thalassemia patients should be provided with Rh and Kell blood group-matched units to reduce the risk of alloimmunization (as per the resources available).

Phenotyping (extended blood grouping) can also be performed for platelets, in patients requiring specific antigen-negative components such as platelets in cases of platelet refractiveness due to alloimmunisation.

D. Irradiation

Blood components containing viable lymphocytes upon transfusion are known to cause immunomodulation in the recipients. These viable lymphocytes when transfused to an immunocompromised patient possess a risk of Transfusion-associated graft-versus-host disease (TA-GVHD). Therefore, these blood components may be irradiated to prevent the proliferation of T-lymphocytes and prevent the risk of TA-GVHD.

- The minimum dose achieved in the irradiation field should be 25 Gy with no part receiving greater than 50 Gy. Red cells may be irradiated at any time up to 28 days after collection, and thereafter stored for a further 28 days from irradiation. Gamma irradiation of red cells may also increase the level of extracellular potassium. The clinical significance of this potassium load depends on both the speed and volume of the transfusion, as well as the age of the blood. It is therefore recommended to transfuse PRBC as soon as possible after irradiation.

- Platelets can be irradiated at any stage in their 5-day storage and thereafter can be stored up to their normal shelf life of five days after collection.

- Granulocytes for all recipients should be irradiated as soon as possible after collection.

5. BLOOD REQUEST IN AN EXTREME EMERGENCY (Life-threatening bleed)

A. Group-Specific Uncrossmatched Blood

When the pre-transfusion sample is available, group-specific uncross-matched blood can be issued within 15 minutes after the blood grouping of the patient.

B. Emergency O Rh (D) Negative Uncrossmatched Blood

In Extreme emergencies, when there is no time to obtain and test a sample, "O Negative PRBC" can be issued within minutes. If O Negative is not available then O Positive PRBC can be issued.

(Only after consent from the clinician as a life-saving measure)

On these occasions, the requesting clinician must take full responsibility for the use of uncrossmatched blood, which carries a significant risk of severe transfusion reaction and should therefore be restricted to life-threatening emergencies. The reason must be documented in the medical record.

6. SINGLE DONOR APHERESIS PLATELETS (SDAP): Requisition Guidelines

Requisition for SDAP :

- The requisition should be sent to the Department of Transfusion Medicine on the requisition form (yellow) for blood components.
- Send 2 ml EDTA sample of the patient along with requisition form and indication for transfusion with platelet count mentioned on the form with signature, name of requesting clinician.
- Send 3-4 healthy donors having the **same blood group as that of the patient** along with the requisition since these products are not available and are made only on demand.

General SDAP Donors Selection Criteria :

- The donors should be in good health, physically fit and mentally alert.
- The donor should be 18-60 years of age.
- The donor should be of the same blood group.
- The donor should not be first-degree relative to the patient,
- The donor should be more than 60 kg of weight,
- The donor should have Hb of more than 12.5 g/dl.
- The donor should have a platelet count $\geq 1.5 \times 10^3/\mu l$.
- The donor should not have taken NSAIDs/ Antibiotics in the last 72 hrs.

The time involved in the SDAP Procedure- 2 to 3 hours (on average)

Storage- Recommended Storage temperature for SDAP is 20-24oC in a platelet incubator and agitator.

Shelf Life- 5 days

All platelet products (SDAP/RDP) should be transfused as and when they are issued and received by patient bedside after proper identification of patient.

7. BLOOD GROUP COMPATIBILITY FOR BLOOD COMPONENTS

Blood Components should always be ABO and Rh matched but in cases of non-availability group specific blood component next compatible available group component can be safely transfused as shown in Table 4.

Table 4: Compatibility charts for blood components transfusion

Patients Blood Group	Compatible donor blood groups			
	Packed Red Blood Cells	Platelets	Plasma	Cryoprecipitate
O Positive	O Positive O Negative	Rh positives/ negatives; O preferred	Any group	Any group
O Negative	O Negative	Rh negatives; O preferred	Any group	Any group
A Positive	A Positive A Negative O Positive O Negative	Rh positives/ negatives; A preferred	A, AB	Any group
A Negative	A Negative O Negative	Rh negatives; A preferred	A, AB	Any group
B Positive	B Positive B Negative O Positive O Negative	Rh positives/ negatives; B preferred	B, AB	Any group
B Negative	B Negative O Negative	Rh negatives; B preferred	B, AB	Any group
AB Positive	Any group; Positive/Negative	Rh positives/ negatives; AB preferred	AB	Any group
AB Negative	Any group; Negative	Rh negatives; AB preferred	AB	Any group

Note: Whole blood is always transfused blood group specific.

8. PREPARING THE PATIENTS FOR TRANSFUSION

- Find out if your patient has had any problems or reactions with previous transfusions. If so premedication may be required.

Table 5: Pre-medications

Indication	Premedication
History of repeated allergic reactions	Antihistamine and/or Steroid
History of repeated febrile reactions	Antipyretic

- Blood components can be transfused through most peripheral or central venous catheters, although the flow rate is reduced by narrow lumen catheters and long peripherally inserted central catheters (PICC lines).

Table 6: IV access and rate of infusion of various blood components

Blood Product	Rate of Infusion	IV Access
PRBC	Rapid transfusion (Adults)	16 to 18 G (Gauge)
PRBC	Routine transfusion (Adults)	20 to 22 G
Other Components		Any Size
Pediatrics		22 to 25 G

- Blood and blood components should be transfused through an administration set with a 170–200 μm integral mesh filter.
- Paediatric administration sets with a smaller prime volume are available for small-volume transfusions.
- Although special platelet administration sets are available, it is safe to use a standard blood administration set, ***but platelets should not be transfused through a set previously used for red cells as some platelet loss will occur.***
- It is not necessary to prime or flush blood administration sets with physiological (0.9%) saline but a new administration set should be used if blood components are followed by another infusion fluid.

- Transfusing rapidly and under pressure through too small an IV access can cause hemolysis of red blood cells.
- Blood products must not come in contact with medications or incompatible solutions (e.g. 5% Dextrose, hydroxyethyl starch, Ringer Lactate).
- When transfusing through a central line with multiple lumens, medications/solutions can be infused through other lumens without damaging the blood product. IV pumps, blood warmers, and rapid infusers must be suitable for transfusion and do not damage the blood product. Do not use devices that have not been approved for use with blood products.

Table 7: Blood component administration to adults (doses and transfusion rates are for guidance only and depend on clinical indication) (based on BCSH *Guideline on the Administration of Blood Components*, 2009)

Blood Components	Administration of Blood & Blood Components
Packed Red Blood Cell (PRBC)	Transfusions must be completed within 4 hours of removal from controlled temperature storage.
	Many patients can be safely transfused over 90–120 minutes per unit.
	A dose of 4 mL/kg raises Hb concentration by approximately 10 g/L. Note: *The common belief that one red cell pack = 10 g/L increment only applies to patients around 70 kg weight; the risk of transfusion-associated circulatory overload (TACO) is reduced by careful pre-transfusion clinical assessment and use of single-unit transfusions, or prescription in millilitres, for elderly or small, frail adults where appropriate.*
	During major haemorrhage, very rapid transfusion (each unit over 5–10 minutes) may be required.
Platelets	One adult therapeutic dose (ATD) (pool of four units of RDPs or single-donor apheresis unit) typically raises the platelet count by 20–40×10^9/L.
	Usually transfused over 30–60 minutes per ATD.
	Platelets should not be transfused through a giving-set already used for other blood components.
	Start transfusion as soon as possible after component arrives in the clinical area.
Fresh Frozen Plasma (FFP)	Dose typically 12–15 mL/kg, determined by clinical indication, pre-transfusion and post-transfusion coagulation tests and clinical response.
	Infusion rate typically 10–20 mL/kg/hour, although more rapid transfusion may be appropriate when treating coagulopathy in major haemorrhage.
	Because of the high volumes required to produce a haemostatic benefit, patients receiving FFP must have careful haemodynamic monitoring to prevent TACO.
	FFP should not be used to reverse warfarin (prothrombin complex is a specific and effective antidote
Cryoprecipitate	Typical adult dose is two five-donor pools (ten single-donor units).
	Will raise fibrinogen concentration by approximately 1 g/L in average adult.
	Typically administered at 10–20 mL/kg/hour (30–60 min per five-unit pool).

9. WARMING OF BLOOD

- There is **NO** need for warming of blood in elective transfusion where a unit of blood is transfused over 2 to 4 hours.
- However, warming of blood can be useful when rapid transfusion of components is required, especially in trauma or surgery settings, because the infusion of cold components can cause hypothermia and cardiac complications, increasing morbidity and mortality for the patient.
- Warmed blood is most commonly required in:
  - Large volume rapid transfusions:
- Adults: greater than 50 ml/kg/hour
- Children: greater than 15 ml/kg/hour
  - Transfusions to neonates
  - Exchange transfusion in infants
  - Patients with clinically significant cold agglutinins.
  - Blood warmers may also be used in patients with clinically significant cold antibodies (discuss with a transfusion medicine specialist).

- Blood should **NOT** be warmed by placing it in a microwave, on a heat source, in hot water or by using other devices not specifically approved for blood warming.
- Blood should only be warmed in blood warmer. Blood warmers should have a visible thermometer and an audible warning alarm and should be properly maintained.

Blood should NEVER be warmed in a bowl of hot water as this could lead to haemolysis of the red cells which could be life-threatening.

- **USE BLOOD PRODUCTS IMMEDIATELY UNPON ISSUE**
- **IF THERE ARE MULTIPLE PRODUCTS ISSUE ONE BY ONE**
- **NEVER KEEP BLOOD PRODUCTS IN WARD REFRIGERATOR**
- **NEVER USE/ REUSE BLOOD PRODUCTS AFTER 4 HOURS OF ISSUE**

10. FINAL CHECK BEFORE TRANSFUSION

- Visually check the blood unit for clots, unusual colour, and any leaks.
- Completely hemolysed packed red blood cell unit can be recognised by a change in colour from red to black. In case of any doubt, you can get blood units checked by the Dept. of Transfusion Medicine staff before transfusion.
- Check the expiration date on the blood bag label.
- Check the transfusion order and verify that consent was obtained.

Patient and blood unit identity Check

- Ask the patient to identify himself/herself by family name. If the patient is unconscious, ask a relative or a second member of staff to state the patient's identity.
- Check that the following details on the compatibility label attached to the blood bag exactly match the details on the patient's file:
  a. Patient's family name and given name
  b. Patient's central registration number (CR NO.)
  c. Patient's ward or operating room
  d. Patient's blood group.
- Check that there are no discrepancies between the ABO and RhD groups on:
  a. Blood bag Label (front label)
  b. Compatibility label (back label) and compatibility report.
- Check that there are no discrepancies between the donation number on:
  a. Blood bag
  b. Compatibility label and report.

If you find any discrepancy do not proceed.
Contact the Dept. of Transfusion Medicine immediately

ALERT: Checking blood immediately prior to the transfusion is the LAST opportunity to catch any errors.

11. TRANSFUSING THE THALASSEMIAS

- Goals of Blood Transfusion Therapy
  - Appropriate goals of transfusion therapy and optimal safety of transfused blood are the *key concepts* in the protocol for routine administration of red blood cells to patients with thalassaemia. The major goals are:
- Maintenance of red cell viability
- Function during storage, to ensure sufficient transport of oxygen
- Achievement of appropriate haemoglobin level
- Avoidance of adverse reactions, including the transmission of infectious agents.

- Thalassemics are a special group of patients requiring routine transfusion therapy from our department. Transfusion becomes their mainstay of treatment for a very long period of time. Chronic transfusion therapy is always associated with adverse transfusion reactions. This usually can be FNHTR (most common) to transfusion-transmitted infections or alloimmunization to various blood groups.

- Leukoreduction (LR) of the blood components transfused to these patients plays an important role in reducing the incidence of FNHTR.

- Antibody (against rare blood groups) and autoantibody screening is a routine parts of their management. Twice yearly screening is executed by the department as well as when a transfusion reaction is suspected.

12. TRANSFUSING THE NEONATES

Neonates are defined as infants up to 28 days after birth. Most neonatal transfusions are carried out in low birth weight preterm infants treated in neonatal intensive care units (NICUs).

- **Neonatal Red Cell Exchange Transfusion**
  - Neonatal red cell exchange transfusion is mainly used in the treatment of severe hyperbilirubinaemia or anaemia in babies with HDFN. It removes antibody-coated neonatal red cells and reduces the level of plasma unconjugated bilirubin (the cause of bilirubin encephalopathy).
  - A 'double volume exchange' (160–200 mL/kg) removes around 90% of neonatal red cells and 50% of bilirubin.

Table 8: Choice of blood group of PRBC for Exchange Transfusion

Baby's Blood Group	Mother's Blood Group	Choice of PRBC	
		1st Choice	2nd Choice
O	O	O	-
	A	O	-
	B	O	-
	AB	O	-
A	O	O	-
	A	A	O
	B	O	-
	AB	A	O
B	O	O	-
	A	O	-
	B	B	O
	AB	B	O
AB	O	O	-
	A	A	O
	B	B	O
	AB	AB	A,B,O
Rh Positive	Rh Negative	Rh Negative	
	Rh Positive	Rh Positive	
Rh Negative	Rh Positive/ Negative	Rh Negative	

13. BEFORE STARTING BLOOD:

- **Record baseline vital signs and assessment before starting each unit**:
  1. Temperature
  2. Blood pressure
  3. Pulse
  4. Respiration
  5. Oxygen saturation if available

- **AFTER STARTING BLOOD:**

1. For the first 15 minutes:

a) Start initially with a slow rate (2 ml/min) unless the transfusion is extremely urgent.

b) Monitor your patient closely.

2. After the first 15 minutes:

a) Reassess your patient and repeat vital signs.

b) Increase flow to the prescribed rate, if no reaction is observed.

3. Monitoring The Transfused Patient

a) For each unit of blood transfused, monitor the patient:

i. Before starting the transfusion
ii. As soon as the transfusion is started
iii. 15 minutes after starting the transfusion
iv. At least every hour during the transfusion
v. On completion of the transfusion
vi. 4 hours after completing the transfusion.

b) At each of these stages, record the following information on the patient's chart:

i. Patient's general appearance
ii. Temperature; Pulse Rate
iii. Blood pressure; Respiratory rate
iv. Fluid balance:
    i. Oral and IV fluid intake
    ii. Urinary output.

When possible, instruct your patient to notify you if they experience:

i. Hives or itching.

ii. Feeling feverish or chills.

iii. Difficulty breathing.

iv. Back pain or pain at the infusion site.

v. Is any feeling different from usual

Table 9: Suggested Adult Flow Rate in Nonemergency Settings

Component	First 15 minutes	After 15 minutes	Special Considerations
Red Blood Cells (RBCs)	1-2 mL/min (60-120 mL/hour)	As rapidly as tolerated; approximately 4 mL/ min or 240 mL/hour	Infusion should not exceed 4 hours For patients at risk of fluid overload, adjust flow rate to 1 mL/kg/hour
Platelets	2-5 mL/min (120-300 mL/hour) during the first 5 minutes	300 mL/hour or as tolerated (after the first 5 minutes)	Generally given over 1 hour
Plasma	2-5 mL/min (120-300 mL/hour) during the first 5 minutes	As rapidly as tolerated (after the first 5 min); apprtely300 mL/hr	Thaw time may be needed before issue
Granulocytes	1-2 mL/min (60-120 mL/hour)	120-150 mL/hr or as tolerated	Over approximately 2 hours Infuse as soon as possible after collection/ release of product; irradiated
Cryoprecipitate / AHF	As rapidly as tolerated		Infuse as soon as possible after thawing; pooling is Preferred

14. Transfusion reactions

- **Recognizing acute transfusion reactions**

  Acute reactions usually occur during or up to 24 hours following the end of a transfusion.

Table 10: Immediate and Delayed Non-infectious Transfusion Reaction Effects

Immediate	Delayed
Immune	
Immediate Hemolytic Transfusion Reactions	Delayed Hemolytic Transfusion Reaction
Febrile Non Hemolytic Transfusion Reaction	Alloimmunization
Allergic Reaction	Post-Transfusion Purpura
Anaphylaxis And Anaphylactoid Reactions	Transfusion- Associated Graft-Versus-Host Disease
Transfusion-Related Acute Lung Injury	Immunosuppression
Non-Immune	
Bacterial Contamination	Iron Overload
Transfusion Associated Circulatory Overload	Air Embolism
Physical Or Chemical RBC Damage Depletion And Dilution Of Coagulation Factors And Platelets	

Table 11: Signs And Symptoms of Immediate Transfusion reactions

Type Of Reaction	Clinical Signs & Symptoms
Hemolytic Transfusion Reaction	Fever/Chills, Hypotension/Tachycardia, Cola Coloured Urine, Nausea, Vomiting, Pain In Flanks/Back/Abdomen/Chest Etc.
Bacterial Contamination	Fever, Chills, Hypotension, Nausea, Vomiting, Dyspnoea And Diarrhoea.
Transfusion Related Acute Lung Injury (TRALI)	Dyspnoea Or Cyanosis, Fever, Tachycardia, Hypotension
Febrile Non Hemolytic Transfusion Reaction (FNHTR)	Fever, Chills, Rigors, Cold, Headache, Nausea, Vomiting
Allergic/Anaphylactic Reaction	Pruritis, Urticaria, Flushing, Angioedema, Hoarseness, Stridor, Wheezing, Chest Tightness, Dyspnoea, Cyanosis, Anxiety, Nausea, Vomiting, Abdominal Cramps And Diarrhoea

Signs and symptoms of various acute transfusion reactions often overlap; hence, complete workup is necessary.

15. TRANSFUSION REACTION MANAGEMENT AND INVESTIGATION

- **Transfusion reaction management**:
  a) Stop the transfusion immediately.
  b) Maintain IV access for treatment if necessary but do not flush the blood tubing
  c) Check vital signs
  d) Take necessary resuscitative measures to stabilize the patient.
  e) Verify that the patient ID matches the compatibility label and compatibility report.
  f) Verify that the blood unit number matches the compatibility label and report
  g) Notify the physician but remain with the patient.
  h) Notify the Dept. of Transfusion Medicine of the reaction.

- **Send the following to the Department of Transfusion Medicine:**
  a) Blood bag with BT set
  b) Post transfusion samples
     a. 2 ml EDTA sample.
     b. 3 ml plain vial sample.
  c) Completely filled and signed reaction form indicating signs / symptoms of reactions)
  d) In case of suspected bacterial contamination: Send cultures both from the patient as well as the blood bag at the bedside immediately.
- **The following investigation should be done**: as per symptoms in a transfusion reaction.
  a) Complete hemogram
  b) Plasma hemoglobin
  c) Coagulation profile
  d) Bilirubin (Unconjugated/conjugated)
  e) Urea; Creatinine
  f) Serum electrolytes

g) Next voided urine for hemoglobin testing:

h) Monitor urine output if hemolysis suspected

i) Chest X-Ray if patient has new respiratory symptoms

j) Blood cultures from the patient:

   a. Drawn from a different vein

   b. Antibiotics should be started immediately if bacterial sepsis suspected.

- **Laboratory Investigation of Hemolytic Transfusion Reactions**

a) First-tier investigation

a. Post transfusion Direct Antiglobulin Test

b. Confirmation Of Pre & Post transfusion ABO/Rh

c. Pre- And Post transfusion Antibody Screen

d. Crossmatch With Pre- And Post reaction Specimens

b) Second-tier investigation

a. Antibody identification panels on pre- and post reaction samples

b. Enhanced antibody screening method: PEG, extended incubation, gel, enzymes

c. Red cell eluate on pre- and post reaction samples

d. Investigation of transfusion technique and blood storage conditions

e. Check of the blood bag, tubing, and segments for hemolysis

f. Enhanced crossmatches: PEG, enzymes

g. Minor crossmatches of implicated units

h. Antibody detection tests on donor units

i. Tests for polyagglutination

j. DAT on donor units

16. RECORDING THE TRANSFUSION / DOCUMENTATION

- Before administering blood products, it is important to write the reason for transfusion in the patient's case-notes in case as well as the transfusion monitoring sheet provided by the blood bank.
- The record you make in the patient's case-notes is your best protection if there is any medico-legal challenge later on.
- The following information should be recorded in the patient's notes.

a) Whether the patient and/or relatives have been informed about the proposed transfusion treatment.

b) The reason for transfusion.

c) Signature of the prescribing clinician.

d) Pre-transfusion checks of:

i. Patient's identity

ii. Blood pack

iii. Compatibility label

iv. Signature of the person performing the pre-transfusion identity check.

e) The transfusion:

i. Type and volume of each product transfused

ii. The unique donation number of each unit transfused

iii. The blood group of each unit transfused

iv. Time at which the transfusion of each unit commenced

v. Signature of the person administering the blood component

vi. Monitoring of the patient before, during and after the transfusion.

f) Any transfusion reactions.

17. Discard of Blood Components

a. Blood bags after completion of transfusion (or incompletely transfused bag), along with the BT set should be discarded in a Yellow Bio-Medical Waste bag.

18. Hemovigilance

- This is a set of **surveillance procedures**, from the collection of blood and its components to the follow-up of recipients to collect and assess information **on unexpected or undesirable effects resulting from the therapeutic use of labile blood products** and **to prevent their occurrence or recurrence.**

- The National Hemovigilance program of India was launched in December 2012 by the National Institute of biological (NIB), Noida, Ministry of health and family welfare Govt. of India.

- The major aim of the program is to track adverse events related to blood transfusion and help to identify trends and recommend best practices and interventions required to improve blood safety in the country.

- Department of Transfusion Medicine, Post Graduate Institute of Child Health (PGICH), Noida is actively participating in the program. All clinical colleagues are requested to kindly participate in the program by reporting all transfusion reactions related to blood transfusion so as to increase transfusion safety in our institute and in our country.

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