

**BLOOD TRANSFUSION
MANUAL**

**Department of Transfusion Medicine
SGPGIMS, Lucknow**

The Role of Blood Transfusion Service of SGPGI:

The blood transfusion service is committed to provide the highest possible standard of service to the patients of this hospital. The main role of the blood center is to provide safe and timely blood and blood components to the patients and provide accurate results of the tests ordered by various departments.

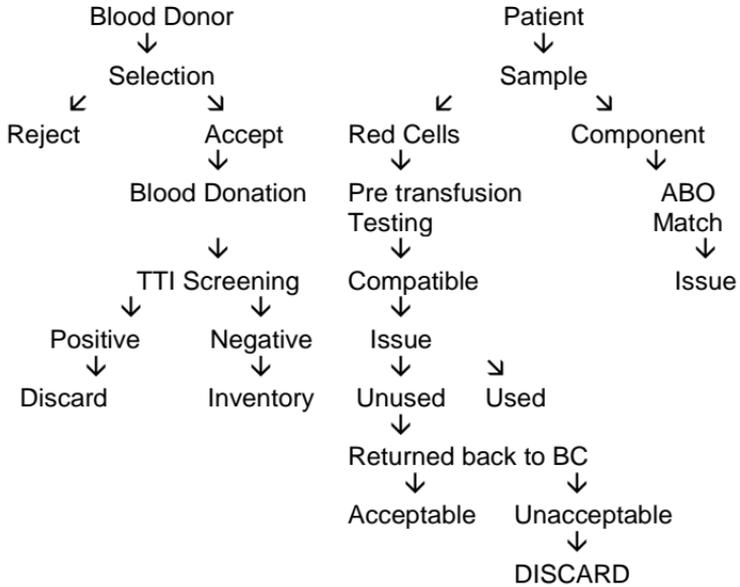
The blood center ensures that there is an adequate inventory of all blood types and blood components to meet the needs of the patients. The blood center does donor selection, blood collection, component preparation, screening for transfusion – transmitted infections and blood processing. Serologically compatible blood and components are provided to the patients after meticulous pre-transfusion testing as per the standard protocol. The Immunohaematology laboratory provides serological investigations for autoimmune disorders, hemolytic disease of newborn and transfusion reactions. In addition, blood center also provides logistical help in cryopreservation of peripheral blood stem cells.

The blood center conducts regular training of Medical Laboratory Technicians and Residents of Transfusion Medicine, Pathology, Microbiology and Clinical Immunology. In keeping with the principles of Good Laboratory Practice and Good Manufacturing Practices, a regular quality control program for components, reagents and equipment is in place in the blood center.

This informative manual on blood transfusion is designed to help the Clinical Residents, Nursing staff and Consultants in arranging blood or component transfusion to the patients in a most efficient manner.

“DONATE BLOOD & SAVE LIFE”

Flow Chart of Functions of Blood Center



SECTION – I

1. Blood and components are provided by the transfusion services to the patients on replacement basis.
2. Generally, requisitions for red cell components will not be accepted without replacement slips attached.
3. In special circumstances, on the request of Clinical Residents, the requisition will be accepted but will be marked "**RELEASE AFTER DONATION**". The blood will be released only after the replacement slips are deposited.
4. While every effort will be made to issue plasma and random donor platelet components without replacement, the blood center may ask for replacement if there is blood shortage.
5. For planned / elective surgeries, blood donation may be made well in advance, at least 24 hrs to three months before the surgery. The patient's relatives should be told to donate required quantity of blood.

Guidelines for referring the donor to Blood Center:

1. Timing of blood donation: 9.00 AM to 5.00 PM from Monday to Friday and 9.00 AM to 1.00 PM on Saturday. Blood donation is closed on Sunday and Gazetted Holidays.
2. Only relatives and friends of the patients will be accepted for blood donation. Paid donation is strictly prohibited and punishable by the law.
3. Certain categories of donors called as Captive donors, such as servants working in a household are not safe donors and therefore should be discouraged.
4. Before referring the blood donor to the blood center, ensure that the donor is in good health and in the age group of 18 to 60 yrs. Detailed medical history and physical examination will be conducted at the blood center. Details of donor selection criteria can be obtained from the Blood Center.

5. Donors can donate blood irrespective of their ABO/Rh groups. Blood group specific compatible blood is provided to the patients on replacement basis.
6. When the donors are sent to blood center for donation, they must be given a paper slip containing the name of the patient and CR number for whom the donation is to be made and the number of units to be collected.
7. After blood donation, donors are given a replacement slip, which should be retained, in the patient file.
8. The replacement slip is valid for three months from the date of donation. It is **“NON-TRANSFERABLE”** which means that it is valid only for the patient for whom the blood is donated. In no circumstances, it will be transferred to other patients as this may bring about malpractice.
9. Hospital staff patients are not exempted from blood replacement.

Referral of Plateletpheresis donors:

1. Single donor apheresis platelets (SDP) are prepared by the use of Cell Separators. SDP are commonly required for the patients who are likely to receive platelets for long time such as BMT recipients or Aplastic Anemia patients on ALG.
2. While every effort will be made to arrange voluntary donors for plateletpheresis, the primary responsibility for arranging donors rests with the Consultant in charge of the case.
3. Timing for Apheresis: 9.00 AM to 4.30 PM from Monday to Friday and 9.30 AM to 1.00 PM on Saturday. Apheresis will not be performed routinely on Sundays and GH.
4. Plateletpheresis Donor Screening
 - ❖ Plateletpheresis donors should be ABO and Rh matched and they are pre-screened for

transfusion transmitted infections before the procedure

- ❖ When donors are referred to the blood center for evaluation, they should bring a consultation form containing the name and CR number of the patient, diagnosis, blood group, weight, height and number of donors to be screened.
- ❖ Relatives and friends of the patient may be sent to the blood center at least 24 hrs before the procedure for evaluation. The Resident in charge of Apheresis will draw the blood sample from the donors for ABO, Rh and TTI screening. The report will be communicated to the clinical Resident and / or Consultant.
- ❖ ABO and Rh matched and TTI screened plateletpheresis donors will be kept reserved for the procedure. Repeat TTI screening is required if the duration between screening and apheresis procedure is more than 30 days as per the law.
- ❖ It will be the responsibility of clinical service resident to ensure that selected donors are available at the time of the procedure.

SECTION – II

REQUISITION FOR BLOOD AND COMPONENTS

1. Open the HIS, click on Health Care, click on tab labeled “Blood Requisition”.
2. All blood requisition must have following information without which requisition will not be accepted.
 - ❖ Name and surname of the patient
 - ❖ CR Number
 - ❖ Location of patient(ward/ bed)
 - ❖ Gender
 - ❖ Age.
 - ❖ Date of admission
 - ❖ Name of the Consultant & Signature of Resident In Charge
 - ❖ Replacement slips
3. Check the appropriate box to indicate what type of component and number of units to be cross-matched.
4. Provide relevant clinical details, such as diagnosis, indication for transfusion, past history of transfusion or reactions, any medications, history of hemolytic disease etc.
5. Check the appropriate box to indicate the priority of the transfusion requirement.

ROUTINE: Blood or component is not required for at least 8 hrs from the requisition is received. In this type, every unit of blood is tested for irregular antibodies with Coomb's test, cold antibodies etc by standard techniques.

URGENT: Blood or component is not required for at least 45 minutes from the time requisition is received. In this type, only Immediate Spin cross match is done which does not rule out irregular antibodies, cold antibodies etc.

IMMEDIATE: Blood is required in less than 30 minutes from the time sample is received. In this type no cross matching is performed, only ABO and Rh matched blood is provided. Therefore, this option should be used with utmost care, as the ordering physician will be responsible for the adverse effects.

6. The person who draws the sample must sign the requisition. Initials are not acceptable. The signature must be legible. The person signing the requisition is attesting that the sample has been drawn from the patient indicated in his / her presence.
7. Attach/ paste required number of donor replacement slips on the requisition form. Please refer to Section I to know how to refer the blood donor to the blood center.
8. Generally, the requisition will not be entertained if the replacement slips are not attached. However, please refer to the Section I to know details of Donor Replacement.
9. If the blood or components need to be irradiated, paste appropriate label "IRRADIATE" on the top of the requisition and check appropriate box on the HIS module for additional charge for the blood component.
10. Although, every blood sample is potentially infectious, special precautions are taken for HIV, HBsAg, or HCV positive samples. Please indicate in bold letters or

use the sticker "BIO-HAZARD" on the top of the requisition form and sample so that persons handling the specimen can take additional precautions.

11. Send the paper print out of the requisition along with blood sample by ward attendant for cross matching. Requisitions sent along with relatives or a friend of the patients is not considered a good laboratory practice and will not be accepted.

Guidelines for samples for blood and components:

1. Only disposable plastic 10 ml vials with screwed caps to be used.

SAMPLE FOR CROSS MATCH **(For Red Cell transfusion only)**

5 ml clotted blood sample is required for cross-match of a unit of red cells in adults. Additional sample is required at 1 ml / additional unit. (e.g. for cross-match of 6 units of blood 10 ml of sample is required.

SAMPLE FOR BLOOD GROUP ONLY

2 ml EDTA blood sample is required for ABO grouping and Rh typing.

The sample must be received in the blood center by 12.30 PM one day before to ensure availability of blood for routine transfusions. For urgent transfusions, sample must reach Blood Center at least 45 minutes before transfusion. In case of immediate transfusion of uncross matched blood, sample must reach Blood Center 30 min before transfusion.

SAMPLE FOR FFP, CRYO OR PLATELET TRANSFUSION

For repeat transfusions of these components, there is no need for any blood sample provided the blood center has record of the blood group of the patient on HIS. For fresh / first time transfusions, 2 ml EDTA sample will be required to determine the blood group.

SAMPLE FOR TRANSFUSION IN NEONATES

Serum of the newborn will have ABO antibodies of mother's origin passively transferred across the placenta. Therefore, cross matching will be performed using mother's sample for neonate till the age of 6 months and blood compatible for both neonates and mother will be issued. 5 ml of clotted sample from mother and 1 ml- clotted sample from the new born will be required

2. Information required on the sample.
 - ❖ Surname and given name of the patient. It should match with the name and surname on the requisition form.
 - ❖ CR number of the patient matching with that on the requisition form
 - ❖ Name of the test to be performed (Grouping, cross matching)
 - ❖ Signature of the phlebotomist
 - ❖ Date of collection of sample
3. Samples from new born should be labeled as "Baby of mother's name" and should be labeled with mother's identification.
4. Samples with requisition in proper packaging may be sent to the blood center along with ward attendant. The samples should not be wrapped in the requisition as it can cause of spillage of blood on the form.
5. Labeling errors
 - ❖ Labeling errors are potentially life threatening and may result in transfusion of mis-matched blood for components.
 - ❖ Significant labeling errors include the followings
 - ***Overwriting not authenticated by signature.***
 - Wrong or no CR on specimen or requisition

- Specimen drawn from the wrong patient, this can be avoided by withdrawing sample at the bed side.
- Name and / or CR number on the specimen not matching with name and / or CR number on requisition.

Note: *The specimen and requisition will not be received by the blood center if these types of labeling errors are found. The Resident and / or Nurse will be informed that a new specimen is required.*

6. Minor labeling errors include the followings

- ❖ Small spelling errors in name or surname of the patient (e.g. Agrawal instead of Agarwal, or Choudhury instead of Chaudhary)
- ❖ No signature of the phlebotomist on the requisition.
- ❖ Abbreviated name or surname of the patient.
- ❖ In such cases, the phlebotomist will go the blood center and correct the error personally. If the phlebotomist is not available, the specimen and requisition will be rejected and fresh sample will be required.

Note: *Cross matched blood units are held for three days from the date of cross-match after which blood units will be taken back into the inventory and fresh requisition with blood specimen will be required and the patient loses the cross matching charges.*

7. Requisition for Fresh Frozen Plasma

- ❖ Fresh frozen plasma is issued ABO group specific only. There is no need for cross match
- ❖ The blood center must have a record of the blood group of the patient on HIS. If the record is not available as in case of fresh admission, a specimen for ABO grouping must be sent along with the requisition.
- ❖ The components are issued in 30 minutes of the receiving requisition.

- ❖ FFP thawed for more than 4 hrs is deficient in labile coagulation factors. Therefore, this product should not be asked in advance and store in refrigerator in the ward.
 - ❖ Further details regarding contents, dose and indications for FFP can be found in Section VI.
 - ❖ **NEVER REFREEZE FFP**
- 8. Requisition for Cryoprecipitate**
- ❖ Cryoprecipitate is issued irrespective of ABO & Rh of the recipient
 - ❖ Rest all procedures and storage are similar to FFP
- 9. Requisition for Platelet Concentrate**
- ❖ The blood center must have a record of ABO group on the HIS before platelets can be issued.
 - ❖ Platelets are issued irrespective of ABO and Rh of the recipient. Therefore, there is no need of blood specimen provided the record of group is already on the HIS.
 - ❖ Platelets are not always available in stock and therefore additional time may be required for TTI screening.
 - ❖ Since platelets need to be kept on agitator and wards do not have proper storage for platelets they should not be ordered in advance. Send the requisition 30 minutes before transfusion is planned.
 - ❖ **NEVER KEEP PLATELETS IN REFRIGERATOR**
 - ❖ Further details regarding contents, dose and indications for platelet transfusion can be found in Section VI.

Guidelines for requisition of blood and components in special circumstances

1. No Replacement Slips

Generally, all requisitions for blood should have replacement slips pasted appropriate for the number of units requested. However, if there are “no donors available for the replacement, the requisition will be signed by the Consultant I/C of the patient”. No such requisition signed by Residents will be entertained. In case of emergency when the Consultant is busy with patient management, the Clinical Resident will discuss the case with him and will state it on the requisition form accordingly.

2. Non Group Specific transfusion:

While every effort is made to cross match ABO group specific blood to the patient, non-ABO group specific blood or component may be issued in cases of emergency due to blood shortages. Contact the blood center in case any clarification is needed.

Compatible blood groups in case on non-ABO group specific transfusion

Patient Group	Permissible donor groups for red cells	Permissible donor groups for FFP
O	O	O, A, B AB
A	A, O	A, AB
B	B, O	B, AB
AB	AB, A, B O	AB
Rh negative	Rh negative	Not applicable
Rh positive	Rh positive, Rh negative	Not applicable

3. Issue of Rh positive blood to Rh negative patients

The incidence of Rh negative in north Indian blood donors is 4.5%. It is therefore not uncommon to face shortages of Rh negative blood. Rh positive blood

can therefore be given to Rh negative patients in emergency. This is based on the following principles:

- ❖ All Rh negative individuals transfused with Rh positive blood do not make antibodies.
- ❖ Rh antibodies are not formed before 48 to 72 hrs of transfusion of a Rh positive blood.
- ❖ Rh antibodies can be detected by a simple test, ICT and Rh antibodies do not cause intravascular hemolysis.

Based on the above principles, Rh positive blood can be given to Rh negative individual in emergency provided following conditions are met.

- ❖ The Transfusion Medicine Resident will contact the Clinical Resident regarding switching over to Rh positive blood transfusion. He will explain the procedure to the Clinical Resident.
- ❖ A 2 ml sample in plain vial is sent to Blood Center for screening for Rh antibodies by ICT.
- ❖ If ICT is negative, the surgery will be planned with transfusion of Rh positive blood. Transfusion of Rh positive blood will be continued for 48 hours as per the need of the patient.
- ❖ After 48 hours, fresh 2 ml sample of the patient in plain vial is obtained to rule out production of Rh antibodies, Rh positive blood can be transfused safely. However, if antibodies are formed (ICT positive), Rh negative blood is to be given. Rh positive transfusion cannot be carried out in any case.

4. Advance cross match of blood before admission of patient:

In special circumstances Blood Center will accept the requisition for blood and components in advance before the patient is admitted. As there will be no CR

number, the requisition may be sent on manual form. The blood center will keep the blood cross matched and ready for issue. Blood will be issued only after the fresh requisition is raised on the computer for accounting purpose after admission of the patient.

SECTION – III

ISSUE OF BLOOD & COMPONENTS:

1. Blood units for routine surgical procedures will be stored in the blood bank refrigerator after cross match. The laboratory attendant from blood center will carry these units to the transfusion laboratory in OT complex on the day of surgery. Blood units will be issued from there as and when required. Remaining unused blood units will be brought back to the blood center.
2. For transfusions in the ward, blood units will be handed over to the Ward attendants only. Relatives or friends of the patients will not be allowed to carry blood units to the ward.
3. Ward Attendant is required to bring a paper slip containing patient name, CR number and type of blood component to be taken.
4. The blood bank personnel will enter the details of the ward attendant carrying the blood units, including number of units issued and time of issue. The ward attendant has to sign in the register before leaving.
5. **Return of unused blood**
 - ❖ If the blood is not to be used for any reasons, return it to blood center immediately so that blood charges (excluding cross matching charges) can be refunded to the patient.
 - ❖ Reaction form need to be sent to the Blood Center along with unused blood.
 - ❖ Only red cell products will be refunded and no refund can be given for platelet or plasma products.
 - ❖ The refund is not possible after the account is closed. Therefore, send unused blood to blood center immediately after the death of patient or before patient is discharged.

- ❖ The red cells units will not be accepted if one of the ports is opened. The blood bag should have the labels attached to it which will help to proper identification of units.

Note: Blood units should not be stored in the refrigerator in the ward. These refrigerators are not specifically designated, monitored, tested and controlled, as are blood bank fridges. Blood should be collected 30 minutes before transfusion is planned

SECTION - IV

ADMINISTRATION OF BLOOD & COMPONENTS:

General Guidelines:

1. Check the blood or components before starting the transfusion. The following must be checked.
 - ❖ Check the physician's order to verify that you have received the required blood or component ordered.
 - ❖ Match ABO and Rh group of the patient with the ABO & Rh group of the blood product label. If there is discrepancy, do not start transfusion. Report to the blood center and Residents in the ward immediately.
 - ❖ Check expiration date, unit number, component label, and special process label such as irradiated.
 - ❖ Check the integrity of the unit by applying light pressure to the unit and examine for any leaks.
 - ❖ Check the bag for presence of clots.
 - ❖ Compare the blood bag number with the number listed on compatibility report
 - ❖ Carefully observe the appearance of the unit.
2. Identification of the Patient:

This is a very important step before starting the transfusion, as misidentification of the patient is the most common cause of mismatched transfusion and prove fatal to the patient

 - ❖ Compare the patient name, CR number and blood group on the blood bag with the patient name and CR number and blood group on the patient file.
 - ❖ If the patient is conscious, confirm the name by having him/her state the name and

- compare it with the name on the compatibility report.
- ❖ Before starting the transfusion, record the time, temperature of the patient, pulse rate and BP on the patient file. This will be helpful to monitor any changes in the vitals during transfusion.
 - ❖ The red cell should not be kept outside if transfusion is delayed. They should be stored at 2 to 4 C.
 - ❖ RED CELLS ARE NEVER STORED IN THE FREEZER COMPARTMENT

Administration of red blood cell components:

1. Ensure the IV line is patent and Gauge of the needle is adequate to transfuse the blood component. Use a standard blood transfusion set with filter.
2. Examine the red cell bag for clots, abnormal dark purple blue color. Red cells will usually be dark red in color. If anything seems abnormal, check with the blood center.
3. Invert the bag several times to ensure re-suspension of red cells. Follow the administration instructions on the blood bag label.
4. Concurrent fluids along with red cell transfusion:
 - ❖ Avoid additions of any type of fluid or drug in to the blood bag.
 - ❖ Only compatible IV solutions, such as isotonic (0.9%) saline may be used along with red cell transfusion.
 - ❖ Do not mix any medication along with red cell unit. Some drugs can cause hemolysis due to their high pH. 5% dextrose can cause agglutination of red blood cells. Lactate ringer solution can result in clotting because of its calcium content. If medication were

added to the blood component it would be difficult to investigate the cause of the transfusion reaction if there is any.

- ❖ Do not mix blood components together, e.g. red cells and platelets before transfusion.
5. Start the transfusion slowly for first 15 minutes and observe the patient. If the clinical status is OK, remaining unit can be transfused as per the indication. However, check the patient frequently for any significant change in the vitals. Record all vital signs on the reaction report sent along with compatibility report.
 6. Change the transfusion set after 2 units of blood.
 7. Red Cell transfusion should be completed within 4 hours of starting. Beyond 4 hours, there is a risk of bacterial contamination.
 8. If the transfusion is uneventful, note down the vitals on reaction report after completing the transfusion and return the Reaction Report to the blood center or keep it in a special folder in the ward to be collected later by the blood center.
 9. If there is any adverse reaction to the transfusions, see "Section V" for action to be initiated.

Note: *If the blood product is not to be used for any reason, do not store in the refrigerator in the ward as these refrigerators are not designated for blood storage. Return the unused blood bags to the blood center immediately. See the procedure for Return of unused blood in Section III.*

10. Discard the empty blood component bag in the **Biohazard Waste Container** in the Ward, unless the patient has suffered an adverse reaction in that case the bag has to be returned to the blood center along with the completely filled reaction form.

Administration of Plasma & Cryoprecipitate:

1. Follow the general guidelines of identification and inspection of blood components as mentioned in red cell administration.
2. Thawed FFP will be clear with color varying from yellow straw to light green to orange. Cryoprecipitate will usually be cloudy.
3. Thawing of plasma components:
 - ❖ Thawing of FFP and Cryo is done at 37° C water bath.
 - ❖ Place the unit in a plastic over wrap so that water in the bath will not contaminate the component.
 - ❖ The ports of the component bag should not come in contact with the water.
 - ❖ Squeeze the component intermittently to ensure rapid thawing.
 - ❖ Generally, thawing of FFP takes 10 to 15 minutes.

Note: *Once thawed, all plasma components should not be frozen. They can be kept at 4° C for not more than 4 hrs.*

4. A standard blood administration set is satisfactory for transfusion of plasma components.
5. Cryoprecipitate:
 - ❖ Cryo can be administered using a 50 ml syringe. After thawing, aspirate all Cryo in a syringe with needle. A significant amount of Cryo will remain attached to the walls of the plastic containers. Injecting 25 ml of isotonic saline in the bag and rinsing it thoroughly can rectify this.

- ❖ Alternatively, Cryo can be pooled together and then administered through standard administration set.
6. Follow rest of the procedure as mentioned in Red Cell administration.
 7. Thawed cryoprecipitate should be store at 4 ° C and used within 4 hours.

Administration of Platelet Products

1. General guidelines for patient identification and component inspection are same as red cell administration.
2. A standard blood administration set can be used for platelet transfusion. After platelets are transfused, it is preferred to rinse entrapped platelets from the filter by flowing 50 ml of isotonic saline through it.
3. ***Transfusion of one unit of random unit of platelets should be completed in 20 minutes due to the risk of bacterial contamination.***
4. Since platelets need to be stored on agitator, indent and collect platelets from blood center just before transfusion.
5. Rest of the procedure is same as for red cell administration.

Note: Platelet products must “NOT” be refrigerated at any state.

Use of Filters for administration of blood and components:

1. Routine blood transfusion sets have a filter with 170µ pore size.
2. Micro-aggregate filters: Micro-aggregate filters have a pore size of 40 micron. They allow rapid transfusion of blood and components at the same time prevent

micro-aggregate from entering the circulation. They are used in cardio pulmonary bypass surgery.

3. **Leukocyte filters:**

Leukocyte filters are used to prevent febrile transfusion reactions and CMV transmission. They are especially useful in multiply transfused patients. Two units of red cells can be transfused using a single filter. The proper selection of the leukocyte filter should be made , depending on the type of component to be transfused.

Warming of blood Products:

1. Generally, there is no need to warm the unit of red cells before transfusion. Keeping the blood unit at room temperature for 30 minutes will be enough in most cases.
2. In special circumstances, such as patients with cold agglutinins in the serum, it is important to pre warm the unit at 37° C before transfusion. Special blood warmers may be used for this purpose. Blood should not be warmed in Dry Incubator in the laboratory. It is important to keep the patient warm during transfusion.
3. Always check for the presence of hemolysis while using a blood warmer.

SECTION – V

TRANSFUSION REACTIONS

1. Types of reactions:

❖ Acute hemolytic transfusion reaction

These reactions are generally due to ABO mismatch. Clerical errors, such as misidentification of the patient, failure to match the ABO type on the blood bag label with the blood group on patient's file are the most common causes. Fever, chills anxiety, loin pain, chest pain and dyspnea soon after transfusion are the presenting symptoms.

❖ Febrile hemolytic reaction

These are the most frequent type of reaction characterized by an increase of 1° C or more in the patient's temperature. These reactions are most commonly seen in multiply transfused patients and follow after platelet transfusion. Cytokines generated during storage of blood components and anti-leucocytes antibodies in the recipient are responsible for these reactions.

❖ Allergic or Urticarial reactions:

They are characterized by development of hives or skin rash following transfusion. They are thought to be due to hypersensitivity reaction to plasma proteins. Rarely, these reactions can lead to anaphylaxis.

❖ Septic reactions

Transfusion of bacterial contaminated blood products can result in a profound shock with high degree fever. They are characterized by high fever, vomiting, diarrhea and severe hypotension. Can be more common with

platelet transfusion , due to its storage temperature.

- ❖ TRALI: Transfusion related acute lung injury

2. Action to be taken in the event of a reaction.

- ❖ **STOP THE TRANSFUSION IMMEDIATELY.** Keep the Intravenous line open with normal saline infusion.
- ❖ Report the event to Resident and Consultant to determine whether the transfusion is to be only temporarily or permanently discontinued.
- ❖ If the transfusion is to be discontinued permanently, preserve the blood bag with administration set removing the needle.
- ❖ Complete the Reaction Report sent along with compatibility form.
- ❖ It is the responsibility of the Clinical resident in charge completely fill all the details in the reaction form such as, vitals of the patients both pre transfusion and post transfusion, time of start of transfusion, presence of fever before transfusion, time of occurrence of reaction, amount of blood transfused, any drug administered during transfusion and signs and symptoms associated with transfusion.
- ❖ Withdraw from the patient from a different site to transfusion 2 ml EDTA blood sample and 5 ml in plain vial; label it with name of the patient, CR number and **POST REACTION SAMPLE.**
- ❖ *The time of withdrawal of sample is important. The post reaction sample should be withdrawn as early as possible and sent to the blood bank for investigation. Delaying may result in loss of important finding which*

may again result in adverse event during transfusion in the patient when transfused.

- ❖ *The blood bag should be sent along with the transfusion set attached.*
- ❖ Open HIS, Click on Investigation of Transfusion Reactions in Transfusion Medicine and fill up the form.
- ❖ Send blood sample, implicated blood unit with administration set and Reaction Report to the blood center immediately for evaluation.
- ❖ After completion of investigation, the blood center Resident will notify the clinical services of the results, offer advice for further transfusion and suggestions for management.

SECTION – VI

BLOOD COMPONENT THERAPY

The goal of transfusion therapy is to correct an abnormality that will not respond to other modes of treatment to provide a patient with life support when safer alternatives are not possible.

Various Component that are available in the Blood Center for clinical use

- ❖ *Oxygen carrying components*
 - Red cell components
 - Leuco-poor red cells
 - Irradiated red cells

- ❖ *Platelet Products:*
 - Single donor platelet concentrate (Apheresis).
 - Random donor platelet concentrate

- ❖ *Plasma Product.*
 - Fresh Frozen Plasma
 - Cryoprecipitate
 - Cryo poor plasma

Broad Indications for Blood Component Usage

Component	YES	NO
Red Blood Cells	To increase oxygen-carrying capacity in anemic patient	<ul style="list-style-type: none"> ❖ For volume expansion ❖ To enhance wound healing ❖ To improve general well being
Platelet	To control or prevent bleed associated with documented deficiencies in platelet number and function	<ul style="list-style-type: none"> ❖ To treat ITP unless there is life-threatening bleeding ❖ TTP
Fresh Frozen Plasma	To increase level of clotting factors in patients with documented deficiency and who are at risk of hemorrhage	<ul style="list-style-type: none"> ❖ For volume expansion ❖ As a nutritional supplement ❖ For prophylaxis during massive blood transfusion ❖ To treat patients with TTP

Packed Red Cell Concentrate (PRBC)

Red Blood cells are the cellular product obtained after centrifugation of whole blood and removal of most of the Plasma. The usual unit of PRBC should raise Hct or Hb by approximately 3% or 1 gm% respectively in an average adult patient and 3 gm% Hb in infants.

Indication of PRBC

RBCs are the component of choice for most patients with symptomatic deficit of oxygen carrying capacity. However, most patients with Hb of 6-7 gm/dl tolerate anemia well and need not be transfused unless there are symptoms of anoxia.

Patient with Hb >10gm/dl almost certainly never require red cell transfusion. Therefore, in any given anemic patient, the aim of transfusion therapy should be to correct the symptoms of the patient rather than correcting the hemoglobin level.

Abuses of PRBC

Red cell transfusion should never be used as empirical transfusion for improving the general well being of the patient, for wound healing or for pre surgical transfusion. Patients with nutritional anemia can be better treated with iron, folic acid or vitamin B₁₂ supplementation.

Modified Red Cell Components

A-Leuco-poor red cell components:

Red blood cells may be modified by removal of buffy coat or filtration by leuco-filters to remove contaminating leucocytes which are responsible for majority of adverse effects associated with transfusion. These leuco-poor products are primarily indicated for patients who receive multiple transfusions such as thalassemics, hemodialysis patients, aplastic anemia and hemato- oncology patients to prevent febrile transfusion reactions to standard products. Leuco-poor products are also helpful in decreasing the transmission of CMV and alloimmunization to HLA antigens. They are also used pregnant women requiring intrauterine transfusions.

B-Irradiated blood products:

In order to minimize the risk of transfusion associated graft versus host disease in susceptible individuals, cellular blood products (PRBC, platelets) should be irradiated to a dose of 25 Gy prior to transfusion. Patient groups who should receive irradiated blood products are as follows:

- ❖ Patients undergoing bone marrow or peripheral blood stem cell transplantation
- ❖ Patients with Hodgkins lymphoma
- ❖ Patients with congenital immunodeficiency syndrome
- ❖ Intra-uterine transfusion

- ❖ Patients receiving directed donations of cellular product

Platelet Concentrate (PC)

There are two types of PC available, random donor PC or single donor PC (apheresis-PC)

1. Random Donor PC:

- ❖ Each unit of PC is currently prepared from a unit of whole blood PC should be stored at 22° C with continuous agitation for up to 5 days.
- ❖ The number of PC to be administered depends on the clinical situation in each patient, such as weight of patient, presence of DIC, sepsis, splenomegaly, alloimmunization etc. The clinical response to platelet transfusion should be monitored by measuring the platelet count post transfusion at **10 min, 1 hr and 24 hr**. Dose of PC to be transfused can be determined by the simple formula that 1 unit of standard PC raises the platelet count by 5000 /ul in adult patient.

2. Single donor PC (Apheresis PC)

- ❖ This component is collected from an individual donor with the help of apheresis machines (cell separators). . A single unit of apheresis PC contains $3-5 \times 10^{11}$ platelets / unit and is suspended in 200 to 300 ml of autologous plasma. Therefore, one unit of apheresis PC is equivalent to approximately 6 units of random donor PC. It is especially useful for patients who are likely to receive long term platelet support such as aplastic anemia or BMT recipients as the number of donor exposures is decreased considerably. One unit of apheresis PC raises the platelet count by 30,000 /ul in adult patient.

Indications:

- ❖ PC are indicated for the prevention (prophylactic) or treatment (therapeutic) of bleeding in patients with decreased platelet count (thrombocytopenia) or defective platelet function or both.
- ❖ Platelet transfusions are not usually effective in patients of ITP.
- ❖ In clinically stable patients with an intact vascular system and normal platelet function, prophylactic platelet transfusions have traditionally been used when the platelet count is less than 20,000/ μ l.
- ❖ Recent studies indicate that the threshold for prophylactic transfusion can be set at 5,000/ μ l in patients without fever or overt bleeding.
- ❖ A patient undergoing surgery or other invasive procedures, in whom thrombocytopenia is unassociated with complicating factors is unlikely to benefit from prophylactic transfusions if the platelet count is higher than 50,000/ μ l.
- ❖ Platelet transfusions may be indicated at higher platelet counts for patients with systemic bleeding and for patients at a higher risk of bleeding because of the presence of complicating factors such as sepsis, platelet dysfunction related to medication or disease process.

Contraindications:

- ❖ Patients with thrombotic thrombocytopenic purpura.
- ❖ Patients with ITP unless there is life threatening bleeding or intracranial hemorrhage.

Fresh Frozen Plasma (FFP)

FFP is indicated in the control or prevention of bleeding in patients with multiple coagulation factor defects. FFP must be thawed at 37 ° C in a water bath with due precautions. FFP should be used as soon as it is thawed to avoid the decay of clotting factors.

Indications for FFP

Each unit of transfused FFP will increase the level of any clotting factors by 2 to 3 % in an average adult. Laboratory tests such as PT and APTT should be done to monitor the FFP use in patients.

- ❖ Broad spectrum coagulation factor deficiency.
- ❖ severe liver disease
- ❖ oral anticoagulant overdose
- ❖ disseminated intravascular coagulation
- ❖ massive transfusion with coagulation problems
- ❖ Thrombotic thrombocytopenic purpura
- ❖ AT III deficiency

Note: Most common abuses of FFP

1. Volume expansion
2. As protein supplements
3. Prolonged bleeding in the absence of coagulation defects.

Cryoprecipitate

Cryoprecipitate is the cold insoluble precipitate having Factor VIII, vWF, fibrinogen and factor XIII as its major constituents. Standards require an average of 80 IU of F VIII in each unit.

Indications:

1. Factor VIII Deficiency (Hemophilia A): The treatment of choice is virus inactivated factor VIII concentrates which is provided by the department for the treatment of hemophilia patients
2. Von Willebrand's Disease
3. Hypofibrinogenemia (<80 mg/dl):
 - ❖ Consumptive coagulopathy (DIC),
 - ❖ Dysfibrinogenemia or Afibrinogenemia.
4. Fibrin Glue for topical hemostasis.

Storage and shelf life of components:

Following table summarizes storage requirements and shelf life of various blood components.

Component	Storage Temp	Shelf life	Compatibility
Packed Red Cells	2 to 6 ° C	42 days	ABO, Rh, Cross-match
Fresh Frozen Plasma	-30 ° C	1 year	ABO
Cryodeficient Plasma	-30 ° C	5 years	ABO
Platelet Concentrate	22 to 24 ° C	5 days	Preferably ABO, but can be given without regard to ABO
Buffy coat	22 ° C	1 day	ABO
Cryoprecipitate	-30 ° C	1 year	Any Group

SECTION VII

BIOSAFETY

1. All blood and blood components are to be considered potentially infectious and Universal Precautions must be observed during handling of blood unit.
2. Discard the empty blood component bag in the Biohazard Waste Container in the Ward, unless the patient has suffered from adverse reaction, then the blood bag has to returned to the blood bank
3. If there is blood spillage, treat it as per the standard guidelines. Disinfect blood spillage with 10% sodium hypochlorite solution. At least 30 minutes should be allowed for hypochlorite solution to act during which spillage is covered with gauze cloth soaked in hypochlorite.
4. All needles should be destroyed in the needle cutter and used syringes are destroyed appropriately before discarding.
5. The sharps and needles should be discarded in a puncture proof container.