ORIGINAL RESEARCH PAPER
VOLUME-6 | ISSUE-6 | JUNE-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"Handling of blood and blood components"

Anaesthesiology

Kanchan Chauhan Professor, Department of Anaesthesia, S.M.S Medical College, Jaipur
Neelam dogra Professor, Department of Anaesthesia, S.M.S Medical College, Jaipur
Girish chouhan dept of general surgery, S.M.S Medical College, Jaipur
Satyanarayan kumhar Third year P.G. student, Department of Anaesthesia, S.M.S Medical College, Jaipur

ABSTRACT

Blood and blood components are most useful tool in operative rooms, wards and intensive care units where healthcare providers come in contacts frequently. Appropriate and adequate knowledge about the transportation, storage and transfusion technique can help to reduce the complication related to blood transfusion. In this article we tried to conclude the various components of blood and handling techniques.

KEYWORDS:

Introduction

- The purpose of this article is to describe simple procedures for the safe storage and transportation of blood & blood components to operating theatre. It also deals with transfusion related issues of blood and blood components.
- Hospitals must have a written policy for the collection of blood components and their delivery to the clinical area where transfusion is to be given.

Recommended procedure

- The policy should define which members of the staff are responsible for this procedure.
- Blood components requiring refrigeration must be stored only in blood storage refrigerators and not in ward or domestic refrigerators.
- Blood components must only be stored or transported as appropriate in boxes designed for this purpose.
- The staff members removing blood components from the storage facility must have documentation containing the patient's identification details and this should be checked before removing the component.
- Staff in the ward or operating theatre must check that the correct blood components have been delivered.
- Ideally only one unit for each patients should be removed at a time from the storage refrigerators unless extremely rapid transfusion of larger quantities of blood is required.

Stages in the movement of blood from collection to transfusion

- Packing and transportation.
- Receipt and handling of incoming, unprocessed blood and plasma derivatives.
- Quarantine policies and procedures.
- Labeling of procedures.
- Method of storage of blood components in available stock.
- Release of blood components for use.
- Procedures or thawing of FFP or cryoprecipitate.
- Procedures for release of platelet concentrate.
- Discarded blood and its safe disposal.
- Monitoring the blood inventory.

SAFE STORAGE OF BLOOD

Whole blood and red cells

- Whole blood and red cells always be stored at a temp.between +2ºC to +6ºC.

If blood is not stored at this temp.then
(1) Its oxygen carrying capacity is greatly reduced.
(2 there is risk of bacterial contamination.

Above +6˚C bacteria that may have inadvertently entered the unit during collectionmay grow to such as extentthat transfusion of this contaminated blood could be fatal.

- Below +2ºC RBCs are very sensitive to freezing. If they are allowed to freeze ,the RBC membranes rupture and haemoglobin is released i.e.cells are haemolysed which can be fatal if transfused .

Storage and transport condition for whole blood and RBCs

Condition	Temp.range	Storage time
Transport of preprocessed blood	+20 ºC to +24 ºC	Less than 6 hrs
Storage of pre-processed or processed blood	+2 ºC to +6 ºC	Approx 35 days
Transport of processed blood	+2 ºC to +10 ºC	Les than24 hrs

ANTICOAGULANT/PRESERVATIVE

- The Anticoagulant/preservative solution in the blood bag contains nutrients for the blood during storage and stops the blood from clotting.
- The RBCs can only carry and deliveroxygen if they remain viable i.e.they retain the same properties as they have during their normalcirculation in the body.
- One of the most common anticoagulant used is CPDA- 1 (Citrate phosphate dextrose adenine), duration 35 days. Dextrose and adenine help the RBC to maintain ATP during storage.
- Citrate is the anticoagulant which prevents clotting

ACD/CPD/CP2D—21 days.

Fresh Frozen Plasma (FFP)

FFP is separated from a unit of whole blood within 6-8 hrs of collection and rapidly frozen and maintained at all time at temp. Of -20ºC or lower. The optimal storage temp. Is -30ºC or lower.

Product	Storage temp.	Max. storage time
FFP	-65 ºC or below	7 yrs
FFP or cryoprecipitate	-40 ºC to -64 ºC	24 months
FFPor cryoprecipitate	-30 ºC to -39 ºC	12 months
FFPor cryoprecipitate	-25˚c to -29˚c	6 months
FFPor cryoprecipitate	-20˚c to -24˚c	3 months

Plasma contains water, electrolytes, clotting factors and other proteins (albumin) most of which are stable at refrigerator temp.i.e. +2ºC to +6ºC.

Factor V and Factor VIII, which are essential in the clotting mechanism, will deteriorate and diminish in quantity if not stored at -20ºCor lower and greatly reduce the clotting activity of plasma.

Cryoprecipitate

Cryoprecipitate is the cold insoluble portion of plasma remaining after FFP has been thawed between +1ºC and +6ºC and is useful for correcting certain coagulation defects.

It contains approx.50% of factor viii and von willebrand factor, 20-40% fibrinogen and some factor Xiii originally present in the fresh plasma.

Plasma is separated from RBC within 6 to 8 hrs of collecting blood. The plasma is frozen solid rapidly within 30 minutes of separation from the cells.

The plasma is then thawed slowly at below+4ºC.The optimal storage temp.is below -30ºC.

Platelet Concentrates

Whole blood should be kept between +20º and + 24ºC until it is processed into platelet concentrates and other components.

Platelet rich plasma mustbe separated from whole blood by centrifugation within 8 hours of phlebotomy. Additional centrifugationand removal of most of the supernatant plasma may then concentrate the platelets.

Platelet concentrate should be stored at temperature between + 20ºC and +24ºC with continuous agitation to maintain their function and viability better. Current plastic bags allow for storage up to 5 days because gaseous exchange takes place between the container and environment which results in maintenance of pH.

Caution

Since platelet concentrates are stored at room temperature, they pose a greater risk for bacterial proliferation. So strict asepsis should be maintained.

Process	Maximum storage time
Storage	5 days
Transport	24 hours
After issue, before transfusion	30 min
Open system and /or for pooled	4 hours

Length of time permitted for storage and transport of platelet concentrate between +20ºC and 24ºC.

Plasma derivatives

Albumin or immunoglobulins are concentrated sterile specific proteins obtained from large pools of donor plasma through a complex pharmaceutical process - Plasma fractionation

Storage of plasma derivatives

Products	Storage	Shelf life	Other
Albumin and plasma protein fraction (liquid)	<+25ºC	3 years	Do not freeze
	+2ºC to +8ºC	5 years	
Immune serum (liquid)	+2ºC to 8ºC	3 years	Do not freeze globulin.use promptly.
Freeze dried factor VIII	+2ºC to 8ºC	2 years	Do not freeze. Use promptly after reconstitution
	<+25º	Upto2 years	
Freeze dried factor IX	+2ºC to +8ºC	1 year	Do not freeze.
	Room temperature	1 month	

Packing of blood and blood components

Red cell components

- Ice should not be allowed to come into direct contact with blood as the RBCs nearest to the ice may freeze and haemolyse.
- The volume of ice should at least equal that of blood.
- The temperature can be considered to be in the +2ºC to +10ºC as long as unmelted ice is still present on arrival at destination.

Plasma

- There should be at least as much wet ice in the cold box as there is plasma.
- Frozen plasma units should be placed in cardboard boxes before freezing to protect the bags from developing small cracks.
- A simple method to determine if plasma units have thawed and refrozen is to place a rubber band around the unit at the time of preparation. Once the unit freezes it leaves an indentation at the sides. If the unit has thawed or thawed and refrozen, no indentation will be there.

Platelets

If outdoor temperature is extremely high, special chemical coolant pouches are available that maintains temperature of +20ºC to +24ºC for up to 12 hrs. Also available are containers with a power source. Platelets should reach their destination within 24 hrs which is the maximum time allowed without agitation.

Transportation

- All products should be appropriately labeled.
- Coolants for cold transport boxes may be purchased from manufacturers or made locally usually ice packs.
- It is important to ensure that transport box is at the desired temperature prior to loading the blood components.
- A temperature monitoring device such as an electronic temperature data logger or maximum / minimum thermometer should be placed in the transport box.
- Ice should be placed above the blood because cool air moves downwards.
- Cubed wet ice may be better than chipped or broken ice because it melts slowly.

Whole blood and packed RBC

Temperature must be kept at +2ºC to +10ºC during transport in specially designed boxed using appropriate coolants or ice packs.

FFP and cryoprecipitate

Temperature can be achieved with suitable quantity of dry or wet ice in well insulated container.

Platelet concentrate

Temperature +20ºC and +24ºC in well insulated container without added ice is often sufficient.

Care of blood products in ward

- If the transfusion cannot be commenced within 30 minutes, the blood may be stored in an approved and monitored blood storage refrigerator until required.
- The refrigerator must maintain a temperature between +2ºC and +6ºCand be fitted with an appropriate temperature alarm.
- Blood bank staff should have access to refrigerator for monitoring the temperature and retrieving unused blood.
- If no approved blood refrigerator is available, blood should be returned to blood bank.
- The refrigerator should only be used for the storage of blood components and no other items to reduce door openings.
- If the alarm on blood refrigerator is activated, the staff should notify the blood bank to take action to safeguard the contents of the refrigerator.

The unit must be discarded if

- It has been out of refrigerator for more than 30 minutes
- If the seal is broken
- If there is any sign that the pack has been opened.
- If there is any sign of haemolysis
- If temperature is over + 10ºC
- Expired units
- Evidence of unusual discolouration or turbidity
- Presence of large clots

Venous Access and equipment for transfusion

Venous access

The size of cannula depends on the size and integrity of the vein. Smaller the gauge, the slower the flow rate which causes a risk of haemolysis. 18-20 Gsize is recommended for adults 22-24 G is for paediatric patients.

Blood administration sets

The component (particularly red cells and whole blood) should be mixed thoroughly by gentle inversion before use.

Blood transfusion set should have a standard 170-200 micron fitter which removes clots and small clumps of debris that may form during collection and storage.

BT set should be primed with normal saline or the blood components. The component should cover the length of the membrane filter when priming the set.

- Dextrose should not be used for priming the BT set
- Because of the risk of bacterial contamination, set should be changed on completion of the red cell transfusion or every 8 hours.
- A set used for red cells should never be subsequently used for platelet transfusion since the red cell debris trapped in the filter would trap the platelets.
- Medications should not be added to any blood component prior to its transfusion.
- When blood is administered by syringe to small infants or neonates the blood should be drawn into the syringe via 170-200 micron filter.

Leucodepletion filters

- These are adsorption filters designed toremove most of the WBCs from either red cell or platelets. In countries like New Zealand all blood component are leucodepleted.

Indications for leucodepleted components

- For patients who have experienced 2 or more non haemolytic febrile transfusion reactions.
- To reduce risk of CMV transmission in immuno compromised patients.
- To reduce the rate of HLA alloimmunisation to leucocyte antigens in patients with haematologic malignant disease and non hepatic solid organ transplant candidate.

Blood warmers

RBC should only be warmed using a specifically designed commercial device with a visible thermometer and audible warning.

Indications

- At flow rates >50 ml/kg/hr in adults

>15 ml/kg/hr in children

And for exchange transfusion in infants.

- When transfusing patients with clinically significant cold agglutinins
- Blood and blood components should not be warmed above 41ºC.

Concurrent fluids

Following fluids can be given through the same IV line as red cell transfusions –

- Normal saline
- 4% albumin
- Plasma protein fraction
- ABO - compatible plasma

Incompatible fluids

- Electrolyte and colloid solution containing calcium (e.g. haemaccel / gelofusine) may cause clotting of the infusion line.
- 5% dextrose in water or hypotonic sodium solutions – may cause red cells to haemolyse.

Medications

- Medication should not be added to the blood bag. If drugs need to be administered via the same IV line ® transfusion should be stopped and line flushed with normal saline ® administer drugs ® flush line with normal saline ® restart transfusion
- Co-administration of morphine, pethidine, ketamine diluted in normal saline via a non reflux valve has no adverse affects on the RBCs (Birch 2001).

Care and monitoring of transfused patients

- Severe reactions are most likely to occur within the first 15 min of start of each component, so patient should be closely observed during this period.
- Rate should be no greater than 5 ml/min for the first 15 min unless otherwise indicated.
- All blood components should be infused within 4 hours (with exception of factor VIII or IX prepared for continuous infusion).
- Vital signs like temperature pulse, BP and respiration must be recorded before start of transfusion.
- Patient must be monitored for any adverse effects like shivering, rashes, flushing, shortness of breath, pain is extremities or in the loins, wheezing etc.
- In case of anaesthetized patients, hypotension, uncontrolled bleeding or generalized oozing during surgical procedures may suggest a coagulopathy e..g DIC. However there symptoms may indicate the possibility of an acute haemolytic reaction due to incompatible transfusion.

Haemoglobinurea or oliguria may also be an early sign of an acute haemolytic transfusion reaction due to an incompatible red cell transfusion.

- **Serious adverse events include –**

o Acute and delayed haemolytic transfusion reactions
o Febrile (non hemolytic) transfusion reactions
o Urticaria and anaphylaxis
o Transfusion related acute lung injury (TRALI)
o Post transfusion purpura (PTP)
o Transfusion associated graft vs host disease
o Transmission of infection

Management of transfusion reaction

- Stop transfusion
- Urgent medical advice sought
- Monitor vital parameters
- Change BT set and maintain venous access using normal saline
- Recheck the blood component labeling and identity of the patient
- Return the component with fresh sample from the patient to blood bank.
- Volume and color of urine recorded sent to laboratory for analysis.
- Document all observations and actions.

Summary

- Whole blood and packed RBCS must always be started at +2ºC to +6ºC and transported between +2ºC and+10ºC.
- Platelets must be stored at +20ºC to +24ºCwith constant agitation and transported at temp.within this range.
- Blood components and plasma derivatives should never be stored in unmonitored equipment.
- RBC platelets or whole blood must never be allowed to freeze.

REFERENCES

1) Manual on the management maintenance and use of blood cold chain.
2) AABB temperature standards 2016: storage and transport.
3) Guidelines for the administration of blood components .
4) Conventional blood banking and blood component storage regulation.
5) Storage and handling of red blood cells.
6) Standards for blood banks and transfusion services.
7) Conventional blood banking and blood component storage regulation: opportunities for improvement.