



MASSIVE TRANSFUSION AND BLOOD PRODUCTS IN SPECIFIC CONDITIONS

BY:

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2nd yr PG

DEPT. OF TRANSFUSION MEDICINE

DEFINITION



Massive transfusion:

- Is defined as replacement of the patients total blood volume by stored blood in less than 24 hrs.
- Replacement of more than 50% of the patients blood volume in 3hrs.
- Blood loss more than 150 ml/min in an adult.
- In children it is defined as transfusion of more than 40ml/kg.
- Massive transfusion implies a single transfusion greater than 2500ml/ 5000ml transfused over a period of 24hrs.
- Involves selection of appropriate amounts & types of blood components to be administered.

MASSIVE TRANSFUSION PROTOCOL



1. All the members of the resuscitation team & their responsibilities are decided.
2. Standardisation of laboratory techniques for management of clinical crisis.
3. To provide optimal blood, replace and maintain blood volume.
 - Component therapy.
 - To maintain main intravascular volume.
 - Avoidance of hypothermia



- Infusion of RBC/ Platelets or plasma in fixed ratio without waiting for lab results.
- Normalisation of acid base status.
- Management of pre-existing hematological & coagulation disorders.
- Maintenance of normal ionized calcium level.
- Assessment of ongoing blood loss
- Optimize oxygen carrying capacity by maintaining hematocrit.

Aggressive volume replacement & swift replacement of ongoing losses is crucial.

INDICATIONS OF MASSIVE TRANSFUSION



1. Traumatic

- Haemorrhagic shock: acute blood loss of more than 20% blood volume in adults or 10-15% in children & pregnancy.
- Severe Trauma.

2. Non traumatic

- Exchange transfusion
- Cardiopulmonary bypass
- GIT bleeding
- APH – Abruption placenta, Placenta previa
- PPH – Atonic uterus, Inversion of uterus.
- Anemia



- In hemorrhage the goal of transfusion is restoration of oxygen carrying capacity & not restoration to a specific Hb level.
- The decision to transfuse in poly trauma or hemorrhage is based on:
 1. The physiological state of the patient
 2. Evidence of amount of blood loss
 3. Potential for ongoing hemorrhage.

TRANSFUSION TRIGGER



- When HB level is $< 7\text{g/l}$, HCT 21% with acute blood loss, transfusion is indicated
- In > 80 yrs old – PCV of 30-33% is the trigger.
- The use of only Hb as a trigger for transfusion should be avoided.

- Decision for RBC transfusion should be based on individual volume status, evidence of shock, duration & extent of anemia & cardiopulmonary physiologic parameters.

EMERGENCY RELEASE POLICY



- The blood bank should be informed of the need for massive transfusion in a patient & the urgency of transfusion.
- Within 5 mins of receipt of sample(extreme emergency) – O Rh (D) negative blood.
- Rh (D) negative women of child bearing age, Rh(D) negative blood supplied.
- Within 15 mins of receipt of sample(urgent cases) – ABO & Rh(D) Type specific cross matched blood.
- Within 45 mins of receipt of sample – Type specific cross matched blood.

LABORATORY INVESTIGATIONS



Investigations

Hb/ HCT

Platelet count

Prothrombin time

PTT

Fibrinogen

Blood gases

Thromboelastography

Target value

10g/dl, 32%

$>50 \times 10^9/l$

< 15 secs

< 1.5 sec

$> 0.8g/l$

BLOOD COMPONENTS



Packed red cells

Leucocyte poor red cell
concentrate

PRP (Platelet rich plasma)

Platelet concentrate

FFP (Fresh frozen plasma)

Cryoprecipitate



**Whole Blood
Processed within
6 hours**

**Packed red blood
cells**

**Fresh frozen
plasma**

Platelets

WHOLE BLOOD



- 450 ml of blood contains:
 - Hb 12g/dl
 - Hct 35-45%

- Indications:
 - Red cell replacement in acute blood loss with hypovolemia.
 - Exchange transfusion
 - When red cell components are not available

PACKED RED CELLS



- 150- 200ml of packed red cells, most of plasma removed.
 - Hb - 20g/dl
 - Hct – 55 - 75%
 - 1 unit of PRBC increases the Hb by 1g/dl , HCT by 3%

➤ Indications:

- Replacement of red cells in anemic patients.
- Use with crystalloid replacement fluid or colloid solution in acute blood loss.



LEUCOCYTE DEPLETED RED CELLS



- A red cell suspension or concentrate containing $< 5 \times 10^6$ /l white cells per pack, prepared by filtration through a leukocyte depletion filter.
- It significantly reduces the risk of transmission of CMV.
- Indications :
 - To reduce risk of CMV transmission
 - Patients who have experienced 2 or more previous febrile reactions to red cell transfusions.
- Administration: a leukocyte filter



RELATIONSHIP BETWEEN PLATELET COUNT & PLATELET TRANSFUSION



- Severe thrombocytopenia – platelet count $<20,000/\text{cumm}$
- Moderate thrombocytopenia – platelet count $20,000 - 50,000/\text{cumm}$. Platelet transfusion given if patients are symptomatic or undergoing surgery.
- Mild thrombocytopenia – platelet count $50,000 - 100,000/\text{cumm}$, Platelet therapy usually not required.

PLATELET TRANSFUSION



SINGLE DONOR PLATELET:

- Usually $3 - 4 \times 10^{11}$ /l platelets are obtained in plasma volume of 300-400ml.

Indications: disorders requiring platelet transfusion are grouped as:

1. Marrow failure – Leukaemia
Marrow Aplasia
Malignant disease
2. Abnormality in platelet function – Hereditary
Acquired



3. Increased platelet destruction – DIC

TTP

ITP

Splenomegaly

- If platelet count fall below $50 \times 10^9/l$, during massive blood loss, platelet concentrate (1 pack/10 kg body wt) should be transfused rapidly.
- Platelet transfusion by cell separator (Apheresis) increases by 30,000 – 70,000/cumm in 70 kg wt adult.



PLATELET CONCENTRATE

- Single donor unit in a volume of 50-60 ml of plasma should contain:
 - At least 5.5×10^{10} / l platelets
 - $< 1.2 \times 10^9$ / l red cells
 - $< 0.12 \times 10^9$ / l leucocytes

- Dosage:
 - 1 unit of platelet concentrate/10 kg body wt in a 60-70 kg adult, 4-6 units containing at least 240×10^9 / l platelets.
 - 1 unit of platelet concentrate increases platelet count by 5000-10,000/cumm in a 70 kg adult.

FRESH FROZEN PLASMA



➤ Fresh plasma obtained by centrifugation of whole blood or by plasmapheresis, within 6hrs of collection to preserve labile coagulation factors, Albumin, frozen at -25°C

➤ Indications:

The only absolute indication for use of FFP is TTP. others are:

- Severe liver disease
- Oral anticoagulant overdose
- Massive transfusion coagulopathy
- DIC
- Factor ii, v, vii, x, xi, xii deficiency





- Coagulation disorders of newborn.
- Mild factor ix deficiency
- Dose:
 - 12-15 ml/kg or appropriately 4-5 units for adult of 60kgs.
 - The timing of FFP infusion depends on clinical setting of patient.
 - When deterioration of normal haemostasis is anticipated or becomes evident, a rapid infusion of 4-5 units should be given.
 - Therefore 4 units of FFP should be given for every 6 units of red cells.

CRYOPRECIPITATE



➤ Constituents:

Factor viii – 80-120 iu

VWF – 40-70%

Fibrinogen – 250mg/pack

Factor xiii – 20-30%

Fibronectin – 20-40 mg

➤ Indications:

1. Factor viii deficiency – hemophilia A
2. VWD
3. Massive blood transfusion



4. DIC

5. Fibrinogen defects – Hypofibrinogenemia

6. Factor xiii deficiency.

Dose:

- 10 – 15 units or 1.5 – 2.0 units/10 kg body weight for factor viii deficiency.
- Each unit of factor viii/ kg raises plasma factor viii by 2 %
- No compatibility testing required.

Suggested ABO Group selection order for Transfusion of RBC'S



<u>Recipient</u> <u>ABO Group</u>	<u>1st choice</u>	<u>2nd choice</u>	<u>3rd choice</u>	<u>4th choice</u>
AB	AB	A	B	O
A	A	O		
B	B	O		
O	O			

EXCHANGE TRANSFUSION



- When other methods to reduce Bilirubin has failed & rate of rise of bilirubin is approaching dangerous level exchange transfusion is given.
- Aim – removing antibody coated RBC & excess of bilirubin. usually done through umbilical venous catheter, taking 5-10 ml/kg of blood out of child at a time & replacing it.
- Types –
 1. Partial exchange transfusion in polycythemia when PCV is above 65%
 2. Single blood volume exchange for anemia with heart failure in hydrops fetalis (80 – 100 ml/kg of blood)
 3. Double volume exchange in severe HDN (160-200 ml of blood)



- Estimated volume to be exchanged:

Estimated blood volume x patients HCT x 2
Hct of transfused blood

Hct of blood - Whole blood 35-45%

Red cell concentrate 55-75%

Red cell suspension 50-70%

INDICATIONS FOR EXCHANGE TRANSFUSION



- Severe anemia at birth with heart failure
- Progressive hyperbilirubinemia in 1st 6hrs after birth
- HDN
- Low birth weight
- Asphyxiated infant
- Polycythemias
- Erythroblastosis fetalis
- Hyperkalemia not responding to therapy
- Drug toxicity
- Septicemia
- DIC



- Blood volume:

Premature infant total volume – 100ml/kg

Newborn infant total volume - 85-90 ml/kg

More than 1 month old, total volume – 80ml/kg

More than 1 yr – 70ml/kg

Transfused red cells should be compatible with mothers serum in case of HDN.

RECENT ADVANCES



1. Recombinant factor vii – given in massive transfusion.
2. Blood substitutes – Perflourocarbons,
Hb based oxygen carrying solutions
3. Others – Plasma proteins
Platelet substitutes.
Recombinant erythropoietin

COMPLICATIONS OF MASSIVE TRANSFUSION



1. Acidosis: results of inadequate treatment of hypovolemia than due to transfusion.
2. Hyperkalemia: stored blood result in a small increase in extracellular K^+ concentration which will increase the longer it is stored.
3. Citrate toxicity & hypocalcemia: rare, due to large volume transfusion of whole blood.
Iv 10% calcium gluconate 10ml with every litre of transfused blood.
- 4 . Depletion of fibrinogen & coagulation factors: plasma undergoes loss of coagulation factors during storage particularly factor v & viii. Red cell concentrate lack coagulation factors.



Dilution of coagulation factors & platelets will occur following administration of large volume of replacement fluids

Management:

if PT is prolonged - ABO compatible FFP

If APTT prolonged, factor viii/ fibrinogen concentration is recommended.

5. Depletion of platelets:

Platelet function is lost during storage of whole blood.

Management:

Give PC only when patient shows clinical signs of micro vascular bleeding or platelet count falls below $50 \times 10^9/l$



6. Hypothermia:

Rapid administration of large volumes of blood or replacement fluids directly from refrigerator can cause reduction in body temperature.

7. DIC: May develop during the course of massive blood transfusion. can also be due to

- a. Hypovolemic shock
- b. Trauma
- c. Obstetric complications

Management- treatment of underlying cause.



8. Air embolism

9. TRALI (Transfusion induced lung injury)

10. GVHD (Graft versus host disease)

Blood transfusion is like marriage...

*It should not be entered upon lightly,
unadvisedly or wantonly...*

*or more often than is
absolutely necessary.”*

R.W. Beal 1976





THANK YOU