

Postpartum hemorrhage PPH

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Class of haemorrhagic shock				
	I	II	III	IV
Blood loss (mL)	Up to 750	750–1500	1500–2000	> 2000
Blood loss (% blood volume)	Up to 15	15–30	30–40	> 40
Pulse rate (per minute)	< 100	100–120	120–140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	> 35
Urine output (mL/hour)	> 30	20–30	5–15	Negligible
Central nervous system/mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

Table 2. Clinical Findings in Obstetric Hemorrhage ^[25] (Open Table in a new window)

Blood Volume Loss	Blood Pressure (systolic)	Symptoms and Signs	Degree of Shock
500-1000 mL (10-15%)	Normal	Palpitations, tachycardia, dizziness	Compensated
1000-1500 mL (15-25%)	Slight fall (80-100 mm Hg)	Weakness, tachycardia, sweating	Mild
1500-2000 mL (25-35%)	Moderate fall (70-80 mm Hg)	Restlessness, pallor, oliguria	Moderate
2000-3000 mL (35-50%)	Marked fall (50-70 mm Hg)	Collapse, air hunger, anuria	Severe

- HR & BP → two most commonly used V/S → Dx hemorrhage
- women → hemorrhage may not develop tachycardia or hypotension until significant blood loss (>1,000 mL)
- *Signs of a hemorrhage* : HR >110 beats/ minute

BP ≤ 85/45 mm Hg

Spo2 <95%

delayed capillary refill

PP (Pulse Pressure) ↓

U/O ↓

pallor

ratio of the heart rate over the systolic BP (HR/Sbp) is called : shock index and may be helpful

A shock index greater than 1 requires immediate management

(lightheadedness, palpitations, confusion, syncope, fatigue, air hunger, and diaphoresis)

1- blood loss (vaginal del > 500 cc or C/S >1000cc & normal V/S)

- angiocath (16 or 18)
- **3.5 lit** (maximally) crystalloids
- **O2 therapy** :

Mask : 6-8 lit/min , cannula : 2-4 lit/min

NS → reasonable solution in the labor ward setting because: (1)low cost (2) compatibility with most drugs and blood transfusions

(If large amounts (>10 L) of crystalloid are being infused, a change to **LRS** can be considered)

Dextrose-containing solutions, such as 5% dextrose in water or diluted NS in 5% dextrose in water, have no role in the management of PPH. Remember that the loss of 1 L of blood requires replacement with 3-4 L of crystalloid because most of the infused fluid is not retained in the intravascular space but instead shifts to the interstitial space.

Continue Blood loss(1000-1500cc)

- second IV line → 16 or 18 (if not available → cv-line)
- invasive monitoring ? If necessary
- u/o

■ PPH of up to **1500 mL** in a *healthy pregnant* woman → usually be managed → **crystalloid** infusion alone if the cause of bleeding is arrested

* A meta-analysis in the Cochrane Library comparing resuscitation with colloid solutions versus crystalloid favored the use of crystalloids with respect to mortality

*The NS groups had a 1% mortality rate, versus an 11% mortality rate in the colloid group

* Large volumes of colloid solutions (>1000-1500 mL/d) can → **adverse effect on hemostasis**

No colloid solution **has been demonstrated to be superior to NS**

expense and the risk of adverse effects with colloids, **crystalloid is recommended**

Given these findings → the authors recommend **against** the use of colloid solutions in resuscitation outside the setting of an RCT

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Continue blood loss(> 1500 cc) or transfusion >2u packed cell or coagulopathy or abnormal lab test or oliguria :

- Newer studies tend to have lower transfusion rates than older studies
- to OPERATING ROOM , TXA
- Ca , inotrope

Cardiovascular collapse(severe hemorrhage , hypovolemic shock amniotic emboli)

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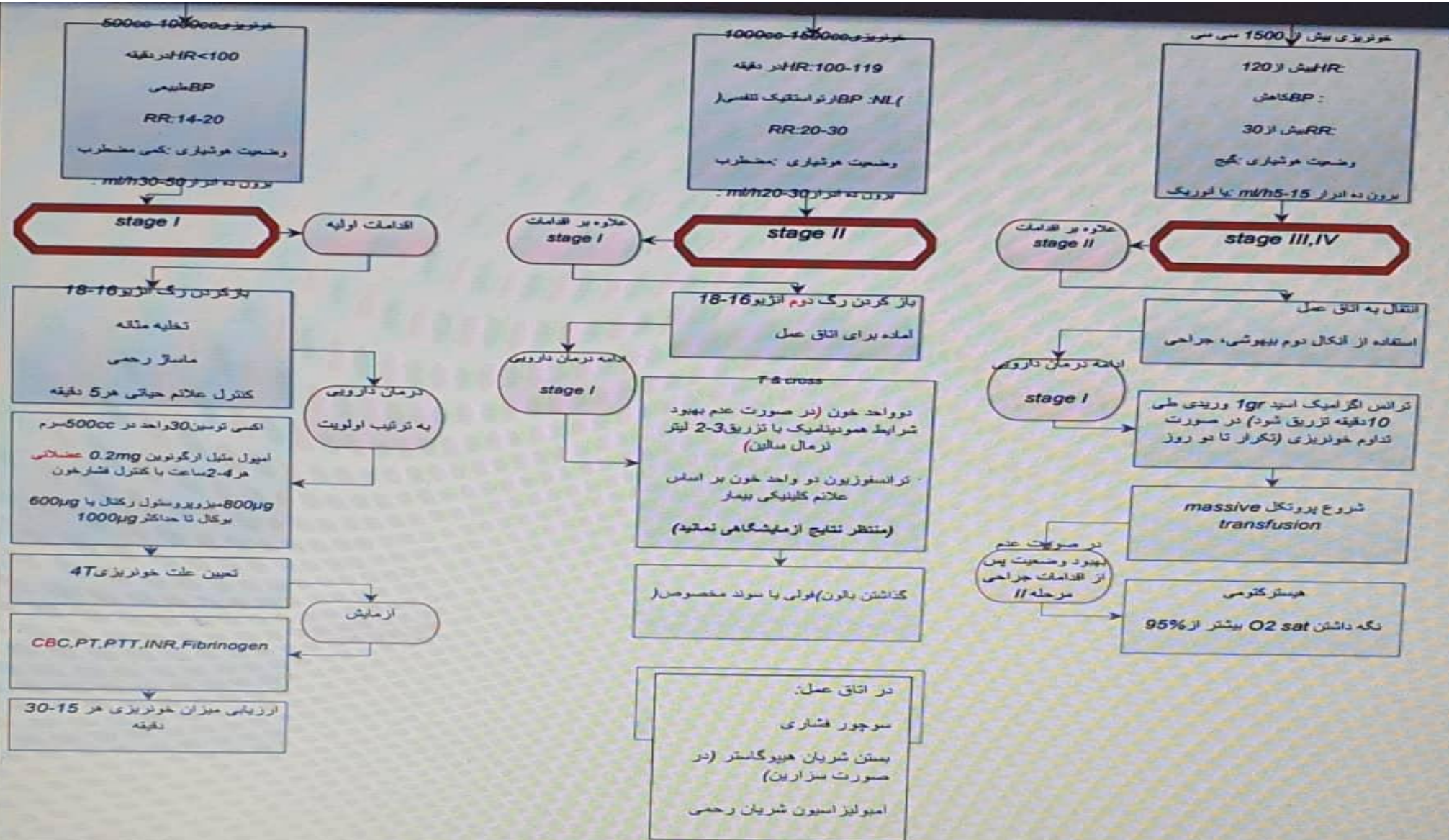
□ Over 500ml after VD, over 1000ml after C/S.

□ *Massive* obstetric hemorrhage is defined as the loss of over *2000 - 2500ml* of blood,

Other definitions include: *drop* in hemoglobin concentration of *$\geq 4g/dl$*

➤ The need for transfusion of *$\geq 5 units$* (PC) or the need to treat coagulopathy or perform invasive management procedure

➤ If available, point-of-care testing should be used to guide goal-directed haemostatic treatment.



massive transfusion:

- 1- PC > 10 U / 24h
- 2- replacement > 1 blood volume /24 h
- 3- replacement $> 50\%$ in 3 h (2h) (adult blood volume = 70 ml/kg)
- 4- > 4 U Pc in 1 h with anticipation of continued need for blood product support
- 5- ≥ 150 ml /min or 10% TBV /min

■ goal:

- * maintain tissue perfusion & oxygenation
- * stop bleeding to use surgical or other intervention

- Check these parameters early and frequently (e.g. every 30-60 minutes while massive transfusion is ongoing)

Parameters	Values to aim for
Temperature	>35 °C
Acid-base status	pH >7.2, base excess <-6, lactate <4 mmol/L
Ionised calcium (Ca)	>1.1 mmol/L
Haemoglobin (Hb)	This should not be used alone as transfusion trigger; and, should be interpreted in context with haemodynamic status, organ & tissue perfusion.
Platelet (Plt)	$\geq 50 \times 10^9 /L$ ($>100 \times 10^9$ if head injury/ intracranial haemorrhage)
PT/APTT	$\leq 1.5x$ of normal
Fibrinogen	≥ 1.0 g/L

First :

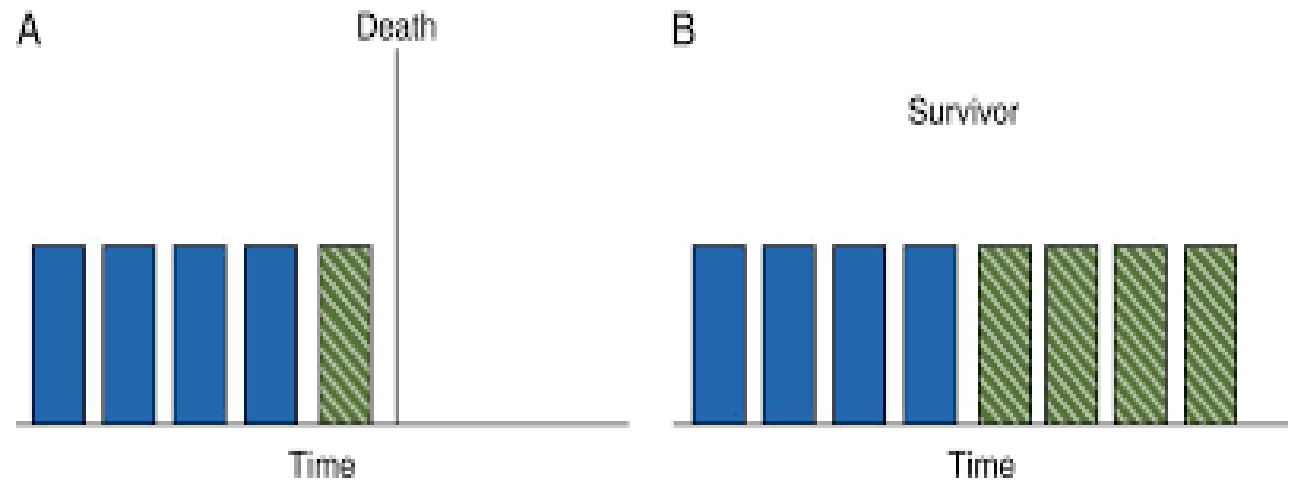
- 1- system activity
- 2- CBC , PT ,PTT , INR , fibrinogen ,ABG
- 3- TXA 1g Qh8
- 4- warming the patients
- 5- preparing **4 U** packed cell :
 - * compatible type – screen or partially cross-match
 - * O –
 - * O + if Rh+

The frequency of anti-D formation after transfusion of D-positive blood products to a D-negative patient is about 20% for RBCs and 4% for platelets

Group A Patient		Group B Patient		Group AB Patient		Group O Patient	
	First choice		First choice		First choice		First choice
Red cells	A	Red cells	B	Red cells	AB	Red cells	O
Platelets	A	Platelets	B	Platelets	AB	Platelets	O
Plasma components	A	Plasma components	B	Plasma components	AB	Plasma components	O
	Second choice		Second choice		Second choice		Second choice
Red cells	O	Red cells	O	Red cells	A or B	Red cells	
Platelets	B ^[c] or O ^[c]	Platelets	A ^[b, c] or O ^[c]	Platelets	A ^[c] or B ^[c]	Platelets	A ^[b]
Plasma components	AB	Plasma components	AB	Plasma components	A ^[d]	Plasma components	A
	Third choice		Third choice		Third choice		Third choice
Red cells		Red cells		Red cells	O	Red cells	
Platelets	AB	Platelets	AB	Platelets	O ^c	Platelets	B
Plasma components	B ^[d]	Plasma components	A ^[d]	Plasma components	B ^d	Plasma components	B
							Fourth choice
						Red cells	
						Platelets	
						Plasma	AB

Second :

- **4 u (PC)** , **4 u (FFP)** , **1 u (Plt SD)** or **10 u (RD)**
- Lab test every 30 -60 min
- 1g calcium
- if Fibrinogen < 100 mg/dl → cryopersipitate
- Platelet & cryoprecipitate (preferably compatible unless except in emergencies)



Thirth

Repeat second

If no surgical causes , fibrinogen > 150 , Plt >50000 , ABG = NI but bleeding (+) or unstable

→ **recombinant factor 7**

- Targets of resuscitation in the setting of massive transfusion include:

Mean arterial pressure (MAP) of 60 to 65 mm Hg

Hemoglobin 7 to 9 g/dL

INR < 1.5

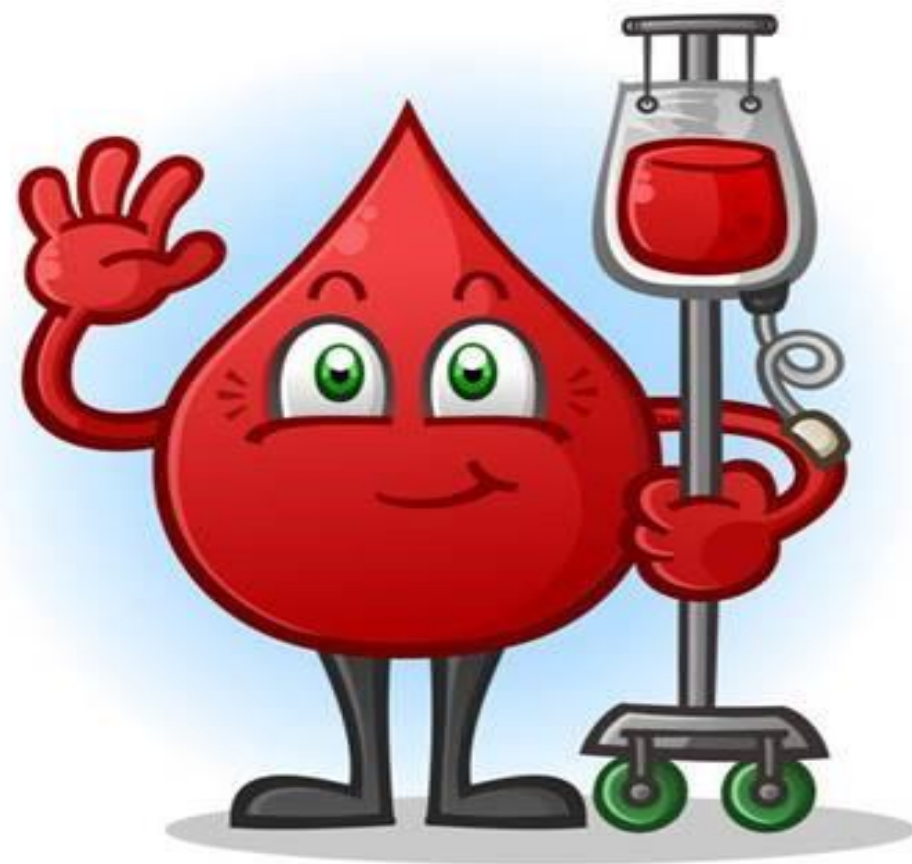
Fibrinogen > 1.5 to 2 g/L

Platelets > 50 000

pH 7.35 to 7.45

Core temperature greater than 35 C

Use of rFVIIa should be considered only for bleeding that cannot be stopped by conventional, surgical or interventional radiological means and when comprehensive coagulation therapy has failed



Packed cell:

1 unit = 250 ml

CPDA -1 → shelf life = 35 d (< 6 °C)

given over 1-2 h but *not longer* than 4 h (child : 2-5 ml/kg/h)

Type – screen & cross-match

1 unit → Hb 1g/dl↑

CMV-negative or CMV reduced risk (leukocyte reduced) RBCs → *should be used* in **pregnant** women who are CMV-negative or whose CMV status is unknown.

Over time:

- Lactic acid - K - Ca ↑
- 2,3 DPG – ATP – PH – glycolysis ↓
- packed cell :
 - * young : < 14 -21 d
 - * old : > 21 d

FFP

- After thawing(30-37 ° C) over 20-30 min → use maximally during 4h → if not → store 1-6 ° C → use within 24h(if no use → discarded)
- 200 – 300 ml/h
- ABO compatible but need no crossmatch, no (leak – clot – abnormal color)
- Once thawed → activity of clotting factors, particularly V ,VIII → decline gradually →re-administration may → every 6 to 8 hours if there is ongoing bleeding due to the short half-life of factor VII; VII has a half-life of 2 to 6 hours
- dose :12 – 15 ml /kg
- 10-20 mL/kg will increase factor levels by 20-30%
- Haemorrhage is ongoing, volumes of FFP in excess of 15 ml/kg are likely to be needed to correct coagulopathy

Platelet:

- pool of 6 whole blood derived (→ referred : random donor) platelets or one apheresis platelet
 - * Random donor : 1 unit → 5000 – 10000 ↑
 - * single donor(apheresis) → 30000 -60000 ↑
- room T (22 ° C) → RD : viable → 5-7 d
- Thrombocytopenia :
 - * procedures > 50,000
 - * CNS & Retina > 100,000
 - * neuroaxial > 80,000
 - * LP >40,000

Contraindication :

TTP , HUS , HIT

If ABO identical platelets : *not available* → **ABO plasma compatible** may be use → but will not cause clinically significant problems

ABO incompatible platelets → only minimal risk of hemolysis(*unless large doses of ABO incompatible platelets are transfused*)

Rh : should be compatible

Pregnancy:

CMV-seronegative or CMV reduced risk (leukocyte reduced) platelets should be used in pregnant women who are CMV-seronegative or whose CMV status is unknown.

Cryoprecipitate:

- prepared from plasma
- fibrinogen , VIII , XIII, von Willebrand factor , fibronectin
- **main** indication : **hypofibrinogenemia**

Cryo should not be used for patients with Hemophilia A (Factor VIII deficiency) **unless** recombinant and/or virally inactivated factor VIII preparations are not available.

It should not be used for patients with von Willebrand disease **unless** they are proven not to respond to DDAVP.

It is not usually given for Factor XIII deficiency, as there are virus-inactivated concentrates of this protein available.

Cryo is sometimes useful if **platelet dysfunction** associated with **renal failure** does not respond to dialysis or DDAVP.

Use for **fibrin glue**

Fibrinogen Replacement:

■ 1 unit of cryo per 5kg → *will increase* fibrinogen by about 100 mg/dL

Number of bags = 0.2 x weight (kg) → provide about 100mg/dL fibrinogen

Many institutions use a standard dose of *10 units* and then repeat if needed

■ 1 unit of cryo has low volume , *ABO compatibility is not required* except in neonates & small children unless high volumes of cryo are to be transfused

- Each unit (~**10-15mL**) provides:
- **Fibrinogen** 150-250 mg with a half-life of 100-150 hours
- **Factor VIII** 80-150 U with a half-life of 12 hours
- **Von Willebrand factor** 100-150 U with a half-life of 24 hours
- **Factor XIII** (13) 50-75 U with a half-life of 150-300 hours
- Cryo also contains **fibronectin**; however there are no clear indications for fibronectin replacement

□ ASA recommends administration of *tranexamic acid* as soon as the diagnosis of PPH is verified.

□ **1g** :tranexamic acid, *IV over 10 min* is to be given regardless of the cause of PPH.

If bleeding ***continues after 30 min*** or ***stops and restarts*** within **24 h** after the first dose → 2nd & 3rd dose of 1 g may be given.

□ TxA : antifibrinolytic that is a lysine analogue that binds to receptors on plasminogen and plasmin, → inhibition of plasminmediated fibrin degradation.

□ TxA → cross the placenta → ***breastmilk*** → recommended to ***wait*** until the ***cord is clamped***

□ TxA is contraindicated → ***active venous thromboembolism, significant renal disease, subarachnoid hemorrhage***, and ***hypersensitivity***

Prothrombine Complex Concentration (PCC)

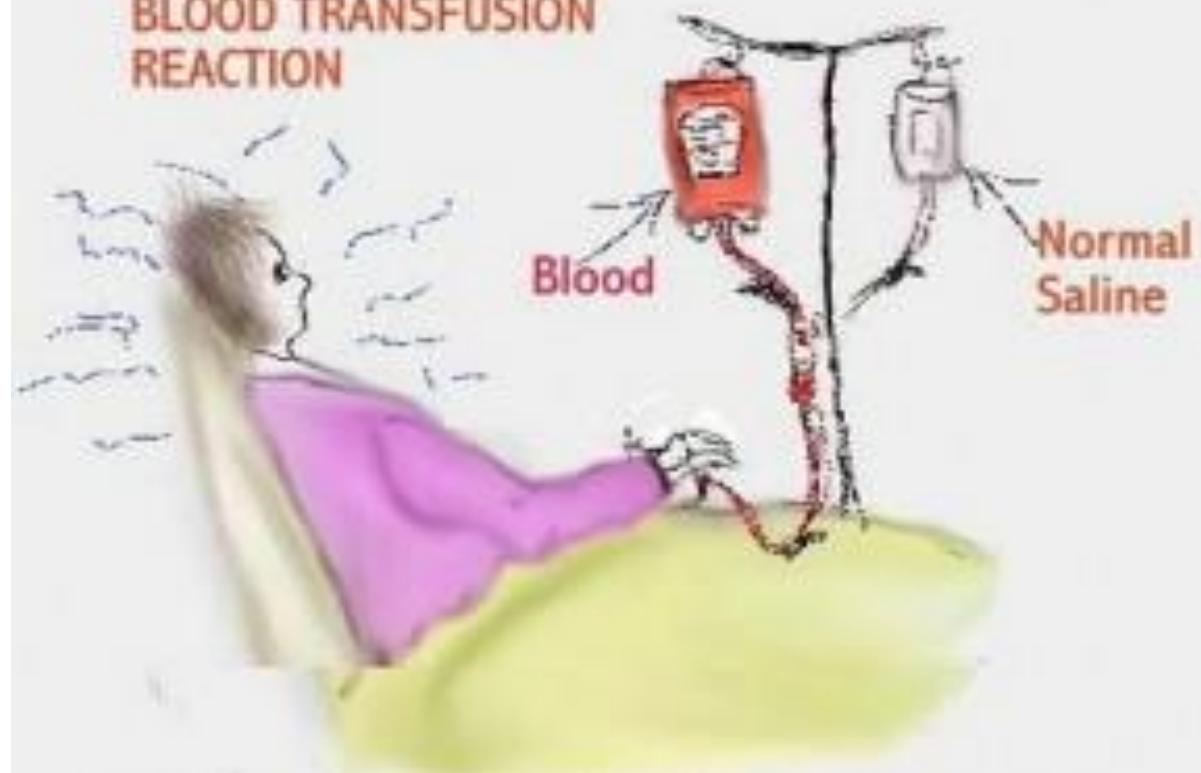
II , VII , IX , X

Can be associated thrombotic events

➤ Its use must be well justified (risk-benefit balance), and should always be carried out after consulting the hematologist

- PCC is currently the first line treatment for rapid reversal of anticoagulant therapy in life threatening bleeding

BLOOD TRANSFUSION REACTION



Acute hemolytic reactions:

- *Early signs* : may *fever, hypotension, flushing, wheezing, anxiety, and/or red-colored urine*
- *Late signs* : may a generalized bleeding tendency (*DIC*) and/or *hypotension*

Nonhemolytic febrile reactions :

- *fever* (some times :shaking, chills, hypotension, and vomiting)

Allergic reaction :

- maculopapular rash and/or urticaria
- Anaphylactic reaction :

Dyspnea, Wheezing ,Anxiety , Hypotension without fever ,Bronchospasm in severe cases

Transfusion-related acute lung injury (TRALI):

■ rapid onset of *shortness of breath*, hypoxemia, and rales, without signs of acute cardiogenic pulmonary edema and fever during 6 h of transfusion

Or late as 6-72h after transfusion

Circulatory (volume) overload :

■ Shortness of breath , Rales ,Orthopnea , Tachycardia , Distended jugular veins ,Other evidence of cardiac decompensation

Acute hemolytic reactions (ABO incompatibility) :

Accidental transfusion of RBCs of a ***different ABO type***

Febrile non- hemolytic reaction:

Cytokines and other normal constituents of ***leukocytes***, ***platelets***, or ***plasma*** accumulate in blood components during storage

When transfused → some recipients → which ***fever*** is the ***most common*** symptom.

Allergic reaction

recipient was exposed → foreign substance in the blood product to which the recipient is sensitized.

Studies in the medical literature sugg → causes of allergic reactions → ***polymorphic proteins*** in the donors' plasma

food (nuts, tomatoes), or ***medications (penicillin)*** → donor ingested immediately before collection

Anaphylactic reaction:

Most cases of anaphylaxis → recipients with *IgA deficiency* → developed *anti-IgA*

(Not all IgA-deficient persons)

Similar reactions in haptoglobinemia → reported

Transfusion-related acute lung injury (TRALI):

Neutrophils → effector cells → adhere to the *pulmonary endothelium* → permeability↑ → pulmonary edema

Elements → activation → neutrophils:

transfused human leukocyte or neutrophil antigen (**HLA or HNA**) antibodies and transfused bioactive substances such as lipids or cytokines

Because pregnancy → *common cause of alloimmunization* → HLAs and HNAs →

most cases of TRALI have been traced to plasma-containing blood components collected from female blood donors

When the American Red Cross converted to predominantly male-donated plasma, the number of cases of TRALI decreased very significantly from 2006 to 2008

Circulatory (volume) overload

Increased fluid volume →

susceptible patients → cardiovascular compromise, elderly patients, and small children → pulmonary edema

A usual **transfusion rate** is *2-2.5 mL/kg per hour* → In at-risk patients, blood products can be transfused at a *slower rate*.

Lab studies:

acute hemolytic reactions : the workup includes :

Visual inspection of the recipient's plasma and urine

Rotyping of donor and recipient red blood cells (RBCs)

Direct antiglobulin (Coombs) testing

febrile nonhemolytic reactions :

Everything normal

Allergic reaction :

Everything normal

Eo may not increase



Anaphylactic reaction:

anti-IgA in a pretransfusion sample of the recipient's serum or plasma establishes the diagnosis

Transfusion-related acute lung injury (TRALI):

plasma levels of **brain natriuretic peptide (BNP)** may be useful in distinguishing the cardiogenic pulmonary edema present in circulatory overload from the noncardiogenic pulmonary edema present in TRALI



Acute hemolytic reactions:

- Immediate ***DC transfusion*** while maintaining ***IV_ LINEs*** for emergency management.
- Anticipate hypotension, renal failure, and DIC.
- Prophylactic → reduce the risk of ***renal failure*** may include ***low-dose dopamine*** (1-5 mcg/kg/min)

Maintain ***U/O*** minimally → ***75-100 ml/h***

- * ***vigorous hydration*** with crystalloid solutions (3000 mL/m²/24 h)
- * If fluid and mannitol → ineffective → ***furosemide***
- * ***urine alkalization*** → ***bicarb***

((osmotic diuresis with 20% mannitol (100 mL/m²/bolus,
followed by 30 mL/m²/h for 12 h).))

If DIC is documented and bleeding requires treatment, ***transfusions of frozen plasma, pooled cryoprecipitates*** for fibrinogen, and/or ***platelet*** concentrates may be indicated.

Febrile, nonhemolytic reactions

fever usually *resolves* in **15-30 minutes** without specific treatment

If fever → discomfort → oral ***acetaminophen*** (**325-500 mg**)

Avoid ***aspirin*** because of its prolonged adverse effect on platelet function

Allergic reactions

diphenhydramine → effective → ***pruritus*** that is associated with ***hives or a rash***

(oral or IV) 25 -100 mg

Anaphylactic reactions

SQ injection of ***Epinephrine*** (**0.3-0.5 mL of a 1:1000**) is standard treatment

If patient → sufficiently hypotensive → efficacy of the subcutaneous route?

Epinephrine (**0.5 mL of a 1:10,000 aqueous solution**) → **IV**

Although ***no documented*** evidence exists that ***IV corticosteroids*** are beneficial

most clinicians → hydrocortisone or prednisolone if an immediate response to epinephrine does not occur.

Transfusion-related acute lung injury (TRALI) :

1- *Immediately discontinue* → transfusion while preserving *venous access IVs*

2- *mild episodes* → respond to *oxygen* administered by *nasal* catheter or *mask*

If *shortness* of breath *persists after oxygen* administration → transfer to an ICU where *mechanical ventilation* can be employed.

3- In the absence of signs of acute volume overload or cardiogenic pulmonary edema *diuretics are not indicated.*

No evidence → corticosteroids or antihistamines are beneficial.

Treat complications with specific supportive measures.

Circulatory (volume) overload (TACO)

- 1- ***sitting position*** and administer ***oxygen*** to facilitate breathing.
- 2- The ***most specific*** treatment is ***discontinuing the transfusion*** and removing the excessive fluid.
- 3- If practical, the unit of blood component being transfused may be lowered to reverse the flow and to decrease intravascular volume by a controlled phlebotomy.
- 3- Less urgent situations may be managed by a ***parenteral or oral diuretic (furosemide)***.