Each blood donation saves 3 lives.

Massive Transfusion Protocol in Obstetric Haemorrhage

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Case

- In one morning, I was called by an anaesthetist who asked if he could continue to transfuse at a rate of 400 ml/hour for a woman after baby delivery?

- What should I do?
- What have been done so far?
- Can I help to save lives?

Massive transfusion - definition

- Massive transfusion is defined, in adults, as replacement of >1 blood volume in 24 hours or >50% of blood volume in 4 hours (adult blood volume is approximately 70 mL/kg).
- (historically defined as the replacement by transfusion of 10 units of red cells in 24 hours or in some countries as three units over one hour)

Symptoms & Signs in clinical bleeding

Blood loss (% Blood Volume)	Systolic BP (mm Hg)	Signs & Symptoms
10-15	Normal	postural hypotension
15-30	slight fall	Tachycardia, thirst, weakness
30-40	60-80	pallor,oliguria, confusion
40+	40-60	anuria, air hunger, coma, death

Order of magnitude in obstetric bleeding

	Antepartum 60 – 65 kg	Postpartum 55 – 60 kg
Blood Volume	4200 – 4500 ml	3850 – 4200 ml
15 – 30 % blood loss	Up to 1300 ml	
40% blood loss	Up to 1800 ml	

Blood loss in vaginal delivery: 300 ml
Blood loss in elective CS: 600 ml

Blood donation: 350 – 450 ml
A unit of red blood cells: ~ 300 ml

Causes of massive bleeding in obstetric settings

- Antepartum
- Postpartum
- With underlying medical illnesses e.g. thrombocytopenia, coagulopathy

Table 1. Mechanisms of coagulopathy dependent on aetiology of obstetric bleed. Late onset is abnormal coagulation usually only after 2000 ml blood loss

Aetiology of bleed	Likelihood of coagulopathy (% transfused FFP)	Time of onset of coagulopathy	Mechanism of coagulopathy		
			Dilution	Consumptive	
				Local to uterus and placenta	Disseminated intravascular
Uterine atony	14	Late	Contributes in severe cases	Contributes in severe case	Very rare
Genital tract or surgical trauma	4	Late	Contributes in severe cases	Contributes in severe cases	Very rare
Placental abruption	42	Early (often before blood loss observed)	Contributes in severe cases	Main cause in mild and moderate cases	Contributes in severe cases
Retained and adherent placenta	8	Early or late	Contributes in most cases	Contributes in some cases	Rare unless associated with infection
Uterine rupture	66	Early	Main cause because large bleeds are common	Contributes in some cases	–
AFE	100	Early	Contributes in large bleeds	–	Main cause
Pre-eclampsia/HELLP	ND	Early (often before labour)	Contributes in large bleeds	Contributes in some cases	Contributes in some cases

AFE, amniotic fluid embolus; HELLP, haemolysis, elevated liver enzymes and low platelets.

Anaesthesia
pages 78-e28, 1 DEC 2014 DOI: 10.1111/anae.12913
http://onlinelibrary.wiley.com/doi/10.1111/anae.12913/full#anae12913-fig-0001

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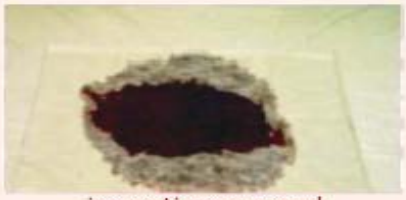
soiled sanitary towel
30ml

saturated small swab (10x10cm)
60 ml

saturated sanitary towel
100 ml



incontinence pad
250 ml

saturated swab (45x45cm)
350 ml

floor spill (100cm diameter)
500 ml

full kidney dish
500 ml

blood spilling on bed
1000 ml

blood spilling to floor
2000 ml

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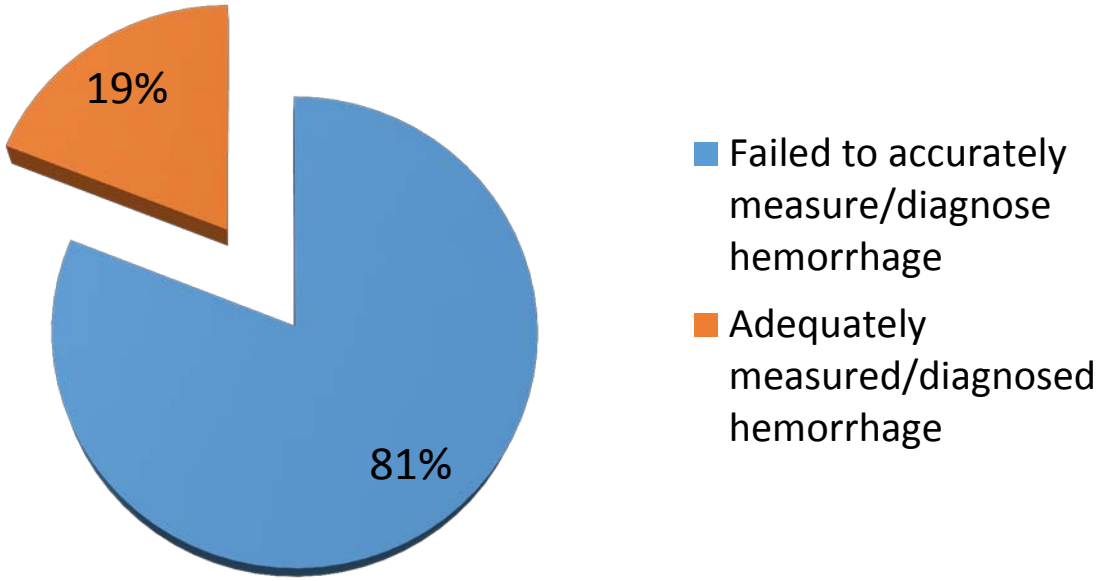
Blood loss estimation

Nurses Estimating Blood Loss



Remember obstetricians can also miss or under-estimate the amount of blood loss

Known problems associated with Massive Transfusion

- Dilutional thrombocytopenia
- Coagulation factors deficiencies
- Metabolic
  - Acid base balance
  - Citrate toxicity
  - Hypocalcaemia
  - Hyperkalaemia
  - Hypothermia

Haematologist point of view

- Aim to save lives (mother and fetus)
- Treat the underlying causes of obstetric bleeding (obstetricians, radiologists +/- surgeons)
- Circulatory and transfusion support with correction of clotting problems (thrombocytopenia and clotting factors); correct metabolic and other problems as far as possible (anaesthetists, blood bank, clinical laboratory, BTS, nurses and porters)

Prevention is always the best but when it happens, how to achieve the best outcome?

Key points in managing any patient with significant bleeding who requires massive transfusion

- Early recognition
- Early activation of life saving procedures before any permanent damage or even death
- Availability of experienced doctors
- Support and correct underlying causes simultaneously
- Repeat assessment – clinical and laboratory including POCT
- (Experience and practice tell the difference)

Repeated assessments are crucial

PP1

In patients with critical bleeding requiring massive transfusion, the following parameters should be measured early and frequently:

- **temperature**
- **acid–base status**
- **ionised calcium**
- **haemoglobin**
- **platelet count**
- **PT/INR**
- **APTT**
- **fibrinogen level.**

With successful treatment, values should trend towards normal.

https://www.blood.gov.au/pubs/pbm/module1/transfusion.html

What parameters points to deterioration?

PP2 Values indicative of critical physiologic derangement include:

- temperature < 35˚C
- pH < 7.2, base excess > –6, lactate > 4 mmol/L
- ionised calcium < 1.1 mmol/L
- platelet count < 50 × 10^9/L
- PT > 1.5 × normal
- INR > 1.5
- APTT > 1.5 × normal
- fibrinogen level < 1.0 g/L

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Will Massive Blood Transfusion Protocol be of help in managing significant Obstetric Haemorrhage?

Simple answer: Yes, but why and how

Massive Blood Transfusion Protocol (MTP)

- Provide a framework for systematic and co-ordinate management of patients with significant bleeding that require massive transfusion
- Evidence based and involve multidisciplinary approach to patient care and blood component support
- *Early recognition and activation, assessment and reassessment, bleeding control and haemostatic/ transfusion support are the key elements*
- Have been successfully used in many settings

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GOAL

To ensure rapid and timely availability of blood components to facilitate resuscitation.

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Massive transfusion protocol (MTP) template

The information below, developed by consensus, broadly covers areas that should be included in a local MTP. This template can be used to develop an MTP to meet the needs of the local institution's patient population and resources

Senior clinician determines that patient meets criteria for MTP activation

Baseline:
Full blood count, coagulation screen (PT, INR, APTT, fibrinogen), biochemistry, arterial blood gases

Notify transfusion laboratory (*insert contact no.*) **to:**
'Activate MTP'

Laboratory staff
- Notify haematologist/transfusion specialist
- Prepare and issue blood components as requested
- Anticipate repeat testing and blood component requirements
- Minimise test turnaround times
- Consider staff resources

Haematologist/transfusion specialist
- Liaise regularly with laboratory and clinical team
- Assist in interpretation of results, and advise on blood component support

Senior clinician
- **Request:**[a]
  - o 4 units RBC
  - o 2 units FFP
- **Consider:**[a]
  - o 1 adult therapeutic dose platelets
  - o tranexamic acid in trauma patients
- **Include:**[a]
  - o cryoprecipitate if fibrinogen < 1 g/L

a Or locally agreed configuration

Bleeding controlled?

YES

NO

Notify transfusion laboratory to:
'Cease MTP'

OPTIMISE:
- oxygenation
- cardiac output
- tissue perfusion
- metabolic state

MONITOR
(every 30–60 mins):
- full blood count
- coagulation screen
- ionised calcium
- arterial blood gases

AIM FOR:
- temperature > 35^0C
- pH > 7.2
- base excess < –6
- lactate < 4 mmol/L
- Ca^{2+} > 1.1 mmol/L
- platelets > 50 × 10^9/L
- PT/APTT < 1.5 × normal
- INR ≤ 1.5
- fibrinogen > 1.0 g/L

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Successful Implementation requires

1. Introduce simulation training for all staff involved in triggering and delivering the massive blood transfusion protocol
2. Ensure an audit system (review) is in place to assess MTP activation, non-activation and blood component wastage to optimize effective use of the toolkit
3. Early intervention (bleeding control) is essential to stop bleeding and ensure pathways are in place to assess these services at all times
4. Allocate key role players in each MTP activation and to ensure effective communication, actions and documentations

Transfusion support

- Timeliness to provide blood and blood components (including availability of thawed plasma)
- Access to important laboratory results and advise to adjust transfusion of blood components
- Access to Blood Transfusion Service for additional blood components

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Blood Components Support

Red Cells

Platelet

Plasma

Availability, Timeliness but not wastage

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POCT to monitor coagulopathy

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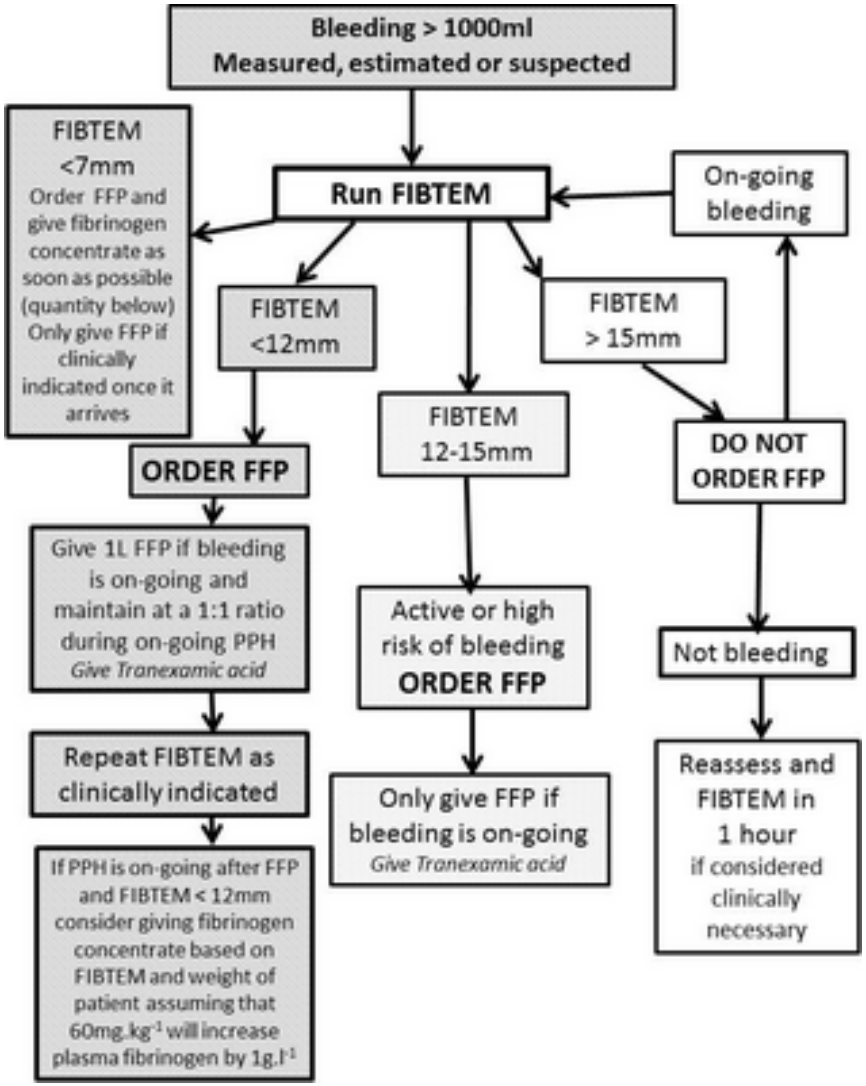
Cryo precipiates to provide fibrinogen

Haemostatic management of obstetric haemorrhage



POCT results provide adjustment of transfusion support within a shorter timeframe

BUT, POCT requires training and experience in interpretation

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Avoid the followings to appear

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Any other important points to note

- Never work alone or within the operating theatre, always seeks advice from haematologist in charge of the laboratory and blood bank to guide therapy
- Ensure blood warmers work
- Always include the support from the minor staff like porters

Conclusion

- Determine the cause of haemorrahge and recognize PPH early
- Activation of MTP with multidisciplinary approach
- Note fibrinogen levels as a marker of severity of bleeding
- Employ point-of-care testing (POCT) as a useful supplementation to standard laboratory tests
- Use goal-directed Frozen Plasma and targeted correction of coagulopathies
- Adopt regular real-time on-site simulation training for members of staff involved in activating and implementing MTP protocols with debrief sessions.

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As a doctor and father, I sincerely wish every pregnancy and delivery should start and end happily.

Thank you

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