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

<table>
<thead>
<tr>
<th>Blood loss (% Blood Volume)</th>
<th>Systolic BP (mm Hg)</th>
<th>Signs &amp; Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-15</td>
<td>Normal</td>
<td>postural hypotension</td>
</tr>
<tr>
<td>15-30</td>
<td>slight fall</td>
<td>Tachycardia, thirst, weakness</td>
</tr>
<tr>
<td>30-40</td>
<td>60-80</td>
<td>pallor, oliguria, confusion</td>
</tr>
<tr>
<td>40+</td>
<td>40-60</td>
<td>anuria, air hunger, coma, death</td>
</tr>
</tbody>
</table>
Order of magnitude in obstetric bleeding

<table>
<thead>
<tr>
<th></th>
<th>Antepartum 60 – 65 kg</th>
<th>Postpartum 55 – 60 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Volume</td>
<td>4200 – 4500 ml</td>
<td>3850 – 4200 ml</td>
</tr>
<tr>
<td>15 – 30% blood loss</td>
<td>Up to 1300 ml</td>
<td></td>
</tr>
<tr>
<td>40% blood loss</td>
<td>Up to 1800 ml</td>
<td></td>
</tr>
</tbody>
</table>

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
Each blood donation saves 3 lives.

Causes of massive bleeding in obstetric settings

• Antepartum
• Postpartum
• With underlying medical illnesses e.g. thrombocytopenia, coagulopathy
Each blood donation saves 3 lives.

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

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

**Table 1.** Mechanisms of coagulopathy dependent on aetiology of obstetric bleed. Late onset is abnormal coagulation usually only after 2000 ml blood loss.
Each blood donation saves 3 lives.
Blood donation saves 3 lives.

Blood loss estimation

Nurses Estimating Blood Loss

- 81% Adequately measured/diagnosed hemorrhage
- 19% Failed to accurately measure/diagnose hemorrhage

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)
Each blood donation saves 3 lives.

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

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.

What parameters points to deterioration?

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 x 10^9/L
- PT > 1.5 × normal
- INR > 1.5
- APTT > 1.5 × normal
- fibrinogen level < 1.0 g/L

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
Each blood donation saves 3 lives.

To ensure rapid and timely availability of blood components to facilitate resuscitation.
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:
  - 4 units RBC
  - 2 units FFP
- Consider:
  - 1 adult therapeutic dose platelets
  - tranexamic acid in trauma patients
- Include:
  - cryoprecipitate if fibrinogen < 1 g/L
  - 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°C
- pH > 7.2
- base excess < –6
- lactate < 4 mmol/L
- Ca²⁺ > 1.1 mmol/L
- platelets > 50 × 10⁹/L
- PT/APTT < 1.5 × normal
- INR ≤ 1.5
- fibrinogen > 1.0 g/L

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
Each blood donation saves 3 lives.

Blood Components Support

- Red Cells
- Platelet
- Plasma

Availability, Timeliness but not wastage
POCT to monitor coagulopathy
Each blood donation saves 3 lives.

Cryo precipitates 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

Each blood donation saves 3 lives.
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 haemorrhage 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.
As a doctor and father, I sincerely wish every pregnancy and delivery should start and end happily.

Thank you