

My Bloody Talk

Dr Ben Turner
MBBS, FANZCA, FCICM
The Royal Children's Hospital, Melbourne

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Disclosures

- No conflicts of interest
- Interest in conflict



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Blood transfusion

- Massive transfusion definitions
- Transfusion triggers
- Massive blood loss complications
- Massive transfusion protocols
- Complications of transfusion

Massive Transfusion

- Trauma
- Major surgery
- GI bleeding
- Birth trauma
- Bleeding diatheses
- Vascular malformations
- Feto-maternal haemorrhage

Signs that you may need to Transfuse

- How's it going up your end?
- Has this patient got a crossmatch?
- If you can no longer hear the music over the suckers
- Shit shit shit.....

Transfusion Triggers

- Lower limit of Hb at which DO₂ becomes critical is not defined
- Theoretical level in adults is 2.5g/dL
 - Validated in animals
- Healthy volunteers diluted to 4-5g/dL
- In Jehovah's Witness adults morbidity and mortality increase with anaemia but patients can survive with Hb 3g/dL. (Carson, 2002)
- Odds of death increase 2.5 times for every 1g/dL Hb is <8g/dL (Carson, 2002)

Massive Transfusion definition

- Paediatrics is different from adult medicine
 - Both absolute and relative blood volumes differ in different sized and aged children
 - 90-100ml/kg in preterm infant
 - 60 ml/kg in female adolescent

Massive Transfusion definition

- Yaser et al, 2013
- >50% TBV in <3hrs
- >100% TBV in 24hrs
- Transfusion for ongoing bleeding of >10% TBV in 10min

Massive Transfusion definition

- Does it matter?
- When you have to give enough blood that the transfusion may have physiologic consequences.
- **STOP, LOOK, LISTEN, THINK**

Physiologic complications of massive haemorrhage

- CVS
- Neurological
- Renal

Critical Triad

- Hypothermia
- Acidosis
- Coagulopathy

Assessment

- Temperature
- Haemoglobin
- Platelet count
- Coagulation screen
 - INR/PT
 - APTT
 - Fibrinogen
- Acid-base status
- Ionised Ca⁺⁺

Assessment

- Values indicative of critical physiological derangement
 - $T < 35^{\circ}\text{C}$
 - $\text{pH} < 7.2$, base excess > -6 , lactate $> 4\text{mmol/l}$
 - Ionised $\text{Ca}^{++} < 1.1\text{mmol/l}$
 - $\text{INR} > 1.5$
 - $\text{APTT} > 1.5 \times \text{normal}$
 - Fibrinogen $< 1.0\text{g/l}$

Hypothermia

- Aetiology is multifactorial
 - Trauma patients are frequently hypothermic on arrival at hospital and are exposed during assessment
 - Surgical patients suffer exposure and effects of anaesthesia
- Most blood products are stored between 1-6°C
- Room temperature fluids are hypothermic

Hypothermia

- For each 1°C drop in temperature coagulation factor activity decreases by 10%
- Patients <34°C will be clinically coagulopathic
- Hypothermia causes platelet pooling in spleen
- <34°C platelet adhesion and aggregation is impaired

Acidosis

- Tissue hypoperfusion
 - Decreased haemoglobin and O₂ carriage
 - Reduced cardiac output due to reduced pre-load
- Prolongs clotting time by impairing enzyme activity
- Reduces fibrinogen levels
- Reduces platelet count

Acidosis

- Treat the cause unless $\text{pH} < 7.2$
 - NaHCO_3 1ml/kg

Coagulopathy

- 25% of trauma patients are coagulopathic on arrival to hospital
- Systemic hypoperfusion has a dose dependent association with coagulopathy as measured by PT/APTT

Coagulopathy

- Shock increases thrombomodulin
 - results in reduced thrombin, factors Va and VIIIa
 - deactivates PAI-1, promoting fibrinolysis
- Complement cascade activation affects coagulation
- ↑ tissue plasminogen activator and
- ↓ thrombin activatable fibrinolysis inhibitor lead to an increase in fibrinolysis

Management

- Most information comes from adult trauma studies
 - Trauma differs in paediatrics
 - Less penetrating trauma and more crush injuries

Guidelines

- 2012 National Blood Authority released:
 - Patient Blood Guidelines: Module 1 – Critical Bleeding/Massive Transfusion
 - Endorsed by all major medical colleges in Australia
 - Evidence based review of the literature using NHMRC grades A-D

Patient Blood Guidelines: Module 1

– Critical Bleeding/Massive Transfusion



- <http://www.blood.gov.au/pbm-module-1>
 - Recommendations – 2
 - Practice points – 10
 - MTP protocol template

Recommendations

- Recommendation 1
 - Institutions develop an MTP that includes the dose, timing, and ratio of blood component therapy for use in trauma patients with, or at risk of, critical bleeding requiring massive transfusion (Grade C)
- Grade C – body of evidence provides some support...

Recommendations

- Recommendation 2
 - The routine use of rFVIIa in trauma patients with critical bleeding requiring massive transfusion is not recommended because of its lack of effect on mortality (grade B) and variable effect on morbidity (grade C)
- Grade B – body of evidence can be trusted to guide practice in most situations

Massive Transfusion Protocol

- A system to streamline the availability and limit complications of massive transfusion in a critically bleeding child
- Provides clear guidelines for
 - Trauma doctors
 - Trauma nurses
 - Haematologist
 - Laboratory staff
 - Distribution orderlies

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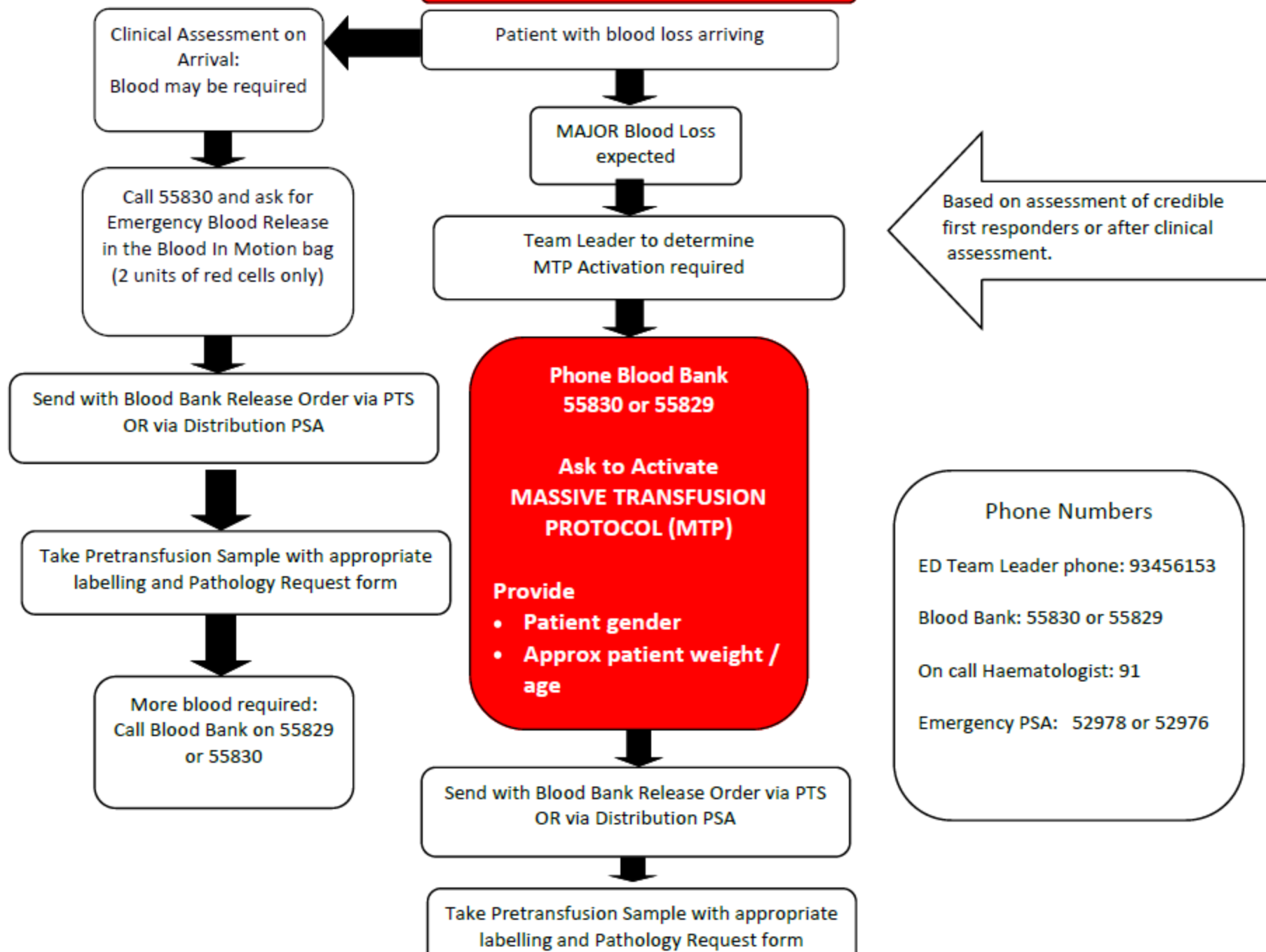
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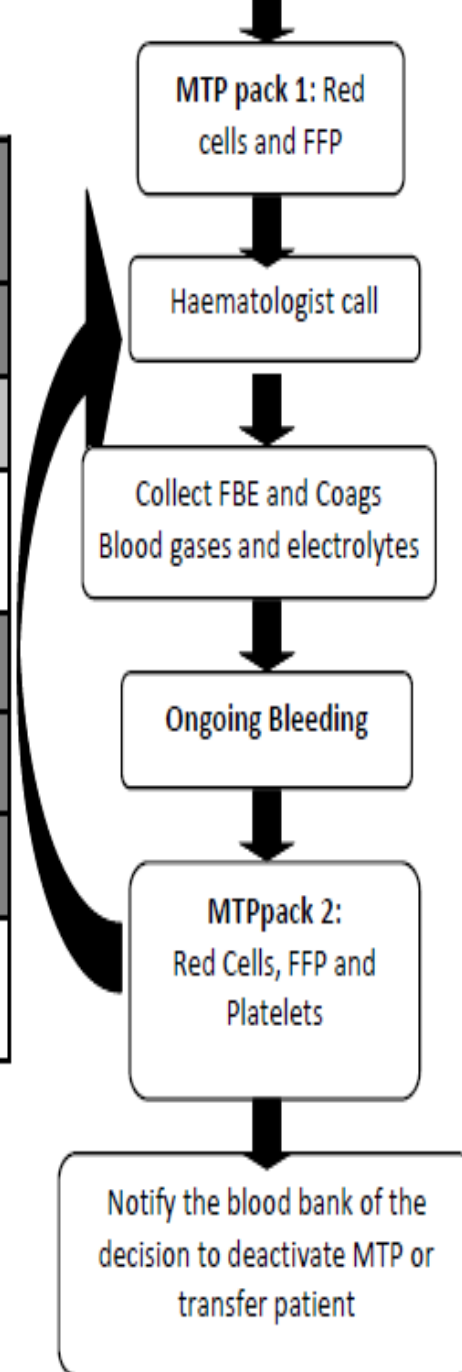
Massive Transfusion Protocol

- Activates a response in the blood bank
 - Increase staff numbers
 - Commence thawing frozen components
 - Order urgent blood from the Blood Service

Massive Transfusion Protocol



MTP 1	≤ 20kg	20-40kg	40-60kg
Red Cells	2 units	4 units	6 units
FFP	2 units of FFP		
MTP 2	Repeat MTP 2 until Deactivation		
Red cells	2 units	4 units	6 units
FFP	2 units	4 units	6 units
Platelets	1 Paedi	1	1
Cryo	As directed by haematologist		



Reference: Medical Haematologists
Laboratory services, Doc number: MH.W.001
Version 3 Issued 16/01/2012 page 1 of 1

Massive Transfusion Protocol - template

- Local adaptation
 - Multidisciplinary
 - Incorporate recommendations and practice points
 - Take into account local resources
 - Provide details on how components will be delivered to the correct patient and location

Special circumstances

- Warfarin
 - Add vit K, prothrombinex/FFP
- Head injury
 - Platelet count $>100 \times 10^9/L$

Practice Point 4

- In patients with critical bleeding requiring massive transfusion insufficient evidence was identified to support or refute the use of specific ratios of RBCs to blood components

Practice Point 10

- Suggested doses of blood components are:
- FFP 15ml/kg
- Platelets 1 adult therapeutic dose
- Cryoprecipitate 3-4g

Practice Point 8&9

- rFVIIa
- MTP should include advice on the administration of rFVIIa
- May be considered if:
 - Patient is salvagable
 - Failed surgical or radiological measures
 - Adequate blood component replacement
 - pH>7.2, Temperature > 34°C
 - Initial dose 90mcg/kg is reasonable

Tranexamic acid

- CRASH II *The Lancet*, 2010
 - 20,000 trauma patients with significant haemorrhage
 - 274 hospitals, 40 countries
 - Treated within 8 hrs of injury
 - Tranexamic acid 1g over 10min, 1g over 8hrs

Tranexamic acid

- Significant reduction in all cause mortality
 - RR 0.91 95% CI 0.85 – 0.97
- Lower risk of death secondary to bleeding
 - RR 0.85 95% CI 0.76-0.96
- No increase in vaso–occlusive disease in TXA group
- More effective if given within 3 hours

Transfusion Associated Complications

- Transfusion reactions
 - AHTR, FNHTR (allergic)
- Immunological complications
 - TRALI, TRIM, TA-GVHD, PTP

Transfusion Associated Complications

- Metabolic complications
 - $\downarrow\text{Ca}^{++}$, $\downarrow\text{Mg}^{++}$, $\uparrow\text{K}^{+}$, $\downarrow\text{K}^{+}$, metabolic alkalosis, impaired glucose homeostasis, Acidosis, Hypothermia
- Coagulopathy
- Infections
- TACO
- TANEC
- Air embolism

Conclusion

- Patients requiring massive transfusion may have significant metabolic derangement
- Prevent and treat the triad
 - Acidosis
 - Hypothermia
 - Coagulopathy
- Develop MTP
- Remember blood transfusion has its own complications