My Bloody Talk

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Disclosures

• No conflicts of interest
• Interest in conflict
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 D02 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
  - $T<35^\circ C$
  - $pH<7.2$, base excess $<-6$, lactate $>4\text{mmol/l}$
  - Ionised Ca++ $<1.1\text{mmol/l}$
  - INR $>1.5$
  - 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 pH<7.2
  • NaHCO3 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

  - 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
  • Haemotologist
  • Laboratory staff
  • Distribution orderlies
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

Clinical Assessment on Arrival: Blood may be required

Call 55830 and ask for Emergency Blood Release in the Blood In Motion bag (2 units of red cells only)

Send with Blood Bank Release Order via PTS OR via Distribution PSA

Take Pretransfusion Sample with appropriate labelling and Pathology Request form

More blood required: Call Blood Bank on 55829 or 55830

Send with Blood Bank Release Order via PTS OR via Distribution PSA

Take Pretransfusion Sample with appropriate labelling and Pathology Request form

Based on assessment of credible first responders or after clinical assessment.

Phone Blood Bank 55830 or 55829

Ask to Activate MASSIVE TRANSFUSION PROTOCOL (MTP)

Provide
- Patient gender
- Approx patient weight / age

Phone Numbers
- ED Team Leader phone: 93456153
- Blood Bank: 55830 or 55829
- On call Haematologist: 91
- Emergency PSA: 52978 or 52976
**MTP pack 1: Red cells and FFP**

- Haematologist call

**MTP pack 2: Red Cells, FFP and Platelets**

- Ongoing Bleeding

- Collect FBE and Coags Blood gases and electrolytes

**Notify the blood bank of the decision to deactivate MTP or transfer patient**

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**MTP 1**

- Red Cells: 
  - ≤ 20kg: 2 units
  - 20-40kg: 4 units
  - 40-60kg: 6 units

- FFP: 2 units of FFP

**MTP 2**

- Repeat MTP 2 until Deactivation

- Red cells: 
  - ≤ 20kg: 2 units
  - 20-40kg: 4 units
  - 40-60kg: 6 units

- FFP: 2 units

- Platelets: 
  - 1 Paedi
  - 1
  - 1

- Cryo: As directed by haematologist

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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 x 10⁹/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
  - ↓Ca^{++}, ↓Mg^{++}, ↑K^{+}, ↓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