What do you do when the bleeding won’t stop?

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Outline

- Case study
- Normal coagulation
- Hemorrhagic shock
- Lethal Triad
- Massive transfusion
- Treatment and Complications
Case Study – Mrs. P

• 26 yr old female
• Called EMS after 1 hour of vaginal bleeding
• PMHx:
  – Nothing significant
  – P5G4
  – Recent miscarriage with D&C for retain POC
Mrs. P cont.....

- At Rural hospital D&C performed
- Unable to achieve hemostasis
- RAH called for consultation
- STARS unable to fly
- Sent to Edmonton by ground
- Stop in Stony Plain due to instability
At the RAH

PEA  VF  ST  VT  Asystole  PEA  VF  ST
Blood Products in ED

- 32 U PRBC
- 10 U Cryo
- 6L Ringers
- 6U FFP
- 1 pooled platelets
In the OR

- 34 U PRBC
- 37 U FFP
- 4 Pooled platelets
- 8 U Cryo
- 4.5L Cell Saver
ICU Admission @ 1255

- HR = 138
- BP = 108/45
- O2 Sat = 83%
- RR = 20
- Temp = would not register
- U/O = 130
- Vent Settings = AC 20 +20 100% TV=700
ICU Vitals @ 1317

- HR = 150
- BP = 69/41
- Levophed started at 20mcg/min
- O2 sat = 69%
- Temp = 34 C
- No changes to vent settings – nitric oxide and steroids added
ICU Labs

- Hgb = 102
- ABG = 7.24/40/39/16.3
- INR = 1.1
- PTT = 41
- Fibrinogen = 1.1
- Electrolytes = K – 4.0 Cl – 115 iCa – 0.78
- Lactate = 11.6
More Blood Products

- 11 U PRBC
- 8 U Cryo
- 8 U FFP
- 2 mg Factor VII
- 1000 mg Tranexamic Acid
• Hemostatsis
  • Is the process of blood clot formation at the site of vessel injury to stop bleeding

• 4 Phases of clotting process:
  • Platelet plug
  • Coagulation Cascade
  • Termination of Clotting
  • Fibrinolysis

Rice, Wheeler, Chest, 2009
4 Classes of Hemorrhage

• Class I
  » Blood loss of 15%
  » Vital signs no change

• Class II
  » Blood loss 15 to 30%
  » Tachycardia, tachypnea and decreased pulse pressure
  » Skin cool and clammy
Hemorrhage

• Class III
  » Involves 30 to 40 % blood volume loss
  » SBP < 90 mmHg, HR > 120 and tachypnea
  » Decreased urine output and delayed capillary refill
  » changes in mental status

• Class IV
  » Involves 40 % or more blood volume loss
  » SBP < 90 mmHg, narrow pulse pressure, HR> 120
  » Urine output absent, skin cold and pale
  » Capillary refill is delayed
Hemorrhage

• Intraoperative hemorrhage
  – Blood loss exceeding 1000 mls or requiring a transfusion

• Massive hemorrhage
  – Acute blood loss of more than 25% of patient’s blood volume
  – Patients with severe hemorrhage may develop acute coagulopathy on admission that worsens with transfusion
  – Mortality is related to severity of hemorrhagic shock and total number of packed cells transfused

Sihler & Napolitano, Chest, 2009
Lethal Triad

- **Hypothermia**
  - Increased loss of heat
  - Decreased production of heat
  - Effects platelet activation

- **Acidosis**
  - Activity of intrinsic and extrinsic pathways reduced
  - Increased fibrinogen degradation rate

- **Coagulopathy**
  - Occurs early after injury in presence of tissue hypoperfusion

Engels et al, Trauma, 2011
Treatment

• Aim of Treatment
  • Restoration of vascular and tissue integrity by surgery or embolization

• Blood transfusion
  • to restore adequate blood volume to maximize tissue oxygen delivery
  • Goal is to maintain hemostasis with blood products

Sihler & Napolitano, Chest, 2009
Massive Transfusion

- Massive transfusion is the administration of > 10 units of PRBC’s in 24 hours
- Goal is to achieve hemostasis without DVT’s, Thrombosis, CVA or MI
- Selection of appropriate amount and types of blood components

Engels et al., Trauma, 2011
This document is applicable at site(s):
GNH MIS RAH SGH UAH STO LCH FSH NEC

Appropriate Initial Interventions
- Intravenous access: 2 large bore IVs + CVC
- Crystalloid: as per attending physician
- Labs: Crossmatch, CBC, INR, PTT, Fibrinogen, electrolytes, Mg, lactate, creatinine, ABGs and Ionized Ca
- Continuous Monitoring
- Aggressive warming
  - Blood warmer if rate >50 ml/kg/h
- Prevent/reverse acidosis
- Correct hypocalcemia: CaCl 1 gm IV slowly
- Transfuse with unmatched RBCs on hand
- Tertiary Trauma Survey

Other Considerations
- Heparin reversal
  - Protamine 1 mg IV / 100U of heparin
- Warfarin reversal
  - Vitamin K 10 mg IV
  - Prothrombin complex 40 mL
- Consider antifibrinolics
- Tranexamic Acid 10 mg/kg IV
- Cell salvage

General Guidelines for Blood Product Replacement in Adults
- RBCs: No threshold
  - Dose: MD discretion
- FFP: If INR >1.5
  - Dose: 10-15 mL/kg
- Platelets: If Pt <50 x 10^9/L or <100 x 10^9/L if CNS injury
  - Dose: 1 platelet pool
- Cryoprecipitate: Fibrinogen ≤1 g/L
  - Dose: 1 U/mL

Capital Health Adult (>50kg) Massive Transfusion Protocol

Identify & Manage Surgical Bleeding
- Surgery
- Angiographic Embolization
- Endoscopy

4 U RDCs transfused in ≤4 hours and ongoing major bleeding
- Consider activating MTP

6 u RBCs transfused in ≤4 hours and ongoing major bleeding

MD activates Massive Transfusion Protocol & designates clinical contact
- Clinical contact then contacts blood bank (TM) and:
  - Provides name of clinical contact
  - Sends all blood work stat with life threatening sticker
  - Provides sex, ULI, name/alias & location of patient
  - Records name of TM contact
- Calls TM if patient location / contact changes

Transfusion Medicine Sends MTP “Pack” (1:1:1 Ratio)
- 6 u RBCs + 6 u FFP + 1 Pool of Platelets
- Allow ~30 min for FFP preparation

Q30 min

Hemostasis & resolution of coagulopathy?
- Yes
  - Clinical designate contacts TM for additional products
  - Attending MD or TMMD can adjust pack based on labs as needed
- Stop MTP
  - Notify Blood Bank
  - Return any unused products ASAP
  - Resume standard ordering practices
  - Q1h consider repeat INR, PTT & fibrinogen
  - Can be repeated in 30 minutes, third dose may be given up to 2 hours later
  - Max 3 doses — stable 3 hours at RT

Consider rFVIIa (Nistase®)
- Dose 40 μg/kg

Print Date: November 17, 2009
Prevention of Lethal Triad

- Early control of Hemorrhage
- Hemostatic Resuscitation
- Hypotensive resuscitation
- Aggressive treatment of Coagulopathy

Engels et al., Trauma, 2011
Hemostatic Resuscitation

- Expedite control of hemorrhage
- Prevent dilutional coagulopathy and thrombocytopenia
- Hypotensive resuscitation
- Transfuse blood products 1:1:1 ratio
- Frequent lab monitoring

Silher & Napolitano, Chest 2009
Dilutional Coagulopathy

- Infusion of RBC and Crystalloid dilute clotting proteins
- Increased PT, PTT
- Decreased Platelets and Fibrinogen
- Ratio of 1:1:1 for FFP, Platelets and red cells
- Cryoprecipitate when fibrinogen decreased

UptoDate, 2012
Hypotensive Resuscitation

- Prehospital minimize fluid resuscitation
- Trauma Practice Guidelines
  - Withhold IV fluids in patients with penetrating injuries
  - Withhold IV fluids until active bleeding is addressed
  - Titrate IV fluid administration to palpable radial pulse
  - Small fixed boluses rather than continuous administration of IV fluids

Engels et al., Trauma 2011
Factor VIIa

- Mechanism of Action
  - Increased tissue factor binding
  - Increased binding to activated platelets
  - Activation of factor X
- Correction of early coagulopathy

Tranexamic Acid

- Mechanism of Action
  - Inhibits the breakdown of the clot
  - Antifibrinolytics
- Crash 2 study

Shiler & Napolitano, Chest, 2009
Complications of MT

• Metabolic Alkalosis
  – Due to citrate accumulation
  – Hypokalemia due to exchange of H ions

• Hypocalcaemia
  – Citrate binding

• Hypokalemia
  – K reenter the red cells
  – Aldosterone, ADH, Catecholamine release

• Hyperkalemia
  – From K leakage from blood (renal failure)

Rice, Wheeler, Chest 2009
Complications of MT

- Hypothermia
  - Decreased clotting, metabolic acidosis
- Dilutional Thrombocytopenia
  - Loss and consumption
- TRALI
- TACO

Shiler & Napolitano, Chest, 2009
Nursing Care

• Prevent Hypothermia
  • Increase room temperature
  • Heating blankets
  • Warm ALL FLUIDS
  • Increase temp on ventilator humidifiers

• Follow Massive Transfusion Protocol
  • 1:1:1 ratio

• Treat acidemia
  • R/L instead of NS
• Temp = 36 C
• Hgb = 90
• ABG = 7.24/40/40
• INR = 1.0
• PTT = 44
• GCS = 3 No sedation/analgesic since the OR
• Lactate = 8.4
ICU Assessment 2000h

- VS began to stabilize
- Requiring less inotropic support
- Temp 38 C
- Improved LOC
• Discharged home in less than 1 month
• No deficits
• Returned to the ICU to visit and thank the staff 6 months post discharge


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