For the patient with shock due to blood loss

**PLAN FOR CONTROLLING HEMORRHAGE & ACTIVATE MASSIVE TRANSFUSION PROTOCOL**
- Activate massive transfusion protocol
- Determine how hemorrhage can be controlled (surgical, IR, or GI intervention) and call for help from the appropriate team(s)

**USE THE RIGHT LINES AND EQUIPMENT**
- Don’t wait for central access to begin resuscitation; often PIVs are superior for resuscitation anyway
- Use a pressure infuser/heater to give product faster
- Don’t wait for central access to begin resuscitation; often PIVs are superior for resuscitation anyway
- Use hemodynamic stability (not hematocrit) as the resuscitation endpoint
- Can use CBC, coags, or TEG/ROTEM to guide additional resuscitation (see OnePager on TEG)

**USE BLOOD PRODUCTS IN A BALANCED RATIO**
- Initially, perform hemostatic resuscitation with blood products in a fixed ratio, e.g. 1 RBC/1 FFP/1 platelet
- Goal is to provide an overall balanced resuscitation (but don’t wait for a particular product to resuscitate)
- Use hemodynamic stability (not hematocrit) as the resuscitation endpoint
- Can use CBC, coags, or TEG/ROTEM to guide additional resuscitation (see OnePager on TEG)

**CONSIDER TXA**
- Effective in trauma (w/i 3 hours), surgical, or obstetrical hemorrhage. Also epistaxis, hemoptysis & maybe GIB. Not indicated for SHD or ICH.
- Initial dose 1g IV /10 min

**MAINTAIN EUThERMIA**
- Hypothermia inhibits clotting.
- Warm resuscitation fluids; apply warming to patient if possible

**CORRECT COAGULOPATHY**
- Reverse anticoagulation depending on agent: warfarin, DOACs, heparin, etc (protocol)
- If platelet dysfunction -> ddAVP 0.3 mcg/kg IV over 30 min

**CORRECT ELECTROLYTES**
- Hypocalcemia is particularly common due to resuscitation with citrate containing blood products.
- Acidosis inhibits clotting & decreases contractility.
- Provide sufficient MV to correct metabolic acidosis. Goal pH >7.2

**VOID ACIDOSIS**
- Acidosis inhibits clotting & decreases contractility.
- Provide sufficient MV to correct metabolic acidosis. Goal pH >7.2

**USE PHYSILOGICAL FLUID**
- If fluids are required (in addition to blood products) use LR or other physiologic solution to avoid acidosis due to hyperchloremia

**VISCOSITY OF FLUID**
- Viscosity depends on the temperature of the fluid; Use a fluid warmer (which is part of a rapid infuser system) and make sure it is actually working!

**PRESSURE DIFFERENCE**
- Maximize the AP by using a pressure infuser (either a pressure bag, or better yet, a rapid infuser system); can increase infusion rates by up to 3x!

**INTRAOSSEOUS**
- Flow determined by bone location more than needle.
  - Tibial is comparable to long 18 gauge PIV
  - Humeral is comparable to long 16 gauge PIV
- Typical flow rates = 50-100 ml/min w/ pressure infuser.

**CATHETER RADIUS**
- Radius is the most important factor that determines flow rate; Wider is better
- Flow rate $\propto \frac{r^4 \Delta p}{L \eta}$

**CATHETER LENGTH**
- Shorter is better; PIVs are shorter than central lines and often achieve faster flow rates. PICCs are useless for resuscitation.

**EXTENSIONS/CONNECTORS**
- Each additional connection can reduce flow by up to 30%. Remove caps, connectors, and extra extension sets.

**INTRAOSSEOUS EXAMPLE**
- 22 ga PIV
  - 0.8 mm x 1.16"
- 20 ga PIV
  - 0.8 mm x 1.16"
- 18 ga PIV
  - 1.0 mm x 2.5"
- 18 ga PIV
  - 1.0 mm x 1.16"
- 16 ga PIV
  - 1.3 mm x 1.77"
- 14 ga PIV
  - 1.6 mm x 1.75"
- PICC
  - 5 Fr x 20" 1 lumen 16 ga
- PICC
  - 5 Fr x 20" 2 lumens: 18 & 22 ga
- TLC
  - 18 ga x 180 mm
  - 18 ga x 190 mm
  - 16 ga x 200 mm
- INTRODUCER
  - 8.5 Fr x 100 mm
- RIC
  - 8.5 Fr x 50 mm

- Reassess continuously
- Learn the color code to quickly identify PIVs

**OTHER CONSIDERATIONS**
- Increase up to 3x by applying 300 mmHg of pressure
- 1M GRAVITY
  - 36 ML/MIN
  - 60 ML/MIN
  - 85 ML/MIN
  - 105 ML/MIN
  - 205 ML/MIN
  - 330 ML/MIN
  - 15 ML/MIN
  - 10 ML/MIN
  - 105 ML/MIN
  - 130 ML/MIN
  - 400 ML/MIN

- Note, that of you place a catheter through the introducer you reduce the flow rate substantially!

- Link to the most current version → onepagericu.com

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