Chapter 19: Hemorrhage & Shock

Introduction to Hemorrhage & Shock

Hemorrhage
- Abnormal internal or external loss of ____________________________________

Homeostasis
- Tendency of the body to maintain a steady and normal internal environment

Shock
- INADEQUATE TISSUE ____________________________________
- Transition between homeostasis and death

Heart
- Cardiac ____________________________________
  - The repetitive pumping action that produces pressure changes that circulate blood throughout the body
- Cardiac ____________________________________
  - The total amount of blood separately pumped by each ventricle per minute, usually expressed in liters per minute

Cardiac Output
- Determined by multiplying the heart rate by the
  ____________________________________ of blood ejected by each ventricle during each beat (stroke volume)
- Cardiac Output (CO) = Heart Rate X ____________________________________ Volume
- Normal cardiac output = ___________ to ___________ liters per minute (LPM)
- Can increase up to ___________ LPM in times of stress or exercise

Cardiac Output is Influenced By:
- ____________________________________ of contraction
- ____________________________________ of contraction
- Amount of venous return available to the ventricle

Circulation (1 of 3)
- Systolic pressure
  - Strength and ____________________________________ of cardiac output
- Diastolic pressure
  - More indicative of the state of ____________________________________ of the arterioles
- Pulse Pressure
  - Difference between systolic and ____________________________________
  - Systolic minus diastolic = pulse pressure

Circulation (2 of 3)
- Mean arterial pressure
  - _________ pulse pressure added to the diastolic pressure
  - Tissue perfusion pressure
- Example: BP is 120/90
- What is the pulse pressure?
  - _________

What is the MAP?
\[ \frac{1}{3} \times 30 = \text{__________} \ 10 + \text{__________} = \text{__________} \text{ mmHg} \]

8. **Circulation (3 of 3)**
   - Vascular control
     - Increased ________________________________ tone results in increased vasoconstriction
   - Microcirculation
     - Blood flow in the ________________________________ , capillaries, and venules
     - Sphincter functioning
   - Most organ tissue requires blood flow 5-20% of the time.

9. The vasoconstriction in peripheral vascular beds results in the characteristic pale, cold ________________________________ of patients suffering from hypovolemic shock.

10. **3 Step Clotting Process**
    - ________________________________ Phase
      - Vasoconstriction
    - ________________________________ Phase
      - Platelets start to bind
    - ________________________________ Phase
      - Release of enzymes
        - FIBRIN release
        - Normal coagulation = 7-10 minutes

11. **Clotting**

12. **Factors Affecting Clotting**
    - Movement of the ________________________________ site
    - Aggressive ________________________________ Therapy
      - Increases BP and pushes clots
      - Fluid dilutes clotting factors
    - Low Body Temperature
      - Ineffective clot formation
    - Medications
      - ASA, ________________________________ , warfarin (Coumadin)

13. **Other Factors Affecting Clotting**
    **Nature of Wound**
    - ________________________________
      - Vessels constrict and draw inward
      - Reduction of blood loss
    - ________________________________
      - Constriction of smooth muscle
      - Enlarges wound
      - Increased blood loss
      - Example: Crushing Trauma

14. **The type of blood ________________________________ injury often affects the nature of the hemorrhage.**

15. **Stages of Shock at the Cellular Level**
Four Stages

Stage 1: ____________________________________

Stage 2: Capillary and venule opening

Stage 3: Disseminated intravascular coagulation

Stage 4: Multiple organ ________________________________

Stage 1: Vasoconstriction (1 of 2)

- Vasoconstriction begins as minimal _____________________________ to capillaries continues
- Production of lactate and hydrogen ions increases and the vessels begin to leak
- _____________________________ stimulation produces:
  - Pale, sweaty skin
  - Rapid, thready pulse
  - Elevated blood _____________________________ levels

Stage 1: Vasoconstriction (2 of 2)

- The release of _____________________________ dilates coronary, cerebral, and skeletal muscle arterioles and constricts other arterioles.
  - Blood is _____________________________ to the heart, brain, skeletal muscle, and capillary flow to the kidneys and abdominal viscera decreases.
- If this stage of shock is not treated by prompt _____________________________ of circulatory volume, shock progresses to the next stage

Stage 2: Capillary and Venule Opening (1 of 3)

- Occurs with a __________-____________% decrease in intravascular blood volume
- Heart rate, respiratory rate, and capillary refill are _____________________________ , and pulse pressure is decreased
- Blood pressure may still be _____________________________.

Stage 2: Capillary and Venule Opening (2 of 3)

- As increasing hypoxemia and _____________________________ lead to opening of additional venules and capillaries, the vascular space expands greatly.
  - Even normal blood volume may be inadequate to fill the container.
- The capillary and venule capacity may become great enough to _____________________________ the volume of available blood for the great veins and vena cava.
  - Resulting in decreased venous return and a fall in _____________________________ output.

Stage 2: Capillary and Venule Opening (3 of 3)

- Sluggish blood flow and the reduced delivery of oxygen result in increased _____________________________ metabolism and the production of lactic acid
- This stage of shock often progresses to the third stage if _____________________________ resuscitation is inadequate or delayed, or if the shock state is complicated by trauma or sepsis

Stage 3: Disseminated Intravascular Coagulation (DIC) (1 of 3)

- Time of onset will depend on _____________________________ of shock, patient age, and preexisting medical conditions.
- Stage 3 occurs with 25%-35% decrease in intravascular blood volume. At this stage, _____________________________ occurs. This stage of shock usually requires blood replacement
Stage 3: Disseminated Intravascular Coagulation (DIC) (2 of 3)
- Stage 3 is resistant to ____________________________ (refractory shock), but is still reversible.
- Blood begins to coagulate in the microcirculation, clogging capillaries.
- ____________________________ acid accumulates around the cell.
  - Cell membranes no longer have the energy needed to maintain ____________________________.
  - Water and sodium leak in, potassium leaks out, and the cells swell and die.

Stage 3: Disseminated Intravascular Coagulation (DIC) (3 of 3)
- Pulmonary capillaries become ____________________________ , leading to pulmonary edema
  - Decreases the absorption of oxygen and results in possible alterations in carbon ____________________________ elimination
  - May lead to acute respiratory failure or adult respiratory distress syndrome (ARDS)
- If shock and disseminated intravascular coagulation (DIC) continue, the patient progresses to ____________________________ organ failure

Stage 4: Multiple Organ Failure (1 of 2)
- The amount of cellular ____________________________ required to produce organ failure varies with each organ and the underlying condition of the organ.
  - Usually ____________________________ failure occurs, followed by renal failure, and then heart failure.
- In this stage, blood pressure ____________________________ dramatically (to levels of 60 mmHg or less).

Stage 4: Multiple Organ Failure (2 of 2)
- If a critical amount of the vital organ is damaged by cellular necrosis, the ____________________________ soon fails.
  - Failure of the liver is common and often presents early.
  - Capillary blockage may cause ____________________________ failure.
- Pulmonary thrombosis may produce hemorrhage and fluid loss into the alveoli.
  - Leading to ____________________________ from respiratory failure.

Classification of Hemorrhage
- ____________________________
  - Slow even flow (oozes)
  - May be bright red but quantity is small
- ____________________________
  - Dark red
  - Flowing
- ____________________________
  - Bright red,
  - Spurting and pulsating

Hemorrhage Classification

Controlling External Bleeding
External bleeding is controlled by:
- Direct, even ____________________________ and elevation
- Pressure dressings and/or splints
• It will often be useful to combine these methods.

**Tourniquet**
- If direct pressure fails, apply a tourniquet ___________________________ the level of bleeding.
- Used only on ___________________________
- It should be applied quickly and not released until a physician is present.

**Applying a Commercial Tourniquet**
- Hold direct pressure over wound
- Place tourniquet around the extremity just ___________________________ the bleeding site
- Click the buckle into place and pull the strap tight
- Turn the dial ___________________________ until pulses are no longer palpable below the tourniquet or until bleeding is controlled

**Releasing a Commercial Tourniquet**
- To release the tourniquet at the hospital, or if instructed by medical control, push the ___________________________ button and pull the strap back.
- Caution: ___________________________ may rapidly return upon tourniquet release and may need to be rapidly reapplied

**Making and Applying a Tourniquet (1 of 2)**
- Fold triangular bandages to ___________" wide and 6 to 8 layers thick
- Wrap the bandage around the extremity ___________________________ just above the bleeding site
- Tie one ___________________________ in the bandage. Place a stick or rod on the knot and tie the ends of the bandage over the handle

**Making and Applying a Tourniquet (2 of 2)**
- Twist the handle to tighten the tourniquet until ___________________________ stops
- Secure the handle
- Write “ ___________ ” and exact time on a piece of tape and apply to patient’s forehead
- A great alternative is the use of a ___________________________

**Making a Tourniquet**

**BP Cuff as Tourniquet**
- BP cuff will work well for a tourniquet
- Pressure the cuff about ___________ mmHg above systolic BP
- Make sure cuff does not leak
- Continuously ___________________________
- Must use ___________________________ cuff for large lower extremities

**Tourniquet Precautions**
- Do not apply a tourniquet directly over any ___________________________.
- Make sure the tourniquet is tightened securely.
- Use ___________________________ padding under tourniquet if possible
- Never use wire, rope, a belt, or any other narrow material.
- Do not ___________________________ the tourniquet.
Internal Hemorrhage Control
- Pocket of blood between muscle and fascia
- Humerus or Tibia/Fibula fracture: 500-750mL
- Femur fracture: 1,500mL
- UNEXPLAINED SHOCK is BEST attributed to trauma
- General Management
  - Immobilization, Elevation

Internal Hemorrhage Control
- Nose Bleed
  - Causes: Trauma, Hypertension
  - Treatment: Lean forward, pinch nostrils
- Hemoptysis
- Esophageal Varices
  - dark, tarry stool
- Chronic Hemorrhage

Internal Bleeding
Provide a patient with suspected internal bleeding with immobilization and
Elevation (of extremities) to aid the body's hemorrhage control mechanisms.

Blood
- _________% of body weight is fluid
- Males have about __________-_________ liters of blood (10 units)
- Females have about __________-_________ liters of blood (9-10 units)

Stages of Hemorrhage: Stage 1
- 15% loss of CBV; 70 kg pt = 500-750 mL
- Compensation
  - Normal BP, Pulse Pressure, Respirations
  - Slight ______________ of Pulse
  - Release of __________________________
    - Epinephrine
    - Norepinephrine
      - Anxiety, slightly pale and clammy skin

Stages of Hemorrhage: Stage 2 (1 of 2)
- 15-25% loss of CBV
  - 750-1250 mL
- Early Decompensation
  - Unable to maintain __________________________
    - __________________________ & Tachypnea

Stages of Hemorrhage: Stage 2 (2 of 2)
- Decreased pulse __________________________
- Narrowing pulse pressure
Significant catecholamine release
- Increase ____________________________________
- Cool, clammy skin & thirst
- Increased anxiety and ____________________________________
- Normal renal output

Stages of Hemorrhage: Stage 3 (1 of 2)
- ___________% loss of CBV
  - 1250-1750 mL
- Late ____________________________________ (Early Irreversible)
  - Compensatory mechanisms unable to cope with loss of Blood Volume

Stages of Hemorrhage: Stage 3 (1 of 2)
Classic Shock:
- Weak, thready, rapid ____________________________________
- Tachypnea
- ________________________________, restlessness
- Decreased ________________________________ and AMS
- Pale, cool and clammy skin

Stages of Hemorrhage: Stage 4
- >35% CBV Loss
  - >1750 mL
  Irreversible Shock
- Pulse: Barely ________________________________
- Respiration: Rapid, shallow and ineffective
- LOC: ________________________________, confused, unresponsive
- GU: Ceases
- Skin: Cool, clammy and very pale
- Unlikely ________________________________

Stages of Hemorrhage
Average Blood Volume = ___________L

Stages of Hemorrhage: Special Factors (1 of 2)
Pregnant Patients
- >___________% blood volume than normal
- Fetal circulation is impaired when mother is compensating
Athletes
- Greater fluid and cardiac ________________________________
Obese
- CBV is based on ________________________________ weight (less CBV)

Stages of Hemorrhage: Special Factors (2 of 2)
Children
- CBV 8-9% of body weight
- Poor ________________________________ mechanisms over a greater period of time
- TREAT ________________________________
Elderly
- Decreased CBV
- ________________________________ : BP, & Anticoagulants
Hemorrhage Assessment (1 of 7)

Scene Size-up
- Is it Safe?
  - BSI
  - Law Enforcement Loss
- Mechanism of Injury/Nature of Illness
- Number of Patients
- Need for Resources

Hemorrhage Assessment (2 of 7)

Primary Assessment
- General
- Obvious Bleeding
- Mental Status
- ABC’s
- Interventions

Hemorrhage Assessment (3 of 7)

Primary Assessment (cont’d)
- Manage as you go
  - Bleeding Control
  - Shock
  - before !
- IV’s should be established unless there are on scene delays

Hemorrhage Assessment (4 of 7)

Focused History and Physical Exam
- Rapid Trauma Assessment
- Full Head to Toe
- Consider Air Medical if Stage 2+ Blood Loss
- Focused Physical Exam
  - Guided by physical exam
  - Vitals, SAMPLE, & OPQRST

Hemorrhage Assessment (5 of 7)

Focused History and Physical Exam (cont’d)
- Orthostatic
- Test
  - BP or P from supine to sitting

Hemorrhage Assessment: Fractures and Blood Loss (6 of 7)
- Pelvic fracture: mL
- Femur fracture: 1,500 mL
- Tibia/Fibula fracture: mL
- Hematomas & Contusions: mL
Hemorrhage Assessment (7 of 7)

Reassessment

- Reassess Vitals & Mental Status
  - Q 5 min: ____________________________ patients
  - Q 15 min: ____________________________ patients

- Reassess Interventions
  - Oxygen, ET, IV, Medications

- Trending: Improvement vs ____________________________
  - Pulse oximetry, capnography

Hemorrhage Management

- ABC's
  - O2, AED, ET, IV

- Protect ____________________________
  - Full immobilization
  - Best splint is the ____________________________

- CPR: BLS & ALS care
- ____________________________ Control
- PASG

Specific Wound Considerations

Head Wounds

- Presentation
  - Severe ____________________________
  - Skull Fx

- Management
  - Control bleeding, not ____________________________

With head injury patients, do not attempt to stop the flow of blood or fluid from the ____________________________ or ear canal, but cover the area with porous dressing to collect the material and bandage ____________________________.

Neck Wounds

- Large vessels can entrain ____________________________

- May occlude with pressure above and below open wound
- ____________________________ dressing

Gapping Wounds

- Presentation
  - ____________________________ sites
  - Gaping may prevent uniform pressure

- Management
  - ____________________________ dressing (multi-trauma dressing)
  - Compression Dressing

Crush Injury

- Presentation
  - Difficult to locate ____________________________ of bleeding
  - Normal bleeding control mechanisms non functioning
Management
- Consider air splint or PASG
- Consider _____________________________ if needed
- If extrication is required, consider _____________________________ syndrome

Transport Considerations
Consider Rapid Transport When:
- Suspected serious blood loss
- Suspected serious _____________________________ bleeding
- _____________________________ Shock
- WHEN IN DOUBT TRANSPORT
- Always strive to spend less than ___________ minutes on scene

In a Nutshell....
- SHOCK is...INADEQUATE TISSUE _____________________________

Cellular Ischemia
- A _____________________________ in the delivery of oxygenated blood to the cells
- As blood loss increases, more and more body cells are deprived of oxygen and more waste products accumulate.
- The bloodstream becomes _____________________________

Stages of Shock
- _____________________________ Shock
  - Minimal Change
  - _____________________________ Shock
  - System beginning to fail
  - _____________________________ Shock
    - Ischemia and death imminent

Compensated Shock
- Blood vessels _____________________________ to maintain BP
- Restlessness and anxiety
- Pulse rate _____________________________
- Pulse strength decreases
- Skin becomes cool and _____________________________
- Thirst, weakness, eventual air hunger

 Decompensated Shock
- Pulse becomes unpalpable
- Blood pressure _____________________________
- Pt begins to lose consciousness
- _____________________________ slow or ceases

Irreversible Shock
- Cells _____________________________
  - _____________________________ do not function properly
- Patient _____________________________

Newer Classifications of Shock
- Hypovolemic shock
• Cardiogenic Shock
  - Interference with blood flow through circulatory system
  - Tension pneumothorax, cardiac tamponade, pulmonary embolism

• ____________________________ Shock
  - Prevents distribution of nutrients
  - Anaphylactic, Septic, Hypoglycemia

Shock Assessment
• Scene Size-up
• Initial Assessment
• Focused History and Physical Exam
  - Rapid Trauma Assessment

Shock Management (1 of 6)
• A primary principle of shock care is to assure the best possible chance for tissue
  oxygenation and carbon dioxide __________________________; do this by
  providing supplemental high-flow oxygen or positive pressure ventilation.

Shock Management (2 of 6)
Airway and Breathing:
• Non rebreather
  - ____________________________ ventilations
• Advanced airway: ET, Combitube, King Airway
• Needle __________________________

Shock Management (3 of 6)
Hemorrhage Control
Fluid Resuscitation:
• Catheter size and length
  - ____________________________ Bore IV or IVs to maintain SIBP at 100mmHg
    - ____________ gauge or larger
    - W/O bolus at increments of ____________ or ___________cc
  - ____________mL/kg of NS or LR for pediatrics

Shock Management (4 of 6)
• ____________________________ control
  - Blankets, warmed IV fluids
  - Increases PVR
  - Shunts blood to thorax and head
  - Immobilizes pelvis and lower extremities
  - Assess for:
    - ____________________________ edema
    - Pregnancy
    - Vital signs

Shock Management (5 of 6)
Cardiogenic Shock:
Shock Management (6 of 6)

Distributive Shock:
- ______________ resuscitation
- Dopamine
- PASG
- Locate and treat - ______________________

Fluid Resuscitation (1 of 2)
- For every liter of blood lost, it takes about __________ liters of fluids to replace the blood (_________:1)
- Check radial pulses. If absent then SIBP< 80mmHg
- Use an isotonic ____________________ (NS or LR)
  - LR is the preferred
- Should be run wide open until BP returns to 100mmHg and LOC improves
- Use large bore (14-16ga.)
- Use ___________ lines if needed

Fluid Resuscitation (2 of 2)
- Can utilize a pressure bag or __________________________ inflated to 100 to 200mmHg
- Run until __________ - __________ cc given and then re-evaluate (Bolus)
- Do not overhydrate and increase volume over what is needed to maintain perfusion
- Pediatrics is __________ cc/kg, then re-evaluate
- Repeat as needed or as authorized

Key Points
- Fluid Resuscitation for trauma should be initiated en route, __________________________ on scene
- Avoid overhydration. Maintain SIBP at or around __________ mmHg.
  - Monitor __________________________ sounds
  - Increased BP can lead to increased blood loss
- Not all trauma need fluids. __________________________ injuries are a prime example. Use INT or set at TKO
- BLS BEFORE ALS