Chapter 19 Hemorrhage & Shock

Introduction to Hemorrhage & Shock

Hemorrhage
• Abnormal internal or external loss of ____________________________
• 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 2)
• Systolic pressure
  – Strength and ____________________________ of cardiac output
• Diastolic pressure
  – More indicative of the state of ____________________________ of the arterioles
• Mean arterial pressure
  – ____________________________ pulse pressure added to the diastolic pressure
  – Tissue ____________________________ pressure

Circulation (2 of 2)
• Vascular control
– Increased tone results in increased vasoconstriction
  • Microcirculation
    – Blood flow in the , capillaries, and venules
      – functioning
  • Most organ tissue requires blood flow 5–20% of the time.

8 The vasoconstriction in peripheral vascular beds results in the characteristic , cold skin of patients suffering from hypovolemic shock.

9 3 Step Clotting Process
  • Phase
    – Vasoconstriction
  • Phase
    – Platelets start to bind
  • Phase
    – Release of enzymes
      • FIBRIN release
      • Normal coagulation = 7-10 minutes

10 Clotting

11 Factors Affecting Clotting
  • Movement of the site
  • Aggressive Therapy
    ☐Increases BP and pushes clots
    ☐Fluid dilutes factors
  • Low Body Temperature
    ☐Ineffective formation
  • Medications
    ☐ASA, , warfarin (Coumadin)

12 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

13 The type of blood injury often affects
the nature of the hemorrhage.

14 Stages of Shock at the Cellular Level

15 Four Stages
   • Stage 1: ____________________________________
   • Stage 2: Capillary and venule ____________________________________
   • Stage 3: Disseminated intravascular coagulation
   • Stage 4: Multiple ______________________________ failure

16 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

17 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

18 Stage 2: Capillary and Venule Opening (1 of 3)
   • Occurs with a __________ - __________% decrease in intravascular blood volume
   • Heart rate, respiratory rate, and ______________________________ refill are increased, and pulse pressure is decreased
   • Blood pressure may still be ______________________________ .

19 Stage 2: Capillary and Venule Opening (2 of 3)
   • As increasing hypoxemia and acidosis lead to opening of additional venules and capillaries, the vascular space ______________________________ 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.

20 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 fluid resuscitation is inadequate
or delayed, or if the shock state is complicated by trauma or

21  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

22  Stage 3: Disseminated Intravascular Coagulation (DIC) (2 of 3)
• Stage 3 is resistant to treatment (_________________________ shock), but
  is still reversible.
• Blood begins to ___________________ in the microcirculation,
  clogging capillaries.
• Lactic ___________________ accumulates around the cell.
  – Cell membranes no longer have the energy needed to maintain homeostasis.
  – Water and sodium leak in, potassium leaks out, and the cells swell and die.

23  Stage 3: Disseminated Intravascular Coagulation (DIC) (3 of 3)
• Pulmonary capillaries become permeable, leading to pulmonary
  – 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

24  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).

25  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.

26  Classification of Hemorrhage
• ___________________
  – Slow even flow (oozes
– May be bright read but quantity is small
  • ____________________________________
  – Dark red
  – Flowing
  • ____________________________________
  – Bright red,
  – Spurting and pulsating

27 □ Hemorrhage Classification

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

29 □ Tourniquet
• If direct pressure fails, apply a tourniquet ____________________________________
  the level of bleeding.
• Used only on ____________________________________
• It should be applied quickly and not ____________________________________ until a
  physician is present.

30 □ Applying a Commercial Tourniquet
• BSI
• Hold direct ____________________________________ over wound
• Place tourniquet around the extremity just above 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

31 □ 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: bleeding may rapidly return upon tourniquet release and may need to be
  ____________________________________ reapplied

32 □ Making and Applying a Tourniquet (1 of 2)
• Fold ____________________________________ bandages to 4” wide and 6 to 8 layers
  thick
• Wrap the bandage around the extremity ____________________________________ just
  above the bleeding site
• Tie one knot in the bandage. Place a stick or
  ____________________________________ on the knot and tie the ends of the bandage
  over the handle
Making and Applying a Tourniquet
• Twist the handle to tighten the tourniquet until bleeding stops
• ____________________________________ 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 ____________________________________ cuff

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 ____________________________ 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
• Esophageal Varices
• ____________________________
• Chronic Hemorrhage
  -Anemia

Internal Bleeding
Provide a patient with suspected internal bleeding with immobilization and elevation (of ____________________________) to aid the body’s hemorrhage control mechanisms.
Blood
- 60% of body weight is fluid
- Males have about _____ - _______ liters of blood (10 units)
- Females have about 4-5 liters of blood (9-10 units)

Stages of Hemorrhage Stage 1
- 15% loss of CBV; 70 kg pt = 500-750 mL
- Compensation
  - ____________________________ BP, Pulse Pressure, Respirations
  - Slight Elevation of Pulse
  - Release of catecholamines
  - ____________________________
  - 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 ____________________________
  - Tachycardia & ____________________________

Stages of Hemorrhage Stage 2 (2 of 2)
- Decreased pulse ____________________________
- Narrowing pulse pressure
- Significant catecholamine release
  - Increase PVR
  - Cool, clammy skin & thirst
  - Increased ____________________________ and agitation
  - Normal renal output

Stages of Hemorrhage Stage 3 (1 of 2)
- 25-35% loss of CBV
  - 1250-1750 mL
- Late ____________________________ (Early Irreversible)
  - Compensatory mechanisms unable to cope with loss of Blood Volume

Stages of Hemorrhage Stage 3 (2 of 2)
- Classic Shock
  - Weak, thready, rapid ____________________________
  - Tachypnea
  - Anxiety, restlessness
  - Decreased ____________________________ and AMS
  - Pale, cool and ____________________________ 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 ________________________________

47 □ Stages of Hemorrhage
Average Blood Volume = _________ L

48 □ 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)

49 □ Stages of Hemorrhage Special Factors (2 of 2)
Children
⊙CBV 8-9% of body weight
⊙Poor ________________________________ mechanisms over greater period of
time
⊙TREAT ________________________________
Elderly
⊙Decreased CBV
⊙_______________________________ : BP, & Anticoagulants

50 □ Hemorrhage Assessment (1 of 7)
Scene Size-up
• Is it Safe?
  – BSI
    – ________________________________ Loss
    – Law Enforcement
• Mechanism of Injury/Nature of Illness
• ________________________________ of Patients
• Need for Additional __________________________

51 □ Hemorrhage Assessment (2 of 7)
Primary Assessment
• ________________________________ Impression
• Obvious Bleeding
• ____________________________________ Status
• ABC’s (C-spine)
• Interventions

52 Hemorrhage Assessment (3 of 7)
Primary Assessment (cont’d)
• ____________________________________ as you go
  – O2
  – Bleeding Control
  – Shock
  – ________________ before ALS!
  – ________________ should be established en route unless there are on scene delays

53 Hemorrhage Assessment (4 of 7)
Focused History and Physical Exam
• Rapid ____________________________________ Assessment (Rapid Scan)
  – Full Head to Toe
  – Consider Air Medical if Stage 2+ Blood Loss
• Focused Physical Exam
  – Guided by c/c and MOI
  – Vitals, ____________________________________, & OPQRST

54 Hemorrhage Assessment (5 of 7)
Focused History and Physical Exam (cont’d)
• Additional Assessment
  – __________________________ Hypotension
  – Tilt Test
  – ♦BP or ♦P from supine to __________________________

55 Hemorrhage Assessment (6 of 7) Fractures and Blood Loss
• Pelvic fracture: __________________________ mL
• Femur fracture: __________________________ mL
• Tibia/Fibula fracture: 500-750 mL
• Hematomas & Contusions: __________________________ mL

56 Hemorrhage Assessment (7 of 7)
Reassessment
• Reassess Vitals & Mental Status
  – Q ___________ min: UNSTABLE patients
  – Q ___________ min: STABLE patients
• Reassess Interventions
  – Oxygen, ET, IV, Medications
• ____________________________________ : Improvement vs Deterioration
  – Pulse oximetry, capnography
Hemorrhage Management
- ABC’s
  - O2, AED, ET, IV
- Protect ________________________________
  - Full immobilization
  - Best splint is the body
- CPR: BLS & ALS care
- Bleeding Control

Specific Wound Considerations

Head Wounds
- Presentation
  - Severe Bleeding
    - ________________________________ Fx
- Management
  - Control bleeding, not ________________________________

With head injury patients, do not attempt to stop the flow of blood or fluid from the nose 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

Gaping Wounds
- Presentation
  - ________________________________ sites
  - Gaping may prevent uniform pressure
- Management
  - ________________________________ dressing (multi-trauma dressing)
  - ________________________________ Dressing

Crush Injury
- Presentation
  - Difficult to locate source of ________________________________
  - Normal bleeding control mechanisms non functioning
- Management
  - Consider air splint or ________________________________
  - Consider tourniquet 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 ___________________________
• Always strive to spend less than ____________ minutes on scene

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
• Compensated Shock
  - ___________________________ Change
• Decompensated Shock
  -System beginning to ___________________________
• Irreversible Shock
  -Ischemia and ___________________________ 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 ___________________________
• Blood pressure falls
• Pt begins to loose ___________________________
• Respirations slow or ceases

Irreversible Shock
• ___________________________ die
• Organs do not function properly
• Patient ___________________________

Newer Classifications of Shock
• ___________________________ shock
• ___________________________ Shock
• Shock
  - Interference with blood flow through circulatory system
  - Tension pneumothorax, cardiac tamponade, pulmonary embolism
• Shock
  - Prevents distribution of nutrients
  - Anaphylactic, Septic, Hypoglycemia

72 Shock Assessment
• Scene Size-up
• Assessment
• Focused History and Physical Exam
  □ Rapid Trauma Assessment
• Detailed Exam
• Ongoing Assessment

73 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 ________________.

74 Shock Management (2 of 6)
Airway and Breathing:
• Non rebreather
• Assist ________________
• Advanced airway: ET, Combitube, King Airway
• Needle ________________

75 Shock Management (3 of 6)
Hemorrhage Control
Resuscitation:
• Catheter size and length
• Large Bore IV or IVs to maintain SIBP at ________ mmHg
  – 18 gauge or larger
• 20mL/kg of NS or LR for ________________

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

77  Shock Management (5 of 6)

- ____________________________ Shock:
  • Drugs ONLY after Fluid Resuscitation
  • ____________________________ Challenge
  • ____________________________ : Dopamine
  • Cardiac Drugs: Epi, Atropine

Spinal & Obstructive Shock:
  • ____________ resuscitation: NS & LR

78  Shock Management (6 of 6)

Distributive Shock:
  • ____________________________ resuscitation
  • Dopamine
  • ____________________________

79  Fluid Resuscitation (1 of 2)

- For every liter of blood lost, it takes about ________ liters of fluids to replace the blood (3:1)
- Check ____________________________ pulses. If absent then SIBP< 80mmHg
- Use an isotonic crystalloid (NS or LR)
  – LR is the preferred
- Should be run wide open until BP returns to ________mmHg and LOC improves
- Use large bore (14-16ga.)
- Use _________ lines if needed

80  Fluid Resuscitation (2 of 2)

- Can utilize a pressure bag or BP cuff inflated to ________ to ________ mmHg
- 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
- Re ____________________________ peat as needed or as authorized

81  Key Points

- Fluid Resuscitation for trauma should be initiated ____________, NOT on scene
- Avoid overhydration. Maintain SIBP at or around 100mmHg.
  – Increased BP can lead to increased ____________________________ loss
- Not all trauma need fluids. Head injuries are a prime example. Use INT or set at TKO
- ____________ BEFORE ____________________________