Project: Ghana Emergency Medicine Collaborative

Document Title: Recognition and Management of Shock (2012)

Author(s): Jim Holliman, M.D., Uniformed Services University

Attribution Key

for more information see: http://open.umich.edu/wiki/AttributionPolicy

Use + Share + Adapt

{ Content the copyright holder, author, or law permits you to use, share and adapt. }

Public Domain – Government: Works that are produced by the U.S. Government. (17 USC § 105)

Public Domain – Expired: Works that are no longer protected due to an expired copyright term.

Public Domain – Self Dedicated: Works that a copyright holder has dedicated to the public domain.

Creative Commons – Zero Waiver

Creative Commons – Attribution License

Creative Commons – Attribution Share Alike License

Creative Commons – Attribution Noncommercial License

Creative Commons – Attribution Noncommercial Share Alike License

GNU – Free Documentation License

Make Your Own Assessment

{ Content Open.Michigan believes can be used, shared, and adapted because it is ineligible for copyright. }

Public Domain – Ineligible: Works that are ineligible for copyright protection in the U.S. (17 USC § 102(b)) *laws in your jurisdiction may differ

{ Content Open.Michigan has used under a Fair Use determination. }

Fair Use: Use of works that is determined to be Fair consistent with the U.S. Copyright Act. (17 USC § 107) *laws in your jurisdiction may differ

Our determination **DOES NOT** mean that all uses of this 3rd-party content are Fair Uses and we **DO NOT** guarantee that your use of the content is Fair.

To use this content you should **do your own independent analysis** to determine whether or not your use will be Fair.

Recognition and Management of Shock

Jim Holliman, M.D., F.A.C.E.P.
Program Manager, Afghanistan Health Care Sector Reconstruction Project
Center for Disaster and Humanitarian Assistance Medicine
Professor of Military and Emergency Medicine
Uniformed Services University
Bethesda, Maryland, U.S.A.

Shock : Lecture Objectives

- Define shock
- Recognize stages or degrees of shock
- Know appropriate management for each stage

Shock

- Definitions :
  - A state of inadequate tissue oxygenation & organ perfusion
  - Situation when the circulation is inadequate for metabolic needs

Principles of Shock Recognition and Management

- Patients in shock may only exhibit subtle signs
- Identifying the cause is usually less important than starting treatment
- Goal is to restore perfusion and correct the shock state
- Frequent reassessment of response to treatment is important

The Body's Mechanisms to Try to Compensate for Shock

- Increase cardiac output : tachycardia
- Increase oxygen supply : tachypnea
- Release of vasoactive mediators
  - Nausea
  - Peripheral vasoconstriction
    - Cool, clammy skin, increased diastolic pressure, decreased urine output
- Note : "Compensated" shock is still dangerous and needs treatment ; pediatric patients may maintain a partially compensated shock and then suddenly catastrophically deteriorate

Types of Shock

- Hemorrhagic : most common in trauma patients
- Hypovolemic (emesis, diarrhea, etc.)
- "Obstructive"
  - Pulmonary embolus, cardiac tamponade, tension pneumothorax
- Cardiogenic
  - Acute myocardial infarction, Myocardial contusion
- Neurogenic
- Septic
- Anaphylactic

Principle of Treatment for Shock

- **In the trauma patient in shock : *always* treat for hemorrhagic shock first**

General Symptoms of Shock

- Weakness
- Dizziness
- Lightheadedness
- Nausea
- Sense of impending doom

General Signs of Shock

- Decreased mental status or confusion
- Cool, clammy, or grey or ashen color skin
- Diaphoresis
- Tachycardia
- Tachypnea
- Hypotension
- Oliguria

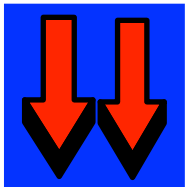
Hemorrhagic Shock

- Hemorrhage definition :
  - Acute loss of circulating blood ; can be internal and / or external
- Normal body blood volume
  - Adults : 7 % of ideal body weight
    - 5 liters in 70 kg adult
  - Children : 8 % of ideal body weight
    - 80 ml/kg

The Four Stages of Hemorrhagic Shock

- Stage 1 hemorrhage : 0 to 15 % of total blood volume (TBV)
- Stage 2 hemorrhage : 15 to 30 % of TBV
- Stage 3 hemorrhage : 30 to 40 % of TBV
- Stage 4 hemorrhage : > 40 % of TBV

Comparison of the Four Stages of Hemorrhagic Shock

Stage	Blood lost (cc)	% TBV lost	CNS SX	Systolic BP	Dias-tolic BP	Resps.	Pulse	Urine Output (ml/hr)	Treat-ment
1	<750	0 to 15	Slightly anxious	Normal.	Normal.	14 to 20	<100	>30	Crystal-loid
2	750 - 1500	15 to 30	Mildly anxious	Normal.		20 to 30	>100	20 to 30	Crystal-loid, may need blood
3	1500-2000	30 to 40	Confu-sed, anxious			30 to 40	>120	5 to 15	Crystal-loid & blood
4	>2000	>40	Lethar-gic or unconc.			>40	>140	Negli-gible	Rapid fluids, blood, surgery

Stage 1 Hemorrhage

- Blood lost : < 750 cc
- % TBV lost : 0 to 15
- CNS Symptoms : Slightly anxious
- Systolic BP : Normal
- Diastolic BP : Normal
- Respirations : 14 to 20
- Pulse : < 100
- Urine Output (ml/ hr) : ≥ 30
- Treatment : crystalloid (3 to 1 ratio) IV

Stage 2 Hemorrhage

- Blood lost : 750 to 1500 cc
- % TBV lost : 15 to 30
- CNS Symptoms : mildly anxious
- Systolic BP : normal
- Diastolic BP : increased
- Respirations : 20 to 30
- Pulse : > 100
- Urine output : 20 to 30 cc/hr
- Treatment : crystalloid, may need blood

Stage 3 Hemorrhage

- Blood lost : 1500 to 2000 cc
- % TBV lost : 30 to 40
- CNS symptoms : confused, anxious
- Systolic BP : ⇩
- Diastolic BP : ⇩
- Respirations : 30 to 40
- Pulse : > 120
- Urine output : 5 to 15 cc/hr
- Treatment : crystalloid and blood

Stage 4 Hemorrhage

- Blood lost : > 2000 cc
- % TBV lost : > 40
- CNS symptoms : lethargic or unconscious
- Systolic BP : 
- Diastolic BP : 
- Respirations : > 40
- Pulse : > 140
- Urine output : negligible
- Treatment : rapid fluids, blood, surgery

Variations in Manifestations of the Four Stages of Shock

- Patients do not always show the progression of signs & sx listed on the prior 4 slides with progression of the degree or severity of shock
- Some adults, especially young adults, may have normal pulse rates or even bradycardia with stage 2 or 3 shock
- Pediatric patients may remain in "compensated" shock until almost preterminal stage 4 shock

Sequence of Assessment of the Patient in Shock

- Airway
- Breathing
  - Oxygenate
  - Ventilate
- Circulation
  - Stop external hemorrhage with direct pressure
  - Start IV fluid resuscitation
  - Assess for "obstructive shock"
    - Tension pneumothorax : needle thoracostomy
    - Cardiac tamponade : pericardiocentesis

Rapid Fluid Resuscitation for Shock

- Draw blood for type and cross-match from the needlestick for the IV line
- Place large bore (> 18 gauge) IV if possible
- Place 2 IV lines if Stage 3 or 4 shock
- Initially run fluid in "wide-open"
  - Use large drip chamber IV tubing
  - May need pressure bags on the IV bags
  - Usually use Lactated Ringers
    - Choose normal saline if patient may be hyperkalemic
    - Normal saline also preferred for same IV line to be used for blood transfusion
- Do not use vasopressors ; treat with fluids

Alternative Vascular Access Sites for Shock Treatment

- Peripheral vein in upper extremity ; Preferred in most patients
  - Avoid if possible proximal limb fracture
- Central veins
- Subclavian or internal jugular vein ; accessible even in Stage 4 shock
  - Access can cause pneumothorax (always get CXR to check)
- Femoral vein ; easy and safer to place
  - If abdominal injury present, fluid may extravasate in abdomen
- Intraosseous line : may be easiest and even preferred initial route in children ; can also be tried in adults
- Intraperitoneal

Other Resuscitative Procedures for Severe Shock

- Blood transfusion
  - Type - O-negative (if needed immediately)
  - Type - specific (if needed in < 15 minutes)
  - Fully crossmatched
- Emergent left thoracotomy, pericardiotomy, aortic clamping
- Autotransfusion
  - Most useful for blood output from chest tubes

Indications for Emergent Transfusion With O-Negative Blood

- No palpable blood pressure at arrival
- Multiple simultaneous patients requiring emergent transfusion
- Rapid deterioration or sudden large volume external blood loss and type specific blood not immediately available

Indications for Transfusion With Type-Specific or Fully Crossmatched Blood

- Type-specific : (usually takes 5 to 10 minutes to obtain from blood bank)
  - Transfusion emergent but can wait 10 minutes but not 60 minutes
- Fully crossmatched : (takes 45 to 60 minutes)
  - Patient stable enough that transfusion can be delayed 45 to 60 minutes until blood is ready

Non-Hemorrhagic Types of Shock

- Hypovolemic (non-hemorrhagic) shock
  - Due to vomiting , diarrhea, "third spacing" of fluid
  - Treat with IV Lactated Ringers or saline
  - Does not need blood transfusion
- Anaphylactic shock
  - Due to allergic reaction with release of vasoactive mediators which can cause airway edema & vasodilatation
  - Treat with IV fluids & epinephrine

Non-Hemorrhagic Types of Shock (cont.)

- Septic Shock
  - Can be a late or delayed complication
  - Patient may have fever or hypothermia
  - Treat with IV fluids ; sometimes need secondary treatment with vasopressors
  - Finding and directly treating the source of the sepsis is critical to save the patient (start antibiotics, drain abscess if present, etc.)

Non-Hemorrhagic Types of Shock (cont.)

- "Obstructive" : key sign is distended neck veins in the patient with shock
  - Tension pneumothorax
    - Treat with anterior needle thoracostomy
  - Cardiac tamponade
    - Treat initially with IV fluids
    - Consider pericardiocentesis
  - Pulmonary embolus :
    - Need to confirm diagnosis (V/Q or spiral CAT scan)
    - Then treat with thrombolytics or embolectomy

Non-Hemorrhagic Types of Shock (cont.)

- Cardiogenic : due to heart pumping dysfunction
  - Acute myocardial infarction (sometimes this can be the original cause of a person injuring themself in a traffic accident or fall)
  - Myocardial contusion
    - Actually is rare even with major blunt chest trauma
  - May require treatment with vasopressors (dopamine)

Non-Hemorrhagic Types of Shock (cont.)

- Neurogenic : due to spinal cord injury and loss of sympathetic nervous system outflow
  - Results in venous pooling, peripheral vasodilation
  - Often has relative bradycardia
  - Treat with IV fluids first, then alpha vasoconstrictors if hypovolemic shock ruled out
- Spinal shock : actually is a "cord-stunning" syndrome
  - Flaccidity and loss of reflexes
  - Is an "electrical" phenomenon of the spinal cord
  - May have complete recovery

Pneumatic Anti-Shock Garment (PASG)

- Also called MAST (Military Anti-Shock Trousers)
- Probably not useful for most trauma cases
- Some studies actually indicate increased mortality with routine use
- Placement can interfere with physical exam and placement of femoral IV lines
- Dangerous if prematurely or rapidly deflated
- Most of complications associated with inflation of abdominal compartment
- Prolonged inflation can cause compartment syndrome

Pneumatic Anti-Shock Garment (PASG)

- Inflation may be helpful for :
  - Reducing bleeding from pelvic fractures
  - Splinting fractured femurs
  - Non-pharmacologic treatment of Supraventricular tachycardia
  - Anaphylactic shock

PASG : Contraindications

- Pregnancy
- Evisceration
- Suspected diaphragm rupture
- Increased intracranial pressure
- Uncontrolled hemorrhage from body area (chest) not covered by the garment
- Pulmonary edema

Measurement of Central Venous Pressure (CVP) in Shock Patients

- CVP acts as measure of right side of heart's ability to accept a fluid load
- Central venous IV line not needed for most trauma patients
- CVP line measurements may be helpful for patients with :
  - Preexistent cardiac dysfunction (CHF)
  - Implanted pacemaker
  - Neurogenic shock
  - Myocardial contusion
  - Suspected cardiac tamponade

Interpretation of Initial CVP in Trauma Patients

- Low (< 6 mm Hg) : Hypovolemia
  - Continue IV fluids or transfusion
- High (> 15 to 18 mm Hg) :
  - Hypervolemia (overtransfusion)
  - Right heart failure (infarction)
  - Cardiac tamponade
  - Lung disease
  - Tension pneumothorax
  - Catheter malposition
  - Vasopressors or PASG inflation

Interpretation of CVP Changes With Resuscitation

Initial CVP	Change	Interpretation	Action
Low	None	Persistent Hypovolemia	More IV fluid
Low	Rising	Resuscitation succeeding	Slow IV rate
Low or Mid	Falling	Ongoing fluid loss	More rapid IV fluid
High	None	Hypervolemia or problems on prior slide	Slow IV rate

Monitoring of the Shock Patient

- Response to therapy judged by monitoring :
  - Patient's mental status & speech
  - Pulse, blood pressure, respirations
  - Urine output (should be at least 1 cc / Kg / hr. or 30 cc / hr in adults)
  - Capillary refill & skin pertusion
  - CVP
  - Lab data (less important than clinical parameters)

Lab Results in the Shock Patient

- Hematocrit
  - May be normal initially despite severe blood loss
  - If low initially may represent very severe blood loss
- Blood urea nitrogen
  - May be elevated if hypovolemic (prerenal azotemia) or if blood in upper GI tract
  - Small elevations may represent severe dehydration in children
- Serum glucose
  - May be highly elevated from stress alone (not due to diabetes)

Lab Results in the Shock Patient (cont.)

- White blood cell count
  - Whether high or normal or low has little diagnostic or prognostic significance
- Serum calcium
  - May be low if citrated blood transfused
  - Usually not necessary to treat

Causes of Coagulopathy in the Shock Patient

- Hypothermia : (usually temp. < 35.5 degrees Celsius)
  - Most common cause
  - Very important to take all possible measures to prevent
- Massive transfusion
  - "Washout" of coagulation factors and platelets
  - May need one unit fresh frozen plasma per 6 to 8 units of blood transfused
  - May need one pack (6 to 8 units) of platelets per 8 to 12 units of blood transfused
- Sepsis
- Preexistent coagulopathy or liver failure
- Drug or toxin effect

Considerations If the Patient Fails to Respond to Treatment for Shock

- Unrecognized fluid loss
- Ventilation problems
- Acute gastric distention
  - Treat by NG tube / suction
- Cardiac tamponade
- Acute myocardial infarction
- Diabetic Ketoacidosis
- Adrenal crisis
- Neurogenic shock
- Hypothermia
- Drug or toxin effect

Hidden Blood Loss from Fractures

INJURY	Range of Blood Loss (ml)
Closed leg fracture	500 to 1000
Closed femur fracture	500 to 2500
Open femur fracture	1000 to > 2500
Closed arm fracture	500 to 750
Closed spine fracture	500 to 1500
Closed pelvis fracture	1000 to > 3000
Open pelvic fracture	> 2500

Shock Assessment & Treatment Summary

- Start shock treatment with the primary survey
- Categorize the initial estimated blood loss
- Assess the type(s) of shock present
- Frequently reassess the response to treatment
- Progressive or non-responsive shock may require emergent surgery for correction