LESSON OBJECTIVES

- Describe shock pathophysiology.
- Recognize the clinical signs of shock.
- Explain basic shock treatment.
- Identify the modalities of fluid replacement.
- Explain the role of blood component replacement in the management of hemorrhagic shock.
- Describe special considerations in shock management (age, athletes, hypothermia, medications, pacemakers, and pregnancy).
40-year-old male

Motorcycle went out of control while passing a car

Patient lying on the ground with blood noted around him
SCENE SIZE-UP AND GENERAL IMPRESSION

Scene size-up

- Motorbike lying on the side of the street
- Traffic stopped by law enforcement

General impression

- Patient lying in a pool of blood beside bike
- Bike not deformed
**PRIMARY SURVEY**

- X—Profuse bleeding from anterior neck wound
- A—Tenuous with sonorous respirations
- B—Fast, shallow chest rise
- C—Rapid, thready radial pulse
- D—Unconscious, moves all extremities to painful stimulus
- E—Lying on ground next to his bike
Is the patient in shock?

What is the definition of shock?

Why is it so time sensitive?

What is special about oxygen transport in the blood?

Is loss of red blood cells the only thing that can cause shock?
CASE PROGRESSION

- Primary survey—reassessed
  - X—Bleeding is controlled with manual pressure.
  - A—Helmet is removed, trauma chin lift to open airway.
  - B—Fast with equal chest rise and clear breath sounds
  - C—Rapid, thready radial pulse
  - D—Regaining consciousness, moving all extremities
  - E—Covered to maintain normothermia
**Discussion**

- Why do we check for major bleeding first?
- What is your priority in the face of external hemorrhage?
- How does direct pressure ideally work?
- What if the dressing becomes soaked with blood?
- Can pressure be released once the bleeding has stopped?
When would you use a tourniquet in the civilian setting?

How does a tourniquet work?

Why is a tourniquet applied so tightly?

Where do I apply the tourniquet and why?

Would a tourniquet be an option in this patient?

What are the special considerations?
CASE PROGRESSION

- Primary survey—reassessed
  - X—External bleeding still controlled by direct pressure
  - A—Patent
  - B—24 breaths/min, good chest rise, clear equal breath sounds, \( \text{SpO}_2 \) 97%/O\(_2\)
  - C—110 beats/min at carotid and radial; skin cool
  - D—Conscious, GCS 15 (E4, V5, M6), moves all extremities
  - E—Abrasion and bruising noted to LUQ
Why is it important to check the airway and breathing in this patient?

What signs of shock are present this patient?

Is there a possibility of internal bleeding?

What is damage control resuscitation in trauma?
What happens in the body if it loses blood?

Can the organs work without oxygen?

Which organs will sustain damage first?

How does the body react to blood loss?

**Table 3-1** Organ Tolerance to Ischemia

<table>
<thead>
<tr>
<th>Organ</th>
<th>Warm Ischemia Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart, brain, lungs</td>
<td>4-6 minutes</td>
</tr>
<tr>
<td>Kidneys, liver, gastrointestinal tract</td>
<td>45-90 minutes</td>
</tr>
<tr>
<td>Muscle, bone, skin</td>
<td>4-6 hours</td>
</tr>
</tbody>
</table>

**DISCUSSION**
Estimating blood loss can be difficult.

External versus internal loss

Average blood volume is 5 liters in adults (65 ml/kg).

Classes of hemorrhage are based on lost blood volume.

Clinical signs reflect progression of shock.
- Mentation: Slightly anxious
- Ventilatory rate: 14–20 breaths/min
- Pulse: < 100 beats/min
- BP: Normal systolic/diastolic
- Pulse pressure: Normal
- Skin: Warm, dry
- Urine output: > 20 ml/hr

CLASS I HEMORRHAGE

750 ml blood loss / 4.25 liters blood volume
Class I hemorrhage = blood loss up to 750 ml
- Mentation: Mildly anxious
- Ventilatory rate: 20–30 breaths/min
- Pulse: 100–120 beats/min
- BP: Normal systolic
- Pulse pressure: Decreased
- Skin: Cool
- Urine output: 20–30 ml/hr

1500 ml blood loss / 3.5 liters blood volume
Class II hemorrhage = blood loss up to 1,500 ml
- Mentation: Anxious, confused
- Ventilatory rate: 30–40 breaths/min
- Pulse: 120–140 beats/min
- BP: Decreased
- Pulse pressure: Decreased
- Skin: Cool, diaphoretic, pale
- Urine output: 5–15 ml/hr
- Mentation: Difficult to arouse
- Ventilatory rate: >35 breaths/min
- Pulse: >140 beats/min
- BP: Decreased
- Pulse pressure: Decreased
- Skin: Cool, diaphoretic, pale
- Urine output: <5 ml/hr

2500 ml blood loss / 2.5 liters blood volume
Class IV hemorrhage = greater than 2,000 ml
SPECIAL CONSIDERATIONS

- Athletes
- Geriatric patients
- Medications
- Pacemaker implants
- Pediatric patients
- Pregnancy
**Discussion**

- What is the purpose of giving IV fluids?
- What are the limitations of crystalloids?
- How do you monitor their effectiveness?
- How should trauma fluid resuscitation be titrated in the prehospital setting?
What are the advantages and limitations of blood products?

What are the objectives of blood resuscitation?

Are the objectives of resuscitation the same in each and every situation?
TRANEXAMIC ACID (TXA)

- What is TXA?
- What are the advantages of TXA?
- What are the objectives of TXA?
- How should TXA be administered?
How can you stop internal bleeding?
What does rapid transport mean?
Should you delay transport to obtain IV access?
What are the components of basic shock treatment?
TYPES OF TRAUMATIC SHOCK

- Cardiogenic
- Distributive
- Hypovolemic
- Neurogenic
- Obstructive
PREVENTION OF HYPOTHERMIA

- What is special about temperature in the human body?
- What happens if a patient becomes hypothermic?
- Does hypothermia affect mortality in the trauma patient?
- What can you do to prevent hypothermia in the field?
CASE PROGRESSION

- Primary survey—reassessed
  - X—Bleeding is controlled by pressure dressing.
  - A—Patent
  - B—20 breaths/min, lungs clear bilaterally, \( \text{SpO}_2 \) 97%/\( \text{O}_2 \)
  - C—105 beats/min, radial pulse present, 18-gauge IV in place with LR running TKO
  - D—GCS 15 (E4, V5, M6), no neurologic deficit
  - E—Body heat maintained with blanket and warm environment
Secondary survey was completed during transport.

Patient was transported to a level I trauma center.

Once in the trauma center, the patient is found to have a ruptured spleen with internal bleeding.

He undergoes a surgical splenectomy and makes a good recovery after 5 days in the hospital.
CRITICAL ACTIONS

- Circulation assessment to identify potential life threats
- Determining the best method to manage perfusion in this patient
- Reassessment of perfusion status after initial management completed
WRAP-UP

- Stop the bleeding! No IV fluid is better than the patient’s blood.
- Use the primary survey to identify life threats.
- Optimize oxygenation.
- Evaluate the need for volume replacement.
- Maintain normothermia.
- You cannot stop internal bleeding in the field—rapid transport is paramount.