Workshop Bleeding and Shock Competencies:
Bleeding, Soft Tissue Injuries
Bleeding I

Equipment Required:

5 4 x 4 dressings
2 roller gauze
trauma dressing
tape

Competencies:

Trauma competencies

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<th>Demonstrate direct then diffuse pressure by applying dressing to the head</th>
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<td>Demonstrate direct then diffuse pressure by applying dressing to the shoulder</td>
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Proctor guidelines:

1. Have a discussion with the students about how to control bleeding and bandaging techniques using the scenarios below and the teaching points.

2. When the scenario states "demonstrate how you would ...." the student(s) must do the skill not just verbalize it.

3. Have a discussion with the students about anemia and sickle cell anemia. Information about anemia and sickle cell anemia can be found on the Teaching Points for Blood Components and Blood Related Diseases.

Scenarios:

1. You arrive at the scene of a report of a 38-year-old male with a wound to his head.

Before you enter the scene what should you do? Put on BSI and ensure the scene is safe.

You put on your gloves and determine the scene is safe. As you approach the patient you notice he is sitting in a chair, he appears alert and oriented, to be breathing adequately, and there is lot of blood on his head.

When you get to the patient what is the first thing you do? Take C-spine control.

You rule out the need to continue C-spine control. You assess the ABCs and determine that the patient is alert and oriented, has a patent airway, and is breathing adequately. His
pulse is strong and regular, his skin is normal warm and dry, and the wound on the top of his head is bleeding moderately (not spurting).

Demonstrate how you would bandage this wound.

**Proctor:** the bleeding is controlled after the student places at least 4 dressings on the wound along with direct pressure; make sure the student does not apply the bandage too tightly or too loosely and that it does not stop the patient from opening his mouth.

2. You have just arrived on scene of a 27-year-old female with a large wound that is bleeding on her right shoulder. You have your gloves on and the scene is safe. The fire department has tried to control the bleeding with 4 x 4's but the wound is too large.

What type of dressing should you try to control the bleeding with? *Trauma dressing*

The patient is alert and oriented, has a patent airway, and is breathing adequately. Her pulse is strong and regular, her skin is normal warm and dry, and she has no other injuries.

Demonstrate how you would bandage this wound with the trauma dressing.

**Proctor:** the bleeding is controlled after the student places a trauma dressing on the wound along with direct pressure; make sure the student does not apply the bandage too tightly or too loosely.

3. You are on scene of a 50-year-old male who has a cut that is bleeding on his right forearm. You have your gloves on and the scene is safe. There is no need to worry about any C-spine injuries. The patient is alert and oriented, has a patent airway, and is breathing adequately. His pulse is strong and regular, is skin is normal warm and dry, and he has no other injuries. You controlled the bleeding, bandaged the wound on his right forearm, and moved him to the ambulance. When you climb in the ambulance you notice that there is blood oozing through the bandage.

What should you do to address the bleeding of the wound? *Apply new dressings and bandage along with direct pressure on top of the existing bandage until the bleeding is controlled.*

What should you do before and after you apply the bandage? *PMS checks*

Demonstrate how you would bandage this wound.

**Proctor:** the bleeding is controlled after the student places at least 2 dressings on the wound along with direct pressure; make sure the student does not apply the bandage too tightly or too loosely.

4. You arrive on scene of a 70-year-old woman who fell down 5 stairs at her front porch. You have your gloves on and the scene is safe. The patient is lying supine outside in her driveway. She has a deep laceration to her left hip. There is a small pool of blood at her left hip. The patient is alert and oriented, has a patent airway, and is breathing
adequately. Her pulse is rapid and a little weak, her skin is pale cool and dry, and she has no other injuries. A firefighter is maintaining C-spine control.

How would you treat this patient? **02 via non-rebreather mask, bandage the laceration on her hip, cover her with a blanket, keep supine, maintain C-spine control, rapid transport, ALS**

Demonstrate how you would bandage this wound.

**Proctor**- the bleeding is controlled after the student places at least 5 dressings or the trauma dressing on the wound along with direct pressure; make sure the student does not apply the bandage too tightly or too loosely
**Bleeding II**

**Equipment Required:**

- 5 4 x 4 dressings
- 2 roller gauze
- tourniquet
- blanket
- adult non-rebreather mask
- blanket
- oxygen tank with regulator

**Competencies:**

**Patient Assessment competencies**

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**Trauma competencies**

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**Proctor guidelines:**

1. Have a discussion with the students about how to control bleeding and bandaging techniques using the scenarios below and the teaching points.

2. When the scenario states "demonstrate how you would …" the student(s) must do the skill not just verbalize it.

3. Have a discussion with the students about clotting disorders. Information about clotting disorders can be found on Teaching Points for Blood Components and Blood Related Disorders.

**Scenarios:**

5. You are on scene of a 16-year-old male who has a deep laceration to his left forearm. You have your gloves on and the scene is safe. There is no need to worry about C-spine control and the patient has no other injuries. You have applied several dressings along with direct pressure to the laceration but you cannot control the bleeding.

What is the next step you should take to control the bleeding? *Apply a tourniquet*
Demonstrate how you would apply the tourniquet and treat the wound after the tourniquet has been applied.

Proctor- make sure the student applies the tourniquet properly including twisting it until the radial pulse can no longer be felt and the time and date it was applied is recorded; make sure the student applies a bandage and does not apply the bandage too tightly or too loosely

6. You are on scene of a 43-year-old female who has a deep laceration to her right knee. You have your gloves on and the scene is safe. There is no need to worry about C-spine control and the patient has no other injuries. The patient is showing signs of hypovolemic shock.

What are the signs and symptoms of hypovolemic shock? low blood pressure, rapid pulse, weak pulse, pale cold clammy skin, altered LOC, rapid breathing, lightheadedness

You have applied several dressings along with direct pressure to the laceration but you cannot control the bleeding. You decide to apply a tourniquet.

Demonstrate how you would apply the tourniquet and treat the wound after the tourniquet has been applied.

Proctor- make sure the student applies the tourniquet properly including twisting it until the pedal pulse can no longer be felt and the time and date it was applied is recorded; make sure the student applies a bandage and does not apply the bandage too tightly or too loosely

7. You arrive on scene of a 67-year-old male who is complaining of abdominal pain after being kicked in the stomach. You have your gloves on and the scene is safe. You have ruled out a need to maintain C-spine control. The patient is alert and oriented, has a patent airway, and is breathing adequately. His pulse is strong and regular and his skin is warm, normal, and dry. You need to perform a blood sweep to look for any major bleeds.

Demonstrate how you would perform a blood sweep.

You do not find any bleeds when you perform the blood sweep. Your patient is now showing signs of hypovolemic shock.

Why do you think the patient is showing signs of shock without any evidence of bleeding? Possible internal bleeding in the abdomen

What signs and symptoms should you look for during the secondary assessment that could also indicate internal bleeding in the abdomen? Bruising, rigidity, tenderness upon palpation

Demonstrate how you would treat this patient.
Proctor- make sure the student performs a hands-on, head to toe blood sweep; the student should lay the patient down in the supine position, apply O2 via non-rebreather, cover the patient with the blanket, verbalize rapid transport, verbalize reassessment every 5 min., verbalize calling ALS

8. You arrive on scene of a 22-year-old female who has a laceration that is bleeding on her left arm just above her elbow. You have your gloves on and the scene is safe. The patient is sitting in a chair and there is no need to worry about C-spine control. The patient has no other injuries. She is alert and disoriented, her airway is patent, she is breathing adequately, her pulse is rapid and weak, and her skin is pale cool and moist.

Demonstrate how you would treat this patient.

Proctor- the bleeding is controlled after the student applies at least 4 dressings along with direct pressure to the wound; make sure the student does not apply the bandage too tightly or too loosely; the student should lay the patient down in the supine position, apply O2 via non-rebreather, cover the patient with the blanket, verbalize rapid transport, verbalize reassessment every 5 min., verbalize calling ALS
**Shock I**

Equipment Required:

none

Competencies:

Trauma competencies

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Proctor guidelines:

1. Have a discussion with the students about different kinds of shock using the scenarios below and the teaching points.

2. Have a discussion with the students about anaphylactic shock. Information about anaphylactic shock can be found in Teaching Points for Shock (Hypoperfusion).

Scenarios:

1. You are on scene of a 43-year-old female who has a deep laceration to her right knee that is bleeding profusely. You have your gloves on and the scene is safe. There is no need to worry about C-spine control and the patient has no other injuries. The patient is showing signs of hypovolemic shock.

   What are the signs and symptoms of hypovolemic shock? low blood pressure, rapid pulse or weak pulse, pale cold clammy skin, altered LOC, rapid breathing, lightheadedness, blood loss, diarrhea and/or vomiting, cyanosis

   How would you treat this patient? control the bleeding on her right knee, rapid transport, vitals every 5 min., ALS, high flow 02, cover with a blanket, transport in supine position

2. You arrive on scene of a 67-year-old male who is complaining of abdominal pain after being kicked in the stomach. You have your gloves on and the scene is safe. You have ruled out a need to maintain C-spine control. The patient is alert and oriented, has a patent airway, and is breathing adequately. His pulse is strong and regular and his skin is warm, normal, and dry. You perform a head to toe blood sweep and do not find any bleeds. Your patient begins to show signs of hypovolemic shock.

   Why do you think the patient is showing signs of shock without any evidence of bleeding? Possible internal bleeding in the abdomen

   What signs and symptoms should you look for during the secondary assessment that could also indicate internal bleeding in the abdomen? Bruising, rigidity, tenderness upon palpation
3. You arrive on scene of a 45-year-old male who has fallen off the second story roof of his home. He is lying on his back on the grass of his front yard. You have your gloves on and the scene is safe. The patient is complaining of numbness and the inability to move all four extremities. He is also having difficulty breathing.

What type of shock would you suspect this patient could develop and why? **Neurogenic shock, because the patient is showing signs and symptoms of a spinal injury**

What are the signs and symptoms of neurogenic shock? **Low blood pressure due to vessel dilation, normal pulse rate or slow pulse rate due to lack of sympathetic nervous system response, altered LOC, pale skin, cyanosis, difficulty breathing, cool or normal skin**

4. You arrive on scene of a 74-year-old female who was complaining of severe chest pain. She is sitting in her kitchen chair clutching her chest. You have your gloves on and the scene is safe. The patient states she had a heart attack three years ago and this feels exactly the same. She is also having a little difficulty breathing. When you listen to her lungs sounds you hear fluid bilaterally. Her blood pressure is 90/76, her pulse is weak, and her skin is pale cool and moist.

What type of shock do you suspect this patient is experiencing? **Cardiogenic shock**

How would you treat and transport this patient? **High flow O2, ALS, rapid transport, cover with a blanket if necessary, place the patient in the position of comfort which will probably be in a sitting position to ease breathing**
**Shock II**

Equipment Required:

none

Competencies:

Trauma competencies

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Proctor guidelines:

1. Have a discussion with the students about different kinds of shock using the scenarios below and the teaching points.

Scenarios:

5. You arrive on scene of a 23-year-old female who has just been in a severe car crash. She is complaining of severe chest pain. She is sitting on the curb beside her car. You have your gloves on and the scene is safe. When you assess the patient you find JVD, bruising to the chest, and she is having difficulty breathing. Her vitals are; BP - 98/88 mmHg, pulse - 120, respirations - 26. You place the patient on high flow 02, call ALS, and prepare the patient for rapid transport.

What type of shock to you suspect this patient is experiencing? *Obstructive shock*

What condition do you think is causing the obstructive shock? *Cardiac tamponade*

What other sign would you expect to observe with this patient? *Muffled heart sounds*

What is another example of a condition that can cause obstructive shock? *Tension pneumothorax*

6. You arrive on scene on a 55-year-old male who has been sick with pneumonia for a week. His wife called 911 because his condition has deteriorated. You have your gloves on and the scene is safe. The patient has a fever (his wife states she took it about half an hour ago and it was 102.6°F), a pulse of 120, respiratory rate of 26, BP of 90/66 mmHg, is very tired and sleepy, and is very weak.

What type of shock do you suspect this patient is experiencing? *Septic shock*

How would you treat this patient? *High flow 02, cover with blanket, call ALS, rapid transport, reassess every 5 min.*
7. You arrive on scene of a patient who has been vomiting and had diarrhea for the past four days. You have your gloves on and the scene is safe. The patient is showing signs of shock. The patient has a normal blood pressure, a rapid pulse, rapid respirations, has cool clammy skin, and is very tired.

What type of shock you suspect this patient is experiencing? *Non-hemorrhagic hypovolemic shock*

If this patient is a six-year-old child what vital sign are you most concerned about seeing a drop in? *Blood pressure*

Why? *By the time they blood pressure drops in children the child is in profound shock and may be close to death*

If this patient is 84-years-old why would this patient show signs of shock sooner than a 30-year-old? *The cardiovascular system is not as efficient, the lungs are not as elastic and lung size and strength decrease, thermal regulation becomes more difficult, organs cannot compensate as well for increased demands*

8. You arrive on scene of a 33-year-old male who fainted. Your gloves are on and the scene is safe. He has a rapid pulse and a normal blood pressure. His respirations are 18. While taking your SAMPLE history he tells you he can’t stand the sight of blood and he just saw someone cut their finger with a knife and the cut bled a lot. After seeing the blood he fainted.

What type of shock do you suspect this patient is experiencing? *Psychogenic shock*

What are some causes of psychogenic shock? *Brain aneurysm, irregular heartbeat, fear, receiving bad news, unpleasant sights*

What type of shock is psychogenic shock? *Distributive shock*
TEACHING POINTS FOR BLOOD COMPONENTS
AND BLOOD RELATED DISEASES

Blood is necessary for the survival of our cells and organs. It is the fluid of life. It is constantly circulating providing the body with nutrition, oxygen and waste removal. It is a liquid composed of blood cells and fluid (plasma).

Functions of blood: transport nutrients and oxygen to tissues; carry carbon dioxide and waste away from tissues; carry hormones produced by endocrine glands to target tissues; protects body from bacteria and foreign substances; and plays key role in temperature regulation and fluid balance. All this to help maintain homeostasis within the body.

ANATOMY AND PHYSIOLOGY

PLASMA: makes up about half the content of our blood. It is a pale yellow fluid composed of water and dissolved or suspended molecules. It contains blood cells, proteins, and salts. It transports nutrients, glucose, fats, hormones, gases and waste material.

BLOOD CELLS: There are three (3) types of blood cells in blood. These are the Red Blood cells (erythrocytes), White Blood cells (leukocytes) and the Platelets.

Red Blood Cells (erythrocytes) are the most numerous cells in our blood. These cells are round flexible discs, their surface is smooth and both sides of the surface curve inward. (think of donuts without the hole in the center, just a depression on both sides) The flexible shape allows it to fit thru the circulatory system. The main component red blood cells is hemoglobin (Hemoglobin A) which is responsible for carrying oxygen to tissues. This is what gives our blood its red color. Freshly oxygenated blood is bright red because it has left the lungs full of oxygen, after it has gone thru the body and dropped off oxygen to all the cells and picked up carbon dioxide (waste product of cellular metabolism), the blood becomes a darker red color. Normally about 2.5 million red blood cells are destroyed and replaced by the body every second. A red blood cell will live for 120 days.

White Blood Cells (leukocytes) do not contain hemoglobin and are clear. There are several types of white blood cells involved in guarding the body against invading microorganisms (preventing infections), and removing dead cells and debris. They play an important role in the immune system and lymphatic system. They are the cleaners and travel to where ever they are needed in the body to do their job.
Platelets (thrombocytes) are small cells in the blood essential for clot formation. When there is damage to a blood vessel platelets are sent to help create a blood clot. The platelets become stimulated when they find a damaged blood vessel and many will flow to the site. First the platelets adhere to the site, change shape, and send out a signal for more to help. They initially begin the clot process by forming a plug. They also release substances that start the chemical reaction of blood clot formation. These substances are dissolved proteins, and are called clotting factors most have Roman numerals for names (Factor V, VII, VIII, IX, X AND XI). Factors signal to each other which results in a rapid chemical chain reaction which makes Fibrin which is the main protein forming blood clots. The fibrin creates a web like mesh at the wound site. This is much stronger and tougher than the platelet plug. The fibrin web will catch Red Blood Cells which harden and externally will become the scab. Once the blood clot is formed the anti-clotting proteins will neutralize the excess clotting factors and prevent the blood clot from extending further than it should go. If the damage to the vessel is very small, or occurs in a small vessel a platelet plug may be all that is necessary.

A blood clot may be triggered to form inside a vessel because of the collection of cholesterol plaque. When the plaque ruptures it triggers the blood clotting process. Blood clots can also form due to poor circulation within the heart or legs, these clots may travel and cause stroke, Pulmonary Embolism or deep venous thrombosis.

**PATHOPHYSIOLOGY OF HEMATOLOGIC DISORDERS**

Anemia is a condition where the concentration of hemoglobin or red blood cells in the blood is below normal. This can be caused by chronic or acute blood loss, decreased production of red blood cells, or increased destruction of red blood cells. Anemia itself is not a disease but rather a symptom of the disease. Two common forms of Anemia are: Iron deficiency – lack of iron prevents bone marrow from making enough hemoglobin for the red blood cells (most common cause in adults is blood loss from menstrual bleeding or intestinal bleeding); Hemolytic Anemia – premature destruction of red blood cells, can be inherited or acquired (blood clots, autoimmune disorders, malaria (red blood cells destroyed by microorganisms).

Sickle Cell Disease or Sickle Cell Anemia is an inherited blood disorder that affects red blood cells, predominantly found in African Americans and persons of Mediterranean descent.

The Red Blood cells are abnormally shaped, either oblong or sickle shaped (crescent) and they are stiff and sticky. This makes the red blood cells poor oxygen carriers and they only live for approximately 16 days, so the body cannot make new Red Blood cells fast enough to replenish the dying ones. The hemoglobin carried by a sickle cell is hemoglobin S. A person with Sickle Cell Disease may be hypoxic all the time. Due to the cells abnormal shape they tend to lodge or get stuck in small blood vessels or spleen which will cause swelling, potential rupture and ultimately death.
There are four (4) types of Sickle Cell Crisis:

*Vaso-occlusive crisis:* blood flow to an organ is restricted causing pain, ischemia and organ damage. This type of crisis typically lasts 5 to 7 days. The Spleen is frequently affected.

*Aplastic crisis:* This is a worsening of the patient’s baseline anemia (lack of circulating red blood cells in the body). This may cause tachycardia, pallor, and fatigue. It may be caused by parvovirus B19 which nearly stops the production of new red blood cells for 2 to 3 days.

*Hemolytic crisis:* an acute, accelerated drop in hemoglobin levels. This is caused by the red blood cells breaking down at a faster than normal rate and is common in patients with an enzyme deficiency.

*Splenic sequestration crisis:* painful, acute enlargement of the spleen, causing the abdomen to become very hard and bloated. This is caused by the red blood cells becoming trapped in the spleen.

Complications of Sickle Cell Disease:

1. Cerebral vascular attack
2. Gallstones
3. Jaundice
4. Avascular necrosis (cell death of bone tissue due to poor circulation)
5. Splenic Infections
6. Osteomyelitis (infection or inflammation of bone tissue)
7. Opiate tolerance
8. Leg ulcers
9. Retinopathy
10. Chronic pain
11. Pulmonary hypertension
12. Chronic renal failure

Signs and Symptoms: Most common symptoms are linked to anemia and pain, the others are due to the disease's complication. Most common signs are: shortness of breath, dizziness, headaches, coldness in the hands and feet, paler than normal skin or mucous membranes, jaundice, pain from the sickle cell crisis is acute. The pain can be mild to very severe and can last hours or weeks.

Treatment: Be aware if patient in pain and of African American or Mediterranean descent, high flow oxygen, if necessary assist ventilations. Patients with sickle cell crisis will have an increased pulse rate (forcing the sickled cells thru smaller vasculature), obtain good medical history and SAMPLE, Normal vitals for a sickle cell crisis – normal to rapid respirations, pale clammy skin, low blood pressure. Note that a pulse oximeter reading may be inaccurate due to patient’s anemic state. Consider ALS if patient in severe pain or dehydrated.
Clotting disorders: any abnormality in the clotting of the blood. Thrombosis is the development of a blood clot, occurring in arterial or venous blood vessels.

**Thrombophilia** - tendency to develop blood clots, affects 5 to 7 percent of Caucasians of European descent in the United States. Thrombosis is common, affecting currently 2 million people. Nearly 50% experience long-term, adverse health effects and is the leading cause of death in hospitalized patients due to lack of mobility. Nearly 40% experience pulmonary embolism. Many patients with thrombophilia take medications to decrease tendency to form clots – examples are: aspirin, Heparin, Warfarin (Coumadin) and there are new ones advertised recently.

Risk factors: recent surgery, impaired mobility, congestive heart failure, cancer, respiratory failure, infectious disease, age (over 40); overweight, smoker, oral contraceptive use, atrial fibrillation.

Treatment is specific to signs and symptoms.

**Hemophilia** – genetic disorder usually inherited from mother, causes uncontrolled bleeding and inability to produce clots. Predominantly occurs in males (1 in every 5 to 10,000 births)

Two types: Hemophilia A – most common and due to low levels of Factor VIII (8) and Hemophilia B – low levels of Factor IX (9)

Bleeding from Hemophilia can occur spontaneously, or after a minor injury, and from some medical procedures. The hemorrhage can occur anywhere in the body, but the most common are joints, deep muscles, urinary tract, intracranial. Head injury for these patients is potentially life threatening. Hemophilia is controlled by infusions of concentrates of factor VIII and can be done by the patient, but serious or unusual bleeding often requires hospitalization. Patients with this disease are knowledgeable about their condition and will only seek emergency care when there is a complication or trauma related issue.

Treatment: based on signs and symptom
TEACHING POINTS FOR SHOCK (HYPOPERFUSION)

Shock (hypoperfusion) is failure and collapse of the cardiovascular system. Initially the body will attempt to maintain homeostasis (balance of all systems in the body), but as shock progresses, blood circulation slows and will eventually cease.

Shock can happen due to medical or traumatic events. Shock must be recognized and treated immediately. Not treating shock can be fatal.

PATHOPHYSIOLOGY

PERFUSION – circulation of blood within an organ or tissue in adequate amounts to meet cells current needs. Delivery of oxygen and nutrients to cells and removal of carbon dioxide and other waste from cells.

The body is perfused via the Cardiovascular System which has three parts:

The Heart- the pump for the system

The Circulatory System - the arteries, arterioles, capillaries, venules and veins. This is the container for the system as it is the set of pipes thru which the blood flows.

The Blood which is the contents of the container.

It is essential these three (3) parts (Heart, Circulatory System, and Blood) work properly. When there is a problem with one or more of these parts a patient will be in shock.

There are two systems that work together to meet the cells needs: The Systemic Circulation which carries the oxygen rich blood from the heart, thru the body to cells and back to the heart with the waste products; and the Pulmonary Circulation which circulates the blood with the waste products from the heart to the lungs so the waste products can be exchanged for oxygen. This exchange must happen to prevent carbon dioxide from remaining in the cells. If carbon dioxide remains in the cells, the cells or organs will die.

The Autonomic nervous system plays a key role in maintaining perfusion by sensing pressure in the system, controlling hormone release, and the constriction and dilation of the blood vessels.

Blood Pressure is a measure of the pressure of blood within the blood vessels (container) at any one time and is carefully controlled by the body to ensure
sufficient circulation or perfusion to tissues and organs. *Systolic* pressure is the pressure generated every time the heart contracts (peak arterial pressure). *Diastolic* pressure is the pressure maintained within the arteries while the heart rests between heartbeats. Regulation of blood flow is determined by cellular need and is achieved by vessel constriction or dilation (which is controlled by the autonomic nervous system). Perfusion requires more than a working cardiovascular system. It also requires: adequate oxygen exchange in the lungs, adequate nutrients (glucose) in the blood, and adequate waste removal done primarily through the lungs. So you can see how any problem within the body that affects perfusion can cause shock.

**CAUSES OF SHOCK**

**Pump Failure:**
Caused by: heart attack, trauma to heart and obstructive causes such as cardiac tamponade and tension pneumothorax

**Low Fluid Volume:**
Caused by: trauma to vessels or tissues, fluid loss from the gastrointestinal tract (vomiting, diarrhea can also lower the fluid component of blood)

**Poor Blood vessel function:**
Caused by: infection, drug overdose (narcotics), spinal cord injury and anaphylaxis

**TYPES OF SHOCK**

**Cardiogenic Shock** - caused by inadequate function of the heart (pump failure). It develops when the heart cannot maintain sufficient output (cardiac output) to meet demands of the body. Cardiac output is the volume of blood the heart pumps per minute. It is dependent on several factors: 1) The strength of the heart determined by the ability of the heart muscle to contract (*myocardial contractility*); 2) The heart must receive an adequate amount of blood to pump. The increase in blood volume causes precontraction pressure or *preload*. When preload increases, the volume of blood within ventricles increases, the heart muscle stretches which increases myocardial contractility which in turn increases the force of the contraction and increases cardiac output; 3) The resistance to the blood flow in the peripheral circulation must be appropriate. The force or resistance against which the heart needs to pump the blood is *afterload*.

So the muscle must be strong for good contraction, there must be adequate volume of blood for precontraction pressure, and the resistance against which the heart needs to pump the blood must not be too high. If the Afterload or resistance is too high the cardiac output will decrease, it will also cause the heart to overwork while it tries to maintain adequate cardiac output. Cardiogenic shock will result from any or a combination of the following: low cardiac output due to high afterload, low preload, poor contractility.
Some signs and symptoms: chest pain, irregular pulse, weak pulse, low blood pressure, cyanosis, cool, clammy skin, anxiety, rales, pulmonary edema.

**Obstructive Shock** - caused by conditions that cause mechanical obstruction of the cardiac muscle which affects pump function.

Two examples:

*Cardiac Tamponade* (also called pericardial tamponade) – collection of fluid between pericardial sac and the myocardium. This is caused by blunt or penetrating trauma and progresses rapidly. As the blood leaks into the pericardium and accumulates within the pericardial sac it compresses the heart. The pericardium itself does not have the ability for stretch so as the heart contracts more blood accumulates and further compresses the heart which decreases the amount of blood the heart can pump.

Signs and Symptoms of cardiac tamponade are called Beck’s Triad. These S&S are JVD, muffled heart sounds and the systolic and diastolic blood pressure start to merge (systolic drops and diastolic rises)

*Tension Pneumothorax* – caused by damage to the lung tissue, which allows air to escape from the lung into the chest cavity (pneumothorax). As more and more air escapes the lung and becomes trapped in the chest cavity it begins to apply pressure to the structures in the mediastinum (space between the two lungs that contains heart, major blood vessels, vagus nerve, trachea, major bronchi and esophagus). The trapped air will begin to shift these organs toward the uninjured side. This now is a Tension pneumothorax. This is life threatening condition. The vena cava cannot stay fully expanded which in turn leads to reduced blood returning to the heart.

Signs and Symptoms you may see are: anxious patient, shortness of breath, heart and respiratory rate increase and become shallow, BP drops, affected side will have decreased or absent lung sounds, cyanosis, you may have difficulty bagging the patient. If you see tracheal deviation this is a late sign.

**Distributive Shock** – results when the arterioles or small venules, or both, dilate and the circulating blood volume pools in the expanded vasculature. This causes a decrease in tissue perfusion.

The four (4) common types of Distributive Shock are: Septic, Neurogenic, Anaphylactic, and Psychogenic.

**Septic Shock** – This is the result of severe infection, generally bacterial. Toxins are created by the bacteria or infected tissues and these toxins damage vessel walls which causes cellular permeability so the vessel walls leak plasma and cannot contract well. Since the blood is pooling in the vessels and plasma is leaking out of the vessels shock results.
This is a complex problem, first there is not enough volume in the container (vessels) due to plasma leakage. Second the fluid that leaked tends to collect in the respiratory system so it interferes with ventilation. Third the vasodilation leads to larger than normal vessels carrying a smaller than normal amount of intravascular fluid. Septic Shock is almost always a complication of a very serious illness, injury or surgery.

Signs and symptoms: warm skin, tachycardia, low blood pressure

**Neurogenic Shock** – This results from an injury to the spinal cord, brain conditions, tumors, pressure on the spinal cord, or Spina Bifida. In this type of shock the muscles in the walls of the blood vessels no longer receive signals from the sympathetic nervous system so they do not know to contract. All vessels below the level of the injury or medical cause dilate widely thus the size and capacity of the container (vessels) increases and the blood pools. The 6 liters of blood in the body is no longer enough to fill the vascular system. No blood or fluid is lost, it is just not able to perfuse organs and tissues because it is pooling in the vessels, thus shock results.

Signs and Symptoms would be consistent with a spinal cord injury: Bradycardia, low blood pressure. You can also look for the absence of sweating below the level of the injury. Also note that this person has lost the ability to control their body temperature below the level of the injury so hypothermia may occur.

**Anaphylactic Shock** – also known as Anaphylaxis, occurs when a person has a violent reaction to a substance he or she is sensitized to. Sensitization means the person has become sensitive to a substance that did not initially cause a reaction. So a person may state this has never happened before. This is because each time the person is exposed to the substance a more severe reaction occurs. Common causes are: injections (tetanus antitoxin, penicillin); stings (honeybee, wasp, yellow jacket, hornet); ingestion (shellfish, fruit, medication, peanuts); and inhalation (dust, pollen).

Anaphylactic reactions can develop within seconds, or minutes after exposure. The signs are distinct and not seen in other forms of shock. The following lists the signs in the order in which they appear for each system:

**Skin:**
1. Flushing, itching, or burning especially over the face and upper part of the chest
2. Urticaria (hives) which may appear over large areas of the body
3. Edema, especially of the face, tongue and lips
4. Pallor
5. Cyanosis (bluish cast to skin) around the lips – NOTE this is a late sign

**Circulatory System:**
1. Dilation of peripheral blood vessels
2. Increased vessel permeability
3. A drop in Blood pressure
4. Weak, barely palpable pulse
5. Dizziness
6. Fainting and coma

**Respiratory System:**
1. Sneezing or itching in the nasal passages
2. Tightness in the chest, with persistent dry cough
3. Wheezing and dyspnea (difficulty breathing)
4. Secretions of fluid and mucus in the bronchial passages, alveoli, and lung tissue, causing coughing
5. Constriction of the bronchi; difficulty drawing air into the lungs
6. Forced expiration, requiring exertion and accompanied by wheezing
7. Cessation of breathing

In anaphylactic shock there is NO blood loss, NO mechanical vascular damage, and only slight possibility of direct cardiac muscle injury. There is widespread vascular dilation, increased permeability and bronchoconstriction. It is the combination of poor oxygenation and poor perfusion that may easily prove fatal.

**Psychogenic Shock** – this is caused by a sudden reaction of the nervous system which produces temporary, generalized vascular dilation, which results in fainting or syncope. The blood pools in the dilated vessels, reducing the blood supply to the brain so the brain ceases to function normally and the patient faints. There are many causes of syncope some very serious, some not. The potentially life-threatening causes may be brain aneurysm, or irregular heartbeat. Non-life-threatening causes may be fear, receiving bad news, unpleasant sights.

Signs and symptoms: syncopal episode, rapid pulse, normal or low blood pressure

**Hypovolemic Shock** – Results from inadequate amount of fluid or volume in the system. There are hemorrhagic and non-hemorrhagic causes. An injury may result in hemorrhagic shock, while vomiting and diarrhea may result in non-hemorrhagic shock. Hypovolemic shock can also occur with severe thermal burns, because the intravascular plasma is lost by the leakage from the circulatory system into the burned tissue. In a crush injury blood and plasma from damaged vessels may leak into injured tissues.

Dehydration (loss of water or fluid from body tissue) can cause or aggravate shock. Patients who are very young or the elderly are very susceptible to fluid loss and at risk to develop shock thru dehydration. Also people who exercise or work outside in hot weather may experience dehydration because they do not drink enough fluid. In these cases the common factor is insufficient volume of blood within the vascular system to provide adequate circulation to the cells and organs.

Signs and Symptoms: rapid, weak pulse, low blood pressure, change in mental status, cyanosis, cool, clammy skin, increased respiratory rate
**Respiratory Insufficiency** - This is an insufficient concentration of oxygen in the blood necessary to meet the metabolic demand of the body. It can be caused by a severe chest injury, such as flail chest or an obstruction of the airway. This affects ventilation and the process of respiration. Some poisons may affect the ability of the cells to metabolize or carry oxygen. Carbon monoxide has a 250 times greater affinity for hemoglobin than oxygen. So it will bind to the hemoglobin, forming carboxyhemoglobin, and not allow the oxygen molecules to bind. This results in a hypoxic state if not corrected. Cyanide poisoning impairs the ability of the cells to metabolize oxygen within the cell and cellular asphyxia may occur.

Anemia is a condition in which there is an abnormally low number of red blood cells, which contain hemoglobin. The hemoglobin transports the oxygen from the lungs to the tissue. Anemia can be a chronic condition, may result from acute bleeding, there may be deficient in vitamins or minerals or an underlying disease. A patient who has anemia, may have hypoxic cells, so the pulse oximetry may indicate adequate oxygen saturation because the hemoglobin in the blood is fully saturated but it is not enough to oxygenate the individual cells. This type of hypoxia is known as hypoxemic hypoxia.

Signs and Symptoms: rapid weak pulse; low blood pressure; change in mental status; cyanosis; cool, clammy skin; increased respiratory rate

**PROGRESSION OF SHOCK**

There are three (3) stages in the progression of shock.

**Compensated shock** – this is the earliest stage when the body can still compensate for blood or fluid loss.

**Decompensated shock** - this is a late stage when the body is no longer able to adapt and the blood pressure is falling.

**Irreversible shock** – this is the last stage and shock is now a terminal stage. A transfusion will not save the patient’s life. The cells and organs are dying.

Signs and Symptoms of COMPENSATED SHOCK:

- Agitation
- Anxiety
- Restlessness
- Feeling of impending doom
- Altered mental status
- Weak, rapid (thread) or absent pulse
- Clammy, (pale, cool, moist) skin
- Pallor, with cyanosis about the lips
- Air hunger (shortness of breath), especially if there is chest injury
- Nausea or vomiting
• Cap refill longer than 2 seconds in infants and children
• Marked thirst

Signs and Symptoms of DECOMPENSATED SHOCK
• Falling blood pressure (systolic blood pressure of 90 mm Hg or lower in an adult)
• Labored or irregular breathing
• Ashen, mottled, or cyanotic skin
• Thready or absent peripheral pulses
• Dull eyes, dilated pupils
• Poor urinary output

NOTE: Blood Pressure may be the last measurable factor to change when a person is in shock. The body has several automatic mechanisms to compensate for initial blood loss and maintain BP. By the time you detect the drop in blood pressure shock is well developed.

IRREVERSIBLE SHOCK – terminal stage and not even a transfusion of any type will save the patient’s life.

INFANTS/CHILDREN AND SHOCK

Infants and Children going into shock are able to compensate extremely well in the beginning stage. They will compensate and maintain a normal Blood pressure until they have lost more than half their blood volume. By the time their blood pressure begins to drop they may be close to death. Therefore you must be vigilant and consider an infant or child to be in the early stage of shock and treat accordingly if the situation warrants.

ELDERLY PATIENTS AND SHOCK

Always keep in mind the normal aging process when managing a geriatric patient. These include:
• Central nervous system often has a delayed response
• Cardiovascular system has variety of changes that result in a decrease in te efficiency of the system
• Respiratory system has significant changes as the elasticity of the lungs and lung size and strength decrease
• Skin becomes thinner, drier, less elastic, and more fragile, thus less protection and thermal regulation (cold and hot)
• Renal system decreases in function and may not respond well to unusual demands such as an illness
• Gastrointestinal system sustains changes in gastric motility that may lead to slower gastric emptying

WHEN TO EXPECT SHOCK

Shock should be considered in many types of medical or trauma situations. Listed are some examples of conditions when one would expect to find shock:
• Multiple severe fractures, femur fracture
• Abdominal or chest injury
• Spinal injury
• Severe infection
• Major heart attack
• Anaphylaxis
• Severe laceration

ASSESSMENT FOR SHOCK:

Assessment for shock follows the assessment you perform for a medical or trauma patient.

Key points to remember:
• Mechanism of injury or nature of illness may give you a clue that shock could be present
• Significant bleeding, either internal or external is an immediate life threat
• Treat for shock aggressively and provide rapid transport
• Request ALS to assist with shock management as early as possible
• When assessing the patient note any signs or symptoms that indicate shock
• Check vitals every 5 minutes if unstable, every 15 if stable
• Reassess often
• Document your findings, treatments and patient response to treatment

TREATMENT FOR SHOCK:

Basic treatment for all shock patients is: Request ALS, high flow oxygen, place patient supine, cover to maintain warmth, control any external bleeding, splint extremity injuries, depending on the type of shock follow your protocols and administer a patient assisted med if warranted, and rapid transport.
NOTE: Not all shock patients should be transported in the supine position. Patients in cardiogenic shock should be transported in a sitting position. Consider transporting patients in anaphylactic shock in a sitting position also.