

D01: Shock

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Reviewed:

Introduction

Shock is a life-threatening condition of circulatory failure, defined as a state of cellular and tissue hypoxia resulting from reduced oxygen delivery, or increased oxygen consumption, or inadequate oxygen use. Four types of shock are recognized:

- Distributive shock, including septic shock, systemic inflammatory response syndrome, neurogenic shock, anaphylactic shock, toxic shock syndrome, end-stage liver disease, and endocrine shock.
- Cardiogenic shock, resulting from myocardial infarction, atrial and ventricular dysrhythmias, and valvular or ventricular septal rupture.
- Hypovolemic shock, due largely to hemorrhagic and nonhemorrhagic fluid losses.
- Obstructive shock, as in pulmonary embolism, pulmonary hypertension, tension pneumothorax, constrictive pericarditis, and restrictive cardiomyopathy.

These should not, however, be considered exclusive; many patients with circulatory failure have more than one form of shock. "Undifferentiated shock" refers to a situation where shock is recognized, but the cause is unclear.

Paramedics should suspect shock when confronted with hypotension, altered mental status, tachypnea, cool, clammy skin, oliguria, and metabolic acidosis (usually from hyperlactatemia). Most of these clinical features are not specific or sensitive for the diagnosis of shock, and should be used primarily to narrow the differential diagnosis so that empiric therapies can be delivered in a timely fashion.

Essentials

- Identify shock states as early as possible
- Attempt to identify possible causes and types of shock
- Initiate treatment expeditiously, primarily fluid resuscitation and hemodynamic stabilization
- Consider CliniCall to discuss treatment plan and/or early transport options

Additional Treatment Information

- Prompt identification of shock state is essential to ensure early and aggressive management of the intended shock state
- When possible, treatment should include specific correction of the cause of shock
- Clinicians may consider hemodynamic stabilization primarily through fluid resuscitation and administration of vasoactive agents when appropriate
- Appropriate and expedient treatment should be based on a good understanding of the possible underlying pathophysiology

General Information

- The effects of shock are initially reversible, but rapidly become irreversible, resulting in multiorgan failure and death
- Patients who present with undifferentiated shock should have immediate therapy initiated while rapidly identifying the cause and type of shock
- IV fluids should be used judiciously in cases of suspected cardiogenic shock. Consultation with CliniCall is encouraged in these cases prior to beginning treatment.

Interventions

First Responder

- Consider [spinal motion restriction](#) where required
- Provide airway management as indicated
 - → [B01: Airway Management](#)
- Supplemental oxygen as required
 - → [A07: Oxygen and Medication Administration](#)
- Control external hemorrhage
- Position patient supine
- Prevent heat loss

Emergency Medical Responder – All FR interventions, plus:

- Administer supplemental oxygen to maintain SpO₂ ≥ 94%.
 - → [A07: Oxygen and Medication Administration](#)
- Control external hemorrhage
 - → [PR03: Tourniquets](#)
 - → [PR04: Wound packing](#)
- Splint pelvis/fractures, if clinically indicated
 - → [PR02: Pelvic Binders](#)
- Transport and consider higher level of care intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access
 - → [D03: Vascular Access](#)
- Consider fluid bolus to correct hypoperfusion or hypotension if clinically indicated
- Consider [tranexamic acid](#) in cases of shock secondary to blood loss, and hypovolemia secondary to occult bleeding

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider an appropriate airway adjunct
 - → [B01: Airway Management](#)
- Consider needle/finger thoracostomy
 - → [PR21: Needle Thoracentesis](#)
- Consider [EPINEPHrine](#), if refractory to fluid resuscitation
- Consider cardiac arrhythmia
 - → [C02: Bradycardia](#)
 - → [C03: Narrow Complex Tachycardia](#)
 - → [C04: Wide Complex Tachycardia](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider rapid sequence induction (RSI)
- Consider [NOREpinephrine](#) infusion
- Consider needle/finger/tube thoracostomy
- Consider balanced blood product resuscitation
- In cardiogenic shock:
 - Consider etiology of cardiogenic shock and potential specialty centers.
 - Identify Killip classification.

- Conduct ultrasound assessment.
- Maintain blood pressure (MAP > 55 mmHg) and cardiac output.
- May require inotropic and/or vasopressor support.
- May require chronotropic support (pharmacological or electrical).
- If MAP is unachievable, attempt to maintain signs of end organ perfusion.
- Consider right heart syndrome and its potential complications

Evidence Based Practice

[Cardiogenic Shock](#)

[Hemorrhagic Shock](#)

[Neurogenic Shock](#)

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [\[Link\]](#)
3. Gaieski M, et al. Definition, classification, etiology, and pathophysiology of shock in adults. In UpToDate. 2020. [\[Link\]](#)

D02: Bleeding

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Introduction

Hemorrhage can result from a number of causes including traumatic, gastrointestinal and obstetrical. In the context of trauma, loss of circulating blood volume from hemorrhage is the most common cause of shock; hemorrhagic shock is a common and frequently treatable cause of death in injured patients and is second only to traumatic brain injury as the leading cause of death from trauma. Timely recognition, appropriate resources, and appropriate response are critical for preventing death.

Essentials

- Obtain rapid control of external hemorrhage
- Control compressible and extremity bleeding with direct pressure
- Recognize serious occult bleeding
- Strive to mitigate the lethal triad of trauma (hypothermia, acidosis, and coagulopathy)
- Initiate rapid transport to an appropriate lead trauma hospital

Referral Information

Select destination facilities in accordance with the pre-hospital triage and transport guidelines for adult and pediatric major trauma in British Columbia.

General Information

- Assessment and stabilization should follow the CABCDE pattern:
 - Catastrophic hemorrhage
 - Airway
 - Breathing
 - Circulation
 - Disability (Neurologic status)
 - Exposure
- The Advanced Trauma Life Support (ATLS) manual produced by the American College of Surgeons describes four classes of hemorrhage to emphasize the early signs of the shock state. Clinicians should note that significant drops in blood pressure are generally not manifested until Class III hemorrhage develops, and up to 30 percent of a patient's blood volume can be lost before this occurs.
 - Class I hemorrhage involves a blood volume loss of up to 15 percent. The heart rate is minimally elevated or normal, and there is no change in blood pressure, pulse pressure, or respiratory rate.
 - Class II hemorrhage occurs when there is a 15 to 30 percent blood volume loss and is manifested clinically as tachycardia (heart rate of 100 to 120), tachypnea (respiratory rate of 20 to 24), and a decreased pulse pressure, although systolic blood pressure (SBP) changes minimally if at all. The skin may be cool and clammy, and capillary refill may be delayed. This can be considered moderate hemorrhage.
 - Class III hemorrhage involves a 30 to 40 percent blood volume loss, resulting in a significant drop in blood pressure and changes in mental status. Any hypotension (SBP less than 90 mmHg) or drop in blood pressure greater than 20 to 30 percent of the measurement at presentation is cause for concern. While diminished anxiety or pain may contribute to such a drop, the clinician must assume it is due to hemorrhage until proven otherwise. Heart rate (≥ 120 and thready) and respiratory rate are markedly elevated, while urine output is diminished. Capillary refill is delayed. Both class III and class IV should be considered severe hemorrhage.
 - Class IV hemorrhage involves more than 40 percent blood volume loss leading to significant depression in blood pressure and mental status. Most patients in Class IV shock are hypotensive (SBP less than 90 mmHg). Pulse pressure is narrowed (≤ 25 mmHg), and tachycardia is marked (>120 beats per minute). Urine output is

minimal or absent. The skin is cold and pale, and capillary refill is delayed.

Interventions

First Responder

- Supplemental oxygen as required
 - → [A07: Oxygen and Medication Administration](#)
- Position patient based on comfort and tolerance
- Consider spinal motion restriction if clinically indicated
- Apply direct pressure to control external hemorrhage
- Prevent heat loss

Emergency Medical Responder – All FR interventions, plus:

- Splint pelvis/fractures, if clinically indicated
 - → [PR02: Pelvic Binders](#)
- Pack wounds, if clinically indicated
 - → [PR04: Wound Packing](#)
- Apply tourniquets, if clinically indicated
 - → [PR03: Tourniquets](#)
- Activate AutoLaunch/Early Fixed Wing Launch, if appropriate.

Primary Care Paramedic – All FR and EMR interventions, plus:

- Establish IV access
 - → [D03: Vascular Access](#)
- Fluid resuscitation to mentation and/or central pulses. Consider permissive hypotension in select patients. Minimize the use of crystalloid.
- [Tranexamic acid](#) in cases of occult bleeding and/or hypovolemic shock
- Apply hemostatic dressing
- Provide analgesia as needed
 - → [E08: Pain Management](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Advanced assessment techniques including point of care ultrasound (POCUS)
- If clinically indicated:
 - Large-bore, single-lumen central cordis
 - Balanced blood product resuscitation
 - Reversal of anticoagulation
 - Balloon tamponade device

Evidence Based Practice

[Limb Amputation/Mangled/Major Hemorrhage](#)

[Hemorrhagic Shock](#)

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [\[Link\]](#)

3. American College of Surgeons. Advanced Trauma Life Support Student Course Manual 10th Edition. 2018. [[Link](#)]
4. Colwell C. Initial management of moderate to severe hemorrhage in the adult trauma patient. In UpToDate. 2019. [[Link](#)]
5. Kutcher M, et al. Acute coagulopathy associated with trauma. In UpToDate. 2020. [[Link](#)]
6. Raja A, et al. Initial management of trauma in adults. In UpToDate. 2019. [[Link](#)]

D03: Vascular Access and Fluid Administration

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Introduction

Peripheral venous cannulation, among the most common medical procedures, has revolutionized the practice of medicine. Peripheral intravenous (IV) catheters allow for the safe infusion of medications, hydration fluids, blood products, and nutritional supplements.

Essentials

- Vascular access should only be performed when there is an indication for use in the prehospital environment. See [→PR26: Venipuncture - Ethical decision making](#) for more information.
- Catheter and site selection varies according to the patient's condition and intended use

General Information

- Initiation of peripheral vascular access is contraindicated when appropriate therapy can be provided through a less invasive route (e.g., intramuscularly, intranasally, or orally).
- Paramedics must make informed decisions with respect to a patient's need for vascular access, with consideration given to:
 - Current clinical status and stability
 - Expected prehospital interventions, such as the need to administer medications or fluid en route to hospital
 - Anticipated in-hospital clinical course. Note that a general expectation that the patient may require IV access at some point during their hospital stay is not, by itself, grounds to attempt IV cannulation.
- Intravenous devices can become dislodged or pulled out during patient movement. Paramedics should consider the timing of patient movements when contemplating IV cannulation.
- Intraosseous access should be considered on critically ill or injured patients who cannot be successfully cannulated in a short period of time.
 - Higher flow rates have been reported when intraosseous needles are placed in the humeral head instead of the tibial plateau; the humeral head is therefore the preferred site in cardiac arrest.

Interventions

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain peripheral vascular access
- Consider need for fluid or fluid replacement. If signs or symptoms of hypotension, hypoperfusion, or hypovolemia are present (including based upon history):
 - **In general, give normal saline in 500 mL increments**
 - Target a systolic blood pressure of 90 mmHg or better. Caution: major trauma, and head and spinal cord trauma have different fluid resuscitation targets. Consult appropriate CPGs for guidance.
 - [→ H01: Principles of Major Trauma](#)
 - [→ H03: Head Trauma](#)
 - [→ H05: Spinal Cord Injuries](#)
- Reassess patient after every 500 mL bolus for blood pressure and presence or absence of pulmonary edema
- Do not exceed 2 L of fluid. If additional fluids are required, consult CliniCall.
- In children, consider increments of 5-10 mL/kg normal saline. Do not exceed 20 mL/kg.

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

If unable to obtain peripheral vascular access:

- Consider external jugular access
 - → [PR13: External Juglar Cannulation](#)
- Consider intraosseous access
 - → [PR12: Intraosseous Cannulation](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Ultrasound-guided peripheral venous access
- Ultrasound-guided central access

Evidence Based Practice

[Hemorrhagic Shock](#)

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [[Link](#)]
2. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [[Link](#)]
3. Chopra V. (2019). Central venous access devices and approach to device and site selection in adults. In UpToDate. 2019. [[Link](#)]
4. Frank R. Peripheral venous access in adults. In UpToDate. 2019. [[Link](#)]
5. Heffner A, et al. Overview of central venous access. In UpToDate. 2019. [[Link](#)]
6. Lairet J, et al. A comparison of proximal tibia, distal femur, and proximal humerus infusion rates using the EZ-IO intraosseous device on the adult swine (Sus scrofa) model. 2013. [[Link](#)]
7. Perron C. Intraosseous infusion. In UpToDate. 2019. [[Link](#)]
8. Sabado J, et al. Principles of ultrasound-guided venous access. In UpToDate. 2019. [[Link](#)]
9. Smith, S. Vascular (venous) access for pediatric resuscitation and other pediatric emergencies. In UpToDate. 2019. [[Link](#)]

