

## Hypovolemic Shock

Hypovolemic shock results from a significant decrease in intravascular volume due to blood loss, severe dehydration, or third-spaced fluid losses.

### Pathophysiology

A significant loss of circulating blood volume leads to decreased venous return to the heart, which reduces cardiac preload and stroke volume. The body compensates initially by activating the sympathetic nervous system, causing tachycardia and peripheral vasoconstriction to maintain blood flow to vital organs. The neuroendocrine system helps respond to hypovolemia by increasing the secretion of antidiuretic hormone (ADH) from the posterior pituitary gland. ADH also promotes salt and water resorption. If the volume loss continues and these compensatory mechanisms become overwhelmed, the patient becomes hypotensive and acidotic.

### Causes

- Hemorrhagic
  - Severe trauma
  - Gastrointestinal bleeding (peptic ulcer disease, esophageal varices, diverticulitis)
  - Ruptured aortic aneurysm
  - Postpartum hemorrhage
  - Spontaneous bleeding in the setting of anticoagulant use
- Non-hemorrhagic
  - Adrenal insufficiency
  - Severe dehydration from vomiting, diarrhea
  - Osmotic diuresis from diabetic ketoacidosis
  - Extensive burns
  - Medication-induced diuresis
  - Third-spaced losses (pancreatitis, cirrhosis)
  - Inadequate oral intake
  - Excessive sweating during heat exposure

### Diagnosis

- Patient history: Note a history of trauma, bleeding, sudden severe back pain, abdominal pain, bloody emesis, black or maroon stools, pancreatic or liver disease, medications such as diuretics or anticoagulants, burns, diabetes, or intense heat exposure.

- Physical exam findings (in addition to signs of hypoperfusion): Overt bleeding, abdominal distension or tenderness, chest or abdominal wall ecchymosis, penetrating injuries, or extensive burns.
- Laboratory tests:
  - A drop in hemoglobin and hematocrit suggests hemorrhage.
  - Supratherapeutic INR in a patient on anticoagulation suggests spontaneous internal bleeding.
  - Elevated blood sugar with ketoacidosis suggests DKA.
- Imaging is guided by the history and physical.
  - Chest X-ray is obtained in unstable trauma patients.
  - The FAST (Focused Assessment with Sonography in Trauma) exam should be performed for unstable trauma patients to evaluate for free intraperitoneal or pericardial fluid.
  - If the patient is stable for transport, consider computed tomography (CT) of the chest, abdomen, and pelvis, with contrast if a vascular etiology is suspected.
  - Endoscopy of the upper and lower gastrointestinal (GI) tract is indicated if GI bleeding is suspected.

### Treatment

- Restore intravascular volume: Rapid administration of intravenous fluids, such as crystalloids (e.g., normal saline (NS) or lactated Ringer's (LR) solution), or blood products (red blood cells, fresh frozen plasma, platelets) for hemorrhagic shock.
- Address the underlying cause, such as controlling the bleeding or treating the underlying cause of the volume deficit.
- Except in cases of traumatic brain injury (TBI), LR is the preferred IV fluid for initial resuscitation. NS is used for patients with TBI. NS can be used more broadly for resuscitation, but caution is advised as it can worsen acidosis in patients with shock.
- The initial fluid bolus should be followed by an immediate assessment of blood pressure, heart rate, and other markers of perfusion to determine whether additional fluids are required.
- Use blood products as soon as available in patients with hemorrhagic shock with ongoing bleeding. Crystalloids in this setting may further dilute out clotting factors.
- Engage the hospital's massive transfusion protocol (MTP) for unstable patients with severe, ongoing bleeding.
  - A massive transfusion is defined as the administration of 10 units or more of whole blood or packed red blood cells (PRBCs) within 24 hours. The foundation

of a MTP is balanced transfusion with PRBCs, platelets, and fresh frozen plasma (FFP), usually in a 1:1:1 ratio.

### Nursing Considerations

- Rapid fluid resuscitation is a priority. Use a minimum of 2 large-bore IV catheters (14 or 16 gauge) to ensure fast fluid administration.
- Monitor vital signs, urine output, and mental status frequently to assess response to treatment.
- Support procedural efforts to achieve hemostasis in the patient with severe traumatic, vascular, gastrointestinal (GI), or obstetric hemorrhage.
- Anticipate and support bedside procedures such as central venous access and arterial line placement. Intubation may be required for patients with severe shock.
- Administer warmed fluids and blood products to prevent hypothermia, which can worsen coagulopathy in hemorrhagic shock.
- For patients with severe hemorrhagic shock, a rapid infusion device can deliver warmed blood and fluids at rates of up to 1 liter per minute. The safe operation of a rapid infuser requires large bore IV access and experienced, trained staff.

### References

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