

A 23-year-old man was extricated from his vehicle following a motor vehicle collision in which he was the unrestrained driver. The patient was found unresponsive at the scene and intubated by paramedics. He received 2.5 L of normal saline over 20 minutes en route to the emergency department. His medical history is not known. At the emergency department, blood pressure is 70/30 mm Hg and pulse is 120/min. The patient responds to strong vocal and tactile stimuli by opening his eyes. Pupils are equal and reactive to light. There are multiple bruises over the anterior chest and upper abdomen. Neck veins are flat, trachea is midline, and extremities are cold. The abdomen is mildly distended. Cardiac monitoring shows sinus tachycardia. Which of the following is most likely to be seen in this patient?

- ☐ A. Diastolic collapse with elevated right ventricular pressure
- ☐ B. Dilated left ventricle with apical hypokinesis
- ☐ C. Inferior vena cava engorgement
- ☐ D. Right ventricular dilation and hypokinesis
- ☐ E. Small left ventricular cavity with ejection fraction of 75%

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- ☐ A. Diastolic collapse with elevated right ventricular pressure [24%]
- ☐ B. Dilated left ventricle with apical hypokinesis [15%]
- ☐ C. Inferior vena cava engorgement [12%]
- ☐ D. Right ventricular dilation and hypokinesis [5%]
- ☒ E. Small left ventricular cavity with ejection fraction of 75% [44%]

Proceed to Next Item

Explanation:

User Id: [REDACTED]

Hemodynamic measurements in shock				
Parameter	Normal	Hypovolemic shock	Cardiogenic shock	Septic shock
Right atrial pressure (preload)	Mean of 4 mm Hg	↓	↑	Normal to slight ↓
Pulmonary capillary wedge pressure (preload)	Mean of 9 mm Hg	↓	↑	Normal to slight ↓
Cardiac index (pump function)	2.8-4.2 L/min/m ²	↓	↓↓	↑

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Systemic vascular resistance (afterload)	Mean of 1,150 dynes•sec/cm ⁵	↑	↑	↓
Mixed venous oxygen saturation	60%-80%	↓	↓	↑

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This patient has blunt thoracic and abdominal trauma and is most likely in **hypovolemic shock** due to massive internal hemorrhage. Loss of intravascular volume leads to a decrease in venous return to the right atrium (**decreased preload**) and a consequent **decrease in cardiac output** and systemic blood pressure. In an effort to maintain adequate cardiac output and organ perfusion, the sympathetic nervous system is activated, resulting in peripheral vasoconstriction (**increase in systemic vascular resistance**) and an increase in heart rate. The left ventricle, decreased in size due to low filling volume, also compensates by **increasing ejection fraction**. These responses create the typical clinical presentation of hypovolemic shock, which includes hypotension, tachycardia, **cold extremities**, evidence of poor organ perfusion (eg, somnolence).

saturation

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Despite the compensatory mechanisms in hypovolemic shock, cardiac output cannot be sustained and circulatory collapse (and death) occurs in the absence of aggressive volume resuscitation and control of volume loss.

(Choice A) Diastolic collapse (failure of ventricular filling) due to elevated right ventricular filling pressure is characteristic of cardiac tamponade. This scenario can occur in the setting of blunt thoracic trauma (eg, hemopericardium); however, jugular venous distension and distant heart sounds should be present. Diastolic collapse also occurs in hypovolemic shock, but right ventricular filling pressure is low rather than elevated.

(Choices B and C) A dilated left ventricle with apical hypokinesis and engorgement of the inferior vena cava are characteristics of cardiogenic shock. Blunt thoracic trauma may cause myocardial contusion, leading to this scenario; however, evidence of elevated ventricular filling pressure (eg, jugular venous distension) would be expected. As in hypovolemic shock, hypotension, tachycardia, and cold extremities due to peripheral vasoconstriction are present.

(Choice D) Right ventricular dilation and hypokinesis can occur due to massive pulmonary embolism. Such a scenario is unlikely immediately following major thoracic trauma and, if present, should be accompanied by jugular venous distension.

Educational objective:

Hypovolemic shock is characterized by an initial decrease in preload and cardiac output followed by a compensatory increase in systemic vascular resistance, heart rate, and ejection fraction. Hypotension, tachycardia, cold extremities, and evidence of hypovolemia (eg, decreased jugular venous pressure) should be present.

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References:

1. [Massive posttraumatic bleeding: epidemiology, causes, clinical features, and therapeutic management.](#)