

CRASH
Center for Research in Anesthesia for Resuscitation and Shock
Guiding the future of patient care

Differentiating Shock with POCUS

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Anesthesiology
UNIVERSITY OF CALIFORNIA
SAN DIEGO MEDICAL CENTER

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Disclosures

- I have no disclosures to report.

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Learning Objectives

- Describe the pathophysiologic mechanisms and clinical indicators that define shock and differentiate between its four primary types.
- Interpret focused transthoracic echocardiography (TTE) images and hemodynamic data to diagnose the underlying etiology of shock in critically ill patients.
- Identify key echocardiographic views (parasternal, apical, subcostal) and explain their role in evaluating cardiac function and volume status in the context of shock.
- Apply point-of-care ultrasound (POCUS) findings and hemodynamic profiles to guide management strategies for each type of shock.

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What type of dad is Canelli?

A. Helicopter parent

B. Sink or swim parent

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What type of dad is Canelli?

A. Helicopter parent 0%

B. Sink or swim parent 0%

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What type of dad is Canelli?

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B. Sink or swim parent 0%

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Outline

- Basics of Transthoracic Echocardiography
- What Constitutes Shock
- The Four Types of Shock
- Test Your Knowledge



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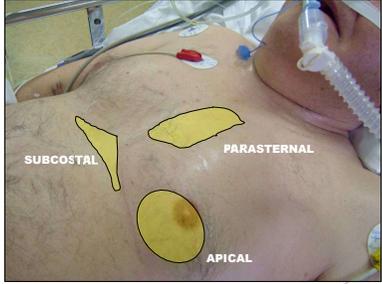
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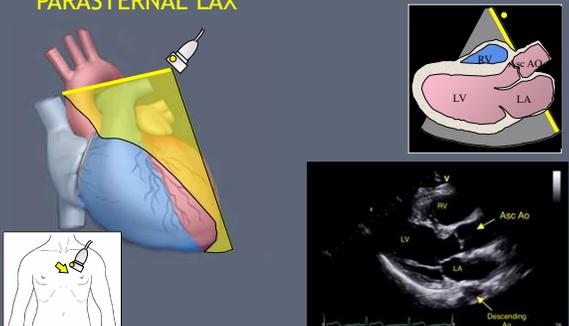
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Basics of TTE



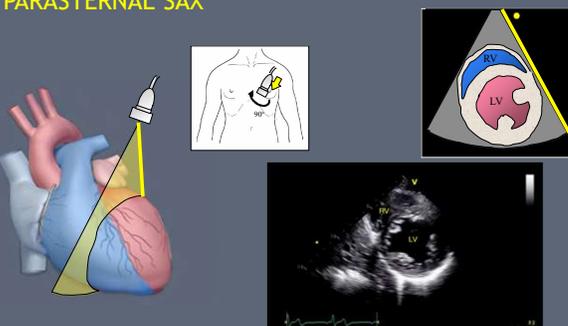
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PARASTERNAL LAX

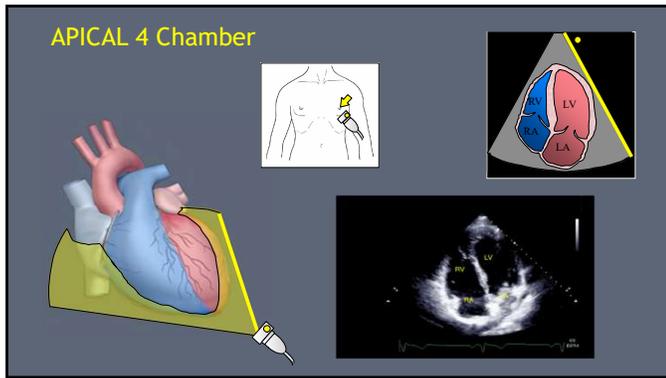


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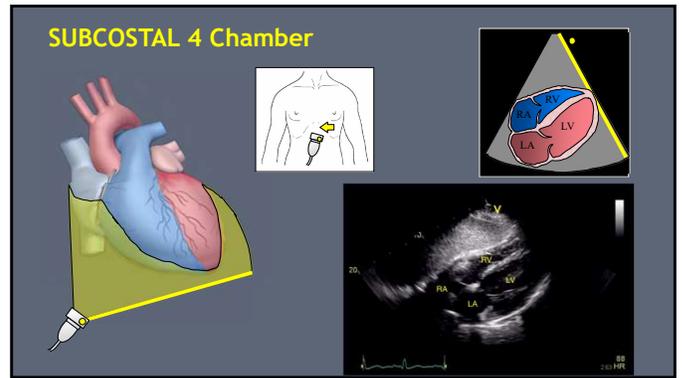
PARASTERNAL SAX



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Outline

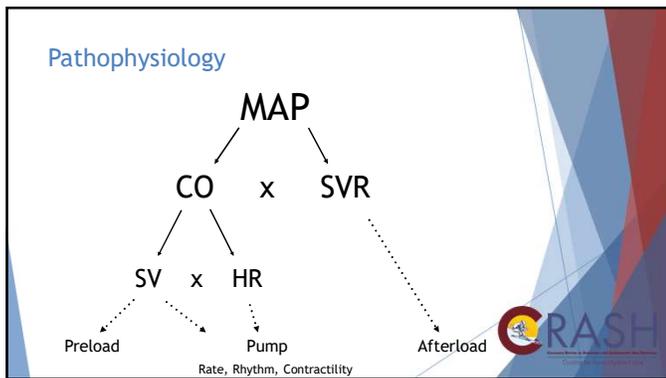
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Shock Defined

- ▶ An abnormality of the circulatory system that results in inadequate tissue oxygenation and end-organ perfusion
- ▶ Brain
 - ▶ Altered mental status
- ▶ Skin
 - ▶ Mottled, clammy
- ▶ Kidneys
 - ▶ Oliguria
- ▶ Heart
 - ▶ Tachycardia
- ▶ Elevated blood lactate

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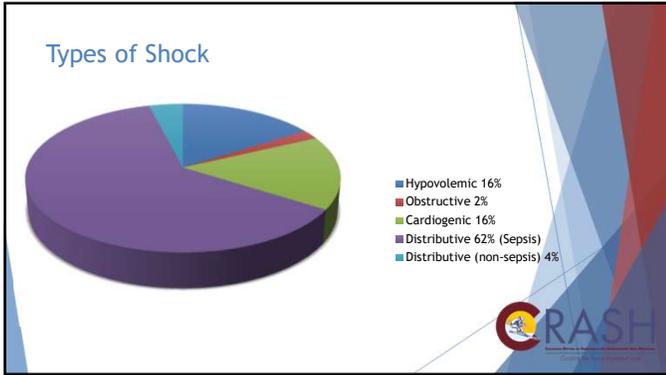


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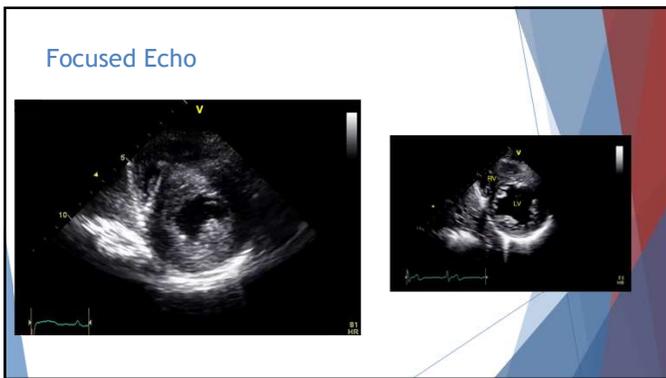
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Patient 1

- ▶ HR 110 bpm
- ▶ BP 70/50 mmHg
- ▶ CVP 3 mmHg
- ▶ PAP 14/7 mmHg
- ▶ PCWP 4 mmHg
- ▶ CO 2.5 L/min
- ▶ SVR 1800 dyne x s/cm²

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Hypovolemic Shock

- ▶ Ddx
 - ▶ Dehydration
 - ▶ Acute blood loss
 - ▶ Pancreatitis
 - ▶ Burns
 - ▶ Hyperglycemia
- ▶ Rx
 - ▶ Fluids
 - ▶ Blood

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Pathophysiology

- ▶ **Preload** issue
- ▶ Loss of intravascular volume
- ▶ **Compensation:**
 - ▶ Vasoconstriction of skin, muscle, gut to preserve flow to brain, heart, kidneys
 - ▶ Venoconstriction
 - ▶ 1HR + 1SVR

Hypovolemic shock
Loss of plasma or blood volume

MAP
CO
SV HR SVR

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Type	CO	SVR	CVP	PAP	Rx
Hypovolemic	↓	↑	↓	↓	Volume Blood

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Patient 2

- ▶ HR 91
- ▶ BP 75/50
- ▶ CVP 21
- ▶ PAP 48/28
- ▶ PCWP 23
- ▶ CO 2.5
- ▶ SVR 1800



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Focused Echo




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Cardiogenic Shock

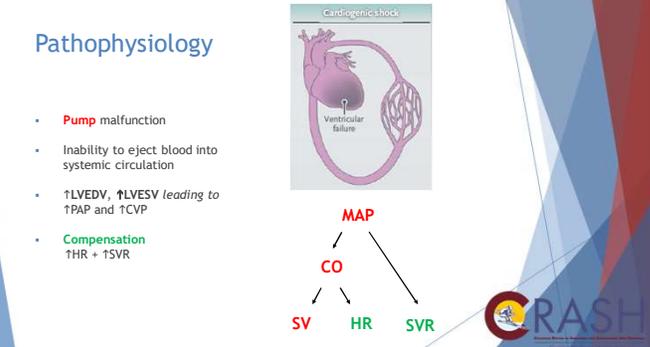
- ▶ DDx
 - ▶ Ischemia
 - ▶ Cardiomyopathy
 - ▶ Arrhythmia
 - ▶ Valvulopathy
- ▶ RX
 - ▶ Inotropy
 - ▶ Antiarrhythmics



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Pathophysiology

- Pump malfunction
- Inability to eject blood into systemic circulation
- \uparrow LVEDV, \uparrow LVESV leading to \uparrow PAP and \uparrow CVP
- Compensation \uparrow HR + \uparrow SVR




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Type	CO	SVR	CVP	PAP	Rx
Hypovolemic	↓	↑	↓	↓	Volume Blood
Cardiogenic	↓	↑	↑	↑	Inotrope B1, PDE



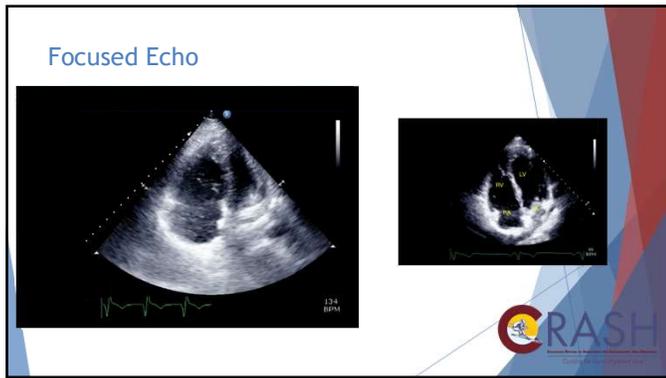
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Patient 3

- ▶ HR 110
- ▶ BP 75/50
- ▶ CVP 22
- ▶ PAP 35/18
- ▶ PCWP 15
- ▶ CO 3.8
- ▶ SVR 1600



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Obstructive Shock

- ▶ DDX
 - ▶ Pulmonary Embolism
 - ▶ Cardiac Tamponade
 - ▶ Tension Pneumothorax
- ▶ RX
 - ▶ Embolectomy
 - ▶ Pericardiocentesis
 - ▶ Decompression

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Pathophysiology

- **Obstructed** blood flow from R heart to L heart
- Functional Hypovolemia
 - ↓LVEDV leading to ↓SV, ↓CO
- **Compensation**
THR + ↑SVR

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Type	CO	SVR	CVP	PAP	Rx
Hypovolemic	↓	↑	↓	↓	Volume Blood
Cardiogenic	↓	↑	↑	↑	Inotrope B1, PDE
Obstructive	↓	↑	= PAP, PCWP	= CVP, PCWP	Decompress

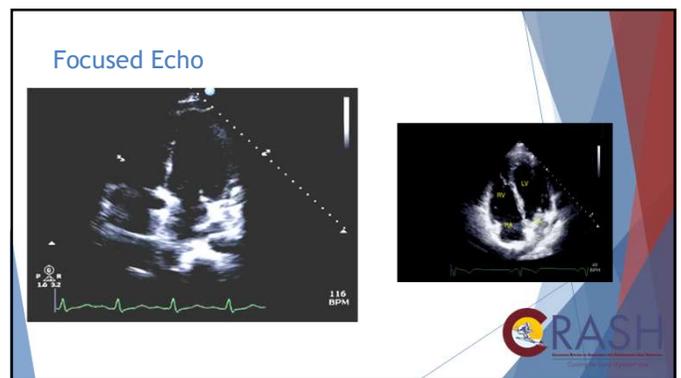
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Patient 4

- ▶ HR 117
- ▶ BP 80/30
- ▶ CVP 3
- ▶ PAP 14/7
- ▶ PCWP 4
- ▶ CO 9.6
- ▶ SVR 600

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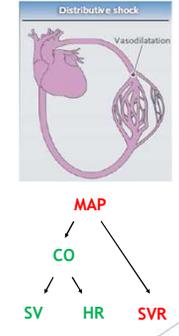
Distributive Shock

- ▶ Ddx
 - ▶ Septic
 - ▶ Anaphylactic
 - ▶ Neurogenic
- ▶ Rx
 - ▶ Vasopressors
 - ▶ Volume



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Pathophysiology



- **Afterload** problem
- Normal circulating volume trying to fill a dilated periphery
- ↓DBP, ↑pulse pressure
- **Compensation**
↑SV + ↑HR



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Type	CO	SVR	CVP	PAP	Rx
Hypovolemic	↓	↑	↓	↓	Volume Blood
Cardiogenic	↓	↑	↑	↑	Inotrope B1, PDE
Obstructive	↓	↑	= PAP, PCWP	= CVP, PCWP	Decompress
Distributive	↑	↓	↓	↓	Vasopressor Volume

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Outline

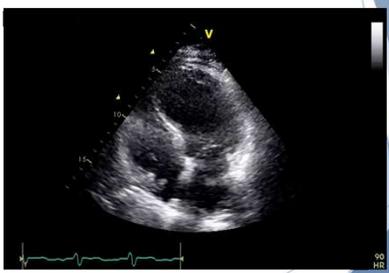
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What type of shock is this?

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- B. Obstructive
- C. Cardiogenic
- D. Distributive



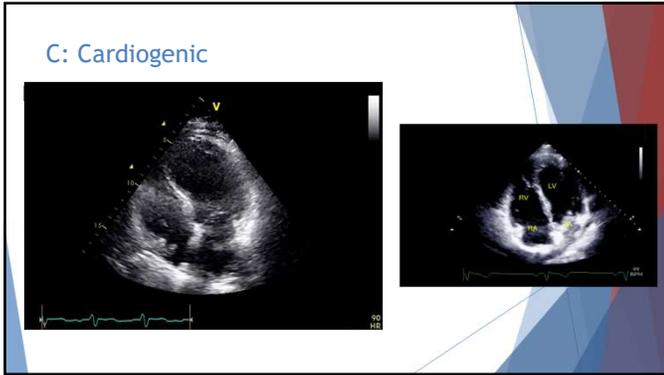
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1. What type of shock is this?

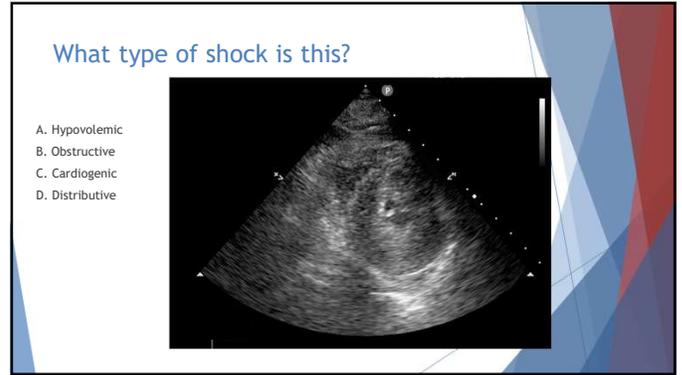
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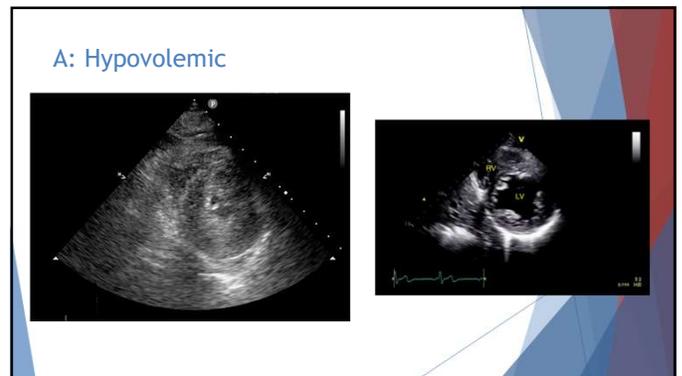
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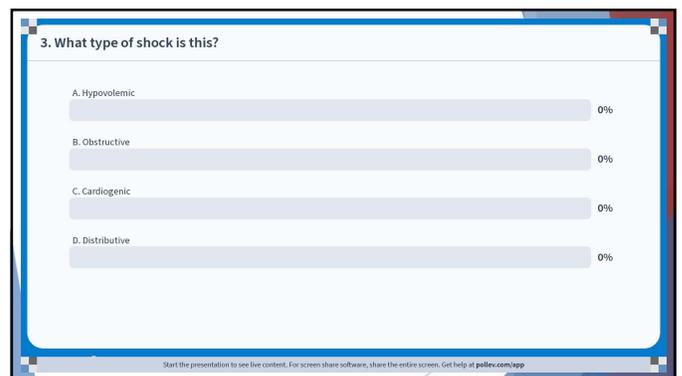
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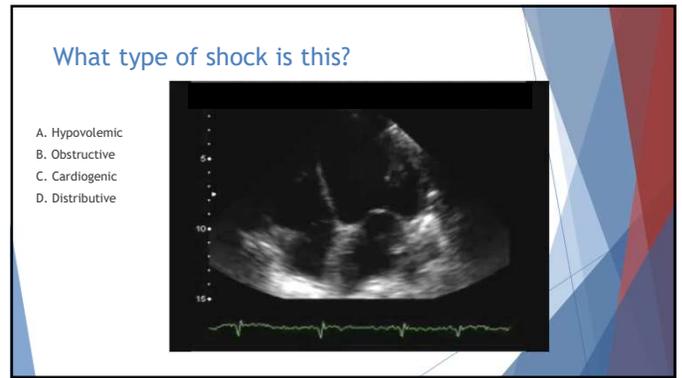
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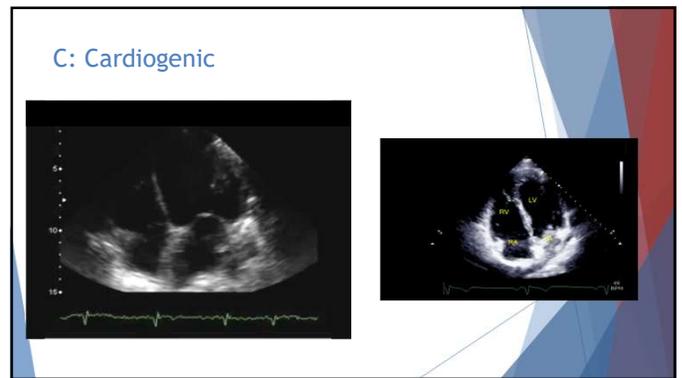
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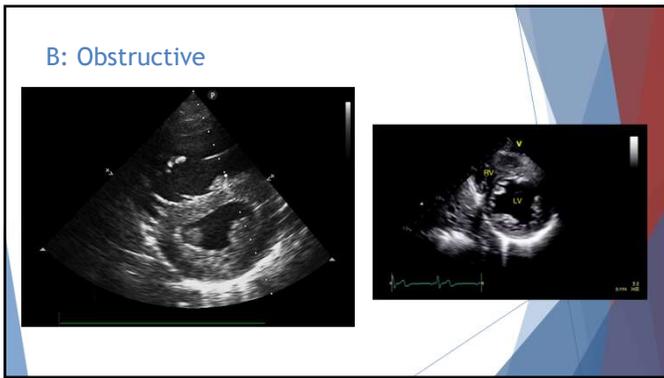
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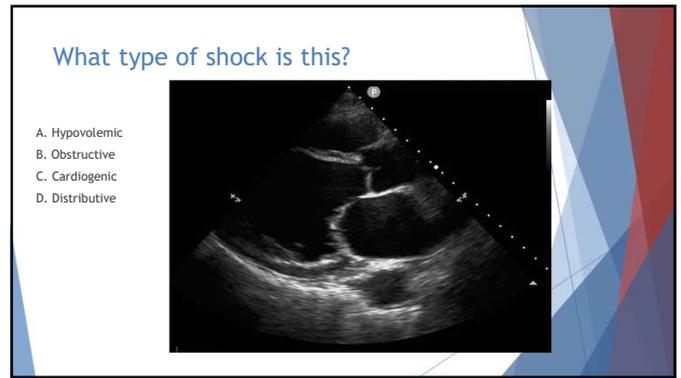
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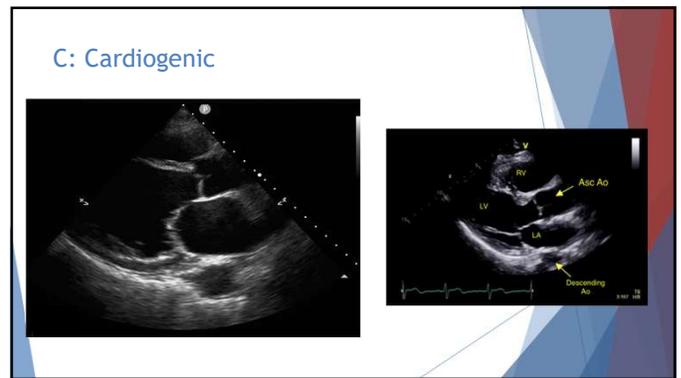
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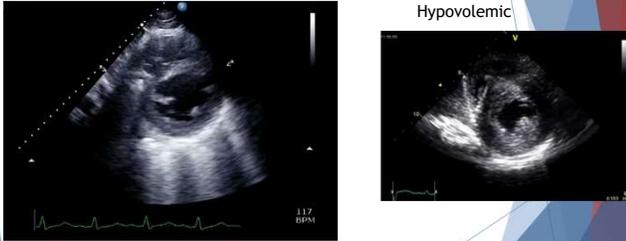


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D: Distributive

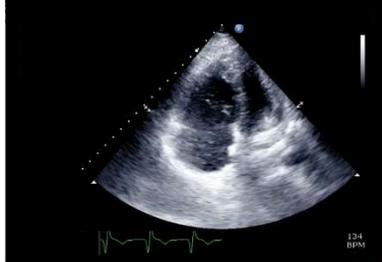


Hypovolemic

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What type of shock is this?

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- B. Obstructive
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- D. Distributive



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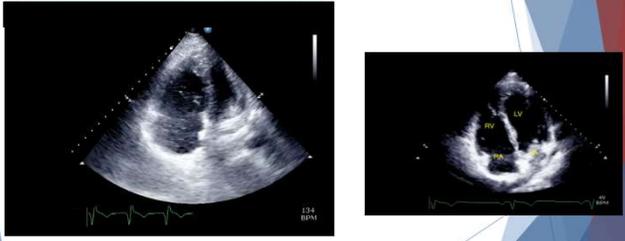
8. What type of shock is this?

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- D. Distributive

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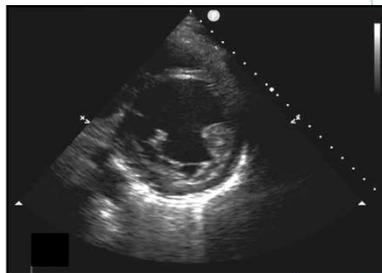
B: Obstructive



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What type of shock is this?

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- C. Cardiogenic
- D. Distributive



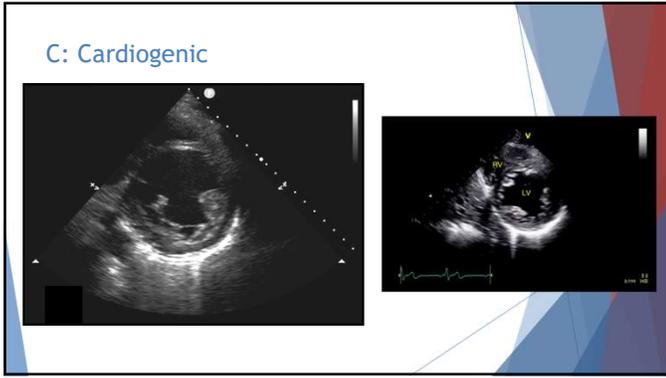
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9. What type of shock is this?

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- C. Cardiogenic
- D. Distributive

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