Cardiogenic shock with preserved ejection fraction

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Clinical and hemodynamic features of cardiogenic shock:

Clinical:
- Hypotension – systolic blood pressure – 90 mm Hg or less
- Impaired organ perfusion-oliguria, cold clammy skin, mental obtundation.

Hemodynamics:
- Systolic blood pressure – 90 mm Hg or less
- Cardiac index – 2.2 L/min/m2 or less
- Pulmonary capillary wedge pressure: 18 mm Hg or higher
  with right atrial pressure lower than pulmonary capillary wedge pressure
  (primary left ventricular failure)
- Right atrial pressure: 15 mm Hg or higher
  with pulmonary capillary wedge pressure usually less than right atrial pressure (primary right ventricular failure)
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Acute causes:

Cardiac tamponade – both right and left ventricular systolic function are preserved

Acute severe valvular regurgitation – both right and left ventricular systolic function are preserved
  - Mitral regurgitation
  - Aortic regurgitation
  - Primary tricuspid regurgitation

Acute massive pulmonary embolism – normal left ventricular ejection fraction, reduced right ventricular ejection fraction

Acute right ventricular infarction – normal left ventricular ejection fraction, reduced right ventricular ejection fraction
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• Cardiac Tamponade

Mechanism:
marked increase in intrapericardial pressure
pan-diastolic restriction of ventricular filling
in shock: ventricles fill only during atrial systole
decreased SV, CO, BP, reflex tachycardia

Management: cardiac decompression
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- Acute RV failure with normal LVEF:
  - Acute RVMI
  - Massive PE
- Mechanism: Low CO, and hypotension
  - Decreased LVSV
  - Decreased LV preload
  - Decreased RVSV
  - IVS shift towards LV
  - Pericardial constrain
  - Decreased LV contractility
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- Acute RVMI:
  - Management: PCI
- Pulmonary embolism:
  - Anticoagulation
  - Thrombolytics
  - Embolectomy
  - Vasopressors
- Inotropic support
- Assist device
- Transplant
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- Acute severe mitral regurgitation:
  - marked reduction in LV FSV-
  - decreased CO, hypotension
  - marked increase in regurgitant volume
  - normal LA size-
  - increased PCWP
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- Acute severe mitral regurgitation
- Management:
  - Surgical replacement or repair
  - catheter based - experimental
  - Supportive to stabilize:
    - vasodilator-nitroprusside
    - IABP
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- Acute severe aortic regurgitation
- Mechanism:
  - marked impairment of LV filling-
  - increased LV afterload
  - decreased SV and CO, BP
  - marked increase in LVDP-
  - increased PCWP
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• Acute severe aortic regurgitation :
  • Management :
  • Surgical replacement
  • Catheter based replacement ?
  • Supportive :
  • vasodilator
  • IABP- contraindicated
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**Chronic causes:**

Primary diastolic heart failure – normal left ventricular ejection fraction
Valvular heart disease – normal left ventricular ejection fraction
  - Aortic stenosis
  - Mitral stenosis
  - Aortic regurgitation
  - Mitral regurgitation
Pericardial disease – normal ejection fraction of both ventricles
  - Constrictive pericarditis
Myocardial disease – normal left ventricular ejection fraction
  - Restrictive cardiomyopathy
  - Hypertrophic cardiomyopathy
Pulmonary Arterial Hypertension- reduced right ventricular ejection fraction,
  - normal left ventricular ejection fraction
Figure 1. Echocardiographic Images in a Normal Person (Panel A) and the Patient with Diastolic Heart Failure (Panel B). The patient with diastolic heart failure has a thickened left ventricular wall and a normal left chamber volume.
A. Systolic dysfunction

Left ventricular volume

B. Normal

C. Diastolic dysfunction

Left ventricular volume
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- Hypertrophic cardiomyopathy:
  - mechanism:
  - secondary mitral regurgitation
  - LVOT obstruction
  - decreased LVSV, CO, BP
  - decreased LV compliance
  - mitral regurgitation
  - increased PCWP
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- Hypertrophic cardiomyopathy
- Management:
  - Vasopressors
  - Diuretics, NTG, inotropes, IABP
  - Contraindicated
  - ASA, myectomy, MVR
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• Restrictive Cardiomyopathy:
  • Mechanism:
    • decreased ventricular compliance
    • marked restriction of ventricular filling
    • decreased SV and CO, BP
    • increased PCWP, RAP
  • Management: palliative, ? transplant
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- Constrictive pericarditis
  - Mechanism:
  - restrictive ventricular filling
  - limited intrapericardial volume-
  - decreased LVSV and RVSV-
  - decreased CO
  - disproportionate increase in LVDP-
  - increased PCWP, RAP
Ventricular Discordance:
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- Constrictive pericarditis
- Management:
  - Pericardiectomy
  - Diuretics
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- Chronic isolated RV failure:
  - precapillary PAH
- mechanism: similar to acute RV failure
- management:
  - supportive: pulmonary vasodilators
  - transplant
• Thank you