Pressure Volume Loops (and more) for the Boards

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Disclosures

None
Objectives

Basics

Specific disease cases

Pharmacology cases
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Stroke volume (SV) varies based on three factors:

- **Preload**
- **Contractility**
- **Afterload**
The image illustrates the cardiac cycle with a pressure-volume loop. Key events are labeled:

- **Isovolumetric contraction**
- **Isovolumetric relaxation**
- **Mitral valve Opens**
- **Mitral valve Closes**
- **Aortic valve Opens**
- **Aortic valve Closes**

The loop shows the relationship between pressure and volume during the cardiac cycle. The stroke volume, indicated as (EDV - ESV), is depicted as the area enclosed by the loop.
1 → 3: increased preload
*SV increases d/t higher **end-diastolic volume**
1 → 2: increased contractility

*SV increases d/t lower **end-systolic volume**

**ESPVR** lines represent end-systolic pressure volume relationship

Slope (Ees) is a measure of contractility
1 → 3: increased afterload
*SV decreases d/t higher end-systolic volume

Slope (Ea) is a measure of afterload
1 → 2: decreased compliance
*Leads to higher *LV filling pressures* (per volume)

**EDPVR** lines represent diastolic pressure volume relationship
Stroke work

PVA = pressure-volume area
(total mechanical work of heart)

SW = stroke work
(externally transmitted work of heart)

PE = potential energy
(residual energy in heart)
Increase preload → increase SV
Increased contractility, or Decreased afterload

Decreased contractility, or Increased afterload
Increase afterload $\rightarrow$ decrease SV
Baseline

Increased contractility, or Increased preload

Decreased contractility, or Decreased preload
Key points

PV loops $\rightarrow$ $\Delta$’s in preload, afterload, contractility

Frank-Starling $\rightarrow$ preload on stroke volume

Force-tension $\rightarrow$ afterload on stroke volume
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Pharmacology cases
ANSWER: CHRONIC HF
ANSWER: AORTIC STENOSIS
ANSWER: MITRAL STENOSIS
ANSWER: AORTIC REGURGITATION
ANSWER: MITRAL REGURGITATION
Key points

Know chronic HF changes → remodeling occurs

Know profiles for valvular disease
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ANSWER: PHENYLEPHRINE
ANSWER: DIURETIC
ANSWER: ISOPROTERENOL OR INODILATOR
ANSWER: NOREPINEPHRINE
Key points

Know effects of adrenergic receptors

Know the receptors the drugs target

Apply to curves