Pressure Volume Loops (and more) for the Boards

Marty C. Tam, MD, FACC

Assistant Professor, Division of Cardiovascular Medicine

Associate Program Director, Advanced Heart Failure & Transplant Cardiology Fellowship

University of Michigan

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Disclosures

None

Objectives

Basics

Specific disease cases

Pharmacology cases

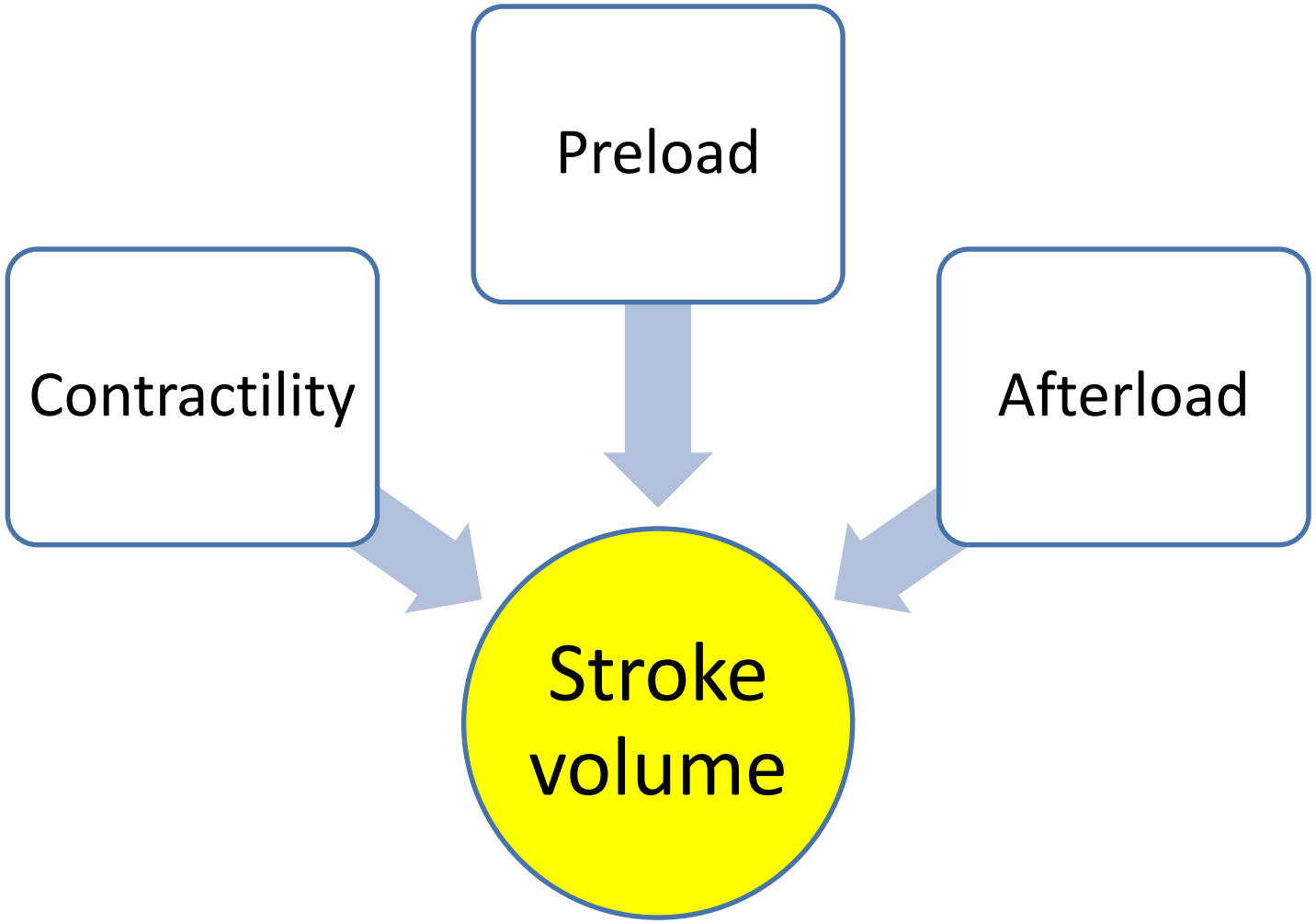
Objectives

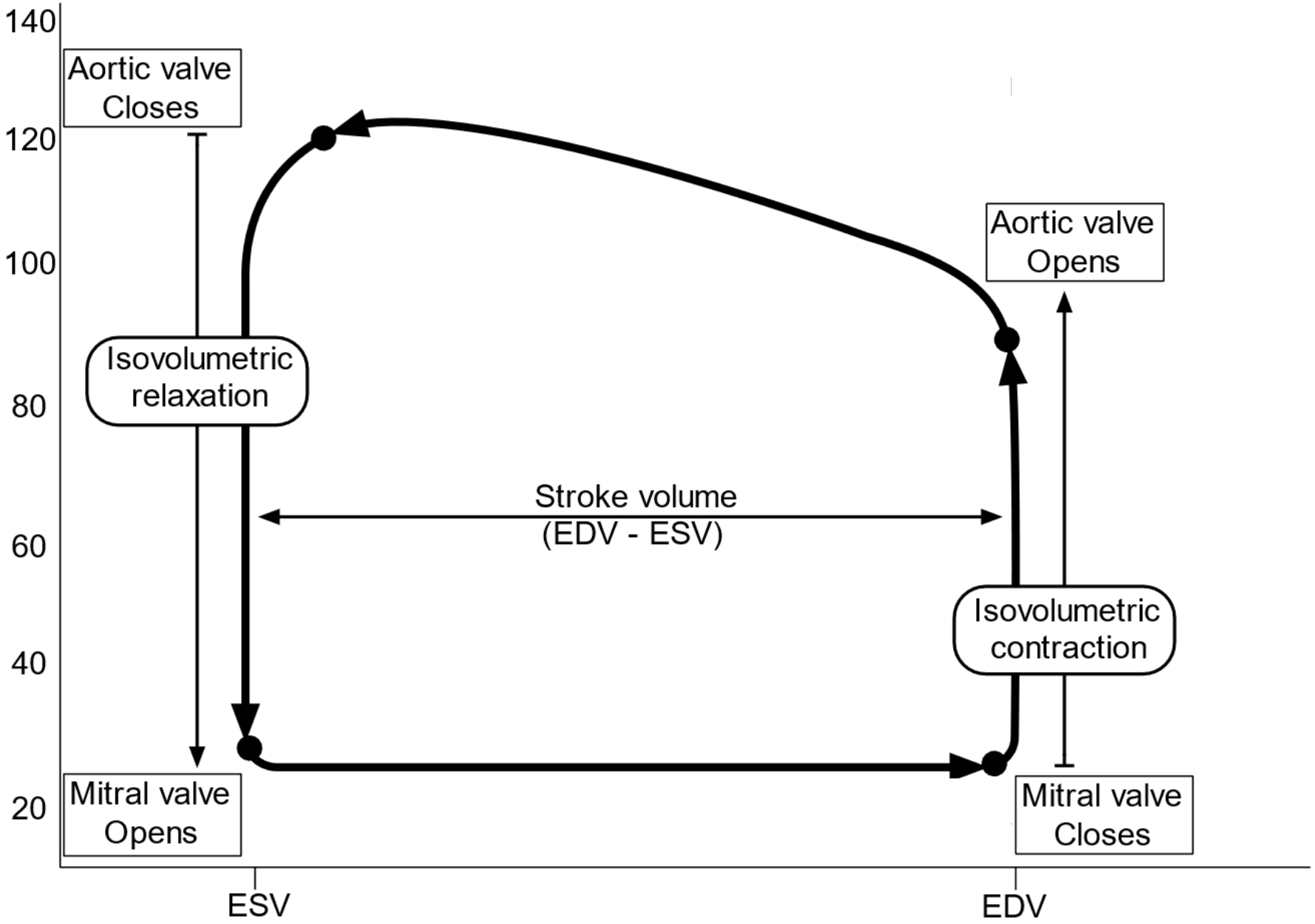
Basics

Specific disease cases

Pharmacology cases

Stroke volume (SV) varies based on three factors





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https://commons.wikimedia.org/wiki/File:Cardiac_cycle_(pressure_volume_loop).svg

1 → 3: increased preload

*SV increases d/t higher *end-diastolic volume*

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Lilly. Pathophysiology of Heart Disease (6th).

1 → 2: increased contractility
*SV increases d/t lower *end-systolic volume*

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ESPVR lines represent end-systolic pressure volume relationship

Slope (Ees) is a measure of contractility

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Lilly. Pathophysiology of Heart Disease (6th).

1 → 3: increased afterload

*SV decreases d/t higher *end-systolic volume*

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Slope (Ea) is a measure of afterload

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Lilly. Pathophysiology of Heart Disease (6th).

1 → 2: decreased compliance

*Leads to higher *LV filling pressures* (per volume)

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EDPVR lines represent diastolic pressure volume relationship

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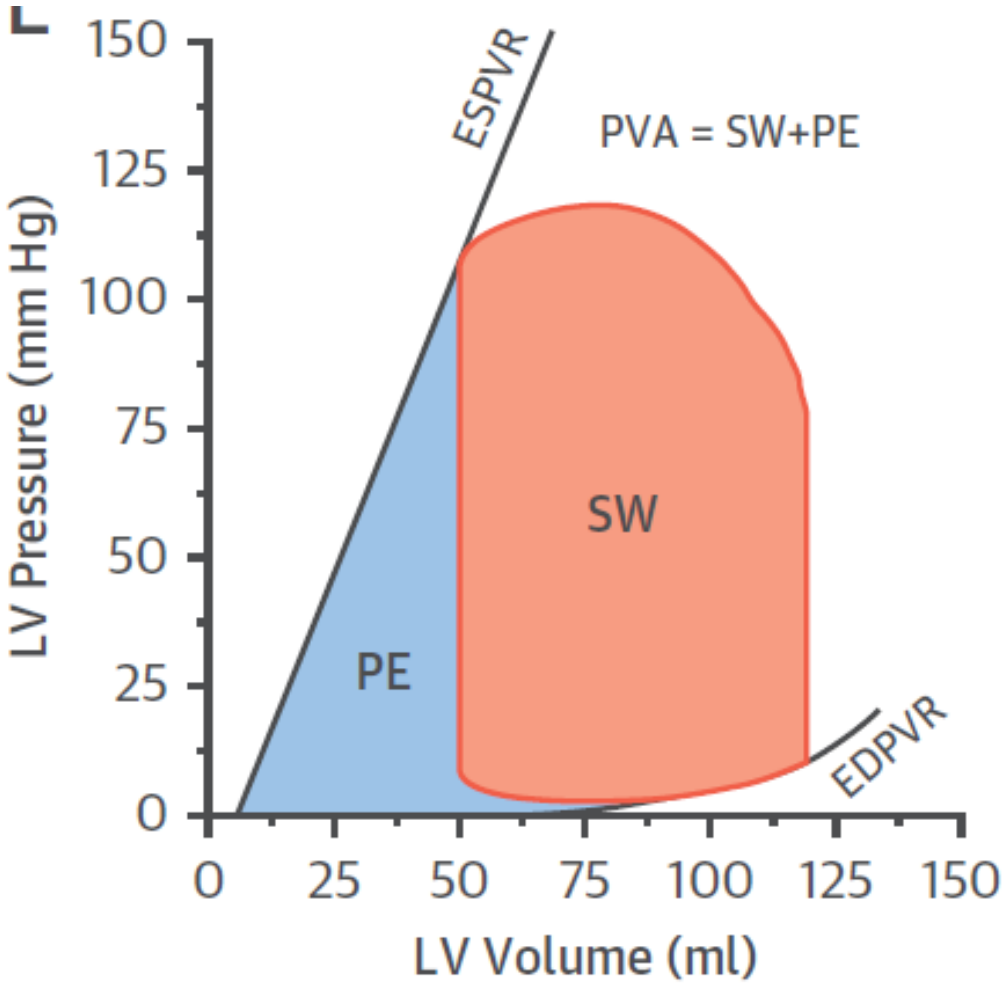
Lilly. Pathophysiology of Heart Disease (6th).

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)

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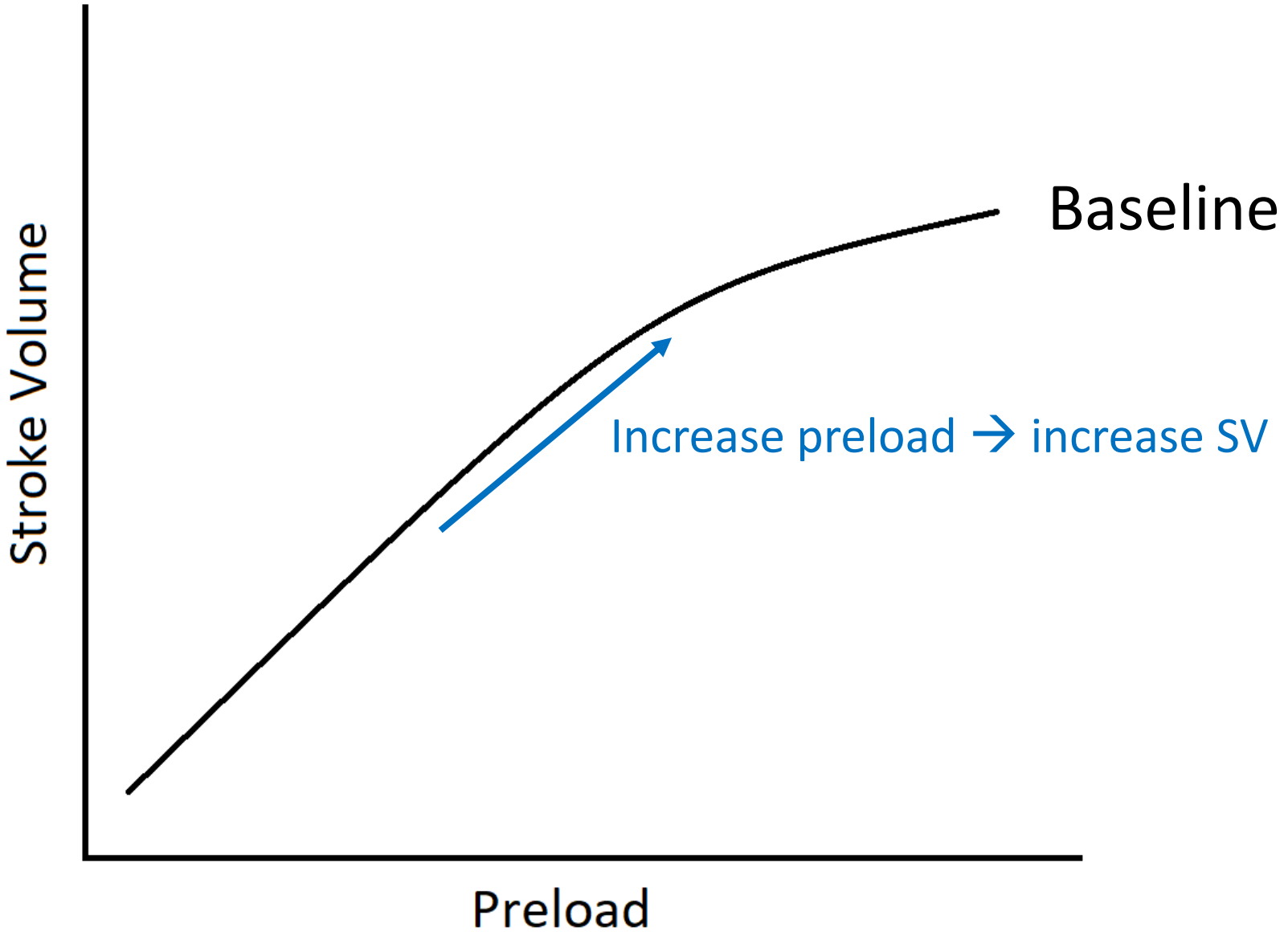
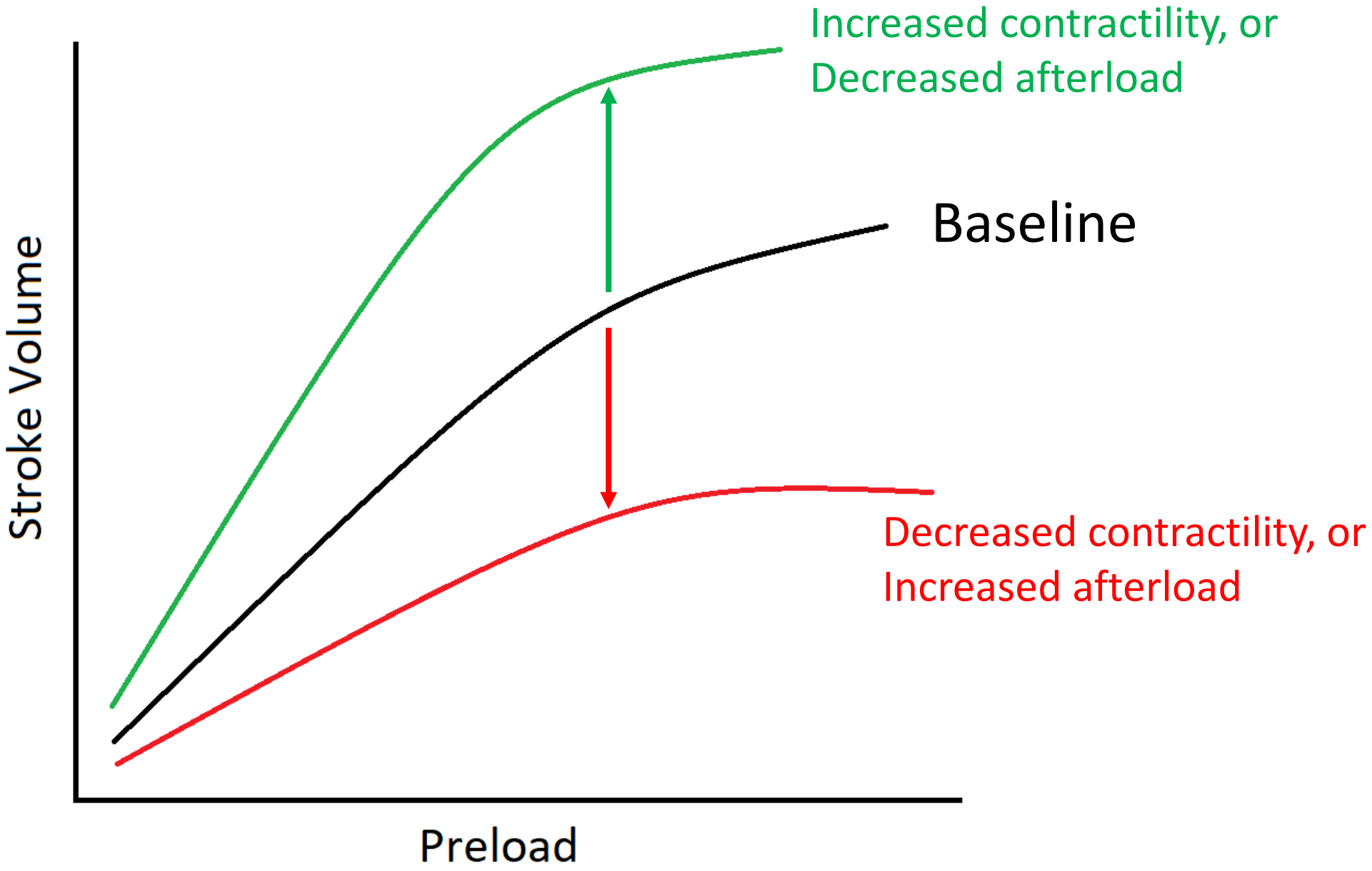
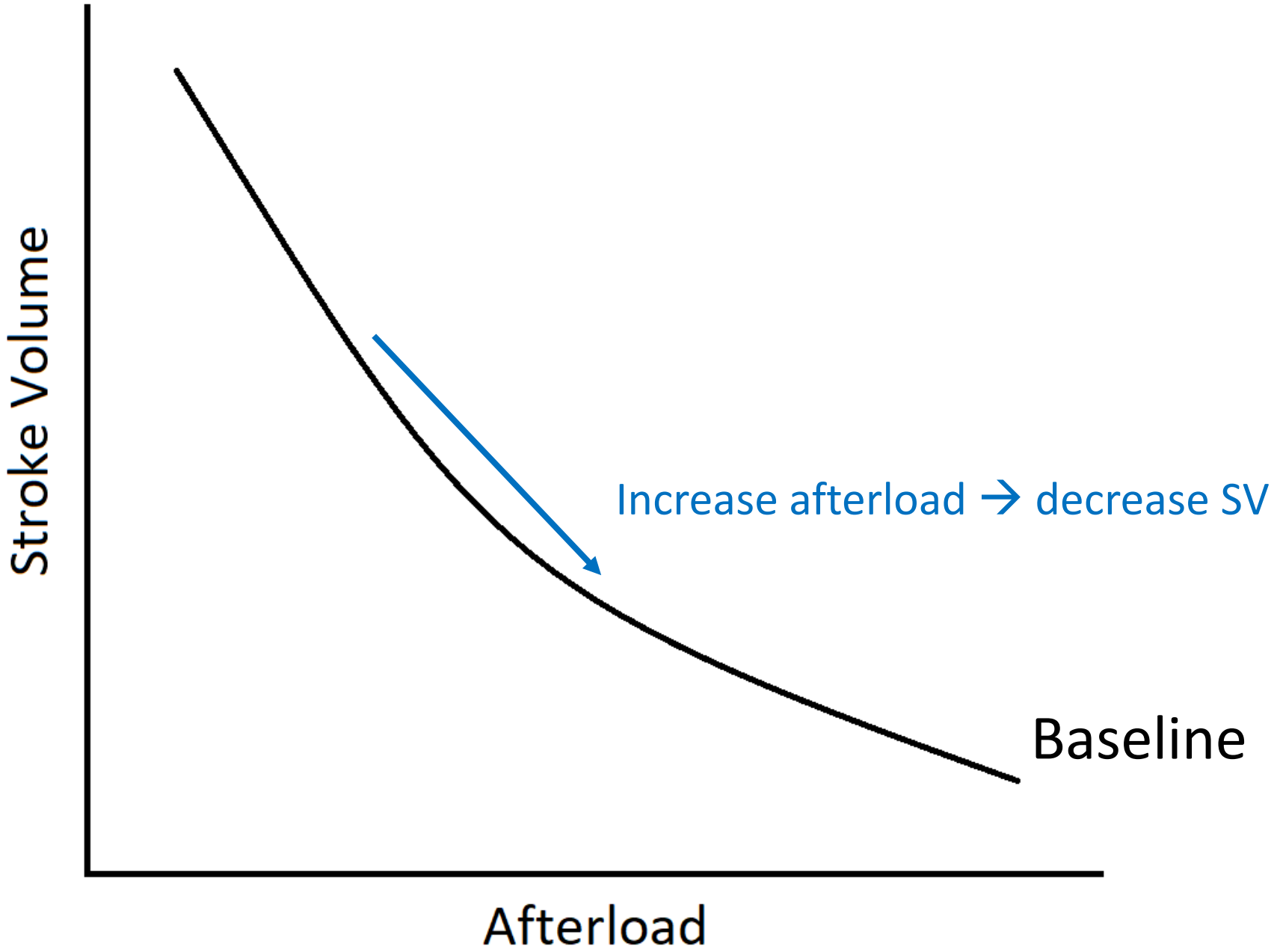
Uriel et al. JACC. 2018.


Stroke Volume
Baseline
Increase preload → increase SV
Preload


Increased contractility, or
Decreased afterload
Baseline
Decreased contractility, or
Increased afterload
Stroke Volume
Preload



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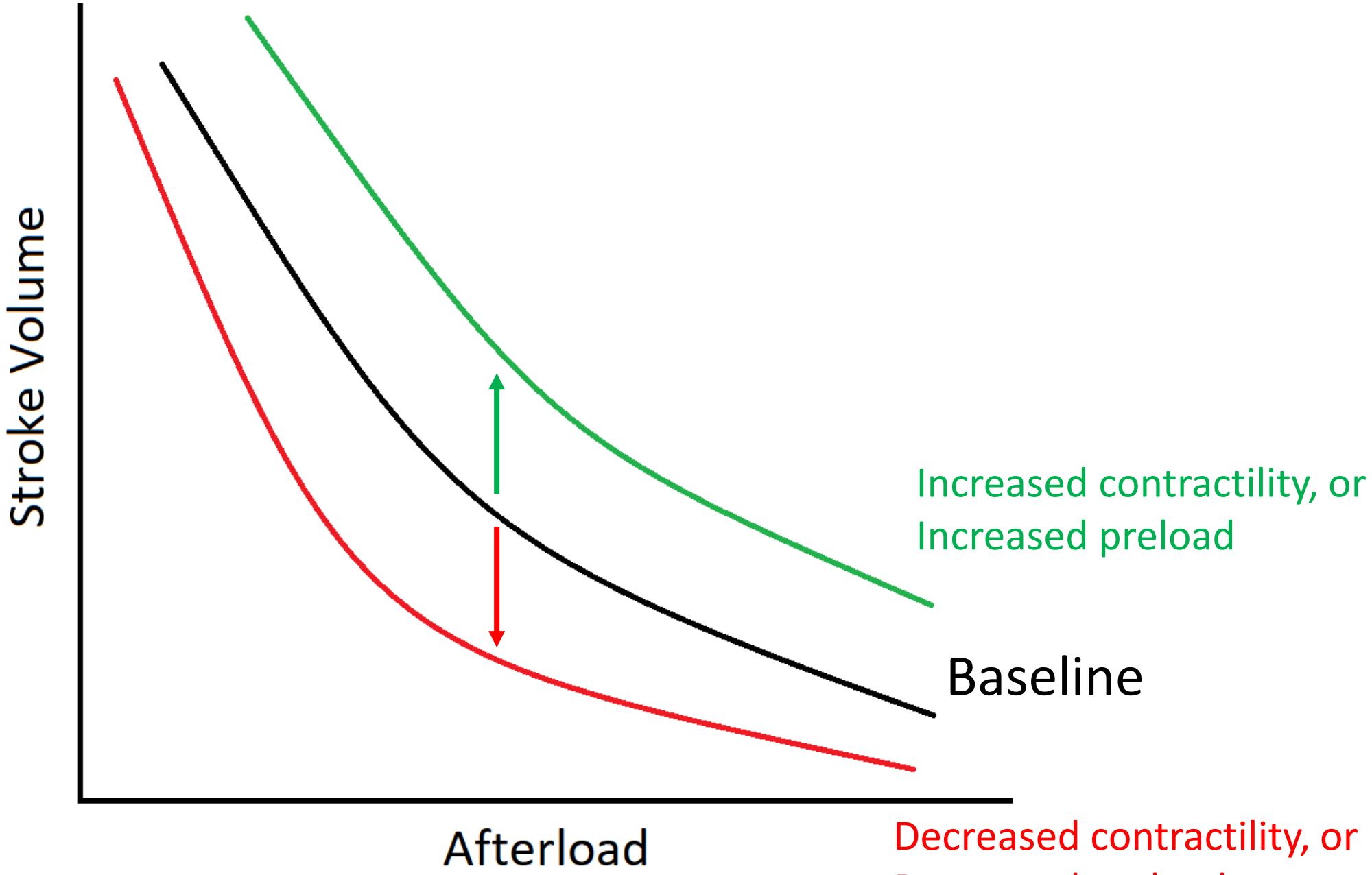
Stroke Volume
Afterload
Increased contractility, or
Increased preload
Baseline
Decreased contractility, or
Decreased preload

Key points

PV loops → Δ's in preload, afterload, contractility

Frank-Starling → preload on stroke volume

Force-tension → afterload on stroke volume

Objectives

Basics

Specific disease cases

Pharmacology cases

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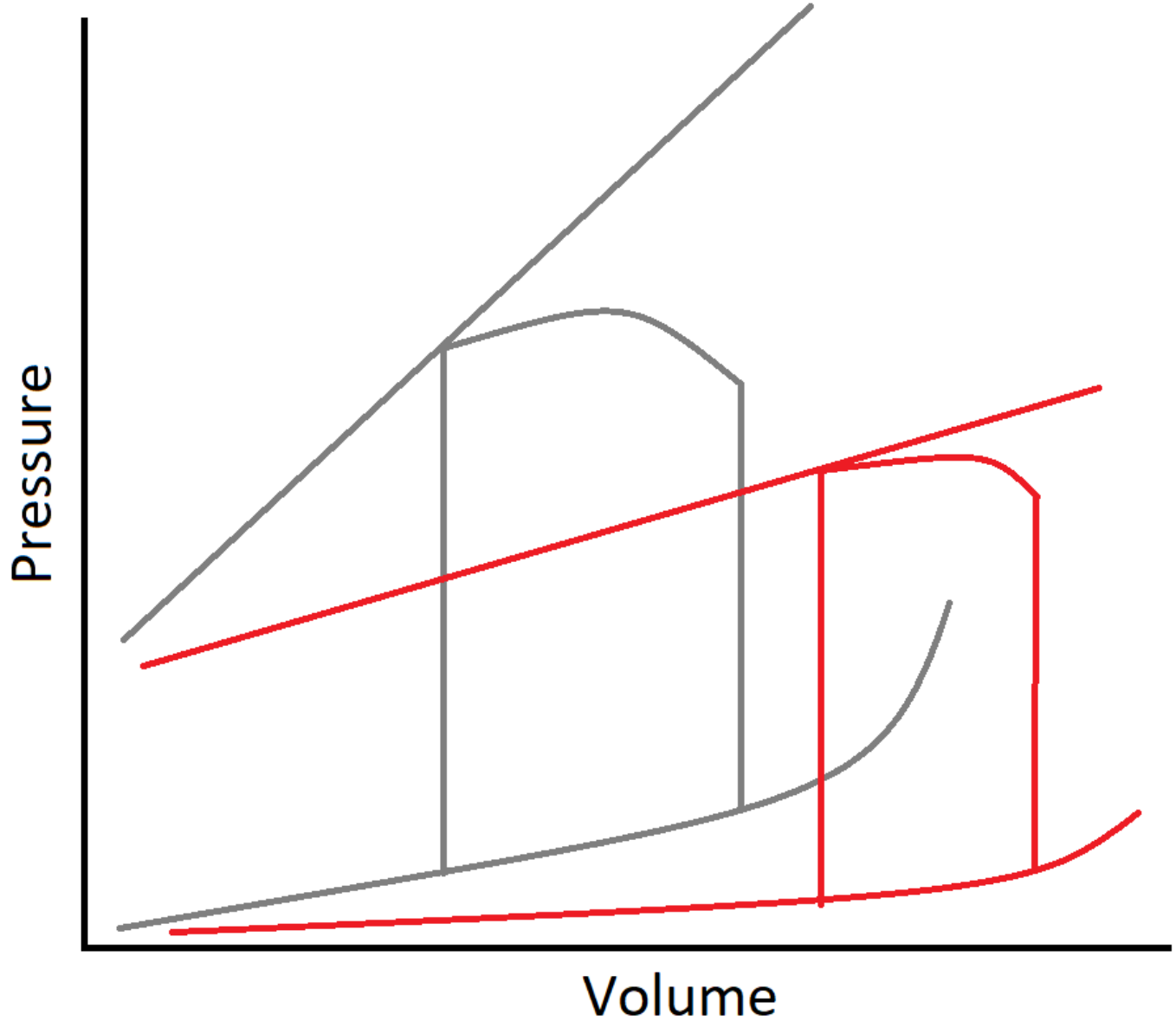
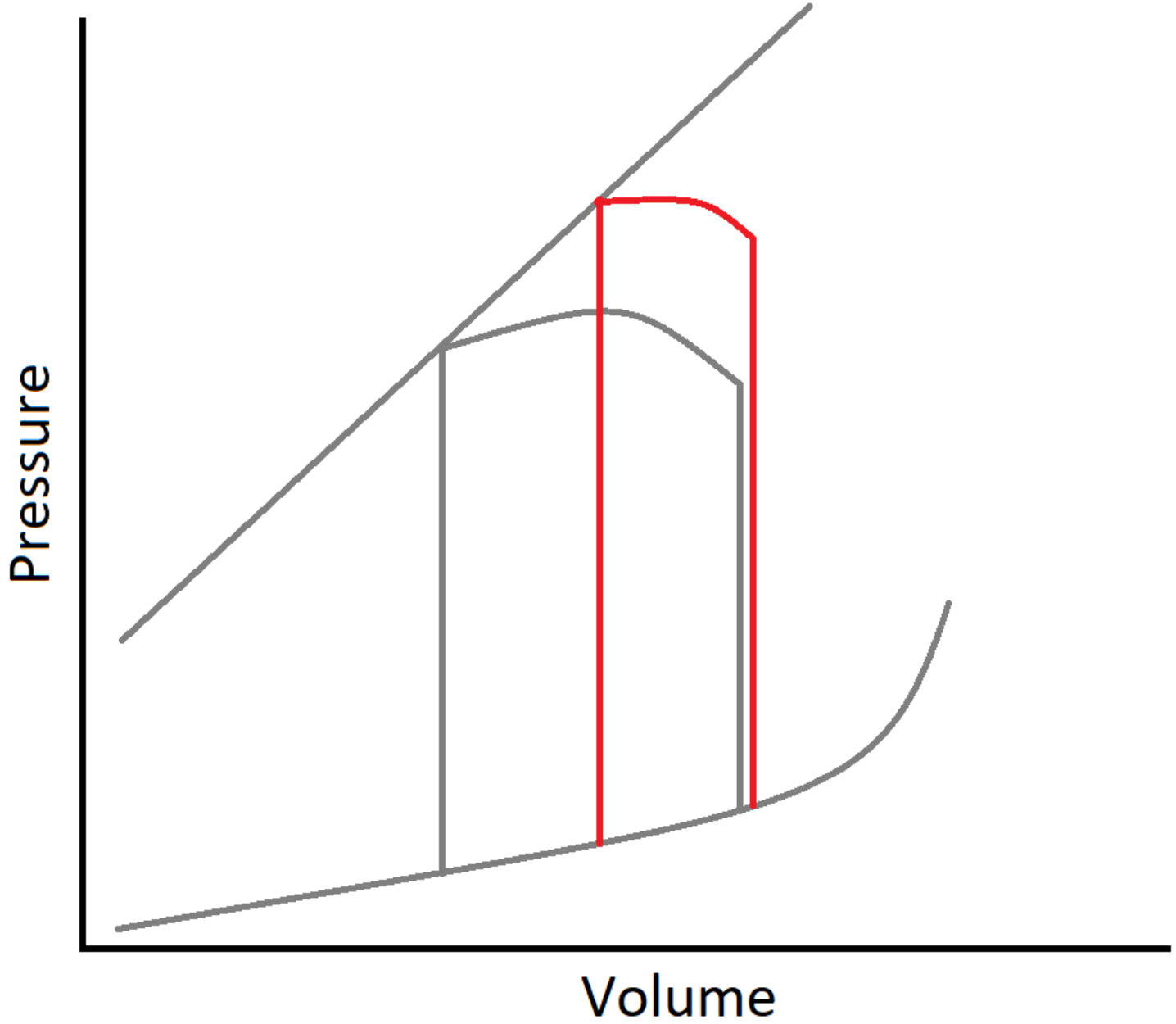
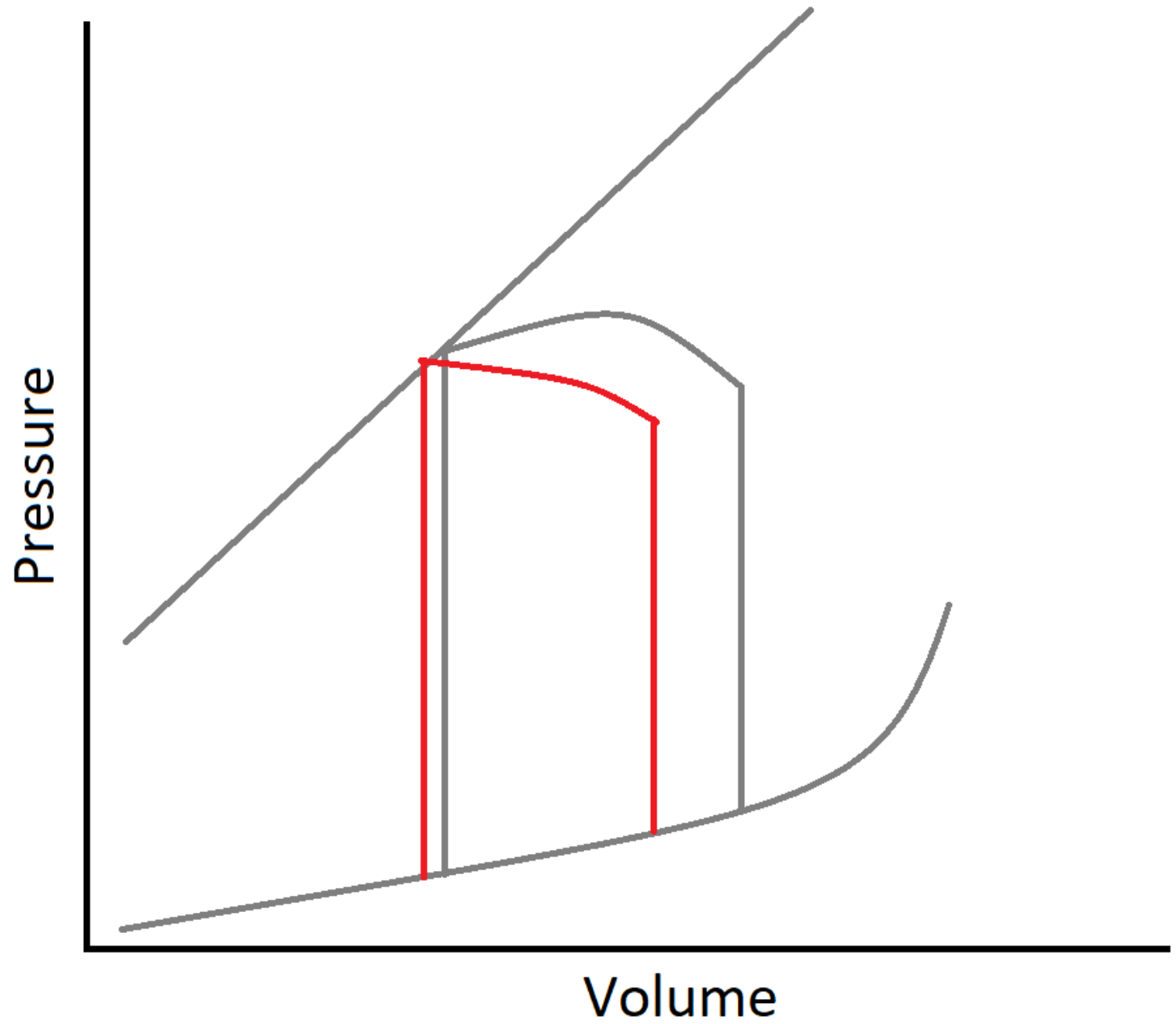

Pressure
Volume

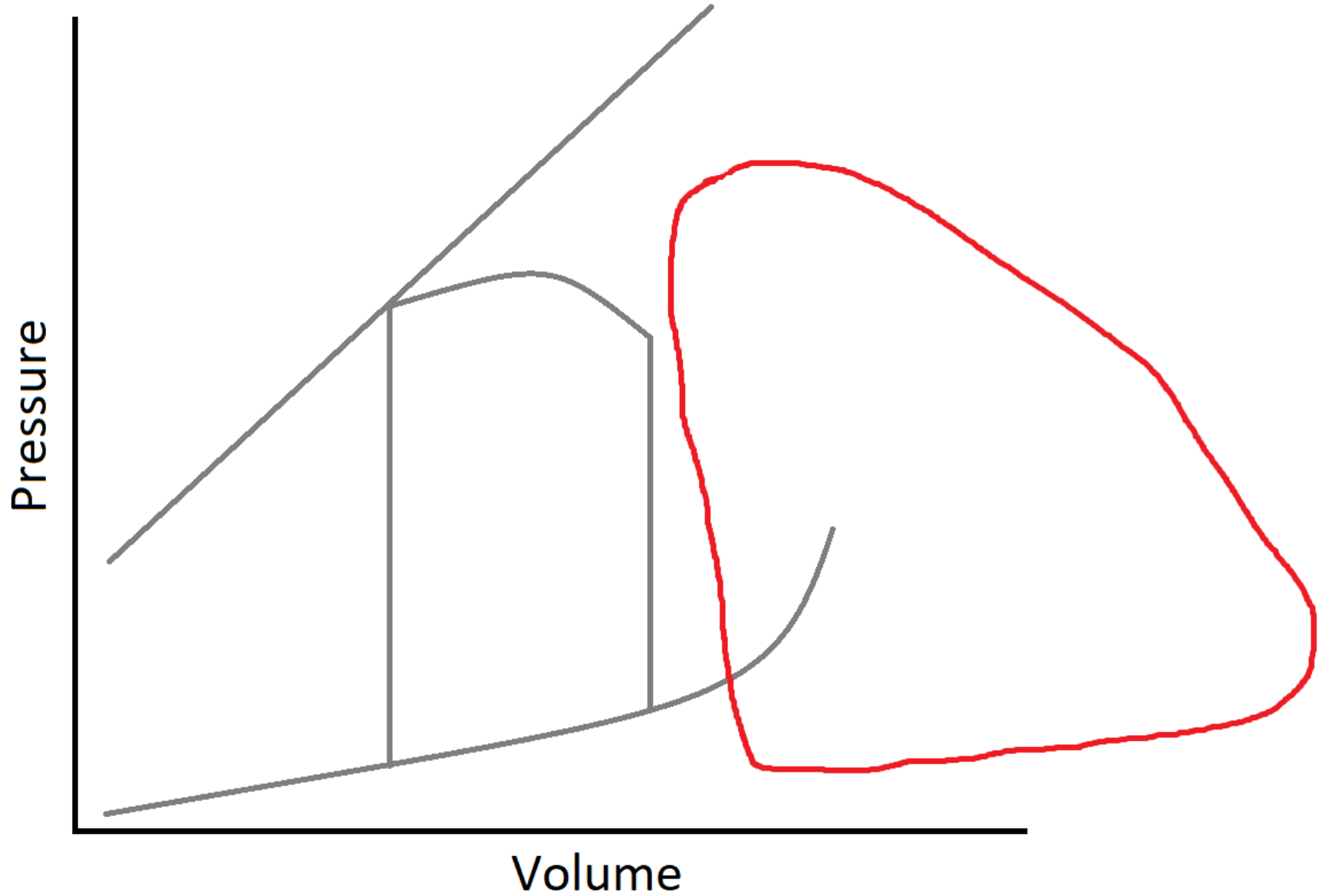
ANSWER: CHRONIC HF


Pressure
Volume

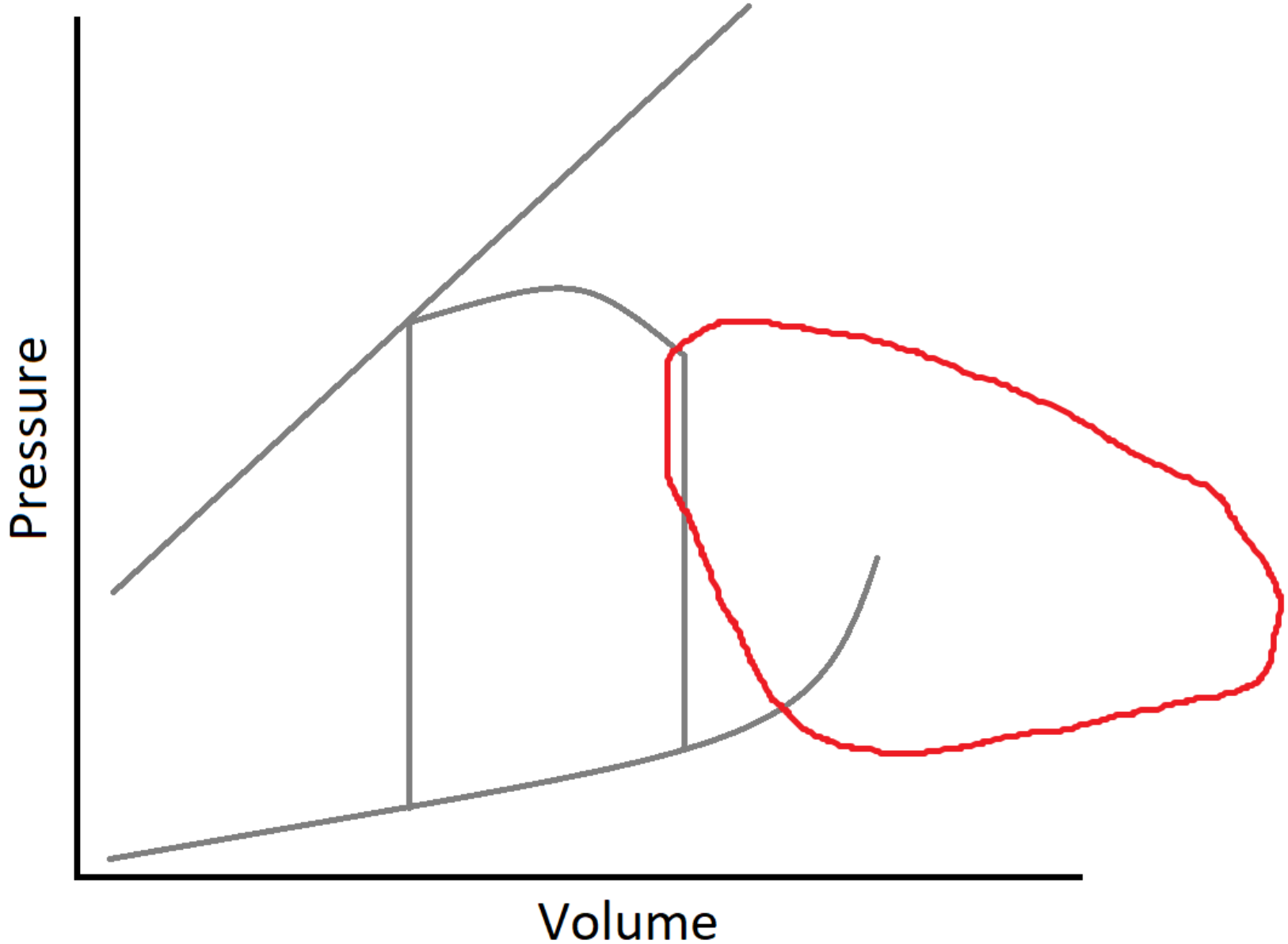
ANSWER: AORTIC STENOSIS


Pressure
Volume

ANSWER: MITRAL STENOSIS


Pressure
Volume

ANSWER: AORTIC REGURGITATION


Pressure
Volume

ANSWER: MITRAL REGURGITATION

Key points

Know chronic HF changes → remodeling occurs

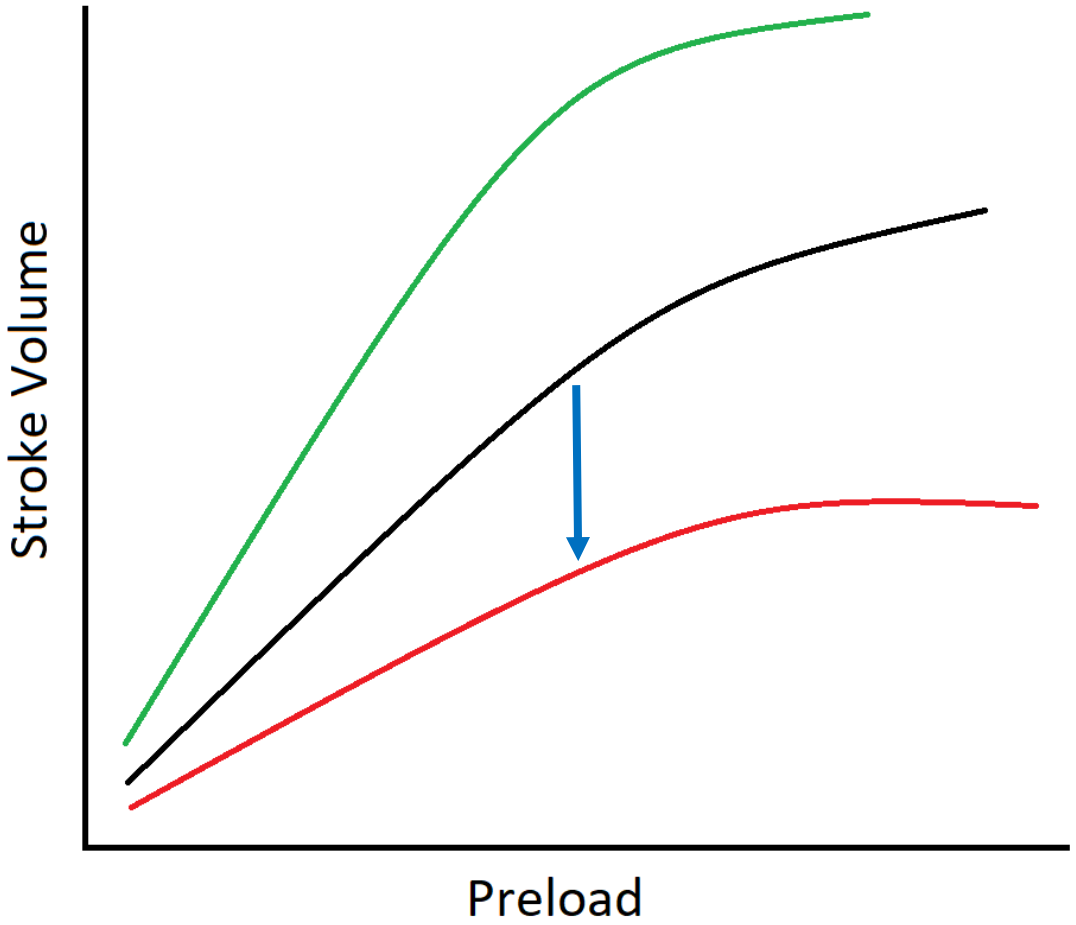
Know profiles for valvular disease

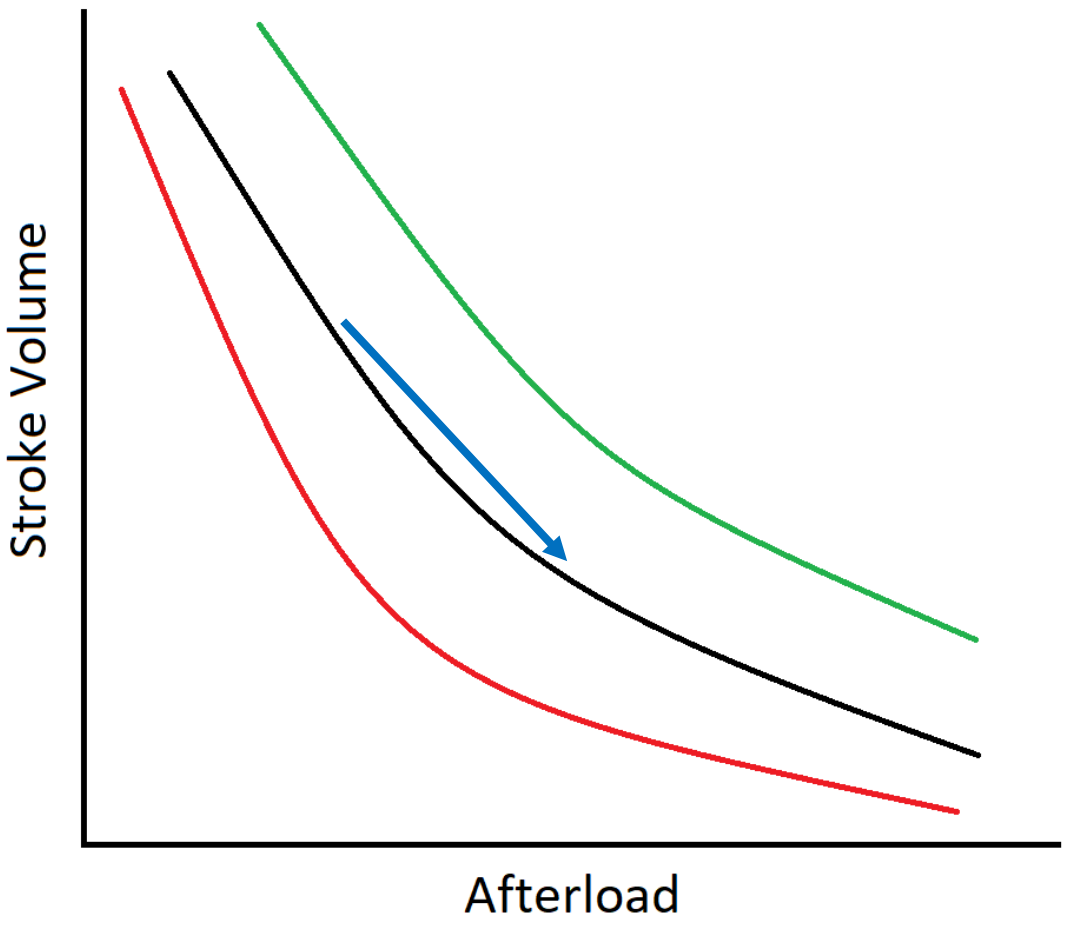
Objectives

Basics

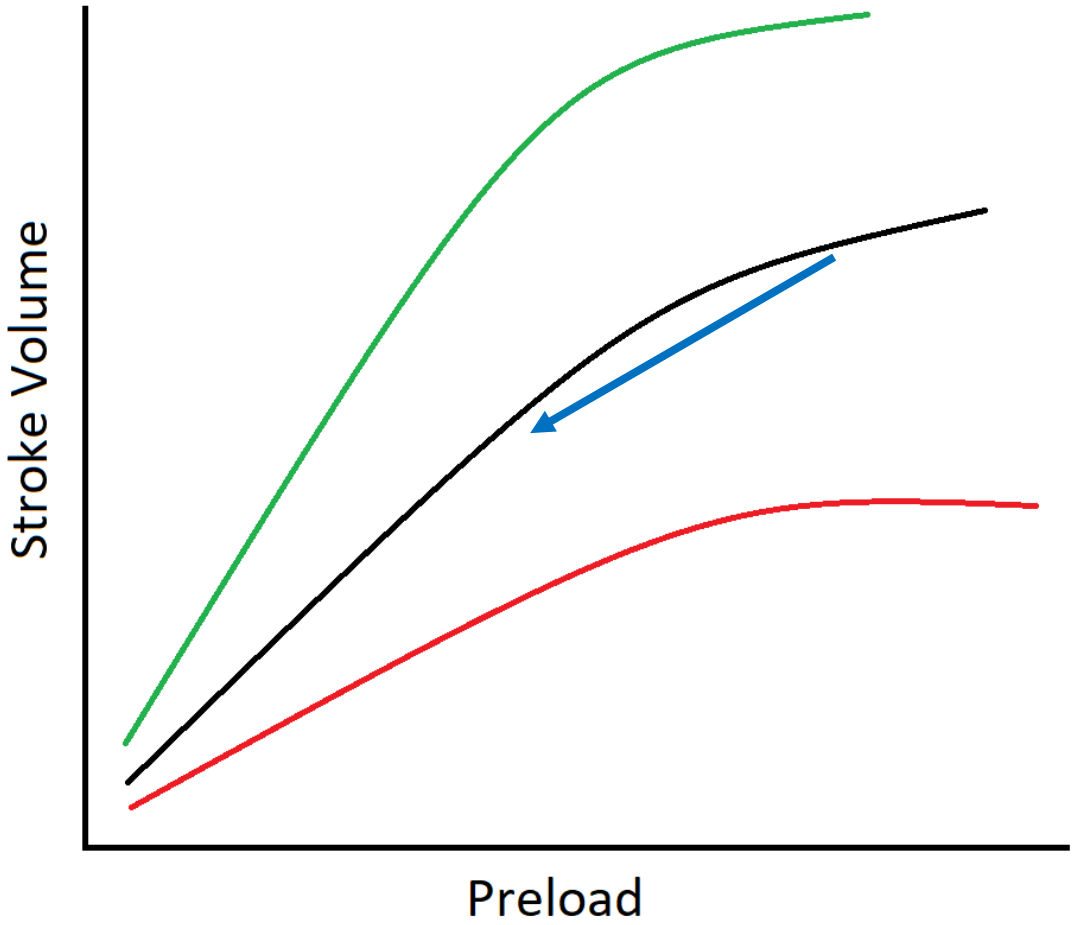
Specific disease cases

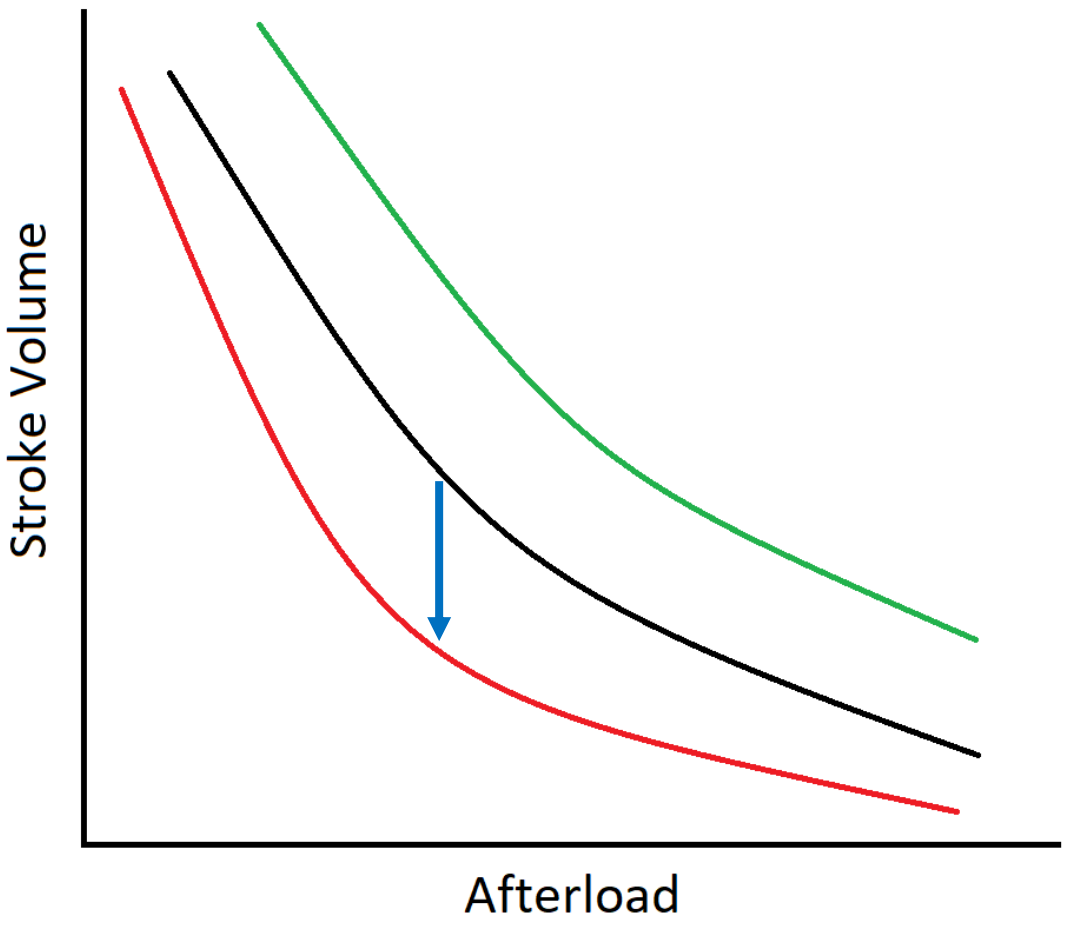
Pharmacology cases


Stroke Volume
Preload

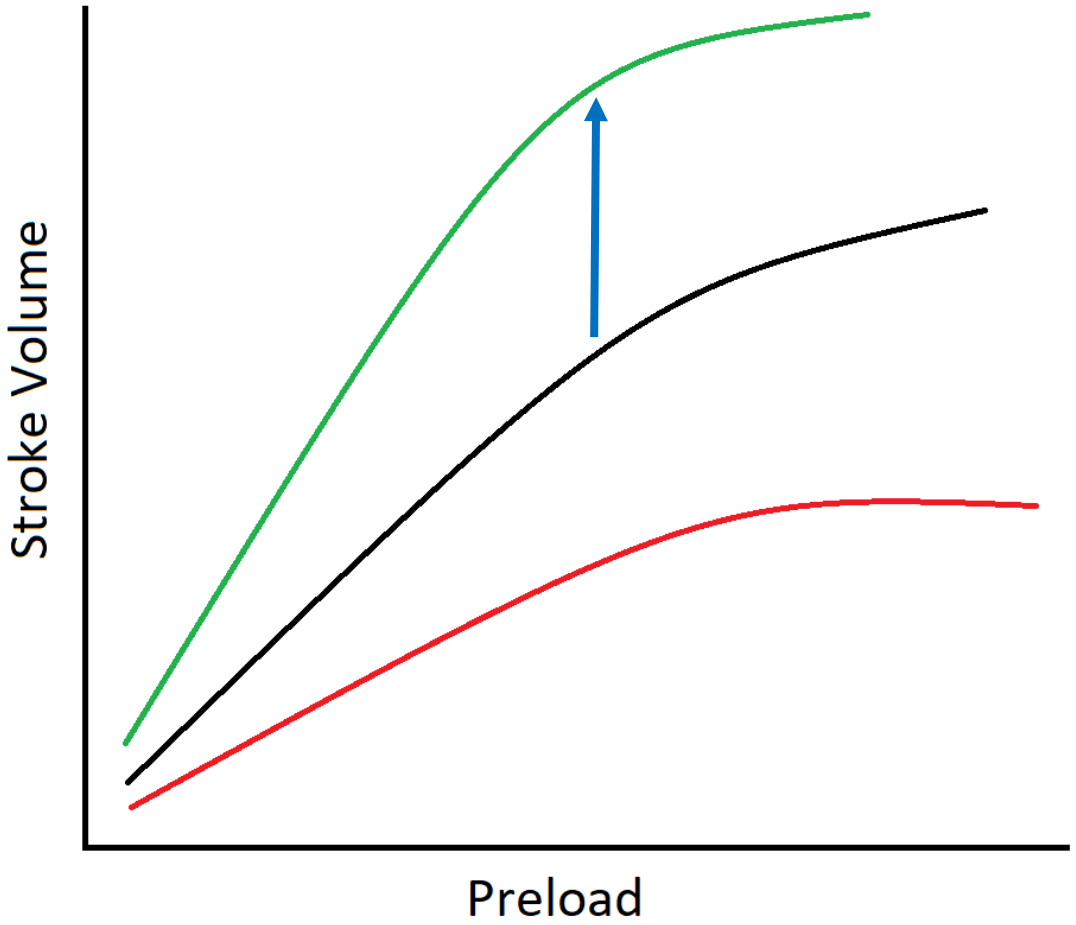

Stroke Volume
Afterload

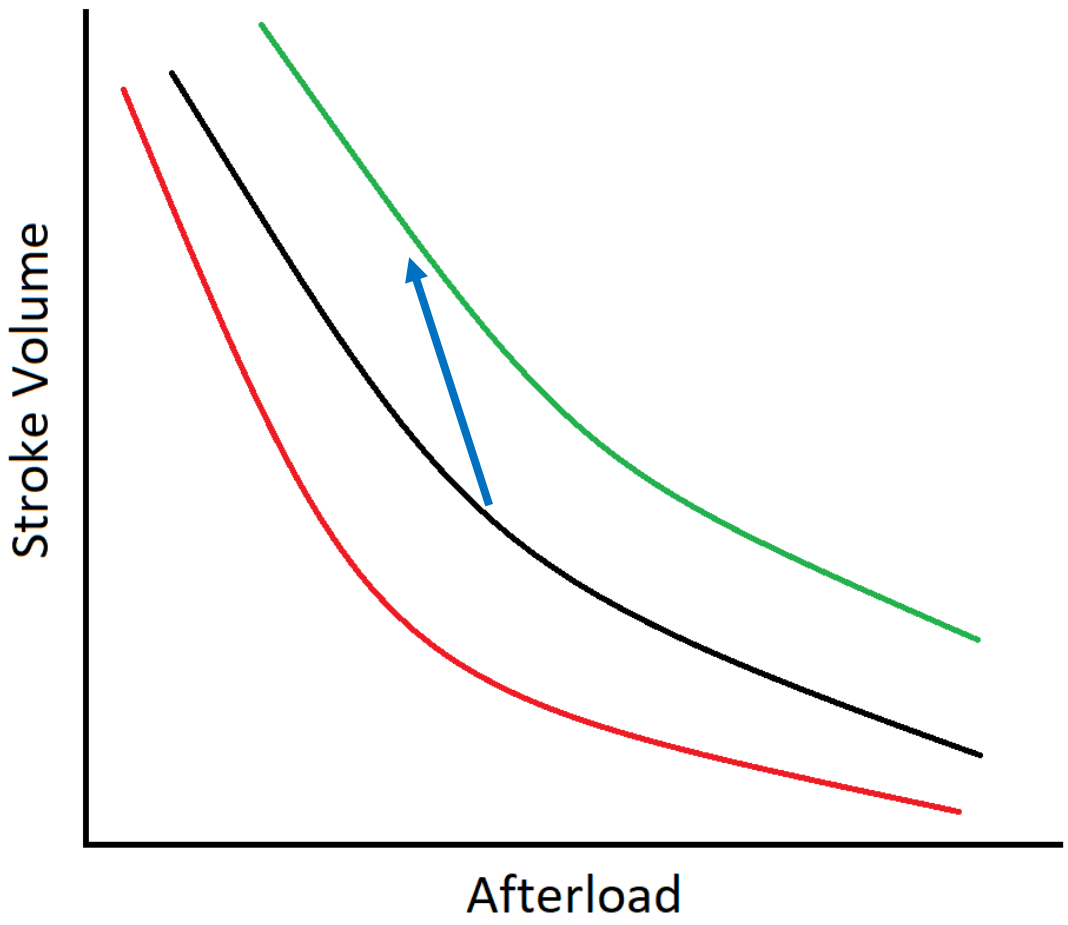
ANSWER: PHENYLEPHRINE


Stroke Volume
Preload

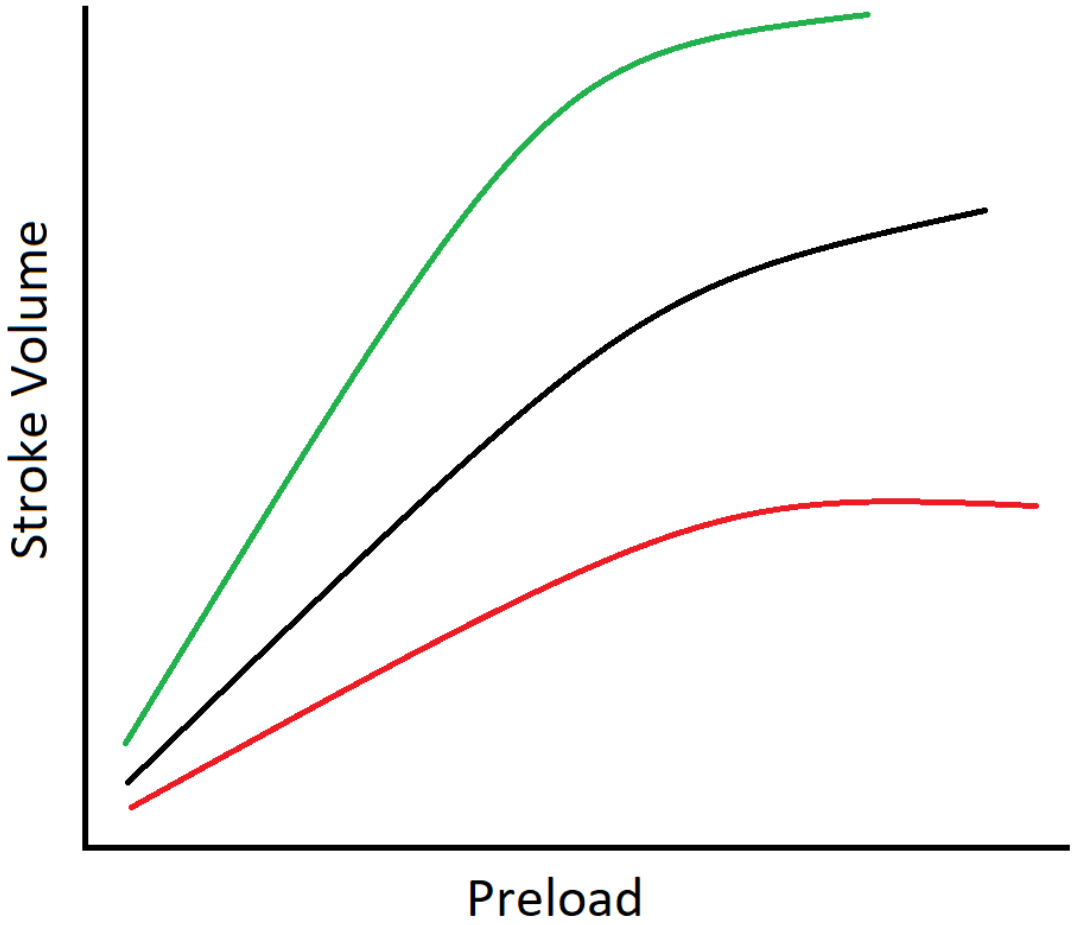

Stroke Volume
Afterload

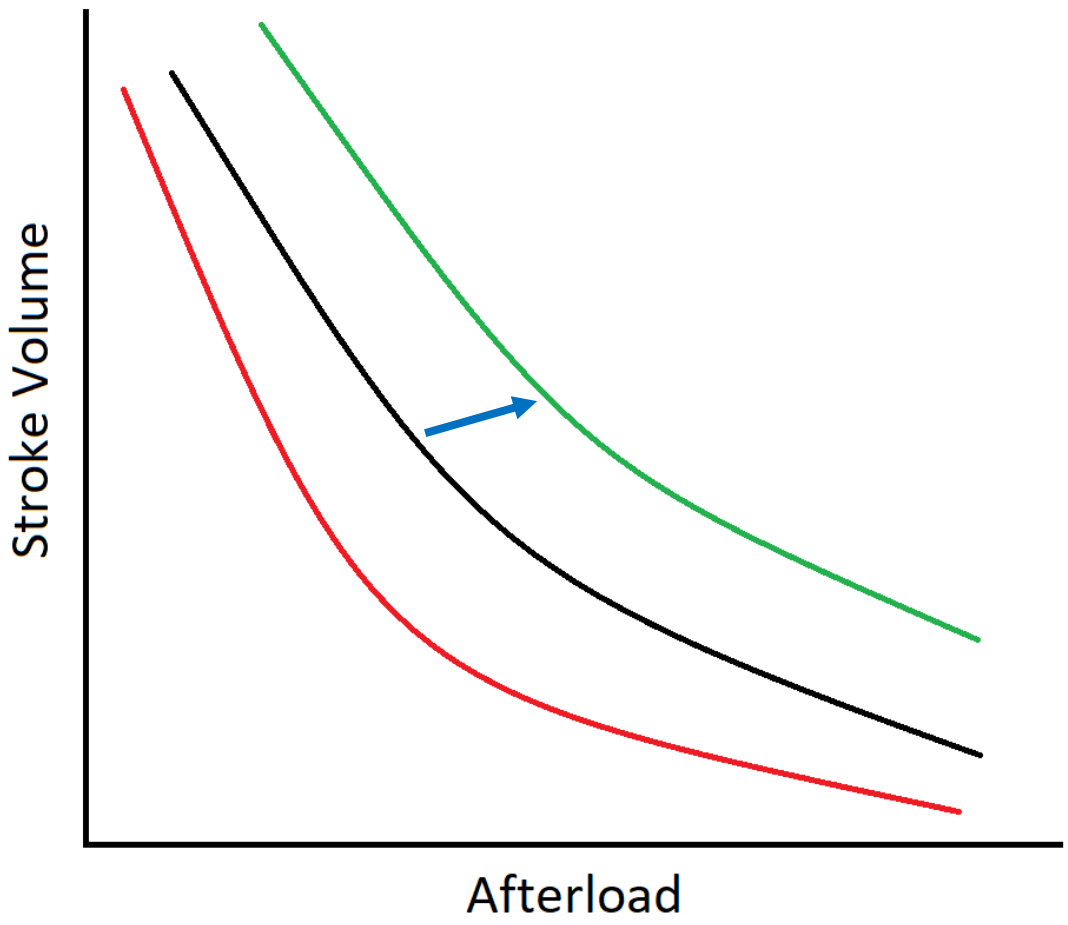
ANSWER: DIURETIC


Stroke Volume
Preload


Stroke Volume
Afterload

ANSWER: ISOPROTERENOL OR INODILATOR





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ANSWER: NOREPINEPHRINE

Key points

Know effects of adrenergic receptors

Know the receptors the drugs target

Apply to curves