

UT Alamo Interprofessional Emergency
Medicine Symposium | AIEMS 2025

**THE FORGOTTEN VENTRICLE
AVOIDING THE RV DEATH SPIRAL**

AARON ALINDOGAN, MD

DISCLOSURE

- I have no relevant financial or non-financial relationships to disclose relating to the content of this activity.**
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of Defense (DoD), nor the U.S. Government.**
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AARON ALINDOGAN, MD

THE FORGOTTEN VENTRICLE

WHEN
COMPLIANCE
IS TOO MUCH

AVOIDING THE RV DEATH SPIRAL

OBJECTIVES

DEFINITION: WHAT IS RIGHT HEART FAILURE?

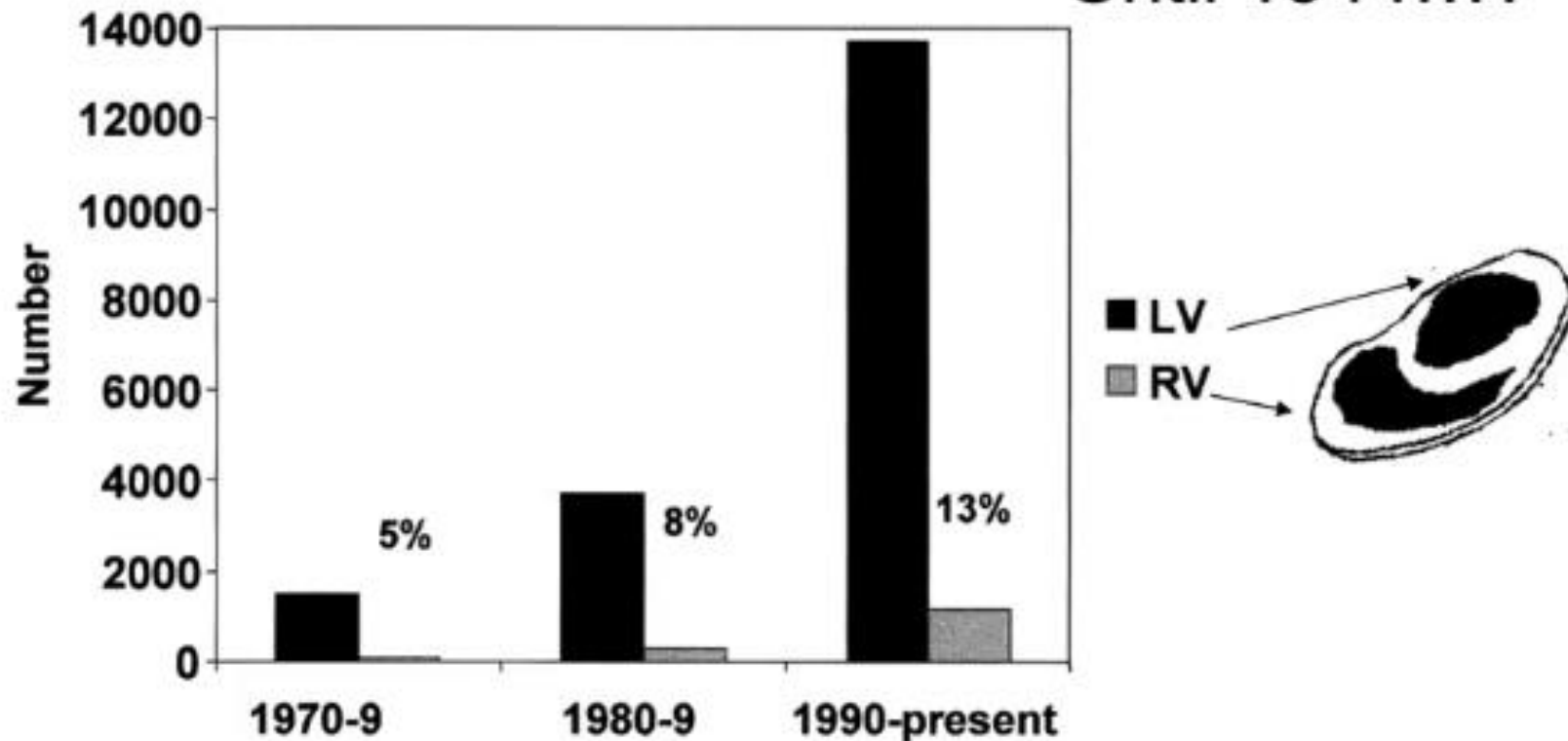
PHYSIOLOGY OF THE RV DEATH SPIRAL

INITIAL MANAGEMENT

VASOPRESSORS

“The Forgotten Ventricle”

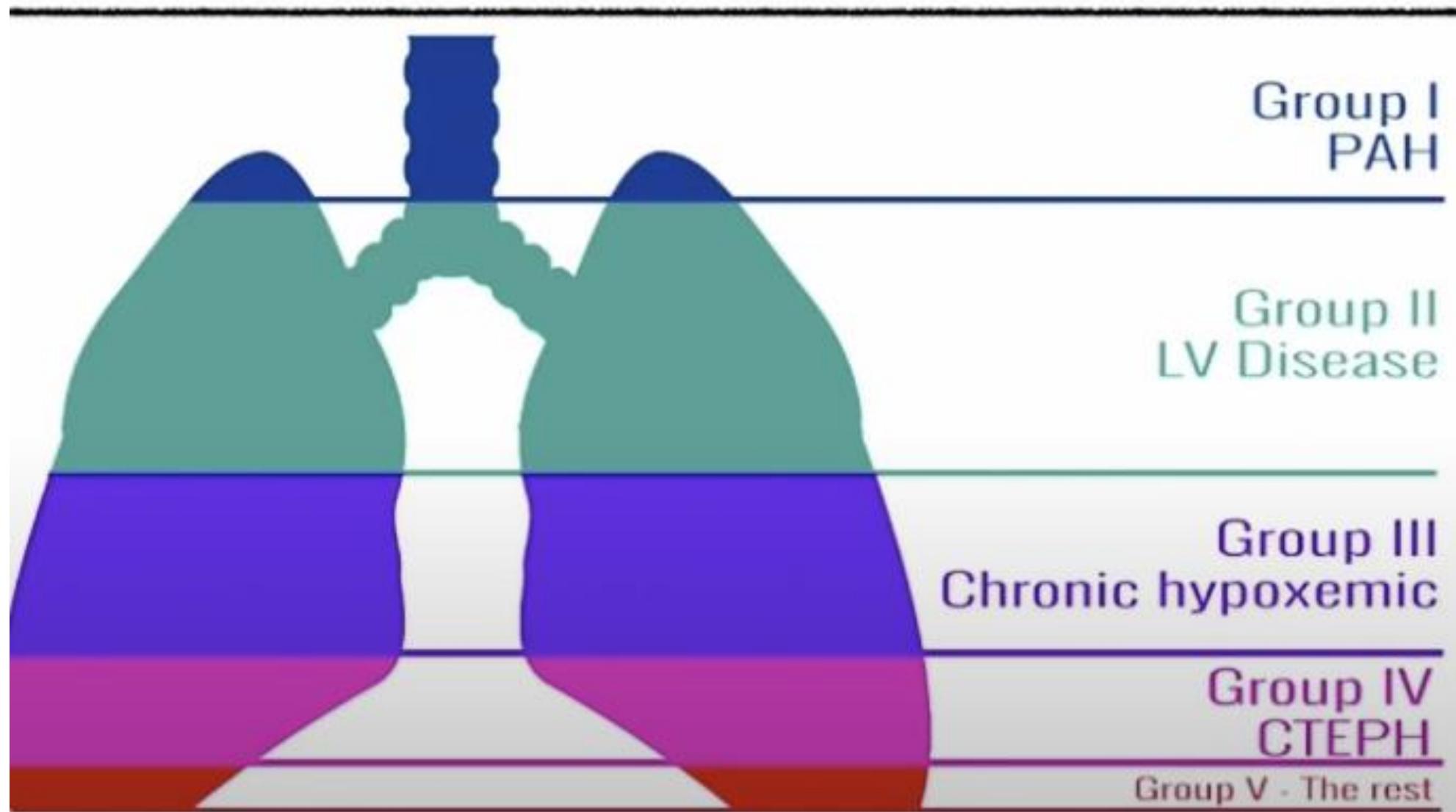
Until 1944...?



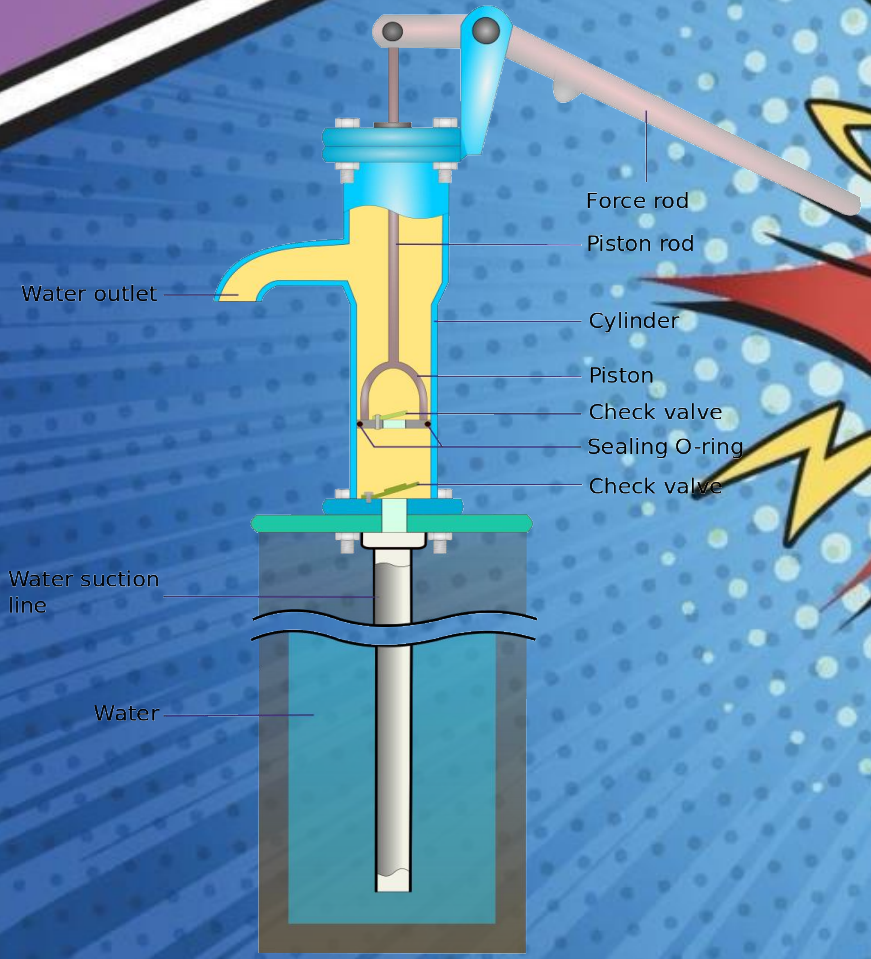
Bar chart showing frequency of publications regarding RV versus the Left Ventricle (LV) function over the last 3 decades of 1900's

Redington AN *Cardiol Clin* (2002) 20: 341-9.

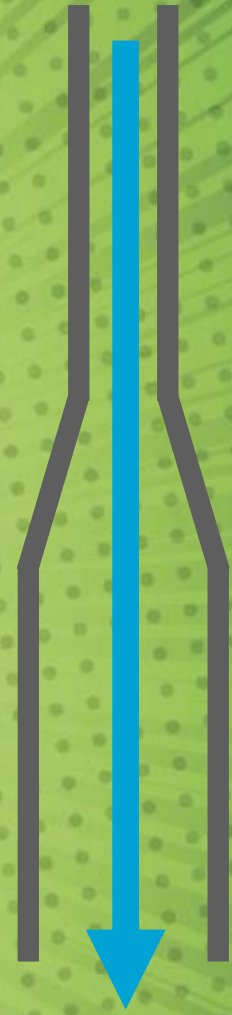
CLASSIC DESCRIPTION OF PH



PUMP



V S



CONDUIT

RIGHT VENTRICLE

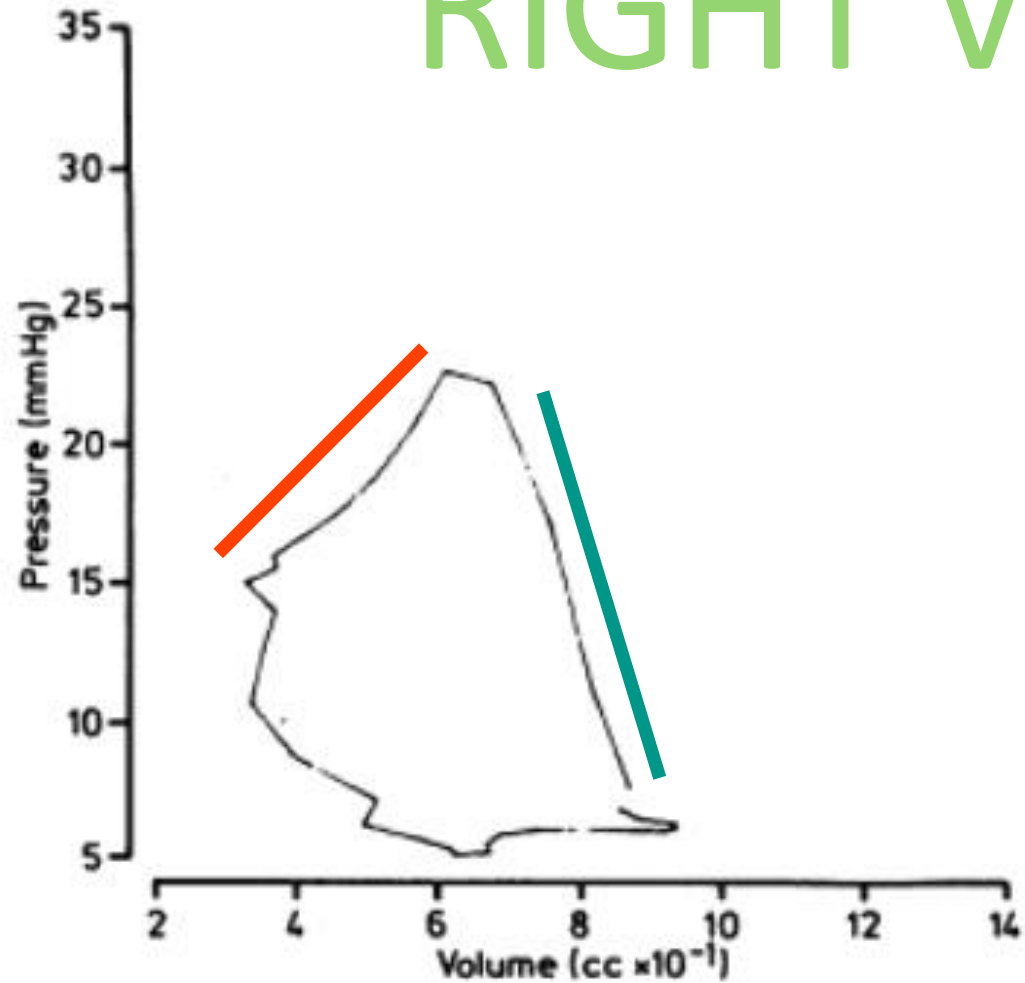


Fig 5 *Normal right ventricular pressure-volume loop. In this example there is a better defined limb of isovolumic relaxation. Maximum work 944.8 mm Hg × ml and efficiency 62%.*

SPECTRUM

DECREASED RV CONTRACTILITY

RV VOLUME OVERLOAD

RV PRESSURE OVERLOAD

SPECTRUM

DECREASED RV CONTRACTILITY

RV VOLUME OVERLOAD

RV PRESSURE OVERLOAD

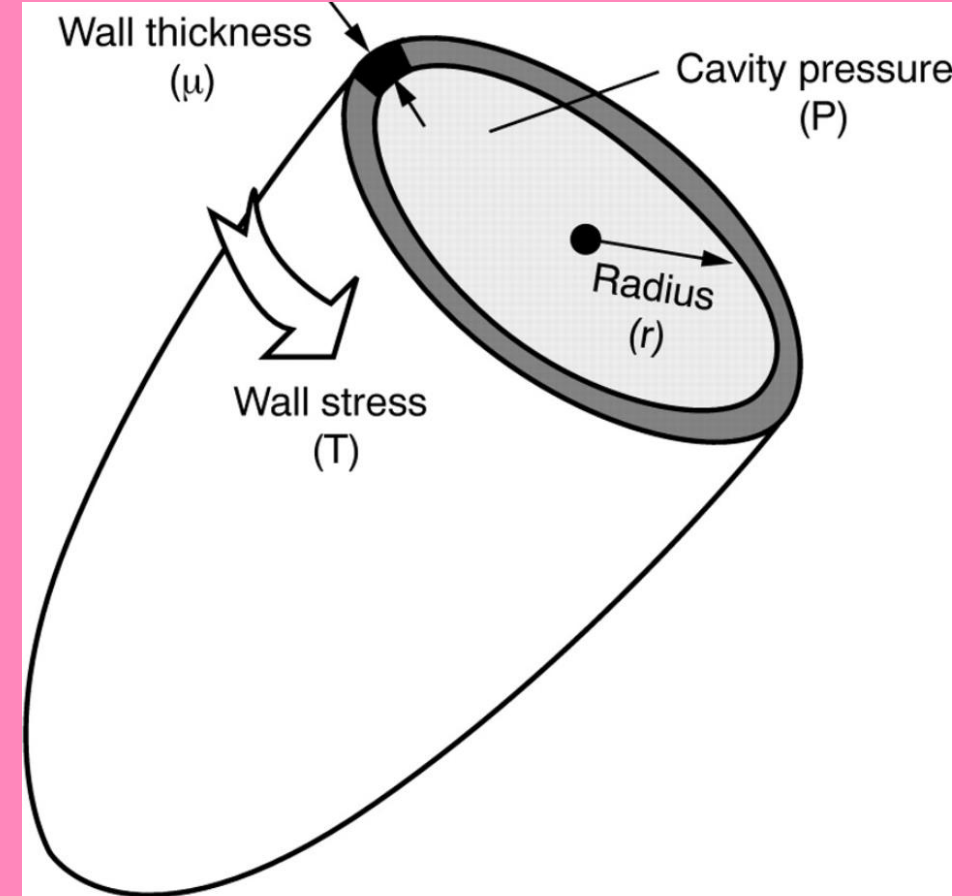
WALL STRESS

THIN WALLS

AFTERLOAD SENSITIVE

WORSE AT HANDLING

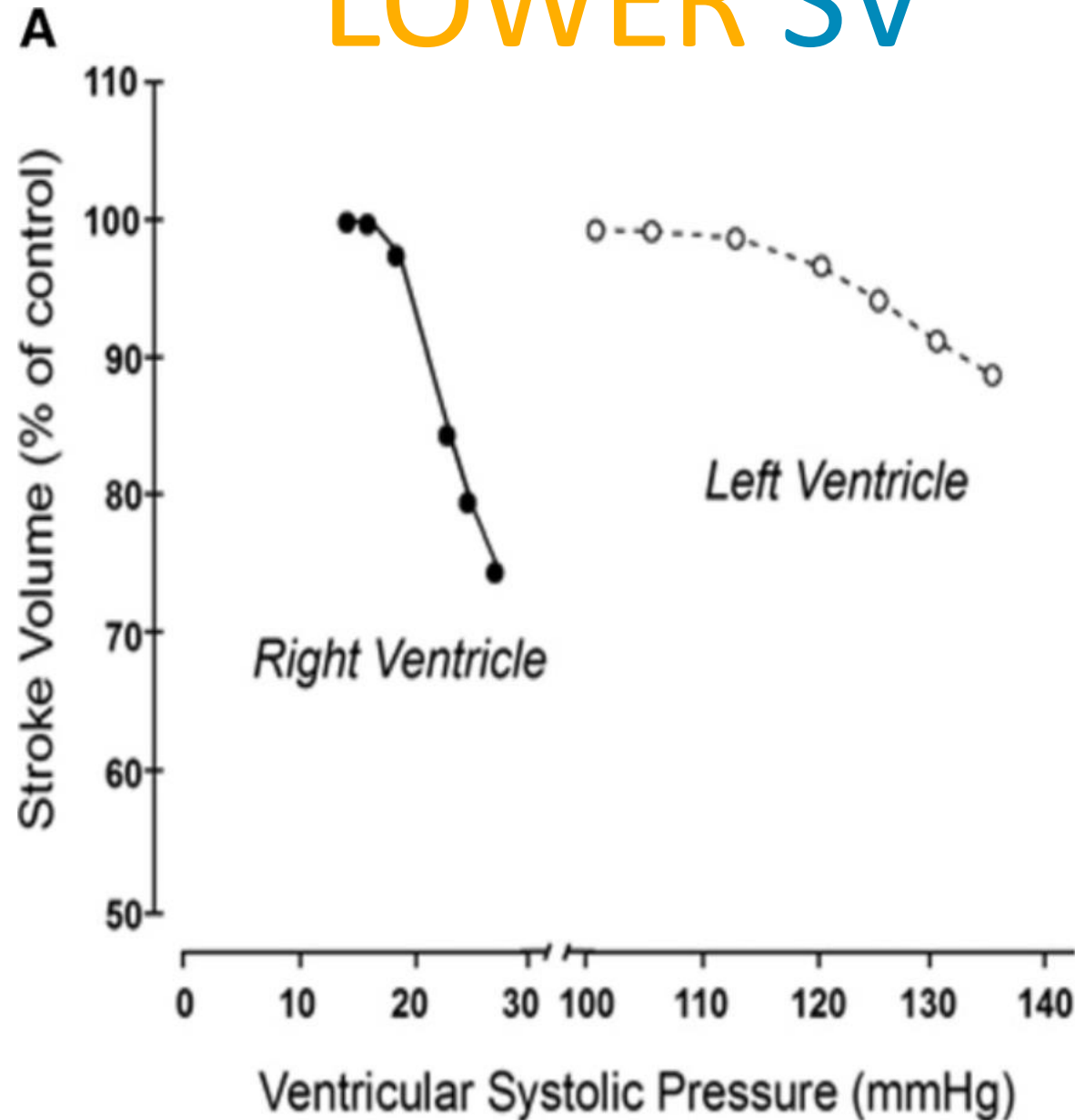
**PRESSURE
OVERLOAD** THAN
VOLUME OVERLOAD



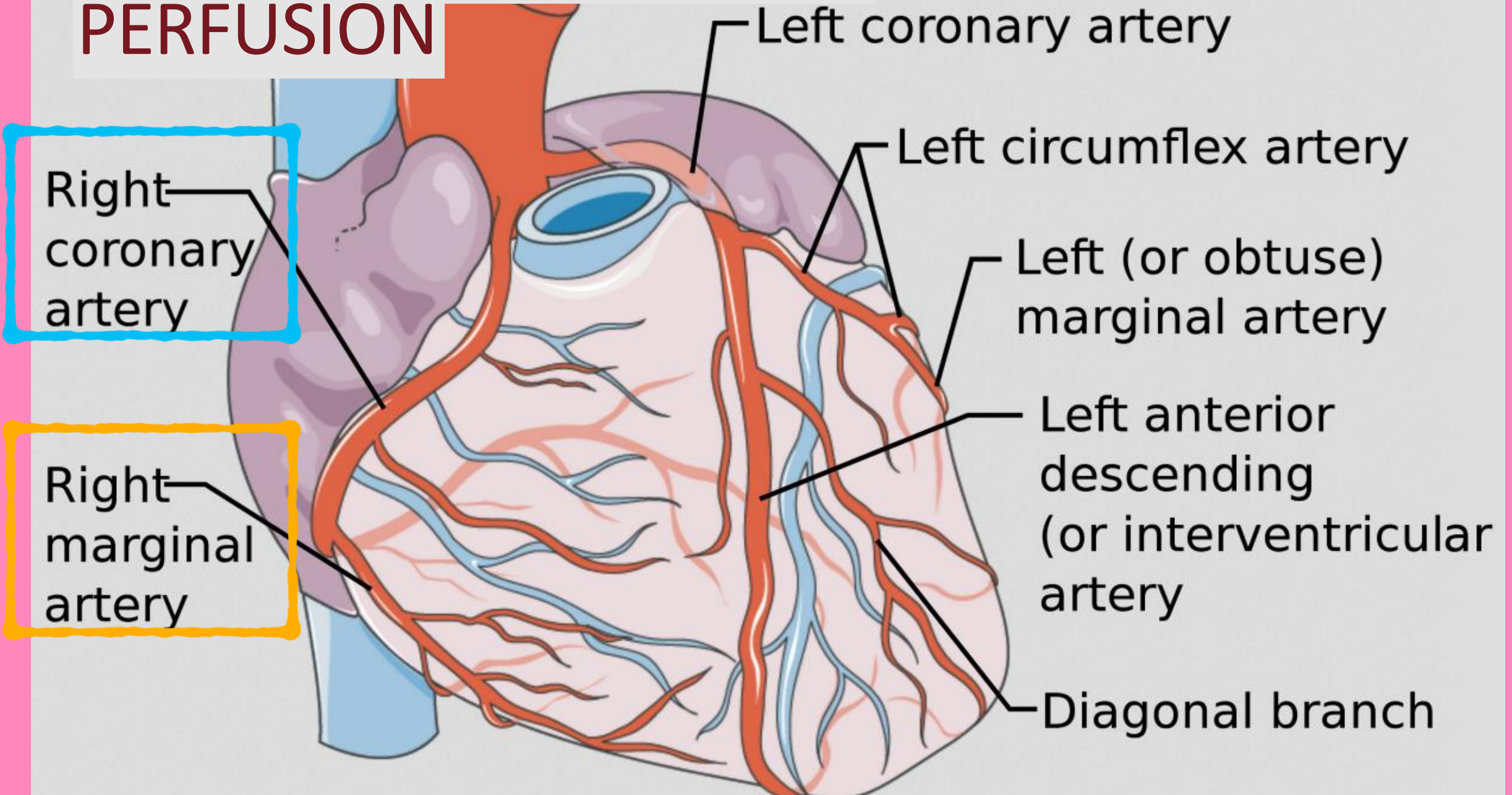
The law of Laplace:

$$\text{Wall stress (T)} = \frac{[\text{cavity pressure (P)}] \times [\text{radius (r)}]}{2 \times [\text{wall thickness (u)}]}$$

INCREASES IN PRESSURE CAUSE MUCH LOWER SV



DIASTOLIC AND SYSTOLIC PERFUSION



LEFT VENTRICLE

HIGH ELASTANCE

RIGHT VENTRICLE

LOW ELASTANCE

LEFT VENTRICLE

HIGH ELASTANCE

SVR 1100

RIGHT VENTRICLE

LOW ELASTANCE

PVR 70

LEFT VENTRICLE

HIGH ELASTANCE

SVR 1100

LOW COMPLIANCE

RIGHT VENTRICLE

LOW ELASTANCE

PVR 70

HIGH COMPLIANCE

LEFT VENTRICLE

HIGH ELASTANCE

SVR 1100

LOW COMPLIANCE

LOW RESISTANCE TO
ISCHEMIA

RIGHT VENTRICLE

LOW ELASTANCE

PVR 70

HIGH COMPLIANCE

HIGH RESISTANCE TO
ISCHEMIA

LEFT VENTRICLE

HIGH ELASTANCE

SVR 1100

LOW COMPLIANCE

LOW RESISTANCE TO
ISCHEMIA

**BETTER WITH
PRESSURE OVERLOAD**

RIGHT VENTRICLE

LOW ELASTANCE

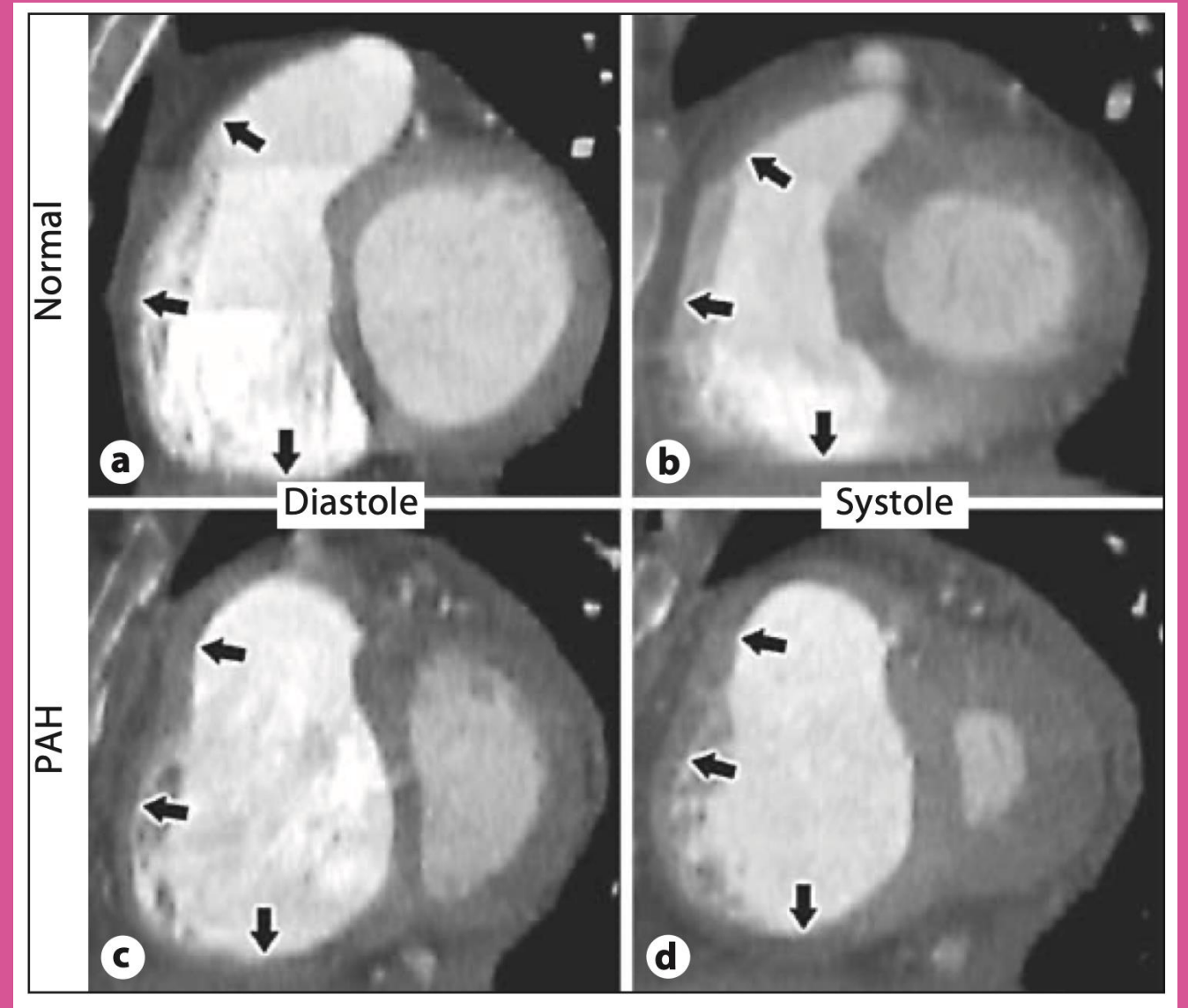
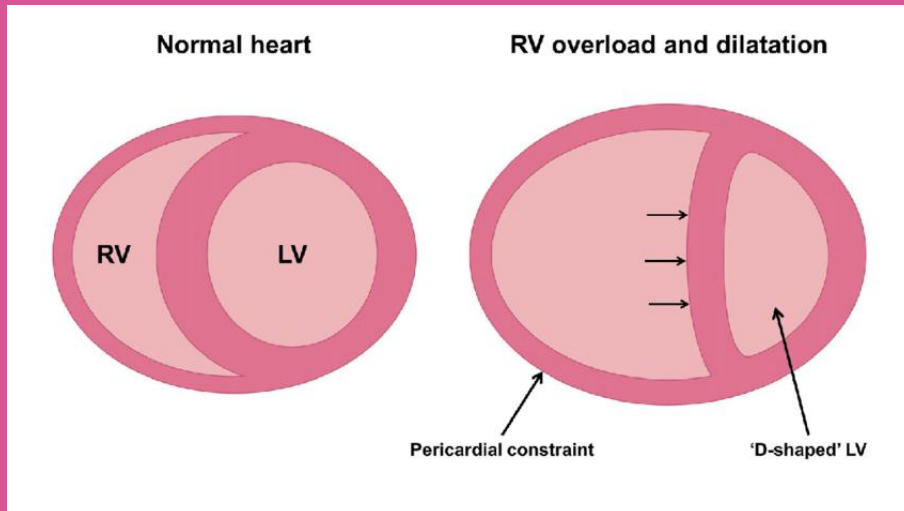
PVR 70

HIGH COMPLIANCE

HIGH RESISTANCE TO
ISCHEMIA

**BETTER WITH VOLUME
OVERLOAD**

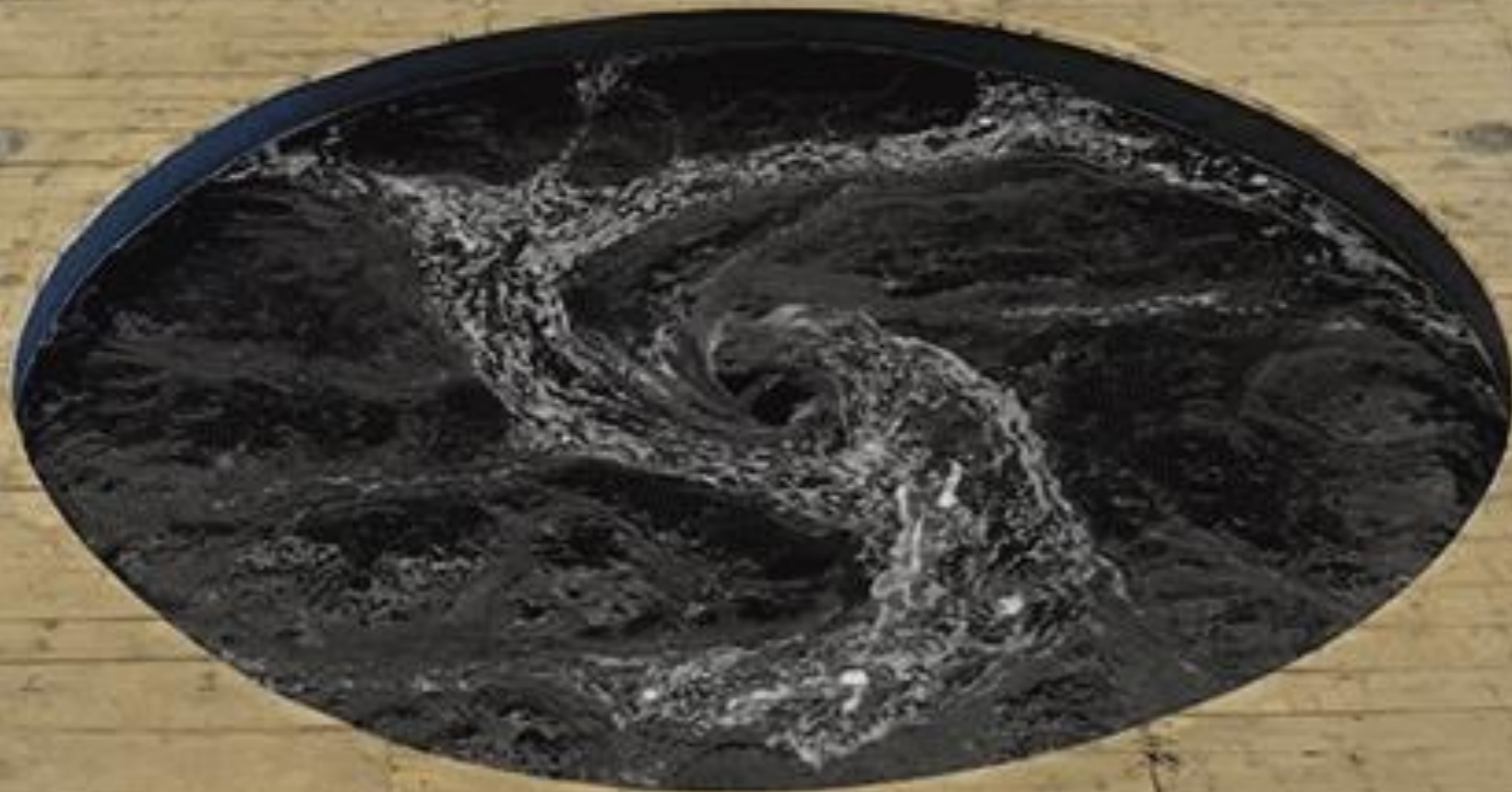
VENTRICULAR INTERDEPENDENCE






CAN'T HANDLE THE PRESSURE

VICIOUS CYCLE





RV ISCHEMIA
RV OVERLOAD ↓ LV OUTPUT
↑ RV ISCHEMIA
↓ RV OUTPUT SEPTAL BOWING
RV OVERLOAD



↓ LV OUTPUT
RV ISCHEMIA SEPTAL BOWING
↓ RV OUTPUT
RV OVERLOAD RV OVERLOAD
↑ RV PRESSURE

SEPTAL BOWING

↓ LV OUTPUT RV OVERLOAD

RV OVERLOAD


RV ISCHEMIA

↑ RV PRESSURE

↑ RV ISCHEMIA

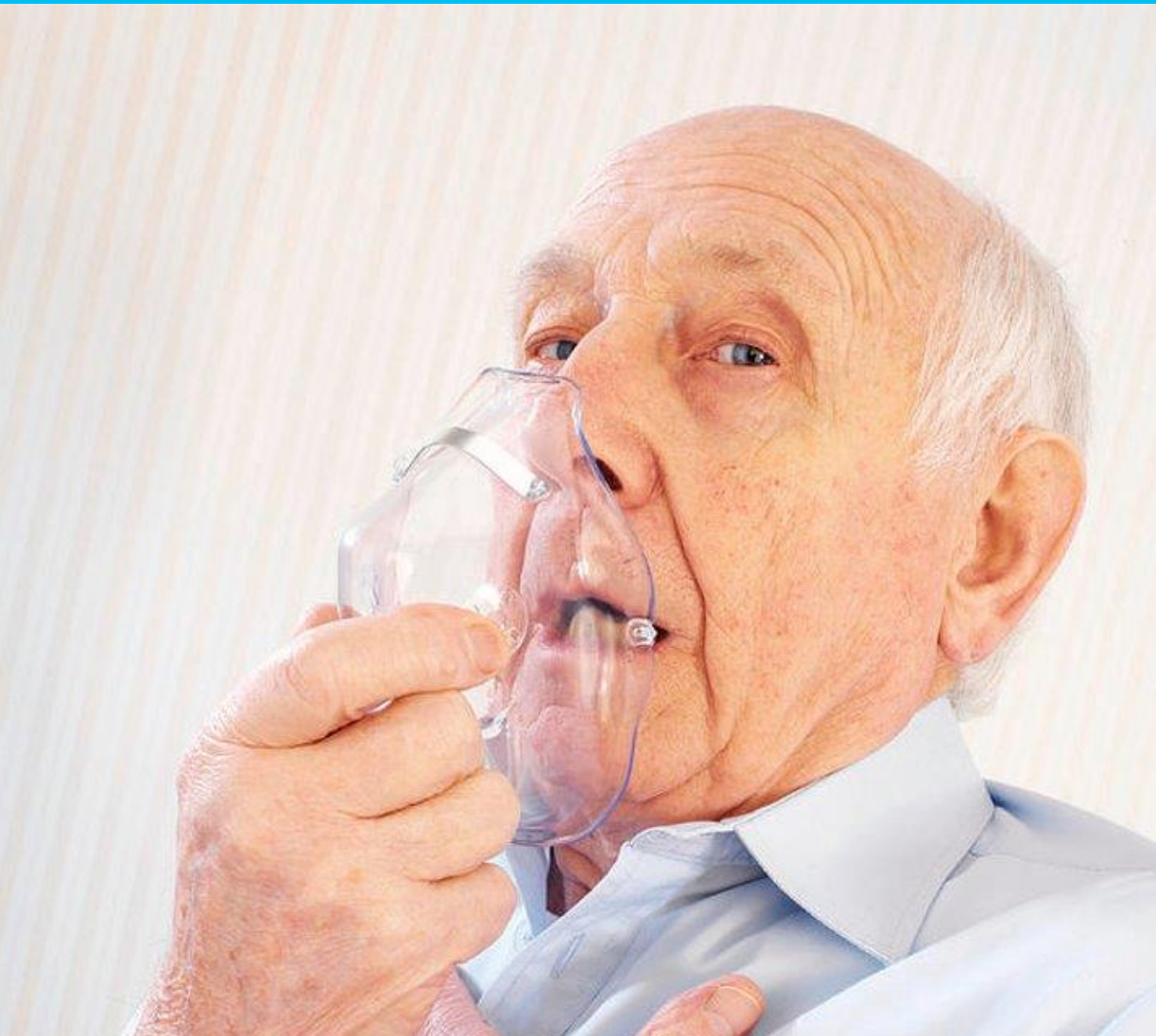
RV OVERLOAD
SEPTAL BOWING ↑ RV PRESSURE
RV ISCHEMIA
↓ LV OUTPUT ↑ RV ISCHEMIA
↓ RV OUTPUT

The image shows a cross-sectional ultrasound of a heart. The right ventricle (RV) is significantly enlarged and compressed against the interventricular septum, which is bowed towards the left ventricle (LV). This mechanical compression leads to RV ischemia and reduced output. The text overlays describe this pathophysiological process: RV overload causes septal bowing, which increases RV pressure and leads to RV ischemia. This ischemia further reduces LV output, which in turn exacerbates RV ischemia, ultimately resulting in decreased RV output.



64F HX CA, COPD,
HTN
SOB
TACHY. HYPOXIC.
COLD EXT.
ALTERED.

SIGNS AND SYMPTOMS



SIGNS AND SYMPTOMS



PHYSICAL EXAM

JVD

SHOCK

HSM

SYNCOPE

ANASARCA

AMS

RV HEAVE

OLIGURIA

SEASON PREMIERE

how
to
get
away
with

Murder

THURSDAY SEPT 22 10/9c

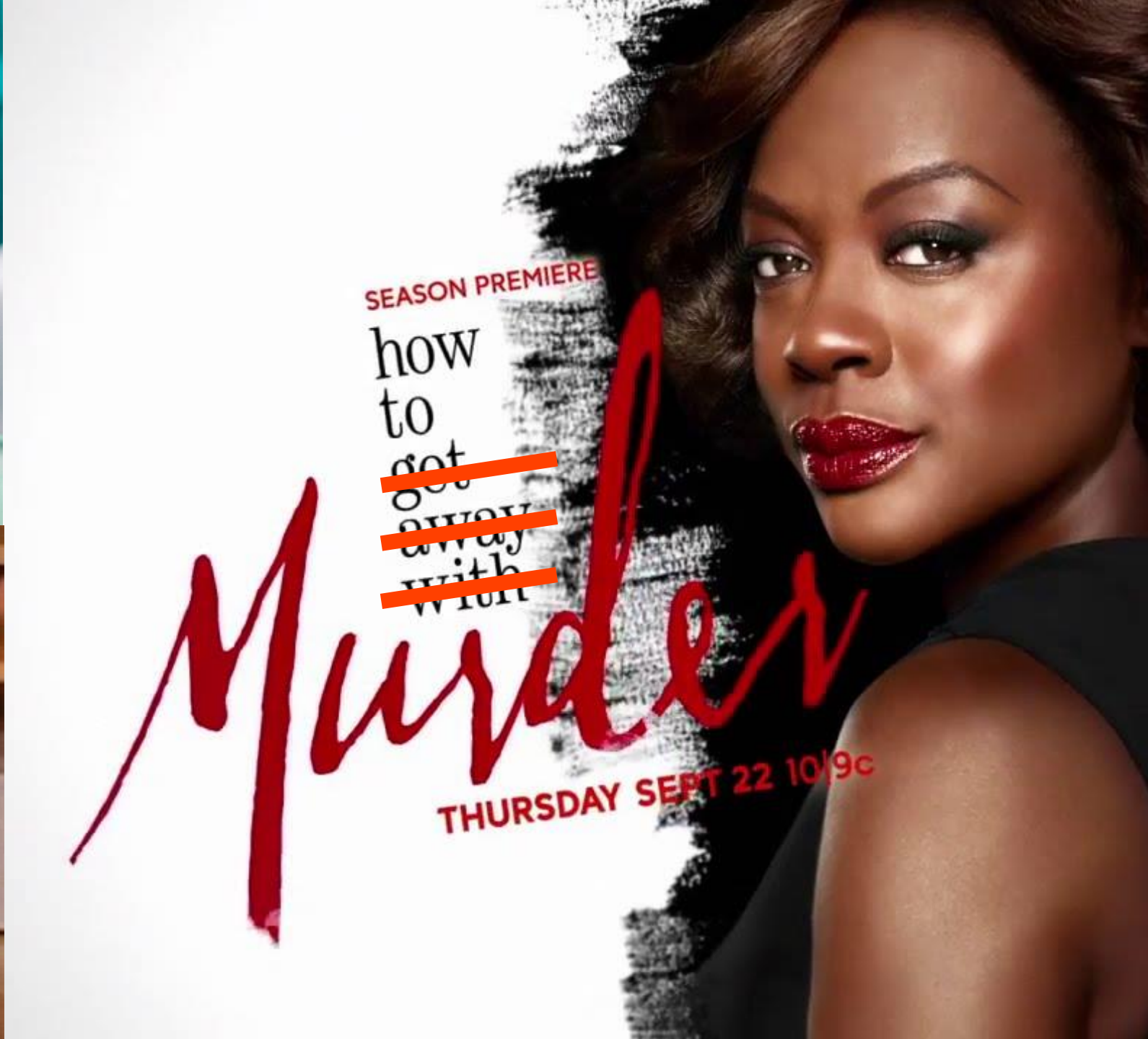




**YOU GET A SEPSIS WORKUP
AND YOU GET A SEPSIS WORKUP**



**EVERYONE GETS
A SEPSIS WORKUP**



SEASON PREMIERE

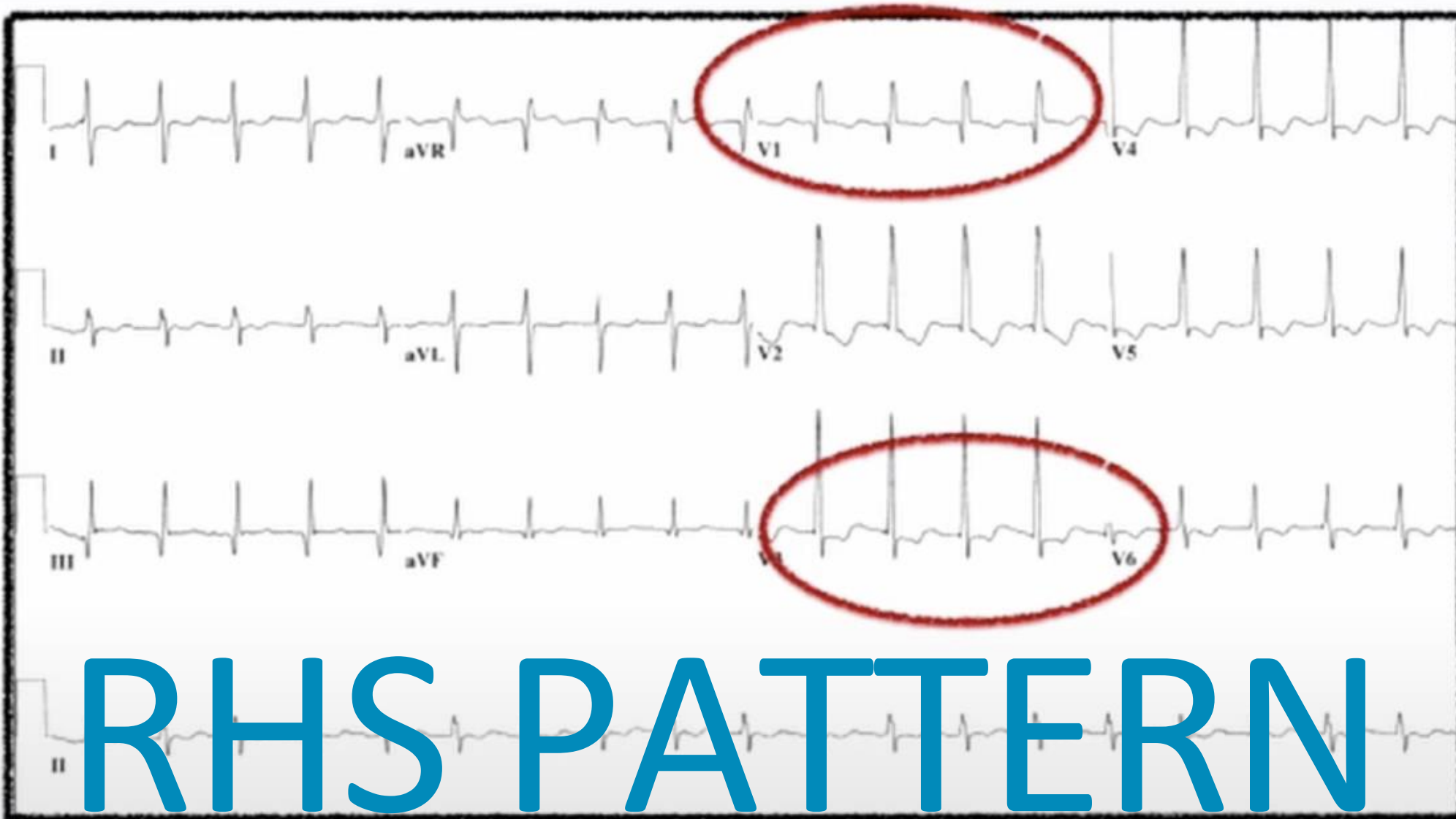
how
to
get
away
with

Murder

THURSDAY SEPT 22 10/9c



WHICH HEART AM I TREATING?



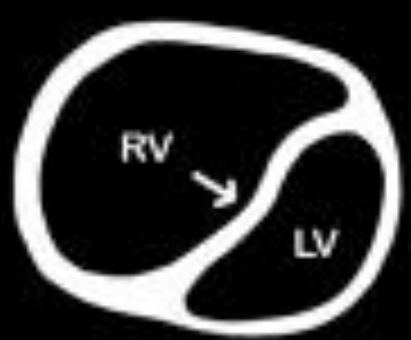
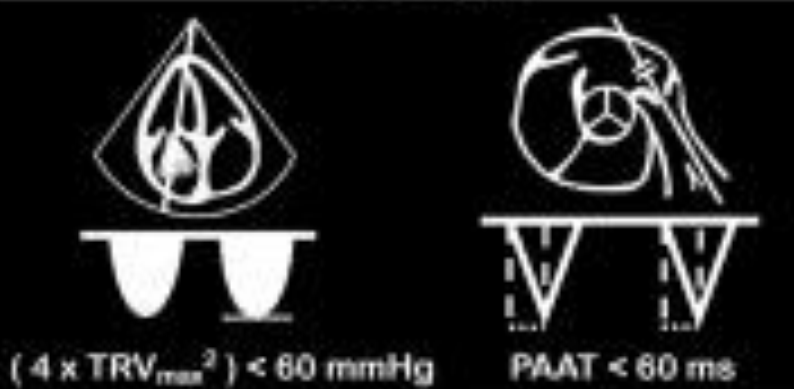
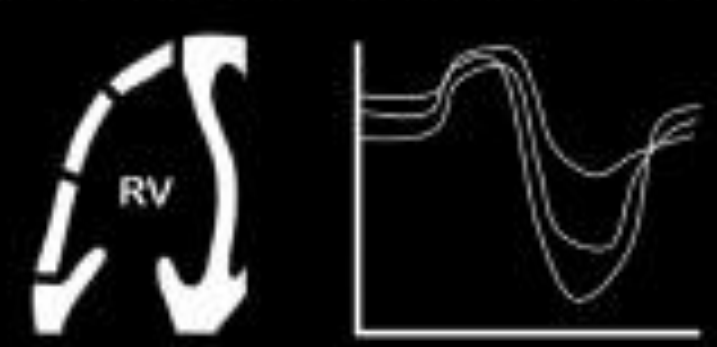
V1: Dominant R wave

V1: R/S > 1

S1/Q3/T3

Incomplete RBBB

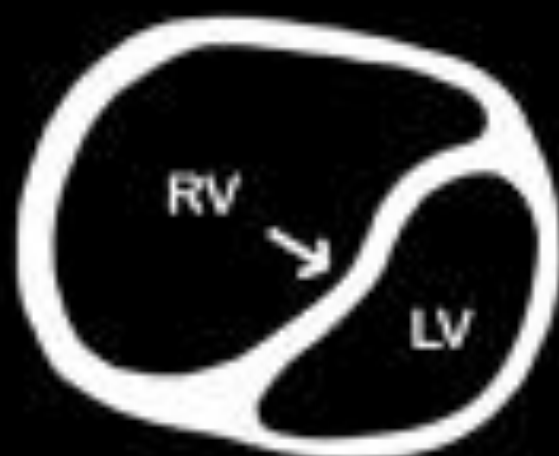


Increased RV:LV Size Ratio**Abnormal Septal Motion****McConnell's Sign****Tricuspid Regurgitation****Elevated Pulmonary Artery Systolic Pressure****Decreased TAPSE****Decreased S'****Pulmonary Artery Mid-Systolic Notching****60/60 Sign****Speckle Tracking: Decreased Free Wall Strain**

Increased RV:LV Size Ratio



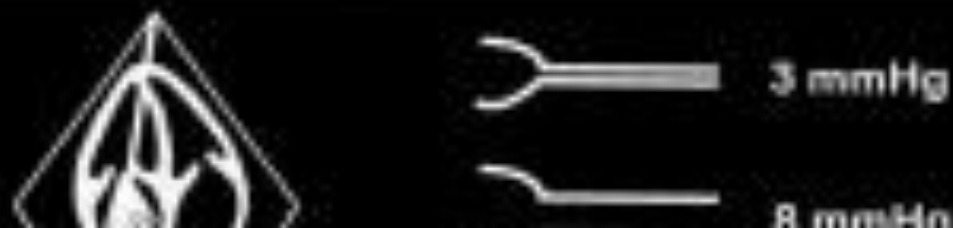
Abnormal Septal Motion



McConnell's Sign



Elevated Pulmonary Artery Systolic Pressure



Decreased TAPSE



Increased RV:LV Size Ratio



Abnormal Septal



Elevated Pulmonary Artery Systolic Pressure



3 mmHg





P

x

x

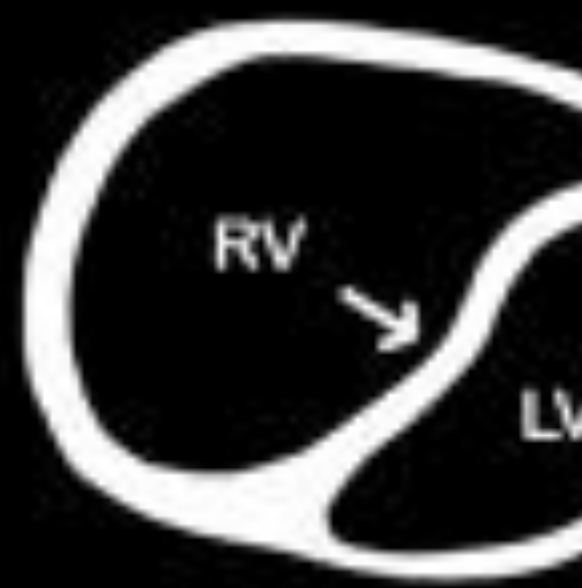
G
P R
1.6 3.2



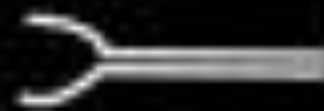
Increased RV:LV Size Ratio



Abnormal Septal



Elevated Pulmonary Artery Systolic Pressure



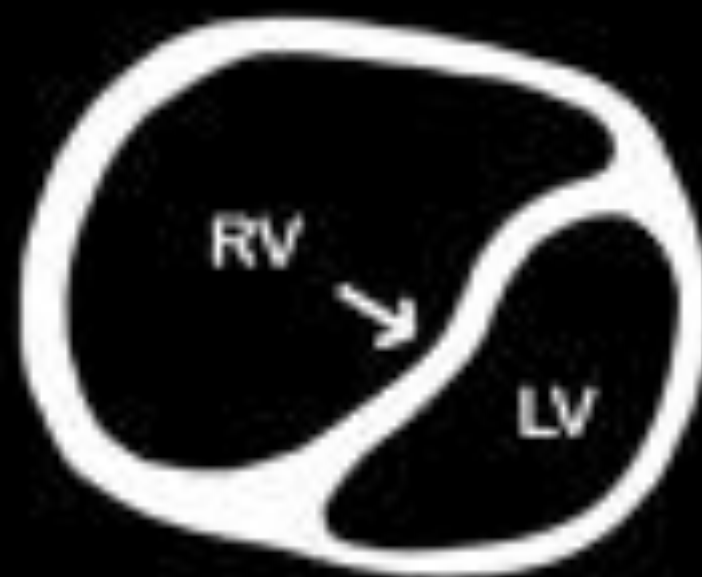
3 mmHg



Increased RV:LV Size Ratio



Abnormal Septal Motion



McConnell's Sign



Pulmonary Artery Systolic Pressure



Decreased TAPSE



148626209

UTHSCSA EMERGENCY MED

02/08/18 9:00:20 AM
R47 Card/Gen

Z



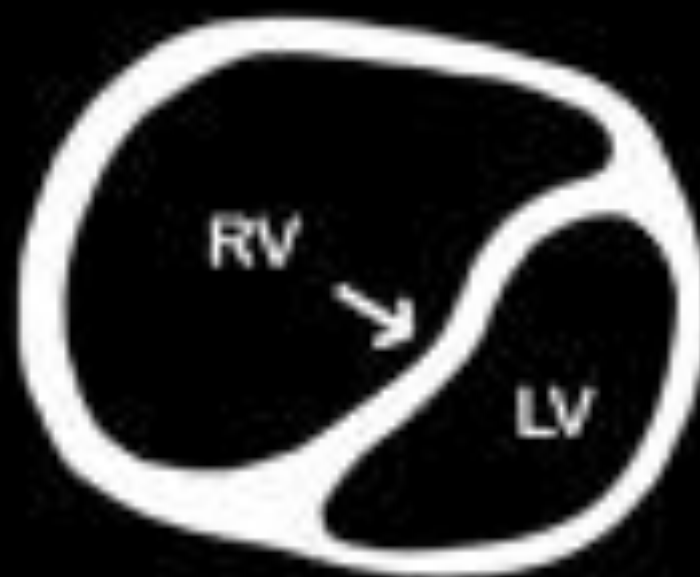
P4-1c/8.3
DR65/M3/P1
G80/E1/100%
MI1.5 TIs0.5
16.0 cm
53/50 Hz
ZSI 0
Image

-5
-10
-15
cm

Increased RV:LV Size Ratio



Abnormal Septal Motion



McConnell



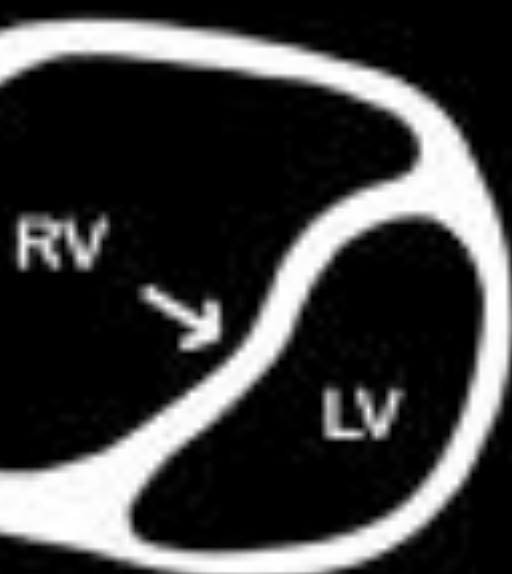
Pulmonary Artery Systolic Pressure



Decreased TAPSE



Normal Septal Motion



McConnell's Sign



Tricuspid Regurgitation



Decreased TAPSE

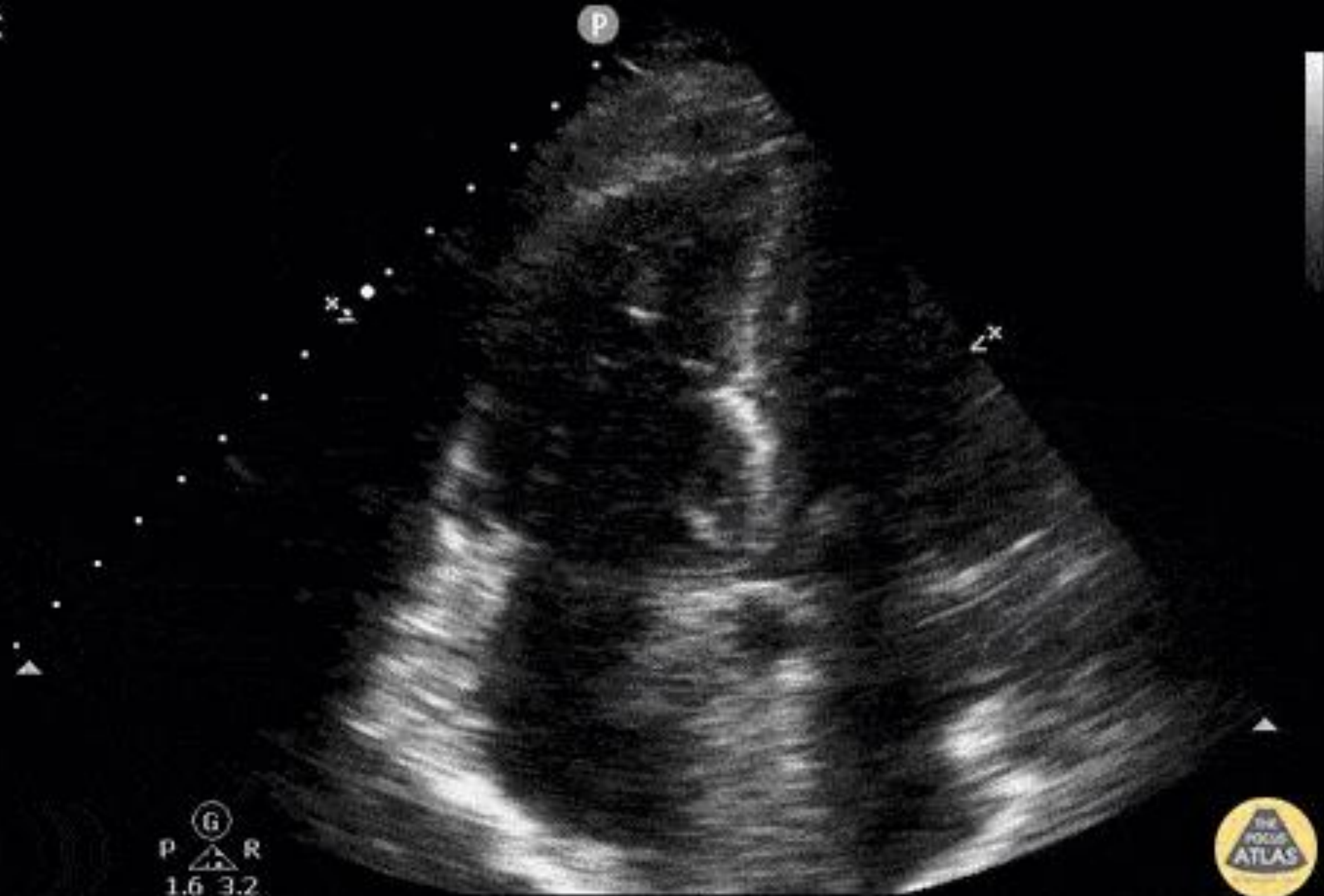


Decreased S'



ECHO KCHC
S4-2
33 Hz
16.0cm

2D
HGen
Gn 50
43
3/2/0



MANAGEMENT

The image features three blue-skinned mannequins standing in a dark, industrial-looking environment. They are dressed in black, long-sleeved turtleneck tops. The mannequin on the left is looking slightly to the right. The middle mannequin is looking forward. The mannequin on the right is looking slightly to the left. In the background, there is a rack of various white and grey pipes and fittings, some with spherical components. The lighting is dramatic, highlighting the blue skin of the mannequins against the dark background. The word "OXYGENATION" is overlaid in large, white, sans-serif capital letters across the center of the image.

OXYGENATION

A man in a red basketball jersey with the number 35 is shown in a hallway. He has a thoughtful expression, with his hand near his chin. The background is a blurred office or hallway setting with a potted plant and other people in the distance.

NO HYPOXIA

#NotInMyHouse

AVOID INTUBATION

AVOID INTUBATION

BIPAP OR HFNC
INSTEAD



OPTIMIZE VOLUME STATUS



DIURESIS

VASOPRESSORS

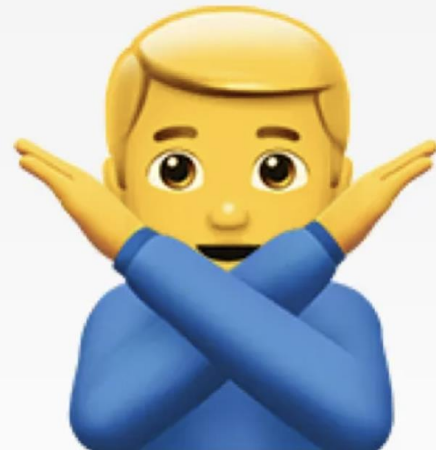
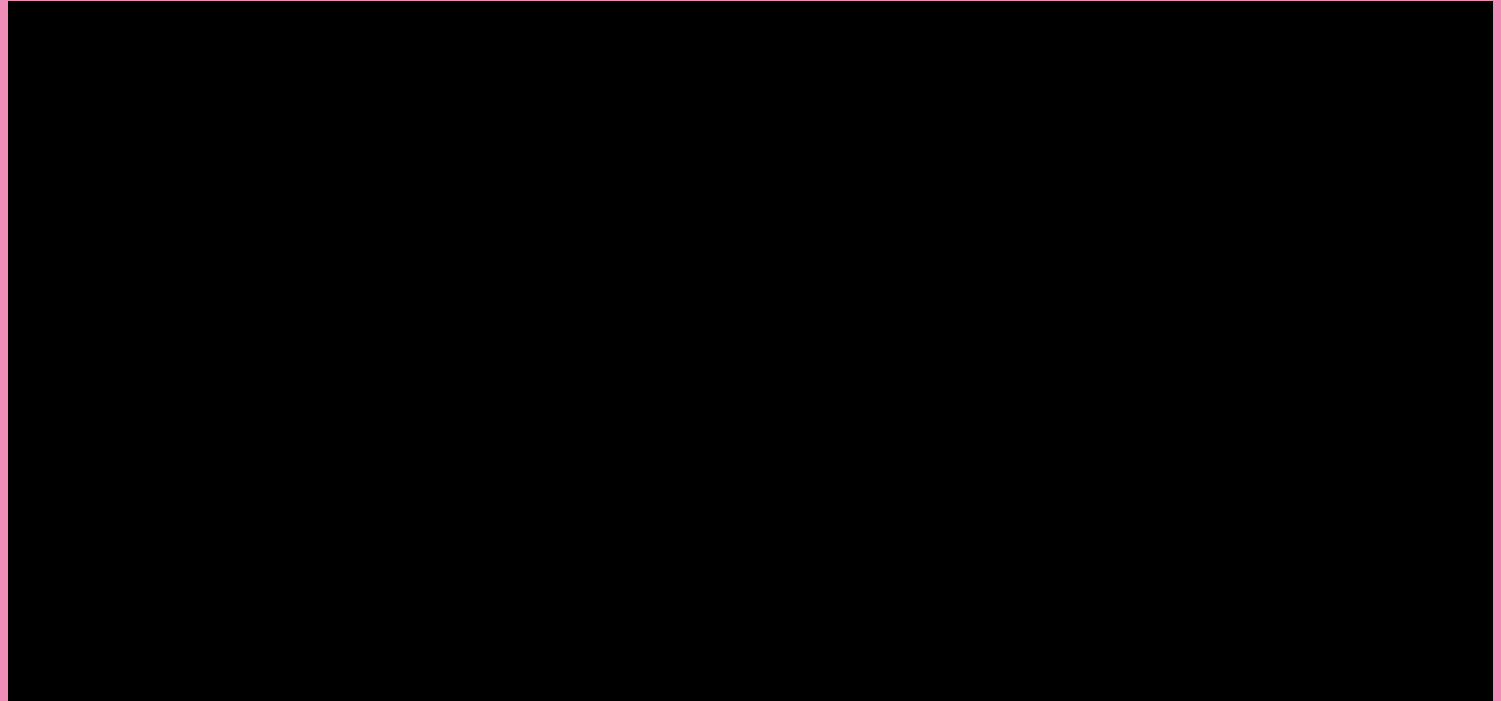


PHENYLEPHRINE

Pure α

Increases PVR

**Increases RV
afterload**



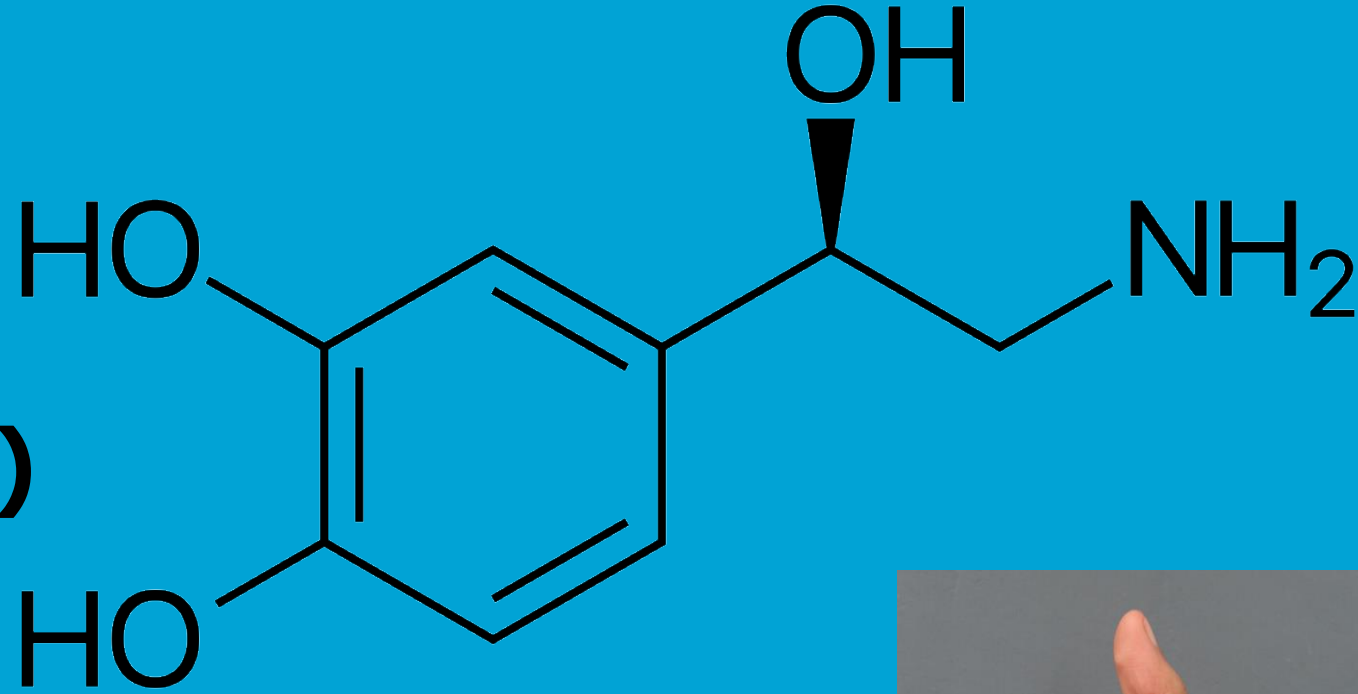
NOREPINEPHRINE (LEVOPHED)

Balanced approach

Gently increase preload

Improve inotropy (has β)

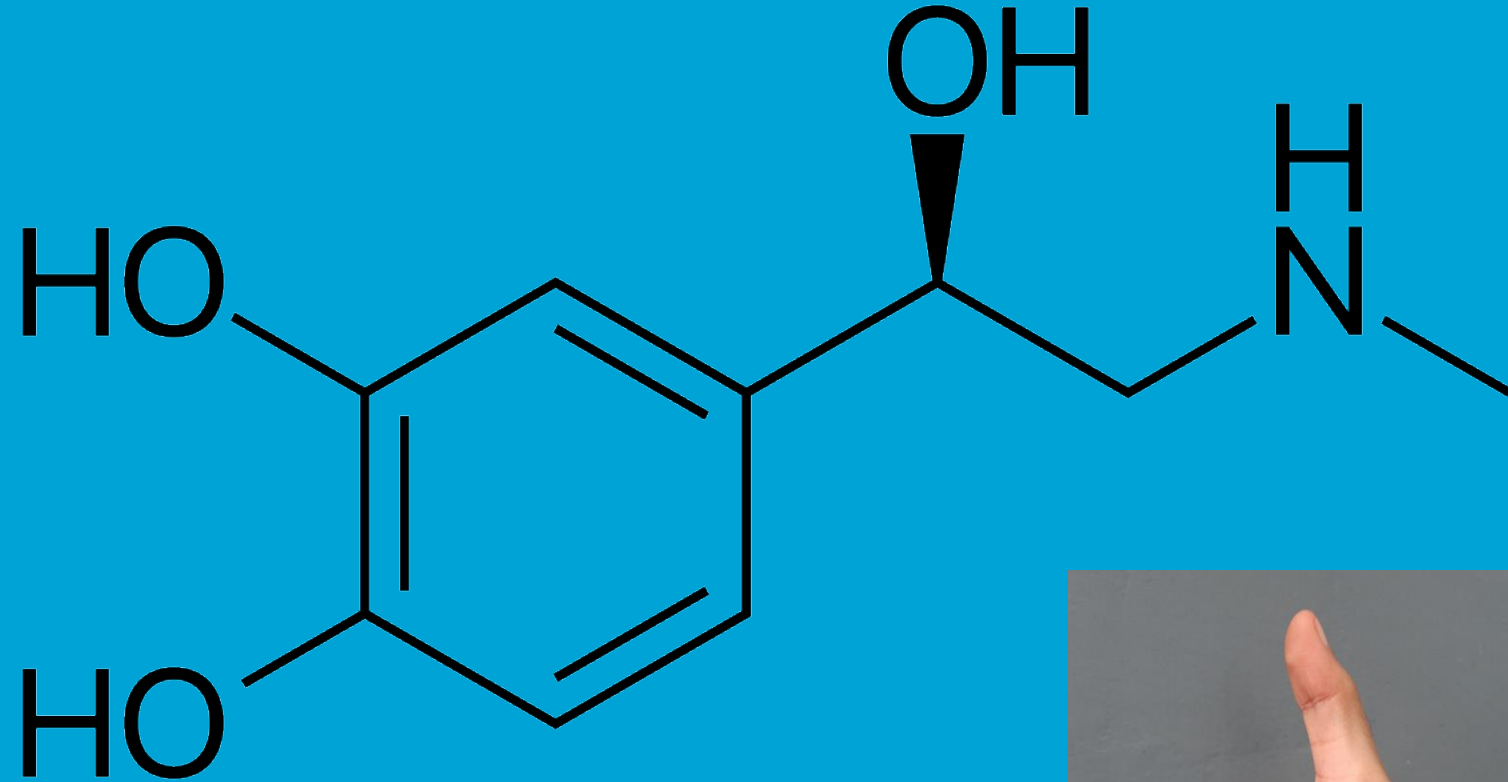
Increased MAP (α SVR)



EPINEPHRINE

Strong inotropic activity

Pulmonary vasodilation (β_2)

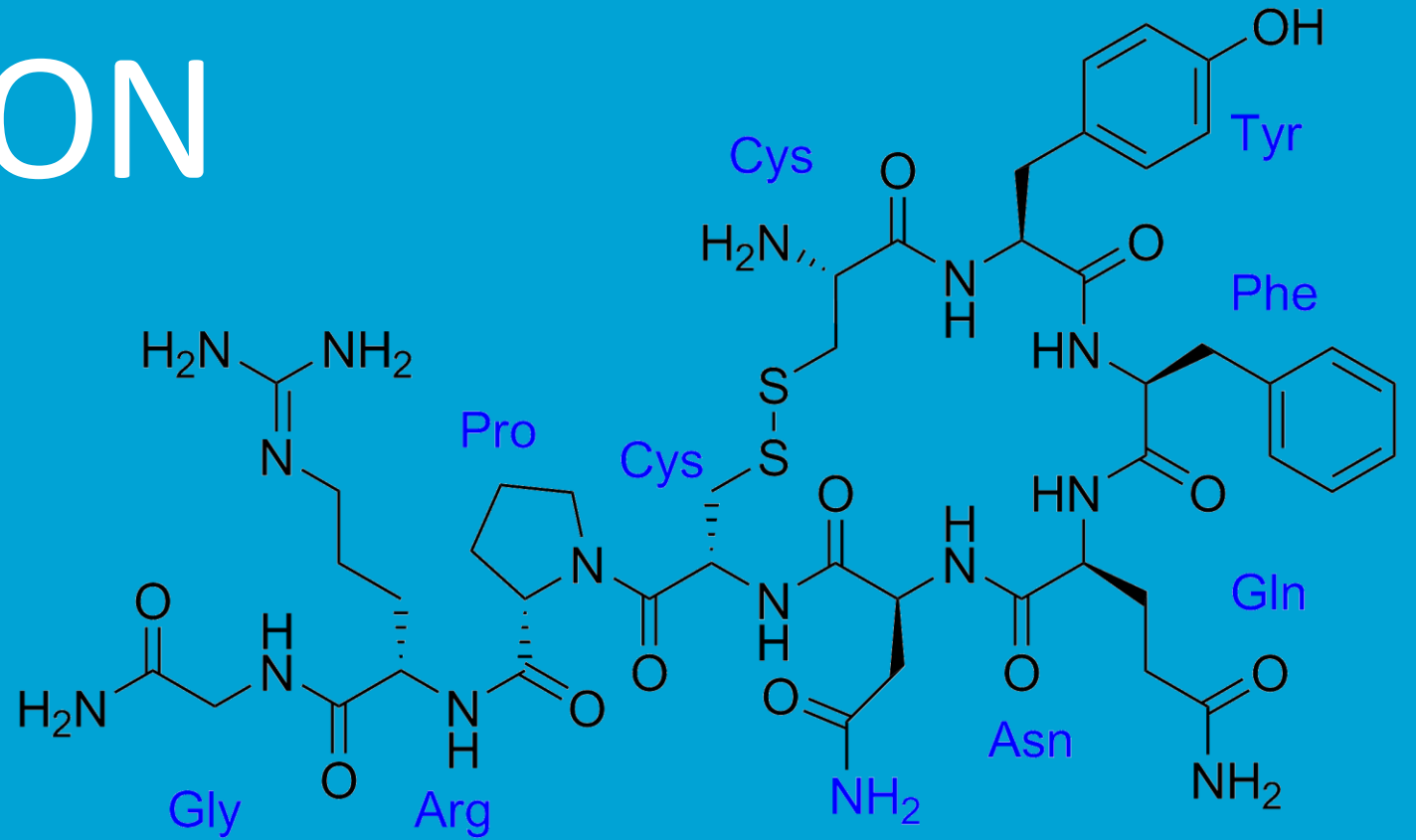


VASOPRESSION

V1/2 agonism

SVR vasoconstriction

PAP vasodilation



A photograph showing a worker in a blue jacket and white hard hat standing inside a large, dark, cylindrical pipe. The pipe is supported by a metal structure. The text "DECREASE AFTER LOAD" is overlaid in white, bold, sans-serif font across the center of the image. The background shows a white, corrugated metal wall.

DECREASE AFTER LOAD

DOBUTAMINE AND MILRINONE

Increases myocardial contractility

Decreases systemic afterload

***may reduce systemic pressure**

meh.

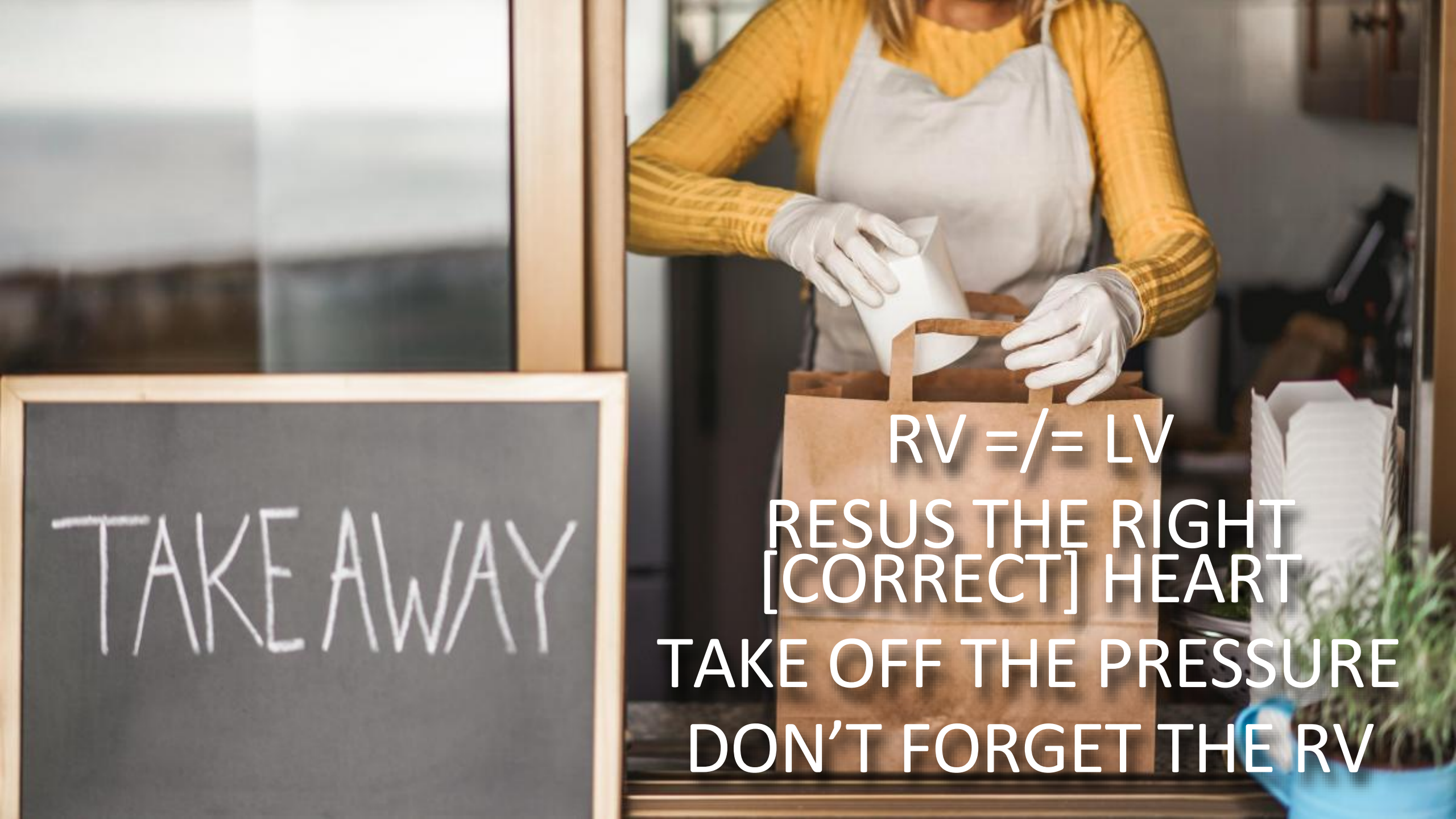


DROP THE AFTER LOAD

CONSULT PHARM

INHALED NITRIC OXIDE
EPOPROSTENOL (FLOLAN)
ILOPROST (VENTAVIS)

Drug	Route	Dosing	
Nitric Oxide	Inhaled	5-80 ppm	Start 5-10 ppm
Epoprostenol	IV	2 ng/kg/min	Increase 1-2 ng/kg/min Q15min until SE (hTN, HA, etc)
Iloprost	Inhaled	2.5-5 mcg per dose	Max 45 mcg
*Nitroglycerin	Inhaled	5mg Q5min PRN	200-400 mcg/mL continuous



TAKE AWAY

RV =/= LV
RESUS THE RIGHT
[CORRECT] HEART
TAKE OFF THE PRESSURE
DON'T FORGET THE RV