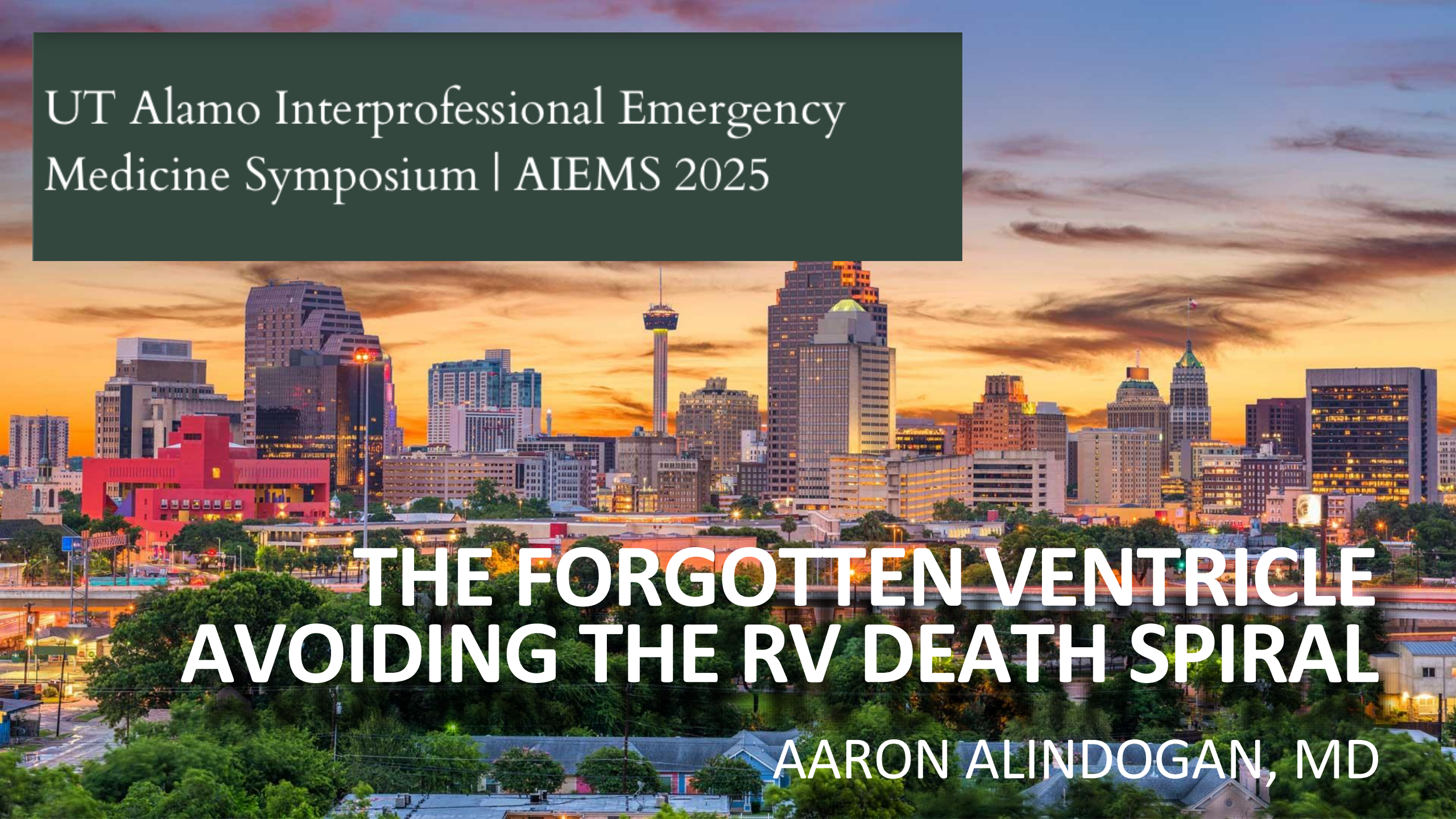
UT Alamo Interprofessional Emergency Medicine Symposium | AIEMS 2025



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.
- Commercial support was not received for this activity.

AARON ALINDOGAN, MD

THE FORGOTTEN VENTRICLE

AVOIDING THE RV DEATH SPIRAL

OBJECTIVES

DEFINITION: WHAT IS RIGHT HEART FAILURE?

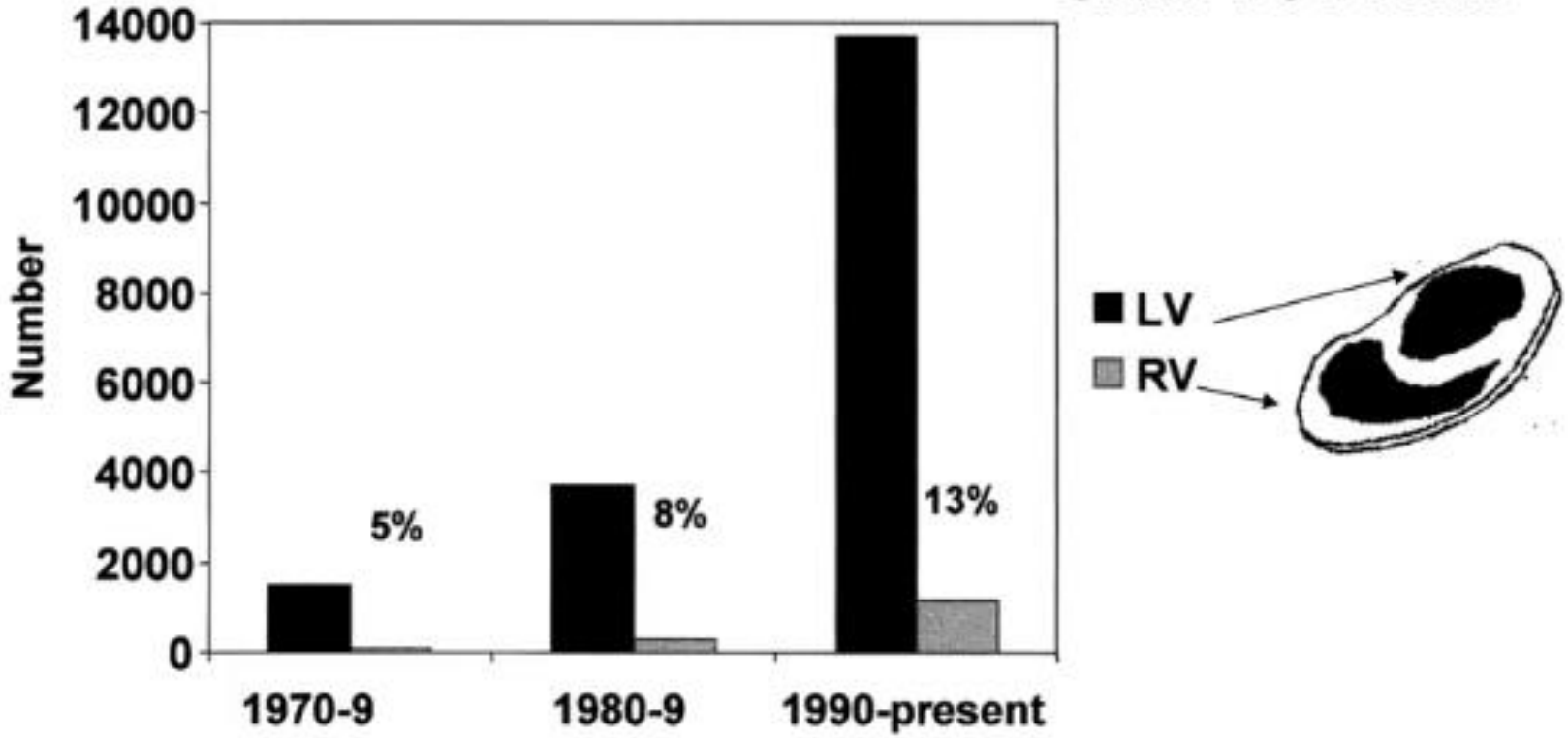
PHYSIOLOGY OF THE RV DEATH SPIRAL

INITIAL MANAGEMENT

VASOPRESSORS

"The Forgotten Ventricle"

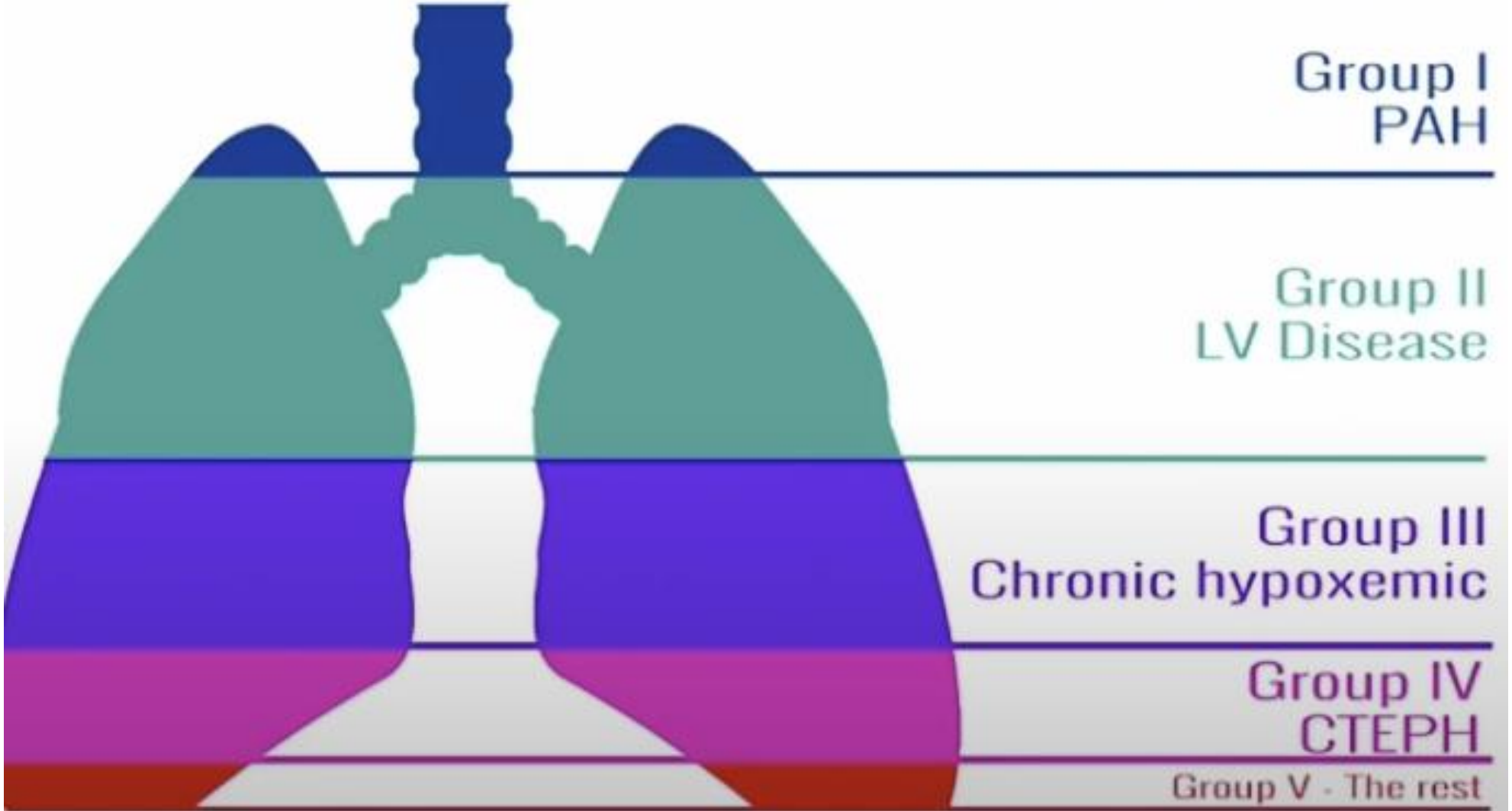
Until 1944…?



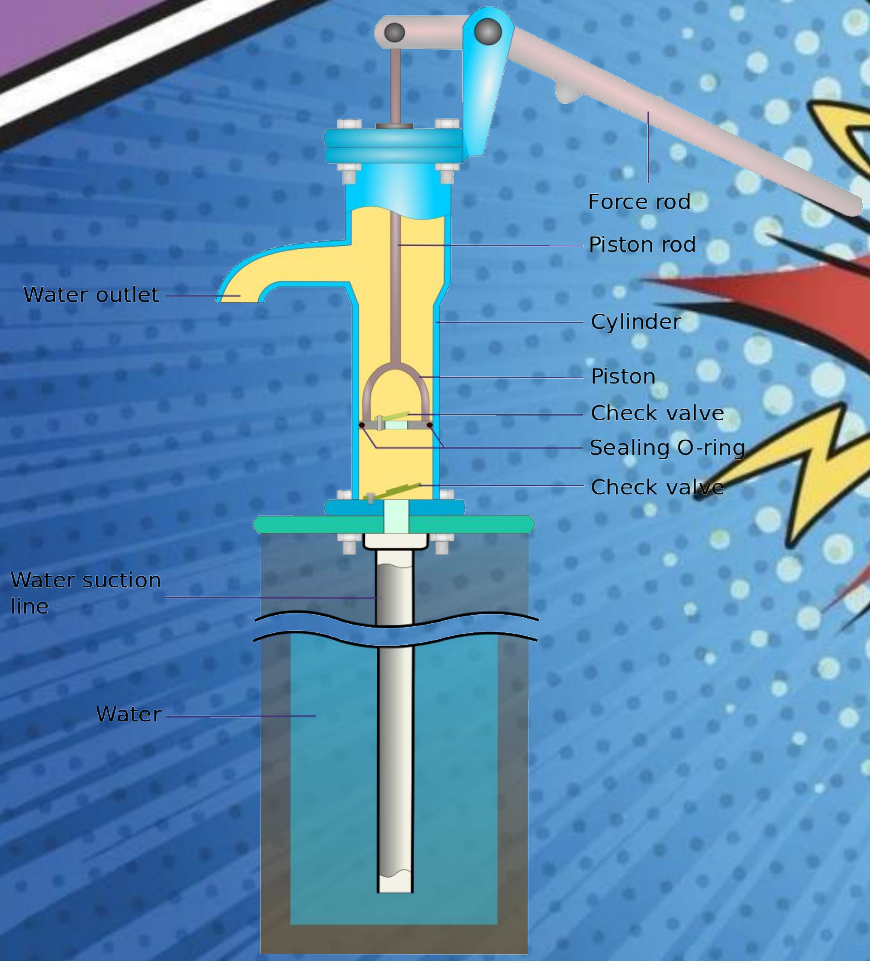
Bar chart showing frequency of publications regarding RV versus the Left Ventricle (LV) function over the last 3 decades of 1900's

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

CLASSIC DESCRIPTION OF PH



PUMP



VS

CONDUIT

RIGHT VENTRICLE

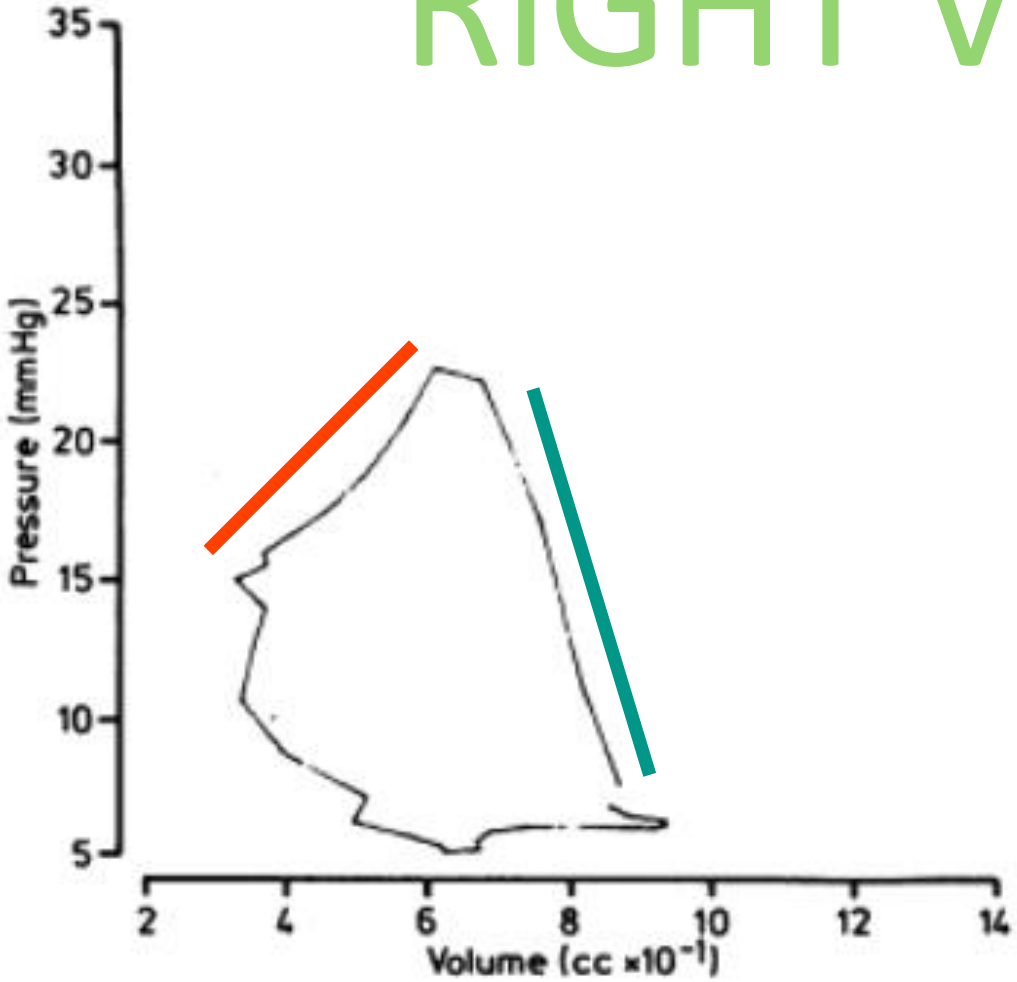


Fig 5 *Normal right ventricular pressure-volume loop. In this example there is a better defined limb of isovolumic relaxation. Maximum work 944·8 mm Hg × ml and efficiency 62%.*

Redington. Br Heart J 1988;29:23

SPECTRUM

DECREASED RV CONTRACTILITY

RV VOLUME OVERLOAD

RV PRESSURE OVERLOAD

SPECTRUM

DECREASED RV CONTRACTILITY

RV VOLUME OVERLOAD

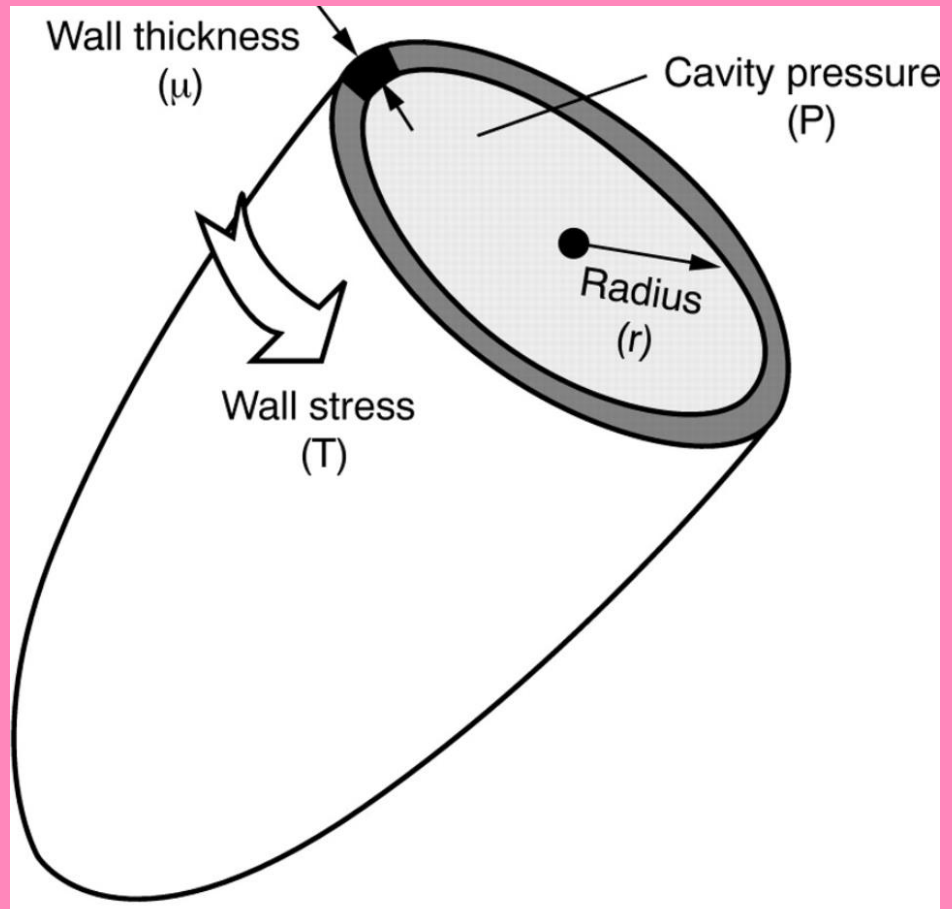
RV PRESSURE OVERLOAD

WALL STRESS

THIN WALLS

AFTERLOAD SENSITIVE

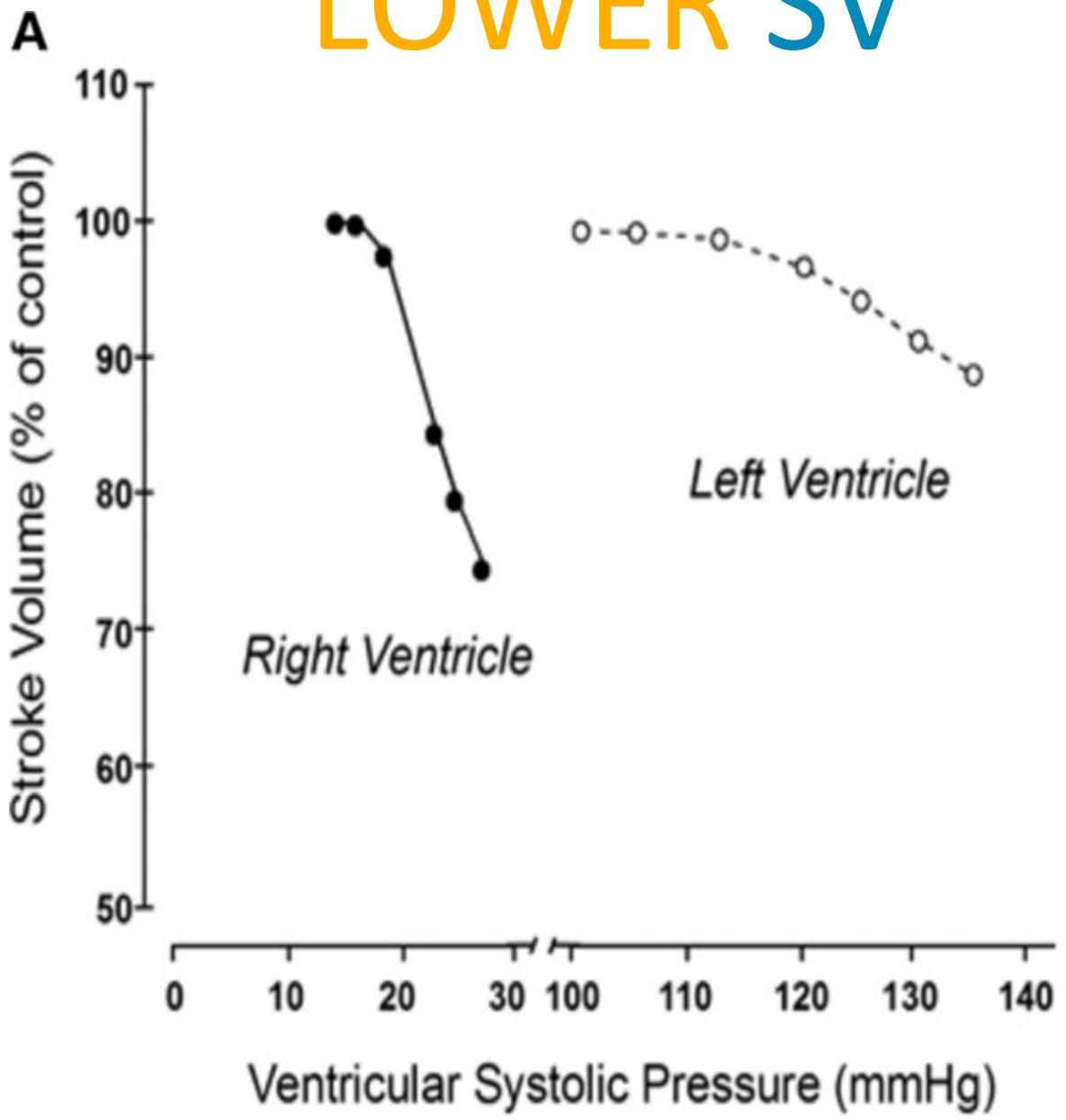
WORSE AT HANDLING **PRESSURE OVERLOAD** THAN VOLUME OVERLOAD



The law of Laplace:

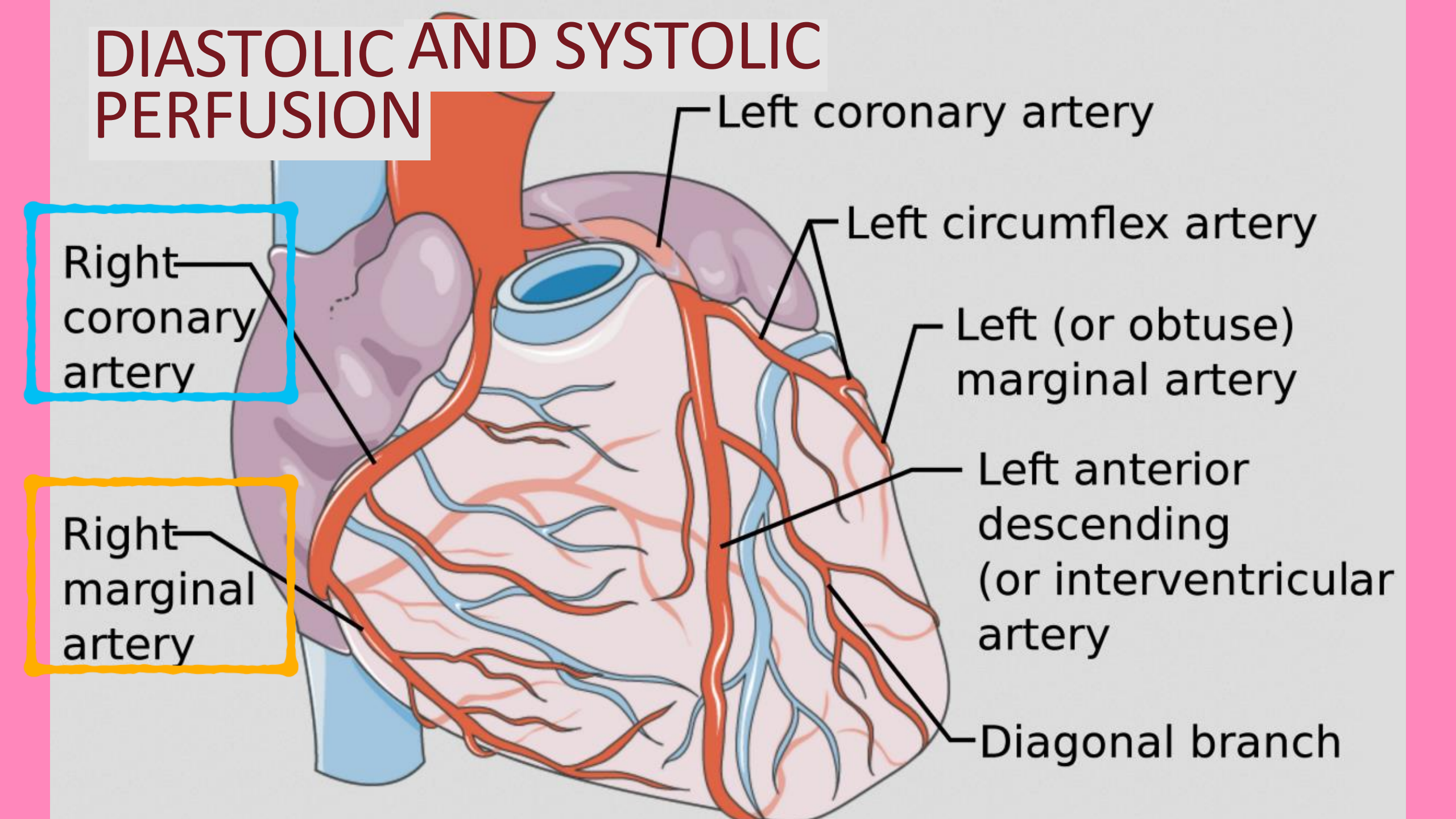
$$\text{Wall stress (T)} = \frac{[\text{cavity pressure (P)}] \times [\text{radius (r)}]}{2 \times [\text{wall thickness } (\mu)]}$$

INCREASES IN PRESSURE CAUSE MUCH LOWER SV



Braunwald, E. Heart Disease: a Textbook of Cardiovascular Medicine. Philadelphia: Saunders; 1984.

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

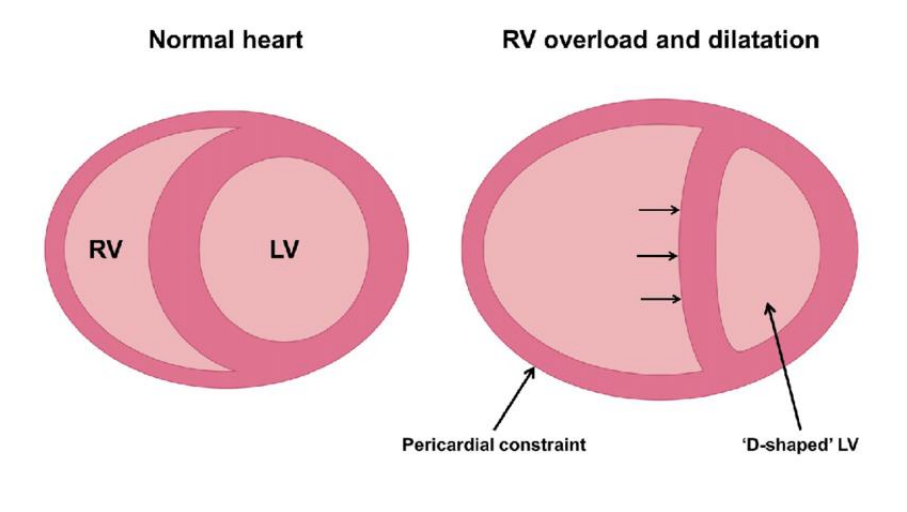
BETTER WITH PRESSURE OVERLOAD

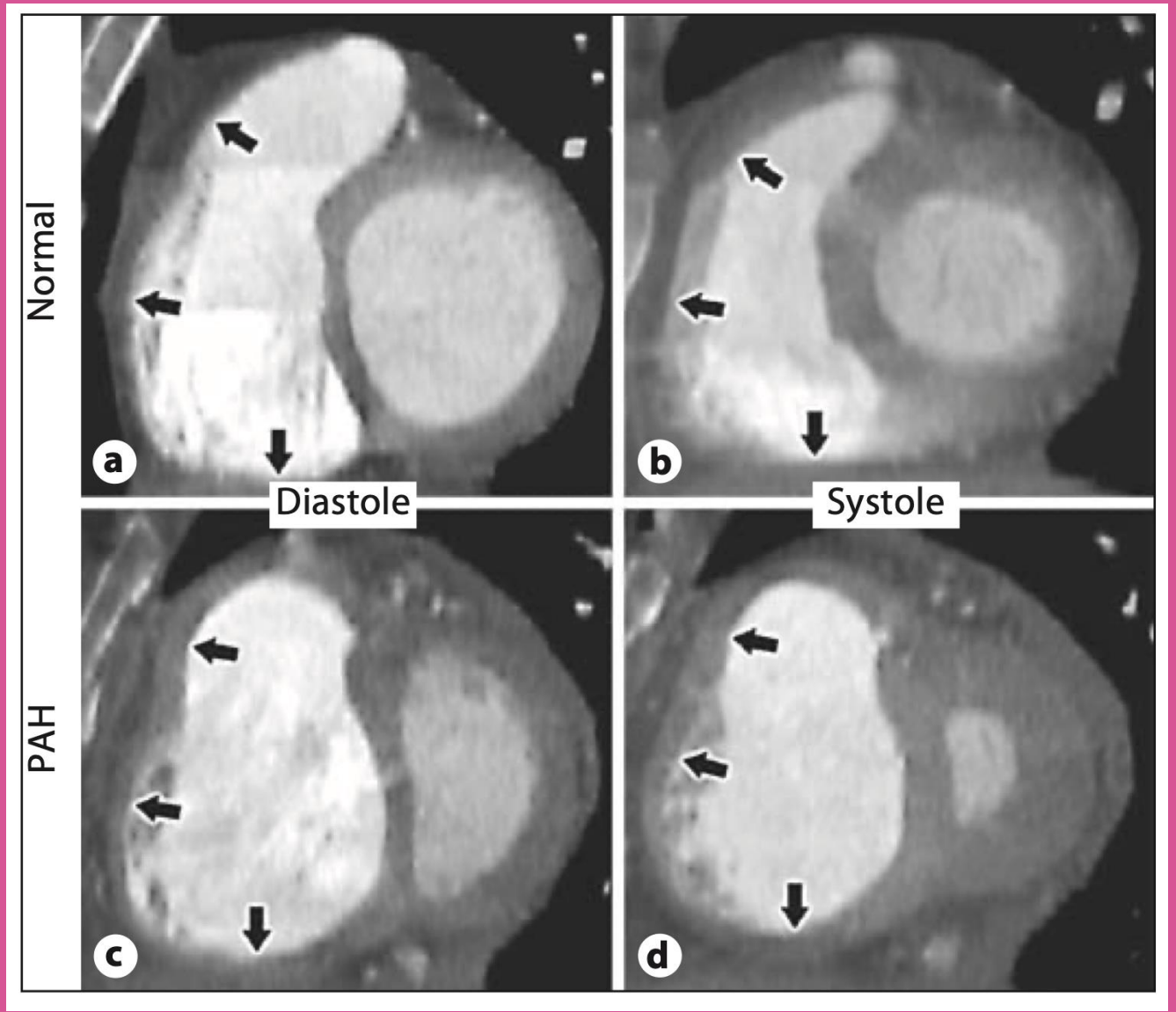
RIGHT VENTRICLE

LOW ELASTANCE
PVR 70
HIGH COMPLIANCE
HIGH RESISTANCE TO ISCHEMIA

BETTER WITH VOLUME OVERLOAD

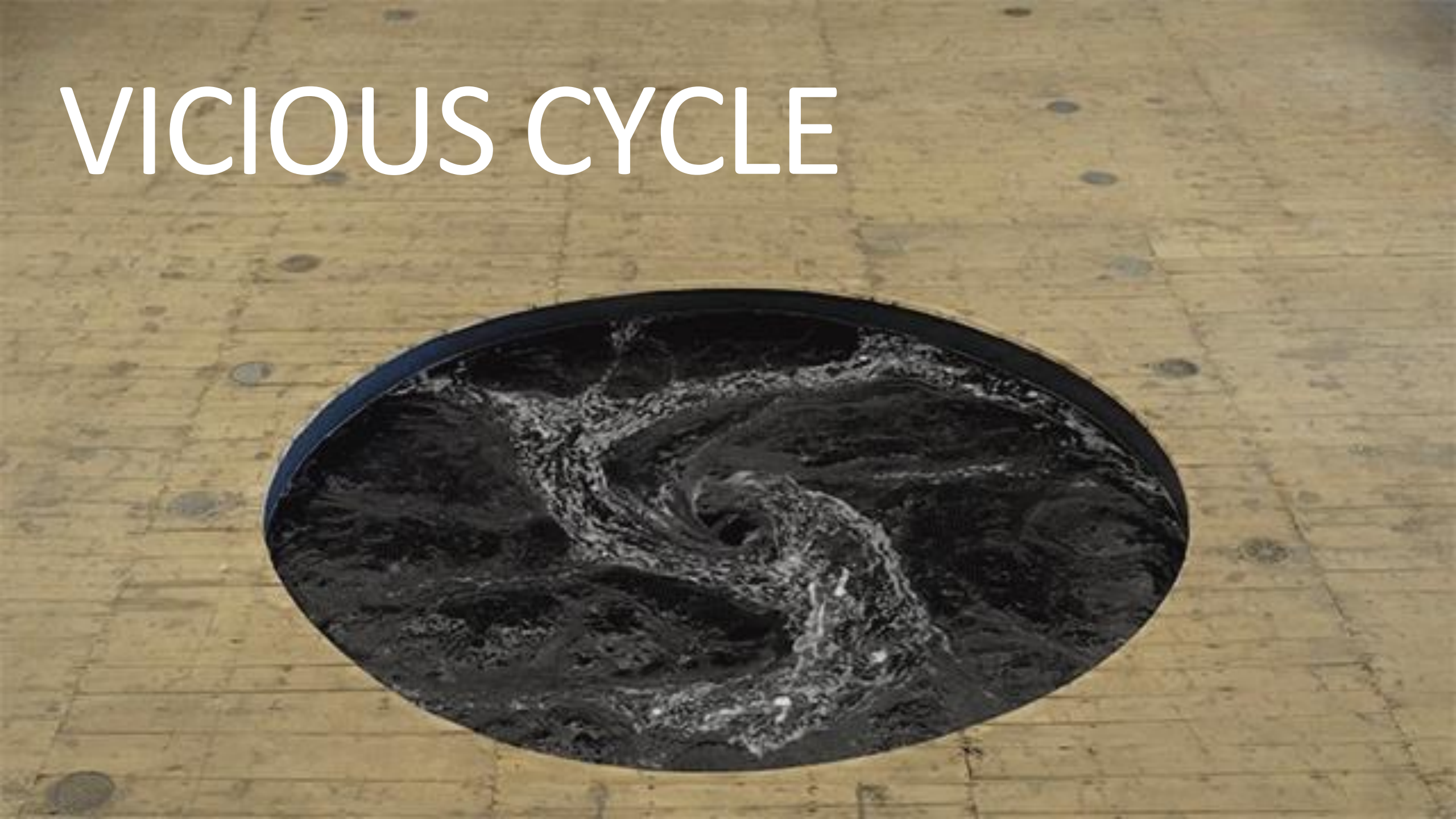
VENTRICULAR INTERDEPENDENCE





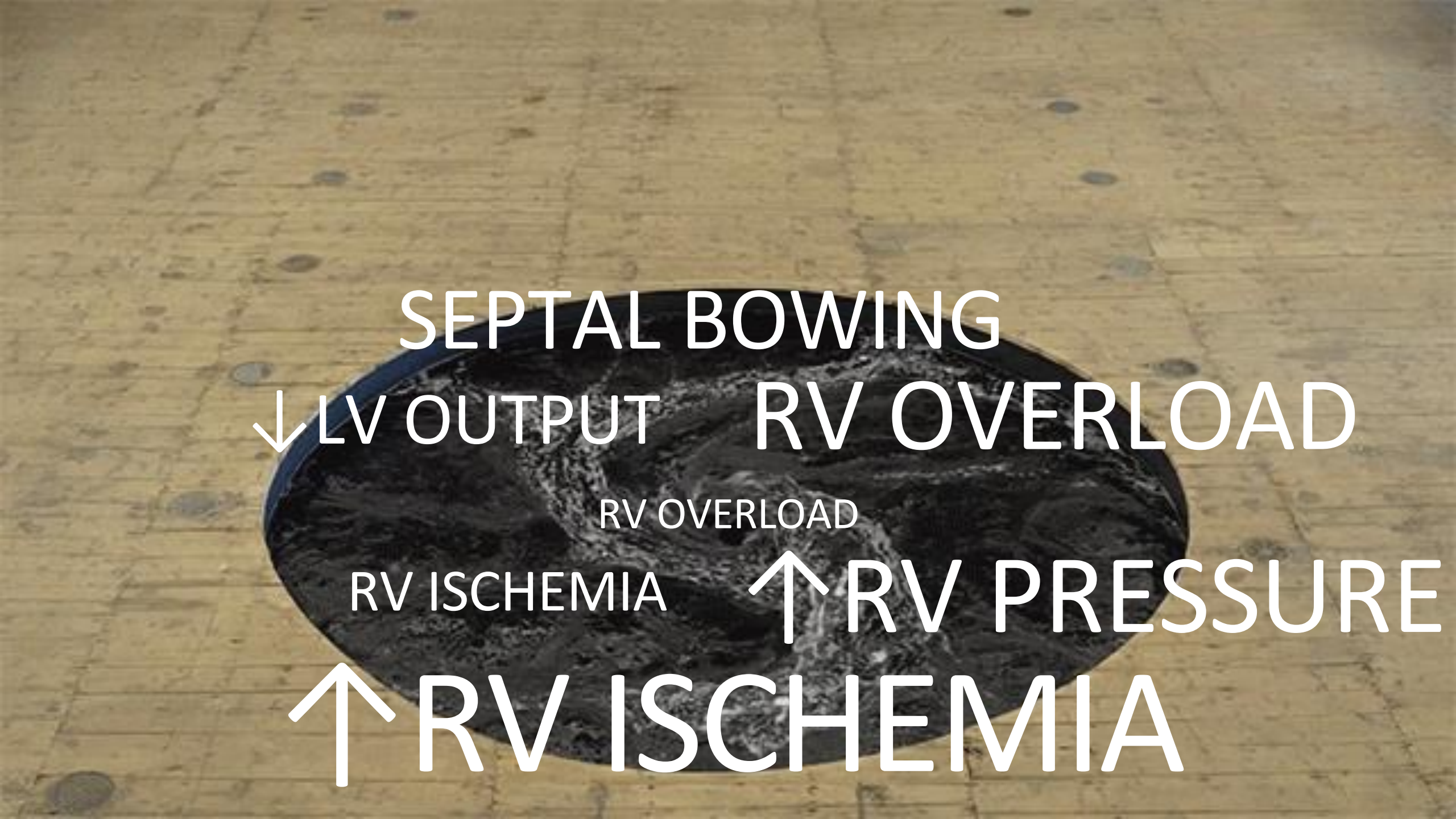
CAN’T HANDLE THE PRESSURE

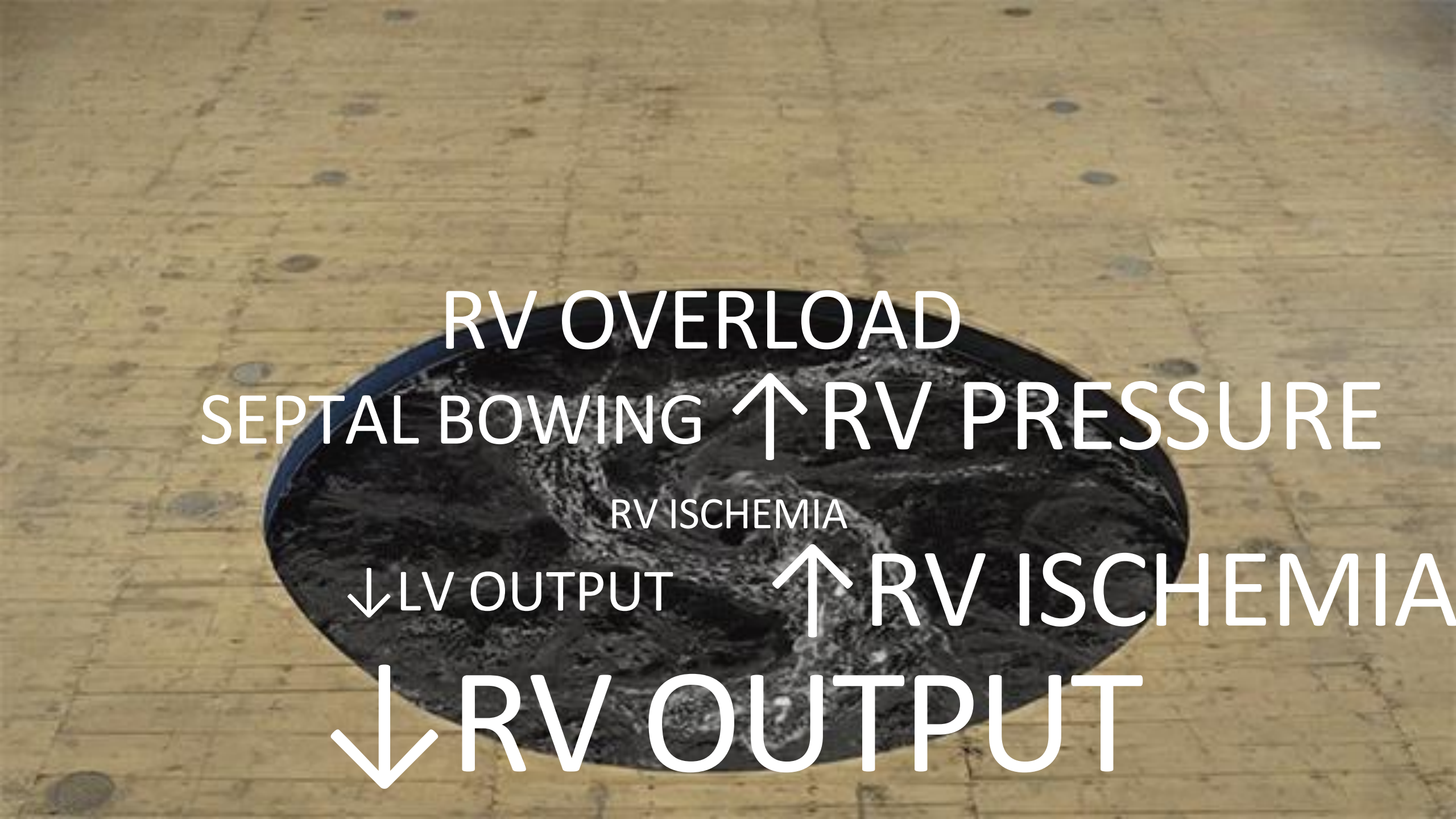
VICIOUS CYCLE



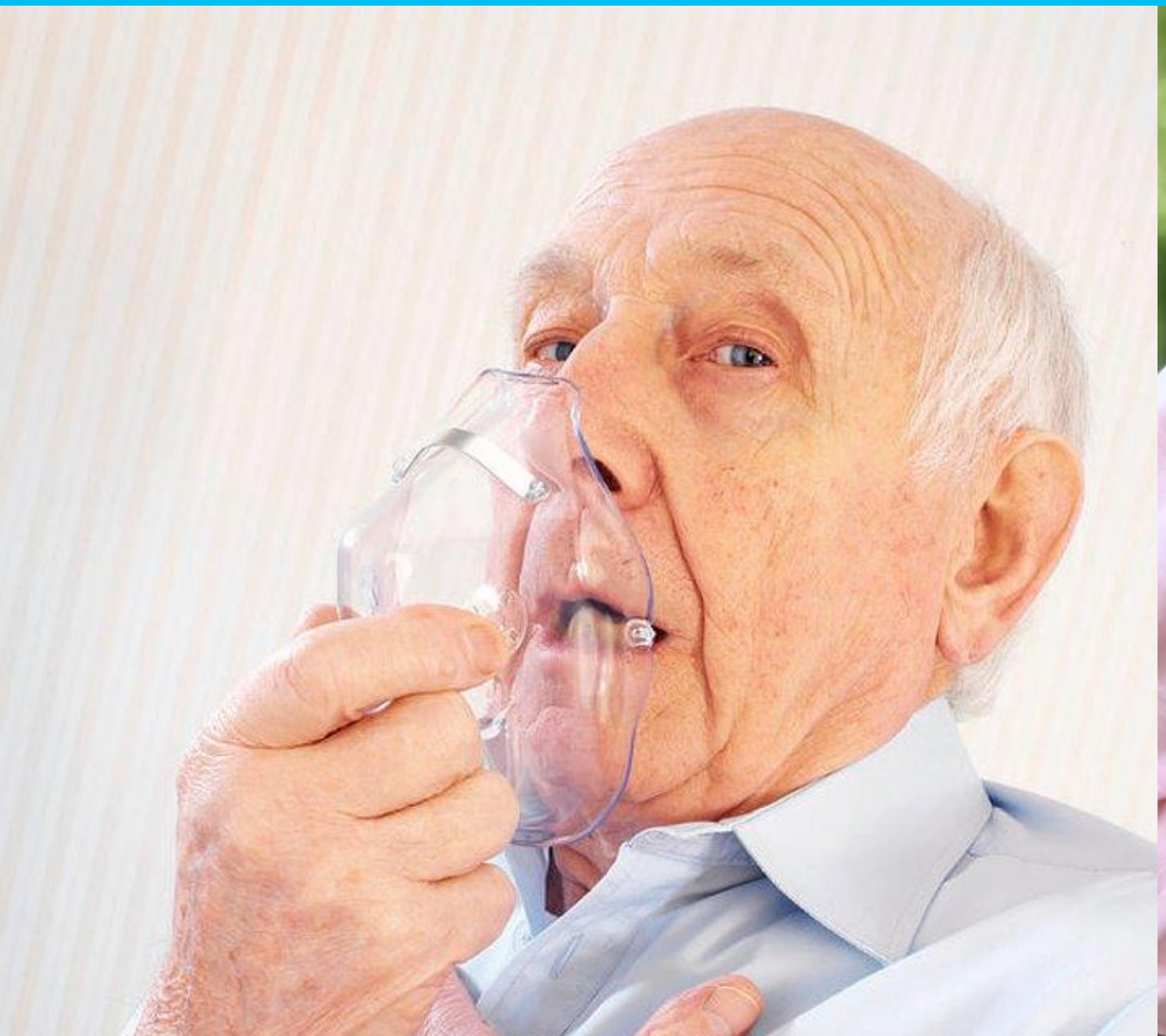

RV ISCHEMIA
RV OVERLOAD
↓LV OUTPUT
↑RV ISCHEMIA
↓RV OUTPUT
SEPTAL BOWING
RV OVERLOAD


↓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

SIGNS AND SYMPTOMS



SIGNS AND SYMPTOMS

PHYSICAL EXAM

JVD

HSM

ANASARCA

RV HEAVE

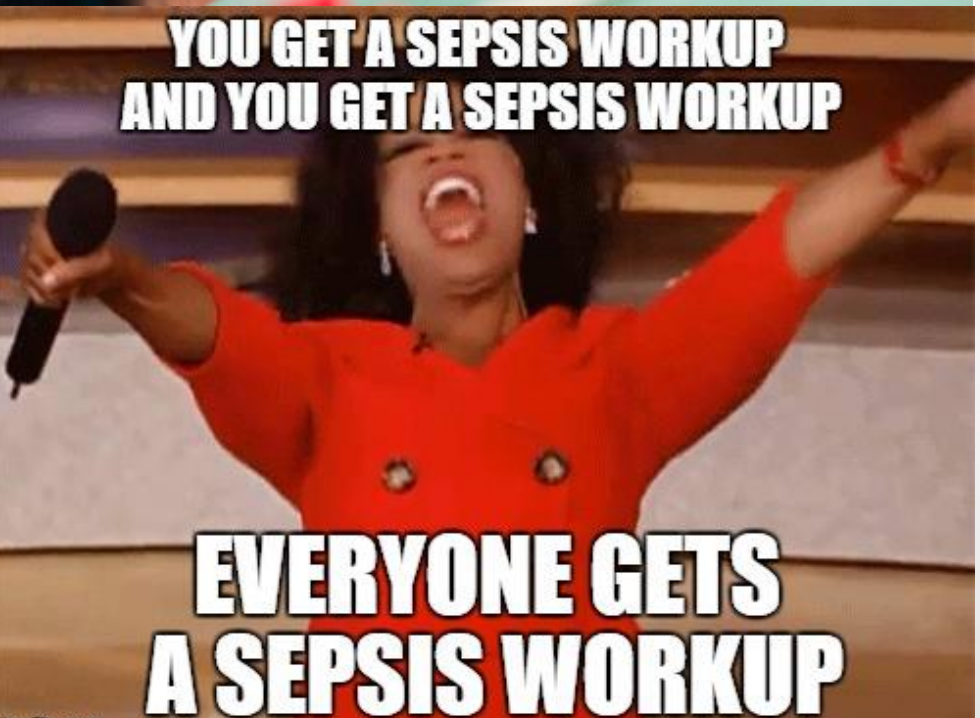
SHOCK

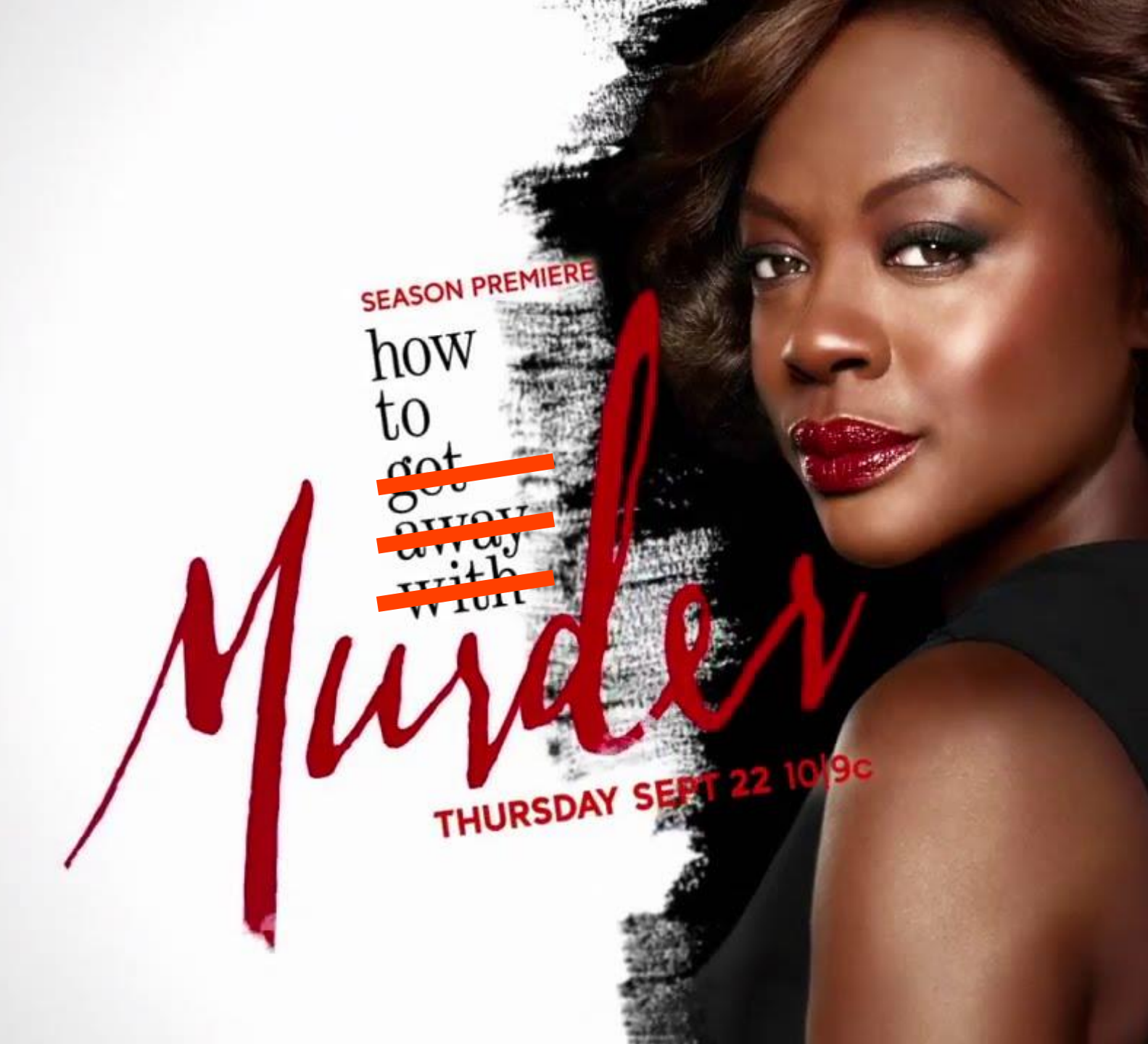
SYNCOPE

AMS

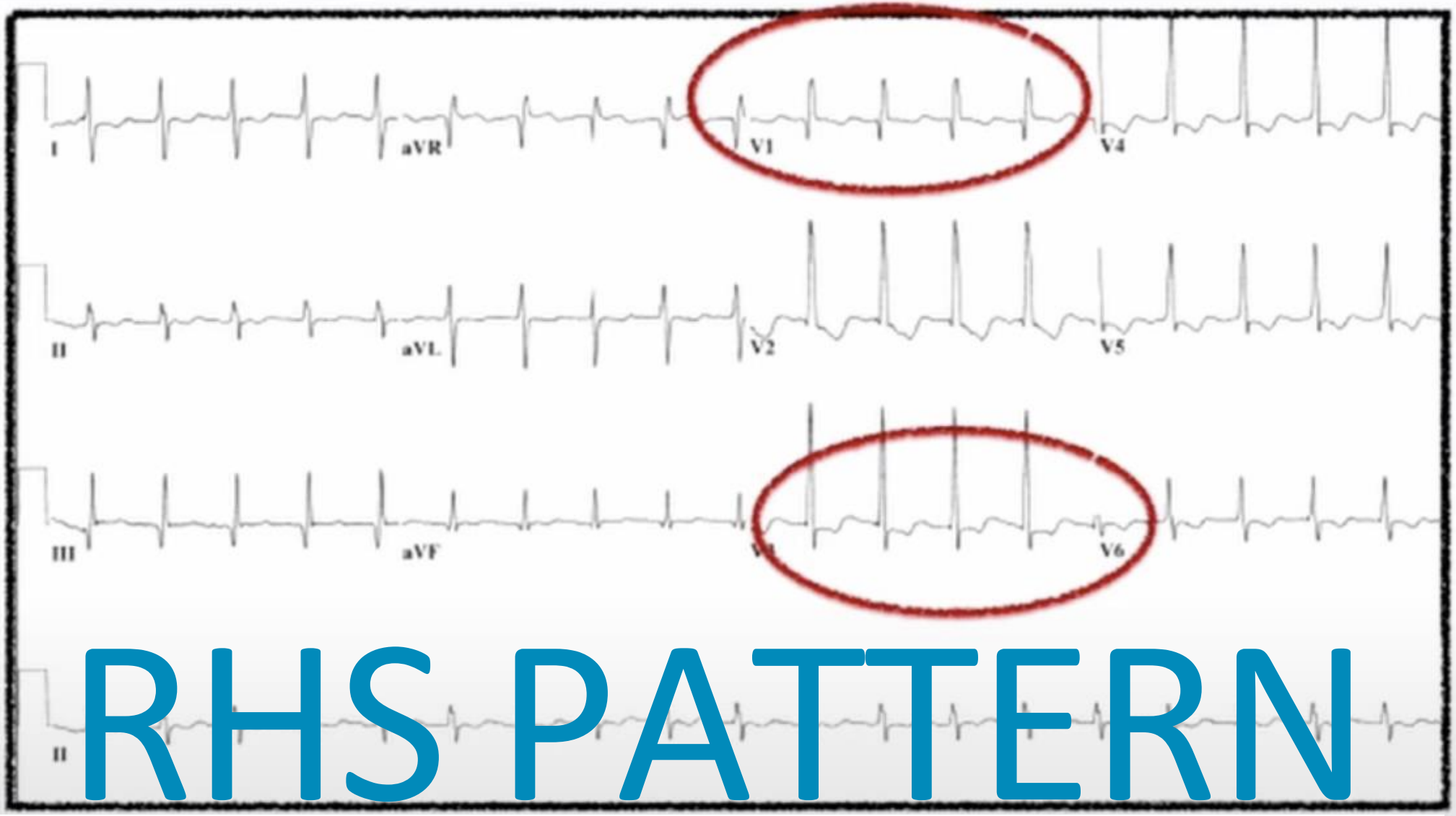
OLIGURIA


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?



RHS PATTERN

V1: Dominant R wave

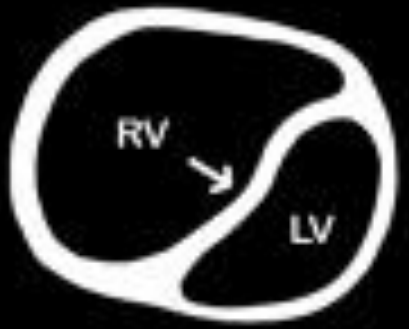
V1: R/S > 1

S1/Q3/T3

Incomplete RBBB

Increased RV:LV Size Ratio

Abnormal Septal Motion



McConnell's Sign

Tricuspid Regurgitation

Elevated Pulmonary Artery Systolic Pressure

$PASP = (4 \times TRV_{max}^2) + RAP > 35\ mmHg$

Decreased TAPSE

Decreased S'

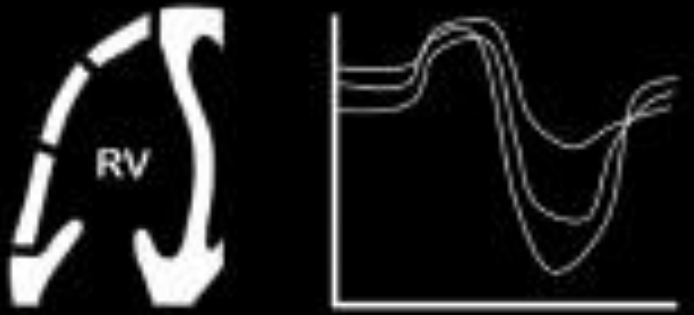
Pulmonary Artery Mid-Systolic Notching

60/60 Sign

$(4 \times TRV_{max}^2) < 60\ mmHg$

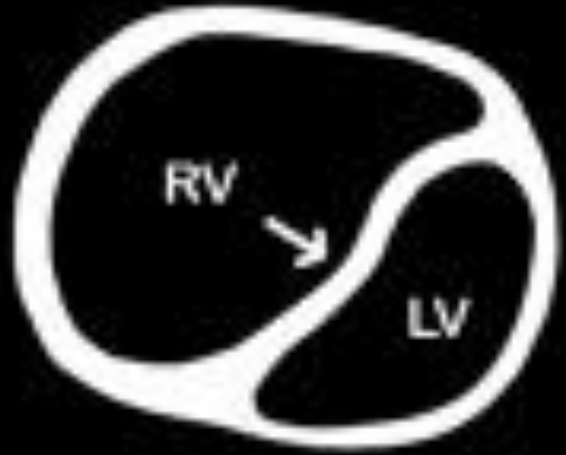
PAAT < 60 ms

Speckle Tracking: Decreased Free Wall Strain



Increased RV:LV Size Ratio

Abnormal Septal Motion



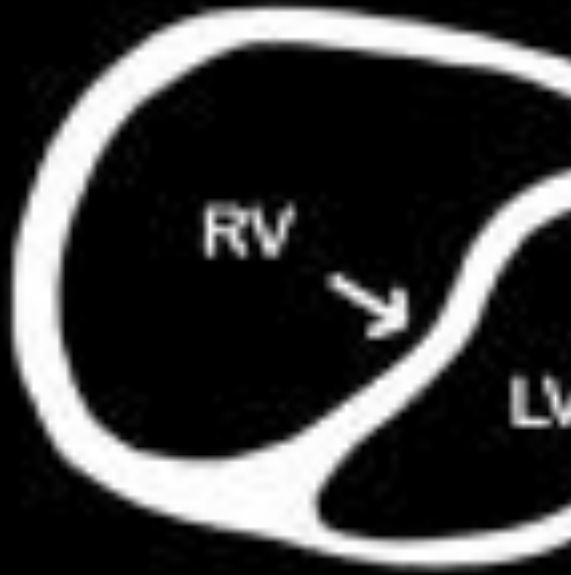
McConnell's Sign

Elevated Pulmonary Artery Systolic Pressure

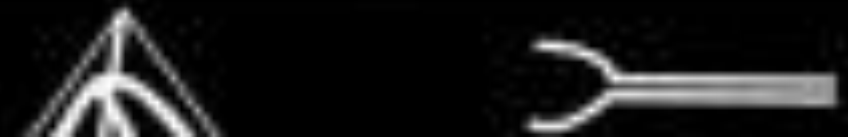
Decreased TAPSE

Increased RV:LV Size Ratio

Abnormal Septal



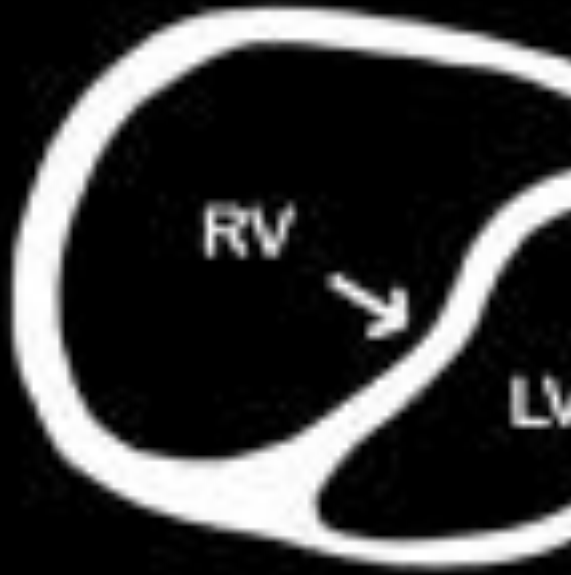
Elevated Pulmonary Artery Systolic Pressure



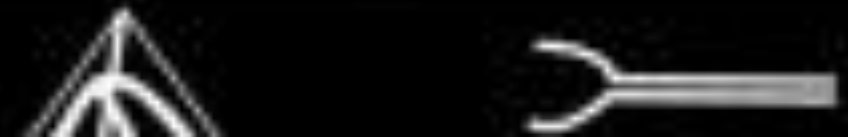

P
G
P
R
1.6 3.2

Increased RV:LV Size Ratio

Abnormal Septal

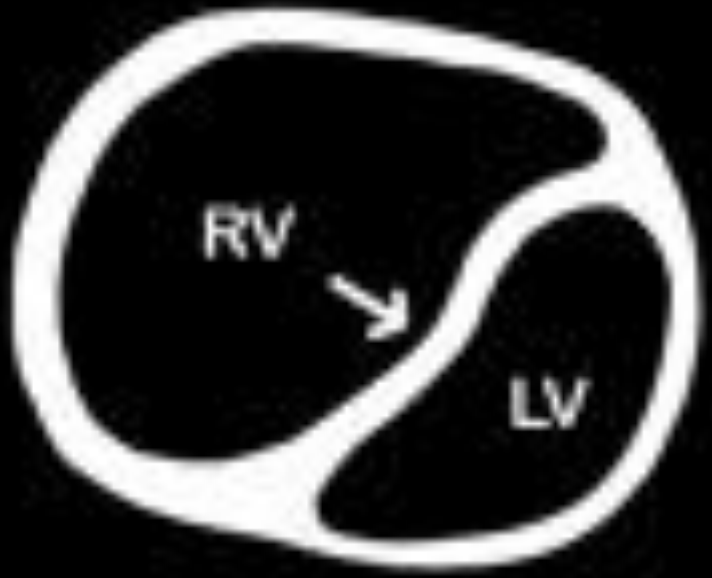


Elevated Pulmonary Artery Systolic Pressure



ed RV:LV Size Ratio

Abnormal Septal Motion



McConnell

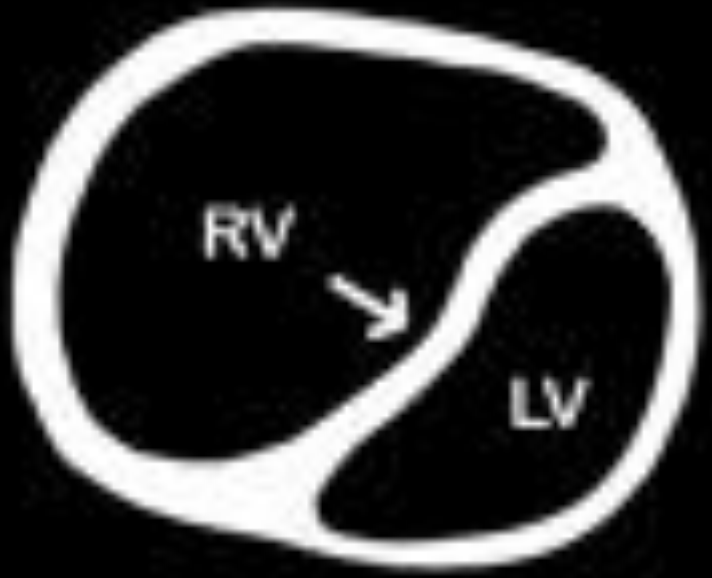
Pulmonary Artery Systolic Pressure

Decreased TAPSE


UTHSCSA EMERGENCY MED
148626209
02/08/18 9:00:20 AM
R47 Card/Gen
P4-1c/H3.5
DR65/M3/P1
G80/E1/100%
MI1.5 TIs0.5
16.0 cm
53/50 Hz
ZSI 0
Image
5
10
15
cm

ed RV:LV Size Ratio

Abnormal Septal Motion

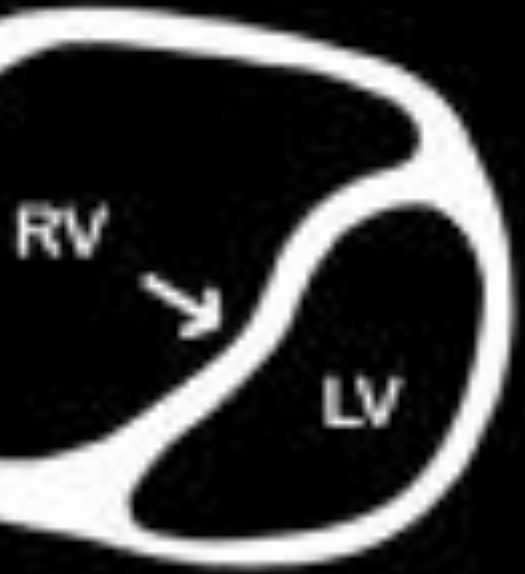


McConnell

Pulmonary Artery Systolic Pressure

Decreased TAPSE

nal Septal Motion

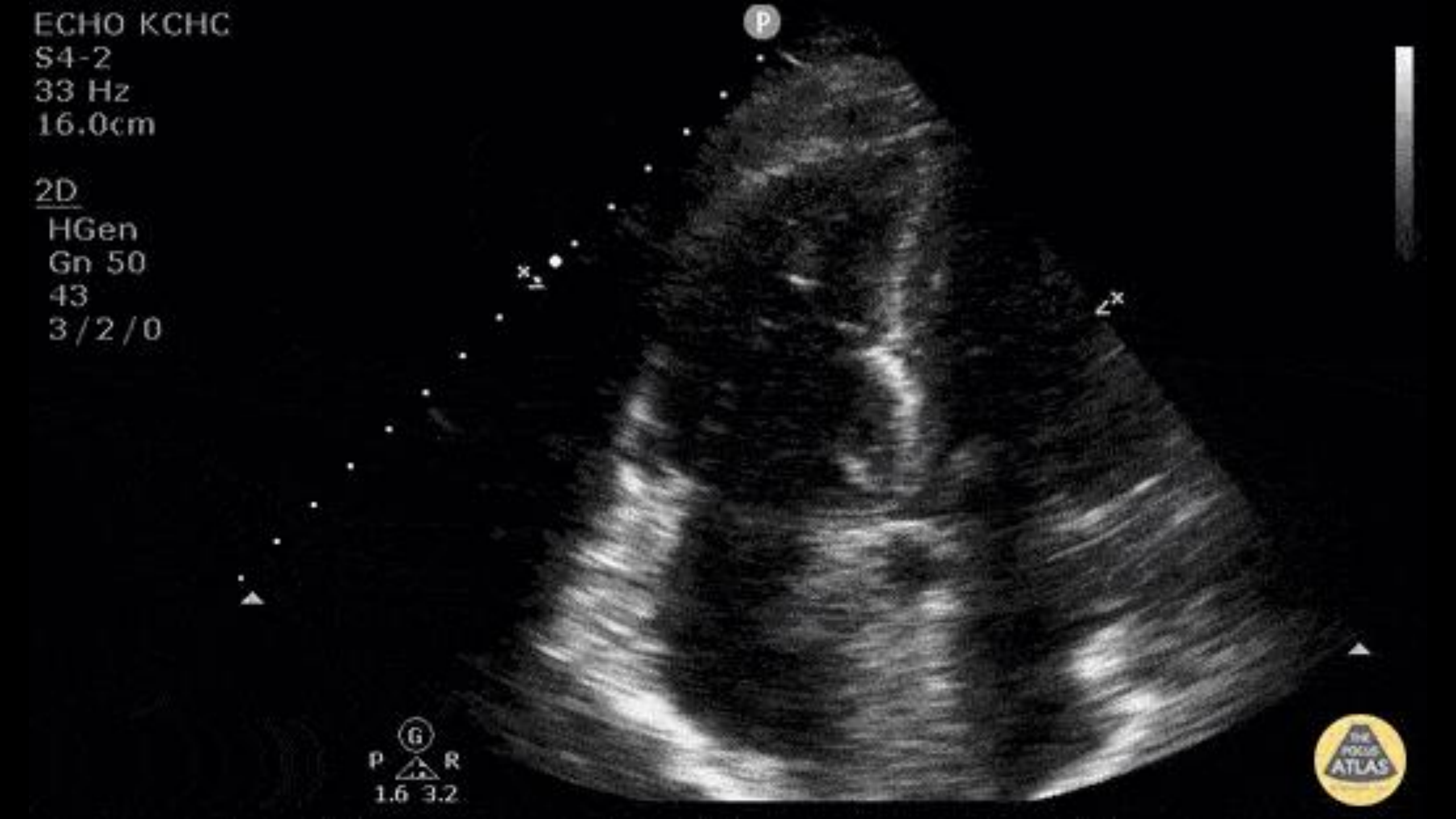


McConnell's Sign

Tricuspid Regu

Decreased TAPSE

Decreased S'


ECHO KCHC
S4-2
33 Hz
16.0cm
2D
HGen
Gn 50
43
3/2/0
P
G
P
R
1.6 3.2

MANAGEMENT


OXYGENATION


NO
HYPOXIA
#NotInMyHouse

AVOID INTUBATION

AVOID INTUBATION

BIPAP OR HFNC INSTEAD

OPTIMIZE VOLUME STATUS


DIURESIS

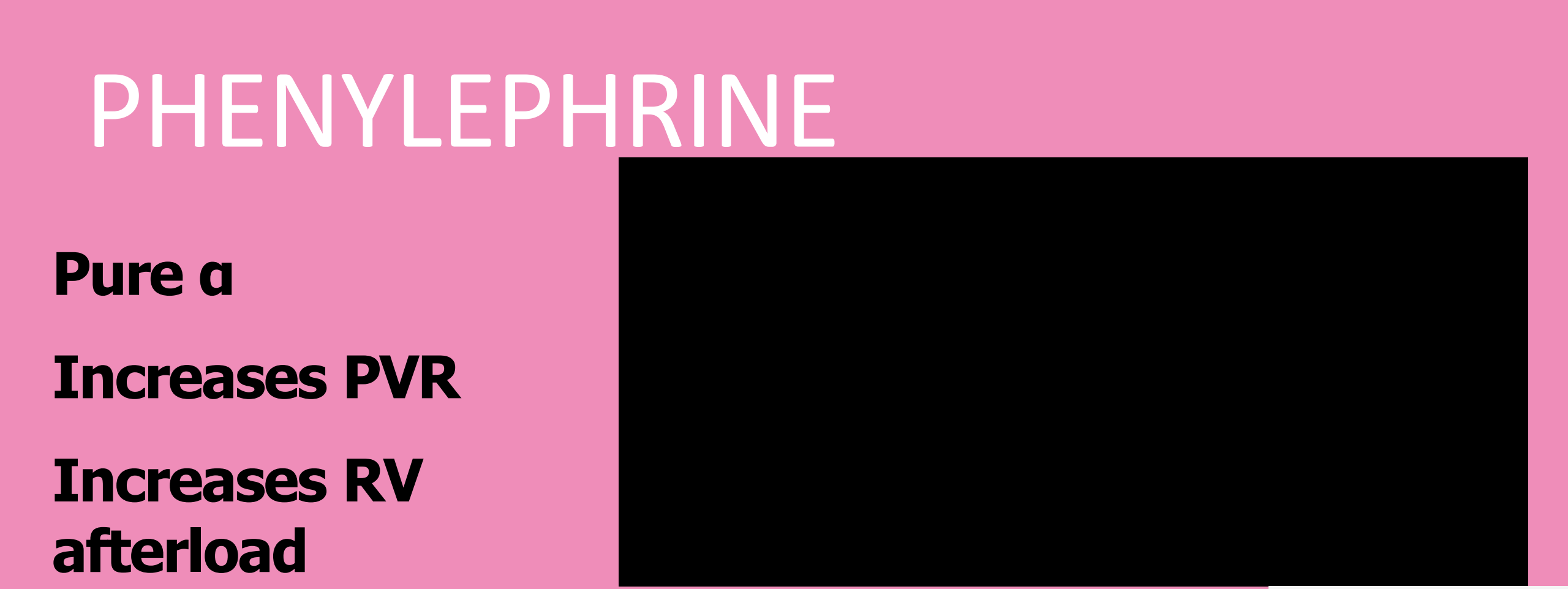
VASOPRESSORS

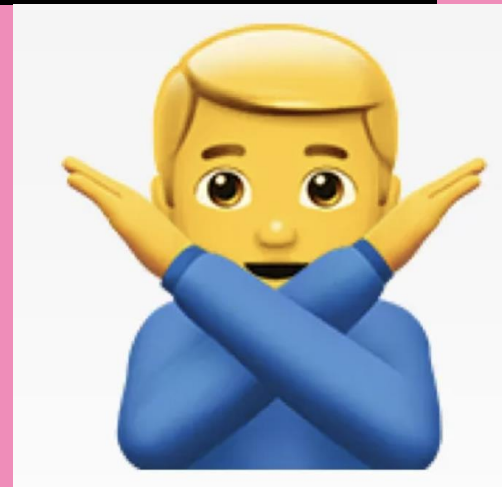
PHENYLEPHRINE

Pure α

Increases PVR

Increases RV afterload





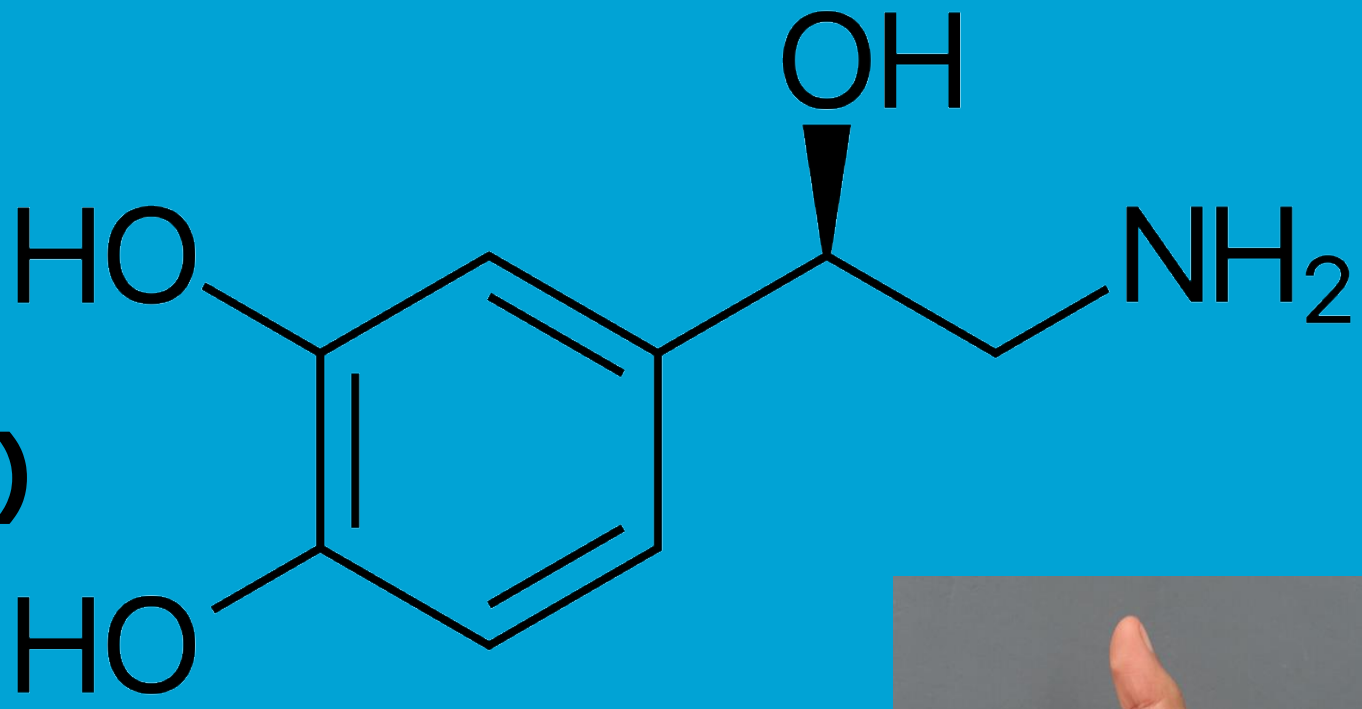
NOREPINEPHRINE (LEVOPHED)

Balanced approach

Gently increase preload

Improve inotropy (has β)

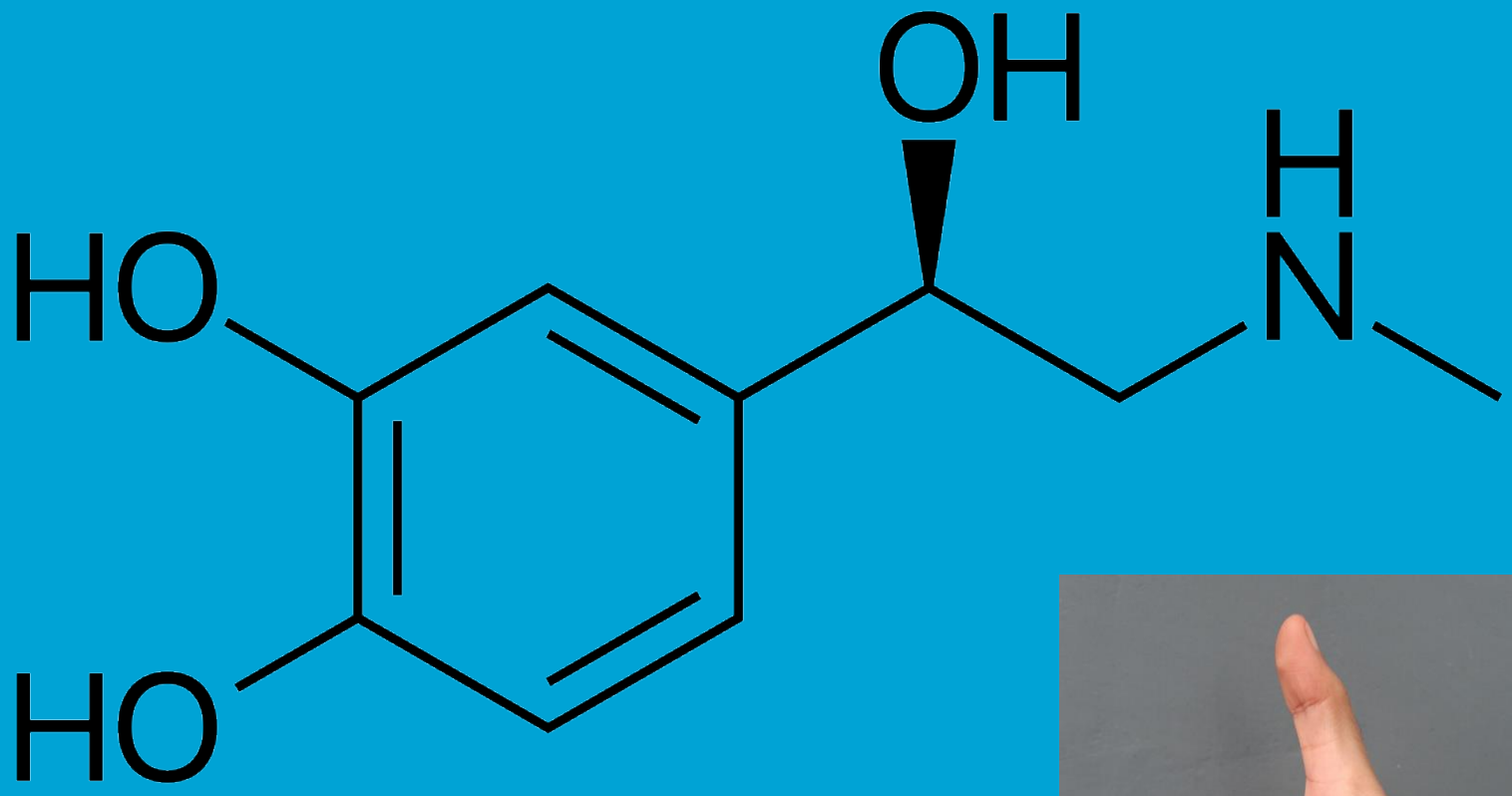
Increased MAP (α SVR)



EPINEPHRINE

Strong inotropic activity

Pulmonary vasodilation (β2)

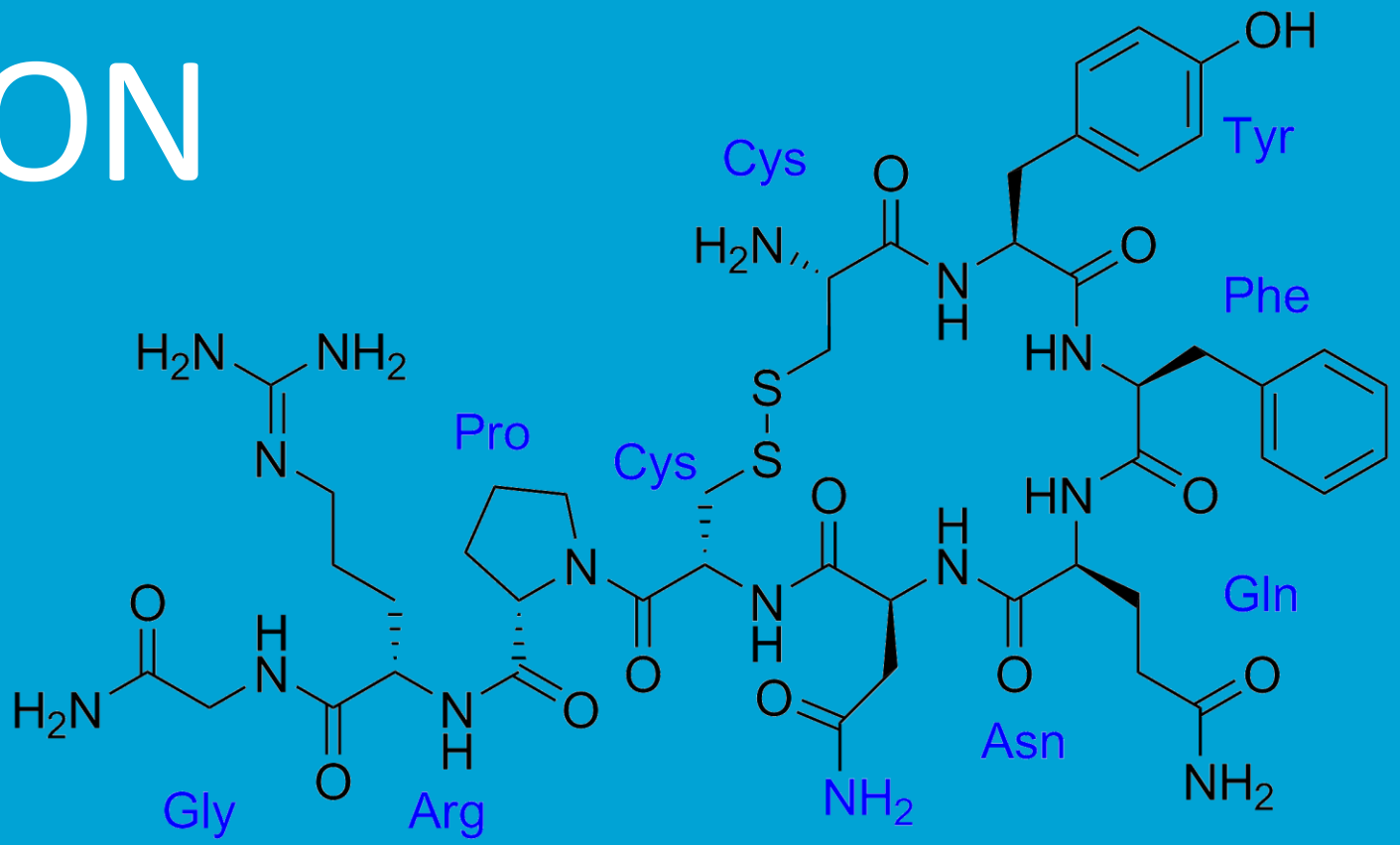


VASOPRESSION

V1/2 agonism

SVR vasoconstriction

PAP vasodilation




DECREASE AFTER LOAD

DOBUTAMINE AND MILRINONE

Increases myocardial contractility

Decreases systemic afterload

***may reduce systemic pressure**

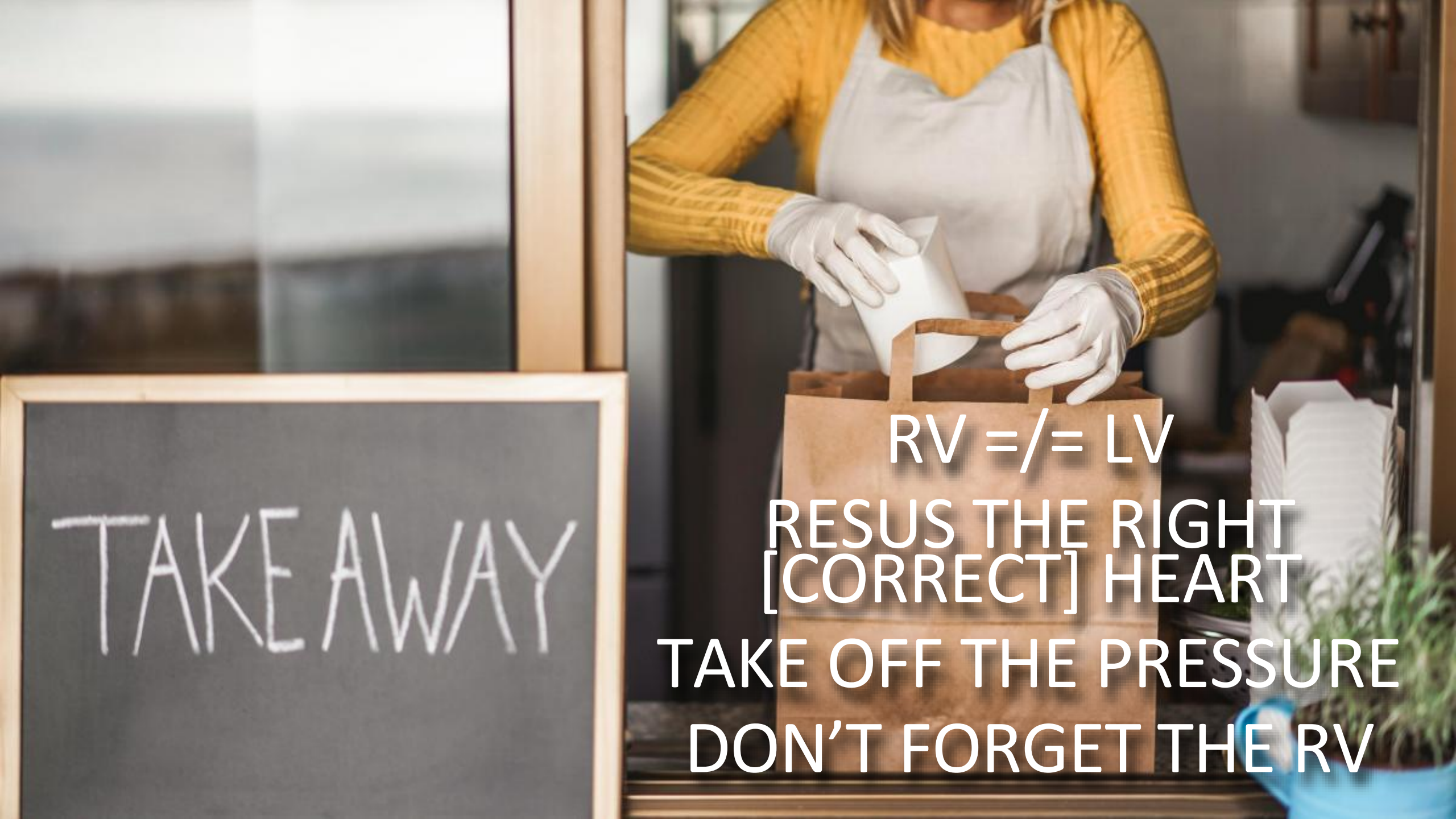
meh.

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



RV =/= LV

RESUS THE RIGHT [CORRECT] HEART

TAKE OFF THE PRESSURE

DON’T FORGET THE RV