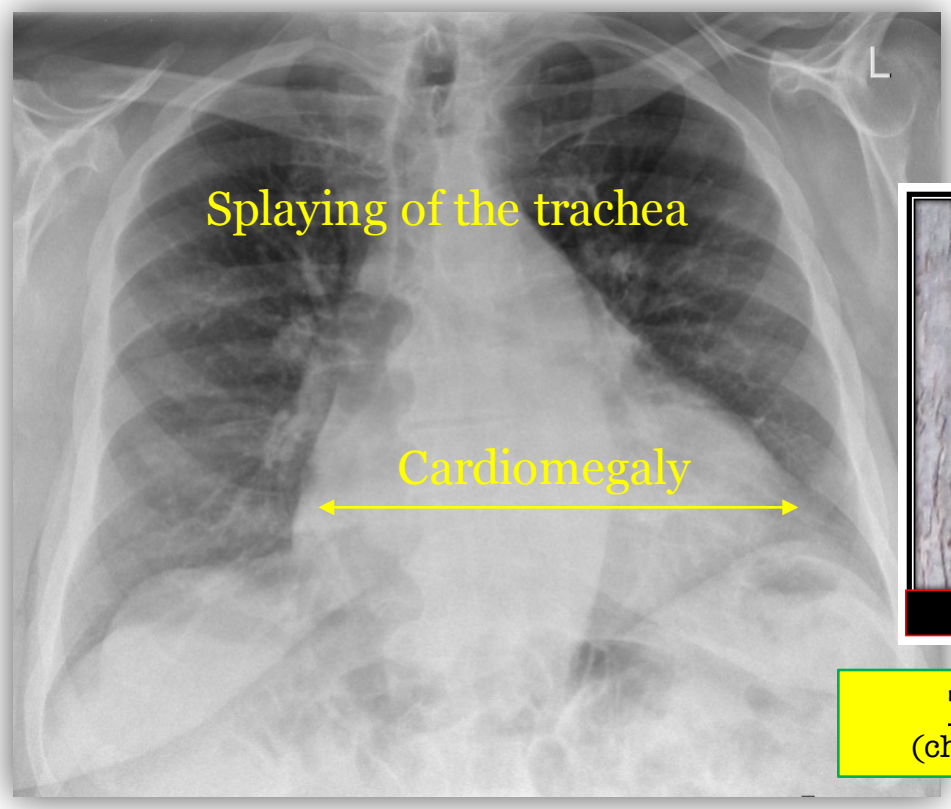
Heart Failure and the Cardiomyopathies for the USMLE Step One Exam: *Part I*: Key Background Information and Test Derivatives



PDF available at
12DaysinMarch.com

Tutorial Services
(check website for details)

Howard J. Sachs, MD
Associate Professor of Medicine
University of Massachusetts Medical School
www.12DaysinMarch.com
E-mail: Howard@12daysinmarch.com

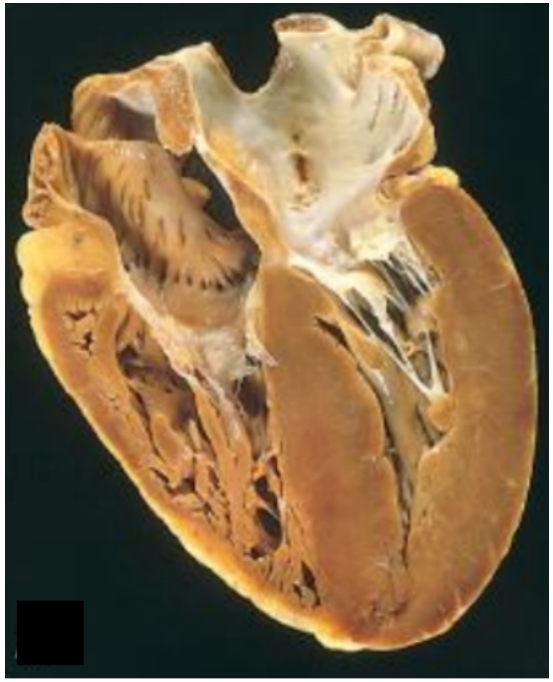
Heart Failure for USMLE Step One

- Definitions
- Key principles & language
- Core derivatives & concepts
  - S3
  - Rales
  - PCWP
  - JVP

Definitions

Heart **Failure**:
Not meeting the perfusion requirements for blood and oxygen

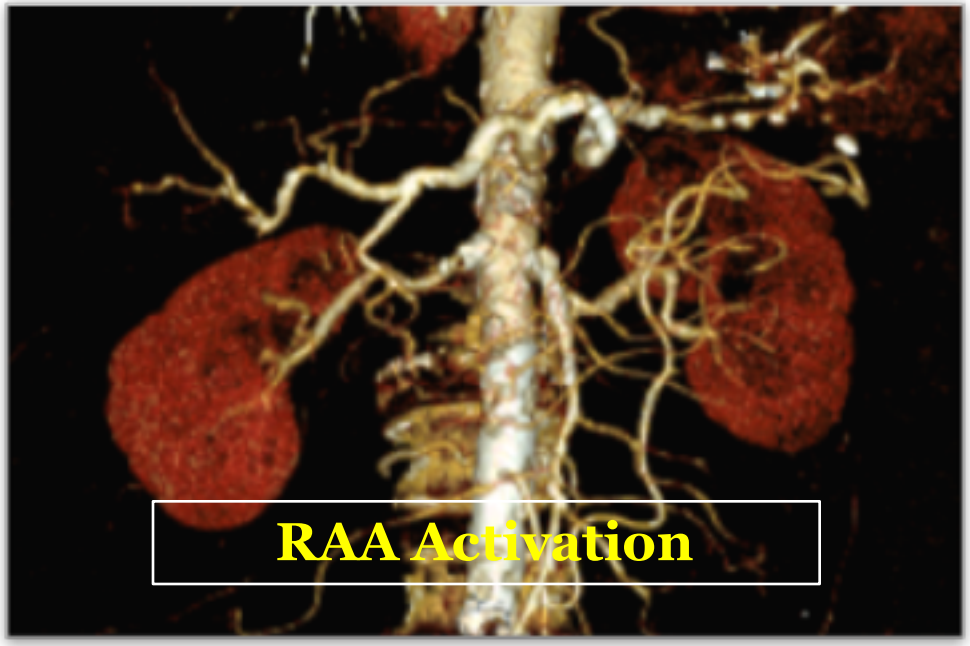
HF**r**EF: ↓ systolic function



HF**p**EF: diastolic dysfunction

Definitions

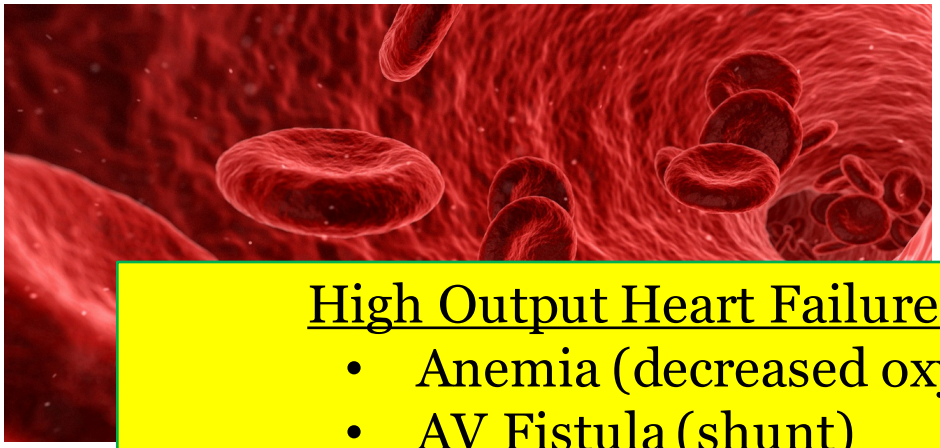
Heart **Failure**:
Not meeting the perfusion requirements for blood and oxygen

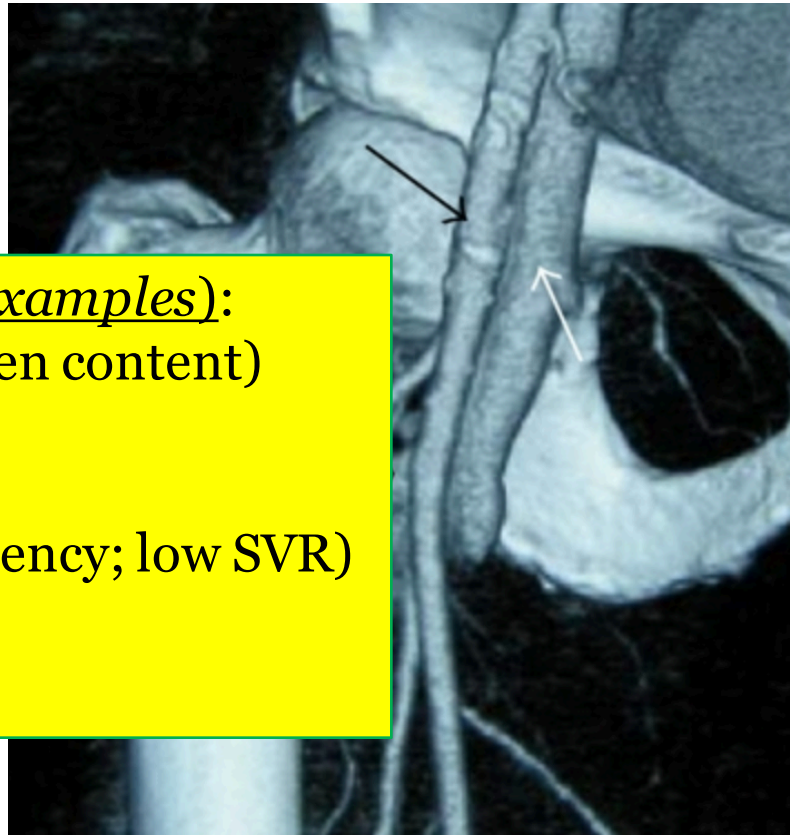


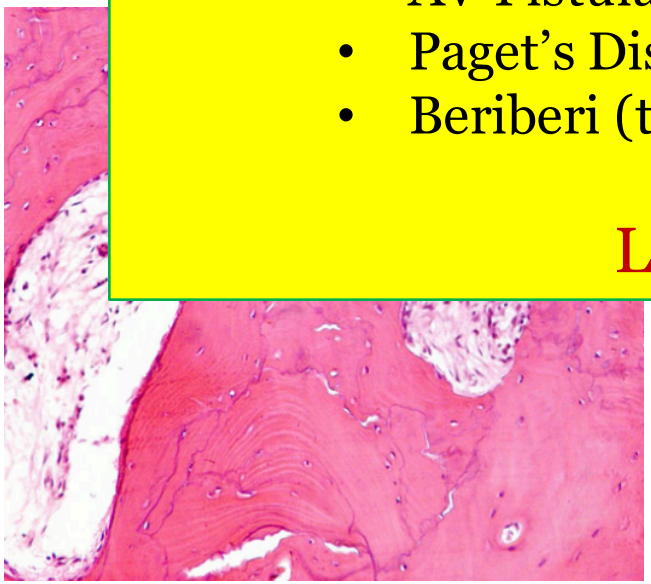
Neurohumoral Activation ➛ ↑ TPR_{Ω}

Definitions

Heart **Failure**:
Not meeting perfusion requirements for blood and oxygen







High Output Heart Failure (*examples*):

- Anemia (decreased oxygen content)
- AV Fistula (shunt)
- Paget's Disease (shunt)
- Beriberi (thiamine deficiency; low SVR)

Low TPR_{Ω}

Definitions

Heart **Failure**:
Not meeting perfusion requirements for blood and oxygen

HFrEF: ↓ systolic function

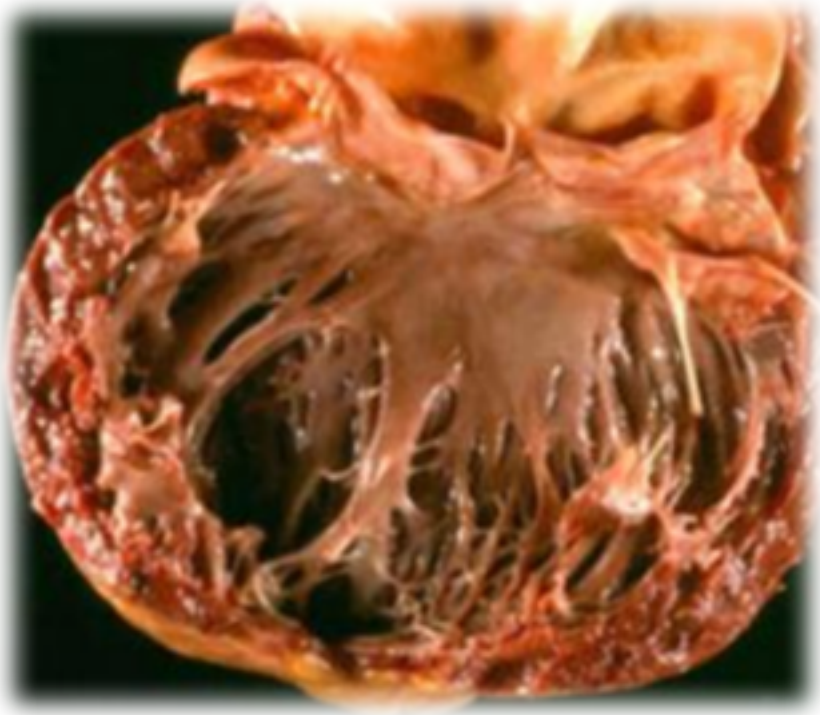
HFpEF: diastolic dysfunction

High Output Heart Failure (*examples*):

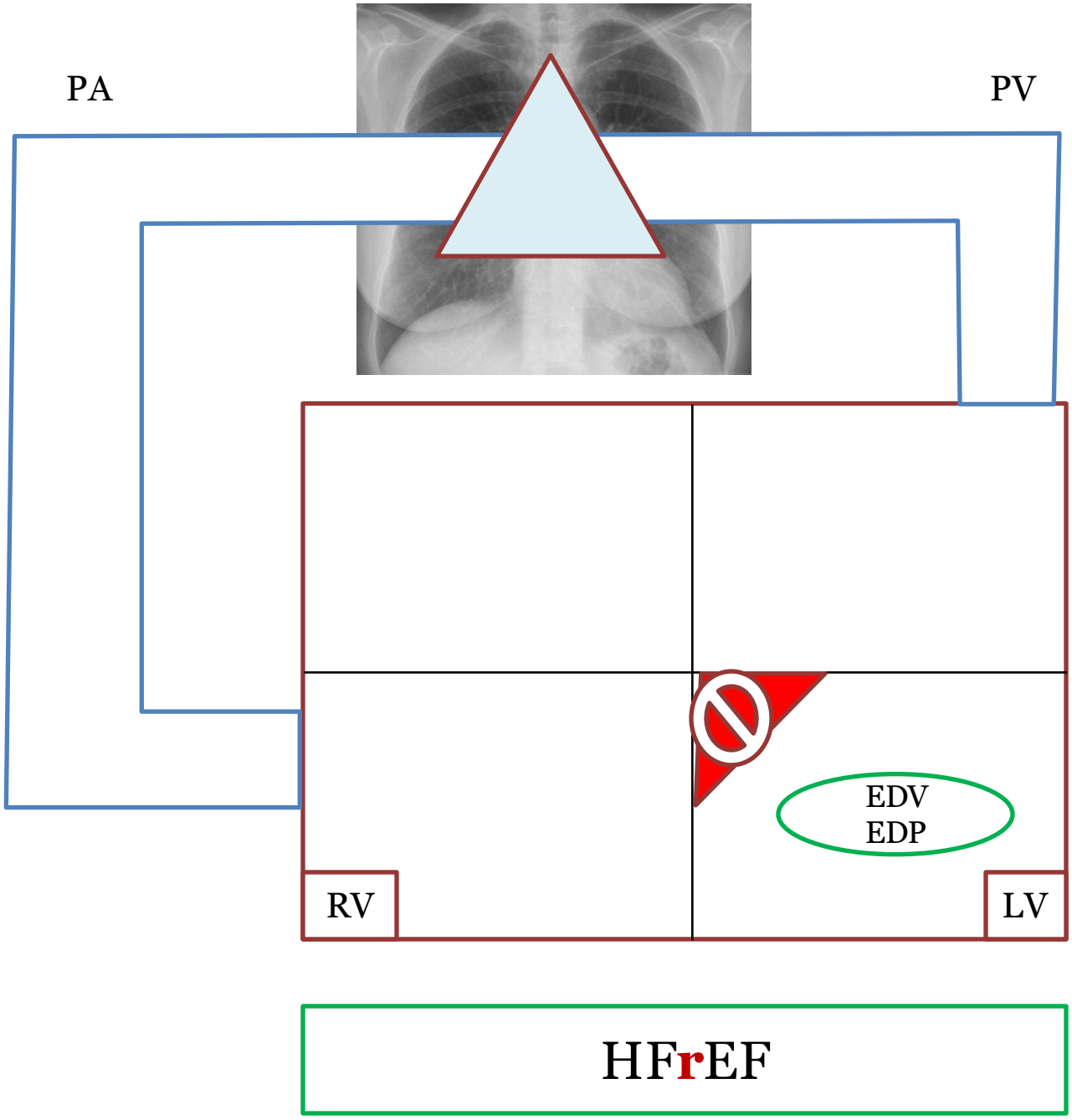
- Anemia (decreased oxygen content)
- AV Fistula (shunt)
- Paget's Disease (shunt)
- Beriberi (thiamine deficiency; low SVR)

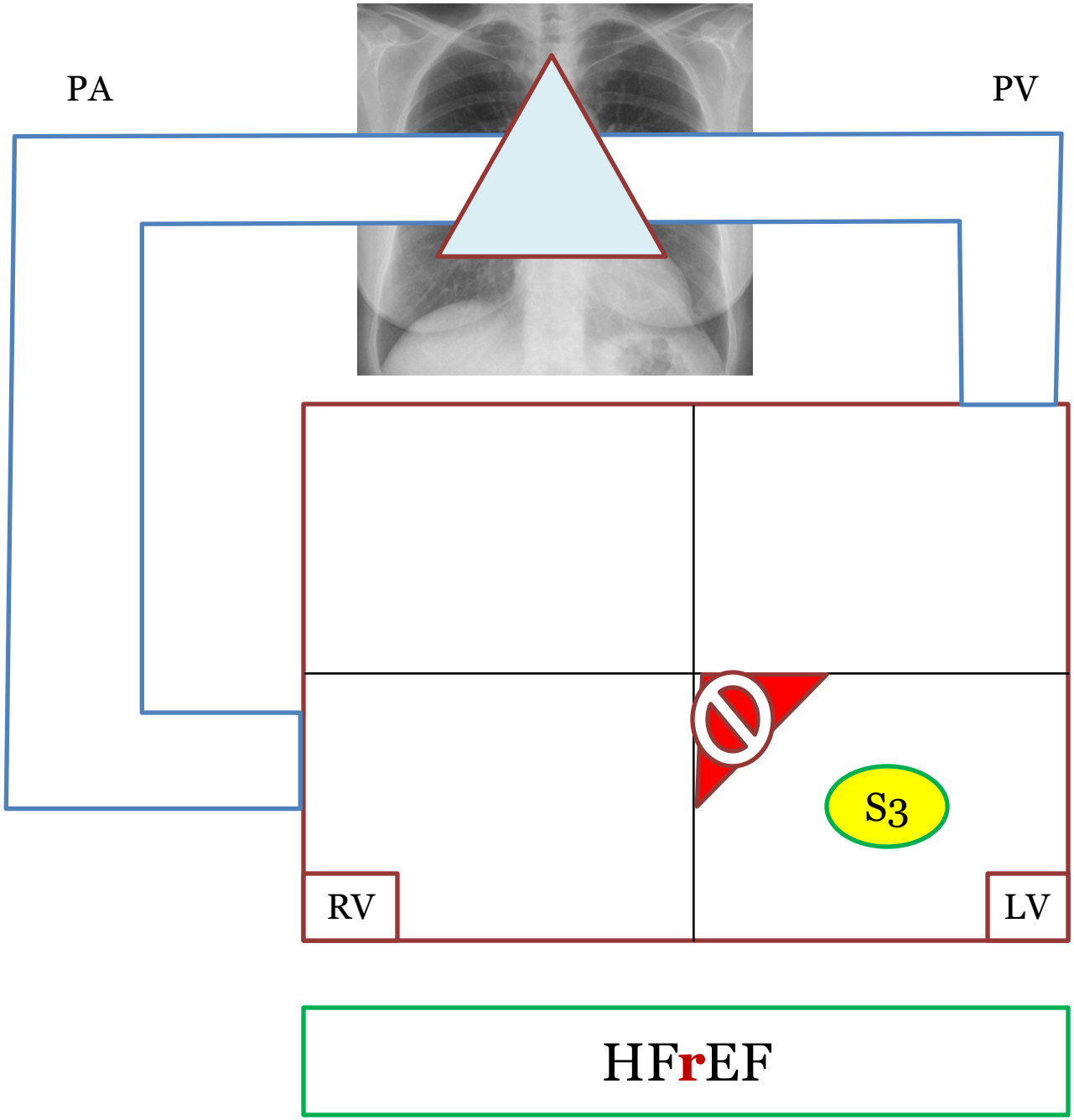
Low TPR_{Ω}

Congestive (Left) Heart Failure
has a unique *Language* with unique *Derivatives*



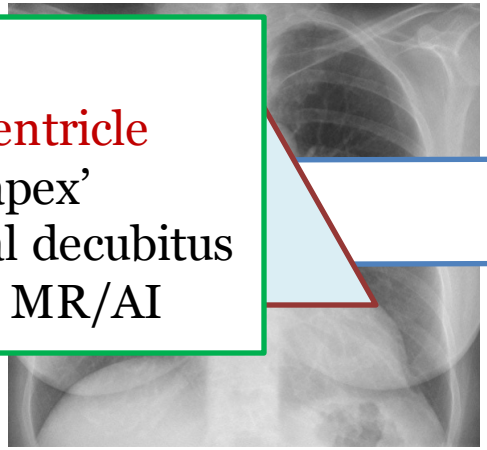
HFrEF
(*Left-sided* Heart Failure with reduced Ejection Fraction)


PA
PV
EDV
EDP
RV
LV
HFrEF

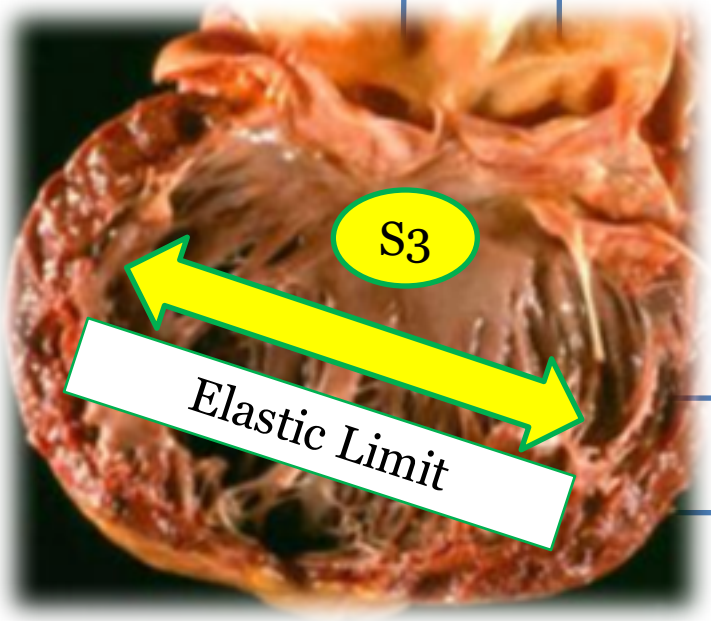

PA
PV
S3
RV
LV
HFrEF

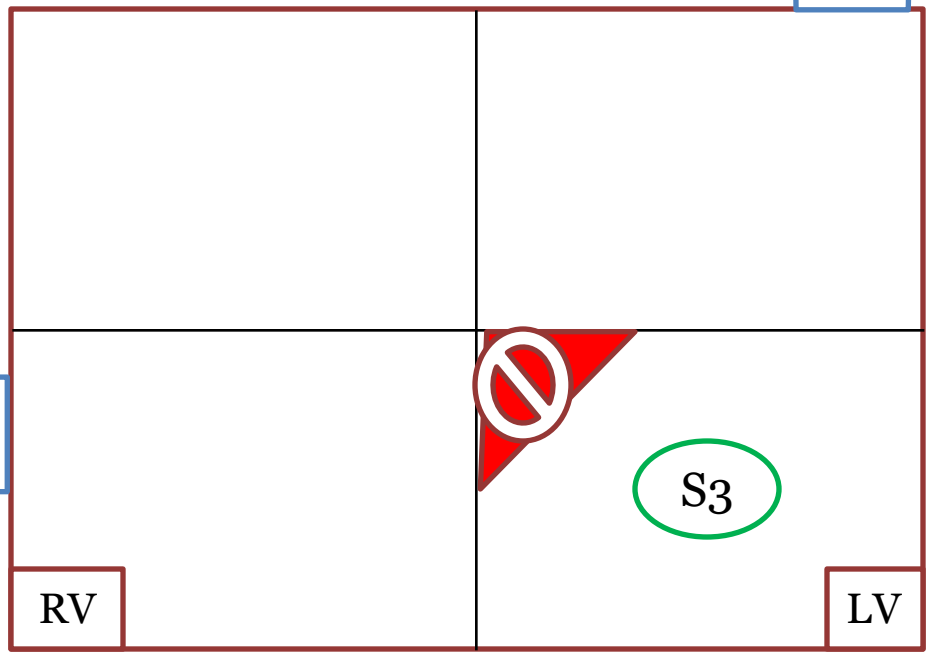
S3 *Heart Sound*

- Blood entering a volume overloaded ventricle
- 'An extra heard sound is heard at the apex'
- Early diastolic; heard best in left lateral decubitus
- *Negative prognosticator*, especially in MR/AI



PV



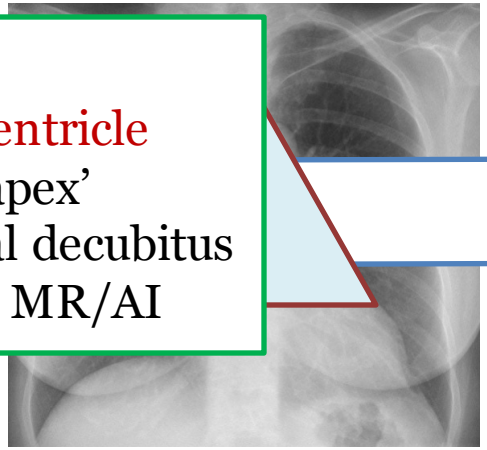


S3 is Boardspeak for CHF

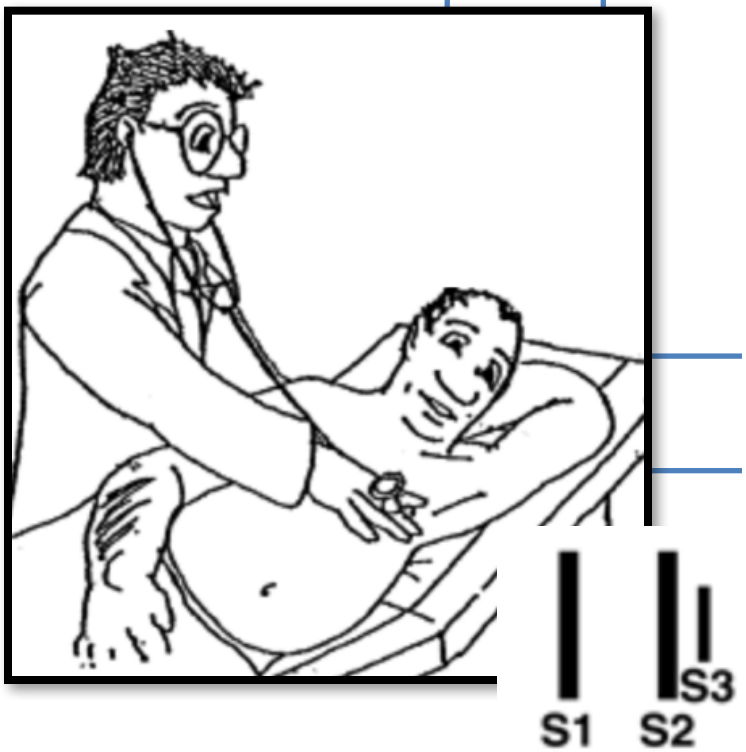
HFrEF

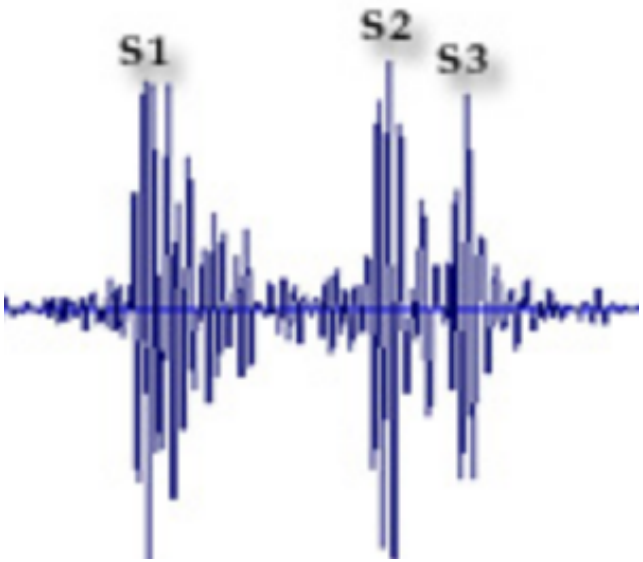
S3 *Heart Sound*

- Blood entering a volume overloaded ventricle
- 'An extra heard sound is heard at the apex'
- Early diastolic; heard best in left lateral decubitus
- *Negative prognosticator*, especially in MR/AI



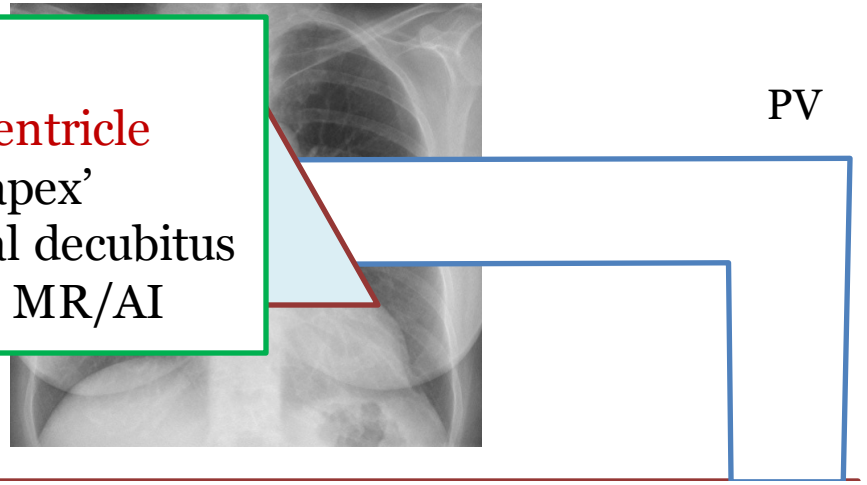
PV





S3 *Heart Sound*

- Blood entering a volume overloaded ventricle
- 'An extra heard sound is heard at the apex'
- Early diastolic; heard best in left lateral decubitus
- *Negative prognosticator*, especially in MR/AI



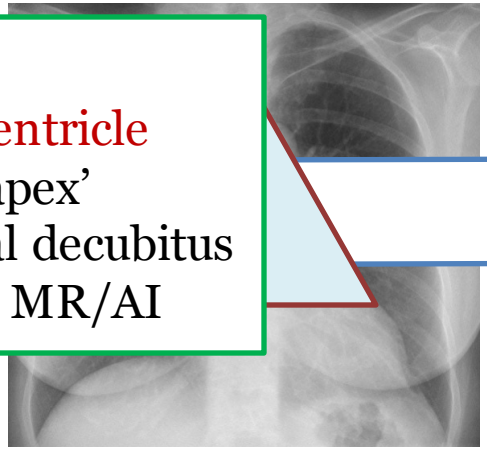
Left Lateral Decubitus, End-expiration:

- Brings heart closer to chest wall,
- Reduces amount of air in lungs

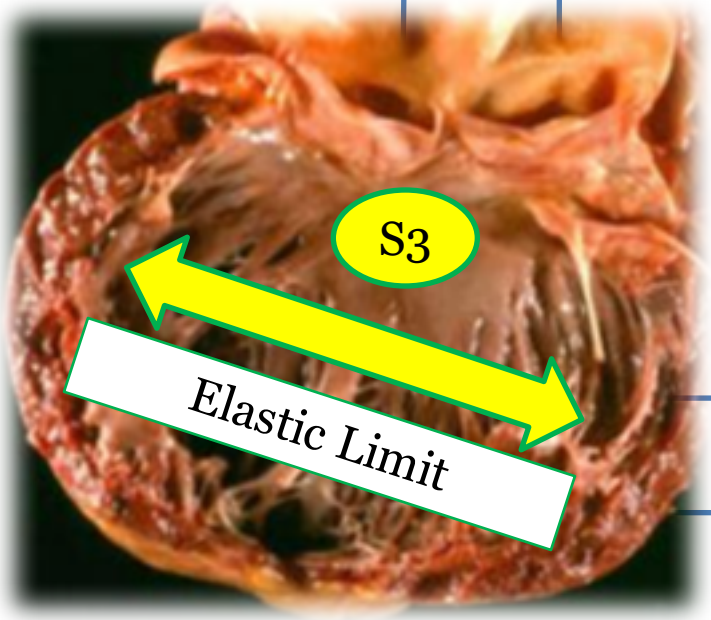
These 'maneuvers' simply makes it easier to hear!

S3 *Heart Sound*

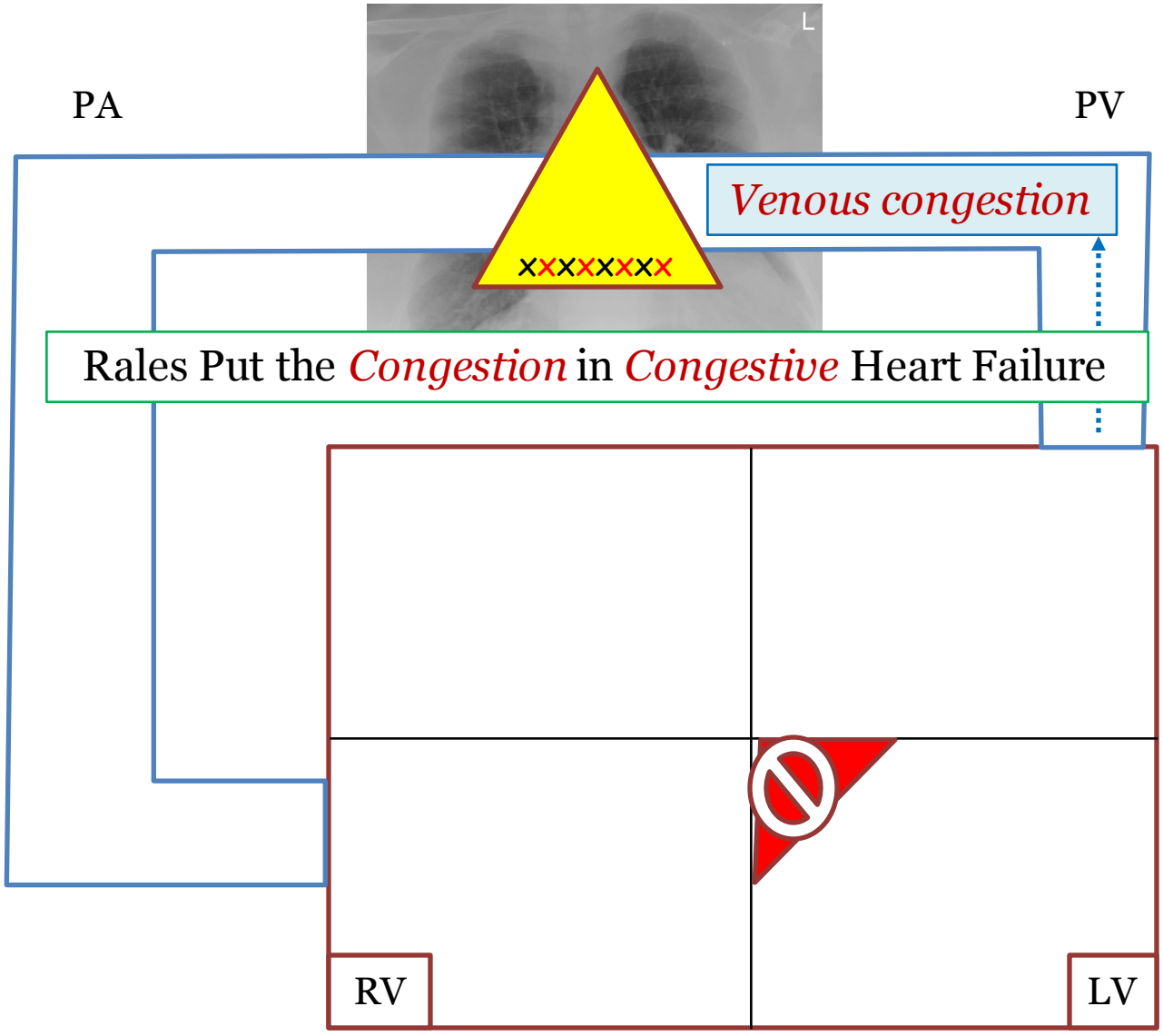
- Blood entering a volume overloaded ventricle
- 'An extra heard sound is heard at the apex'
- Early diastolic; heard best in left lateral decubitus
- *Negative prognosticator*, especially in MR/AI



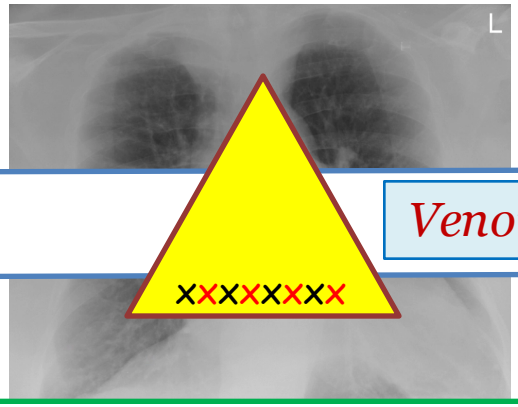
PV



HF**r**EF



Left-Sided Congestive Heart Failure



PA

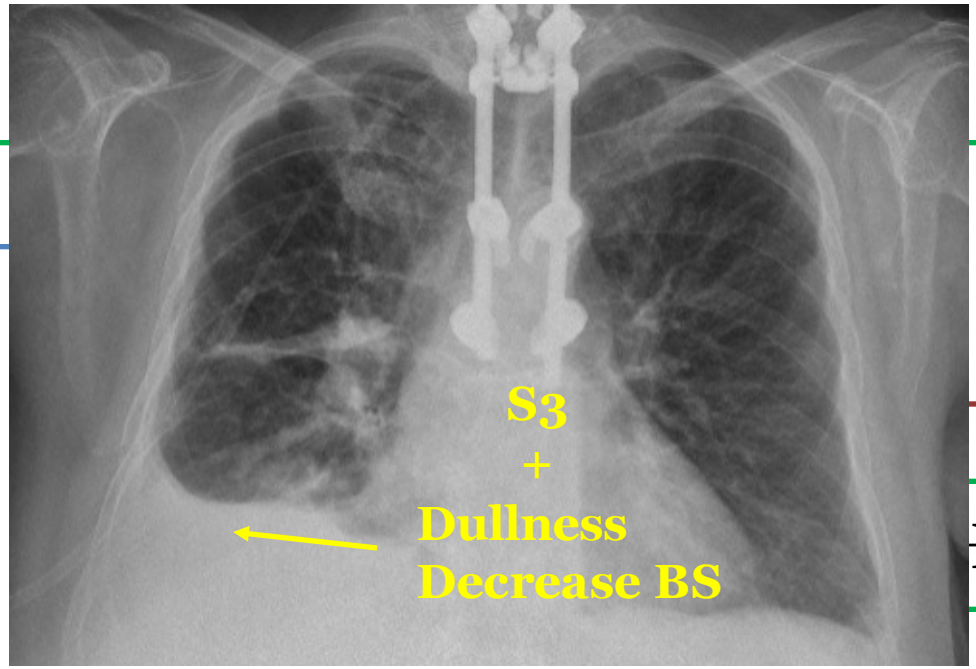
PV

Venous congestion

xxxxxxxx

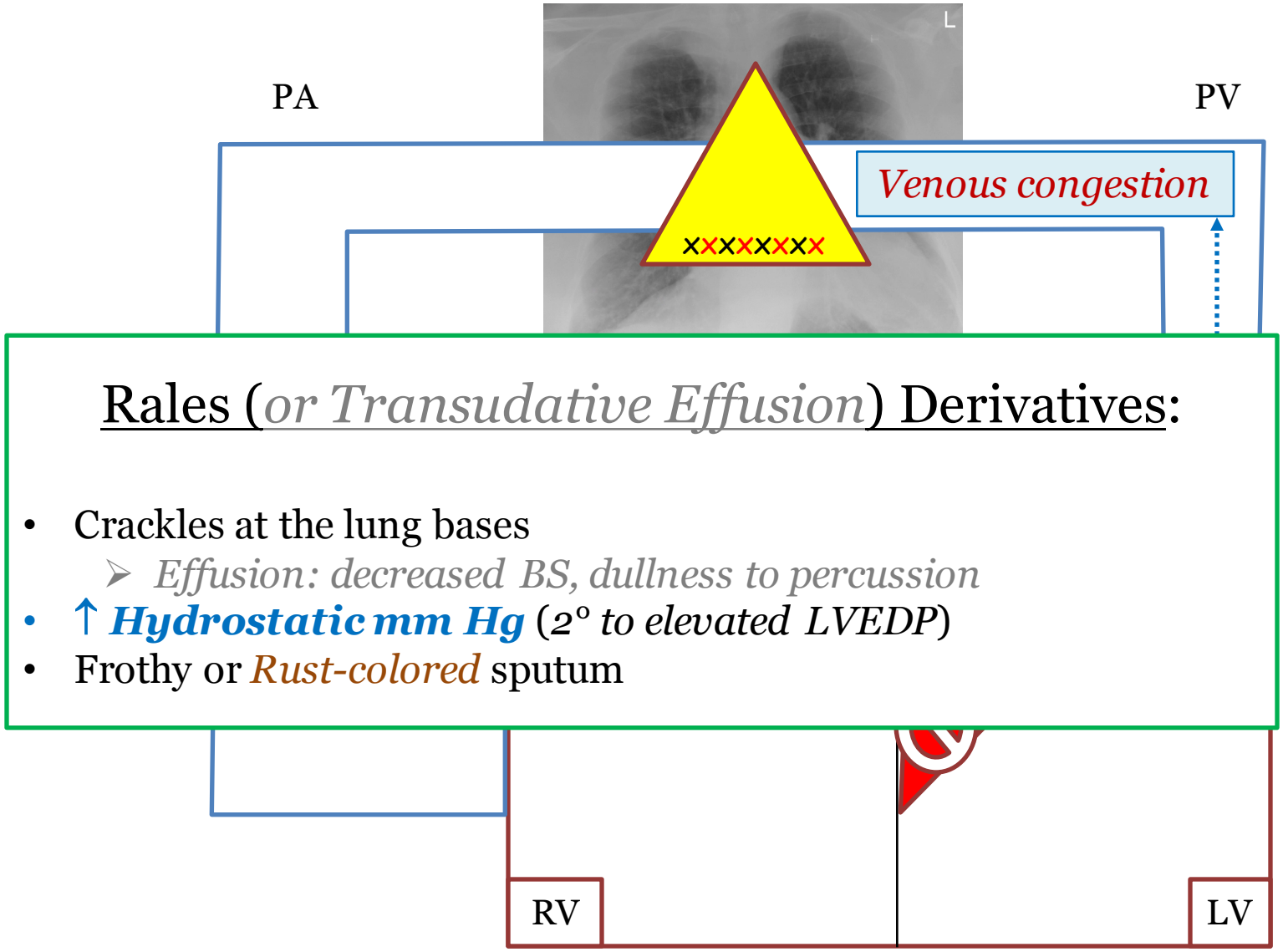
Rales (*or Transudative Effusion*) Derivatives:

- Crackles at the lung bases
  - ➢ Effusion: *decreased BS, dullness to percussion*



LV

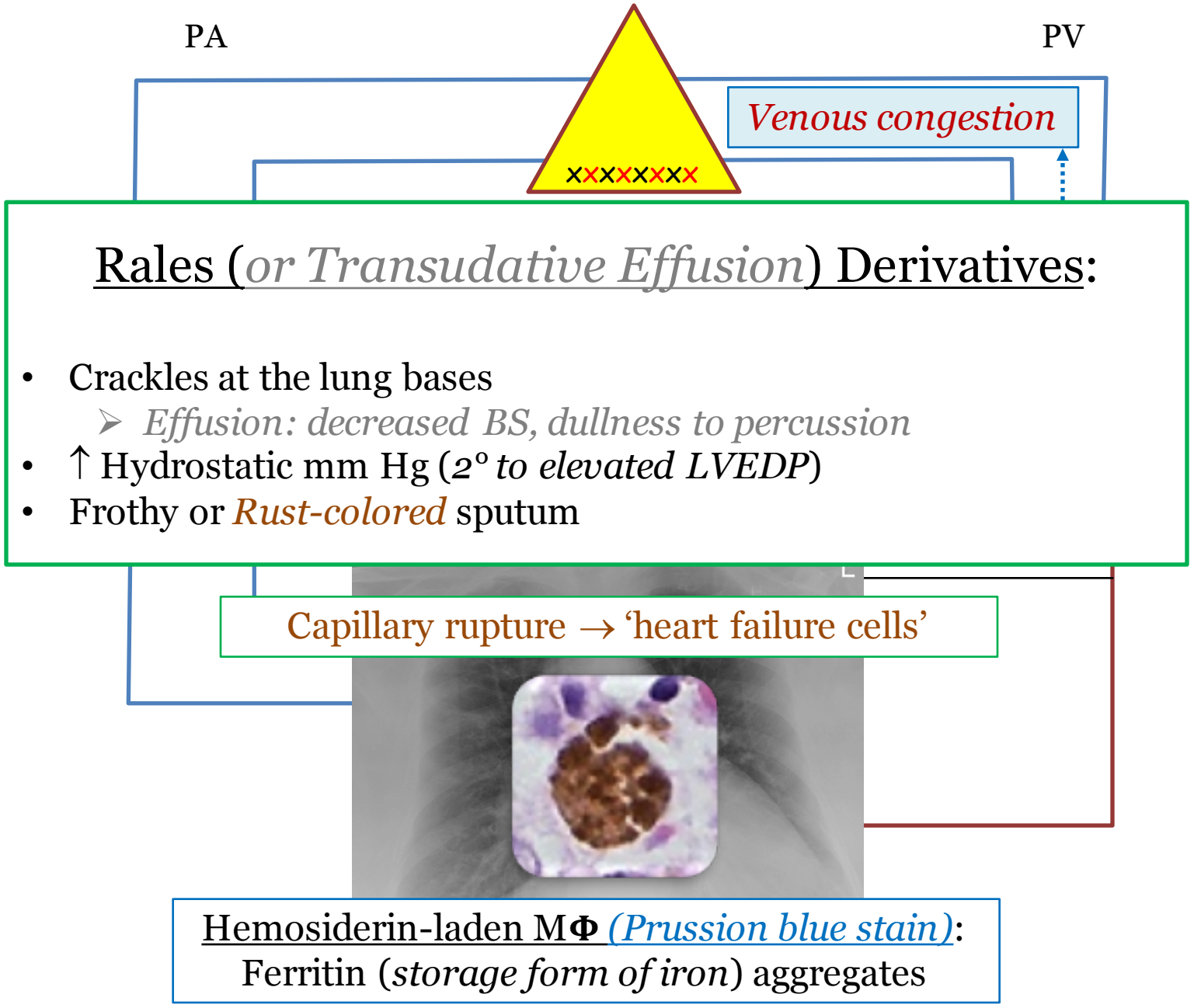
Heart Failure

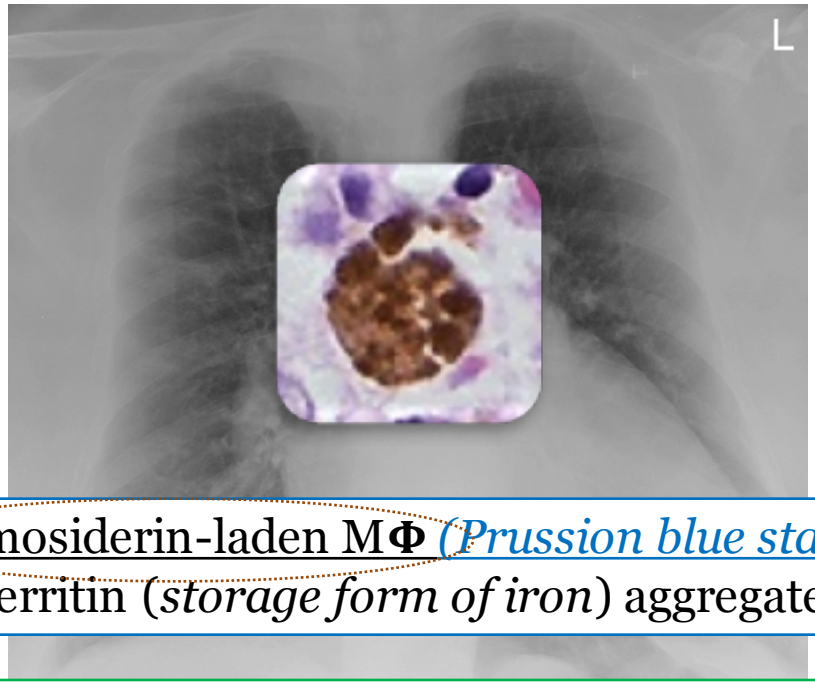


Rales (*or Transudative Effusion*) Derivatives:

- Crackles at the lung bases
  - *Effusion: decreased BS, dullness to percussion*
- ↑ ***Hydrostatic mm Hg*** (*2° to elevated LVEDP*)
- Frothy or *Rust-colored* sputum

Left-Sided Congestive Heart Failure

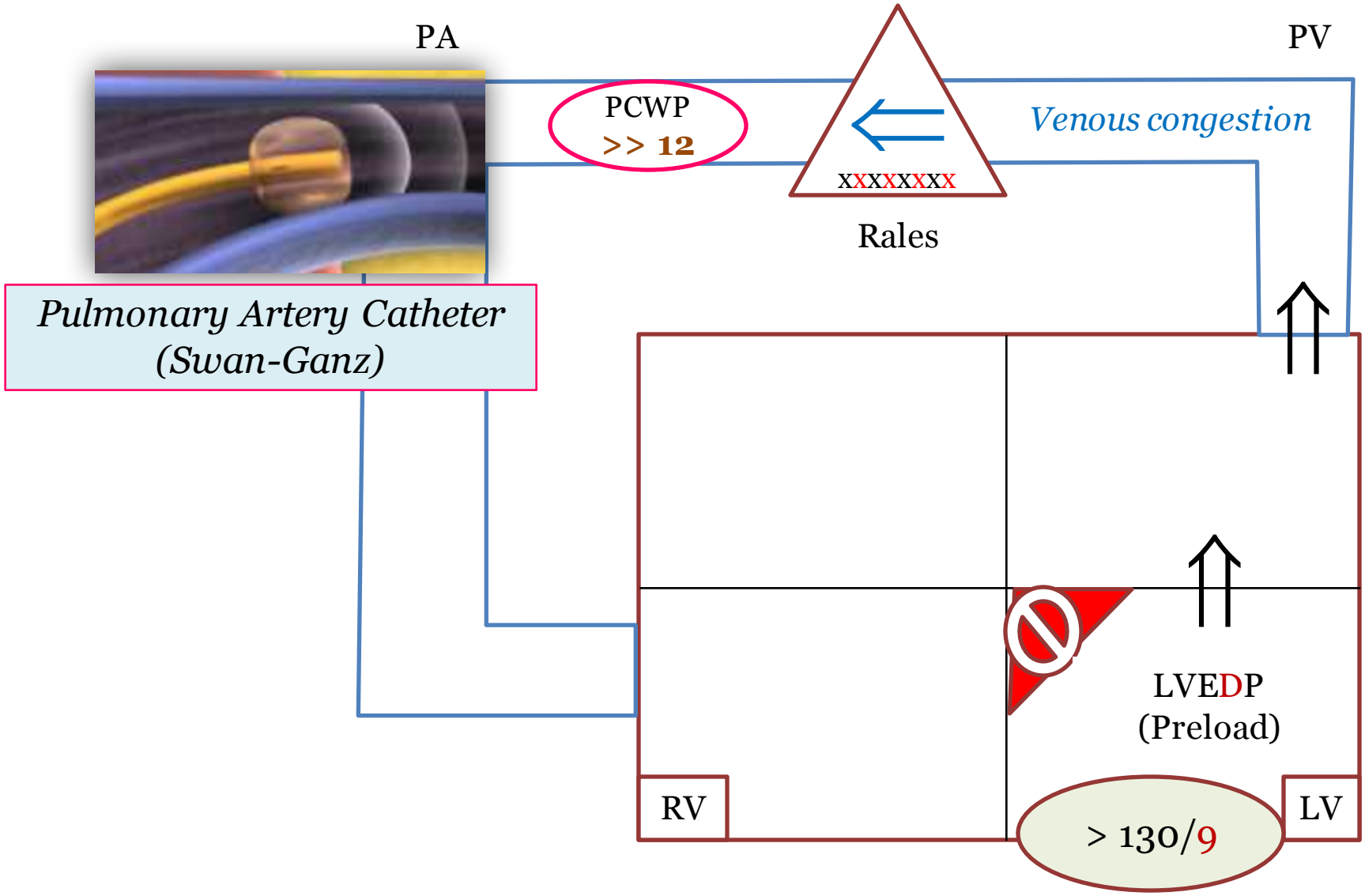

PA
PV
Venous congestion
xxxxxxxx
Rales (or Transudative Effusion) Derivatives:
• Crackles at the lung bases
➢ Effusion: decreased BS, dullness to percussion
• ↑ Hydrostatic mm Hg (2° to elevated LVEDP)
• Frothy or Rust-colored sputum
Capillary rupture → 'heart failure cells'
Hemosiderin-laden MΦ (Prussion blue stain):
Ferritin (storage form of iron) aggregates

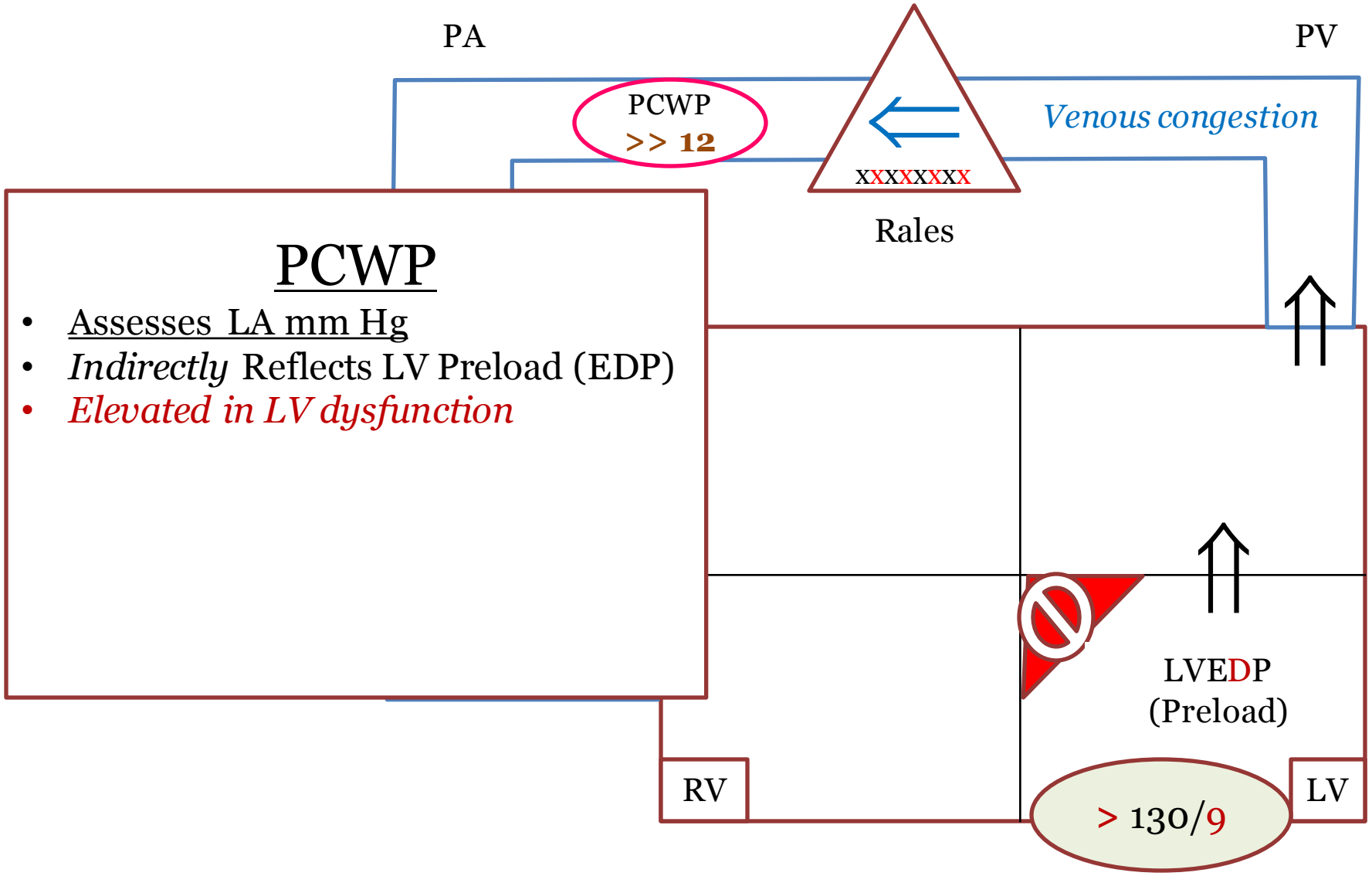


Hemosiderin-laden MΦ *(Prussion blue stain)*:
Ferritin (*storage form of iron*) aggregates

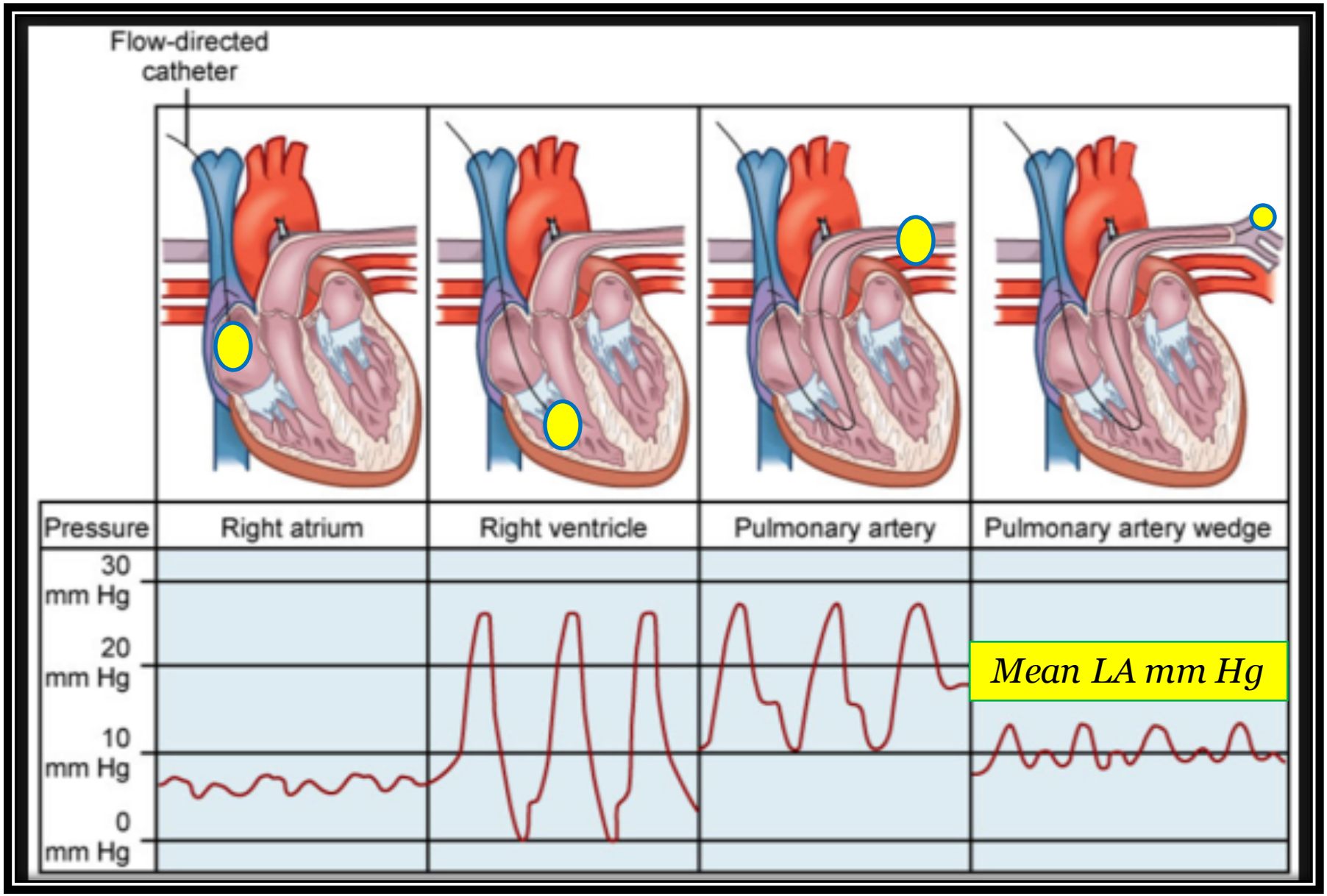
Patient noted at autopsy with *hemosiderin-laden* MΦ. Which of the following were present prior to patient's death?

- Elevated hydrostatic mm Hg
- Proximal LAD lesion with occlusive thrombus
- Increased EDV/EDP/Preload
- Reduced CO/SV

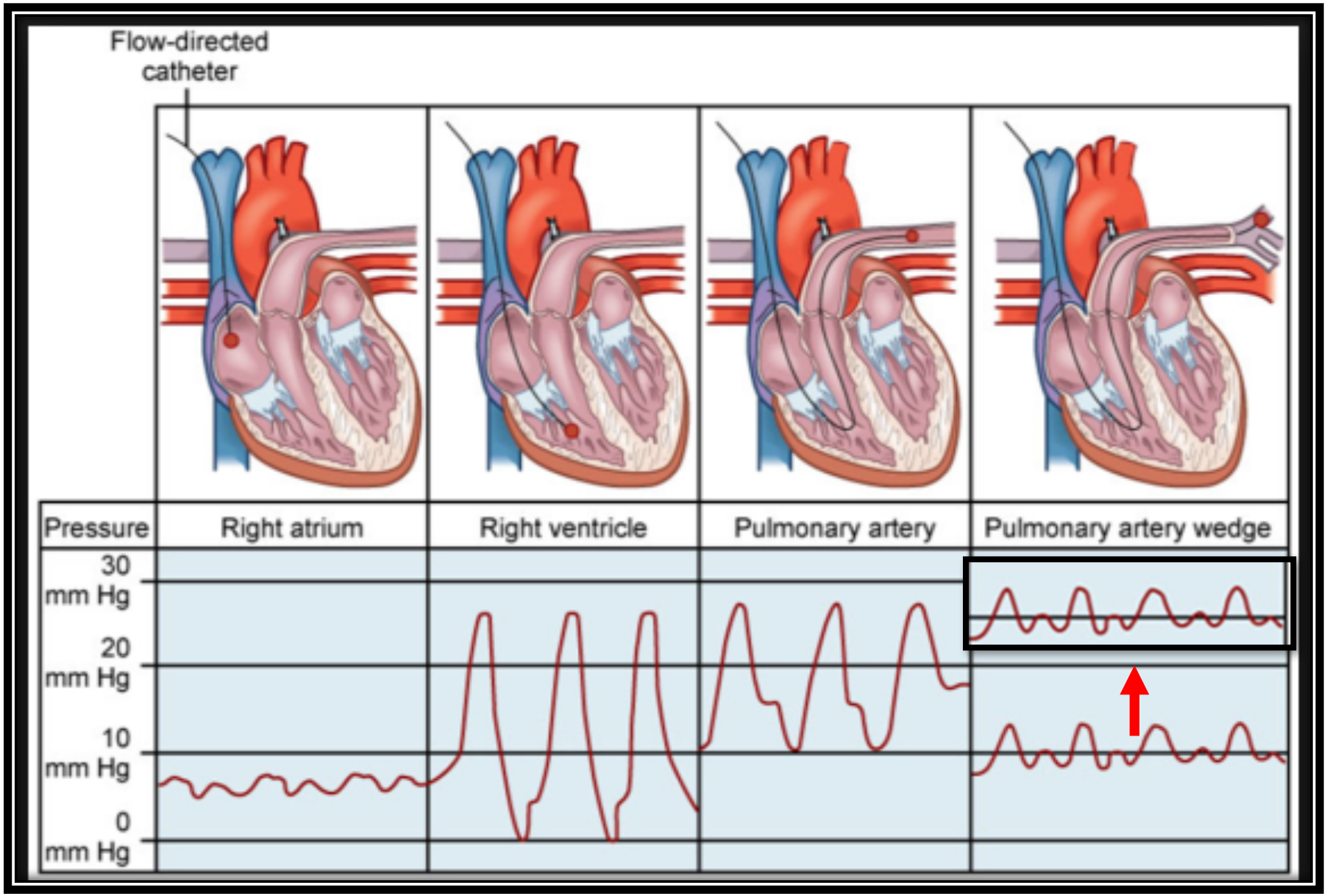

PA
PV
PCWP
>> 12
xxxxxxxx
Rales
Venous congestion
Pulmonary Artery Catheter
(Swan-Ganz)
LVEDP
(Preload)
RV
LV
> 130/9

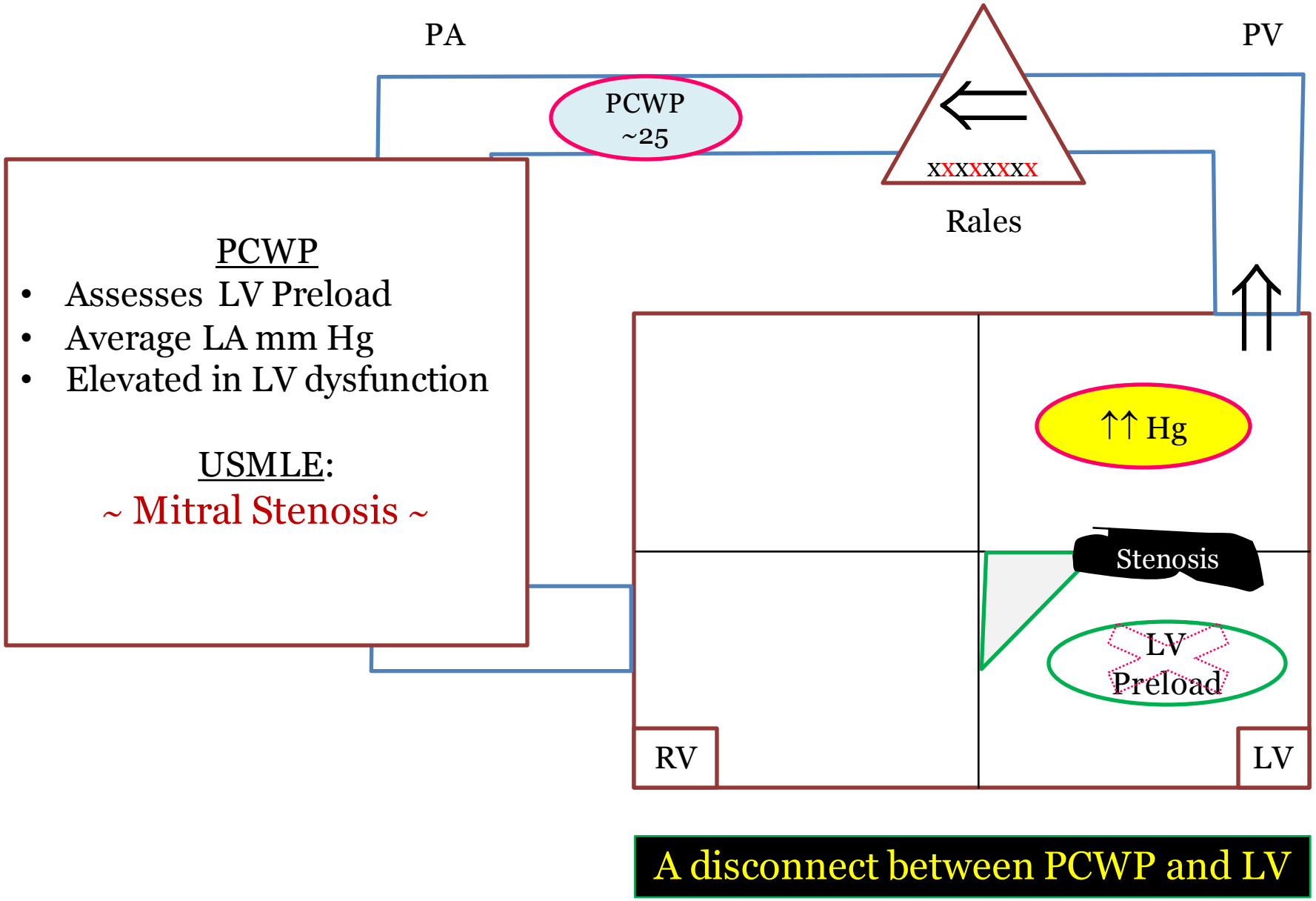

PA
PV
PCWP
>> 12
Venous congestion
xxxxxxxx
Rales
PCWP
Assesses LA mm Hg
Indirectly Reflects LV Preload (EDP)
Elevated in LV dysfunction
LVEDP
(Preload)
RV
LV
> 130/9

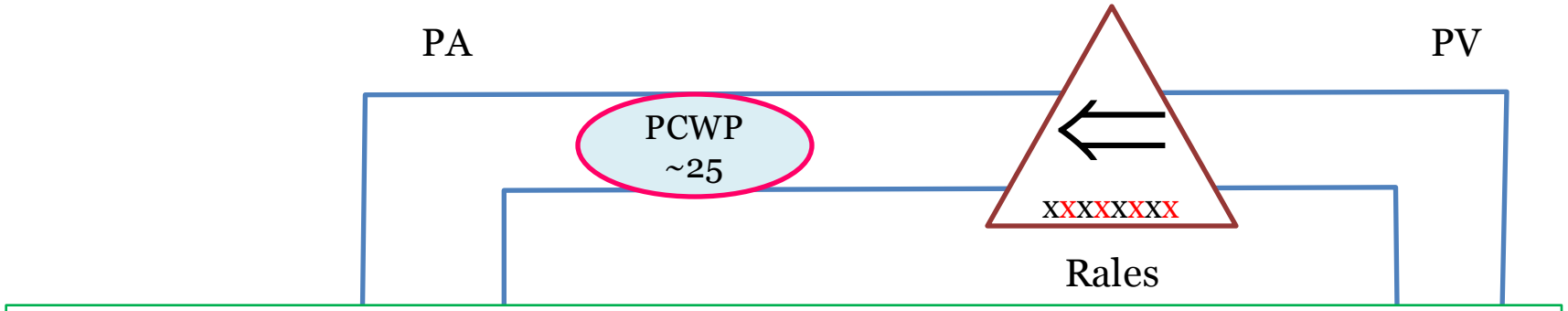
Normal pressures, waveforms. Note the catheter balloon being floated out to the pulmonary artery. When inflated, it gives 'wedge' pressure



In CHF, the PCWP rises *reflecting the elevated LVEDP*



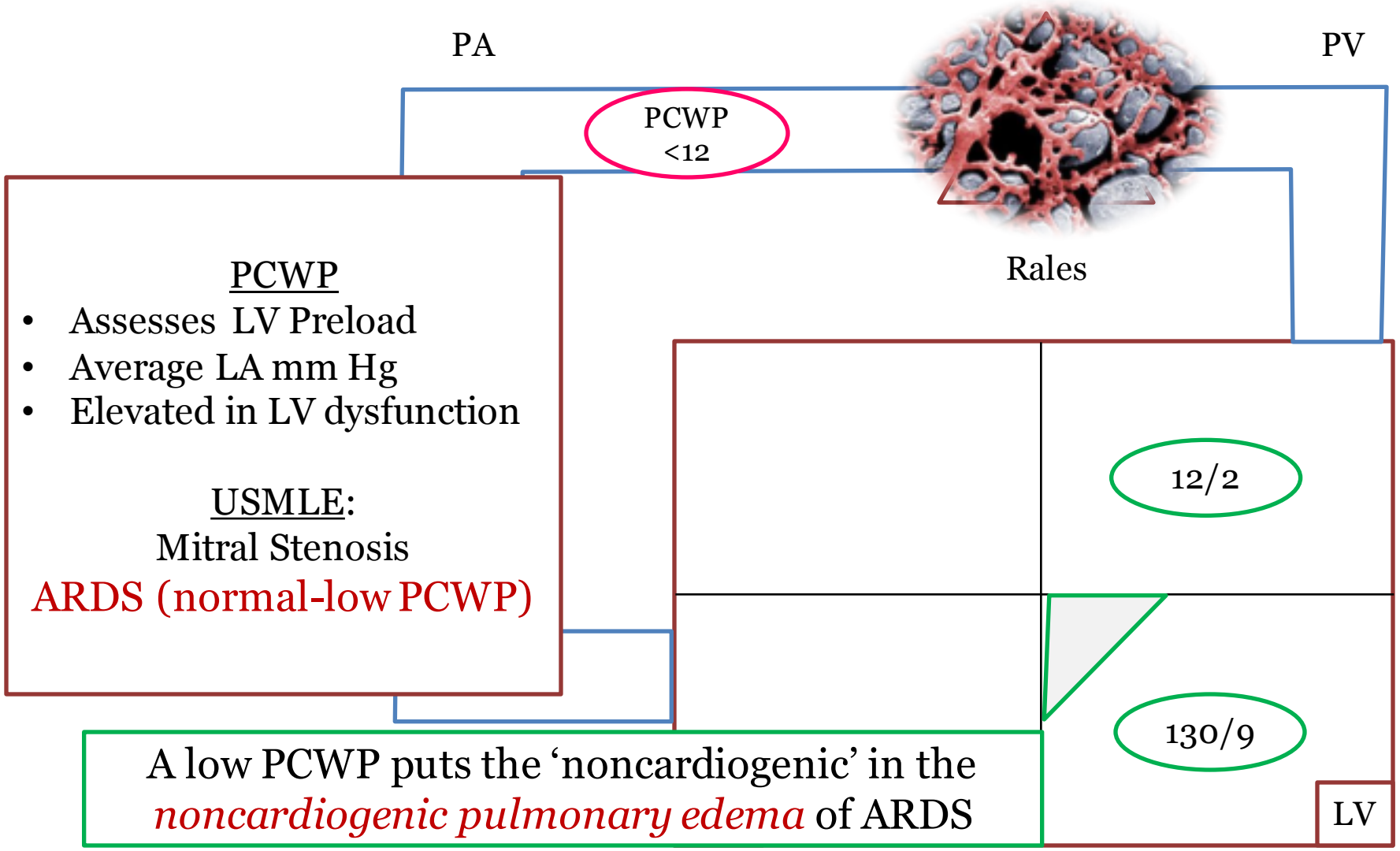

PA
PV
PCWP
~25
xxxxxxxx
Rales
PCWP
• Assesses LV Preload
• Average LA mm Hg
• Elevated in LV dysfunction
USMLE:
~ Mitral Stenosis ~
↑↑ Hg
Stenosis
LV
Preload
RV
LV
A disconnect between PCWP and LV



Mitral Stenosis Derivative:

Patient presents with SOB. PE: (+) JVD, lung bibasilar crackles
Further investigation reveals a PCWP of 25 mm Hg and LV pressure of 130/9.
What is the most likely diagnosis/cause/finding?

Dx: Mitral Stenosis
Cause: Repeated bouts of GAS (S pyogenes) infection
Finding: Opening Snap/Diastolic rumble at the apex



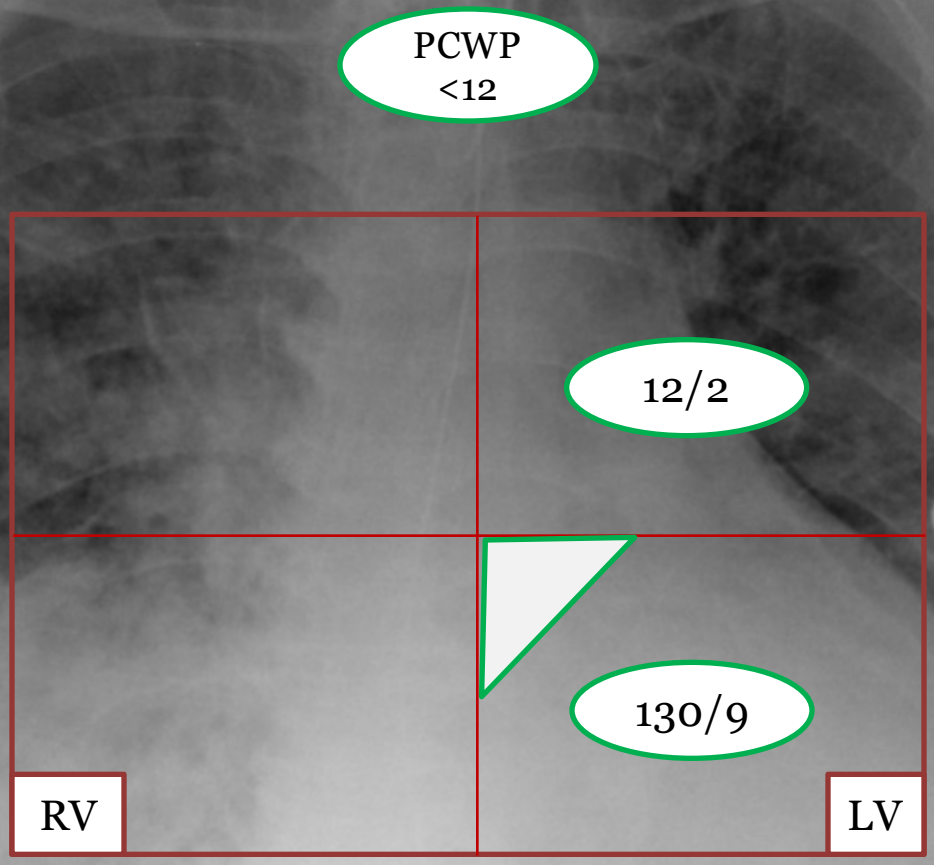
PCWP

- Assesses LV Preload
- Average LA mm Hg
- Elevated in LV dysfunction

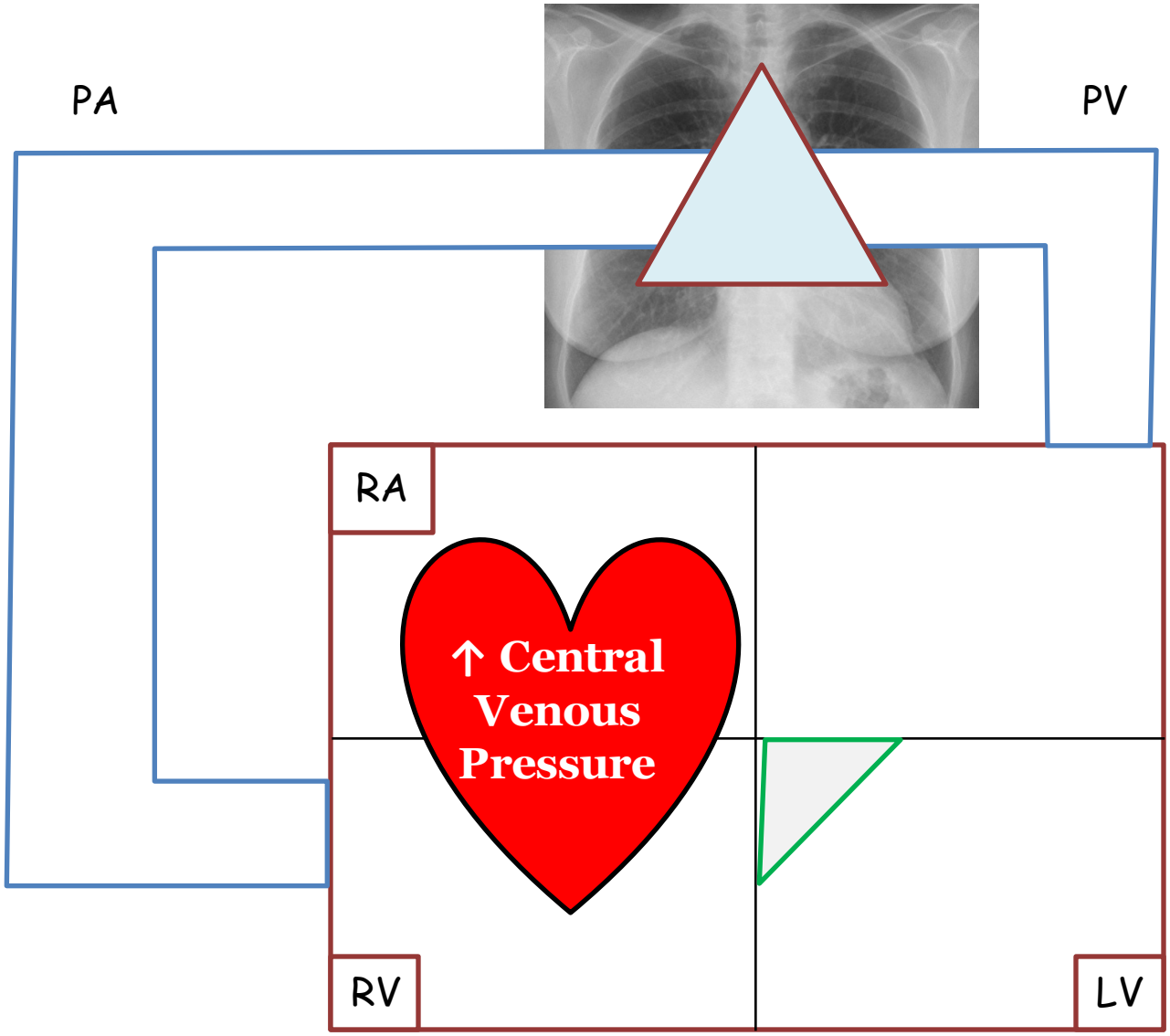
USMLE:
Mitral Stenosis
ARDS (normal-low PCWP)

A low PCWP puts the 'noncardiogenic' in the *noncardiogenic pulmonary edema* of ARDS

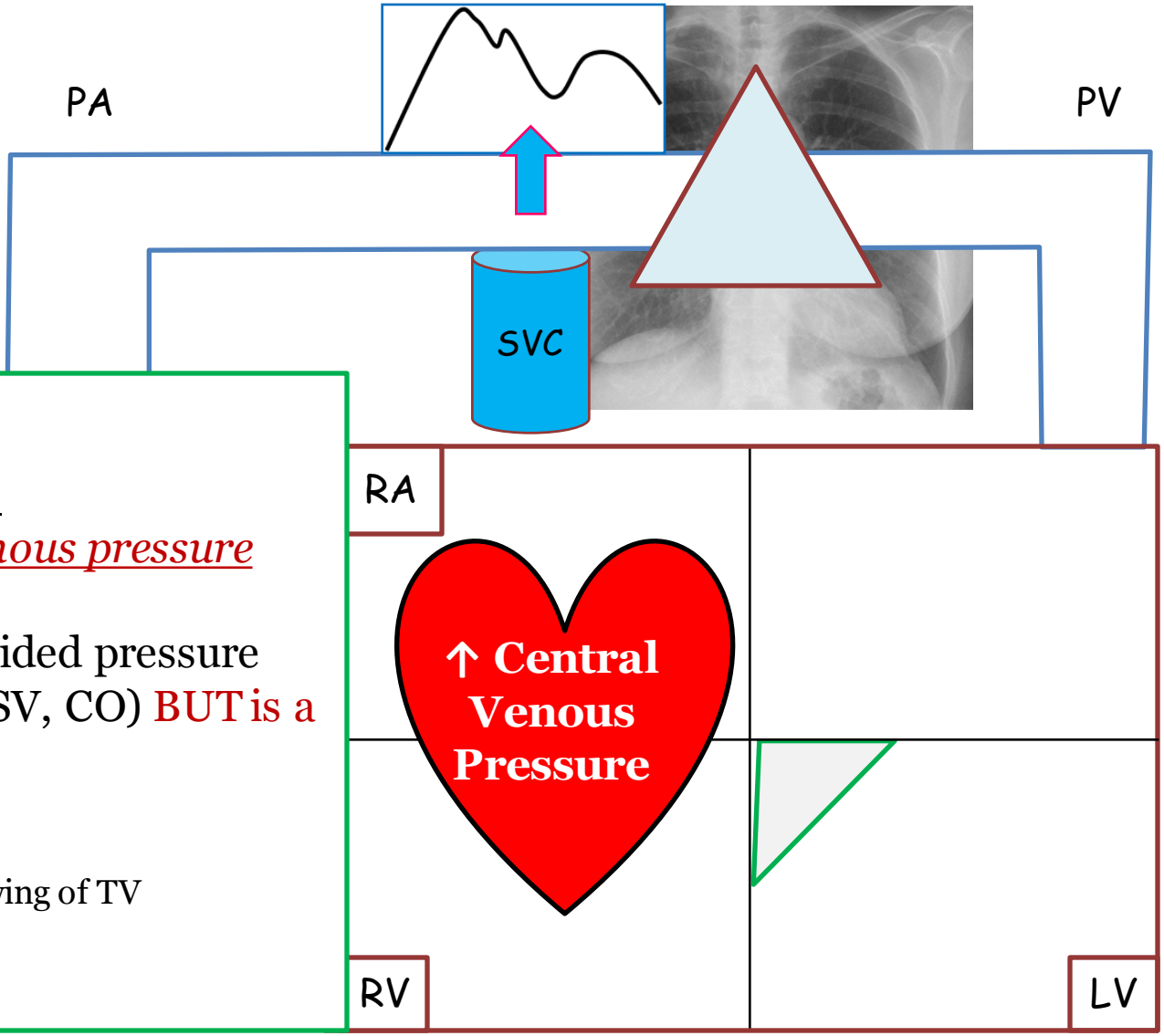
↑ Capillary Permeability (leak) NOT ↑ Hydrostatic Pressure



A low PCWP puts the 'noncardiogenic' in the *noncardiogenic pulmonary edema* of ARDS



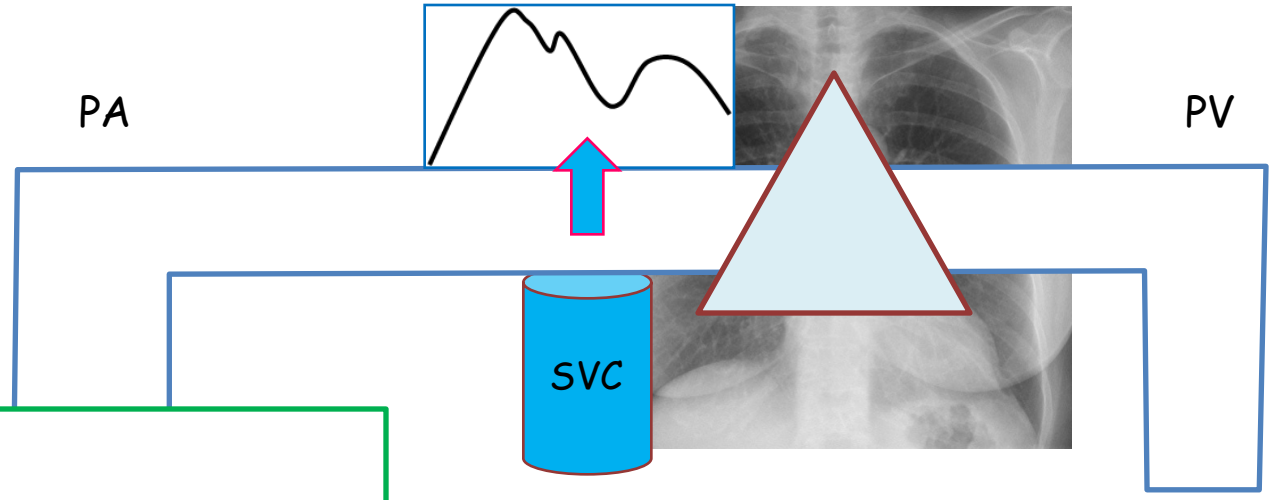
Right-sided Congestive Heart Failure



JVP

- Reflects *central venous pressure*
- Influenced by left-sided pressure determinates (*e.g.* SV, CO) BUT is a measure of CVP

A – Atrial contraction
C – RV contraction with bowing of TV
V – Venous return



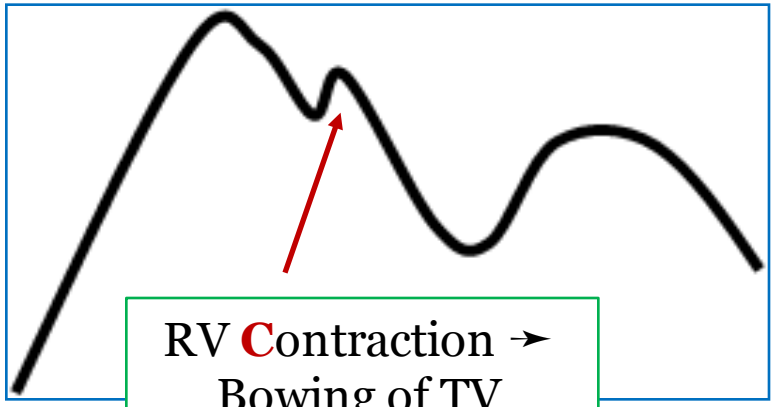
JVP

- Reflects central venous pressure
- Influenced by left-sided pressure determinates (*e.g.* SV, CO) BUT is a measure of CVP

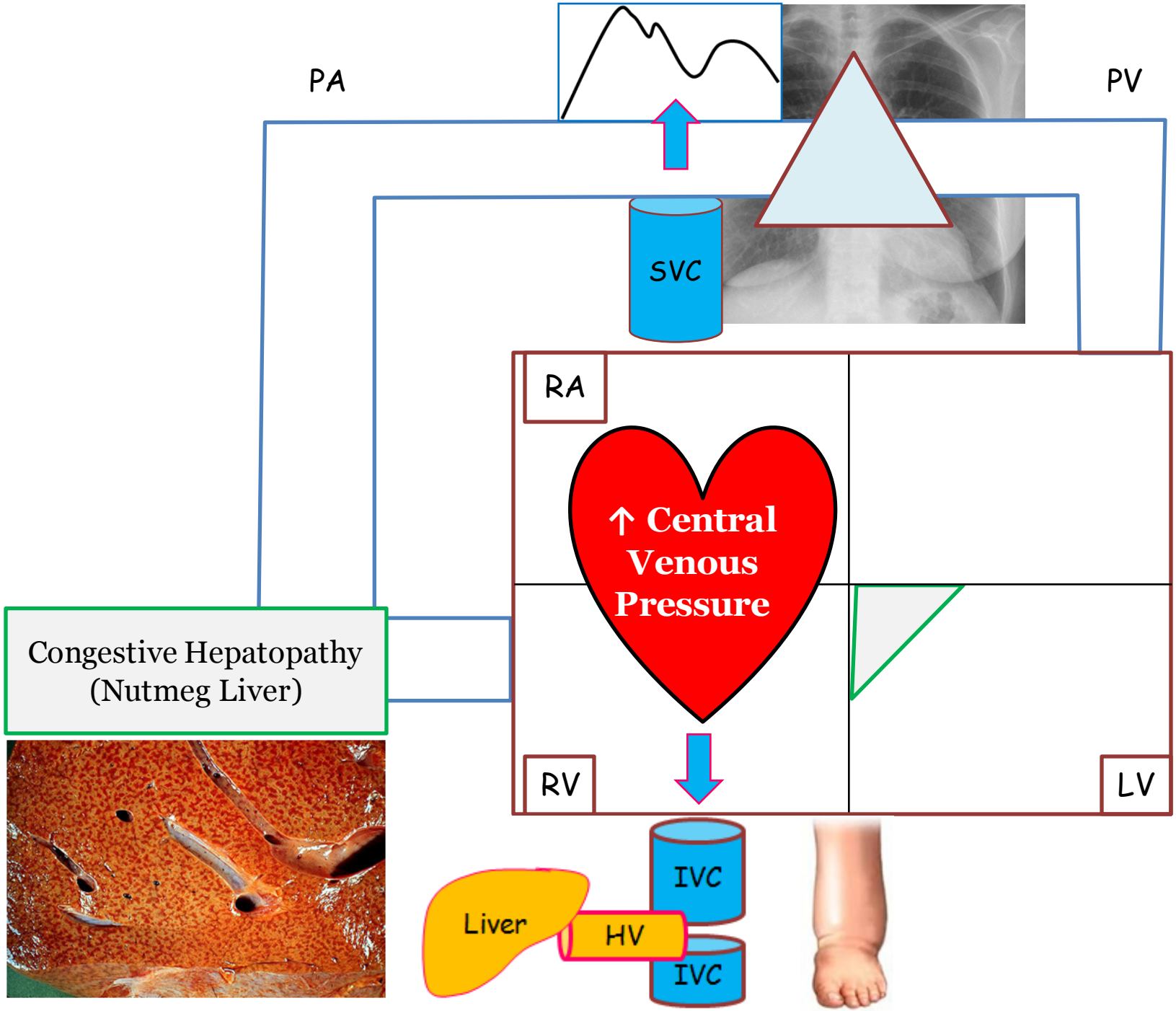
A – Atrial contraction
C – RV contraction with bowing of TV
V – Venous return

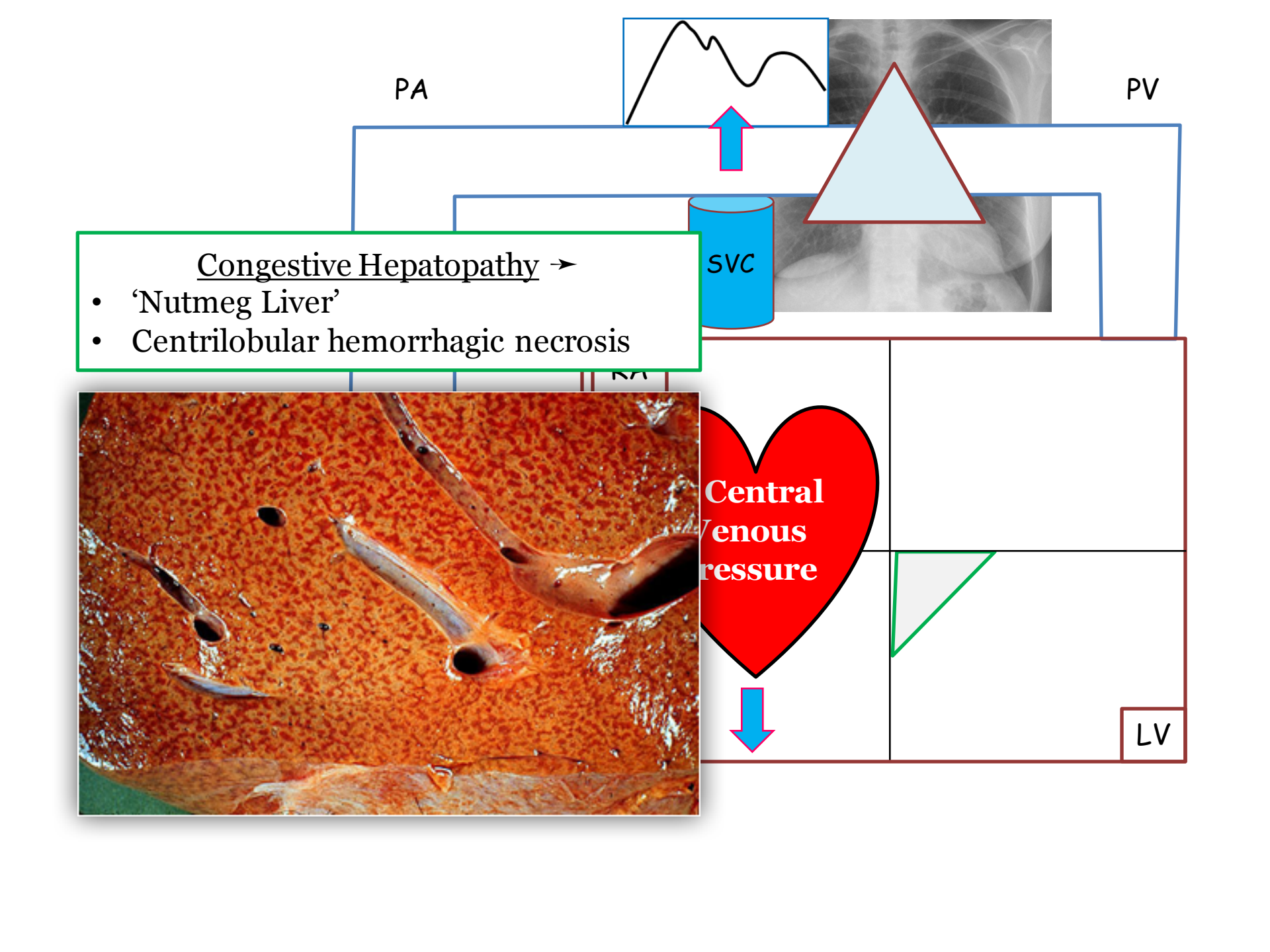
Atrial Contraction

Venous Return



RV **C**ontraction → Bowing of TV


PA
PV
SVC
RA
↑ Central Venous Pressure
RV
LV
Congestive Hepatopathy (Nutmeg Liver)
IVC
Liver
HV
IVC



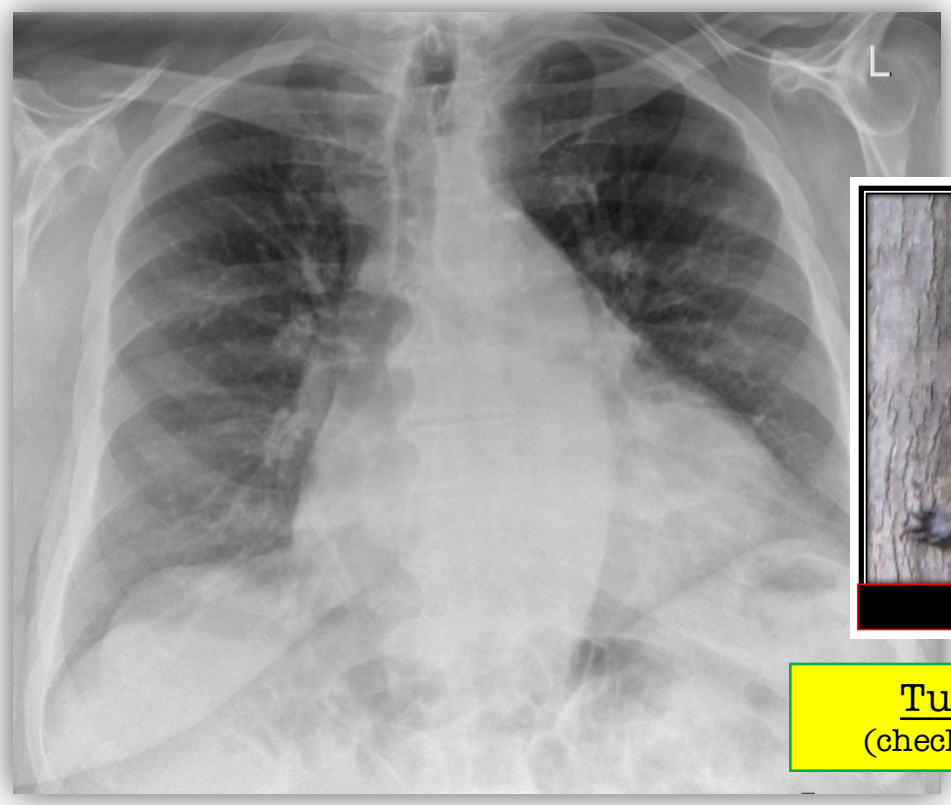
Congestive Hepatopathy →

- 'Nutmeg Liver'
- Centrilobular hemorrhagic necrosis

Heart Failure and the Cardiomyopathies for the USMLE Step One Exam: *Part I*: Key Background Information and Test Derivatives

- *Definition*: inadequate perfusion, oxygenation of visceral organs
  - HFrEF
  - HFpEF
  - High output heart failuare
- Key principles & language
- Core derivatives & concepts
  - *S3*
  - *Rales*
  - PCWP
  - JVP

Heart Failure and the Cardiomyopathies for the USMLE Step One Exam: *Part I*: Key Background Information and Test Derivatives



PDF available at 12DaysinMarch.com

Tutorial Services
(check website for details)

Howard J. Sachs, MD
Associate Professore of Medicine
University of Massachusetts Medical School
www.12DaysinMarch.com
E-mail: Howard@12daysinmarch.com