Rescuing The Right Ventricle

CHEST

Vallabhajosyula et al. Chest 2021;159(6):2254-2263

Impact of Right Ventricular Dysfunction on Short-term and Long-term Mortality in Sepsis

Metanalysis: 1373 patients with sepsis or septic shock

33% of patients had RV dysfunction

Associated with increased mortality (OR 2.4)

CRITICAL CARE

Sato et al. Critical Care 2021;152(1):181-193

The impact of right ventricular injury on the mortality in patients with acute respiratory distress syndrome: a systematic review and meta-analysis

Metanalysis: 1861 patients with ARDS

20% of patients had RV dysfunction

Associated with increased mortality (OR 1.45)

RCM
Reviews in Cardiovascular Medicine
Iglesias-Garriz et al. Reviews Cardiovascular Medicine 2012;13:e62-69

Contribution of right ventricular dysfunction to heart failure mortality: a meta-analysis

Metanalysis: 4732 patients with chronic heart failure

47% of patients had RV dysfunction

Associated with increased mortality

scientific reports

Corica et al. Nature Scientific Reports 2021;11(17774)

Prevalence of right ventricular dysfunction and impact on all-cause death in hospitalized patients with COVID-19: a systematic review and meta-analysis

Metanalysis: 3813 hospitalized COVID patients

20% of patients had RV dysfunction

Associated with increased mortality (OR 3.3)

ATS Journals

Kolaitis et al. Ann Am Thoracic Soc 2021;18(4):613-22

Clinical Differences and Outcomes between Methamphetamine-associated and Idiopathic Pulmonary Arterial Hypertension in the Pulmonary Hypertension Association Registry

Analysis of Pulmonary Hypertension Association Registry

>20% of patients had methamphetamine-associated PAH

More likely to seek care in ED, and more likely to be admitted

RV Failure Physiology

RV Failure Differential Diagnosis

RV Spiral of Death

RV Failure Management

RV Failure Physiology

RV Failure Differential Diagnosis

RV Spiral of Death

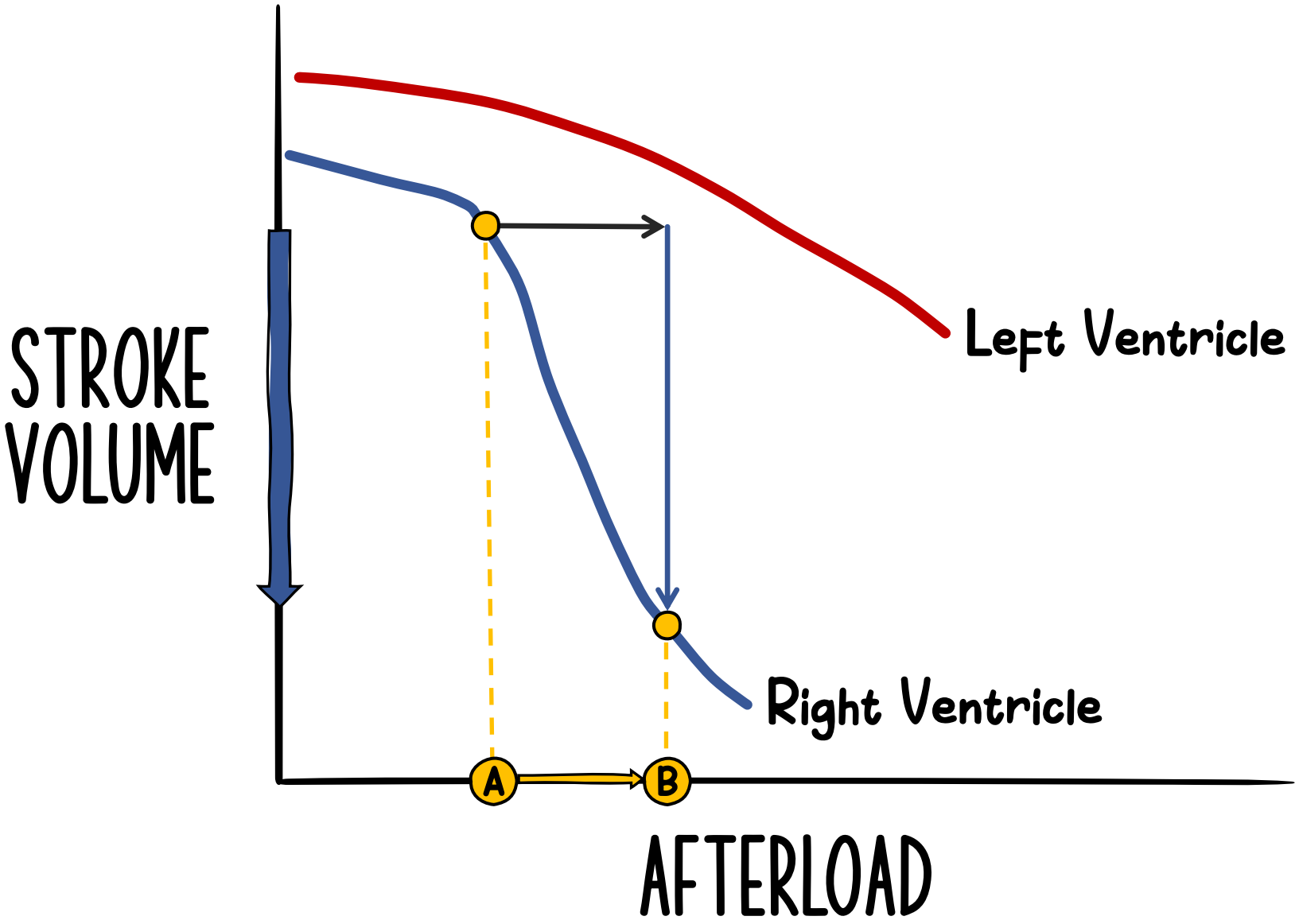
RV Failure Management

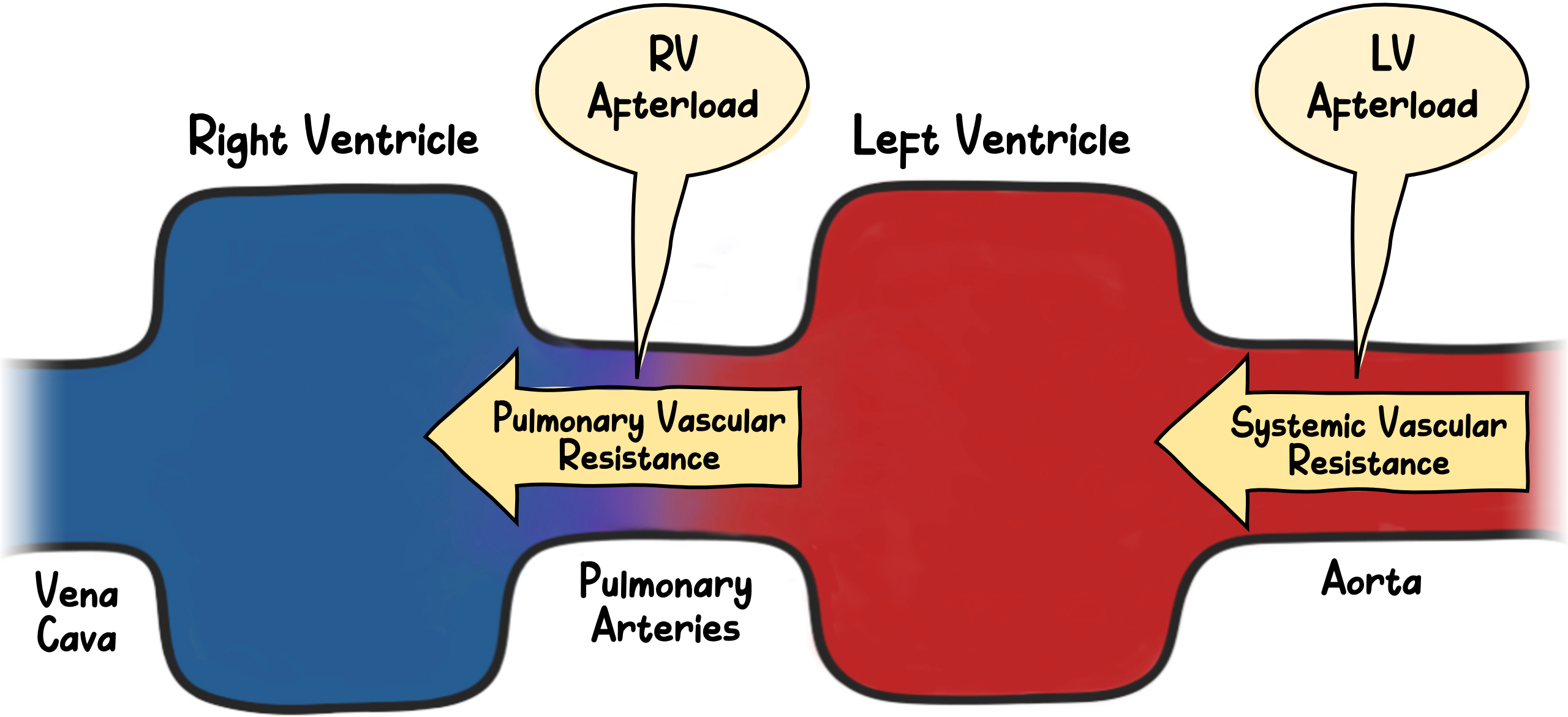
PRINCESS PHYSIOLOGY 1

EASILY OFFENDED BY MISTAKES

Princess Physiology 2

Crumbles At The First Sign Of Resistance


STROKE VOLUME
Left Ventricle
Right Ventricle
A
B
AFTERLOAD


RV
Afterload
LV
Afterload
Right Ventricle
Left Ventricle
Pulmonary Vascular
Resistance
Systemic Vascular
Resistance
Vena
Cava
Pulmonary
Arteries
Aorta

OBSTRUCTIVE

Thromboembolism

Lung disease

Primary pulmonary hypertension

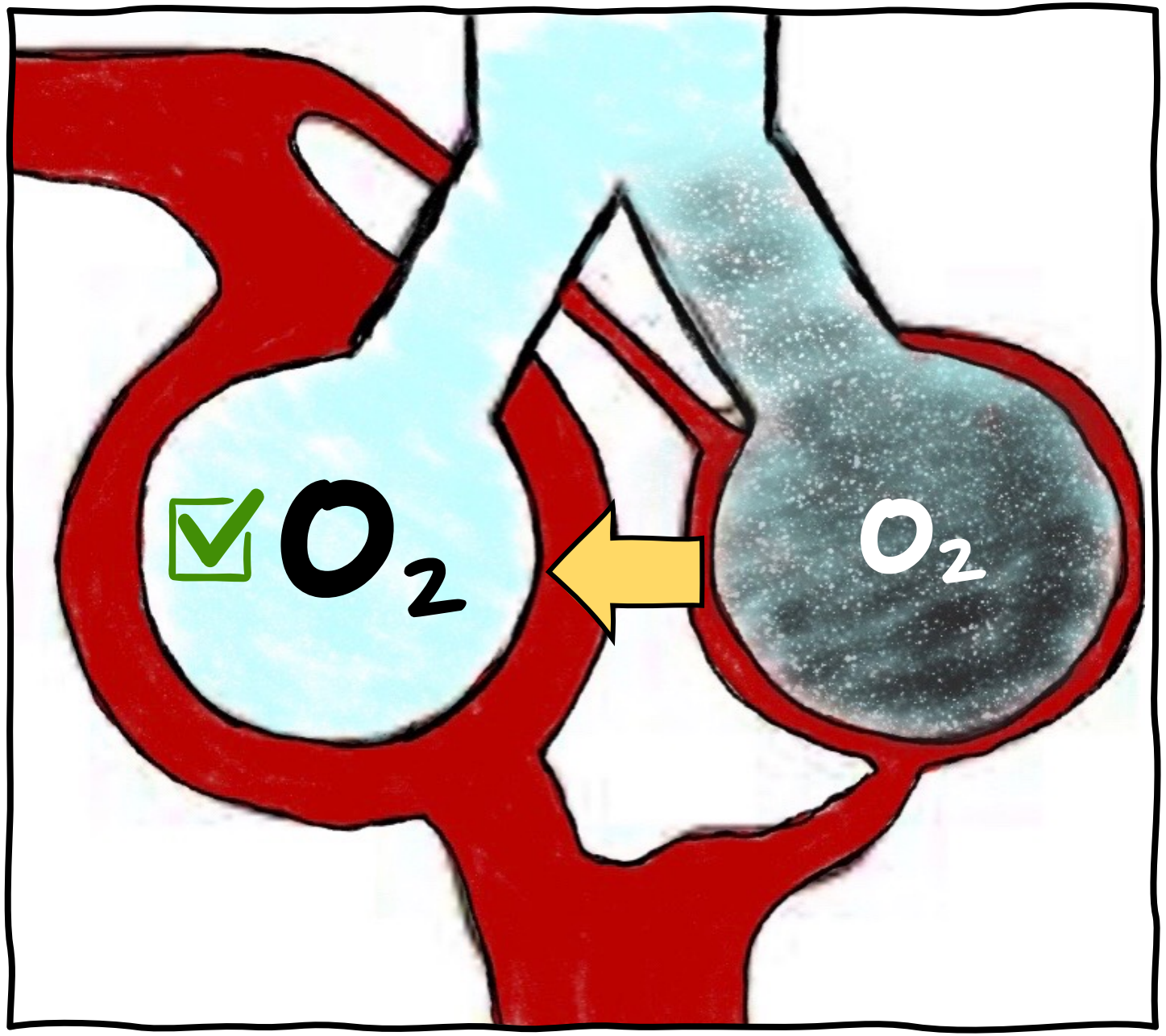
VASOCONSTRICTIVE

Hypoxemia

Hypercarbia

Acidemia

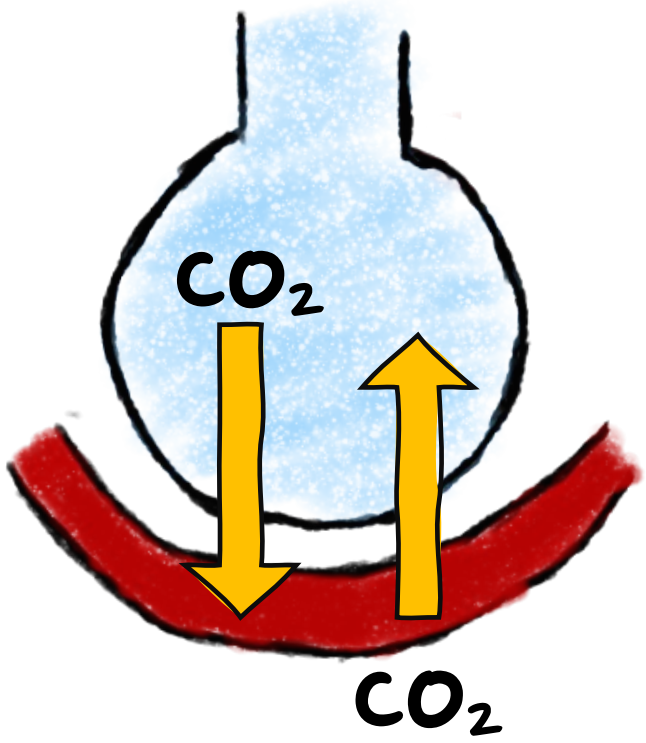
Inflammation



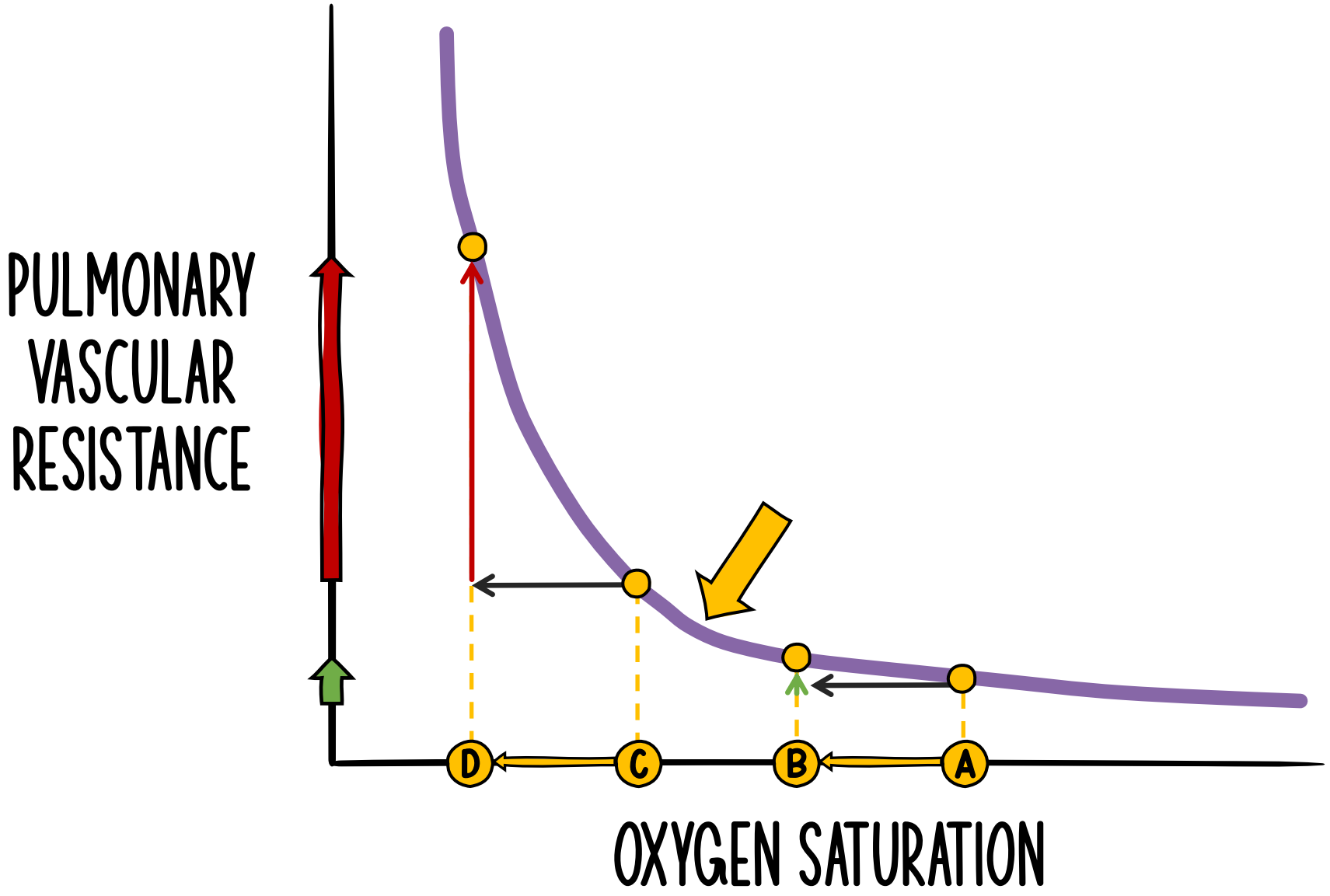
HYPOXIC PULMONARY VASOCONSTRICTION

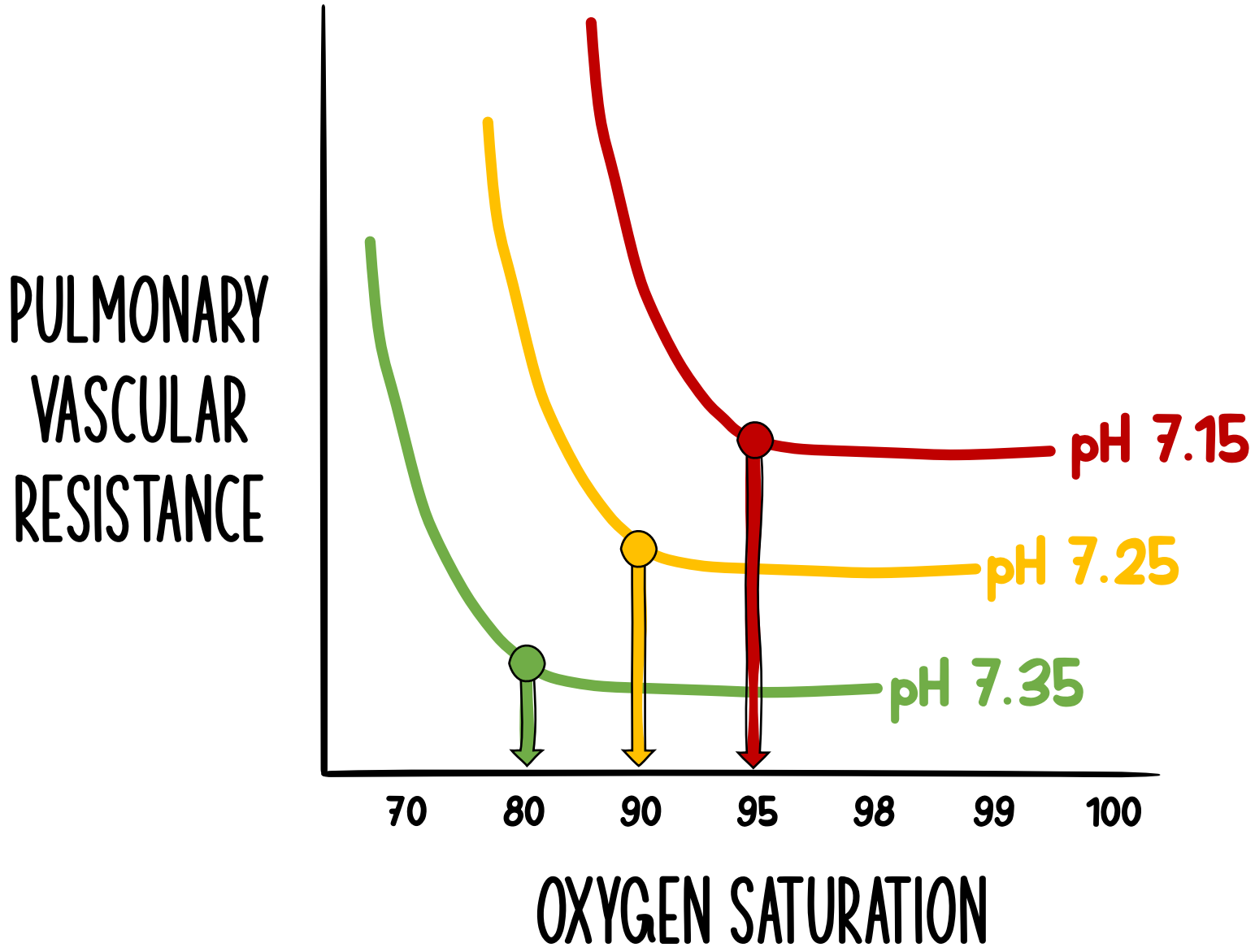
VENTILATION-PERFUSION MATCHING

SHUNT



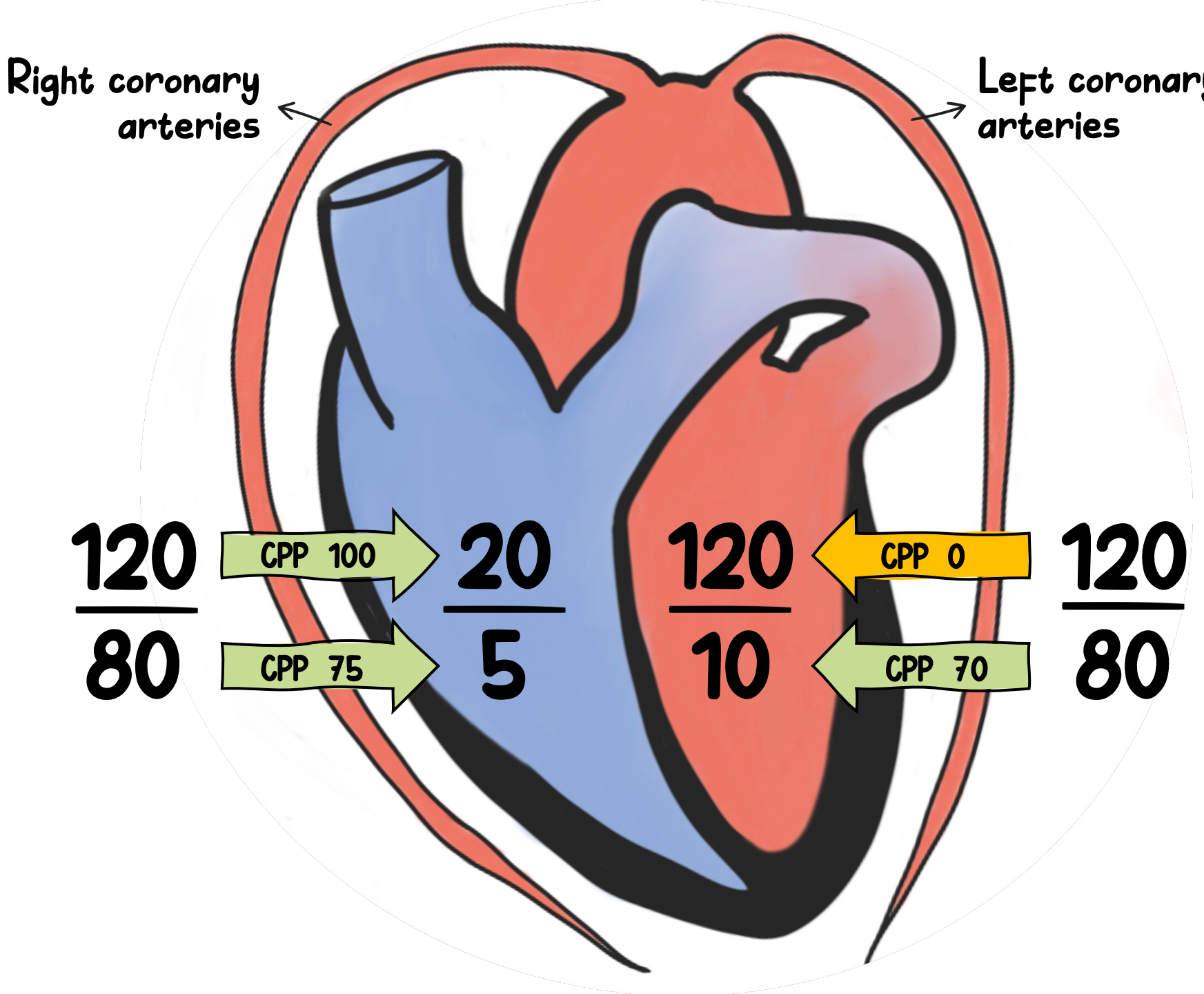
DEAD SPACE


PULMONARY
VASCULAR
RESISTANCE
D
C
B
A
OXYGEN SATURATION


PULMONARY VASCULAR RESISTANCE
pH 7.15
pH 7.25
pH 7.35
70
80
90
95
98
99
100
OXYGEN SATURATION

Princess Physiology 3

Feels Entitled To Constant Perfusion


Right coronary arteries
Left coronary arteries
120/80
CPP 100
CPP 75
20/5
120/10
CPP 0
CPP 70
120/80

RV Failure Physiology

RV Failure Differential Diagnosis

RV Spiral of Death

RV Failure Management

PRESSURE OVERLOAD

(Pipes Problem)

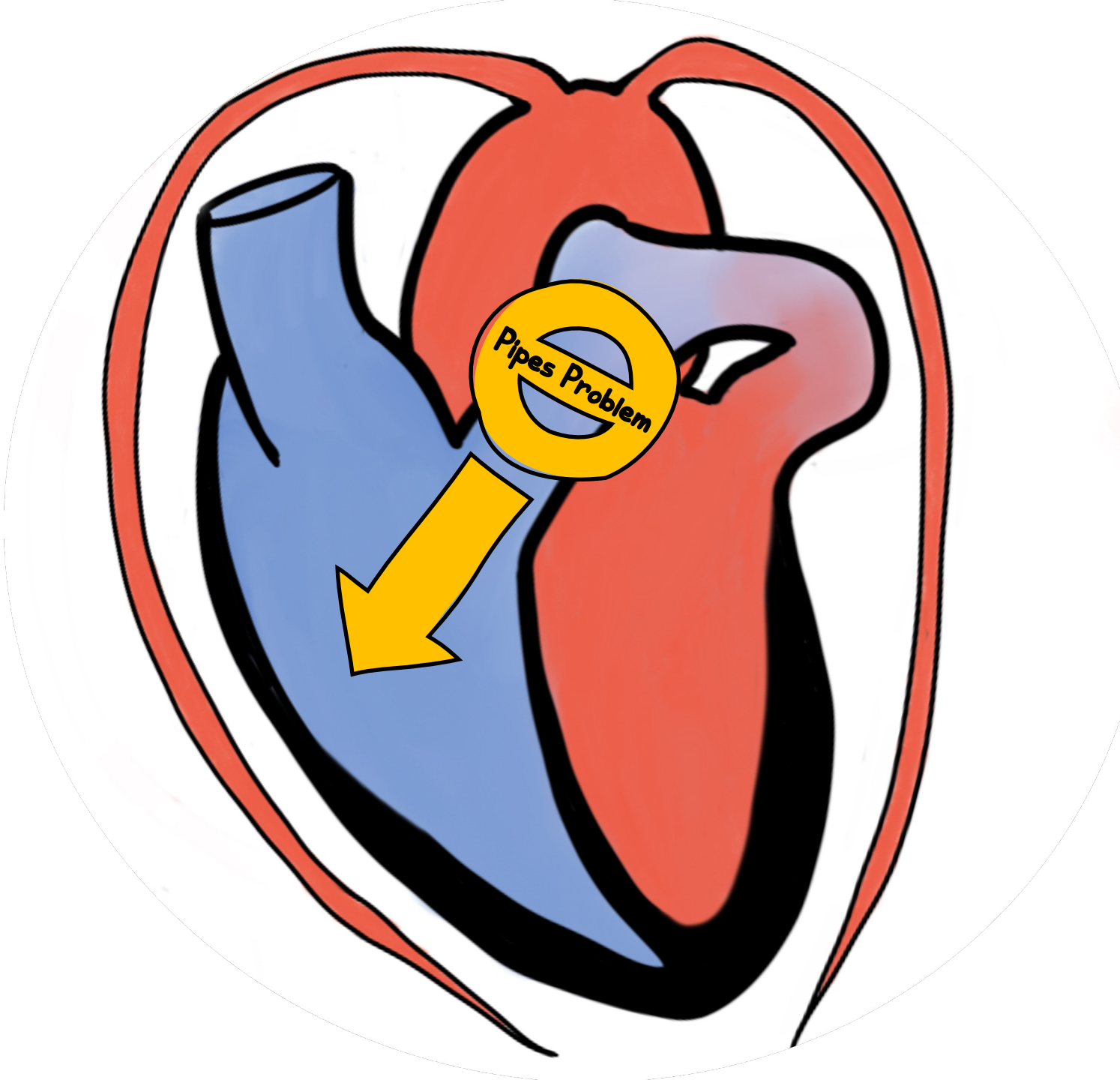
VOLUME OVERLOAD

(Tank Problem)

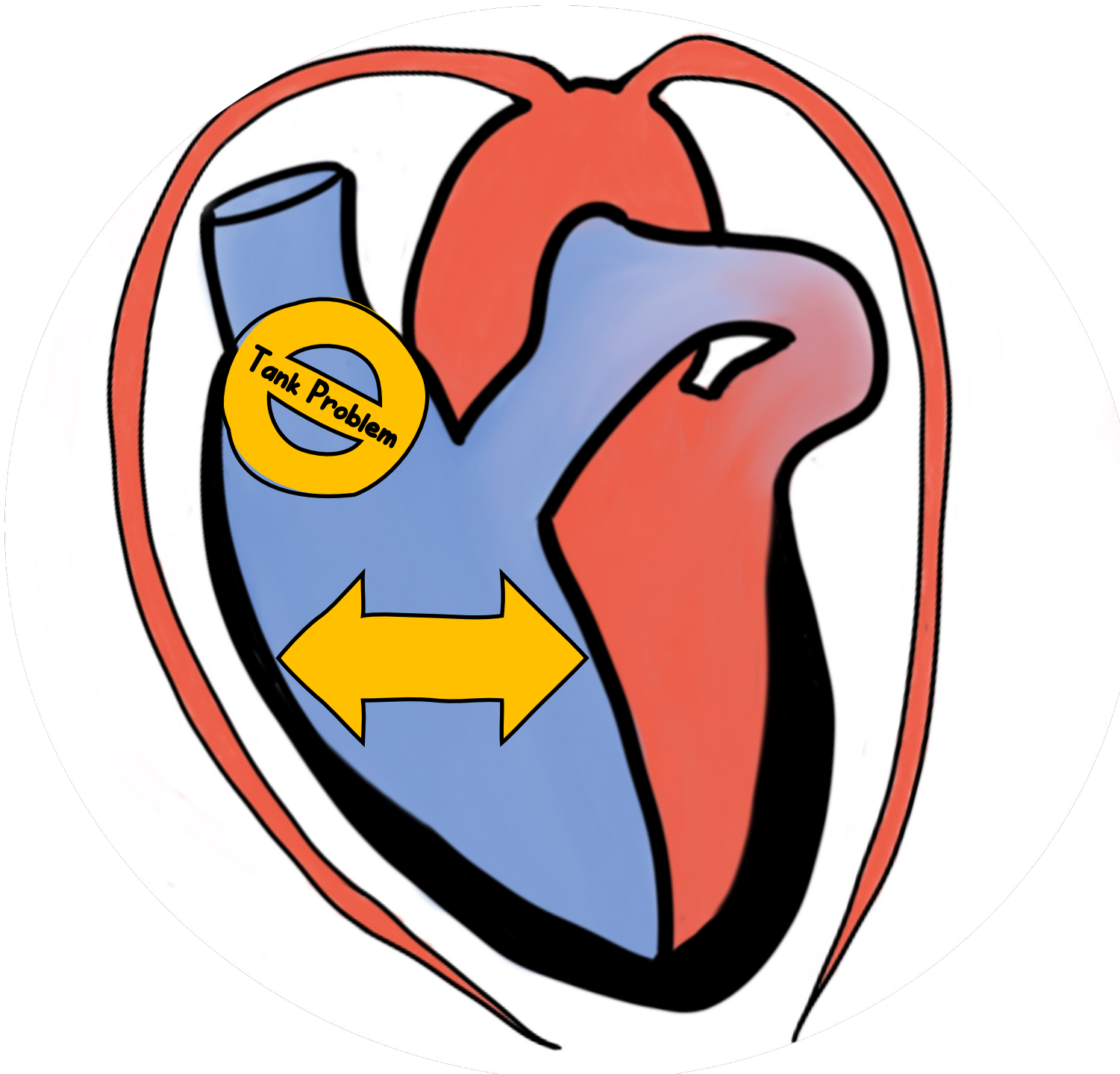
DECREASED CONTRACTILITY

(Pump Problem)

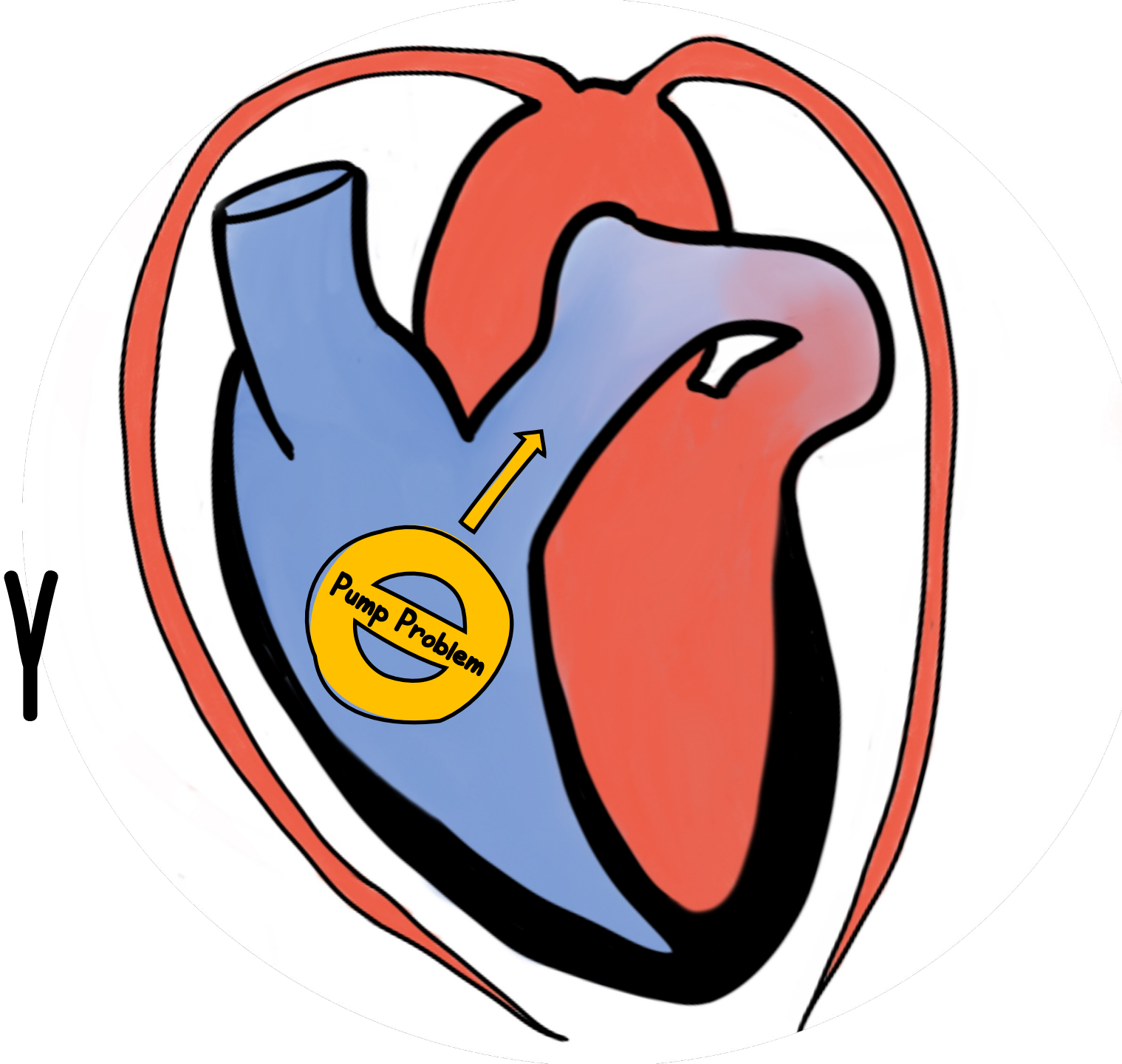
PRESSURE OVERLOAD



VOLUME OVERLOAD

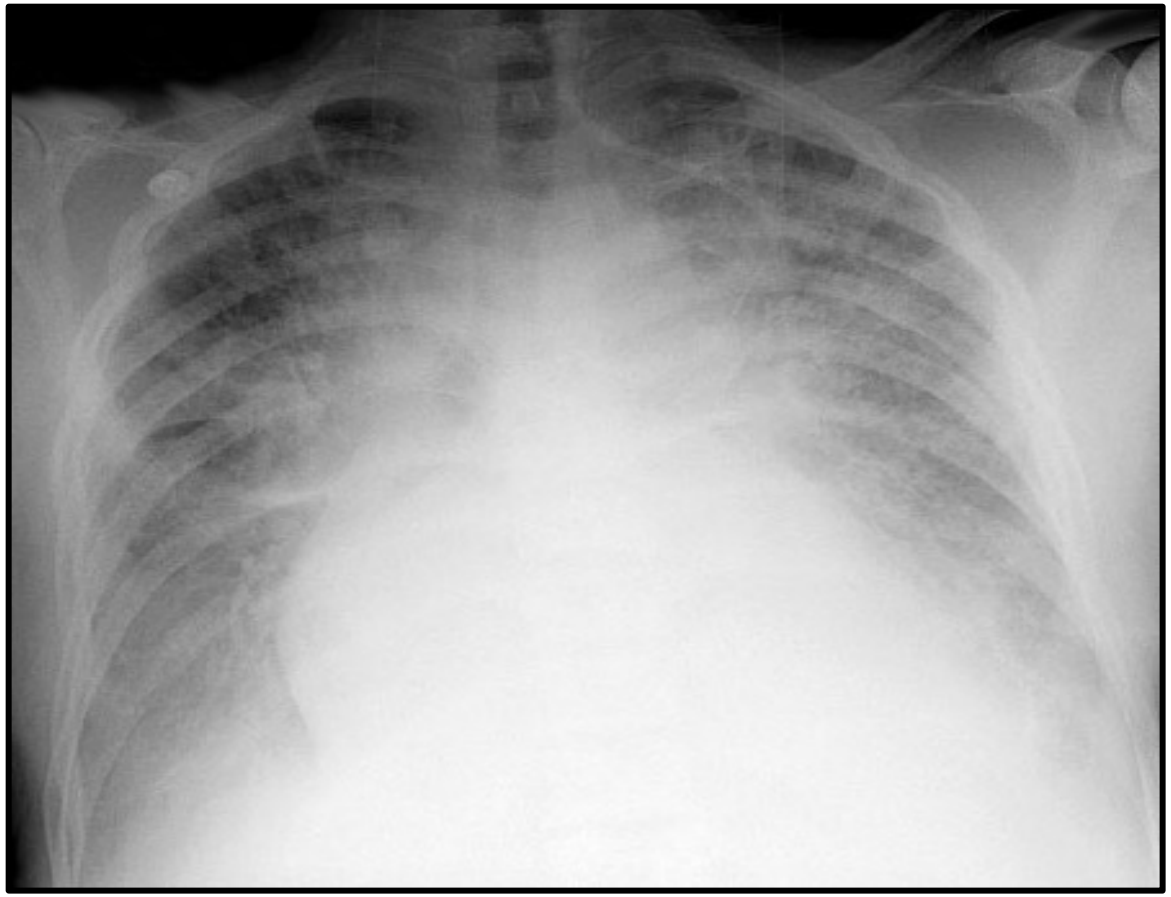


DECREASED CONTRACTILITY

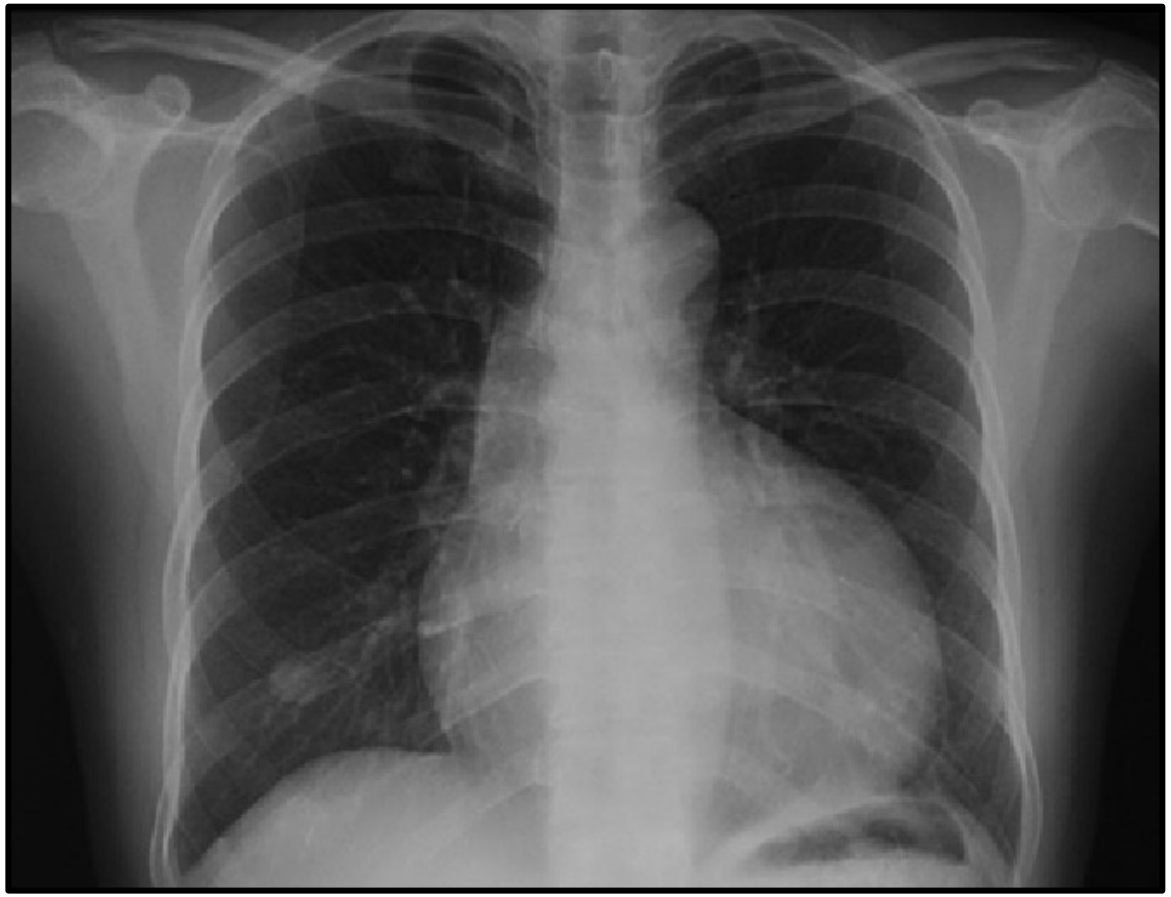


Recognizing RV Failure is Half the Battle...

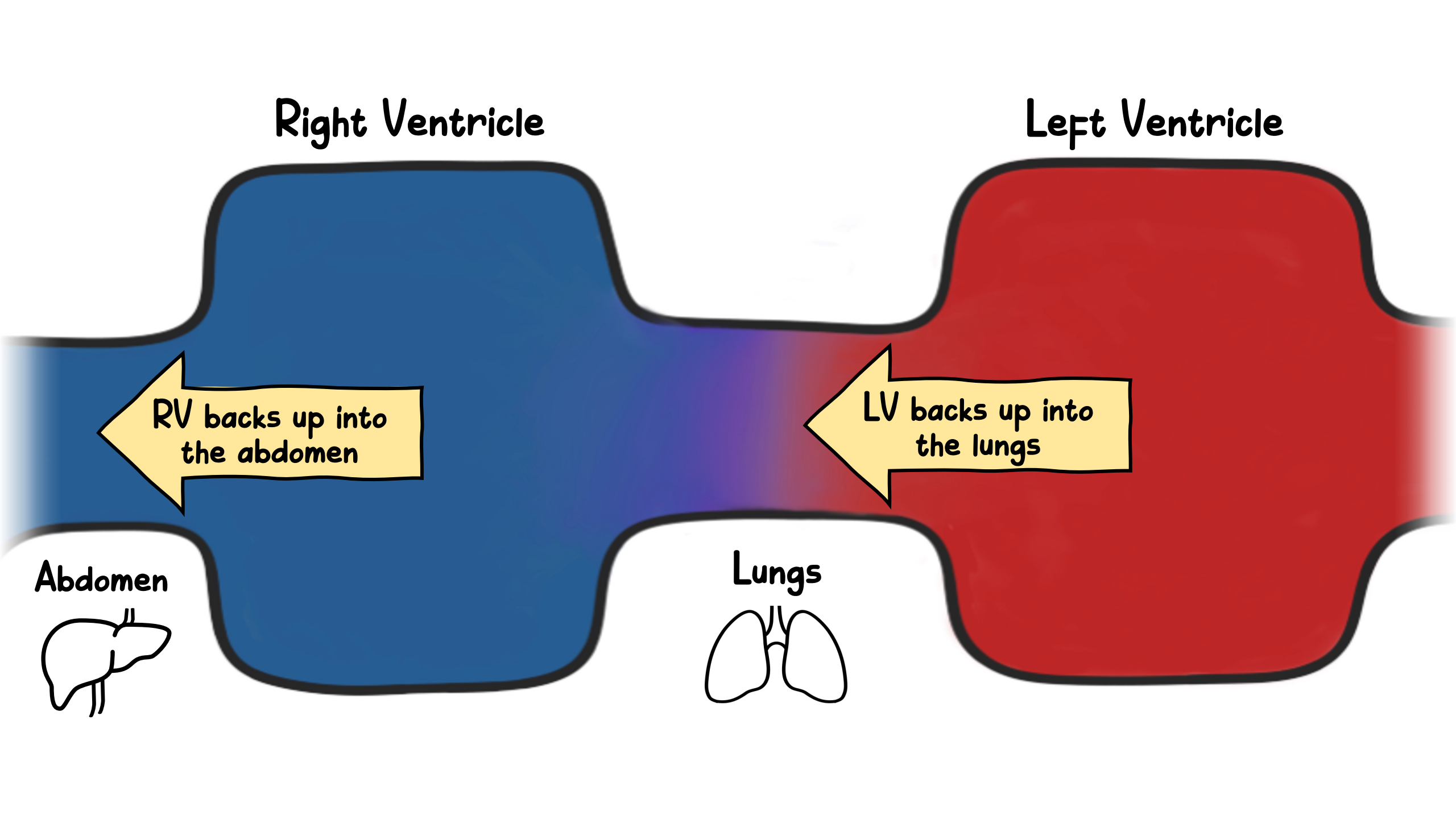
AVOID MISINTERPRETATION OF COMMON LABS

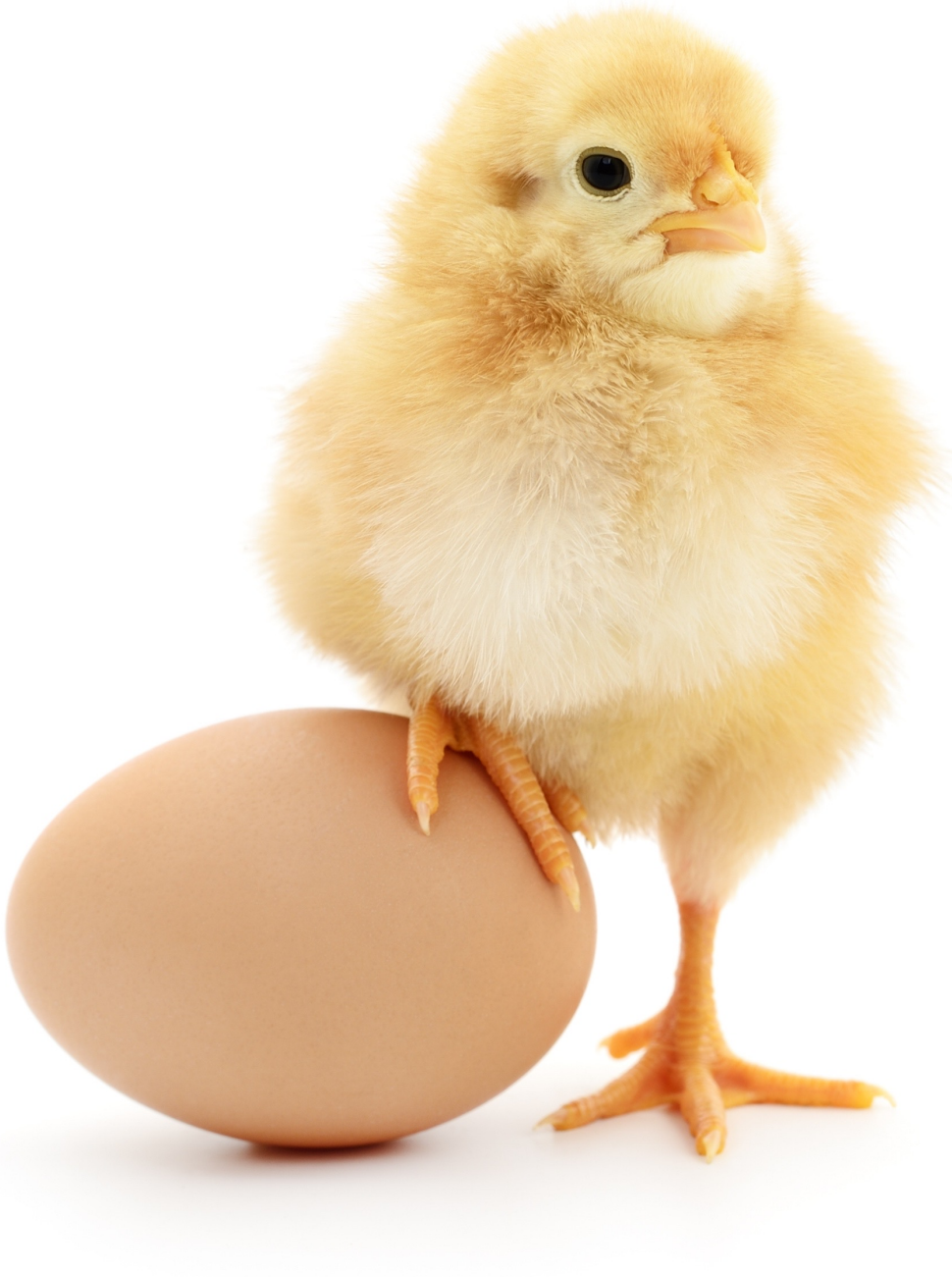


Left Heart Failure

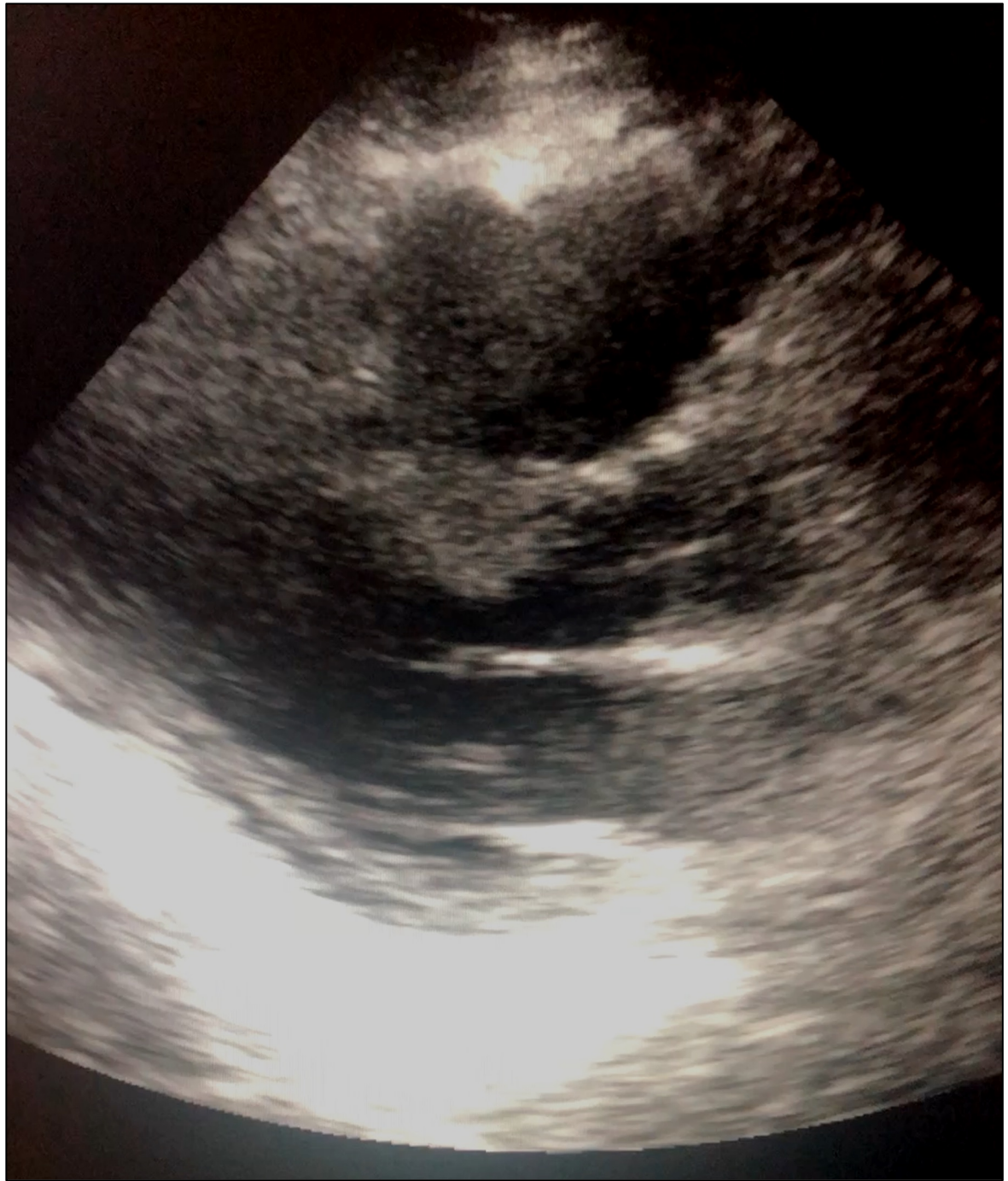


Right Heart Failure


Right Ventricle
Left Ventricle
RV backs up into the abdomen
LV backs up into the lungs
Abdomen
Lungs



Acute RV Failure In Chronic Lung Disease



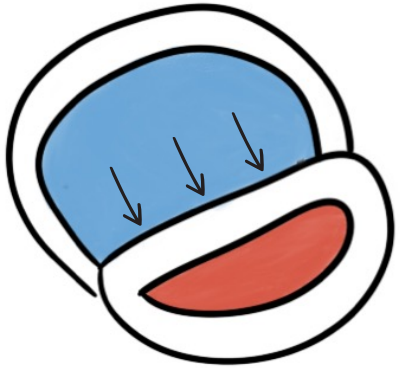
Hyperdynamic Left Ventricle

Distended IVC Without Respiratory Variation

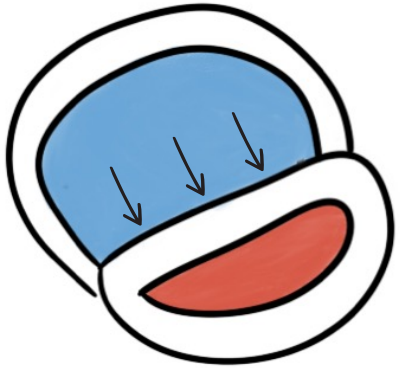
Septal Flattening

PRESSURE OVERLOAD

Systole

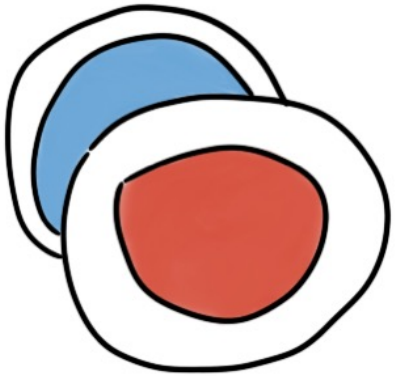


Diastole

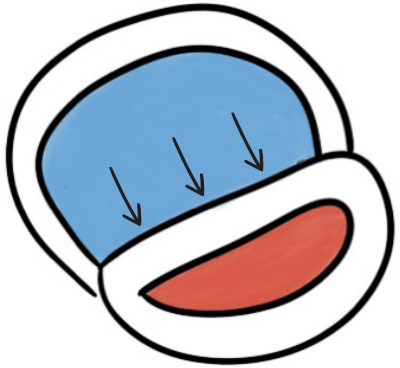


VOLUME OVERLOAD

Systole

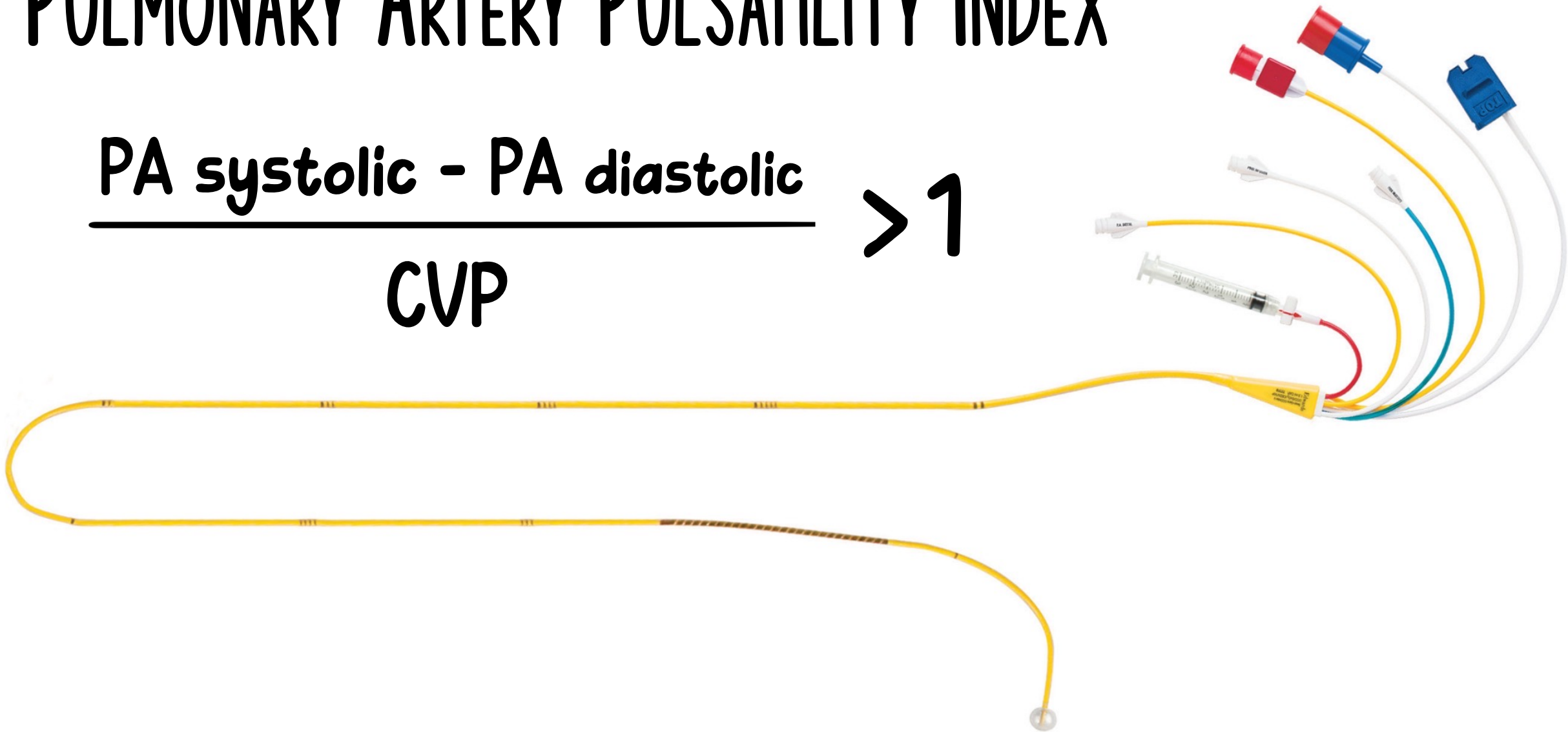


Diastole



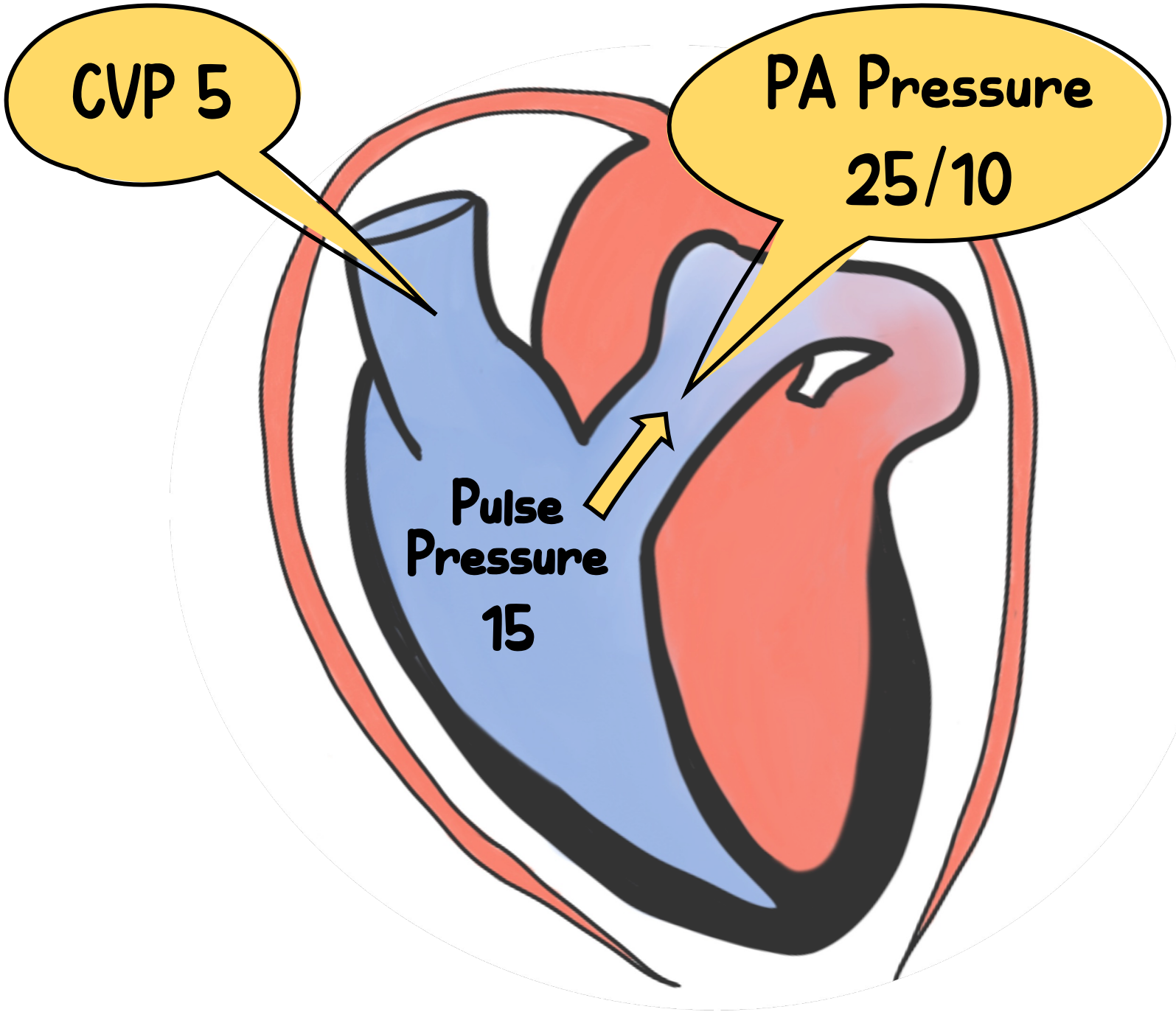
Pulmonary Artery Pulsatility Index

$$\frac{\text{PA systolic} - \text{PA diastolic}}{\text{CVP}} > 1$$



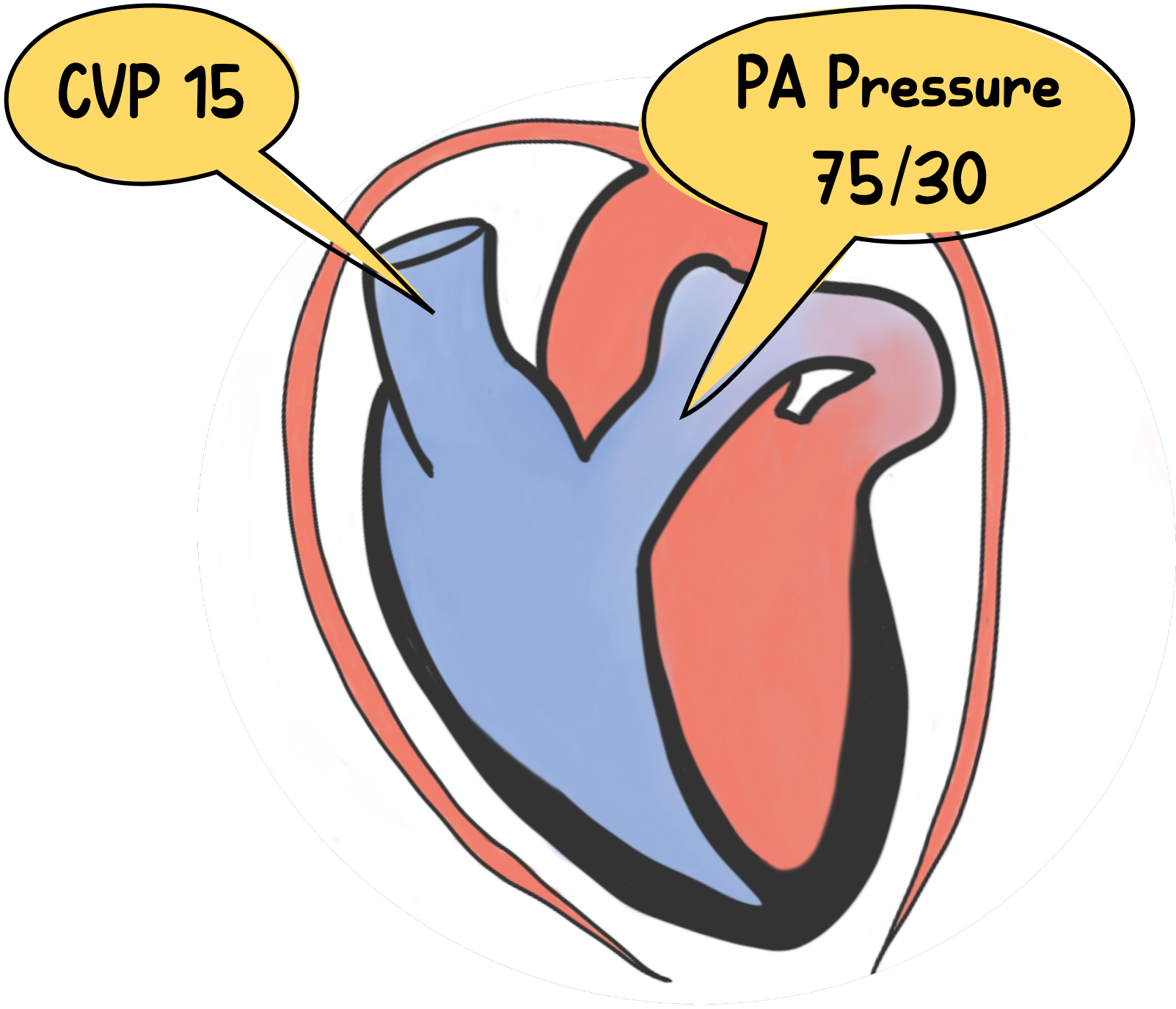
$$\frac{25 - 10}{5}$$

PAPi = 3



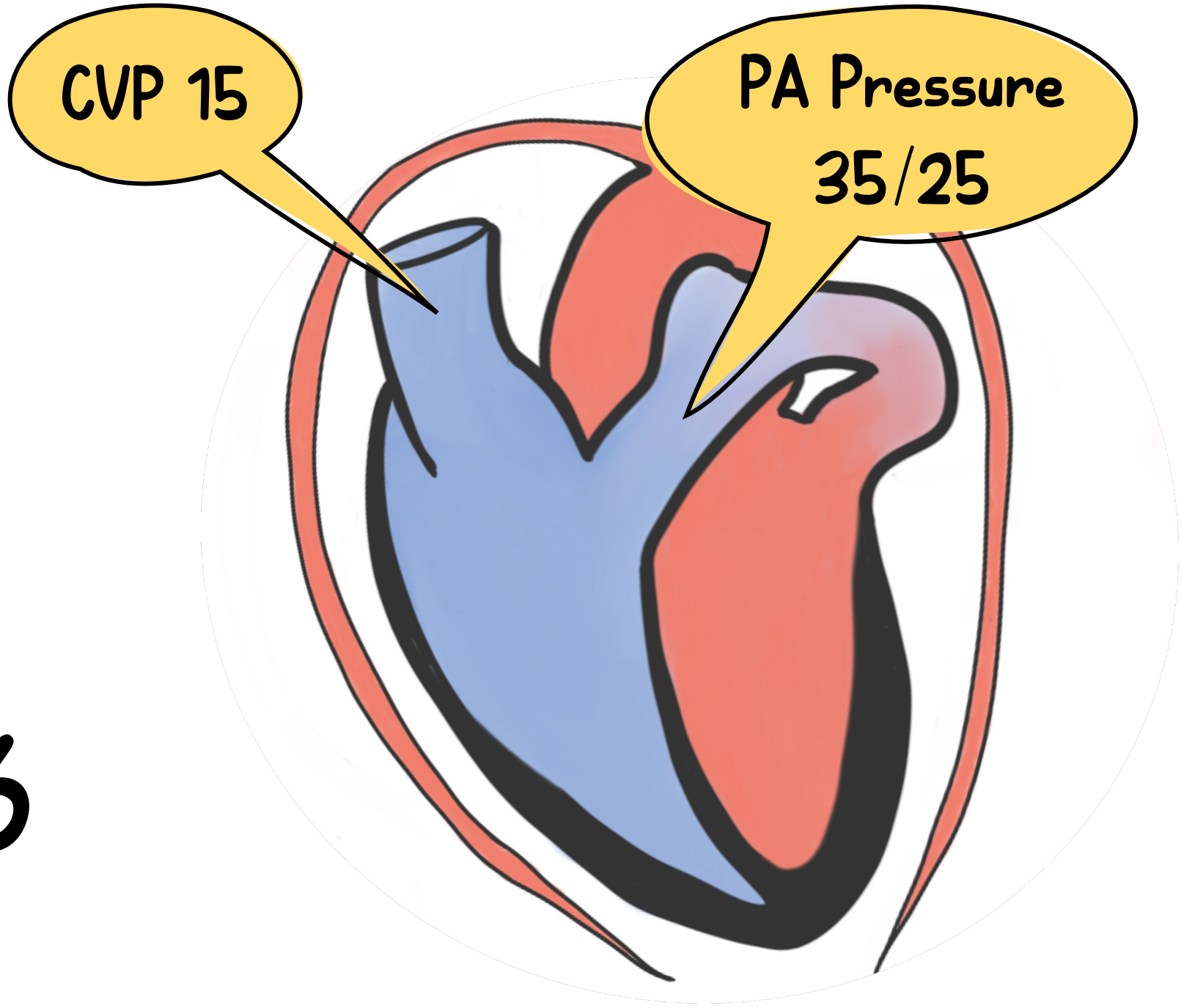
$$\frac{75 - 30}{15}$$

PAPi = 3



$$\frac{35 - 25}{15}$$

PAPi = 0.6

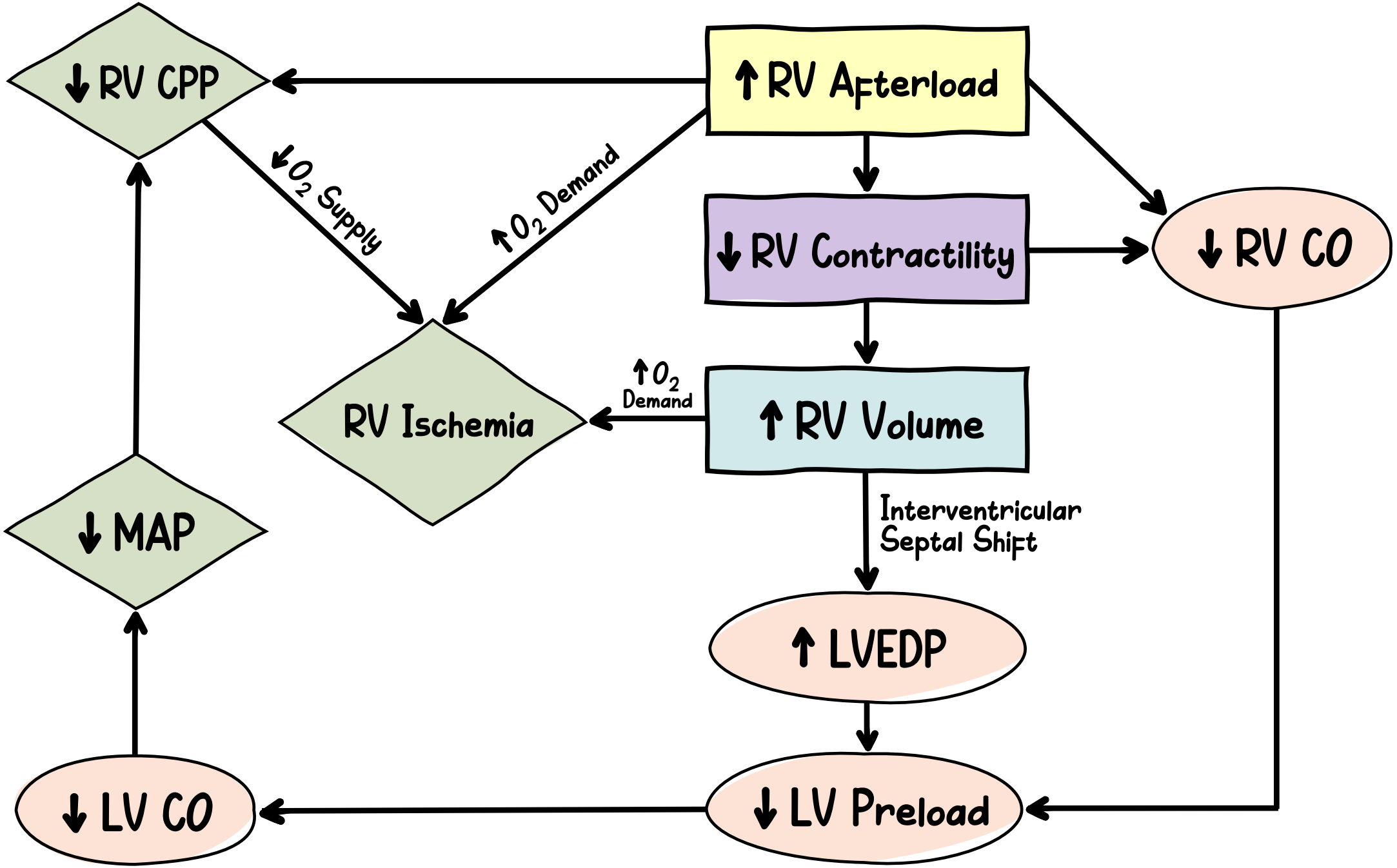


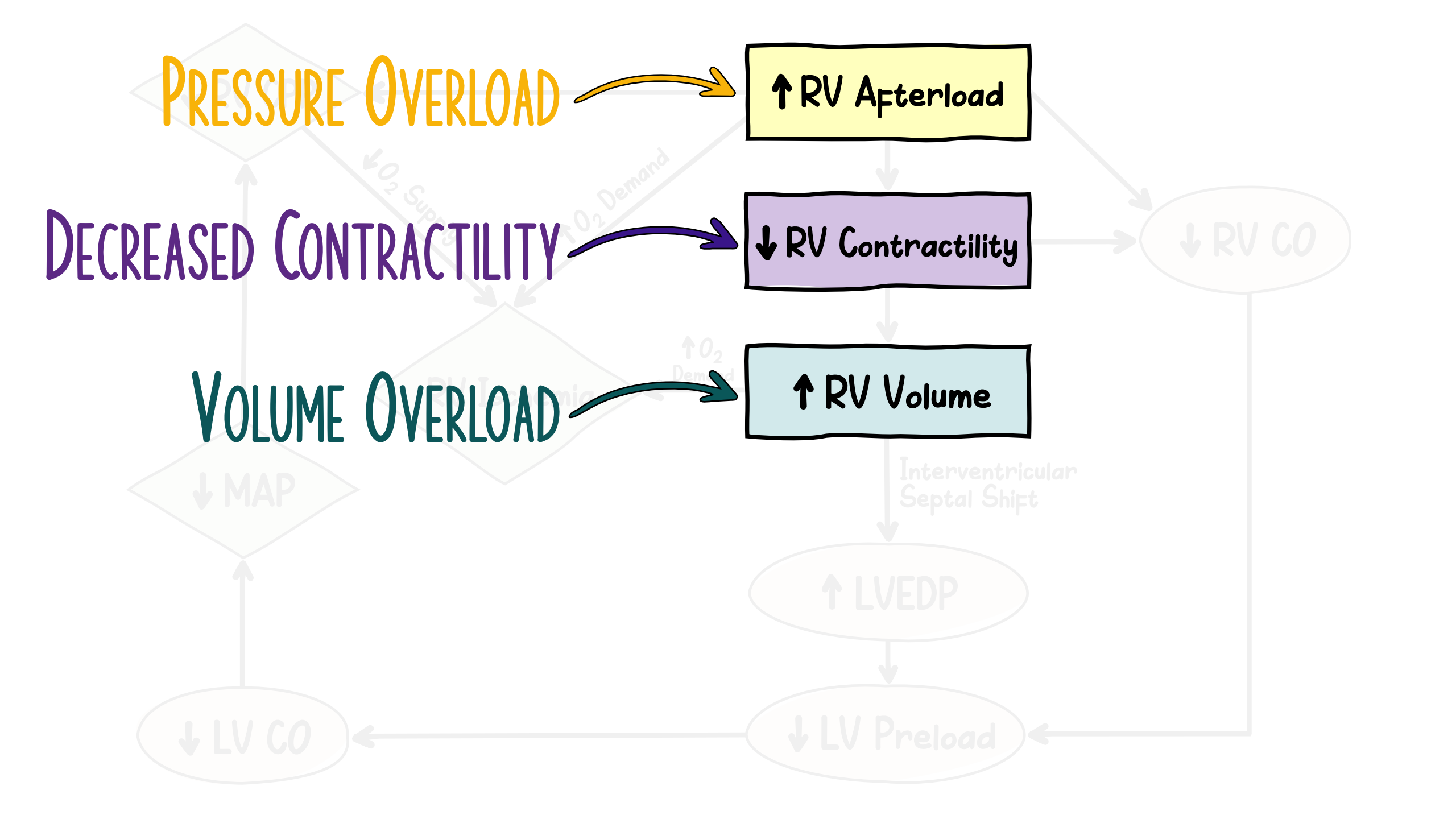
RV Failure Physiology

RV Failure Differential Diagnosis

RV Spiral of Death

RV Failure Management


↓ RV CPP
↑ RV Afterload
↓ O_2 Supply
↑ O_2 Demand
↓ RV Contractility
↓ RV CO
RV Ischemia
↑ O_2 Demand
↑ RV Volume
↓ MAP
Interventricular Septal Shift
↑ LVEDP
↓ LV CO
↓ LV Preload


Pressure Overload
↑ RV Afterload
Decreased Contractility
↓ RV Contractility
Volume Overload
↑ RV Volume
↓ RV CO
Interventricular Septal Shift
↑ LVEDP
↓ LV Preload
↓ LV CO
↓ MAP

RV Failure Physiology

RV Failure Differential Diagnosis

RV Spiral of Death

RV Failure Management

- ⚠ Fluids
- ⬇ RV Afterload
- ⬆ Blood Pressure
- ⬆ RV Contractility
- ⚠ Intubation