Medical Practice Improvement Lecture

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December 5, 2024

Shock Part III

Hemodynamic Monitoring and Endpoints of Resuscitation

Disclosures

I have no financial disclosures

Learning Objectives

1. Understanding the endpoints of resuscitation
2. Understanding the monitoring devices and the information they are transmitting
3. Interpretation of the information
4. Evaluating the patient for ongoing intervention or resuscitation

Goal Directed Therapy

- End points of resuscitation
  - Lactate
    - Takes normal liver 4-6 hours to process
    - Make initially climb once tissues start reperfusion
    - Serial labs q6 hours
    - Direct correlation with rising lactate and mortality

Goal Directed Therapy

- Base Deficit
  - Is a fancy way of saying too many Protons in the blood from glycolysis
  - The more negative the worse it is
  - Corrects quickly
  - There is a formula to do that
    - (wt in Kg)(0.3)(base deficit)= meq of bicarb deficit
    - meq of bicarb deficit/50 meq per amp = number of ampules to correct

Goal Directed Therapy

- End points of resuscitation
  - Urine output is the only true measure of tissue perfusion. We do not have a tissue perfusion device
  - CVP is a measure of the Central Venous Pressure but is subject to the intrathoracic pressure
  - Rule of thumb is to subtract 1/3 of the peep from the CVP to get an accurate CVP while on the ventilator with positive pressure ventilation
  - CVP goal is greater than 10mmHg but less than 18 mmHg

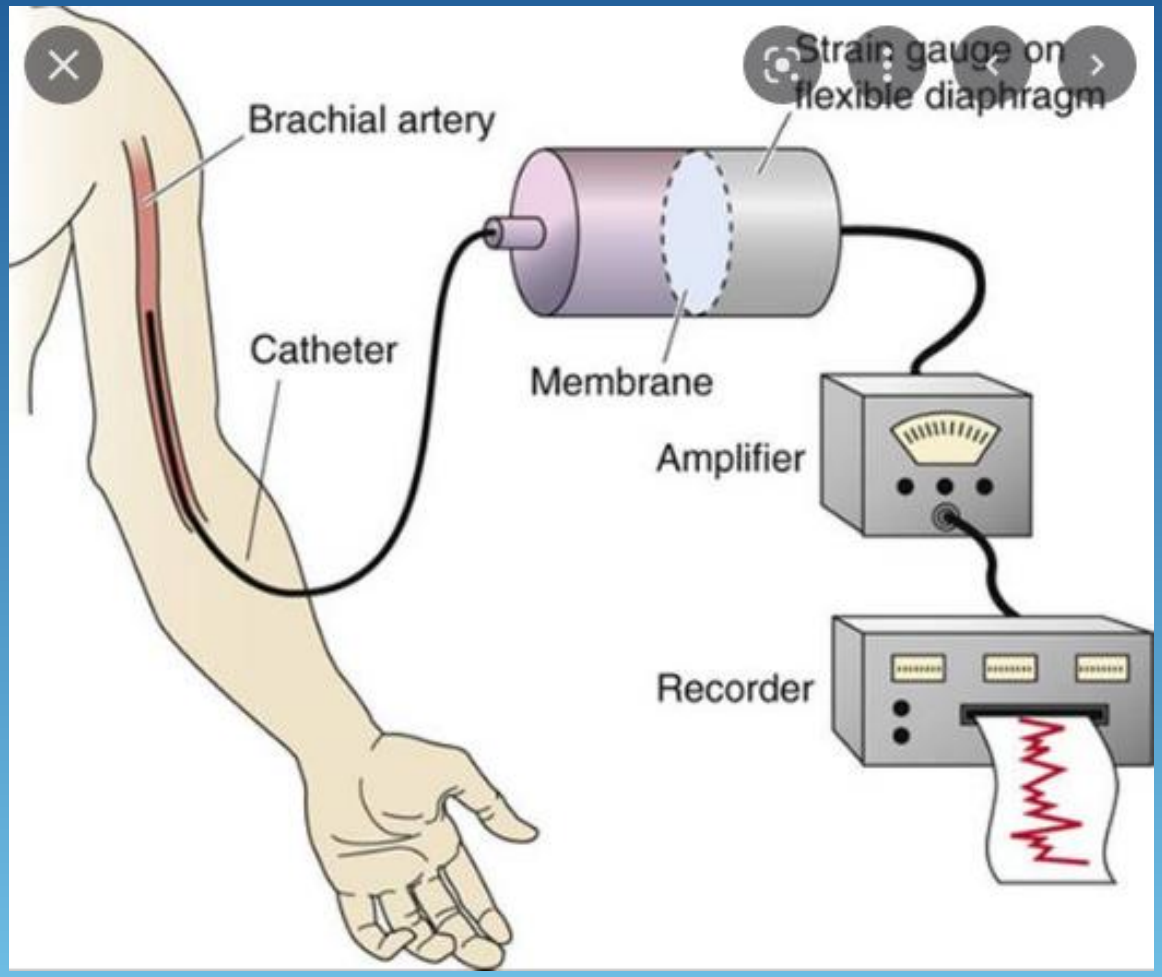
Goal Directed Therapy

- SCVO2 is the measure of the oxygenation remaining in the blood returning to the heart
  - Normal 70 % saturation
  - Less than 70 either extracting a lot or not oxygenating enough. ABG shows the outgoing saturation. This is the incoming saturation
  - Greater than 80% means that the tissues are not extraction oxygen
    - Capillary shunt → this leads to rapid death.
    - Histotoxic Hypoxia → cyanide poising, covid 19 vasculitis

Goal Directed Therapy

- End points of resuscitation
  - MAP goal greater than 60mmHg
    - Titrate that number higher in head injury
      - CPP = MAP-ICP
      - Brain trauma foundation goal CPP 60-80 mmHg

Devices

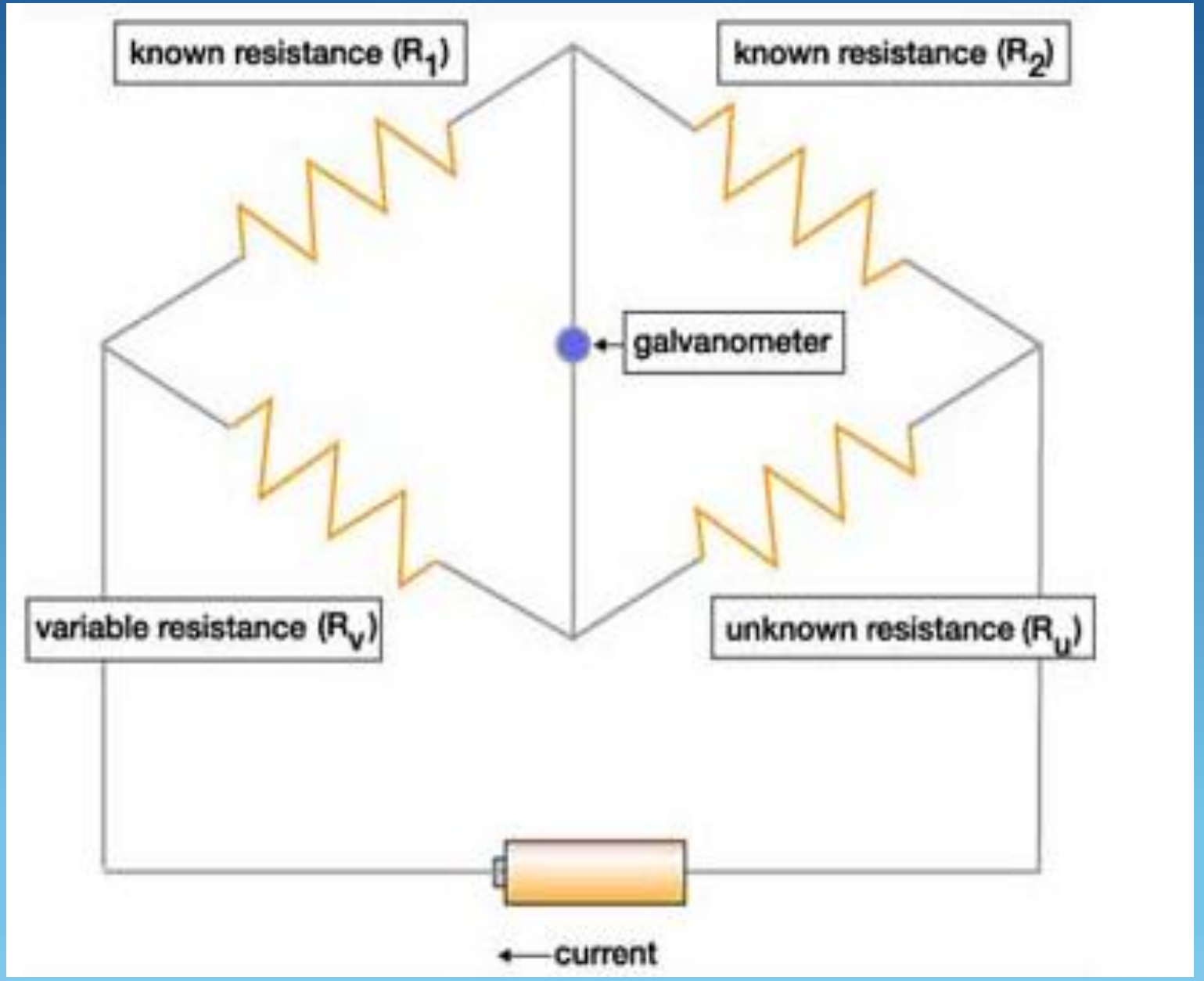


- Arterial Line
  - How does this device work?

A-Line

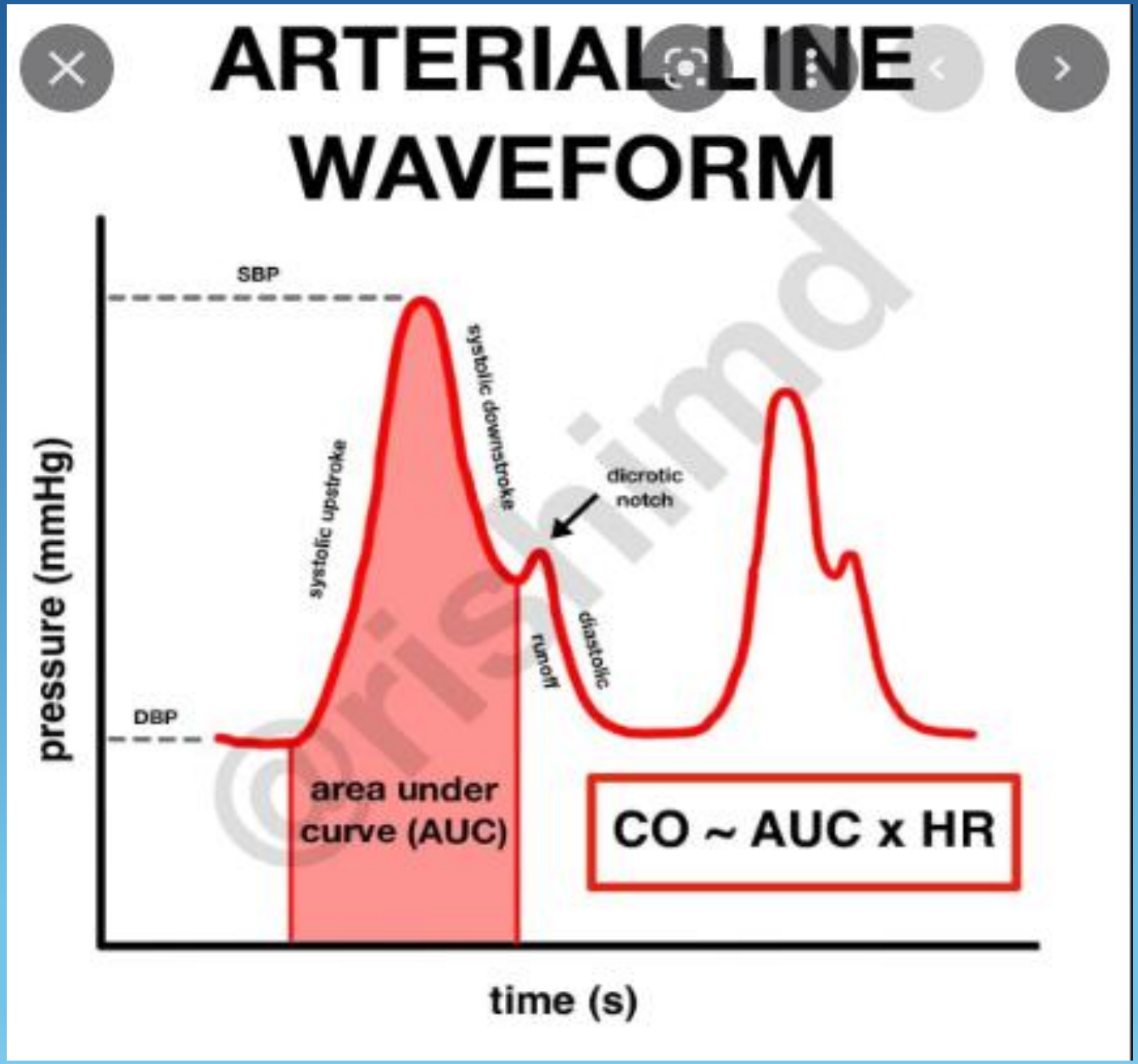
- The saline column moves back and forth with the pulsation.
- This causes the diaphragm to move. This movement results in a change in resistance and current flow (V=IR) through the transducer.
- The transducer is connected to a Wheatstone bridge.
- The heparinised saline allows flushing of the cannula and prevents backflow.

Wheatstone Bridge



Null deflection of the galvanometer implies R1/R2=Rv/Ru

A-line Tracing



Flo-Trac

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Flo- Trac

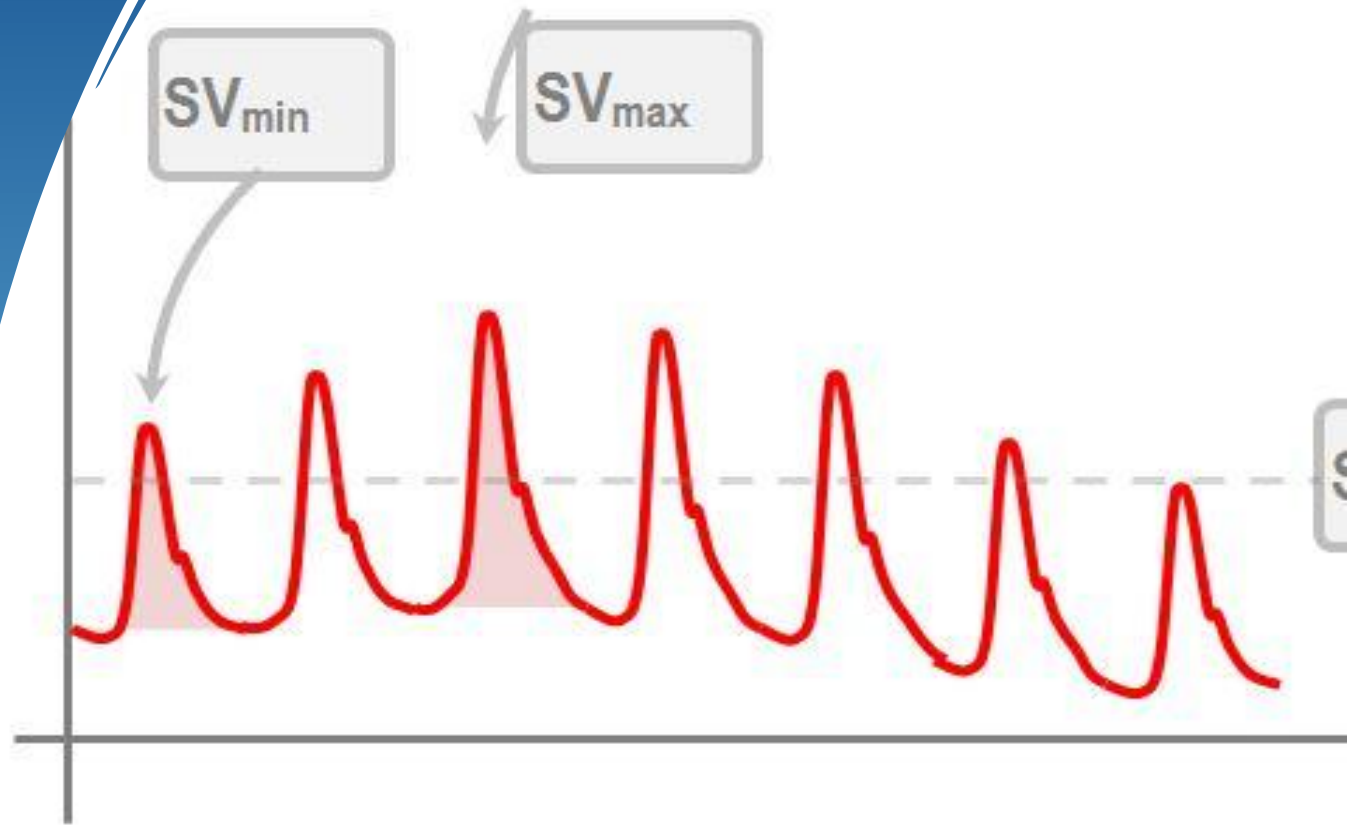
- Goals of therapy
  - CO is not used it variable by the size of the human
  - So, we index it to get a range
    - CI (Cardiac index) = CO/TBSA
      - Review CO= Heart rate x stroke volume

- Normal range and goal is

  CI 2.5-3.5

Stroke Volume Variability

- SVV
  - Is the difference in the peak of the A- line tracing per heartbeat
  - Difference in the amount of filling per heartbeat
  - In resuscitated patient every heartbeat should have the same volume so the SVV should be less than 13
  - More than 13 consider more resuscitation, fluid or blood products



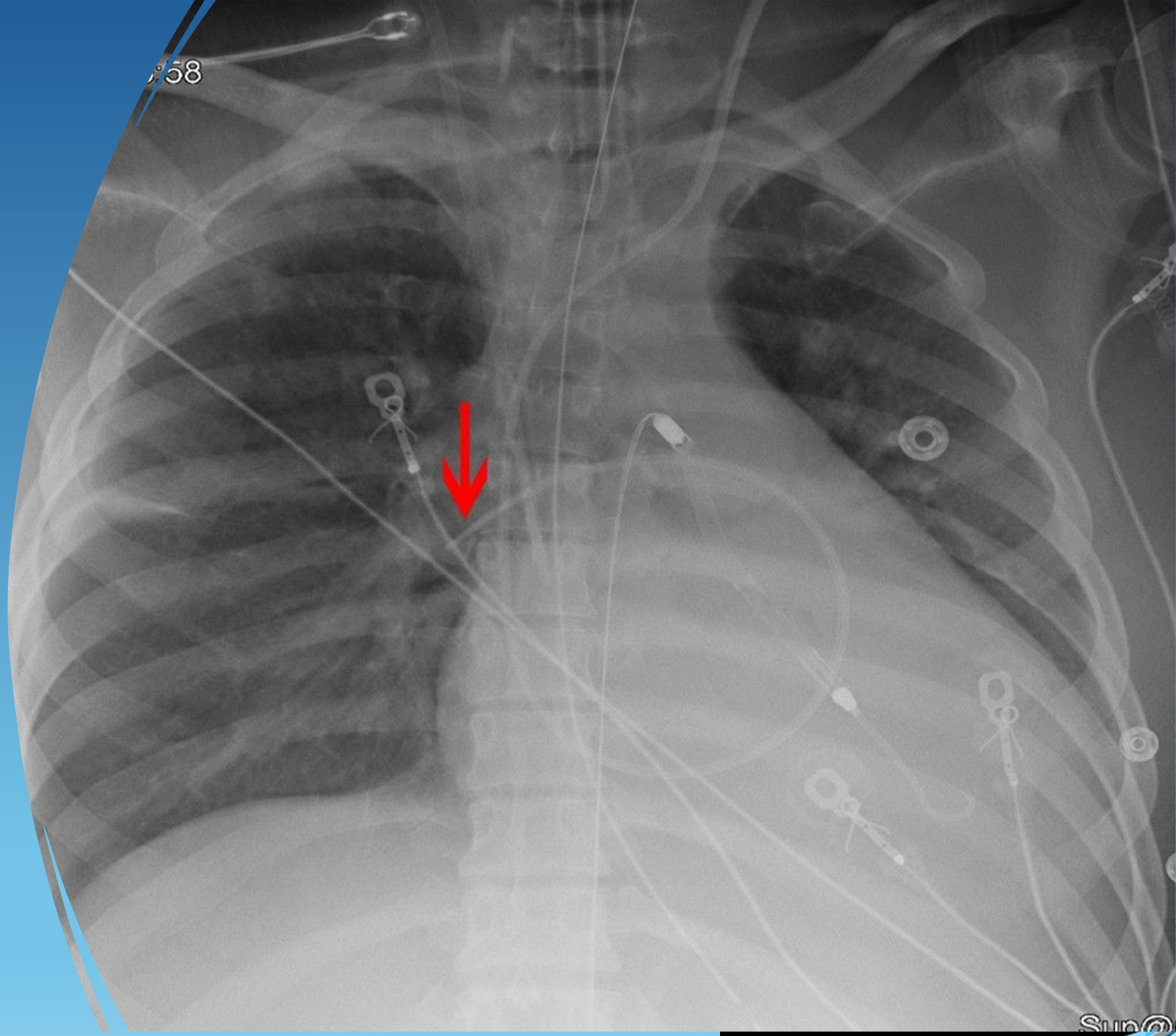
$$SVV = \frac{SV_{max} - SV_{min}}{SV_{mean}}$$

Swan Ganz Catheter

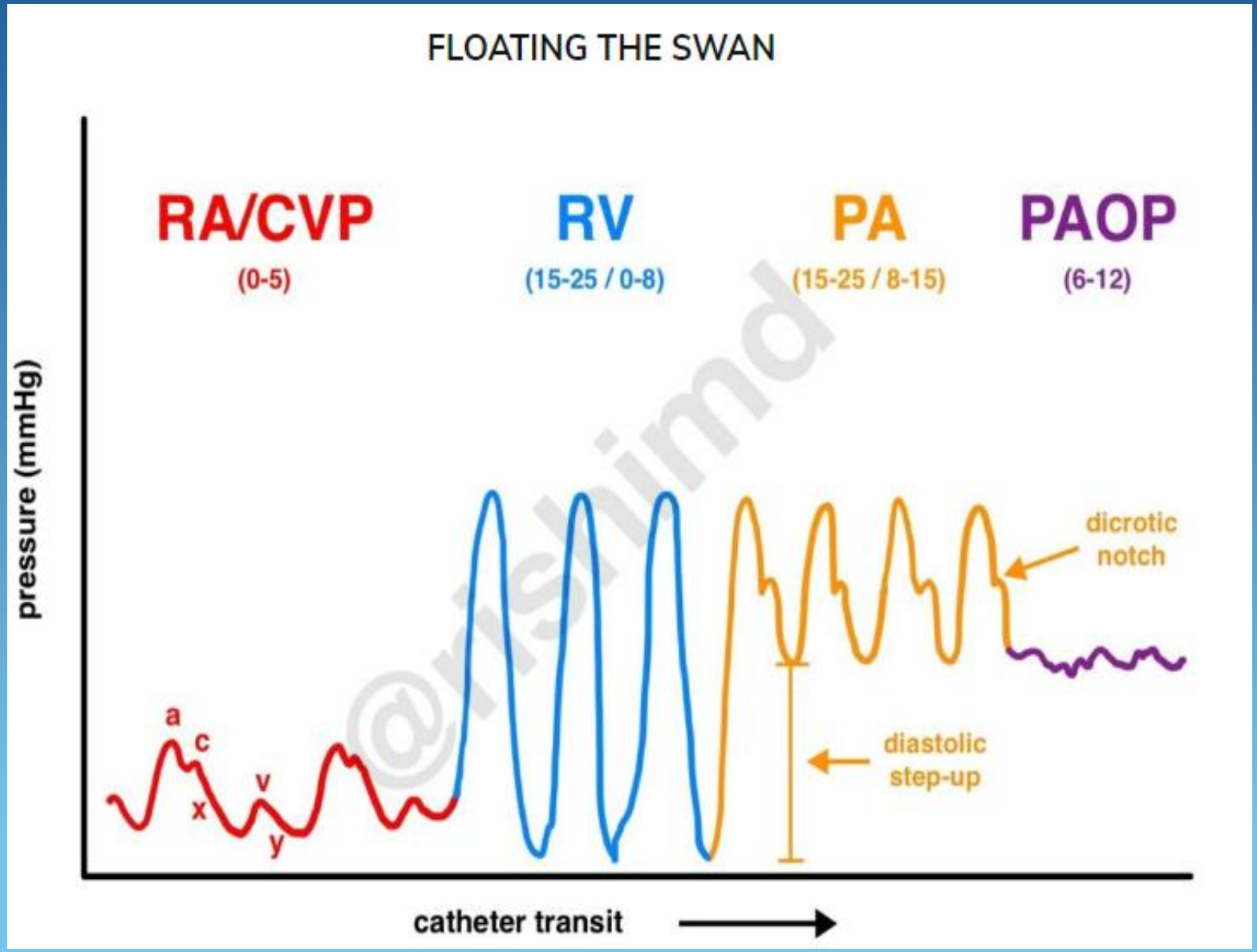
https://youtu.be/dT_ul3nvB3o

SWAN-Ganz Catheter placement

- Should be 1-2 cm to the right of the spine



Waveforms



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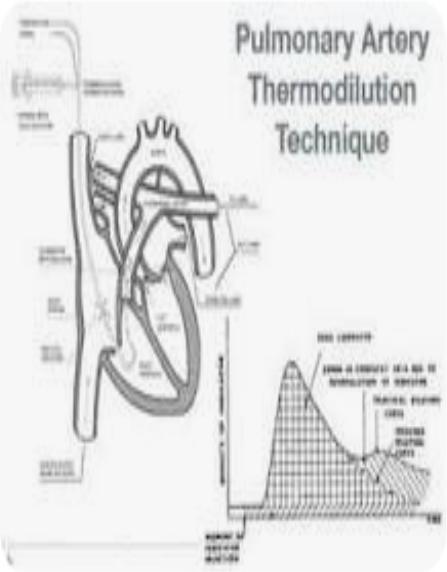
Pulmonary Artery Catheter

Pulmonary Artery Catheter

- continuous cardiac output monitoring.
- central temperature monitoring.
- measurement of pulmonary artery pressure (can also measure RA and RV pressures during insertion)
- measurement of mixed venous saturations.
- estimation of diastolic filling of left heart (normal PCWP 2-12mmHg)



Pulmonary Artery Catheter

- PAWP Goal for resuscitation in sepsis is 10 mmHg to less than 18 mmHg
- Calculated Values
  - SVR
  - PVR
  - CI

Putting it Together

1

1. **Identify the class of shock**

- a. History
- b. Examination
- c. Look at data from devices

2

2. **Address the underlying cause to correct the problem**

- a. Figuring out which class of shock can be difficult
- b. Patient may have more than one class of shock at the same time

3

3. **Support the patient**

- a. patients do not do better when they code
- b. earlier intervention leads to better outcomes

Work Cited

- stroke volume variability on aline tracing picture - Search Images
- swan ganz catheter placement - Search Images

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