Paediatric Intensive Care Unit

Arterial Line Waveform Interpretation

Staff relevant to:	PICU staff
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1. Introduction and who this document applies to:

The document is primarily aimed at education to provide some basic understanding of arterial line wave form.

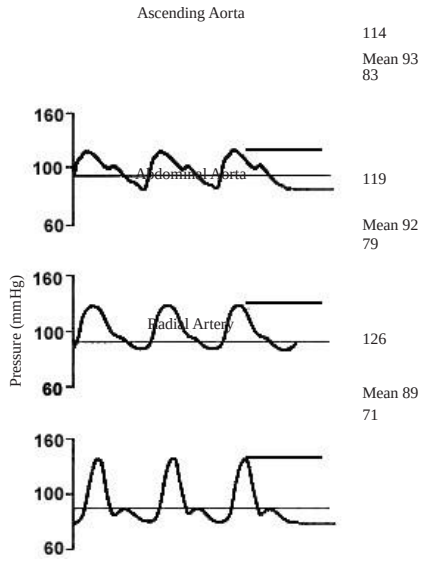
The interpretation of arterial traces requires experience and should not be considered in isolation i.e. the patient needs to be examined and if in doubt discussed with the Duty Intensivist.

2. Examples of Traces

Normal trace variation

The diagram to the right shows the variation that occurs in different arteries.

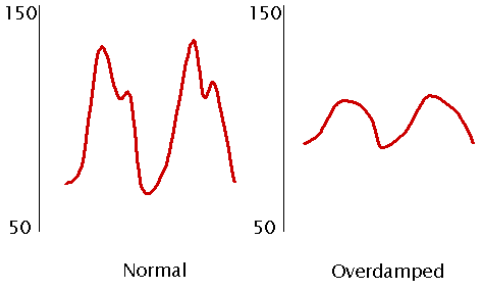
This is related to turbulent flow. Note that although there can be large variations between the systolic and diastolic pressure the mean stays stable.



Dampened Trace

- Air Bubbles
- Catheter Kinks
- Clots
- Injection Ports
- Low Flush Bag Pressure Or No Fluid In The Flush Bag
- Overly Compliant, Distensible Tubing

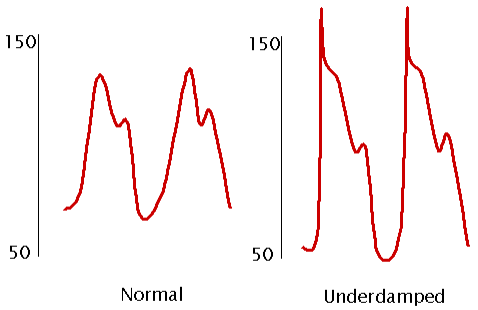
This type of trace **UNDERESTIMATES** blood pressure.



Hyperactive Trace

- Long tubing
- Overly stiff, non-compliant tubing
- Increased vascular resistance
- Reverberations in tubing causing harmonics that distort the trace (i.e. High systolic and low diastolic)
- Non-fully opened stopcock valve

This type of trace **OVERESTIMATES** blood pressure.



Arterial Line Swing

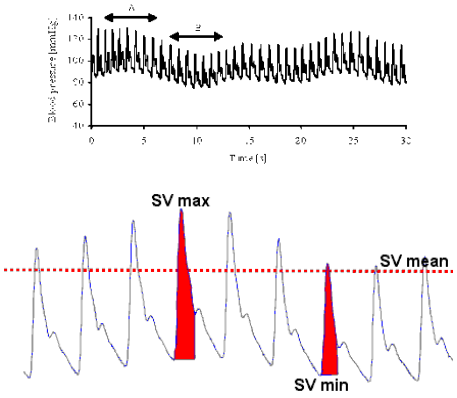
Reduction in Venous return

Dehydration - check CVP and Capillary Refil

Asthma or Hyperexpansion of the lungs (Pulsus Paradoxus)

Pneumothorax or Pleural effusions

Pericardial effusions



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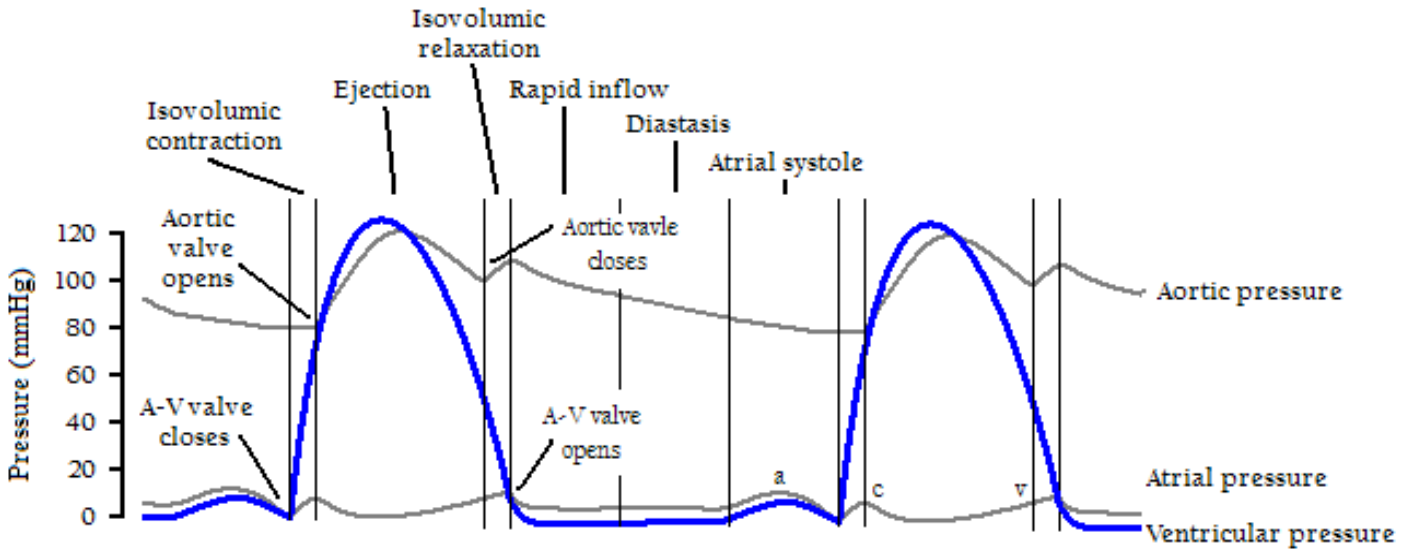
3. Relationship of Contraction, Valves and Pressure



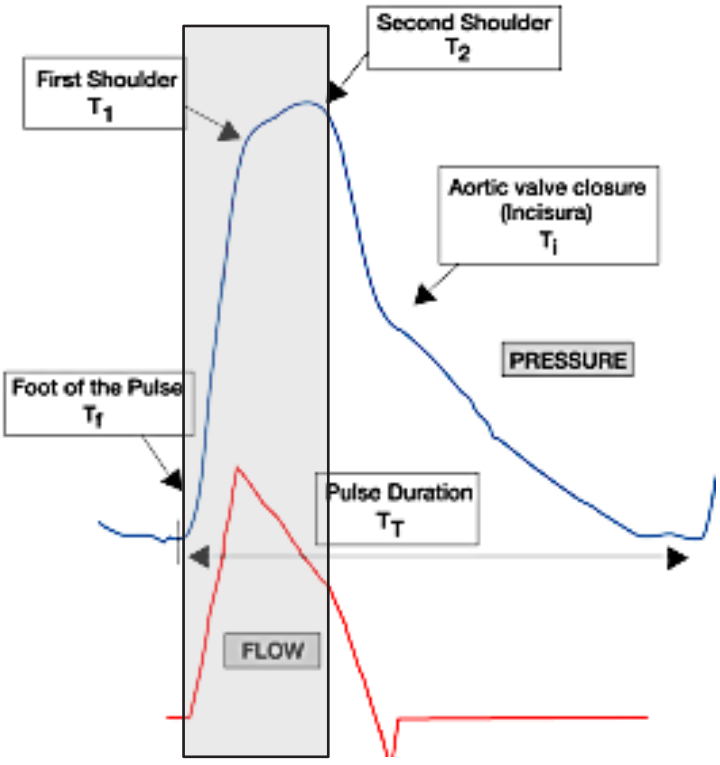
Anacrotic Limb

Represents T_f to T_2 (the shaded area of the diagram)

It occurs as the ventricles eject the blood into the arterial tree and gives a visual record of the arterial pressure rising to that of the end systole.

The steepness of the ascending phase can be affected by:-

- Heart rate,
- Increased systemic vascular resistance (more steep incline)
  - Cooling
  - Vasopressors such as noradrenaline
- Decreased systemic vascular resistance(less steep incline)
  - Septic shock
  - Vasodilators - Milrinone, GTN, Dobutamine.

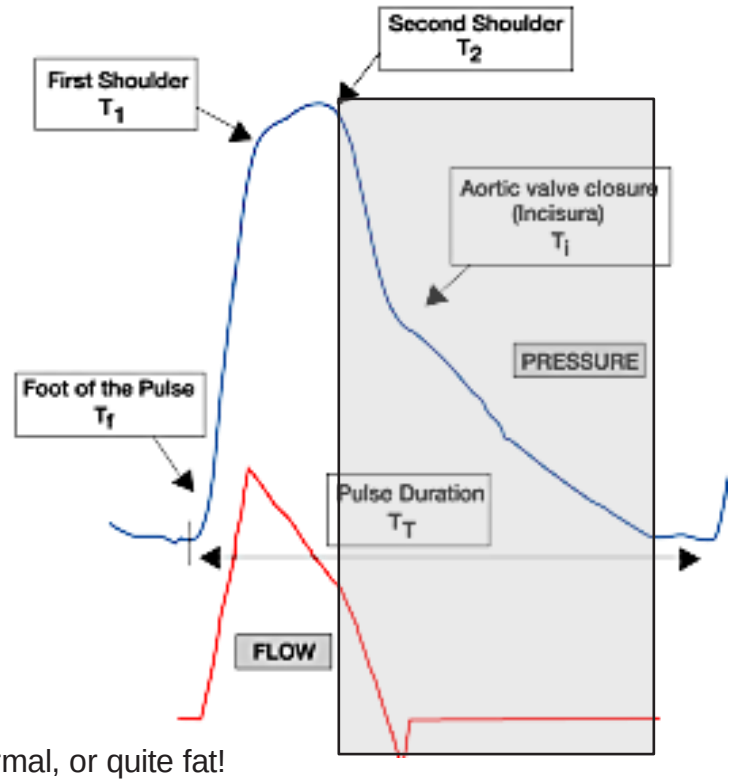


Myocardial contractility also effects the steepness of the anacrotic limb – during impaired contractility (post bypass) the up-sweep, or the rate of pressure increase can be prolonged.As the pressure reaches maximum, and the wave makes sharp turn to level off, this is called the anacrotic notch (T_1)

Dicrotic Limb

T_2 to T_f

The rate of dicrotic 'fall-off', or the rate at which the arterial line trace falls from end- systole to early-diastole changes in relation to systemic vascular resistance.



In patients with a severely reduced arteriolar resistance, fall-off time is rapid. This occurs as soon as end-systole finishes due to the greatly reduced pressure in the arterial tree (representing reduced afterload, i.e. systemic to pulmonary shunts). The arterial waveform in this clinical state looks thin and pointed (don't confuse this with resonance).

In patients with increased vascular resistance, such as main vessel stenosis for example, the dicrotic fall-off time is greatly increased. This occurs due to the length of time it takes to return to end-diastolic pressure.
The arterial waveform in this clinical state may be normal, or quite fat!
Dicrotic means 'twice beating' – meaning that this phase of the arterial pressure pulse should have a second, smaller wave, known as the dicrotic notch. This can occur at any point that there is a fluctuation in pressure during the descending arterial limb. The most common time for this to occur is when the aortic and pulmonary valves snap shut causing pressure reverberations through the arterial system

Flat or non-existent notch can mean that the patient is dehydrated (line trace will also 'swing')
Low notch can also mean high pulse pressure (due to the low diastole in septic shock for example)
Flattened notch can be present in cardiopulmonary valve insufficiency

4. Education and Training

None

5. Monitoring Compliance

None

6. Supporting References

None

7. Key Words

Anacrotic, Diastolic, Dicrotic, Systolic

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.
As part of its development, this document and its impact on equality have been reviewed and no detriment was identified.

CONTACT AND REVIEW DETAILS	
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Details of Changes made during review: **June 2023 – No changes**	