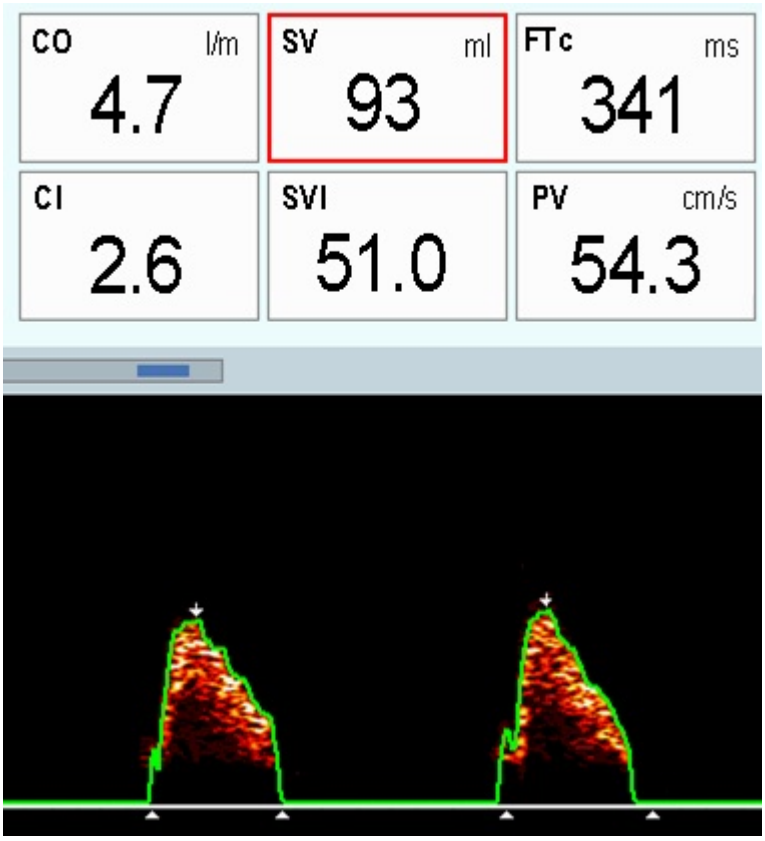
Effects of vasodilation and the diagnostic value of ectopic heartbeats

83 year old man, weight 66 kg, height 177 cm, BSA 1.82m$^{2.}$

Closure of colostomy. No cardiac history.

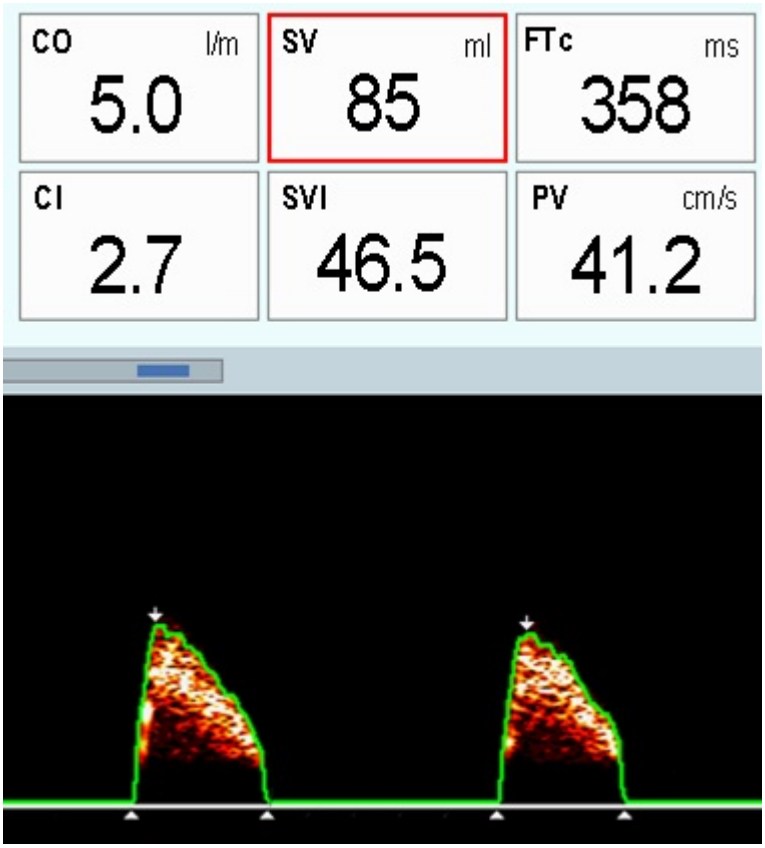
Screenshot 1 – Baseline at start of surgery



For abbreviations see Appendix 1

CO, SV and FTc may be acceptable for a healthy resting individual. **CI and PV are on the lower end of normal.** A normal PV for this age is approximately 50-80cm/s. Although these parameters appear normal, vasodilation and therefore low resistance/afterload is usually expected with anaesthesia, but since FTc is 'normal', the vasodilation could be masked by a relatively low preload.

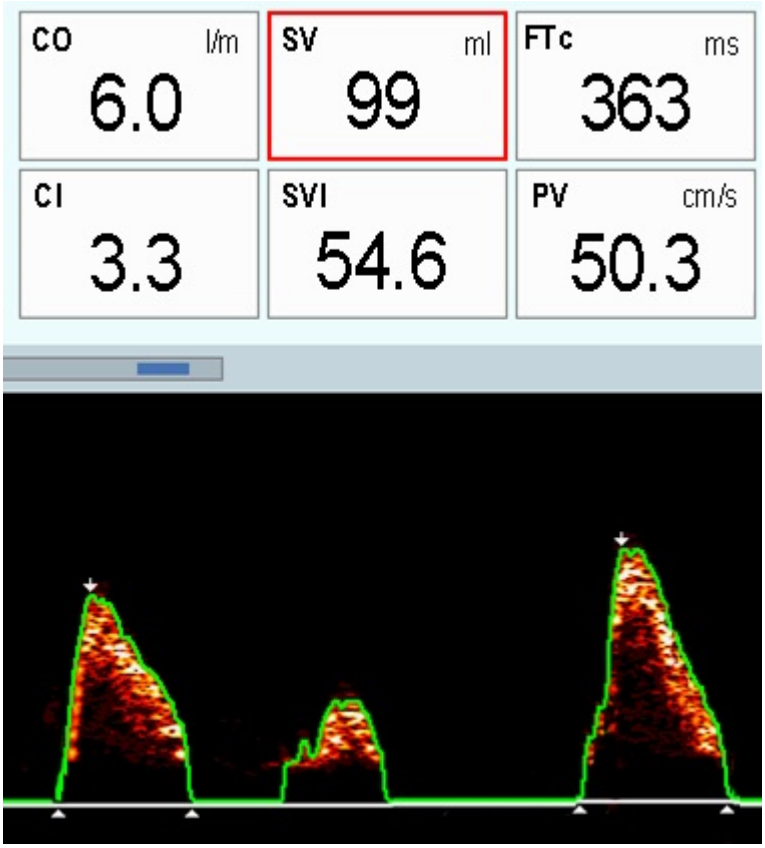
Screenshot 2 - **After epidural top up**



For abbreviations see **Appendix 1**

Before a fluid challenge was considered, a bolus of the epidural was given. This is likely to cause further dilation. **SV, SVI and PV have reduced**, which may indicate that preload may not be sufficient. **CO/CI is similar, FTc has increased slightly**. The clinician surmised that there may be relative hypovolaemia present due to vasodilation, and two 200ml rapid fluid challenges were given to fill the dilated vascular space.

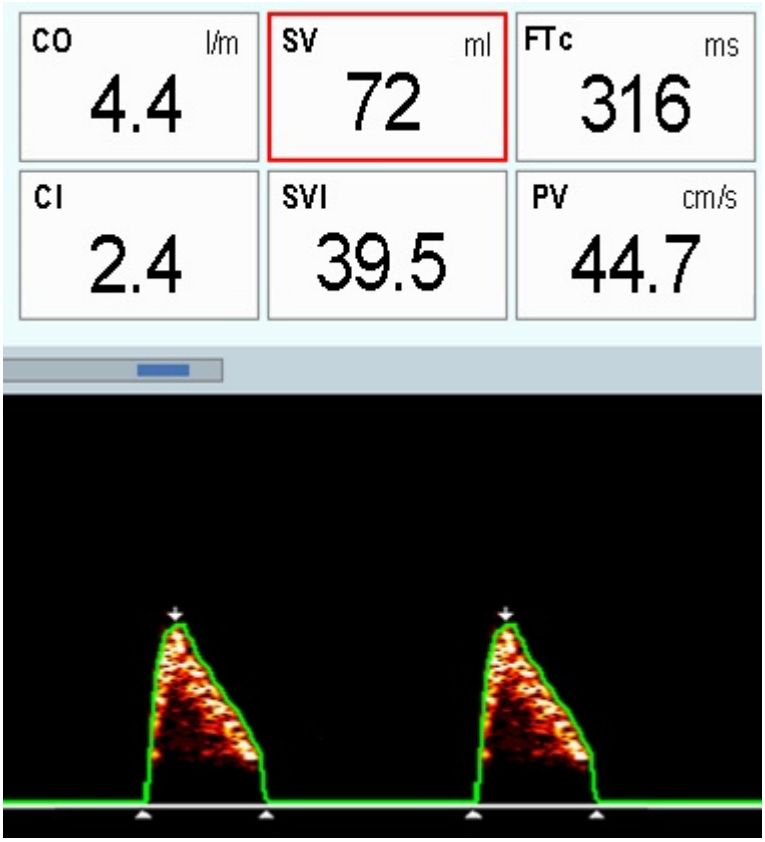
Screenshot 3 - Useful ectopic



For abbreviations see Appendix 1

All parameters have increased following the fluid and in particular the SV has increased by >10% indicating fluid responsiveness. Subsequently, isolated atrial ectopics were seen on the ECG. This can be useful when using CardioQ-ODM monitoring to determine fluid responsiveness. If the waveform after the ectopic is larger than a normal waveform, this indicates that the compensatory pause allows more filling and this larger waveform indicates fluid responsiveness.

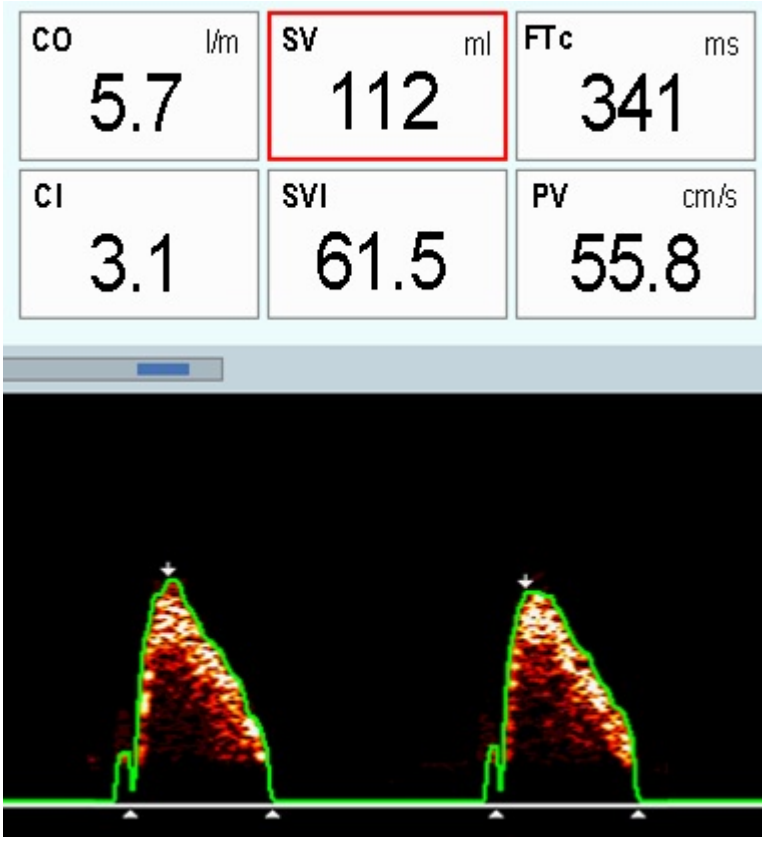
Screenshot 4 - Flow parameters reduced



For abbreviations see Appendix 1

Despite these indications of a possible reduction in circulating blood volume, no further fluid was given and 10 minutes later, **SV and other parameters reduced**. The clinician then gave three fluid challenges as per algorithm with good SV increases.

Screenshot 5 - **After 3rd fluid challenge. Abdomen now closed**



For abbreviations see **Appendix 1**

SV increased by >10 %. Other flow parameters increased. These indicate good responses to fluid.

Summary

This case scenario describes how relative hypovolaemia can be missed. Since FTc is inversely related to resistance/afterload, it can be assumed that when the patient is dilated, FTc should rise. However if the vascular space remains under-filled (relative hypovolaemia), the flow numbers may reduce initially until filling commences. It also describes how the presence of isolated ectopics could have helped the clinician to diagnose fluid responsiveness earlier. Both of these issues can be observed and corrected using the Cardio-ODM monitors.

Appendix

Abbreviations:

CO - cardiac output	SV - stroke volume	FTc - flow time corrected	
CI - cardiac index	SI - stroke index	PV - peak velocity	HR - heart rate
BP - blood pressure	CVP - central venous pressure	BMI - body mass index area	BSA - body surface area

Doppler parameter details:

FTc - duration of flow during systole and is inversely affected by afterload. Normal range in a resting healthy individual approximately 330-360ms. If afterload is increasing, FTc is likely to reduce and vice versa. Most common cause of a low FTc is hypovolemia - a low circulating blood volume causes vasoconstriction and subsequent reduced FTc. A high FTc is seen in low resistance/afterload states such as sepsis or anaesthesia.

PV - can be a good indicator of contractility but is affected by load and age. The shape of the waveform can indicate left ventricular function - more upright waveforms usually indicate good ventricular function whereas a flatter waveform usually indicates reduced ventricular function.