

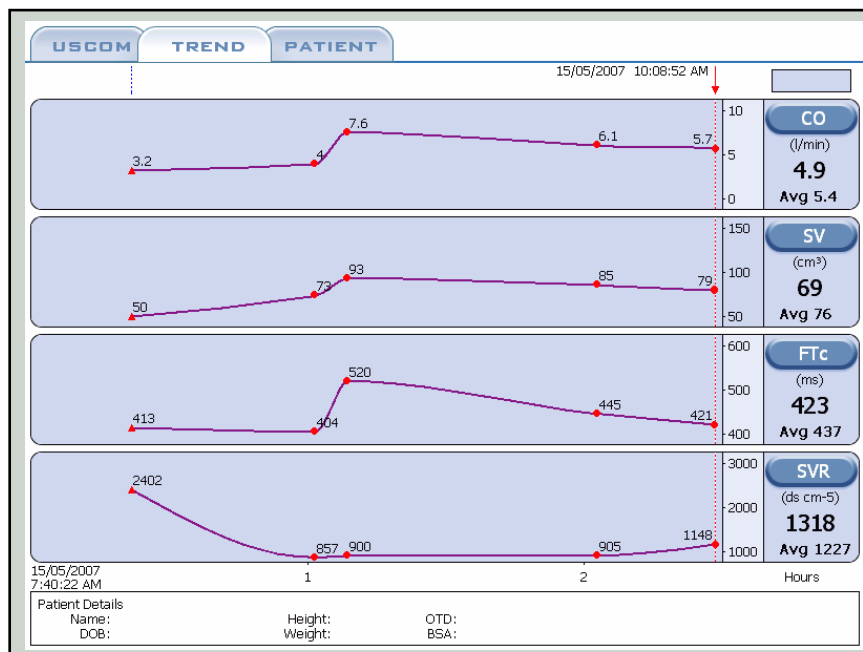
Clinical Case 2: USCOM in the Intensive Unit – Case Study



Hypotension post-op? Hypovolaemia? Septicaemia? Cardiac?

In intensive care, we have to look at the patient's cardiopulmonary system as a whole rather than looking at individual parameters; it is all too easy to focus on one parameter but miss the big picture.

A 62 year old man was admitted to ICU following an emergency laparotomy for a strangulated inguinal hernia. At surgery, approximately 1.5 metres of small bowel was resected as being of doubtful viability. His BP during the surgery had been consistently low averaging 85/50. Towards the end of surgery he was commenced on a norepinephrine infusion which increased his BP to 105/60. The presumptive diagnosis was that he had developed septicaemia. Here is his trend display.



Take a look at his figures on admission to ICU (first reading on the trend display). What do the figures tell us? Well firstly his cardiac output is low at 3.2 L/min. This could be cardiac in origin, it could be hypovolaemia. Although a raised CO is common in septicaemia, we cannot yet exclude this possibility.



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What do the other figures suggest? His SVR is high at 2402. A figure around 1000 would be normal. He is clearly vasoconstricted. This makes septicaemia less likely, but would fit with a cardiac cause or with hypovolaemia. Given that his weight is 82 kg and that a normal stroke volume is around 1-1.5 ml/kg in an adult, clearly an SV of 50 ml is low. However this could still fit with a cardiac or hypovolaemic origin.

The final figure is the corrected flow time (the duration of systolic flow corrected as if the heart rate were 60/min, rather like QTc in the ECG) which is a good indicator of ventricular preload.¹ In hypovolaemia the figure is low, whilst it is high in left ventricular failure. The normal FTc at this age is around 450 ms. At just 413 ms his FTc is low. Hypovolaemia is looking very likely now, whilst LVF seems most unlikely. Remember that he is on norepinephrine also which should increase his FTc by shunting blood from the peripheral to the central circulation.

He was treated by gradual withdrawal of the norepinephrine with simultaneous volume expansion. At the 1 hour marker, his norepinephrine was discontinued and 500 ml of Hartmann's solution infused rapidly. Notice the rapid rise in FTc as the preload is increased. Although the USCOM showed that this bolus of fluid was largely equilibrated after one further hour, his haemodynamics remained adequate and maintenance fluid only was sufficient to keep his cardiovascular parameters in the normal range.

¹ FTc is a measure of how long it takes the ventricle to eject a given stroke volume. Assuming that inotropy (myocardial contractility) is normal, then the ventricle will eject a normal SV in a normal time. SV depends largely on the left ventricular end diastolic volume and inotropy. If inotropy stays constant then a smaller LVEDV leads to a smaller SV which is consequently ejected in a shorter time, so low preload results in low FTc. A failing ventricle (low inotropy) on the other hand will take longer to eject a given stroke volume, resulting in a high FTc. In addition, the LVEDV will be increased in LVF increasing the FTc still further.

