Guidelines for using the CardioQ & CardioQ-ODM in the Operating Theatre

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The Oesophageal Doppler Guidelines

The CardioQ™/CardioQ-ODM™, when used for Individualised Doppler Guided Fluid Management (iDGFM) for patients undergoing surgery, has been shown to improve patient outcomes and reduce hospital stay. Please refer to the bibliography at www.deltexmedical.com.

The CardioQ/CardioQ-ODM *(figures 1 & 2)*, produces real time information about cardiac function and fluid status. Oesophageal Doppler Probes (ODP), Doppler Probes (DPn) and Instant Intervention Probes (I_2n) are inserted into the patient's oesophagus to approximately T5/T6, where the oesophagus & descending aorta lie within 1 cm of each other *(figure 3)*. Information regarding blood flow in the descending aorta is reflected back to the CardioQ/CardioQ-ODM. DPn and ODP are used for sedated or anaesthetised patients. The I_2n probe can be used in not only sedated and anaesthetised patients, but also in awake patients.

Figure 1 The CardioQ

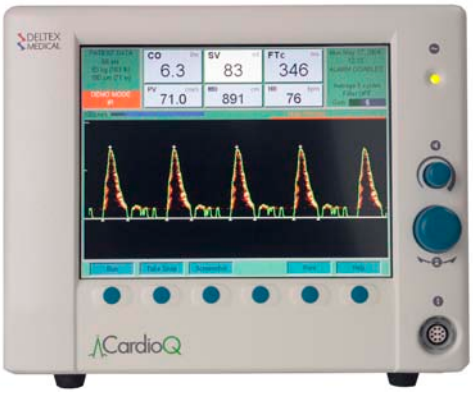
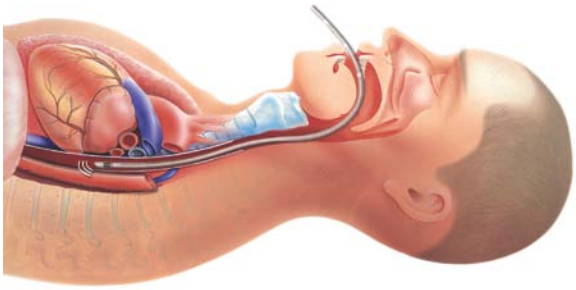
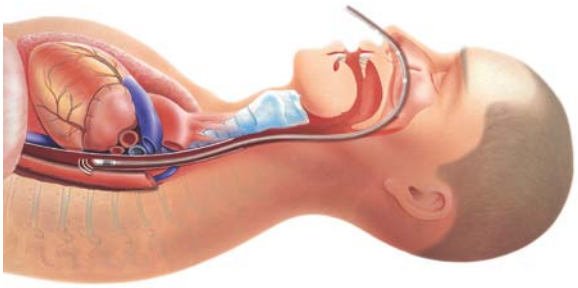


Figure 2 The CardioQ-ODM

Figure 3 Oesophageal Doppler Probe Placement



Oral Placement



Nasal Placement

Insertion and Use of Oesophageal Doppler Probes

Use and Indications

1. Elective surgery for moderate and major risk patients;
2. Emergency surgery;
3. For peri-operative iDGFM, by monitoring Stroke Volume/Stroke Distance responses to colloid challenges:

    a For use in patients with a significant change in circulatory status;
    b To assess cardiac output and effectiveness of treatment in the patient with a failing heart and to aid titration of vasoactive drugs.

Contraindications

- Doppler probes (ODP, DPn and I_2n) should not be placed in patients under 16 years of age. A dedicated paediatric probe and monitor are available separately.
- Do not use where nasal injuries are apparent or may have occurred.
- Do not use where nasal polyps exist.
- Do not use where there are circumstances of facial trauma.
- Do not use where there is a risk of brain injury.
- Do not use in patients undergoing intra-aortic balloon pumping.
- Do not use with carcinoma of the pharynx, larynx or oesophagus.
- Do not use with aneurysms of the thoracic aorta.
- Do not use with tissue necrosis of the oesophagus or nasal passage.
- Do use in close proximity to laser surgery.

For detailed precautions and warnings on probe usage, refer to the individual probe packaging for instructions for use.

Special Considerations

- Base of skull fractures;
- Careful insertion in the patient with head injury;
- Moderate to severe coagulopathies.

NB Please refer to Operating Handbook for full list of precautions, warnings and contraindications.

Preparation & Use

The user should seek specific training and/or assessment on insertion of the oesophageal Doppler probes by an experienced user, or attend an oesophageal Doppler training workshop.

Before Insertion

- Consider any contraindications;
- Choose appropriate probe i.e. consider duration of expected use and if either an awake or sedated procedure;
- Explain the procedure to the patient if using I_2n probes, or ensure patient is adequately sedated if using DPn probes.

Insertion & Set-up

- Plug in and switch on the CardioQ/CardioQ-ODM – please note the CardioQ/ CardioQ-ODM does not have an integral battery and must be plugged into the mains supply;
- When using a CardioQ, connect the probe to the interface cable, to display the Patient Data Screen. Follow the on-screen instructions to enter the patient's age, weight and height;
- When using a CardioQ-ODM, connect the probe to the interface cable and select New Patient. Enter hospital number ID or select Auto number. Follow the instructions on Screen to enter patient gender, age, weight and height;
- Press Accept Data to display the Probe Focus Screen. The probe is now ready for use;
- Check the probe is new and free from damage or abrasions;
- Liberally smear the tip of the probe with a water based lubricant as this aids insertion and signal acquisition;
- Insert the probe to a depth of 40cms (middle marker), if inserting orally, or to a depth of 45cms (proximal marker) if inserting nasally;
- A descending aortic signal may be obtained between the distal and middle markers for oral insertion and the middle and proximal markers for nasal insertion. The patients torso length will dictate the depth of the probe;
- Increase the volume and alter depth of probe using small adjustments until a waveform and audible signal, characteristic of descending aortic blood flow is located. Rotate the probe to achieve optimum signal. The optimum signal has the clearest and sharpest pitch, the brightest colour and tallest peak, indicating that the probe tip is lying closest to the descending aorta. Once the correct signal is identified, activate the "auto gain" button to achieve a clear outline to the waveform;
- Run Screen is now displayed and monitoring begins.

For additional set up features refer to the Operating Handbook or Quick Reference Guides (QRGs).

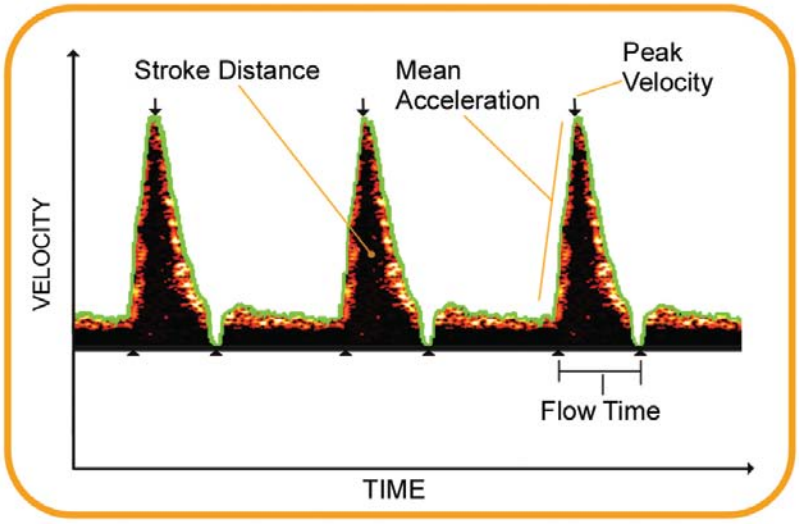
Troubleshooting

If a good trace cannot be obtained consider the following:

- Is the probe inserted using the appropriate depth markers?
- Could a nasogastric or other intraoesophageal tube be lying between the Doppler probe and the oesophagus wall, i.e. is the signal diminished in any way? If possible, re-site these to allow repositioning of the Doppler probe.
- If air is suspected to be present in the nasogastric tube, try inserting a small bolus of fluid into the tube as this can aid focus, as ultra sound cannot be conducted through air.
- Allow 5 - 10 minutes for a better contact to build up between probe tip and wall of oesophagus if focusing is proving difficult.
- A large hiatus hernia may prevent good contact against the oesophageal wall.
- If no signal can be obtained, remove the probe and re-apply a liberal amount of gel to the probe tip, before re-inserting probe.
- Consider other orifice i.e. oral or nasal.
- Occasional interference may occur from other electrical devices in the vicinity. This may affect monitoring. If so, use alternative socket.
- Some diathermy of the same frequency strongly interferes with the signal. Use beat-to-beat cycle time to obtain information from individual beats if actively filling during periods of diathermy.

Interpreting Data

It is recommended that the data gained from the CardioQ/CardioQ-ODM must be used in conjunction with assessment of all other patient physiological data.



Descending Aortic Waveform

Key Results

Stroke Distance (SD)

- Stroke distance (SD) is the distance in cm that a column of blood moves along the aorta with each contraction of the left ventricle of the heart.
- Values are age and size dependent.
- Changes in SD will be directly related to changes in stroke volume (SV).

Stroke Volume (SV)

- Stroke Volume (SV) is the amount of blood ejected by the heart during each systolic period.
- Typical values for SV in a healthy adult are 60-100ml.
- Stroke Volume Index (SVI) is the SV normalised for body surface area (BSA).
- Typical values for SVI in a healthy adult are 35-65ml/m2.
- A low value for SV/SVI may indicate hypovolaemia or an increased afterload.
- A high value for SV/SVI may indicate decreased afterload.
- Administration of certain drugs may affect the SV/SVI.
- Typical values should not be confused with a physiological target for a specific patient.

Flow Time Corrected (FTc)

- Flow time corrected (FTc) is the duration of flow during systole corrected for heart rate.
- Typical values for FTc in a healthy adult are 330-360 ms.
- A low value for FTc may indicate hypovolaemia, or other causes of increased afterload.
- A high value for FTc may be seen in patients with low afterload.
- Typical values should not be confused with a physiological target for a specific patient.

Peak Velocity (PV)

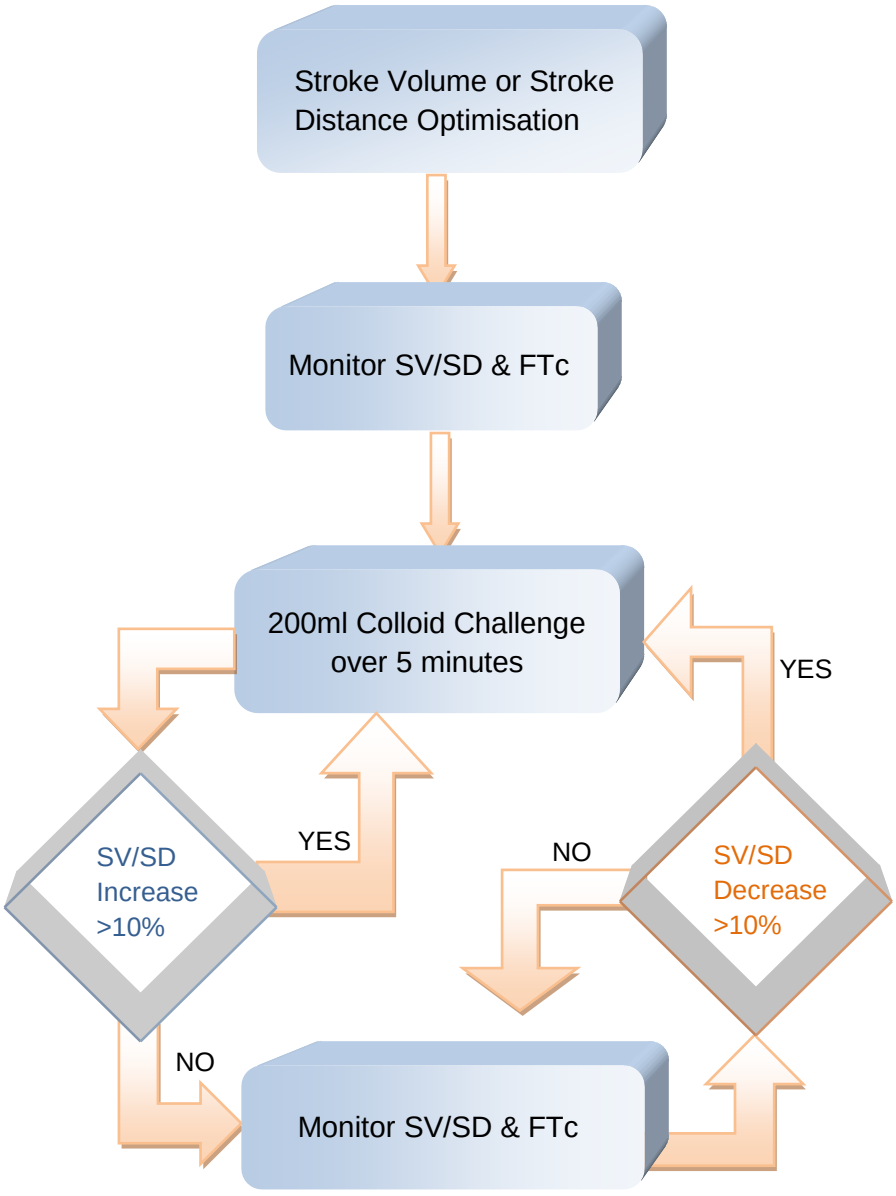
- Peak velocity (PV) is the highest blood velocity detected during systole, and may be used as an indication of left ventricular contractility.
- Typical values for PV are: 90-120 cm/s for a 20 year old; 70-100 cm/s for a 50 year old; and 50-80 cm/s for a 70 year old.
- Typical values should not be confused with a physiological target for a specific patient.

NB References are available at www.deltexmedical.com

Individualised Doppler Guided Fluid Management (iDGFM)

When using iDGFM, consider SV/SD responses to fluid challenges. A rise of 10% in SV/SD following a 200ml colloid challenge, indicates a positive response to filling. See algorithm below.

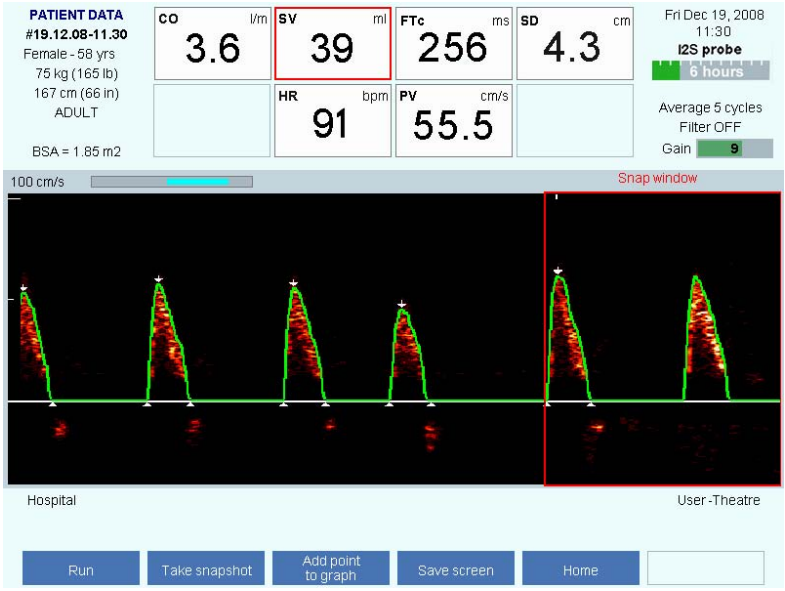
iDGFM Algorithm



Examples of Doppler Waveforms

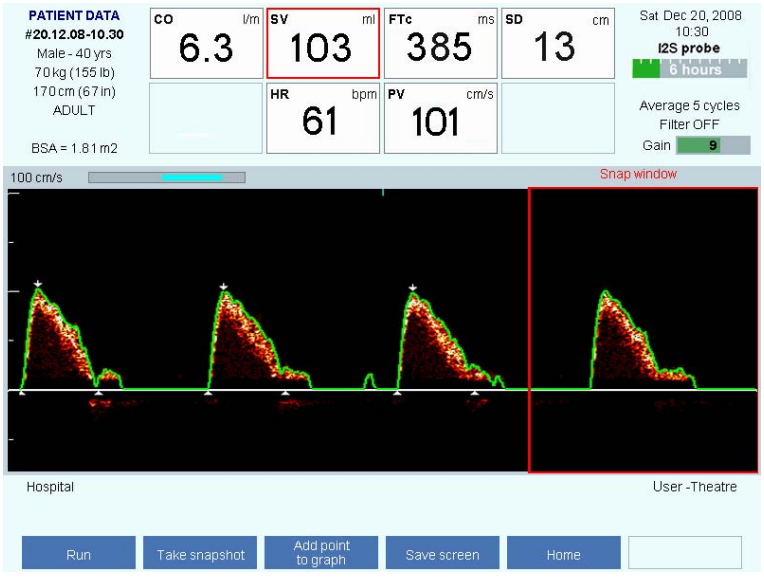
1. Hypovolaemia

This patient was having an emergency laparotomy and was suspected to be hypovolaemic. Her SV/SD were low and the FTc was short indicating an increased afterload. The most common cause of this is hypovolaemia. Following 200ml colloid challenge, the SV increased to 50ml and the SD increased to 6.4cm indicating a positive response to filling.



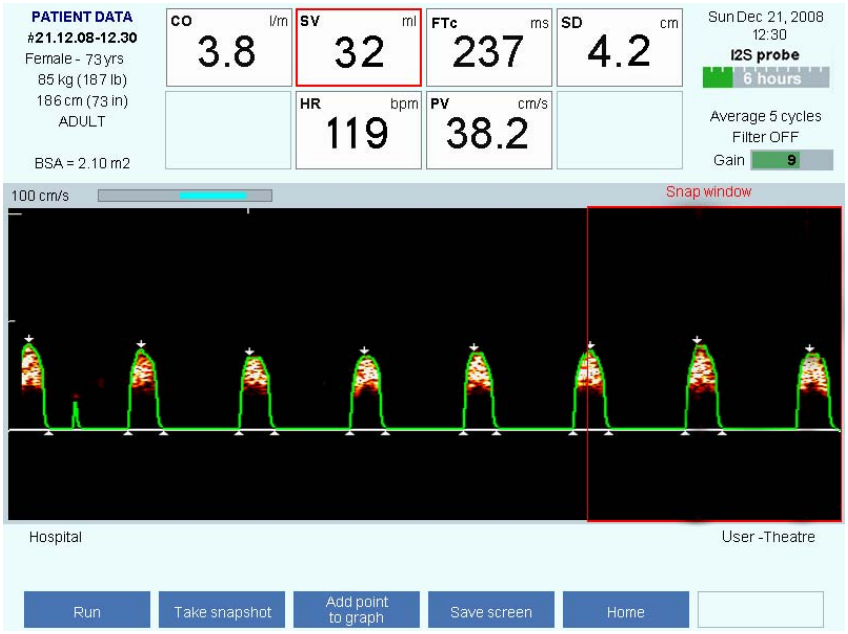
2. Vasodilated Circulation

This patient was undergoing an elective laparotomy, with an epidural infusion in progress. His SV/SD were high and FTc was lengthened. This may indicate a vasodilated circulation, often seen in this situation. Following a 200ml colloid challenge, the SV increased to 118ml and the SD increased to 14.2cm indicating a positive response to filling. A further fluid challenge only increased the SV to 125ml and the SD increased to 14.8cm. Following the iDGFM algorithm, a vasoconstrictor was commenced as the patient's BP remained low.



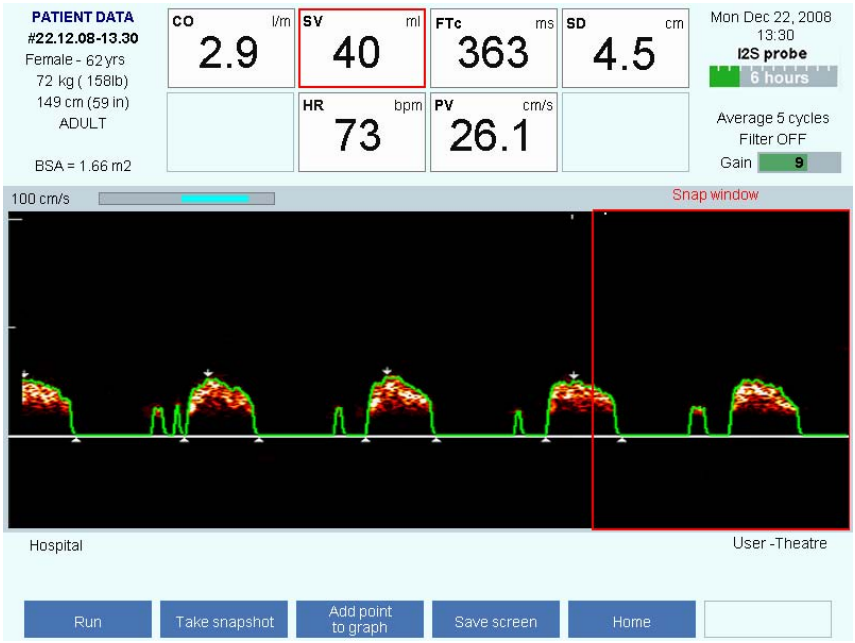
3. Vasoconstricted Circulation

This patient was undergoing elective bowel resection and a vasoconstrictor was administered, resulting in an increased afterload. This is indicated by the low SV/SD, short FTc and reduced PV.



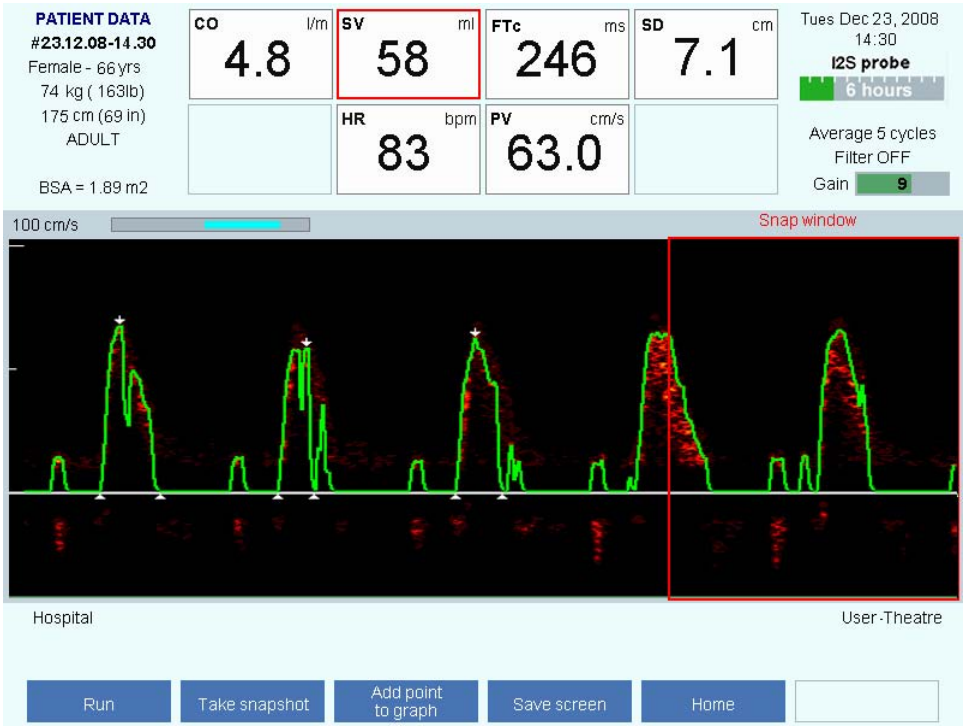
4. Cardiac Failure

This patient was having a hip replacement and has a history of left ventricular dysfunction. This is indicated by low SV/SD, reduced PV with rounding of waveform.



5. Poor Focus

Typically represented by reduced brightness of waveform, therefore the green line cannot follow the waveform. The audible sound will also be reduced. Re-focus the probe.



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