First 2008
VIVA 8

What equipment do you require to measure cardiac output via thermodilution techniques?

An understanding of the principles of monitoring in clinical practice including the evaluation of the accuracy, reliability, convenience and hazards of methods of monitoring (S 1) was the subject of this viva.

This question required candidates to describe the components of a thermodilution cardiac output catheter system (R 2.e) and invasive blood pressure transducer (R 2.d). Detailed knowledge of the physics of accurately reproducing biological waveforms, including discussion of natural resonant frequency and damping co-efficient was essential. Understanding of the sources of error such as zeroing, baseline drift, suboptimal damping and performance of a “flush test” was assessed (C1h 2.b, S 2.b). Candidates were expected to discuss the Fick Equation and the Stewart-Hamilton Equation related to cardiac output measurement by the indicator method (C1h 2.c, S 2.c). Better answers incorporated a labelled diagram of the thermodilution curve. Additional marks were awarded for a discussion of the sources of error in cardiac output measurement, computation constant and potential complications of pulmonary artery catheterisation.

**“What is the Fick equation”**

is an application of the conservation of mass
blood flow to organ = uptake or excretion/arterial to venous difference in concentration

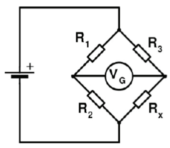
**“What is the Stewart Hamilton equation and what assumptions are made in its application?”**

Stewart Hamilton equation is used to calculate CO when undertaking thermodiution
Application of this equation assumes three major conditions;
- complete mixing of blood and indicator
- no loss of indicator between place of injection and place of detection and
- constant blood flow

The errors made are primarily related to the violation of these conditions

**“What is a transducer?”**

Transducer converts one kind of energy to another
- the strain guage is most commonly used in IABP
- a wheatstone bridge may be employed to more accurately assess the change in resistance




**“What do you know about natural frequency in IABP measurement and how can it be checked?”**

- dependent on the length, diameter and compliance of the cannula, the density of the fluid
- it is usually around 200Hz but is reduced by the addition of three way taps, bubbles etc.
- if it gets down to 25Hz then it will interfere with the recording
- it can be checked with a fast flush test

**“Discuss how you would calibrate an IABP system”**

- Static calibration - zeroing the transducer, adjusting for gain, checking for time stability
  - zeroing is removing the atmospheric pressure from the measurement
  - levelling is setting the measurement at the same height as the patient
- Dynamic calibration - adjusting the resonant frequency and damping coefficient
  - resonant frequency - is the freq at which the system would oscilltate if disturbed
  - damping co-efficient is the amount of damping and affects the sys/diastolic no.s
    - it is the property which decreases the magnitude of the oscillations
    - if it is zero the system will continue to oscillate
    - critical damping = 1, there is no overshoot but the system takes time to settle
    - optimal damping = 0.64, minimal overshoot and quick