Pulmonary Artery Catheter: Thermodilution measurement of cardiac output

- A bolus of 5-10ml cold 5% dextrose into the right atrium should decrease the temperature in the pulmonary artery.
- The rate of blood flow is inversely proportional to the change in temperature over time.
- Thus, the mean decrease in temperature is inversely proportional to the cardiac output.
- The Stewart-Hamilton Equation describes this relationship.

\[ Q = \frac{V \times (T_b - T_i)K_1 \times K_2}{T_b(t) \, dt} \]

Some catheter manufacturers have a heating filament near the tip, which means you don't have to bother with intermittent bolus injections; the catheter just does this automatically every 3 or so minutes, and you have a near-continuous cardiac output measurement.

This shows good agreement with the Fick method and with the indocyanine green dye dilution method. However, there is a lot of variability.

- You should take measurements in expiration.
- You have to take a mean of 3 measurements.
- The mean has to be 15% different to the previous mean, otherwise it is within the margin of error.
- The thermodilution cardiac output can vary by 10% from measurement to measurement without any change in the condition of the patient.

Too much injected cold stuff = underestimation of cardiac output
Too little injected cold stuff = overestimation of cardiac output
Room temperature injectate = less accuracy, but safer
Very cold injectate (0-4 degrees) = more accurate, but can induce bradycardia and decreased cardiac output

Why isn't this working? What are the causes of inaccuracy in thermodilution cardiac output measurement?

- Catheter is in the wrong position
- The thermistor tip is up against the wall
- The respiration is erratic
- There is an intracardiac shunt
- Tricuspid regurgitation
- Cardiac arrhythmia
- Rapid infusion happening via the IJ line
- Abnormal hematocrit
- Slow injectate delivery
- Injectate not cold enough, or not enough of it