SUMMARY

Understanding of the biology of both healthy and critically ill patients has been in evolution for more than 100 years., our understanding of the clinical circulation has always been thought of as" complete" with creative clinicians invoking a variety of reasons to explain away apparent discrepancies between commonly used mental models and the realities of clinical medicine.

Measurement of CVP has been a mainstay for over 50 years since it had been invented by Aubaniac, seldinger and Wilson. while the CVP is simply a pressure ideally measured in the superior vena cava, it is a false but widely held belief that it indicates, and or correlates to, the intravascular volume status. from a physiologic standpoint it makes sense that volume status cannot be inferred form the statically measured CVP or from its change over time .

The PACS ability to measure cardiac output (Co) and pressure in the pulmonary artery was a great physiologic advance. These easily obtained measurements combined with the basic concept that the wedge pressure should equal the left atrial and left ventricular pressure during diastole, and the ability to measure a mixed venous oxygenation, lead to a rapid widespread acceptance of this technique within only a few years of its clinical introduction.

Flick's principle states "the total uptake or release of a substance by an organ is the product of the blood flow to the organ and the arteriovenous concentration difference of the substance." physicians are most familiar with the Fick's principle applied C.O. to oxygen and its use

to calculate CO Clinically this principle can be used to used determine C.O when the oxygen consumption is determined using a metabolic cart and an arterial sample and mixed venous sample of blood can be obtained and their oxygen contents determined.

These devices employ computer driven algorithms to translate the arterial pressure tracing into a CO as well as other variables. the PICCO and LIDCO require that the CO of the devices be calibrated to another accepted, albeit unconventional, method first, while the FLOTRAC/ VIGELEO employs a more mathematically advanced algorithm permitting no required calibration. They all allow continuous monitoring of the arterial pulse pressure. Variation which alone, even in the absence of other functionality, may be quite useful.

The PICCO device (pulse Medical systems, Germany) is widely used in Europe and was recently introduced in the united states the device relies on several principles that are relatively new to most Anesthesiologist and intensives. The primary physiologic assumption that the technology utilizes is that the contour of the arterial pressure waveform can be analyzed and the stroke volume equals the integral of the area under the curve divided by the impedance of the aorta**.**

The LIDCO device (LIDCO LTD, UK), much like the PICCO device requires the CO to be determined in order to "calibrate" its internal algorithm. it utilizes a peripheral injection of lithium ion 0.15-0.3 mMol with a 15ml saline flush combined with a proprietary arterial line containing a lithium sensor just outside of the arterial line that is used to construct a dilution curve for the lithium ion.

The **flotrac/vigileo** system (Edwards's life sciences, lrvine CA) differs significantly from the PICCO and LIDCO devices in that no

external calibration for CO is required at all and the device can be used with a standard arterial line. instead of calibrating the device to a measured CO (transpulmonary thermo dilution CO in the case of PICCO and lithium dilution CO in the case of LIDCO), the arterial pressure waveform is analyzed in conjunction with demographic data consisting of age, height, weight and gender, this device has recently had its algorithm updated and improved its bias, precision and limits of agreement. The underlying mathematics and physics employed quit sophisticated and difficult for the non- engineer to comprehend, as opposed to the PICCO which is a relatively straightforward algorithm.

CO can also be determined completely noninvasively. The basic technical premise relies on the fact that flow throw a tube is equal to the cross section of the tube (in the case of the aorta it is a cylinder) times the velocity of the fluid.