

Central Venous Pressure

Clinical Education

CVP Physiology

Central Venous Pressure (CVP) is the clinical measurement of right atrial pressure. It is used to evaluate the adequacy of circulating blood volume and cardiac preload. Central venous pressure is comprised of the pressure generated by the volume of blood returning to the right atrium and the pressure adjacent to the heart, called juxta-cardiac pressure. The gradient between mean systemic filling pressure and CVP creates venous return and cardiac output¹.

Venous return is the rate that blood returns to the heart. Mean systemic filling pressure, right atrial pressure, and vascular resistance all play a key role in venous return. Cardiac output correlates with the function and performance of the heart. Ventricular afterload, autonomic tone, and many intrinsic factors affect cardiac output.

Any factor that causes a change in venous return and/or cardiac output can greatly influence CVP. An elevated CVP may be due to an impediment to venous return, hyperinflation, venous return has exceeded the limit of cardiac accommodation, dysfunction in the right heart or obstruction to right ventricular outflow - causing retention of blood, renal failure, or hepatic dysfunction. A lower CVP could be a response to venodilation - causing low venous return, volume loss, sympatholysis, or from any cardiac function that encourages the ejection of blood¹⁻⁴.

Due to the fact that CVP is very responsive to any change in venous return or cardiac output, it has shown to be an important measurement to integrate with other monitoring techniques, to better evaluate the patient's hemodynamic instability and to confirm a preliminary diagnosis. It has been used in the ICU for hemodynamic intervention, and bedside for interpretation of a bedside echocardiogram⁴.

Current Method

Currently the common practiced method for attaining CVP is by invasive central venous catheter. Many risks and complications are associated with central venous catheters therefore it would be an attractive option to have a non-invasive technique. Mespere LifeSciences has developed a novel device to continuously monitor CVP non-invasively.

The Mespere VENUS 2000 CVP system will help make the physical examination of CVP an easier and reliable process for the physician. In addition, the Mespere VENUS 2000 CVP system will have the additional benefits of allowing physicians to continuously assess CVP over a period of time and to observe the plethysmographic waveform, a feature not available with physical examination.

Interpreting a Change in CVP Measurement

Normal range for CVP is between 4-12 cmH₂O or 3-8 mmHg. A CVP reading outside of this range should be monitored, and appropriate measures should be taken to get the CVP back into the normal range.

Accuracy of the Mespere VENUS 2000 CVP System Compared to Catheters

Current risks involved with taking continuous CVP measurements, are catheter placement and maintenance. Catheters are susceptible to conflicting results due to, the rate that fluids are introduced, head positioning, and correct tip placement⁵. The current precision for commonly used catheters is -0.1 ± 3.5 cmH₂O⁶. Contrary to catheters, the Mespere VENUS 2000 CVP is not susceptible to these risks since it is non-invasive, and there is no placement or insertion of a catheter. The accuracy and precision of the Mespere VENUS 2000 CVP is ± 1.35 cmH₂O or ± 1 mmHg, therefore it is more precise than the current traditionally practiced method for attaining CVP.

Clinical Applications of Non-Invasive CVP

The Mespere VENUS 2000 CVP system is indicated for individuals to measure hemodynamic cardiac pressures in the human body to allow physicians to better understand cardiovascular health. The Mespere VENUS 2000 CVP system should be used by health care professionals as a non-invasive, spot-checking and/or continuous monitoring tool for physical assessment of central venous pressure (CVP) of an individual. This is done via an adhesive neck sensor placed over the external jugular vein. The device is intended for use in hospital and clinical environments.

The Mespere VENUS 2000 CVP System is ideal for preload and volume status assessment and monitoring for patients with congestive heart failure, sepsis, renal failure, congenital heart disease etc. It can be used in a variety of settings including Emergency Departments, Intensive Care Units, Heart Failure Clinics, and Long Term Care Facilities.

References

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