

Monitoring Parameters – Part 4

Central Venous Pressure

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Pathophysiology

Central venous pressure (CVP) is a function of four independent forces: volume and flow of blood in the vena cava, distensibility and contractility of the right chambers during filling, venomotor activity in the vena cava, and intrathoracic pressure. When right heart function and intrathoracic pressure are normal, CVP can be used as a reflection of intravascular volume. Changes in blood volume will result in pressure changes in the vena cava and are reflected by the CVP.

Procedure

Central venous pressure monitoring set-up: Central venous pressure measurement requires placement of a central catheter into the cranial vena cava with the tip lying near the base of the heart (i.e. right atrium). The catheter is attached to IV extension tubing, which is connected at right angles to a water manometer by a three way stopcock. Across from the IV extension tubing on the stopcock is an IV line and fluids. The zero on the water manometer should be at the level of the right atrium. A horizontal line drawn between the thoracic inlet and the manometer establishes the zero reference level.

The stopcock is off to the manometer when the patient is receiving intravenous fluids. To measure CVP, the manometer is filled with fluid from the IV bag and then the stopcock is turned off to the bag leaving a column of fluid within the manometer. The stopcock is then opened towards the patient, allowing the fluid in the manometer to access the patient. The fluid level in the manometer is allowed to equilibrate with the pressure in the jugular vein. The fluid level may oscillate a few millimeters with each respiration or heart beat. Three values or readings are obtained to ensure consistent readings.

Assessment

Normal CVP measurements are reported as -1 to 5 cmH₂O. However, critical animals are resuscitated to supra-normal values and the CVP is optimally maintained between 5-8 cmH₂O. Values less than 5 are suggestive of insufficient intravascular volume. Values over 14 cmH₂O are of concern for right heart failure or significant volume overload. Factors unrelated to right heart function and volume overload (such as pleural, pericardial or mediastinal pressure, and increases in pulmonary hypertension) can also raise the CVP.

If readings do not fluctuate with respiration, the readings are inaccurate. Note

what side the animal is positioned and, future reading should be made with the animal lying on the same side. Always use the same zero point reference (thoracic inlet), so that readings are comparable. Always obtain three or five consecutive readings at a time. Each reading should be approximately close in measurement. Huge discrepancies in readings should alert the nurses to trouble shoot the CVP set-up for kinks, clogs or changes in catheter or patient position.

Intervention

The CVP can be used to guide aggressive intravascular fluid resuscitation. When the CVP is low in a hypotensive animal, crystalloids and colloids are rapidly administered until the CVP is between 5-8 cmH₂O. At that time if hypotension persists, positive inotropes or pressor agents are administered.

High CVP measurements warrant examination of the system for occlusion of the catheter. If the system is patent, then fluid overload or right heart failure are suspected. The fluid rate is lowered and the veterinarian will opt to administer diuretics or drugs specific for the cardiac condition. Any CVP measurements outside of the target values set by the veterinary team should be reported to the attending veterinarian.