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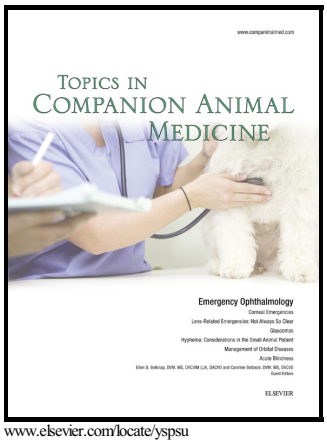

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A review of CVP and its reliability as a hemodynamic monitoring tool in veterinary medicine

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Abstract
Objective – To review the current literature regarding central venous pressure (CVP) in veterinary patients pertaining to placement (of central line), measurement, interpretation, use in veterinary medicine, limitations and controversies in human medicine.
Etiology – CVP use in human medicine is a widely debated topic as numerous sources have shown poor correlation of CVP measurements to the volume status of a patient. Due to the ease of placement and monitoring in veterinary medicine, CVP remains a widely used modality for evaluating the hemodynamic status of a patient. A thorough evaluation of the veterinary and human literature should be performed to evaluate the role of CVP measurements in assessing volume status in veterinary patients.
Diagnosis – Veterinary patients that benefit from accurate CVP readings include those suffering from hypovolemic or septic shock, heart disease and/or renal disease. Other patients that may benefit from CVP monitoring include high-risk anesthetic patients undergoing major surgery, trending of fluid volume status in critically ill patients, patients with continued shock and patients that require rapid or large amounts of fluids.
Therapy – The goal of CVP use is to better understand a patient's intravascular volume status, which would allow early goal-directed therapy.
Prognosis – CVP will most likely continue to play an important role in the hemodynamic monitoring of the critically ill veterinary patient, however when available, cardiac output methods should be considered the first choice for hemodynamic monitoring.

Keywords: central venous pressure;CVP;hemodynamic;monitoring;cardiac output;central line

Introduction

Central venous pressure (CVP) has been a major tool in assisting clinicians with fluid therapy during resuscitation efforts for decades. Many authors have recently questioned the ability of CVP to predict fluid responsiveness and its usefulness has been under intense scrutiny. Despite this, it has remained a popular technique to guide fluid therapy amongst veterinary professionals. The primary purpose of this manuscript is to review the current literature associated with CVP including a description of CVP, placement of central lines, obtaining and interpreting CVP measurements, evaluating its usefulness and limitations and summarizing the controversies in human and veterinary medicine.

Early identification and treatment of hypovolemia by means of fluid therapy is considered one of the cornerstones of proper resuscitation. It has been described in the human literature that earlier and more aggressive use of fluid therapy during resuscitation efforts of certain patients has the potential to improve macro and microcirculatory dysfunctions, secondary tissue hypoxia and the incidence of multiple organ failure. This early goal-directed therapy (EGDT) has been shown to be especially true in patients suffering from septic shock, albeit in a small number of trials [1-6]. Early resuscitation has also been noted to maximize stroke volume (SV), reduce post-operative complications, length of hospital stay, decrease morbidity and mortality and ultimately improve outcome [7-15]. Assessment of appropriate resuscitation can be difficult since apparent normalization of perfusion as measured by physical findings may occur in patients with ongoing shock syndrome [16-21]. Furthermore, the relationship between the physician's assessment of cardiac output (CO) and measured output is poor [21]. Thus, more advanced hemodynamic monitoring such as CVP is widely used.

Implementation of appropriate volume therapy is important as multiple reviews [22-24] have shown that about half of critically ill human patients do not appropriately respond to conventional fluid resuscitation efforts [23-