Using the external jugular vein collapsibility index as an indicator for reestablishment of normovolemia in a hypotensive dog - a case report

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Introduction

The correct use of fluid therapy ensures the maintenance of patients' fluid balance in several ways: by restoring the sensitive and insensitive losses of fluids and electrolytes, promoting volemic expansion of dehydrated and/or hypovolemic patients, maintaining and/or restoring acid-base balance, and providing electrolytes and buffer solutions. It is one of the pillars in the therapy of critical patients, as in cases of sepsis, septic shock and trauma.

Considering the possible complications that fluid overload and the positive water balance can bring to critical patients (Kelm *et al.*, 2015), several methods have been proposed to evaluate the real need for volume resuscitation, its quantity, time of administration and monitoring.

Researches have been proposed using the internal jugular vein to evaluate the hemodynamic status in human patients (Bilgili *et al.*, 2017; Guarracino *et al.*, 2014; Unluer & Kara, 2013). The location outside the abdominal cavity, the possibility of being evaluated in several recumbencies and the ease of localization through ultrasonography make the external jugular vein (EJV) (of larger diameter than the internal jugular vein in dogs) a possible alternative to evaluate the hemodynamic status in veterinary patients.

Objectives

The objective of this case report was to describe the variability of the EJV diameter and collapsibility index (CI) pre and post fluids resuscitation in a dog.

Case presentation

A 13-year-old neutered female Chihuahua with hypoadrenocorticism, treated with fludrocortisone for the last two years was presented with weakness, vomiting and anorexia. The dog was off the medication for one week.

On the primary survey the dog presented pale mucous, moderate dehydrated (6-7%), 60bpm of heart rate (HR), 24mpm of respiratory rate (RR), temperature of 36,5°C, weak peripheral pulses, systolic blood pressure (SBP) 90mmHg and lactate 4mmol/L.

With the dog in right lateral recumbency, using a linear probe (10 MHz), the EJV was measured during the respiratory cycle. All the exams were performed in B mode. Once the external jugular vein was identified (figure 1), the position was adjusted so that the sectional image was as circular as possible. The EJV CI was calculated following the formula:

$$\text{Collapsibility Index} = \frac{\text{(Maximum diameter of EJV – Minimum diameter of EJV)}}{\text{Maximum diameter of EJV}}$$

The patient evaluated was awake, so it was not possible to have a full control of their respiratory cycle. Given that the dog had no cardiac or respiratory diseases that could alter the central venous pressure, we assume that the maximum diameter of the jugular vein corresponded to the expiration, and the minimum diameter to the inspiration (figure 2).

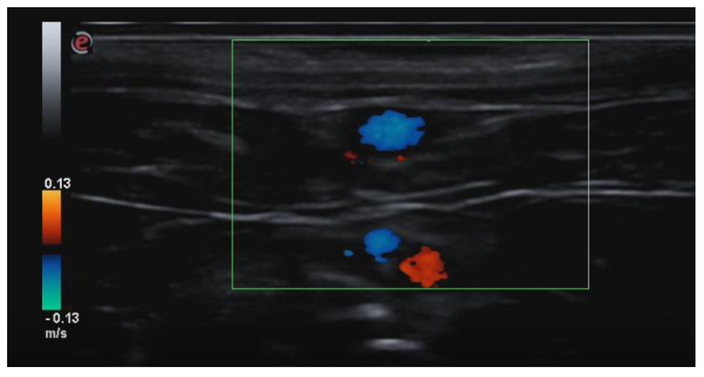

Figure 1 – Ecodoppler visualization of the EJV (upper blue circle), carotid artery (red circle) and internal jugular vein (smaller blue circle)

The EJV maximum and minimum diameters initially were 23mm and 19mm, respectively. The EJV CI was 17%.

It was initiated fluid therapy with crystalloids and a 10mL/kg bolus administrated during 20 minutes, followed by a secondary survey where the dog presented HR 112bpm, RR 20mpm, temperature of 36,5°C, weak peripheral pulses, and SBP 140mmHg. The EJV maximum and minimum diameters were 33mm and 31mm, respectively. The EJV CI was 5%.

It was administered another 10mL/kg bolus of crystalloids and the fluid therapy continued. After 40 minutes the patient presented HR 76bpm, RR 24mpm, temperature of 37,3°C, SBP 130mmHg, and lactate 1,3mmol/L. The EJV maximum diameter and minimum diameters were 35mm and 34mm, respectively. The EJV CI was 3%.

The patient continued hospitalized receiving fluid therapy, and appropriated treatment with corticoids, and was discharged after 48 hours.

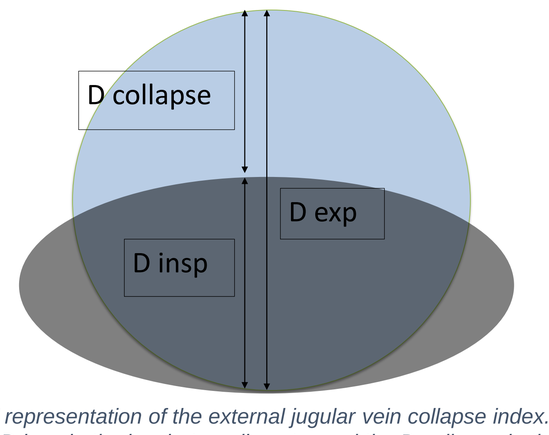

Figure 2 - Conceptual representation of the external jugular vein collapse index. The D exp consists in the expiratory diameter, the D insp in the inspiratory diameter and the D collapse in the collapse of the jugular vein during the respiratory cycle.

New/Unique Information

EJV measurements using ultrasound was easy and swiftly performed, it was not stressful to the patient and did not require any invasive approach.

Using the EJV diameter and CI variation to estimate the hypovolemic condition contributed to an adequate rapid volume replacement during an emergency approach in a dog. The successful EJV CI targeted reestablishment of normovolemia is reflected in a controlled fluid administration that allowed a reduction of the CI from 17% to 3% in just 40 minutes.

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References

Bilgili B, Haligoglu M, Tugtepe H, Umuroglu T (2017) The assessment of intravascular volume with inferior vena cava and internal jugular vein distensibility indexes in children undergoing urologic surgery. doi 10.1080/08941939.2017.1364806.

Kelm DJ, Perrin JT, Cartin-Ceba R, Gajic O, Schenck L & Kennedy CC (2015) Fluid overload in patients with severe sepsis and septic shock treated with early-goal directed therapy is associated with increased acute need for fluid-related medical interventions and hospital death. doi 10.1097/SHK.0000000000000268.

Guarracino F, Baldassarre F, Forfori F, Bertini P, Magliacano L & Pinsky MR (2014) Jugular vein distensibility predicts fluid responsiveness in septic patients. doi 10.1186/s13054-014-0647-1.

Unluer EE. & Kara PH (2013) Ultrasonography of jugular vein as a marker of hypovolemia in healthy volunteers. doi http://dx.doi.org/10.1016/j.ajem.2012.07.003.