The assessment of intravascular volume status (IVS) is one of the great challenges in the care of critically ill patients. An accurate IVS evaluation is essential to properly manage fluid therapy and responsiveness to treatment. For this reason, the main ultrasound protocols in use in Emergency Department include the volume assessment [1].

Many reports have been published on the role of ultrasound measures as tool to estimate the volume status and fluid responsiveness in ventilated patients but few on spontaneously breathing patients [2,3].

The main ultrasound measures used as IVS surrogates are the diameter of inferior vena cava: the diameter of inferior vena cava maximum and minimum (IVC Dmax, IVC Dmin); the IVC distensibility or caval index (IVC Dmax – IVC Dmin / IVC Dmax * 100 expressed as a percentage), IVC ratio (IVC max transversal/ IVC max longitudinal).

All these measures are obtained during one respiratory cycle and are suggested as a tool for intravascular volume status evaluation by international emergency scientific society (www.acep.org).

Many studies have tested the diagnostic accuracy of the previous measures using the following quality indicators: validity in predicting fluid responsiveness [2] and central venous pressure (CVP) value [4].

Although, according to a previous meta-analysis, the Central Venous Pressure (CVP) does not seem to predict the volume status [5].

According to the current opinion consensus (www.acep.org) and to the literature [3], among shock patients, with an absolute hypovolemia, the maximal IVC diameter should be low and the IVC distensibility or caval index, expressed as a percentage, higher than 50%.

In particular, Dipti A et al, in a meta-analysis on the diagnostic accuracy of IVC ultrasound measures among spontaneously breathing patients, suggested that the maximal IVC diameter was significantly lower in shock patient group respect to euvoletic control, with a difference of 6,26mm (95%CI - 6,51,-6,02).

In the same meta-analysis, among the 5 studies included, the mean range value of maximal IVC diameter was lower in the shock group (range from 6 to 16 mm) respect the control group (range from 13 to 77 mm).

In my opinion, there are divergent conclusions on the efficacy of the IVC distensibility’s in the assessment of volume status among spontaneously breathing patients [2,6, 7] and some reports suggest that the IVC distensibility’s ability to distinguish patients who are fluid responsive from those who are not is low [2,8].

Anyway there is not review neither meta-analysis on the comparison of the efficacy in assessment of volume status among the different inferior vena cava ultrasound measures.

According to my personal data, the maximal and minimal IVC diameter (IVC Dmax and IVC Dmin) show the best correlation with the central venous pressure and the best validity in predicting its values.

The main limitation of clinical use of IVC Ultrasound measures is that there are scarce data on their reliability. The few studies published on this topic suggest that the only IVC Dmax could have a fair-moderate inter-rater reliability.

But the role of these Ultrasound measures is also fundamental to evaluate the hypervolemia: eg. decompensate acute heart failure and pre-dialysis.

Among these patients, recent data suggest that: in patients with chronic HF with or without a reduced LVEF, increasing IVC diameter identifies patients with an adverse outcome [9]; the mean IVC diameter was higher among the patients with decompensated HF than among the patients with compensated HF; there was a significant positive correlation between IVC diameter and NT-pro BNP; a cut off value of an IVC diameter greater than or equal to 20.5 mm predicted a diagnosis of compensated HF [10]. However we should be prudent when we...
use the IVC ultrasound measures to manage fluid resuscitation because they have limitations in some clinical context. For example in patients with cor pulmonale, cardiac tamponade, right myocardial infarction or right heart failure an high IVC diameter and a reduced caval index does not exclude fluid responsiveness. For this reason a complete ultrasonic evaluation of volume status should include a focused cardiac and thorax ultrasound and the IVC ultrasound measures. Naturally all the ultrasonic findings should be interpreted in the clinical setting and added to other diagnostic findings (laboratory and radiology). In conclusion the evaluation of volume status in critically ill patients is still a best challenge for the emergency doctor because the IVC ultrasound measures are limited by scarce research on inter-rater reliability and the caval index could be inappropriate in Spontaneously Breathing patients. The previous measures should be added to a focused cardiac and thorax ultrasound to improve diagnostic accuracy. Finally all the ultrasound findings should be read in the clinical context. In any case the Point-of-care ultrasonography allows an easy and rapid assessment of intravascular volume status.

REFERENCES


