

# VEXUS—The Third Eye for the Intensivist?

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The hemodynamic management of a critically ill patient is based on the assessment of venous pressure. The physicians nowadays rely heavily on inferior vena cava (IVC) measurement as the representative of the fluid status of the patient. But IVC measurement is a static parameter and is associated with subjective variability. Similarly, central venous pressure (CVP) measurement has been associated with measurement errors as the appropriate trigger for resuscitation is unclear.<sup>1</sup> With fluid overload, the interstitial edema sets in which results in decreased organ perfusion, specifically in encapsulated organs like liver, kidney, and the brain.<sup>2</sup> So, how to resuscitate the patients with optimal fluid volume is the biggest question bothering the intensivist.

Is Venous Excess Ultrasound Score (VEXUS) the answer to this dilemma? This is the question which modern-day intensivists are trying to decipher by combining IVC measurement, hepatic vein Doppler, and portal vein pulsatility. Beaubien-Souligny et al.<sup>3</sup> looked at various grading systems of venous congestion and validated the VEXUS protocol by concluding that two severe alterations in hepatic and portal vein flow patterns and an IVC diameter exceeding 2 cm is associated with a high incidence of acute kidney injury (AKI) after cardiac surgery. Du et al.<sup>4</sup> proposed monitoring hepatic venous velocities to assess for fluid responsiveness in shock patients and found that  $\Delta D$  wave velocity change of >21% is indicative of lack of fluid responsiveness.

In the current issue of the *Indian Journal of Critical Care Medicine*, Bhardwaj et al.<sup>5</sup> evaluated their modified VEXUS protocol in predicting AKI in patients with cardiorenal syndrome. Thirty patients were enrolled for the study who already were falling in one of the stages of AKI. On day 3, they were reevaluated on the basis of VEXUS grading. They found a strong correlation between grades of VEXUS and the stages of AKI. With improving AKI, the grades of VEXUS also became better ( $p = 0.003$ ). But this being a single center study and being performed in non-septic patients, the exact relevance in patients who require the maximum fluid resuscitation still cannot be established. Secondly, they modified the original protocol where intraparenchymal renal Doppler was also performed.

The venous congestion in cardiorenal syndrome has very specific pathophysiological changes like activation of renin-angiotensin system, increase in intra-abdominal pressure, sympathetic overactivity in association with iron deficiency anemia.<sup>6</sup> So, the presence of AKI in cardiorenal syndrome is just not due to venous congestion but also other contributing factors. The VEXUS grading improving with resolution of AKI should not be taken plainly as decrease in venous congestion. It could also be the improvement in the cardiac function of the patient which could have contributed to improvement in AKI. Similarly, septic patients are a very different and difficult subset in intensive care unit (ICU). They are vasodilated and require fluid resuscitation for optimization of venous volume and cardiac output. Central venous

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pressure measurement which has been used for ages, is not the ideal monitoring technique as it does not correlate with blood volume and does not give a true representation of the response of fluid challenge.<sup>7,8</sup> Other functional hemodynamic tools like stroke volume variation or pulse pressure variation or passive leg raising test require specific monitoring equipment or are invasive in nature. Clinical parameters like peripheral edema, pleural effusion, or ascites do not guide the clinician about the fluid status of the patient, although the incidence of AKI is higher in patients with peripheral edema.<sup>9</sup> Point-of-care ultrasound (PoCUS)-based hemodynamic monitoring and judgment of fluid responsiveness is the current flavor among the intensivist but it has to be utilized very cautiously.

The IVC diameter measurements and its variability with respiration is probably the most commonly used noninvasive technique nowadays. But these measurements do not represent the true status of the patient's preload. Inferior vena cava dilatation can be present in healthy athletes<sup>10</sup> along with in certain pathologies like valvulopathies or pulmonary hypertension. Similarly, measurements of hepatic and portal venous flow patterns are dependent on the expertise of the intensivist and also on the respiratory movements of the patient as rapid breathing may mask or completely occlude the hepatic vein and hence measurements may become difficult.

The concept is very encouraging but before labeling it as the first tool in the armamentarium, it has to be validated in various subsets of critical care and also with various degrees of expertise of the performer. Can the modification of the original VEXUS protocol also hold true for most of the subjects needs to be studied in bigger studies and preferably multicentric. Till that time, we can gain more expertise of the protocol but also continue the current practice of hemodynamic monitoring and indices of fluid responsiveness.

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