

Clinical utility of VExUS score for anaesthesiologists

Dear Editor,

Appropriate fluid management in the perioperative period is always challenging. Unfortunately, many physicians who use point-of-care ultrasound (POCUS) use inferior vena cava (IVC) measurements only to determine whether patients are fluid-deficient or overloaded. It is also possible for the IVC to enlarge in the absence of comorbidities or valvulopathies, or pulmonary hypertension. Thus, a dilated IVC does not necessarily indicate that the individual is fluid overloaded. In addition, the amount of venous congestion in other vital organs like the lungs, liver, gut and kidneys cannot be determined by measuring IVC dilation alone.^[1] With the rise of POCUS, the venous excess ultrasound score (VExUS) is a novel and potentially useful clinical tool that grades the hepatic vein, portal vein and intrarenal venous system using Doppler ultrasonography [Table 1].^[2] As one moves away from the heart, the venous pulse weakens, resulting in undulating and phasic flow in the smaller veins. However, right ventricular failure or intravascular volume overload congests the venous compartment and limits venous compliance. The pulsations are transmitted back into the smaller veins, dampening the venous pulse. Significant liver and portal vein abnormalities can cause increased retrograde and pulsatile flow. These abnormalities may become more severe as systemic congestion increases. The pulsatility index of a normally functioning portal vein should be less than 30%. This pulsatility index can

reach 100% with severe systemic congestion, resulting in a visibly pulsating portal vein. The VExUS scores range from 0 to 3, with higher scores indicating more severe abnormalities in venous blood as described in Table 1.^[2-4] Even with inotropic support, volume overload can reduce right ventricle (RV) venous return from acutely elevated right atrial pressures. Thus, renal perfusion gradient decreases, and renal fluid retention likely increases. Unloading the RV steepens the Frank–Starling curve, allowing venous decongestion and better renal perfusion.

Clinical utility: VExUS can identify patients who will tolerate and benefit from fluid removal and set fluid resuscitation halt points. Fluid resuscitation traditionally increases cardiac output or forward flow. However, published evidence suggests that venous congestion, measured by central venous pressure (CVP) or venous Doppler indices, can eventually negate the benefits. Venous congestion can stimulate antidiuretic hormone and cause hyponatraemia, when combined with other clinical and laboratory parameters, VExUS score can also help evaluate patients with hyponatraemia.^[3] Singh *et al.*^[4] found that the VExUS score can guide dilated cardiomyopathy decongestive therapy. There is a high risk of postoperative acute kidney injury (AKI) if there are at least two severe pulse-wave Doppler ultrasound alterations in the hepatic vein, portal vein or intrarenal venous flow and an IVC of 2 cm upon intensive care unit (ICU) admission following cardiac surgery.^[5]

It is limited to certain clinical conditions. Arteriovenous malformations and thin, healthy people without venous congestion may have portal vein pulsatile flow. Cirrhosis

Table 1: VExUS score and grading of congestion

| VExUS score ^[2] | POCUS assessment | |
|------------------------------------|------------------|---|
| Grade 0 No organ congestion | IVC <2 cm | - |
| Grade 1 At risk/mild congestion | IVC ≥2 cm | Normal Doppler flow pattern in all three veins (hepatic, portal and renal vein) |
| Grade 2 Moderate congestion | IVC >2 cm | Severe flow abnormality in at least one Doppler pattern |
| Grade 3 Severe congestion | IVC >2 cm | Severe flow abnormality in multiple Doppler patterns |

IVC=inferior vena cava, POCUS=point-of-care ultrasound, VExUS=venous excess ultrasound score

and non-alcoholic fatty liver disease patients may have a non-pulsatile portal vein despite severe venous congestion due to a lack of pressure transmission from the right atrium through the liver sinusoid. The parenchymal renal disease affects intrarenal Doppler venous waveforms. Right atrial compliance may prevent hepatic vein changes even in severe tricuspid regurgitation.

To conclude, VExUS score can detect clinically significant organ congestion despite its limitations. This information can reduce the risk of postoperative AKI, right heart failure and pulmonary oedema by guiding decongestive therapy.

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Conflicts of interest

There are no conflicts of interest.

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