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Lymph Node Enlargement as a Manifestation of Systemic Venous Congestion in Patients with High VExUS Scores: A Case Series

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ABSTRACT

Introduction: Fluid overload in critically ill patients increases central venous pressure (CVP) and induces systemic venous congestion, a recognized contributor to organ dysfunction. The Venous Excess Ultrasound Score (VExUS) is a bedside ultrasonographic method that grades venous congestion by integrating inferior vena cava (IVC) diameter with hepatic, portal, and renal venous Doppler patterns. Because the major lymphatic vessels drain into the central venous circulation through the thoracic duct, sustained elevation of CVP may also impede lymphatic outflow and cause reactive enlargement of regional lymph nodes. To describe supraclavicular lymph node enlargement as a clinical manifestation of systemic venous congestion in critically ill patients with high VExUS scores.

Methods: This case series included five mechanically ventilated patients with respiratory failure and fluid overload admitted to the intensive care unit of H. Adam Malik General Hospital, Medan. Bedside ultrasonography assessed the IVC diameter and hepatic, portal, and renal venous Doppler to determine the VExUS grade, together with the evaluation of the subclavian vein and supraclavicular lymph nodes.

Results: The five patients (aged 57–77 years) had a mean IVC diameter of 2.14 ± 0.21 cm. Four patients had a VExUS grade of 3, and one had a grade of 2. All patients demonstrated supraclavicular lymph node enlargement (10.3–17.6 mm), with larger nodes tending to occur in patients with higher VExUS grades.

Conclusion: Supraclavicular lymph node enlargement may represent a reactive manifestation of systemic venous congestion in critically ill patients with high VExUS scores and could serve as an adjunctive parameter for assessing fluid overload in the intensive care unit setting.

Keywords

VExUS, Venous Congestion, Fluid Overload, Lymph Node, Intensive Care Unit

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INTRODUCTION

Fluid overload is common in critically ill patients and, when sustained, raises central venous pressure (CVP) and promotes systemic venous congestion, which is increasingly recognized as an important driver of organ dysfunction, particularly acute kidney injury [1,2]. The Venous Excess Ultrasound Score (VExUS) is a bedside ultrasonographic tool that provides a comprehensive, semi-quantitative assessment of venous congestion by combining the inferior vena cava (IVC) diameter with the Doppler waveform patterns of the hepatic, portal,

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and renal veins [3]. Higher VExUS grades have been associated with worse clinical outcomes, especially renal dysfunction, and have been proposed to guide decongestive (de-resuscitation) therapy in the intensive care unit [4].

Systemic venous congestion arising from fluid overload is not confined to the intra-abdominal venous compartments evaluated by VExUS; it also extends to the thoracic venous compartment, including the subclavian and internal jugular veins. Importantly, the major lymphatic vessels return lymph to the systemic circulation at the junction of the subclavian and internal jugular veins via the thoracic duct. Consequently, an increase in CVP can increase the outflow resistance of the lymphatic system, impede lymphatic drainage, and lead to lymphatic stasis and tissue congestion [5]. Although the pathophysiological link between venous congestion and impaired lymphatic drainage is recognized, its clinical manifestation as enlargement of regional lymph nodes has rarely been reported, particularly in critically ill patients in the intensive care unit. Therefore, we described supraclavicular lymph node enlargement as a clinical manifestation of systemic venous congestion in critically ill patients with high VExUS scores and explored its potential value as an adjunctive bedside marker of fluid overload.

METHOD

Bedside ultrasonography was performed in five patients admitted with fluid overload to the intensive care unit (ICU) of H. Adam Malik General Hospital, Medan. All patients underwent bedside ultrasonographic assessment of systemic venous congestion, comprising measurement of IVC diameter and collapsibility and Doppler interrogation of the hepatic, portal, and renal veins for VExUS grading according to the standard protocol [9]. In addition, physical examination and ultrasonography of the veins and lymph nodes were performed, focusing on the supraclavicular region, to evaluate venous and lymph node enlargement.

Written informed consent was obtained from each patient or their legal surrogate for the ultrasonographic examination and for the use of anonymized images and clinical data for publication. The report was prepared in accordance with the CARE (CAse REport) guidelines. As a descriptive case series of routinely acquired bedside imaging, no inferential statistical testing was performed; continuous variables are presented as mean ± standard deviation (SD) and range.

RESULTS

This case series evaluated systemic venous congestion using VExUS in five critically ill patients with respiratory failure. All patients were elderly: four men aged 57–77 years and one woman aged 60 years. The primary diagnoses were respiratory failure with sepsis (Case 1), respiratory failure with pneumonia (Case 2), respiratory failure with sepsis and acute kidney injury (Case 3), and respiratory failure with chronic kidney disease (Cases 4 and 5). Patient characteristics are summarized in Table 1.

Table 1. Clinical and ultrasonographic characteristics of the five patients

Variable	Case 1	Case 2	Case 3	Case 4	Case 5
Age (years) / Sex	66 / M	62 / M	60 / F	77 / M	57 / M
Diagnosis	RF + sepsis	RF + pneumonia	RF + sepsis + AKI	RF + CKD	RF + CKD
IVC diameter (cm)	2.13	2.42	2.26	2.02	1.86
VExUS grade	Grade 2	Grade 3	Grade 3	Grade 3	Grade 3
Lymph node (mm)	12.4	13.6	17.6	10.3	11.7
Subclavian vein (cm)	0.90	0.56	0.80	0.66	0.74

Note: RF, respiratory failure; AKI, acute kidney injury; CKD, chronic kidney disease; IVC, inferior vena cava; M, male; F, female.

Descriptive analysis (Table 2) showed a mean IVC diameter of 2.14 ± 0.21 cm, indicating a tendency toward inferior vena cava dilatation consistent with venous congestion; IVC dilatation (>2 cm) was present in four of the five patients. VExUS grading indicated moderate systemic venous congestion in one patient (grade 2) and severe congestion in the remaining four (grade 3). All patients showed supraclavicular lymph node enlargement, with diameters ranging from 10.3 to 17.6 mm (mean 13.12 ± 2.82 mm), exceeding the

conventional upper limit for normal cervical lymph nodes (<10 mm). The subclavian vein diameter ranged from 0.56 to 0.90 cm (mean 0.73 ± 0.13 cm).

Table 2. Descriptive statistics of the measured variables (n = 5).

Variable	Mean	SD	Minimum	Maximum
Age (years)	64.4	7.9	57	77
IVC diameter (cm)	2.14	0.21	1.86	2.42
Lymph node (mm)	13.12	2.82	10.3	17.6
Subclavian vein (cm)	0.73	0.13	0.56	0.90

Note : SD, standard deviation; IVC, inferior vena cava.

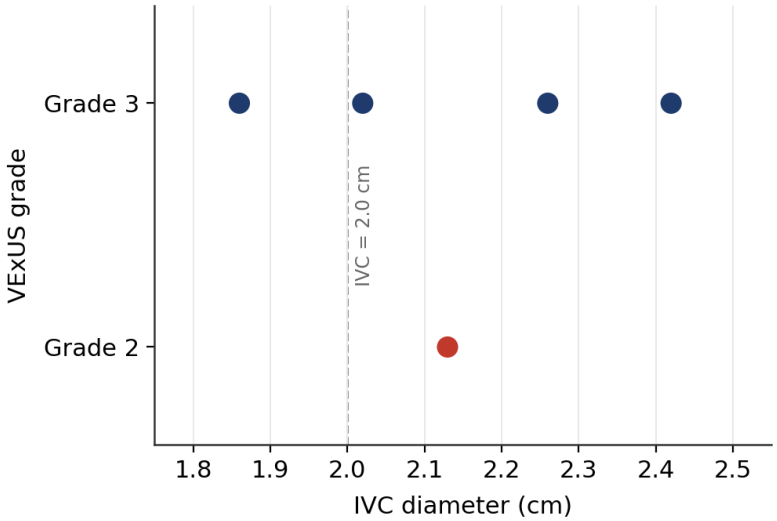

Figure 1. Relationship between inferior vena cava (IVC) diameter and VExUS grade. Patients with larger IVC diameters tended to have higher VExUS grades; IVC >2 cm occurred predominantly in grade 3.

Patients with larger IVC diameters tended to have higher VExUS grades, and an IVC diameter >2 cm was found predominantly in patients with grade 3 congestion, reflecting severe systemic venous congestion. Owing to the small sample size (n = 5), this relationship represents a clinical trend rather than a statistically significant association.

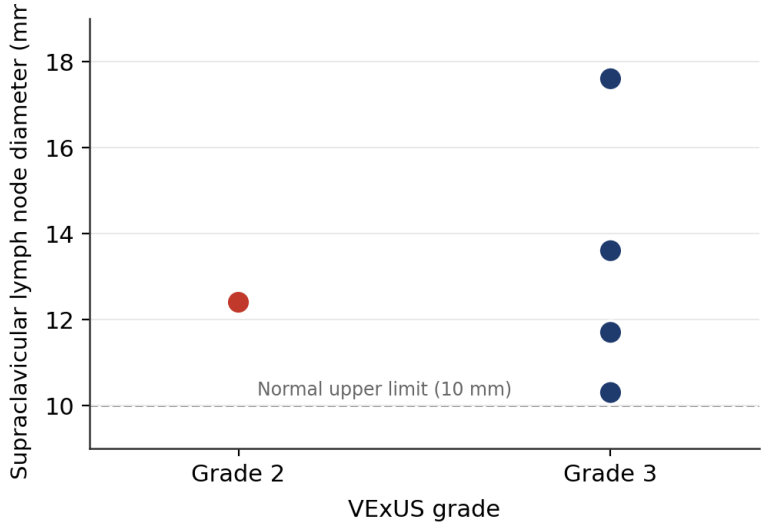

Figure 2. Relationship between VExUS grade and supraclavicular lymph node diameter. Higher VExUS grades were associated with a tendency toward larger lymph node diameters.

Patients with higher VExUS grades (grade 3) tended to have larger supraclavicular lymph node diameters than those with grade 2. Although lymph node size varied within the grade 3 group, an overall trend toward larger nodes was observed with more severe venous congestion. Taken together, increasing severity of

systemic venous congestion was accompanied by supraclavicular lymph node enlargement, supporting the hypothesis that elevated CVP may impair lymphatic drainage and produce dilatation of peripheral lymph nodes in critically ill patients.

Figure 3. Bedside ultrasonography of the inferior vena cava (IVC) showing dilatation of the IVC.

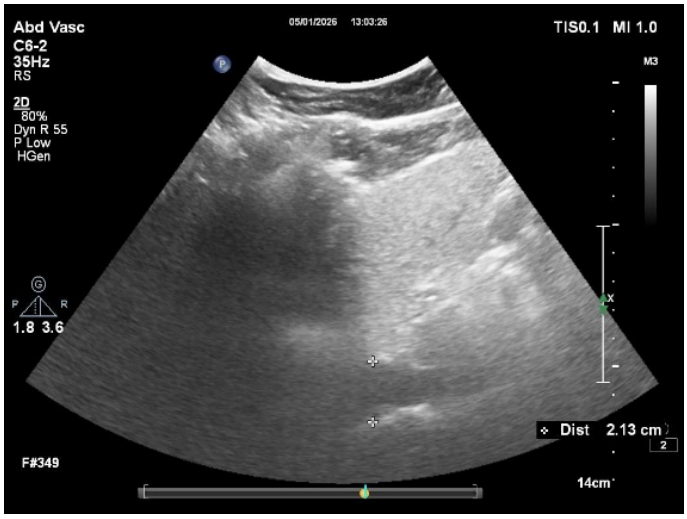

Figure 4. Supraclavicular region near the thoracic duct, demonstrating an enlarged lymph node.

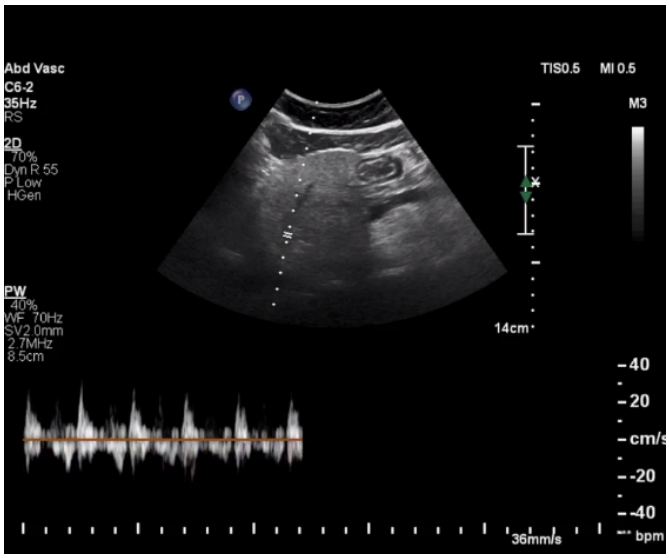

Figure 5. Hepatic vein Doppler waveform used for VExUS grading.

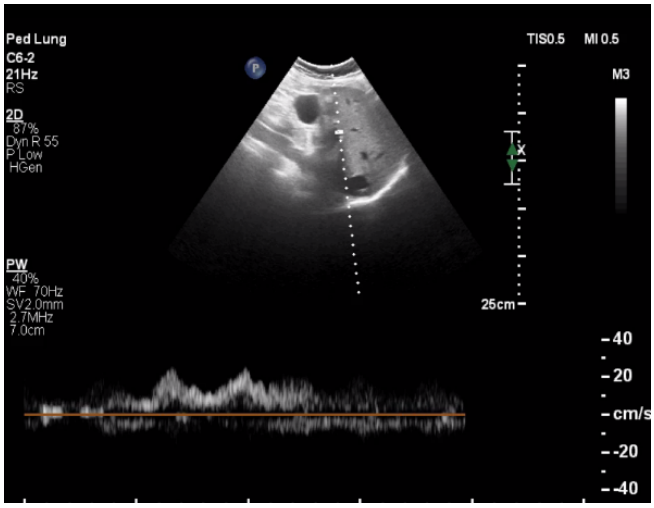

Figure 6. Portal vein Doppler waveform used for VExUS grading.

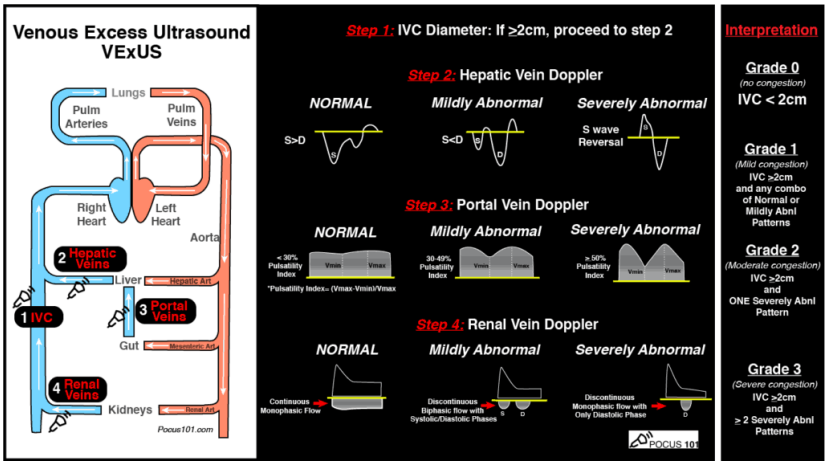

Figure 7. Renal (intrarenal) venous Doppler waveform used for VExUS grading.

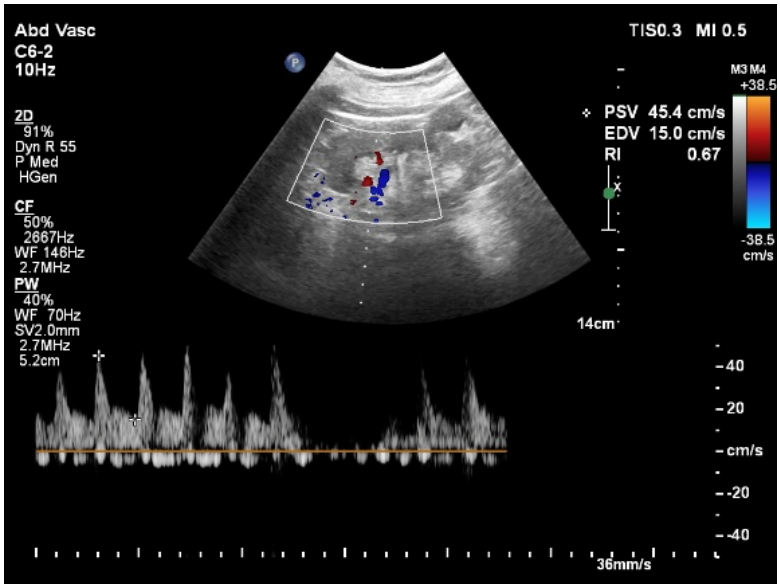

Figure 8. VExUS grading protocol integrating the IVC diameter with hepatic, portal, and renal venous Doppler patterns.

DISCUSSION

In these five patients with fluid overload, VExUS demonstrated significant systemic venous congestion, as evidenced by inferior vena cava (IVC) dilatation and abnormal hepatic, portal, and renal venous Doppler patterns reflecting persistently elevated CVP [3,4]. Pathophysiologically, elevated CVP affects not only the venous system and organ perfusion but also the lymphatic system, which drains directly into the central venous

circulation [6]. The lymphatic system maintains interstitial fluid balance by returning fluids and proteins to the venous compartment. An increase in CVP raises the lymphatic outflow resistance, impairs drainage, and causes lymphatic stasis. This leads to interstitial fluid accumulation and an increased lymphatic load on regional lymph nodes, which may manifest as reactive lymph node enlargement [7].

In our cases, the supraclavicular lymph nodes were enlarged without local signs of infection or malignancy, favoring a reactive process [8]. Concurrently, systemic venous congestion affected the thoracic venous compartment: CVP transmitted to the subclavian vein produced subclavian venous dilatation, which was identified by bedside ultrasonography. This dilatation reflects increased proximal venous pressure and may further impede lymphatic outflow, given that the thoracic duct drains at the junction of the subclavian and internal jugular veins [5]. The relationship between the VExUS-defined congestion severity and lymph node enlargement supports the hypothesis that systemic venous congestion contributes to lymphatic stasis and lymph node enlargement. Accordingly, subclavian venous and lymph node dilatation in ICU patients with fluid overload may be regarded as clinical manifestations of systemic venous congestion and secondary lymphatic dysfunction. VExUS may therefore be valuable not only for grading venous congestion and the associated risk of organ dysfunction, but also for identifying downstream lymphatic consequences [7].

This study has several limitations. The small number of cases and case-series design precluded causal inference and inferential statistical analysis. Lymphatic evaluation relied solely on ultrasonography of the supraclavicular lymph nodes without quantitative assessment of lymphatic flow. Moreover, other factors that may influence lymph node size, such as systemic inflammatory responses, could not be fully excluded [8]. Larger prospective studies are needed to confirm the relationship between systemic venous congestion severity, impaired lymphatic drainage, and lymph node enlargement. Future studies should combine VExUS with invasive hemodynamic parameters and more specific lymphatic imaging to clarify the underlying mechanisms. Integrating assessment of venous congestion and the lymphatic system may provide a more comprehensive approach to the management of critically ill patients with fluid overload.

CONCLUSION

Supraclavicular lymph node enlargement may represent a reactive manifestation of systemic venous congestion in critically ill patients with high VexUS scores. The combination of VExUS and lymph node ultrasonography may offer a novel bedside approach for assessing fluid overload and guiding de-resuscitation therapy in the intensive care unit setting.

DECLARATIONS

None

CONSENT FOR PUBLICATION

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COMPETING INTERESTS

All authors have reviewed and approved the final version of the manuscript and have agreed to its publication in the Journal of Society Medicine.

AUTHORS' CONTRIBUTIONS

All authors contributed to the conception and design of the study, data collection, analysis, and interpretation of data, drafting, and revising the manuscript. All authors have reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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