

## **Response to Fluids with Measurement of the Internal Jugular Vein by Ultrasound in Patients with Spontaneous Ventilation**

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### **ABSTRACT**

Assessing intravascular volume status (IVS) in critically ill patients, especially those in shock, is crucial for appropriate fluid therapy. While central venous pressure (CVP) serves as a gold standard, limitations in predicting IVS prompt exploration of alternative methods. Ultrasound measures of the inferior vena cava (IVC) have been proposed for fluid responsiveness. However, the role of internal jugular vein (IJV) ultrasound measures in estimating IVS and their correlation with CVP in spontaneously breathing critically ill patients remains understudied. This review aims to evaluate the reliability, validity, and correlation of IJV ultrasound measures as indicators of IVS in this patient cohort.

**KEYWORDS:** IVS assessment, Internal jugular vein, Ultrasonography, Central venous pressure, Spontaneous ventilation

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### **INTRODUCTION**

Effectively managing intravascular volume status (IVS) in critically ill patients, particularly those encountering shock, remains a formidable task in clinical practice. Accurate assessment of IVS is imperative for guiding appropriate fluid therapy, especially in conditions of hemodynamic instability. While conventional metrics such as central venous pressure (CVP) have traditionally served as a cornerstone for IVS evaluation, their limitations in accurately predicting fluid responsiveness have ignited the exploration for more reliable assessment modalities<sup>1</sup>.

The emerging role of ultrasound, specifically its application in assessing the inferior vena cava (IVC), has demonstrated promising potential as a dynamic measure for gauging fluid responsiveness. However, the scope narrows when considering the internal jugular vein (IJV) ultrasonographic measures in estimating IVS and their association with CVP, particularly in spontaneously breathing critically ill patients. The dearth of comprehensive research in this domain has left a crucial gap in understanding the efficacy and reliability of IJV ultrasound measures as predictive tools for IVS in this specific patient cohort<sup>1-3</sup>.

This review endeavors to delve into the intricacies of IJV ultrasonography, examining its reliability, validity, and correlation with CVP in spontaneously breathing critically ill patients. By exploring the nuanced relationship between IJV ultrasound measures and IVS, this review seeks to address the

current limitations and delineate the potential of IJV measures as a pivotal component in assessing volume status in critically ill patients.

### **DEFINITION**

The intricate evaluation of intravascular volume status (IVS) in critically ill patients represents a pivotal aspect of clinical care. The utilization of traditional metrics, notably central venous pressure (CVP), has long been fundamental in this assessment. However, the limitations of CVP in accurately predicting fluid responsiveness, particularly in dynamically changing clinical scenarios, have sparked the exploration of alternative methodologies. Ultrasound techniques, focusing predominantly on the inferior vena cava (IVC), have emerged as dynamic measures offering promise in predicting fluid responsiveness in critically ill patients<sup>1-3</sup>.

#### **Internal Jugular Vein (IJV) Ultrasonography**

The sphere of Internal Jugular Vein (IJV) ultrasonography serves as an underexplored yet potentially promising avenue for evaluating intravascular volume status (IVS) in critically ill patients with spontaneous respiration. Despite extensive research focusing on various ultrasound measures in critical care, the attention given to IJV ultrasonographic measures remains limited. Specifically, exploring the ultrasound evaluation of IJV dimensions, alterations in AP-IJV Dmax, and IJV Area in spontaneously breathing critically ill patients presents an exciting opportunity. These measures, if

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validated, could provide valuable insights into the dynamic changes in venous architecture and their association with IVS, potentially bridging the existing gap in understanding IVS assessment in such patients<sup>4</sup>.

### AP-IJV Dmax and IJV Area

The meticulous analysis of AP-IJV Dmax, a key parameter reflecting the maximum diameter of the internal jugular vein, along with IJV Area, holds potential significance in elucidating the fluctuations in venous size and their correlation with volume status. This in-depth exploration could shed light on the reliability and validity of IJV ultrasonographic measures as predictive tools for assessing IVS in dynamically changing clinical contexts. Understanding the interplay between AP-IJV Dmax, IJV Area, and central venous pressure (CVP) in spontaneously breathing critically ill patients stands as a crucial frontier for further exploration, potentially revolutionizing the approach to IVS assessment in this specific patient population<sup>1,5</sup>.

### DISCUSSION

Limited research has addressed the correlation between ultrasound-based measurements of internal jugular vein (IJV) diameters and central venous pressure (CVP), along with their reliability. In a systematic review, the AP-IJV Dmax and IJV area exhibited the strongest correlation with CVP, displaying superior accuracy in predicting CVP values and demonstrating excellent inter-rater reliability<sup>1</sup>.

A careful interpretation of IJV ultrasound measures is necessary in certain clinical scenarios. For instance, in patients with cor pulmonale, elevated IJV diameter and a reduced caval index may not exclude fluid responsiveness<sup>1-3</sup>.

The application of IJV ultrasound examination by emergency department physicians may be beneficial in diverse settings, especially when IVC ultrasound is impractical due to challenges such as poor acoustic windows caused by factors like obesity, abdominal air interposition, or surgical wounds<sup>1</sup>.

### CONCLUSION

The limited data and inconclusive evidence regarding the reliability, validity, and correlation of internal jugular vein (IJV) ultrasonographic measures in estimating intravascular volume status (IVS) among spontaneously breathing critically ill patients highlight the critical need for further research. Comprehensive studies investigating the efficacy of IJV measures in predicting CVP and their role as an IVS assessment tool in this patient population are warranted. Additionally, exploring the potential of pulmonary ultrasound in estimating IVS could offer a more holistic approach to volume assessment in spontaneously breathing critically ill patients.

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