



## Ultrasound-guided CVC Placement: A Structured Approach



Ultrasound guidance can improve patient safety and procedural quality during central venous catheter (CVC) placement in the internal jugular vein, according to a new study published in the journal *Critical Care*.

Although CVC placement is a routine procedure in intensive care medicine and anaesthesiology, acute severe complications (such as arterial puncture or cannulation, haematoma, haemothorax, or pneumothorax) occur in a relevant proportion of patients. The use of ultrasound (US) has been proposed to reduce the number of CVC complications and to increase the safety and quality of CVC placement.

Static and real-time US can be used to visualise the anatomy and patency of the target vein in a short-axis and a long-axis view. US-guided needle advancement can be performed in an "out-of-plane" and an "in-plane" technique. The advantage of the short-axis/out-of-plane view is that it allows better visualisation of the vein in relation to the artery and other anatomic structures, and thus might more sufficiently help to avoid accidental arterial puncture.

"There is clear evidence that US offers gains in safety and quality during CVC placement in the internal jugular vein. For the subclavian and femoral veins, US offers small gains in safety and quality. Based on the available evidence from clinical studies, several guidelines from medical societies strongly recommend the use of US for CVC placement in the internal jugular vein," the study says.

For example, the guidelines for the appropriate use of bedside general and cardiac US from the American College of Critical Care Medicine give a strong (1-A) recommendation for the general use of US for central venous access in real-time technique (1-B) using a short-axis approach (1-B). Regarding the site for CVC placement, the guidelines give a strong (1-A) recommendation for the internal jugular vein (IJV) and the femoral vein (FV), but a conditional recommendation (2-C) for the subclavian vein (SV).

However, data from survey studies show that there is still a gap between the existing evidence and guidelines and the use of US in clinical practice. For instance, among emergency physicians in the United States, 44% stated in 2014 that they never use US to guide CVC placement. On the other hand, 20% and 9% of respondents stated using US in at least 90% and 100% of cases, respectively.

For clinical practice, the study authors recommend a six-step systematic approach for US-guided central venous access that includes assessing the target vein (anatomy and vessel localisation, vessel patency), using real-time US guidance for puncture of the vein, and confirming the correct needle, wire, and catheter position in the vein.

To achieve the best skill level for CVC placement, the authors say the knowledge from anatomic landmark techniques and the knowledge from US-guided CVC placement need to be combined and integrated.

"It has been demonstrated repeatedly that positioning of the patient in a head-down (Trendelenburg) position increases the filling and thus the cross-sectional lumen of the IJV. On the contrary, to increase the lumen of the FV, patients can be positioned in a head-up (reverse Trendelenburg) position. Positioning of the leg in an abducted and externally rotated position also can help to maximise the cross-sectional diameter of the FV," the authors write.

For the IJV, imaging studies showed that the position of the head plays an important role in optimising the conditions during CVC placement. Several studies demonstrated that rotation of the head to the opposite side increases the overlap of the IJV and the carotid artery.

"DeAngelis et al. described that the IJV becomes more vertically separated from the carotid artery at more extreme angles of contralateral head rotation. These findings underline that US should be used in each individual patient to assess the optimal angle of head rotation and best approach to the IJV," the authors note.

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