

Single-Plane vs Real-Time Biplane Approaches for Ultrasound-Guided CVC



Central venous catheterisation (CVC) is a lifesaving procedure for critically ill patients, commonly used during fluid resuscitation, safe intravenous administration of medication, and to facilitate haemodialysis and monitor haemodynamic variables in the ICU. Over 15 million CVCs are performed annually in the United States, and nearly 70 CVCs per 100 patient-days are performed in European ICUs.

CVC is typically attempted through the internal jugular vein (IJV), subclavian vein, or femoral vein (FV), with IJV and FV being preferred due to fewer mechanical complications. Ultrasound (US) guidance has become standard to enhance safety and quality during CVC procedures, with various techniques, including out-of-plane and in-plane approaches, both single-plane display techniques.

The out-of-plane method provides simultaneous visualisation of the vein and nearby critical structures but may make it challenging to control the needle tip. On the other hand, the in-plane method is recommended for better needle visualisation and precise control, but it can be difficult in cases with anatomical limitations like a short neck, and there's a risk of arterial puncture without proper visualisation. Hence, there's no definitive conclusion about which approach is clinically superior, as each has its own pros and cons. The x-plane technique, a real-time three-dimensional (3D) imaging method, offers a comprehensive view of the needle trajectory, vein, and surrounding structures without the need to rotate the probe.

While previous studies have compared out-of-plane and biplane imaging for IJV catheterisation, this study aims to compare the success rates and safety of the in-plane and x-plane US-guided CVC techniques (for IJV and femoral vein catheterisation) in critically ill patients. The aim was to investigate whether using real-time biplane US guidance for CVC could enhance the success rate of the first puncture and reduce mechanical complications.

A total of 256 critically ill participants in need of CVC were included in the study. Study patients were randomly assigned to one of two groups: the single-plane ultrasound-guided CVC group (n=128) or the biplane ultrasound-guided CVC group (n=128). The study collected data on various aspects, including the success rate of CVC placement, the number of puncture attempts required, the procedure duration, complications related to catheterisation, and the operators' confidence scores.

As per the findings, successful central vein cannulation was achieved in all 256 participants, including 182 who underwent IJVC and 74 who underwent FVC. The biplane ultrasound guidance approach was associated with a higher rate of successful first puncture attempts than the single-plane approach. The biplane approach was also associated with a higher first-puncture single-pass catheterisation success rate, fewer undesired punctures, shorter cannulation times, and fewer immediate complications for both IJVC and FVC.

These findings show that real-time biplane imaging of ultrasound-guided CVCs improves the success rate of the procedure and reduces associated complications compared to the single-plane approach.

Source: [Critical Care](#)

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