LETTER TO THE EDITOR

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Patient positioning and access-site selection during central venous cannulation in patients with raised intracranial pressure: a reply

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Dear Editor,

We read with interest the paper entitled "Patient positioning during central venous cannulation in neurocritical care: an evidence gap across guidelines", which highlights the evidence gap regarding patient positioning during central venous cannulation (CVC) in neurocritical care [1]. The authors note, in line with the recent Polish Society of Anaesthesiology and Intensive Therapy guidelines, that Trendelenburg positioning, recommended to improve cannulation conditions, is essentially contraindicated in patients with intracranial pathology and elevated intracranial pressure (ICP) [2]. Although appropriate patient positioning may help prevent a rise in ICP, other factors should also be considered during CVC in patients with intracranial hypertension. This paper prompted us to identify several additional challenges encountered during CVC in neurocritical care.

First, the principal parameter assessed in the studies examining the Trendelenburg position was the cross-sectional area (CSA) of the target vein (internal jugular or axillary/subclavian vein) [3, 4]. However, the CSA of the vein intended for cannulation is only one of several factors that may theoretically influence procedural success. To date, there are no data on how CSA affects the overall success of cannulation, as this question has never been examined in clinical trials.

Second, an increase in CSA before cannulation appears to be especially relevant for the landmark-based technique of CVC. During ultrasound-guided (UG) cannulation, meticulous pre-scanning is routinely performed. This step allows assessment of the location, patency and CSA of the vein, the position of the adjacent artery and nerves, and the variation in CSA across different patient positions before cannulation.

Third, patients with raised ICP should ideally be cannulated with the trunk and head elevated approximately 30° above the horizontal plane. Unfortunately, the CSA of the internal jugular vein (IJV) is smaller in this position than in the flat position (see Figure 1). An alternative may be cannulation via an infraclavicular approach, because the reduction in CSA of the axillary vein with trunk elevation may be less pronounced than that of the IJV (see Figure 2). Moreover, the infraclavicular approach appears easier to perform than the jugular approach when the trunk is elevated, since the operator stands beside the patient's thorax, not behind the patient's head, as is required for IJV cannulation.

Fourth, the choice of access site itself, not merely patient position during insertion, may have implications for patients with raised ICP. Cerebral venous blood drains predominantly through the dural sinuses into the jugular bulbs and internal jugular veins, and the IJV constitutes the dominant outflow route in the supine position [5]. Hence, an indwelling IJV catheter might obstruct venous outflow, thereby increasing intracranial hypertension. In the sitting position, by

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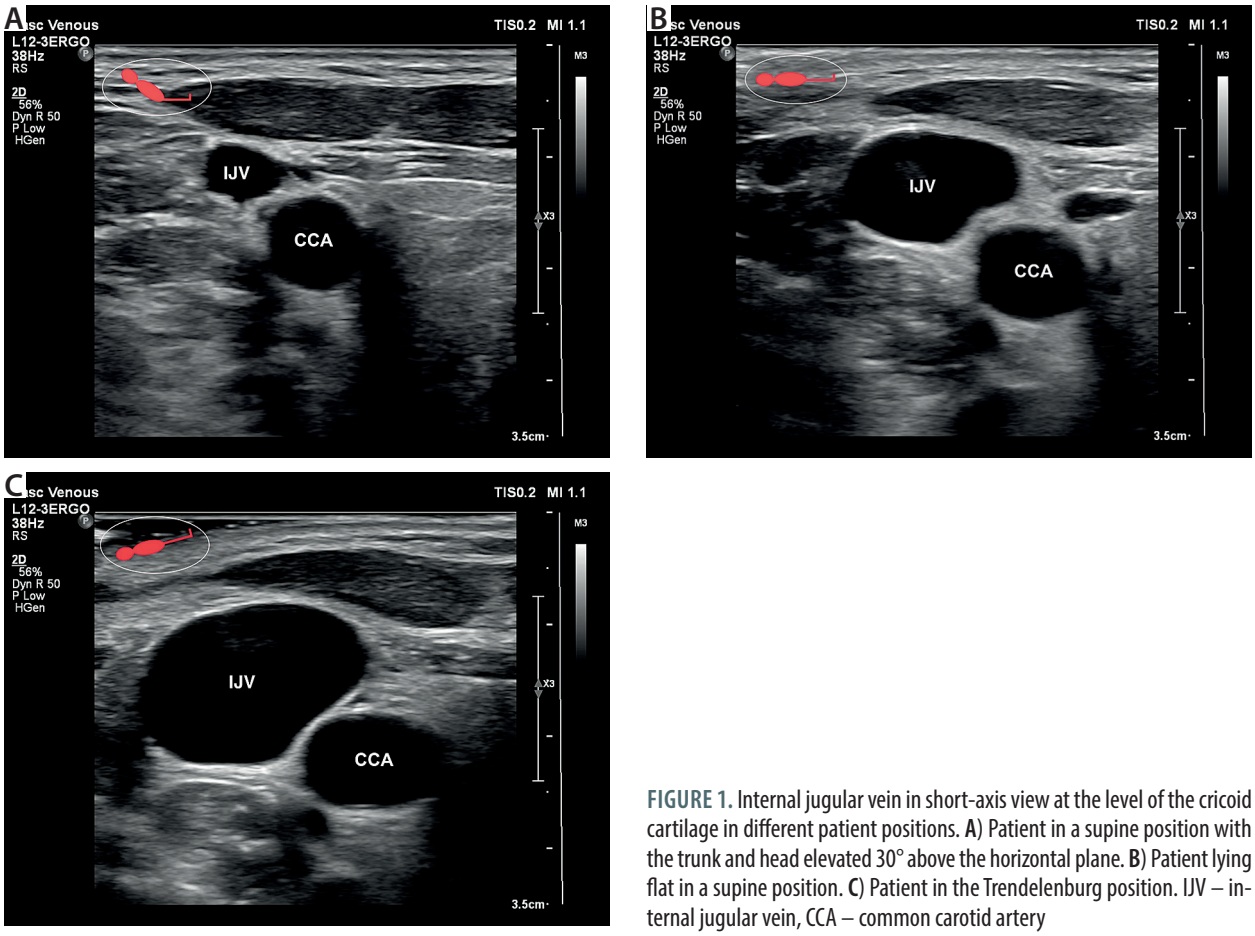


FIGURE 1. Internal jugular vein in short-axis view at the level of the cricoid cartilage in different patient positions. **A**) Patient in a supine position with the trunk and head elevated 30° above the horizontal plane. **B**) Patient lying flat in a supine position. **C**) Patient in the Trendelenburg position. IJV – internal jugular vein, CCA – common carotid artery

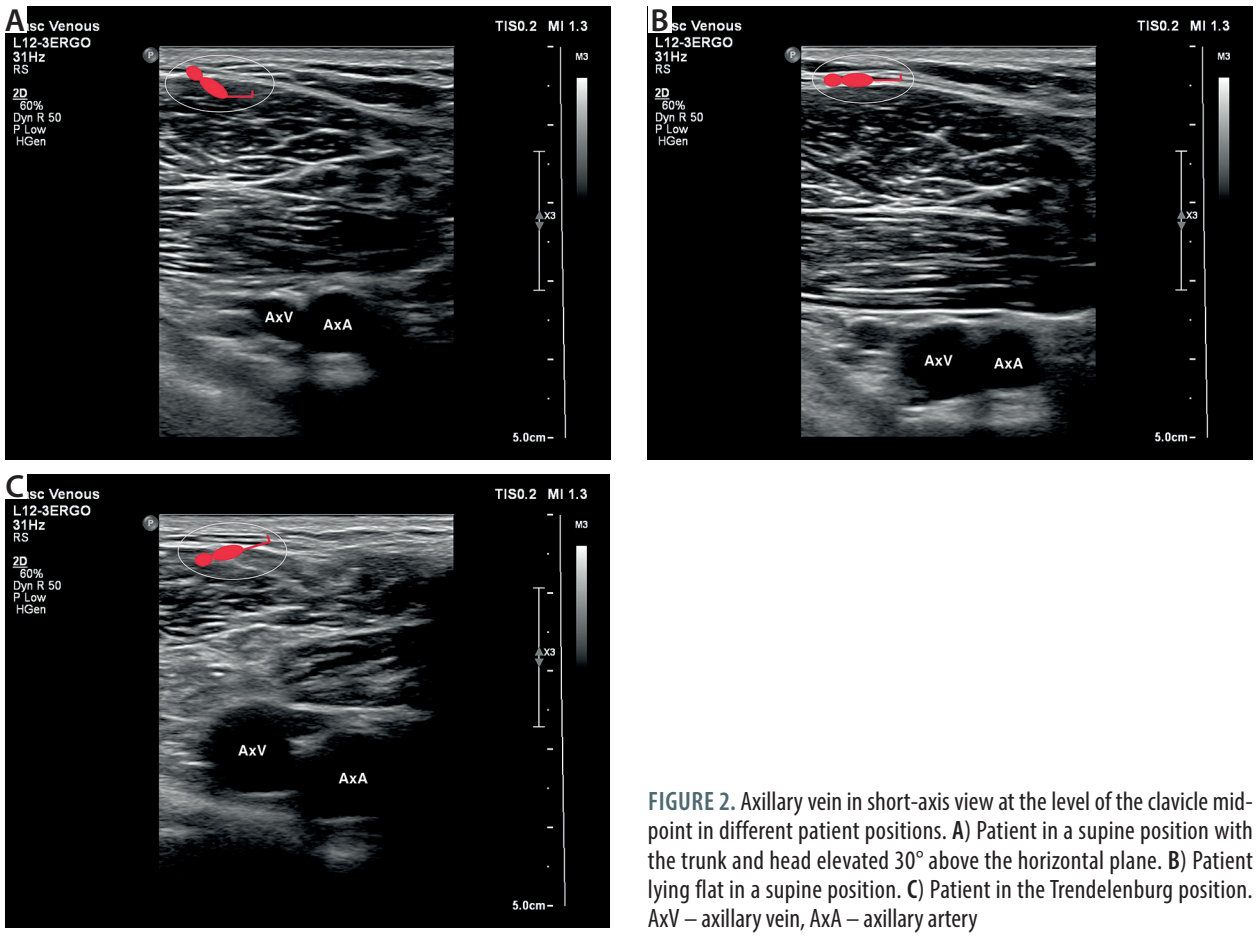


FIGURE 2. Axillary vein in short-axis view at the level of the clavicle midpoint in different patient positions. **A**) Patient in a supine position with the trunk and head elevated 30° above the horizontal plane. **B**) Patient lying flat in a supine position. **C**) Patient in the Trendelenburg position. AxV – axillary vein, AxA – axillary artery

contrast, the vertebral venous plexus is mainly responsible for venous outflow from the brain [5, 6]. A prospective study by Vailati *et al*. [7] in patients at risk of intracranial hypertension demonstrated that UG IJV cannulation did not significantly reduce IJV diameter or jugular venous flow in either the supine or the 30° head-up position; however, ICP was not monitored in these patients. Retrospective data from Akbik *et al*. [8] likewise indicate that IJV cannulation is not associated with worsening ICP in patients with subarachnoid haemorrhage. To the best of our knowledge, prospective data on jugular cannulation in patients with real-time ICP monitoring are scarce. In one such study of 11 patients, ICP did not change significantly after right IJV cannulation [9].

Beyond the direct effect of an IJV catheter on ICP, another clinically relevant concern is catheter-associated IJV thrombosis, as it can obstruct venous outflow and thereby elevate ICP. An axillary/subclavian vein approach, which avoids the cervical venous compartment entirely, may therefore be preferable for minimising the risk of thrombosis [2, 10]. In the cohort of Akbik *et al*. [8], however, the rate of catheter-associated deep vein thrombosis was 0.5% with jugular and 0.9% with subclavian access. Testing for thrombosis in that study was clinically driven, so the true incidence at both sites may be higher, and the site comparison remains uncertain. To facilitate CVC via the infraclavicular route, various positioning manoeuvres have been proposed. Arm abduction during UG axillary/subclavian vein cannulation reduces the risk of catheter malposition [2]. The so-called "stop sign" manoeuvre may be useful in neurocritical care, since it increases the CSA of the subclavian vein in patients positioned 30° head-up [11].

To conclude, patients at risk of elevated ICP may not require the Trendelenburg position during CVC at all. Pre-scanning of all central veins can help identify the vessel with the most suitable conditions for UG catheter insertion, including an adequate CSA. An infraclavicular approach, with the trunk and head optimally elevated, may be a viable alternative to IJV cannulation. Further advantages of infraclavicular access include the ability to perform the procedure 1) with a cervical collar in place and 2) with the patient's head kept neutral in the midline, potentially reducing jugular vein compression. We agree that these suggestions warrant dedicated prospective studies, ideally pairing procedural endpoints with real-time ICP measurement. We thank the authors for drawing attention to a neglected but clinically important issue.

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