Relationship between Trendelenburg tilt and internal jugular vein diameter

S Clenaghan, R E McLaughlin, C Martyn, S McGovern, J Bowra

Methods: Using a tilt table, healthy volunteers were randomised to Trendelenburg tilts of 10°, 15°, 20°, 25°, and 30°. Ultrasound was used to measure and record the lateral diameter of the right IJV at the level of the cricoid cartilage. Following each reading the table was returned to the supine position. Balanced randomisation was used to assess cumulative tilt effects.

Results: A total of 20 healthy volunteers were recruited (10 men, 10 women). Mean supine IJV diameter was 13.5 mm (95% CI 12.8 to 14.1) and was significantly greater at 10° (15.5 mm, 95% CI 14.9 to 16.1). There was no significant difference between 10° and greater angles of tilt. The effect of the previous angle of tilt did not prove to be statistically significant.

Conclusion: Increasing the degree of Trendelenburg tilt increases the lateral diameter of the IJV. Even a 10° tilt is effective. The cumulative effect of tilt (that is, the effect of the previous angle) is not significant. Ultrasound guided cannulation is ideal, but in its absence Trendelenburg tilt will increase IJV diameter and improve the chance of successful cannulation. While 25° achieved optimum distension, this may not be practical and may be detrimental (for example, risk of raised intracranial pressure).
reduce the rates of complication and improve the rate of cannulation success. In the absence of ultrasound guidance most clinicians would use Trendelenburg positioning, though this can be poorly tolerated and associated with increased complications (such as risk of raised intracranial pressure) in some patient populations.\textsuperscript{2,5,7}

Our study demonstrates that 10° Trendelenburg significantly increases UV diameter in healthy adults, although this did vary greatly between individuals, with an actual distension of between 1.2 mm and 7.0 mm. There was a nonsignificant trend to further increases with greater angles of tilt, maximal at 25°; however, this increase was relatively small, with a mean of 1.2 mm. Larger studies may demonstrate significant increases at angles of tilt greater than 10°, although our subjects reported discomfort with angles greater than 10°. Furthermore, most ED trolleys tilt only to 10–15°. Hence, greater angles of tilt are not only impractical in unstable patients but may also be of little benefit.

Armstrong et al.,\textsuperscript{3} Verghese et al.,\textsuperscript{8} and others\textsuperscript{9–12} have demonstrated that various manoeuvres are effective in increasing UV diameter in healthy adults. The Valsalva technique is particularly effective and a combination of techniques has been advocated. However, the Valsalva technique is often impractical in critically ill patients.

In the present study, the effect of respiratory cycle on UV diameter was overcome by measuring maximal diameter over three respiratory cycles for each subject at each angle of tilt. Interobserver variability was eliminated because only one researcher carried out the measurements.

**CONCLUSION**

Increasing the degree of Trendelenburg tilt increases the lateral diameter of the UV. Even a 10° tilt is effective. The cumulative effect of tilt (that is, the stretching effect of the previous angle) is not significant. Ultrasound guided cannulation is ideal but in its absence Trendelenburg tilt will increase UV diameter and may improve the chance of successful cannulation. While 25° may achieve optimum distension, this is impractical and may be detrimental. There was no benefit in tilting the patient to a steeper angle prior to settling at a lesser angle to carry out the procedure. There did not appear to be any “stretching” of the UV to allow greater distension at a lesser angle.

Trendelenburg tilt is used in UV cannulation to optimise conditions for successful cannulation. Our results show that UV distension shows marked inter-subject variability and that minimal increases in diameter may occur. Although this may be statistically significant, is it clinically significant? It is difficult to say. This study was not designed to assess the success of cannulation, but it highlights a significant problem with blind cannulation in that we do not know, in an individual patient, how the UV will respond. What we can do is provide optimum conditions to facilitate cannulation.

We recommend that practitioners use 10° of tilt when attempting central venous cannulation in the absence of real time ultrasound. However this technique assumes normal anatomy and therefore real time ultrasound is preferable.

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