Pre-procedure ultrasound for central venous cannulation: a peep into reality

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Nothing in the world is more dangerous than sincere ignorance and conscientious stupidity
—Martin Luther King Jr

Today, we are caught in the middle of an indefinably difficult situation with regard to the technique of central venous cannulation (CVC). In spite of being a routine procedure commonly performed by healthcare professionals, it continues to be marred by complications such as cannulation failure, arterial puncture, haematoma, and pneumothorax. The proponents of the age-old landmark technique have been repeatedly accosted by compelling evidence towards high rate of complications. On the other hand, the propagators of real-time two-dimensional (2D) ultrasound (US)-guided CVC are often
found to have poor procedural skills when required to perform without the guiding equipment in certain scenarios such as emergencies, non-availability of equipment, or equipment malfunction.

So the question that we face today at a global level is what should we teach our future generations? Should we continue to teach the conventional landmark technique and remain sincerely ignorant about its complication rates or else acquire conscientious stupidity to rely wholly on US guidance for establishing central venous access? The various aspects of US guidance vs landmark technique based on scientific evidence and real-world problems are discussed in this editorial.

It is true and now proven that real-time 2D US-guided CVC is more successful and safer, both in adults and children, especially for internal jugular vein (IJV) cannulation. The ASA Task Force has recommended the use of static (pre-procedure use of US for identification of anatomy to determine vessel localization and patency) and real-time US guidance for vessel localization and venepuncture for elective cannulation of IJV. US may also be one of the methods used for confirming wire and catheter position in the vein. Their recommendation is equivocal for other sites like subclavian or femoral vein and in emergency situations or in the presence of other clinical constraints.

National Institute for Health and Clinical Excellence (NICE) Guidelines, 2002, reviewed the clinical and cost-effectiveness of US-guided CVC. The results from seven randomized controlled trials in adults clearly indicated the superiority of US guidance over the landmark technique for IJV cannulation. The outcome variables that they considered were failed catheter placements, catheter placement complications, and failure on the first catheter placement attempt, and fewer attempts to achieve successful catheterization. In infants, similar variables showed better efficacy and safety of the US-guided CVC. There was limited evidence to prove the superiority of US guidance for other sites like the subclavian and femoral vein.

The assessment group developed an analytical model to work out the possible cost-saving with the use of US for CVC based on a calculation on 1000 adult patients requiring CVC before surgery with low to moderate risk of complications. The calculated cost on managing the complications was more than the equipment, provided the machine was used more frequently (number of procedures per machine per week not <11). This particular aspect should be more relevant in today’s time because there is increased familiarity, training, and extended use of the US facility for other common procedures like the various peripheral nerve blocks when compared with what it was 10 yr back.

In 2006, the Royal College of Anaesthetists proposed that all CVCs in the IJV should have US guidance and should be inserted by healthcare practitioners trained in the use of 2D US imaging. It was also suggested that the complication rate should be <3% haematoma, <5% pneumothorax, and <4% incorrect placement for IJV.

The above evidence-based recommendations clearly indicate that US guidance must be used for CVC, and therefore, we logically derive that the training of the future generations should focus on the US-based procedure and the age-old landmark technique could be completely discarded. In all fairness, this is possible in healthcare set-ups that have enough numbers of US machines to implement the theory.

On the other hand, when we compare the ideal vs the real-world issues, some of the studies show limited use of US for CVC guidance in some parts of the world because of either non-availability of the equipment, limited training and expertise, issues of maintaining sterility during the procedure (requirement of sterile sleeve and conducting gel for the US probe), and/or requirement of extra personnel to perform the procedure. There may be similar constraints in emergency scenarios and in wards or some clinical settings where the equipment and staff is not adequately available. Keeping all these factors in mind, Schummer and colleagues in a recently published study in this journal have advocated the use of pre-procedure US (static US) for IJV cannulation. They used US guidance to see the course, calibre, and patency of the IJV, presence of a thrombus, and determine its relationship to the carotid artery. They have suggested that this technique is easier to learn and easier to implement in routine use. Besides, the sterility issues are also avoided while performing the actual cannulation. Higher success rate and safety of CVC have been demonstrated with the use of pre-procedure US when compared with the landmark technique. Better results have also been seen in patients with high risk for complications like those with the presence of goitre, a previous CVC, and extremes of body weight (BMI <21.4 and >32.4).

In the Third Sonography Outcomes Assessment Program (SOAP-3) Trial on 201 patients undergoing IJV cannulation, Milling and colleagues compared the static and dynamic US guidance with the conventional landmark technique. They proposed that though real time or dynamic US assistance is superior to pre-procedure or static US, the latter should not be dismissed as it gives vital information regarding the course and patency of IJV and its relation to neighbouring structures, thereby increasing the success rate and decreasing the complication rates compared with the landmark technique.

At this point, I would suggest that wherever possible, a ‘quick look’ pre-procedure US scan must be done for every CVC, whether emergency or elective and thereafter, depending upon the feasibility, a real-time US-guided or landmark technique should be attempted. Once the anatomy of the vein is assessed by static US scan (it is optional to mark the course of the vessel), it should certainly be safer to perform the procedure by the landmark technique. Besides, a pre-procedure scan offers more flexibility to the caregiver, as it need not necessarily be done at the time or site of the actual procedure.

In the health set-ups where the US machines are either less in number or the portable versions are not available, it would be easier to do a pre-procedure US rather than a real-time scan for every cannulation. The order of preference in clinical practice and a teaching tool should however be real-time US-guided, pre-procedure US and the landmark technique. Learning is always inclusive, not exclusive.
Not everything that counts can be counted, and not everything that can be counted counts

—Albert Einstein

Declaration of interest
None declared.

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