Original article

Ultrasound-guided insertion of subclavian venous access ports

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Introduction: Central venous cannulation is an integral part of venous access port (portacath) placement for intravenous chemotherapy. NICE guidelines have suggested that CVC should be performed under ultrasound guidance. The technique of ultrasound-guided subclavian cannulation is reviewed and our experience presented.

Patients and Methods: Retrospective analysis of data on patients undergoing ultrasound-guided portacath placement for the failure rate and the incidence of complications.

Results: We were successful in cannulating the subclavian vein in 44 of 55 patients. There was one arterial puncture and no haemothorax or pneumothorax with the technique (complication rate 1.8%).

Conclusion: An ultrasound-guided approach should be the standard technique for central venous cannulation in portacath placement.

Key words: Ultrasound – Central venous cannulation – Portacath – Chemotherapy

Intravenous chemotherapy through a dedicated port is an integral part of the treatment of many cancers. Placement of the portacath is performed under a general anaesthetic with central venous cannulation of the subclavian vein usually undertaken by a landmark technique. The technique is, therefore, subject to the potential complications associated with central venous access that occur in more than 15% of patients.¹ Recent UK guidelines² for the placement of central venous catheters (CVCs) have recommended that an ultrasound-guided technique should be adopted as this technique is associated with reduced incidence of failure and mechanical complication.

We have been using an ultrasound-guided technique for the placement of subclavian vein portacaths for 5 years and present the technique used and the results of our experience.

Patients and Methods

Technique

A sterile 3-cm linear 5-MHz transducer (Aloka, Japan) is placed slightly inferior to the middle third of the clavicle. The subclavian vein is then located by angling the transducer superiorly until the vessel is clearly seen (Fig. 1). The needle is introduced under ultrasound guidance (Fig. 2) and the wall of the vein can be seen to tent before it is punctured under vision. A Seldinger technique is used and the wire placement again confirmed by ultrasound. The catheter and port are then introduced as per standard practice. Image intensification is used to confirm the position of the catheter in the superior vena cava.

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Methods

A retrospective study was undertaken of all patients who had undergone subclavian vein portacath placement under ultrasound guidance in our unit. Data were reviewed for the failure rate and the incidence of complications.

Results

Since we started using ultrasound for this procedure in 1998, we have performed 55 portacath placements using the technique described and have been successful in 44 patients. In 11 patients (20%), percutaneous subclavian vein access was not achieved due to a thrombosed

Figure 1 Ultrasound image of the subclavian vein

Figure 2 The needle is advanced toward the subclavian vein under ultrasound guidance

subclavian vein in one patient, aberrant anatomy or inability to puncture the vein in six patients, no reason was given in a further four patients. In these cases, the portacath was inserted using an open approach. There was one arterial puncture using this ultrasound-guided technique and no patients developed a pneumothorax or haemothorax following the procedure. The complication rate was 1.8%. Two catheters were malpositioned on the follow-up chest X-ray and required minor adjustment.

Discussion

The failure rate of 20%, which includes our institutional learning curve, and complication rate of 1.8% described in this series is consistent with previously published data on ultrasound-guided central venous access and reinforces that this technique has the advantage of reduced complication and failure rates compared to the landmark technique.

A review by the National Institute of Clinical Excellence (NICE) of randomised controlled trials on the advantages of ultrasound-guided CVC placement over the landmark method demonstrated a reduction in rate of failure of placement (relative risk reduction 86%; $P < 0.001$) and catheter placement complications (relative risk reduction 57%, 95%; $P = 0.02$) using the ultrasound technique.² Similar reductions using ultrasound in the number of attempts, placement failure and complications were shown in a meta-analysis by Randolph *et al.*³ The internal jugular approach has been used predominately in these studies, as it is perceived to be more easily accessible using ultrasound guidance, although similar studies have shown a reduction in failure rate from 55% to 8% and complication rate from 41% to 4% using ultrasound guidance in subclavian vein puncture.⁴ Complication (28–41%)^{4,5} and failure rates (35–55%)^{4,6} for the landmark technique for CVC differ depending on experience and skill; however, these studies still demonstrate an improvement using ultrasound guidance.

As with all technical procedures, the learning curve depends on the individual's core skills and abilities; the senior trainees in our unit use ultrasound on a daily basis and have become proficient with ultrasound guidance after the placement of 5–10 subclavian lines. As many surgeons are using ultrasound in their day-to-day practice, we feel that with appropriate training and mentoring this technique could easily be adopted by consultants and trainees alike.

Conclusions

Although the recommendation from the National Institute for Clinical Excellence² did not specifically include portacath placement this would appear to be a logical extension of these guidelines and we would recommend from our experience that an ultrasound guided approach be the standard technique for central venous cannulation in portacath placement.

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