Inadvertent extradural insertion of an internal jugular catheter in an infant

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Summary
We present an unusual complication of left internal jugular vein catheterization in an 11-week-old infant which we believe has not been described previously. After failed subclavian catheterization, a left internal jugular catheter was placed without apparent difficulty. Confirmatory chest x-ray revealed that the tip of the catheter was in the extradural space. (Br. J. Anaesth. 1995; 75: 790–793)

Key words

The use of central venous catheters in neonatal and paediatric care is now commonplace, either for nutritional support, drug therapy or central venous pressure monitoring. The siting of such catheters may be difficult and time-consuming. Complications arising from this practice are well known [1, 2].

In this report we describe the difficult siting of a central venous catheter in an 11-week-old infant, the tip of which was shown subsequently to be in the extradural space below the C6 vertebra. A search of the literature reveals this has not been reported previously, although erroneous positioning in the subarachnoid space after retrograde cannulation of the jugular vein in an adult has recently been reported [3].

Case report
An 11-week-old infant, weighing 5.2 kg, was scheduled for general anaesthesia for insertion of a central venous catheter for continuing nutritional support and removal of a tunnelled long catheter which had been inserted 12 days earlier. The patient had been born by elective Caesarean section at term, weighing 4.1 kg, and was well until 4 days old when he developed an acutely distended abdomen. He subsequently underwent three consecutive laparotomies for necrotizing enterocolitis and Hirschsprung’s disease, with lower bowel resections, colostomy and closure. Venous cannulation had been noted to be a persistent problem with the exception of the left internal jugular vein.

At 11 weeks old he was making good progress but was still taking inadequate amounts of nutrition orally. The surgically tunnelled Broviac catheter inserted 12 days earlier into the right external jugular vein was found on contrast x-ray to be coiled in the soft tissues above the right clavicle. The contrast injection demonstrated a possible fistula from the tip of the catheter down to the superior vena cava, with irregular margins. The patient had also received two previous left subclavian catheters inserted under anaesthesia.

General anaesthesia was induced via an existing scalp vein cannula with propofol and vecuronium. The trachea was intubated and the lungs ventilated with nitrous oxide and enflurane in oxygen. Colloid was administered in addition to maintenance fluids to ensure venous filling. The patient was positioned 15° head down with a rolled towel beneath the shoulders. The existing tunnelled catheter was removed complete and without difficulty. Full aseptic precautions were taken in all attempts at siting a central venous catheter.

Using a Seldinger technique [4] and an infraclavicular approach, the right subclavian vein was identified with a 21-gauge, 4-cm needle from the mid-clavicular point. The vein was located several times by both authors but it proved impossible to advance the guidewire beyond the end of the needle and hence this site was abandoned. The left subclavian vein was approached in the same manner and again the vein was located repeatedly by both authors. Again the guidewire proved impossible to advance satisfactorily. After subclavian artery puncture this site was also abandoned.

The left internal jugular vein was then located from the apex of the triangle formed by the two heads of sternomastoid muscle, with the needle angled at 45° towards the ipsilateral nipple. This was selected because of the possible fistula demonstrated on the right side from the contrast x-ray of the previous catheter and also because it had been cannulated successfully in the past. The left internal jugular was located rapidly with free aspiration of blood and followed by easy insertion of the guidewire. A 20-gauge Hydrocath was subsequently

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placed over the guidewire without difficulty. After removal of the guidewire, blood could not be aspirated from the catheter but 2 ml of saline was injected without resistance. An x-ray with contrast injected through the catheter was then performed. This revealed the catheter tip to be situated in the extradural space below C6. Contrast was seen spreading throughout the cervical and upper thoracic extradural space (fig. 1).

The catheter was removed immediately without difficulty. Subsequently, a 22-gauge, 15-cm, single-lumen Hydrocath was inserted under direct vision into the left brachial vein following a surgical incision. This could be inserted only 6 cm and it rested in the lateral aspect of the left subclavian vein at the junction with the axillary vein when confirmed by x-ray.

The patient made an uneventful recovery after these procedures. The total duration of anaesthesia was 210 min.

Discussion

Central venous catheterization has become common practice in the management of paediatric patients but complications are common [1, 2]. Fatalities may be associated with air embolism, pericardial tamponade and pneumothorax [2–6]. Difficulty had been noted on several previous occasions when attempting central venous cannulation in our patient. Difficulties may be increased when the operator is inexperienced. Previous studies have shown that experience is associated with a higher rate of success [7, 8]. Both authors experienced the same difficulties in this patient and both are experienced in central venous cannulation.

The subclavian approach was chosen initially as the preferred site as this would provide ease of nursing care, greater comfort and less restriction to an otherwise active baby. The subclavian vein is less likely to collapse when performing central venous catheterization and fixation is more convenient. The subclavian approach may not be favoured by some practitioners because of the report by Groff and Ahmed [9] describing major complications and two deaths after subclavian catheterization in 44 patients under 4 yr of age. However, a more recent prospective analysis of 13 800 subclavian catheterizations [10] showed that this is a safe route with only 19 (0.1 %) serious complications and no fatalities; the rate of arterial puncture was less than 1 % overall. The use of the Seldinger technique has been associated with a higher success rate and lower frequency of arterial puncture [11]. Experience shows that difficulty inserting a Seldinger-type guidewire is not uncommon but this is not usually reported as a complication. However, Alderson and colleagues found this was their most common complication occurring in 11 of 50 children [12]. The incidence of difficulty in inserting a catheter when a catheter-through-needle technique has been used has been reported as 7 % [10].

The internal jugular vein may provide the best means of reliably cannulating central veins [13], although it has been noted to be more difficult in children less than 3 months old or under 4 kg in weight [13]. Normally the right internal jugular vein is preferred as it runs a straight course to the superior vena cava and avoids the thoracic duct, which may be punctured and cannulated [8, 14, 15]. The pleural dome is also lower on the right side.

We considered that there may have been some derangement to the anatomy on the right side of our patient because the contrast study of the previous Broviac catheter suggested a possible fistula. It is possible this may have contributed to the difficulty of inserting the guidewire into the right subclavian vein. Because the left internal jugular vein had

Figure 1 X-ray of 11-week-old infant after injection of contrast to determine the position of the left internal jugular vein catheter (arrowed). Contrast is seen spreading through the extradural space.
previously been cannulated successfully, it was decided this would be our next approach.

The left internal jugular vein was located rapidly with free aspiration of blood into a syringe attached to a 21-gauge, 4-cm needle. The guidewire and catheter were introduced without apparent difficulty. Despite this, blood could not be aspirated from the catheter, although 2 ml of saline was injected without resistance. In common with the recommendations of other workers [1, 2, 8], we checked immediately the position of the catheter by radiography. Contrast was shown by x-ray to have entered the extradural space.

In order for this to occur, the guidewire, catheter, or both, must have penetrated the posterior aspect of the internal jugular vein, travelled posterior to the carotid artery, penetrated the prevertebral fascia and scalenus anterior, and entered an intervertebral foramen to reach the extradural space. It may be postulated that haematoma formation from the perforated left subclavian artery may have distorted the anatomy of the left internal jugular vein or that previous cannulations had resulted in a thrombus or scarring.

Damage to the sympathetic chain resulting in Horner’s syndrome has been reported previously [16, 17] with internal jugular catheterization, secondary either to direct injury or localized oedema with or without haematoma formation. We found no evidence of this in our patient. The relative stiffness of guidewires [1] and the short distances between structures in an infant’s neck may contribute to uncommon complications.

A recent study [12] has shown that anatomical factors may contribute to the difficulties of percutaneous internal jugular cannulation in children. The authors found that 18% of patients younger than 6 yr who had not previously undergone cannulation had anatomical anomalies that may complicate a landmark-guided approach. These were caused by the unusually small diameter of vein, or displacement of the vein from its usual position to lie entirely over the carotid artery or widely lateral to it. Anomalous venous drainage and anatomical deformity have also been cited previously [15] as causes of failure to cannulate. It has been suggested that the incidence of anomalous anatomy compares similarly with the proportion of children in whom internal jugular cannulation is difficult [12].

In our patient, the left internal jugular vein had been cannulated previously and we identified the vein rapidly using a landmark method. It is therefore unlikely that an anatomical anomaly was present in the left internal jugular vein, although a small diameter cannot be excluded. The use of an ultrasound scanner to determine the course of the internal jugular vein may reduce the time and number of needle insertions required to cannulate the vein [12].

It is most likely that in our patient either the introducing needle or the guidewire penetrated beyond the vein. As has been suggested previously [12] the most likely reason for difficulty in inserting the guidewire or its aberrant course in infants is probably the ease with which the introduser needle tip can be displaced from the lumen of the vein as the aspirating syringe is disconnected or guidewire introduced.

Finally, we inserted a catheter via the left antecubital fossa but difficulty was experienced in advancing the catheter tip beyond the left distal subclavian vein–proximal axial vein junction. This may have been caused by the effects of the previously attempted left subclavian vein catheterization. A recent study [18] showed that correct positioning can be difficult with catheters inserted via the axillary approach.

Difficulties and complications may be lessened by scrupulous attention to detail, ensuring correct patient position and adequate venous filling. Precautions to avoid air bubbles must be taken. The use of a 22-gauge cannula rather than an introducer needle, as supplied in most commercially available central venous catheterization kits, may guard against needle movements that may occur when the aspirating syringe is disconnected or guidewire introduced. The use of this technique may have prevented the unusual complication that occurred in this infant, but does not guarantee that the guidewire will not perforate the vein and lead to eventual catheter misplacement.

References

15. Rao TLK, Wong AY. A new approach to percutaneous
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