A new percutaneous infraclavicular approach to the axillary vein

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Abstract

A new percutaneous infraclavicular approach for cannulating the axillary vein is described. The technique was devised using surface landmarks established by cadaver dissection. This is a relatively safe procedure with no risk of pneumothorax, provided that the tip of the needle remains inferior to the clavicle.

1 Introduction

Direct percutaneous cannulation of the large central veins is most commonly achieved using either the internal jugular or the subclavian vein. However, these techniques are not without hazard. Indeed, in view of the proximity of the thoracic inlet, these two routes probably have the most potential for serious acute complications, particularly pneumothorax and haemothorax. While a pneumothorax can be effectively treated by inserting a chest drain, a vascular laceration (artery or vein) sufficient to cause a haemothorax usually requires surgical exploration.

The more distal axillary approach to the axillary vein avoids these particular complications, although there is a risk of damaging the medial cutaneous nerve of the arm, since this nerve lies immediately medial to the vein in the axilla. Access to the central veins via the external jugular vein is sufficiently unreliable for it not to be considered a route of first choice, although it is being increasingly used surgically for tunnelled Hickman catheters, as well as for central venous pressure monitoring.

There are also complications with this approach.

Access via the femoral vein is complicated by the potential for thrombo-embolism and therefore only tends to be used when the usual central venous access routes are particularly difficult. The basilic vein can only be used with long narrow catheters, which are sometimes very difficult to thread centrally.

There are, therefore, sufficient problems associated with the commonly used routes for cannulation of the large central veins, to stimulate a continued search for safer routes of access. One approach is to consider different ways of using existing routes; for example, the ‘half-way’ catheter concept, whereby a peripheral arm-catheter is advanced only as far as the axillary vein. Although not suitable for central venous pressure monitoring, such a technique is satisfactory for intravenous feeding. Alternatively, new routes of access can be sought. To this end, the infraclavicular region was explored in the dissecting room (adult female cadaver) with a view to establishing suitable surface landmarks to facilitate an infraclavicular approach to the axillary vein.

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2 Anatomy

The axillary vein is the continuation of the basilic vein and extends from the lower border of teres major to the outer border of the first rib, where it continues as the subclavian vein (Fig. 1). The axillary vein is crossed immediately anteriorly by pectoralis minor, which divides the vein topographically into three parts, namely proximal, posterior and distal to pectoralis minor. The medial border of pectoralis minor extends from the coracoid process along a line roughly 45° to the long axis of the body (Fig. 2). However, there is some variation, since although this muscle is usually inserted into the third, fourth and fifth ribs, it not uncommonly arises from the second, third and fourth ribs.

The axillary vein is a large vein, with a mean proximal diameter of 16 mm in adults during a Valsalva manoeuvre; this compares well with a value of 19 mm for the proximal part of the subclavian vein under similar conditions. With the arm adducted to the side of the trunk, dissection shows that the axillary vein is somewhat folded and tortuous. This is also well shown in adult venograms. However, when the arm is abducted to 45° from the trunk, the course of the axillary vein becomes quite straight. This is presumably the reason why abducting the arm often facilitates central cannulation via the basilic vein. The axillary artery is closely related to the axillary vein. It is posterolateral to the vein as it passes over the first rib and becomes lateral to the vein as it enters the upper arm.

Surface landmarks

The dissection study suggested the following medial and lateral surface landmarks for the infraclavicular course of the axillary vein in an adult; these are shown in Fig. 2. The lateral landmark (A) is three finger breadths (5 cm) below the inferior aspect of the coracoid process. The coracoid process is a particularly suitable reference point, since it
is easily palpable even in obese patients. The medial landmark (B) is that point below the medial end of the clavicle where the space between the clavicle and the thorax just becomes palpable. This is approximately at the junction of the medial quarter and the lateral three-quarters of the clavicle.

3 Method for cannulation the axillary vein

Position the patient as for the subclavian vein approach\(^1\) (supine and approximately 15° Trendelenberg). Abduct the arm to 45° from the trunk, keeping the arm straight. Mark the lateral (A) and medial (B) surface landmarks as shown in Fig. 2. Mark the position of the medial border of pectoralis minor where it cuts the line AB. Under the usual sterile conditions, enter the skin on the line AB and lateral to the medial border of pectoralis minor, directing the needle medially in the anteroposterior (A-P) plane which passes through the line AB. Aim to enter the vein between pectoralis minor and point B. Should there be any resistance at all while advancing the needle, the needle should be withdrawn and redirected in an A-P plane, parallel to the line AB.

4 Patients

This method for cannulating the axillary vein has so far been used successfully and easily in 13 out of 14 patients, using a Seldinger technique (Leder-cath; Vygon). There were no arterial punctures or other complications. The one failure to locate the vein using this approach was in a grossly obese patient, in whom a standard subclavian
approach had eventually to be used.

5 Discussion

The particular merit of this approach to the axillary vein is that it combines cannulation of a large vein well away from the thoracic inlet, with the convenience of easy and clean skin fixation in the infraclavicular region. Experience so far in adults (both male and female) suggests that the given surface landmarks are reliable, in spite of their being determined only in one female cadaver. Cannulation is facilitated by the fact that when the arm is abducted to 45° from the trunk the vein is quite straight, allowing the needle to be directed along the line of the vein.

Although the risk of pneumothorax with this technique would seem to be minimal (provided that the tip of the needle remains inferior to the clavicle), there is a risk of inadvertent puncture of the axillary artery, since the artery cannot generally be felt infraclavicularly. Initial probing with a small-gauge needle to locate the vein is therefore recommended.

The results so far are encouraging, and demonstrate that cannulation of the axillary vein via an infraclavicular approach is a practical proposition.

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7 References


