



THE ALTERNATIVE METHOD OF PERCUTANEOUS CATHETERISATION
OF THE INTERNAL JUGULAR VEIN IN CHILDREN AND INFANTS,
A REPORT OF 170 CASES.

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This paper describes the results of 170 percutaneous catheterisation of the internal jugular vein in children and infants.

Several techniques of central venous catheterisation for pressure recording or mixed venous sampling have developed previously. The complications of infraclavicular subclavian venepuncture have been described by several authors, the commonest being pneumothorax. Damage to the subclavian vein, extravenuous placement of the catheter in the tissues or pleural cavity and septicaemia have also occurred (3-5-7). A supraclavicular technique has been described with low incidence of complication⁽⁹⁾ although we have as yet no experience with this method. Percutaneous femoral vein catheterisation has also been described but has a high (46%) complication rate⁽¹⁾. The

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insertion of a long catheter from the antecubital fossa either by cutdown or venepuncture quite often results in thrombophlebitis⁽¹⁰⁾ and⁽¹³⁾ it is frequently difficult to thread the catheter into the central veins. External jugular venous anatomy is inconstant and it is difficult to thread a catheter past the valve commonly present at its termination⁽³⁾.

The value of central venous pressure monitoring is unquestioned as it is frequently necessary in cardiac surgery we have developed two techniques for catheterising the internal jugular vein by percutaneous venepuncture.

ANATOMY

The internal jugular vein is the principal venous trunk of the neck and is the largest of the relatively superficial veins of the body⁽²⁾. It begins in the posterior compartment of the jugular foramen, as the direct continuation of the sigmoid sinus and emerges from the base of the skull posterior to the internal carotid artery. The vein runs downwards through the neck within the carotid sheath and behind the sternal end of the clavicle. It unites with the subclavian to form brachiocephalic vein (Innominate vein). Its commencement is dilated and forms the superior bulb, a second dilation called the inferior bulb is present at the lower end of the vein; it is bound either above or below by a valve of two or three semilunar cups, and sometimes by valves both above and below. The vein is influenced greatly by respiration, emptying during inspiration and filling during expiration, so that the thin-wall

tube may be distended to 1.5cm in diameter, or it may be a flaccid, ribbon like structure with its wall in contact. During inspiration, air may be drawn into a rent in the vein and may embarrass respiration seriously by the formation of air emboli in the pulmonary artery, or cause death if sufficient air reaches the heart.

RELATION

Posterior to the vein are the prevertebrale muscles and the cervical plexus.⁽⁴⁾ The phrenic nerve descends on the scalenus anterior behind the vein, and at the root of the neck the vein lies in front of the first part of the subclavian artery, and on the left side, the terminal part of the thoracic duct. Medially the vein is related to the internal and common carotid arteries and the vagus nerve superficially the vein is covered by the sternocleidomastoid muscle and is crossed by the posterior belly of omohyoid and near its lower end by the anterior jugular vein. Below the omohyoid it is covered by the sternocleidomastoid and by the infrahyoid muscles.

SURFACE ANATOMY

When the head is turned to the opposite side the internal jugular vein in the lower part of the neck lies just lateral to a line which joins the medial edge or the clavicular head of the sternocleidomastoid to the mastoid process and is crossed by this line about half way up the neck. Its lower bulb lies behind the depression which marks the interval between the sternocleidomastoid.

Catheterisation of the right side is preferred as the internal jugular and innominate veins and the superior vena cava are nearly in a straight line, although the left internal jugular vein has been used with equal facility on several occasions.

In infants and small children where the head is relatively large and the neck short we have found it best to have the neck well extended by placing the body on a pillow, or a folded towel beneath the shoulders. The alternative technique (see below) has usually been used in infants as it is difficult to feel the small internal jugular vein clearly.

TECHNIQUES

We have developed two techniques for effecting internal jugular venepuncture (Elective technique and alternative technique). With each technique a head-down tilt is used both to prevent air embolism and, by distending the internal jugular veins, to make venepuncture easier. In both cases the sternomastoid muscle is the guide to the position of the vein.

Eight inch (80cm) intracaths are used, size large for adults and size medium for small children and infants and neonates. Intracaths without stillets should be used as a reflux of blood into the catheter is the sign of a successful venepuncture.

ELECTIVE TECHNIQUE

This is the preferred method in anaesthetised adult patients. It demands profound muscular relaxation, prefera-

bly by neuromuscular blockade, as the internal jugular vein has to be felt beneath the sternomastoid. A head-down tilt of twenty to thirty degrees should be used. For a right internal jugular venepuncture the head is turned to the left. The sternomastoid muscle is then clearly seen and its sternal and clavicular heads can be identified. The internal jugular vein can usually be palpated slightly lateral to a line joining the medial edge of the clavicular head of the sternomastoid to the mastoid process, and should be distinguished from the carotid artery. Venepuncture is made at a point where the vein is most clearly felt behind the muscle. The needle is inserted through the skin slightly cephalad and medial to the position where the vein is most easily felt at an angle of thirty to forty degrees to the skin surface and is advanced caudally and laterally. The deep cervical fascia is usually pierced with a definite 'give' followed by the same sensation of 'give' as the vein is entered. It is quite often necessary to insert the needle through the substance of the sternomastoid if the internal jugular vein is felt some way lateral to its medial edge. Whether the muscle is transfixed or not appears to make no difference. A reflux of blood into the catheter confirms venepuncture. The catheter is then threaded down the needle into the vein and the needle is withdrawn and placed in its plastic holder. The intravenous drip is then connected and a folded swab is applied firmly to the puncture site to prevent haematoma formation.

ALTERNATIVE TECHNIQUE

This was originally developed as an alternative approach to the internal jugular vein in children and infants as it is difficult to feel the small internal jugular vein clearly in them.⁽⁶⁾ This technique can be used also in cases when the elective technique fails. However as it does not depend on muscular relaxation, it can be used under local analgesia on conscious patients, or in emergency situations such as cardiac arrest or severe shock.

The patient should be positioned as for the elective technique. Again, the sternomastoid is the guide to the position of the internal jugular vein. In this technique the triangular gap between the sternal and clavicular heads of the sternomastoid with its base on the medial end of the clavicle is identified. The terminal part of the internal jugular vein lies behind the medial edge of the clavicular head of the muscle. The intracath needle is inserted near the apex of this triangle at an angle of about thirty to forty degrees to the skin surface and advanced caudally and laterally towards the inner border of the anterior end of the first rib behind the clavicle. The deep cervical fascia is not usually evident here, although entry into the vein is again often felt. A reflux of blood confirms venepuncture and the catheter and intravenous infusion are secured as previously described.

RESULTS

One hundred and seventy internal jugular cannulations via alternative technique have now been performed. In table 1

'failure' indicates inability to achieve satisfactory venous cannulation. There were twelve such failures in the 170 cases (7%). There were three arterial punctures, all causing a haematoma, although none was serious. There was one pneumothorax. ⁽¹¹⁾ This occurred in an emergency situation where the anaesthetist was compelled to work over head of a bed and where the patient could not be tipped head down. The pneumothorax was treated by underwater seal drainage and caused no further problem. There were no instances of clinically evident thrombosis of the internal jugular vein. The average duration of the presence of a cannula in the internal jugular vein has been about 48 hours. On two occasions the catheter was threaded back up the subclavian vein, but in the great majority of patients the tip of the catheter can be seen to be in the junction of superior vena cava and right atrium or in the high right atrium on post-operative chest films.

DISCUSSION

Possible complications with the alternative technique are few, the only structure likely to be encountered being the carotid artery and can be avoided if its position is located beforehand. Arterial puncture is usually recognizable by the bright red colour of the blood, its rapid reflux up the catheter and the high hydrostatic pressures for the drip to run. Removal of the needle and firm pressure will readily control the bleeding and subsequent haematoma is usually small and of no consequence. The anterior jugular vein or a branch of it may be

entered: as a result the catheter cannot be advanced. The brachial plexus and subclavian artery are separated from the vein by the scalenus anterior muscle at its insertion into the scalene tubercle of the first rib. The cervical pleura is postero-medial to the line of advance of

Table (1)

Age group (Years)	Number of cases	Internal Jugular V		Result	
		Palpable	Inpalpable	Success	Failure
0 - 1	24	-	24	23	1
1 - 5	52	4	48	45	7
5 - 15	94	8	86	90	4
Table	170	12	158	158	12

the needle. It should be noted that in this technique the direction taken by the needle is such as to minimise the risk of pleural damage.

SUMMARY

This report analyses 170 percutaneous puncture of the internal jugular vein by alternative technique from March 1970 to February 1977 in Insurance Hospital No2 and Amir-Alam Hospital. There have been no serious complications or difficulties. The method allows free movement of the limbs postoperatively and avoids the painful thrombotic sequelae associated with the use of superficial veins for long term cannulation.

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