JUGULAR VENOUS PULSATIONS AS THE SOLE LANDMARK FOR PERCUTANEOUS INTERNAL JUGULAR CANNULATION

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SUMMARY

Successful internal jugular venous cannulations were obtained in 210 of 212 consecutive patients using the venous pulsations as the sole landmark with which to locate the vein. Jugular venous blood was aspirated on the initial insertion of a 23-gauge seeker needle in 87.7% of the patients and successful passage of either a 14- or 8-French cannula occurred on the first attempt in 82.5% of patients. The ease, success and relative safety of this technique compare favourably with other techniques. The carotid artery was punctured in three patients (1.5%).

Most techniques for performing internal jugular puncture utilize the clavicle and the two heads of sternocleidomastoid as landmarks (Civetta, Gabel and Geimer, 1972; Vaughan and Weygandt, 1973; Rao, Wong and Salem, 1977). These are essentially blind approaches, with no guarantee that the internal jugular vein lies beneath that part of the muscle. Incorrect needle placement has resulted in carotid puncture, pneumothorax, thoracic duct injury and tracheal puncture (Morgan and Morrell, 1981; Rosen, Latto and Ng, 1981). An alternative has been to palpate the carotid artery with the fingers of one hand and insert the cannula immediately lateral to the artery (English et al., 1969; Mostert, Kenny and Murphy, 1970). This technique may tend to compress the vein, dislodge emboli from an arteriosclerotic carotid artery (Hertzer et al., 1978) or induce cardiac arrhythmias (Sprigge and Oakley, 1979).

Jugular venous pulsations are clearly visible in the neck (Isselbacher et al., 1980), and have been used in this series as the sole landmark for the internal jugular vein. This has enabled cannulation to be performed under direct vision, without having to palpate adjacent anatomical structures.

PATIENTS AND METHODS

Routine clinical observations were recorded on 212 adult patients aged 22–95 yr who require central venous cannulation during the course of a general anaesthetic for thoracic, peripheral vascular (intra-abdominal) or intracranial operations. Most of the patients were elderly and suffering from cardiac, renal or respiratory diseases.

Before jugular cannulation the trachea was intubated and the lungs ventilated artificially with the patient in the supine position. The head was rotated approximately 30° to the left and the skin prepared with 10% povidone–iodine solution. The right side of the neck was carefully examined for venous pulsations, which are usually visible in the middle of the neck beneath the body of the sternocleidomastoid muscle. The location of the vein was defined by inspection only.

Venepuncture is best performed with a slight head-down tilt. If the internal jugular is seen to collapse during expiration, more head-down tilt should be applied to distend the vein further, as this facilitates venous cannulation.

Before insertion of the needle, the skin was retracted and the neck was stabilized by placing the fingers of the left hand beneath the body of the mandible. An initial venepuncture using a 23- or 22-gauge needle attached to a 3-ml syringe was performed to verify the correct location of the internal jugular vein. The needle was advanced directly into the venous pulsation at an angle of 45° to the neck in the paramedian plane. Successful venous entry was verified by aspiration and the definitive puncture of the internal jugular vein with the larger central venous cannula was performed in similar fashion using the same puncture site.

Records of the number of needle passes to enter the vein were recorded for the 23-gauge “seeker” needle and for the larger cannula. Successful central venous cannulation was verified in all cases by satisfactory fluctuation of the central venous pressure.
manometer. Routine chest x-rays were performed in the period immediately after operation to exclude pneumothorax and document catheter location. Any other complications were recorded.

RESULTS

The success rate is detailed in Table I. Carotid puncture was obtained in three patients, in two of whom successful venepuncture was performed subsequently via the contralateral (left) jugular vein. In the third patient, who had a previous thyroidectomy, no further venepuncture was attempted. Of the remaining 209 patients, successful internal jugular cannulation was obtained in all but one patient (who was grossly obese). Successful jugular venepuncture on the initial insertion of the needle was obtained in 87.7% using the 23-gauge seeker needle and in 82.5% of patients using the larger central venous cannula.

DISCUSSION

The low frequency of carotid puncture, lack of pneumothoraces and successful central venous cannulation in 99% of patients compare favourably with other techniques of internal jugular puncture (Rosen, Latto and Ng, 1981; Anagnou, 1982; Ellison et al., 1982). This study does not prove the superiority of this technique over any others, but demonstrates the reliability of venous pulsations in the neck as a useful landmark for locating the internal jugular vein. The venous pulsations may be used exclusively, as in this study, or in combination with other landmarks to facilitate internal jugular cannulation.

Internal jugular venous pulsations are described in textbooks on cardiology or internal medicine (Isselbacher et al., 1980) and reflect phasic changes in the right atrium. The characteristic biphasic "a" and "v" waves are clearly visible at normal central venous pressures, but with greater pressures the separate waves become less distinct as the internal jugular vein is distended constantly. Nevertheless, even with higher central venous pressures (greater than 10 cm H2O), venous pulsations from both cardiac and respiratory cycles are still visible. Nodal rhythms may present with giant "a" waves.

The jugular venous pulse also varies with respiration, distending during the inspiratory phase of mechanical ventilation and on expiration when breathing is spontaneous. These respiratory fluctuations further aid in localizing the internal jugular vein.

It is technically easier and safer to cannulate an internal jugular vein if it is distended. This is readily obtained by a slight head-down tilt and augmented by the increase in venous pressure during the inspiratory phase of artificial ventilation. Needle insertion and catheter advancement are best coordinated with the inspiratory phase of ventilation, as it minimizes the risk of air embolism and provides a more turgid vein to which a catheter can be introduced.

The success rate in this series was partly aided by the anaesthetic state which provided a still patient, control of venous pressure and a relaxed sternocleidomastoid muscle. The lack of tone in the body of the sternocleidomastoid muscle facilitated transmission of the venous waves, aiding localization of the underlying internal jugular vein. Identifying the venous pulsation in awake patients may be more difficult, especially if the sternocleidomastoid muscle is tense. However, most patients can be encouraged to relax their neck muscles so that the venous pulsations become readily visible.

Arterial pulsations are usually not visible in the neck. The pulsations seen are venous. However, occasionally in an elderly patient a tortuous carotid or subclavian is visible suprasternally and can be differentiated easily. If any doubt exists it can be gently palpated; venous pulsations have little turgor. Such gentle palpation of the carotid is quite benign, whereas more vigorous pressure used to tether the carotid before jugular puncture (English

<table>
<thead>
<tr>
<th>Table I. Number of needle insertions before successful internal jugular venous entry (a) or cannulation (b)</th>
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<tbody>
<tr>
<td>No. patients</td>
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<tr>
<td>---------------</td>
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<tr>
<td>(a) &quot;Seeker&quot; 22- or 23-gauge needle</td>
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<tr>
<td>1st Attempt</td>
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<td>2nd Attempt</td>
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<td>(b) 14- or 8-French catheters</td>
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<td>&gt; 3 Attempts</td>
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<td>Carotid punctures</td>
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et al., 1969; Mostert, Kenny and Murphy, 1970) may induce emboli in arteriosclerotic patients. Practising physicians should familiarize themselves with neck pulsations before using these signs for jugular venous location. The routine use of a seeker needle (22- or 23-gauge) before definitive venepuncture is recommended.

Difficulty was encountered on several occasions. With reduced central venous pressures the vein may be visible, but catheter advancement may be difficult because of a partially collapsed vein (Stevens and Hamit, 1978). This is overcome by gradually tilting the head down and watching the neck veins until they remain distended during expiration as well as inspiration. The neck veins may be fully distended with increased central venous pressures making it difficult to localize the minimal venous pulsations. However, the waves can be located on careful examination. Venous pulsations may also be difficult to observe in markedly obese patients, but again can usually be seen with thorough inspection of the neck. In most of the unsuccessful attempts at venepuncture, the needle passed lateral to the vein, reflecting a desire to avoid carotid puncture. Each of the carotid punctures occurred with the needle directed too medially rather than along the line of the neck (paramedian or sagittal plane). Carotid punctures in this series occurred in a patient with previous neck surgery (thyroidectomy) and in another with a fever (38.5 °C) and heart rate of 130 beat min⁻¹. Internal jugular puncture in either of these settings should be approached with caution. The pulsations in the neck should not be used to locate the venous pulse in patients with fever and tachycardia. These patients are hypovolaemic and 20° head-down tilt is advisable before jugular puncture.

The technique offers several anatomical advantages over previously described methods. It enables more cephalic needle insertion, making pneumothorax extremely unlikely. Secondly, a “no touch” technique lends itself to improved asepsis and avoids the necessity to palpate or retract the carotid, which may have potential complications (Hertzler et al., 1978; Sprigge and Oakley, 1979). Carotid puncture has not been eliminated as a complication, but is not common.

Since this method of locating the internal jugular vein is safe and simple, it should be used as the primary means of locating the vein when the venous pulse is visible. Other techniques may be used if the pulsations are not clearly visible.

**REFERENCES**


**LES PULSATIONS DE LA VEINE JUGULAIRE COMME UNIQUE REPÈRE DANS LE CATHETERISME PER-CUTANE DE LA JUGULAIRE INTERNE**

**RESUME**

La veine jugulaire interne a été cathétérisée avec succès dans 210 sur 212 cas consécutifs en utilisant les pulsations veineuses comme seul repère pour localiser la veine. Du sang veineux jugulaire était aspiré dès la mise en place d’une aiguille-repère de calibre 23 chez 87,7% des patients et dans 82,5% des cas une canule de calibre 14 ou 8 Fr a pu ensuite être placée avec succès dès le premier essai. La simplicité, la fiabilité et l'absence relative de complications de cette technique la situent en bonne place par rapport aux autres. La carotide a été ponctionnée chez trois patients (1,5%).
In 210 von 212 aufeinanderfolgenden Fällen gelang die Katheterisierung der Vena jugularis interna nach ihrer Lokalisierung allein anhand ihrer Pulsation. Bei 87,5% der Patienten konnte nach Einführen einer 23-Gauge-Führungs­nadel Jugularvenenblut aspiriert werden, bei 82,5% gelang beim ersten Versuch das Schieben eines 14- oder 8-Fr. Katheters. Die einfache, erfolgreiche und relativ sichere Technik hält dem Vergleich mit anderen Techniken stand. Im drei Fällen (= 1,5%) wurde die Arteria carotis punktiert.

Se hicieron canulaciones de la vena jugular interna con éxito en 210 casos de 212 casos consecutivos al usar las pulsaciones de la vena como única señal para localizar la vena. La sangre venosa jugular fue aspirada durante la inserción inicial de una aguja buscadora de calibre 23 en 87,7% de los pacientes y se obtuvo un paso exitoso de una cánula de calibre 14 u 8 francés en la primera tentativa en un 82,5% de los pacientes. La facilidad, el éxito y la relativa seguridad de dicha técnica se compara favorablemente con las demás técnicas. La arteria carótida fue perforada en tres de los pacientes (1,5%).