APPLICATION OF THE DOPPLER ULTRASOUND BLOODFLOW DETECTOR IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

P. du P. la Grange, P. A. Foster and L. K. Pretorius

SUMMARY

A Doppler ultrasound bloodflow detector was used to localize the third division of the subclavian artery, rendering the supraclavicular approach to the brachial plexus safer and highly successful.

The supraclavicular approach for a brachial plexus block is a technique favoured by many as it produces a more extensive area of blockade than the axillary approach for the same dose of local anaesthetic. However, the risk of pneumothorax and, to a lesser extent, of arterial puncture and haematoma formation is less with the axillary approach, although puncture is made through skin with a high population of microorganisms. Any method which may decrease the problems of the supraclavicular approach warrants attention. The method described here has reduced the risks and made it possible to carry out supraclavicular brachial plexus blocks successfully in the obese patient or where the normal anatomy is distorted. No complications have been encountered.

METHOD

The major nerve trunks lie close to the major vessels. We have used a standard 9.5-mHz ultrasonic Doppler bloodflow detector for the localization of the subclavian artery. On the basis of a constant relationship between the third division of this artery and the six divisions of the three trunks of the brachial plexus, accurate placement of local anaesthetic drug should be possible. Sixty-one adult patients undergoing orthopaedic procedures were anaesthetized. The patient was positioned supine with the arm to be blocked at the side and the chin fully rotated in the opposite direction. The shoulder was depressed as far as possible. Palpation of the subclavian artery above the midclavicular point was attempted. If there was any doubt about its location, the Doppler probe head containing transmitting and receiving elements was applied over the area using a sterile coupling jelly. The artery and its accompanying vein were then located precisely and marks made with a water-soluble dye on the skin outside the area to be sterilized (figs 1, 2). The puncture area was cleansed and sterilized. A skin weal was raised with local

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TABLE I. Comparison of various approaches to the brachial plexus, showing success rate and complications

<table>
<thead>
<tr>
<th>Series</th>
<th>Route</th>
<th>No. of patients</th>
<th>% Success</th>
<th>Pneumothorax</th>
<th>Phrenic nerve palsy</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balas (1971)</td>
<td>Subclavian and paravertebral</td>
<td>300</td>
<td>95.33</td>
<td>2.67</td>
<td>0</td>
<td>0.67 Total spinal</td>
</tr>
<tr>
<td>Brand and Papper (1961)</td>
<td>Axillary</td>
<td>246</td>
<td>91.5</td>
<td>0</td>
<td>1</td>
<td>2 Haematoma</td>
</tr>
<tr>
<td>De Jongh (1961)</td>
<td>Supraclavicular</td>
<td>230</td>
<td>84.4</td>
<td>6.1</td>
<td>0</td>
<td>3 Haematoma</td>
</tr>
<tr>
<td>La Grange, Foster and Pretorius (present study)</td>
<td>Supraclavicular</td>
<td>94</td>
<td>91.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ward (1974)</td>
<td>Interscalene</td>
<td>61</td>
<td>98.00</td>
<td>0</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>Winnie (1970)</td>
<td>Interscalene</td>
<td>34</td>
<td>91</td>
<td>3</td>
<td>6</td>
<td>3 Recurrent laryngeal</td>
</tr>
<tr>
<td>Winnie and Collins (1964)</td>
<td>Subclavian</td>
<td>200</td>
<td>94</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

FIG. 2. The anatomical relations of the subclavian artery and brachial plexus.

analgesic and a 22-gauge needle (3 cm length) attached to a 20-ml syringe containing 2% mepivacaine with adrenaline 1:200,000 was inserted downwards and backwards, in a direction towards the 3rd and 4th thoracic vertebrae (Atkinson et al., 1977). If paraesthesiae were felt, 10 ml of the solution was injected. The needle was withdrawn slightly and 5 ml deposited medial and 5 ml lateral to the area at which paraesthesiae were found, taking care always to aspirate for blood before injection. If paraesthesiae could not be elicited after one or two needle thrusts, the upper surface of the rib was contacted and mepivacaine 10 ml was injected between this spot and the skin during slow withdrawal of the needle. A further 5 ml was deposited between the anterior border of the rib and skin and the posterior border of the rib and skin (a total volume of 20 ml).

In a few instances the Doppler detected the position of the artery, but it was not possible to contact the surface of the first rib or elicit paraesthesiae after one or two needle thrusts; further careful probing was undertaken for paraesthesiae. Care was taken never to penetrate more than 2 cm and the patient was instructed to report immediately any discomfort in the chest. As soon as paraesthesiae were elicited in this way, mepivacaine 10 ml was injected in the position for paraesthesiae and 5 ml just lateral and 5 ml just medial to this.

RESULTS

The success rate with this technique is shown in table I.

DISCUSSION

Our blocks were performed for various procedures: surgery for carpal tunnel syndrome, tendon transplant, nerve suturing, tendon suturing, repair of Dupuytren's contracture and excision of a ganglion. For this type of work many orthopaedic surgeons prefer the patient to receive brachial plexus block rather than general anaesthesia because of the lesser frequency of vasospasm and oedema after operation. Our colleagues also found that the accompanying sympathetic blockade reduced infection after operation by inhibiting sweating in the arm (Rank, Wakefield and Hueston, 1973; Flynn, 1975). All patients were assessed 24-48 h after operation by the anaesthetist
or surgeon. No neurological sequelae were found. In addition there were no symptoms or clinical evidence of pneumothorax. During the 6-month period of this series, the authors were not always able to attend every operative session, in which case the orthopaedic surgeons performed the nerve blocks. Supraclavicular brachial plexus blocks performed without Doppler control have been associated with pneumothorax in approximately 5% of the patients.

It would seem that by utilizing the ultrasonic Doppler bloodflow detector it is possible to block the brachial plexus as successfully by the supraclavicular approach as by any other technique, and virtually without complications. The standard ultrasonic Doppler bloodflow detector used is a small, simple and relatively inexpensive apparatus.

REFERENCES