AN OPERATIVE APPROACH TO SUPRACLAVICULAR PLEXUS INJURIES

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Injuries to the brachial plexus above the clavicle are not infrequent either in civilian or military practice. They are serious problems because of the site and extent of damage, and the residual disability which may remain. The slow process of regeneration after nerve injury at this high level makes preservation of the muscle end-plate mechanism difficult; it favours muscle atrophy and digital contractures. Such harmful sequelae of denervation can be greatly limited by adequate palsyotherapy and electrotherapy, but if one is to embark on the long programme of conscientious treatment that is essential for useful recovery, the possibilities of axon regeneration should be established early. If this cannot be settled by clinical and electromyographic studies it is better to explore early, rather than wait eighteen or twenty-four months for clinical verification of complete neurotmesis. There has been more reluctance to explore these injuries than in the case of nerve injuries in the extremities; the deterrents have been the possibility of damage to adjacent vital structures, and also the possibility of vascular and other complications. In exploring twenty-one, of one hundred and five of these injuries, the author has used a slightly different approach which has proved helpful.

OPERATIVE APPROACH

The classical supine position on the operating table has been altered to a sitting posture (Fig. 1). With the head rotated away from the injured side, the point of the shoulder drops and remains dependent in this position, thus increasing the length of nerve trunks which can be explored above the clavicle. The operating field is lifted so that it is directly in front of the surgeon; and it remains comfortably accessible during the long and sometimes tedious dissection. An almost vertical incision is used, extending from the mid-point of the lateral border of the sternomastoid to the middle third of the clavicle. It may terminate at the inner third to reach the lower roots, or veer towards the outer third when exploration of fifth and sixth roots is most important. The external jugular vein is ligated and the sternomastoid muscle retracted. The omohyoid is exposed and divided. The suprascapular and transverse cervical vessels are ligated. The brachial plexus is then obvious, streaming out between the scalenes. The dependent position of the shoulder places the structures of the posterior triangle on a gentle stretch, facilitating dissection and identification in layers. Through the vertical incision, access to the front and back of the roots is afforded (Fig. 2). Once the upper root is identified, the structures may be "wiped" forwards and medially, allowing dissection from the posterior aspect. This is often helpful, because scar tissue may not have penetrated to this layer and the roots may thus be identified more easily.

After identification of the upper roots and trunks, from the side as it were, dissection is continued along the anterior and posterior aspects, tracing the roots distally into the interval between the two scalenes (Fig. 3). The scalenus anterior may then be retracted medially and the other roots identified in serial fashion. Once the correct plane of the trunks has been obtained, dissection towards the medial side is greatly facilitated even in densely scarred areas. The plexus may be followed distally, and freed well under the clavicle. The dependent position of the shoulder tends to pull the clavicle out of the way and it allows the trunks to be explored well beneath the clavicle. At the same time, the trunks remain closer to the surface instead of dropping posteriorly as is the case when the horizontal position is used, in which position, incidentally, a sand bag behind the scapula tends to push the whole girdle forwards and obstruct the base of the posterior triangle.
FIG. 1
A semi-sitting posture is used, allowing the shoulder to "drop."

FIG. 2
Dissection for exposure of the roots begins from the lateral side in the region of the dotted line lateral to the upper trunks.

FIG. 3
The trunks are dissected from anterior and posterior aspects and exposed from above downwards.
When further exposure is necessary, the incision described is extended in a "Z" fashion with the transverse part along the middle third of the clavicle and the distal part extending from the lateral third of the clavicle. The clavicle is divided just lateral to the mid-point and retracted by steel wires placed through drill-holes which are inserted before the bone is divided. These wires serve as retractors and as a quick method of fixation and closure.

## TABLE I
**Supraclavicular Plexus Injuries**

<table>
<thead>
<tr>
<th>Operations</th>
<th>No.</th>
<th>Upper trunk</th>
<th>Middle trunk</th>
<th>Lower trunk</th>
<th>Recoveries</th>
<th>Complete</th>
<th>Partial</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.S.W.</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Traction lesions</td>
<td>13</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>10</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Percentage: 48% 19% 33% 24% 76%

Number of injuries . . . 105
Number of operations . . . 21

Incidence of involvement of the various trunks and the results are shown.

## SUMMARY

The use of the upright position of the patient, and a vertical incision for exposure of the brachial plexus, has been attended by no complications or serious hazards. The aid of skilled anaesthetists is acknowledged. The structures are visible and accessible; the operative field is steady; bleeding is controlled easily; and dissection is facilitated. By this technique it has been possible to explore a larger field from above, and division of the clavicle has seldom been necessary. Finally, and of importance, the operative area at shoulder level enables the surgeon to continue tedious dissection for some hours comfortably, and to escape post-operative postural complications in his own back.