IATROGENIC INJURIES OF PERIPHERAL NERVES

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In this study, we discuss 68 cases in which peripheral nerve trunks were inadvertently divided by surgeons. Most of these accidents occurred in the course of planned operations. Delay in diagnosis and in effecting repair was common. We list the nerves particularly at risk and the operations in which special care is needed. We recommend steps to secure prompt diagnosis and early treatment.

Accidental division of a major nerve by a surgeon is an avoidable disaster, the consequences of which can be minimised if the injury is recognised and treated early. Our experience at two secondary referral centres suggests that early management is rarely ideal; diagnosis was delayed for six months or more in nearly half the cases discussed here.

PATIENTS AND METHODS

From 1979 to 1986, about 2000 patients with lesions of major peripheral nerves attended St Mary's Hospital or the Royal National Orthopaedic Hospital, London. In nearly 200 of these the nerve injury was the result of medical treatment. In this report we shall not consider those caused by compression, injection, traction or ionising radiation, nor those cases of laceration of minor sensory nerves or partial divisions of the sciatic or femoral nerves occurring during hip operations.

This report is concerned with 68 patients (3% of all referrals) in whom a major nerve was completely divided in the course of a surgical operation.

RESULTS

The surgical operations and the nerves divided are recorded in Table I.

The most common injuries were to the brachial plexus and the accessory nerve (20), the radial and posterior interosseous nerves (18), the ulnar nerve (8) and the common peroneal nerve (10). The patients' ages ranged from four to 73 years. Orthopaedic surgeons performed 37 of the operations, general surgeons 31. In 26 cases (24 orthopaedic), the operation was performed as an emergency for the treatment of a fracture or for vascular problems.

Delay in diagnosis ranged from seconds to 40 months and in nearly half the patients, diagnosis was delayed for more than six months. Two cases are reported in some detail to illustrate this problem.

Case report. A 58-year-old woman presented with a discharging sinus in the right groin. A lymph node biopsy was performed and after the operation the patient complained of pain and loss of sensation over the front of her thigh and inability to actively straighten her knee. These complaints were recorded at the time of discharge from hospital and at later attendances. A diagnosis of 'conduction block' of the femoral nerve was made, although two electromyographic examinations confirmed evidence of degeneration of the femoral nerve.

Despite these findings, hope of spontaneous recovery was entertained. Eventually, the patient was referred to a specialist unit, and eight months after the original operation the femoral nerve was explored. It had been transected and the gap, after resection of the nerve ends, was 8 cm. A nerve graft was performed, but recovery of function two years later was poor.

Review of the original biopsy sections showed large numbers of myelinated nerve fibres grouped into bundles - an observation recorded by the pathologist but never appreciated by the surgeon.

Comment. To the initial mistake of dividing the nerve were added the mistaken diagnosis, the failure to understand the electromyographic findings and the failure to heed the pathological report.

Case report. A 22-year-old man presented with a painful lump in the right posterior triangle of the neck. The surgeon resected the lump and recorded that a nerve had been divided. Advice was immediately sought and a course of action agreed. Histological examination showed the tumour to be a benign neurofibroma. Seven days later
the brachial plexus was explored and the divided upper trunk was displayed and repaired by a graft, after removal of residual tumour. There was early relief of pain. Powerful active flexion of the elbow returned at 12 months, and by 18 months the deltoid and spinati muscles had recovered to Grade 4 (MRC).

Comment. Quick diagnosis and immediate action by an alert surgeon made possible early repair and minimised the consequences of the original mistake.

DISCUSSION

Narakas (1987) mentioned 25 iatrogenic lesions in a series of over 800 injuries of the brachial plexus. Seddon (1975) referred to 65 patients with partial or complete injuries of nerves sustained during operations. In his series, the radial, the posterior interosseous and the ulnar nerves accounted for 49 cases.

Regrettably, such injuries continue to occur.

Nerves at risk. The accessory nerve is extremely vulnerable in its course across the posterior triangle of the neck. Indeed, it is placed so superficially that the overenthusiastic surgeon may divide it with the skin incision. Valtonen and Lilius (1974) described a series of such lesions.

The upper trunk of the brachial plexus is often surprisingly superficial and it is at risk of injury during operations for lymph node biopsy. The lower trunk of the brachial plexus is vulnerable during excision of a cervical or first thoracic rib, during cervical sympathectomy and in the course of the operation for removal of a tumour at the apex of the lung. The anatomy of the accessory nerve and the components of the brachial plexus may be so distorted by the local pathological process that their recognition may be difficult and a nerve stimulator is an invaluable instrument in such cases.

The musculocutaneous nerve is at risk during operations for recurrent anterior dislocation of the shoulder. Franken (1984) recorded three cases in which the nerve was divided. It is not generally appreciated that the nerve may enter the coracobrachialis muscle as little as 2 cm below the coracoid process.

The radial nerve is vulnerable during exposure of the shaft of the humerus and the elbow, and the posterior interosseous nerve is at risk in operations on the head of the radius. Strachan and Ellis (1971) described an approach designed to minimise this risk.

The sciatic nerve is constantly at risk in the course of the posterior approach to the hip; the femoral, in the course of the anterior or anterolateral approach. Ratliff (1984) collected 50 patients who had suffered injury to the sciatic or femoral nerve during such procedures. His series included injuries from scissors and the knife, from encirclement by wire, from heat from cement, from misplaced prostheses and from compression by haematomy. Adams (1964) commented on the vulnerability of the sciatic nerve during ischiofemoral arthrodesis and proposed methods of diminishing this risk. There is evidence, not necessarily clinical, of damage to the sciatic nerve in a high proportion of operations for arthroplasty of the hip (Bonney 1983). Recovery after a lesion at this level is always incomplete and often fails entirely. The decision in such cases is difficult. The patient is likely to be old; his or her condition may be poor; the chances of recovery after repair are not good; the eventual disability may be preferable to the hazards of intervention. We consider it right to recommend exploration if the lesion of the nerve or of either of its components is complete or near complete, or if there is severe pain, provided that the patient’s condition is good enough to justify this further intervention.

The common peroneal nerve is placed very near the

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<th>Table 1. Nature of operations</th>
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<tr>
<td>Operation</td>
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<tr>
<td>Wound exploration or fracture fixation (n = 21)</td>
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<td>Removal of an implant (n = 7)</td>
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<td>Lymph node biopsy (n = 13)</td>
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<td>Removal of a cyst, ganglion or other benign tumour (n = 10)</td>
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<td>Cervical sympathectomy (n = 2)</td>
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<tr>
<td>Excision of a cervical or first thoracic rib (n = 2)</td>
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<tr>
<td>Varicose vein or arterial surgery (n = 13)</td>
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surface as it winds round the neck of the fibula. It is particularly at risk here from surgeons ligation or avulsing varicose veins, especially when short incisions are used. **Prevention.** The surgeon must be familiar with the anatomy of the nerves in the field of his operation. Long incisions are best to expose the nerves at risk, particularly when the normal anatomy has been distorted by scar. Especially to be deprecated is the practice of removing ‘ganglions’ or ‘synovial cysts’ through small incisions which give no glimpse of important axial structures.

In all operations performed in the vicinity of major nerves, a stimulator should be available. Often enough its use may stay the unwary hand poised to divide a nerve. Suitably approached, most anaesthetists will desist from the use of neuromuscular blocking agents throughout the operation or during the period of exploration.

A serious problem is posed by the unexpected finding, during operation for a ganglion, of an intraneural or epineural tumour. Careful clinical examination before operation should indicate the true nature of such tumours. Paraesthesiae in the distribution of the affected nerve produced by tapping the tumour should alert the clinician. However, the inexperienced surgeon may remove such a tumour with a length of nerve, unaware until the patient awakes that a nerve has been damaged. Sometimes, in the case of a Schwannoma, the tumour can be enucleated. If it is inextricably connected with conducting elements, excision and repair with a nerve graft may be the best course. Biopsy in such cases is generally wrong since the operation may damage conducting tissue and make later enucleation more difficult because of scarring.

**Diagnosis.** When a patient awakes from an operation with signs of a lesion of a nerve within the field of that operation it should be assumed that the nerve has been divided. It is unwise to make the comforting diagnosis of neurapraxia. Neurapraxia means loss of nerve function through conduction block without peripheral axonal degeneration (Seddon 1942). In such a lesion the axons peripheral to the site of injury continue to conduct electrical impulses.

Persistent pain at the site of the lesion with radiation in the distribution of the nerve commonly indicates an irritative lesion caused, perhaps, by persistent pressure or by accidental ligation. Partial division of a nerve may cause such pain which is not a feature of neurapraxia. Loss of sudomotor and vasomotor function in the cutaneous distribution of a nerve is a valuable sign of its division (Bonney 1983). It has long been known that the small autonomic fibres are less susceptible to pressure than are the larger motor and sensory fibres and are commonly spared in simple conduction block. After complete nerve section there is, in the first 24 hours, vasodilatation and anhidrosis in the cutaneous distribution of the divided nerve.

**Electrophysiological examination.** Too often the refined methods of diagnosis now available are used as a means of deferring decision and postponing action. Their place and significance should be known to all clinicians working in or near this field. Persistence of conduction distal to the lesion after the period required for axonal degeneration plainly indicates neurapraxia or conduction block. Failure of conduction through the site of the lesion with similar failure below it, and later with spontaneous electrical activity in the paralysed muscles, indicates that there is a degenerative lesion. Only time or exploration will determine whether the lesion involves connective as well as conducting tissue; whether it is an axonotmesis or a neuromatosis.

We have not discussed the results of repair of these divided nerves. On the whole the results were poor, particularly when there was delay in diagnosis. We recommend that surgeons be familiar with the anatomy of the field of proposed operation, plan their incisions accordingly and make due allowance for distortion by scarring, inflammation or tumour. We urge the use of a nerve stimulator and draw attention to the need to remember the possible diagnosis of a benign tumour of a nerve trunk.

Finally, we would quote from Bonney (1986): “If there is an incision over the line of a main nerve and if, after operation, there is complete paralysis (including vasomotor and sudomotor paralysis) in the distribution of that nerve, speculation is unnecessary: the nerve has been cut and there will be no recovery until it is explored and repaired”.

The authors chose not to respond to the request for a conflict of interest statement.

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