ANTERIOR INTEROSSEOUS NERVE PALSY FOLLOWING INTERNAL FIXATION OF THE PROXIMAL RADIUS

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Three cases of anterior interosseous nerve palsy were diagnosed after internal fixation of fractures of the proximal radius. The suggestion that the nerve was injured at operation by bone-holding forceps was supported by operations on 12 cadaver forearms, in which the nerve was frequently trapped. Care should be taken to place such forceps in a subperiosteal plane.

Internal fixation of fractures of the radius and ulna requires extensive dissection of the forearm and any local injury may compromise the result of the operation. Damage to the posterior interosseous nerve is recognised to occur during operation on the proximal radius, but the anterior interosseous nerve also is at risk. Lesions of this nerve following internal fixation have rarely been reported, but this may be due to the minimal clinical signs and the eventual recovery of nerve function. Three cases are reported, together with an experimental study on cadaver forearms.

CASE REPORTS

Three patients sustained severe, displaced fractures of the proximal radius, two with dislocation of the head of the radius. On admission, no neurological deficit was recorded, though specific tests for the anterior interosseous nerve may not have been performed. Each case had open reduction and internal fixation, reduction forceps being used both to manipulate and reduce the fractures, and later to hold the plate against the bone while screws were inserted. In this circumstance the curved serrated edges of the forceps almost encircle the circumference of the bone.

Case 1. A 17-year-old motorcyclist sustained closed fractures of the proximal right radius and ulna with anterior dislocation of the head of the radius (Fig. 1). At operation, the ulna was exposed along its subcutaneous border and the radius through a posterior approach (Thompson 1918). A six-hole plate was applied to the fractured radius, the dislocation of the radial head was reduced by manipulation, and an eight-hole plate was screwed to the ulna (Fig. 2).

The day after operation there was complete paralysis of flexor pollicis longus and the deep flexor of the index finger. Five months later the patient had no complaint but flexion of the distal phalanges of thumb and index finger had recovered only to MRC Grade 3.

Case 2. A 26-year-old man fell and sustained closed fractures of the left radius and ulna (Fig. 3). The ulna was exposed subcutaneously and the radius through an anterior approach (Henry 1973). A six-hole plate was used to fix each fracture.

Two days later, radiographs revealed posterior dislocation of the elbow which had not been present on admission; this was probably caused by forceful manipulation during reduction of the fractures. The dislocation was reduced by manipulation. Anterior interosseous nerve palsy was first detected seven days later, and had partially recovered after one month. Six months later flexion of the distal phalanges of the thumb and index finger remained weak (MRC Grade 3) but the patient reported no disability.

Case 3. A 20-year-old man fell while running and sustained closed fractures of the proximal shafts of the left radius and ulna (Fig. 4).
ulna was exposed subcutaneously and the radius through a posterior approach. Six-hole plates were used for fixation and cancellous bone graft was added.

Anterior interosseous nerve palsy was first detected 17 days after operation with reduced power of flexion of the distal phalanges of the thumb and index finger (MRC Grade 3). This recovered fully after five weeks.

MATERIALS AND METHODS

Twelve upper limbs from eight cadavers were used to investigate the risk of damaging the anterior interosseous nerve with bone-holding forceps. In six limbs the proximal radius was exposed by an anterior approach (Henry 1973), and in six by a posterior approach (Thompson 1918). A six-hole plate was applied to the shaft of the bone and each end held firmly in place with ASIF fracture reduction forceps. The anterior interosseous nerve was then located and dissected so as to establish its relationship with the forceps.

RESULTS

In the 12 dissections, bone-holding forceps had trapped the main trunk of the anterior interosseous nerve in three cases, two after an anterior and one after a posterior approach. The branch of the nerve to flexor pollicis longus was trapped in five cases, two after an anterior and three after a posterior approach. In all eight cases the nerve had been trapped at the distal end of the plate, approximately 10 cm from the head of the radius (Fig. 5.).

DISCUSSION

The anterior interosseous nerve arises from the median nerve 5 cm distal to the lateral humeral epicondyle and passes with the main trunk between the two heads of pronator teres. It runs along the volar surface of flexor digitorum profundus and then passes between this muscle and flexor pollicis longus to continue along the interosseous membrane and enter pronator quadratus. It provides the motor supply to the index and sometimes the middle finger sections of flexor digitorum profundus, to flexor pollicis longus and to pronator quadratus.

Lesions of the anterior interosseous nerve cause weakness or paralysis of flexion of the distal phalanges of the thumb and index and occasionally middle fingers giving a characteristic “square pinch” sign. Injury to the nerve may result from accidental or surgical wounds, external pressure, misplaced injections or supracondylar fractures of the humerus. The nerve may be compressed by fibrous bands or variant muscles (Spinner 1978).

There is considerable anatomical variation: the nerve may supply all or none of flexor digitorum profundus and may supply part of flexor digitorum superficialis (Sunderland 1978). Flexor digitorum profundus and flexor pollicis longus may be congenitally absent (Spinner 1978) or their tendons may rupture in cases of rheumatoid disease or fracture of the distal radius. Warren (1963) described two cases of complete anterior interosseous nerve palsy in patients with closed forearm fractures treated without internal fixation. Engber and Keene (1983) reported one case of palsy following a Monteggia injury and considered that the nerve had become tented over the angulated ulnar fracture. Griffiths (1966) reported three cases of incomplete palsy following plating of fractures of the radius, while Spinner (1970, 1978) suggested that damage could occur if dissection around the proximal or middle thirds of the radius is extra-periosteal, and described two such patients. Many published reports of large series of forearm fractures treated by plate and screw fixation make no mention of anterior interosseous nerve lesions. Burwell and Charnley (1964), Dodge and Cady (1972).

![Fig. 5](image-url)

Dissection of the forearm to show the anterior interosseous nerve (A) branching from the median nerve (M), in relation to the head of the radius (R). A plate is held against the proximal shaft of the radius with fracture reduction forceps. The branch of the anterior interosseous nerve to flexor digitorum profundus (nearest to the median nerve) has been crushed by the distal pair of forceps, and vulnerability of the branch to flexor pollicis longus is obvious.
and Anderson et al. (1975) report only rare instances of palsy of the radial nerve and its branches.

In the cases now reported, nerve injury could have resulted from the fracture itself, from joint dislocation or soft-tissue swelling, or during operation for internal fixation. It seems likely that iatrogenic injury was at least a contributory cause and this is supported by the results of cadaver dissection. It is therefore suggested that special care should be taken in the application of forceps to the radius. Sharp subperiosteal dissection should be used to provide tracks for the tips of the forceps.

The spontaneous improvement of nerve function in the three reported cases suggest that re-operation is not required for nerve lesions apparently caused by internal fixation. This procedure might be hazardous, and if recovery does not occur the wisest course may be late tendon transfer. Spinner (1970) recommends transfer of the superficialis tendon from the ring finger to flexor pollicis longus, and suture at the wrist of the profundus tendon of the index finger to that of the middle finger.

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REFERENCES


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