TRAUMATIC ULNAR NEURITIS

THE RESULTS OF ANTERIOR TRANSPOSITION OF THE ULNAR NERVE *

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In the groove behind the medial epicondyle of the humerus the ulnar nerve is in a position of unusual vulnerability. It is particularly liable to be damaged as the result, either immediate or late, of fractures in the neighbourhood of the elbow-joint; and traumatic ulnar neuritis is one of the more common peripheral nerve lesions encountered in civil surgery. This paper deals with the results in 26 cases treated by operation at a Peripheral Nerve Injuries Unit between September 1941 and March 1944; the series includes all cases except gunshot wounds or other direct injuries of the nerve, and the cases are summarised in the Table. The majority of the patients (20 out of 26) were members of H.M. Forces. Their ages ranged from 19 to 53 years, with an average of 33 years. In 12 cases the right arm was affected, in 14 cases the left.

CLASSIFICATION

Platt (1926) described three clinical groups:—(1) Ulnar nerve lesions associated with recent fractures of the lower end of the humerus; (2) late involvement of the ulnar nerve after fractures in the region of the elbow (tardy ulnar palsy); and (3) recurrent dislocation of the ulnar nerve. To these the following additional groups may be added:—(4) ulnar nerve lesions associated with arthritis of the elbow, without any history of previous trauma; (5) lesions associated with congenital cubitus valgus; (6) lesions resulting from occupational pressure upon the ulnar nerve; and (7) injuries near the nerve. The present series does not contain any case in which the nerve lesion resulted from a recent fracture. The cases have been grouped as follows.

1. Tardy Ulnar Palsy (Cases 1-15).—The lesion which is most frequently associated with the development of tardy ulnar palsy is a fracture of the lower end of the humerus sustained in childhood, in which a fragment consisting of the lateral humeral condyle remains ununited; later cubitus valgus develops (Figs. 1 and 2). Seven of the 15 cases of tardy ulnar palsy had sustained fractures of this type. The majority of these patients had an elbow-joint which, although greatly distorted, was functionally little short of normal. Two patients had old ununited fractures of the medial epicondyle (Fig. 3). Two had old fractures of the head of the radius, and in one of these the

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head of the bone had been removed elsewhere. In the remaining 4 cases, when the patient came under observation the elbow was so arthritic that it was impossible to decide the nature of the original fracture. Platt (1926) states that in 75 per cent. of the recorded cases of tardy ulnar palsy the interval between the initial injury and the onset of symptoms referable to the ulnar nerve is not less than 10 years; in his own cases the longest interval was 51 years. In the present series the interval varied from 18 months to 44 years, with an average of 14·6 years.

2. Arthritis of the Elbow (Cases 16-20).—One of the cases in this group (Case 16) might have been included in the previous group; after a latent period of 11 years, a tuberculous infection of the left elbow-joint was followed by ulnar neuritis. In the remaining cases there was clinical and radiological evidence of arthritis of the elbow-joint without any history of previous trauma (Fig. 4). The neuritis associated with arthritis of the elbow-joint appears to be more severe and to develop more rapidly than that which follows fracture of the humerus or pressure upon the nerve.

3. Recurrent Dislocation (Cases 21 and 22).—Recurrent dislocation of the ulnar nerve may occur in those who have an abnormally shallow ulnar groove, associated with a mild degree of congenital cubitus valgus and hyperextensibility of the elbow-joint. Repeated dislocation of the nerve may occur almost unnoticed until the symptoms of ulnar neuritis develop in late middle life. The condition is often hereditary and, although bilateral, in a right-handed person symptoms usually appear first in the right arm. Occasionally injury in the region of the medial epicondyle may cause sudden dislocation of the nerve followed by persistent symptoms (Case 21).

4. Occupational Pressure (Cases 23-25).—This group is closely related to the preceding. The depth of the ulnar groove and the mobility of the ulnar nerve vary considerably; in a shallow groove a relatively fixed nerve may be subjected to prolonged pressure as the result of an habitual posture of the limb. Harris (1943) has described cases in which ulnar palsy developed as the result of pressure of the elbows on a work-bench with an edge upturned like that of a tea-tray. In the present series, the 3 patients in this group were all in the habit of spending hours at a telephone, with the left elbow resting upon the edge of a table.

5. Local Sepsis (Case 26).—In the remaining case the neuritis was the result of an injury in the neighbourhood of the medial epicondyle. A rusty nail was driven into the arm and cellulitis followed; when this resolved, ulnar neuritis persisted.

Clinical Features

Whatever the predisposing cause, the clinical features of the ulnar neuritis are the same. In the majority of cases they develop insidiously, and may have been present for months or even years before the patient
seeks medical advice. Not infrequently a minor injury in the region of the medial epicondyle is the precipitating factor which draws the patient's attention to his lesion. In the present series the duration of symptoms before the patient was admitted to hospital varied from 4 days to 7 years.

### TABLE

| Case No. | Age in Years | Arm. | Original Lesion. | Latent Period | Duration of Symptoms | Subjective. | Objective. |
|----------|--------------|------|------------------|---------------|---------------------|-------------|------------|
|          |              | L.   | Fracture internal condyle of humerus | 18 months     | 6 months            | +           | - + + - + |
| 1        | 21           | L.   | Fracture of elbow with cubitus varus | 3 years       | 1 year              | +           | - + - + + |
| 2        | 39           | R.   | Fracture both epicondyles and olecranon | 4 years       | 1 year              | +           | - + - + + |
| 3        | 33           | L.   | Old fracture of lower end of humerus : cubitus varus | 6 years       | 5 months            | +           | - + - + + |
| 4        | 19           | L.   | Fracture head of radius with cubitus varus | 8 years       | 7 years              | +           | - + - + + |
| 5        | 33           | L.   | Fracture lateral epicondyle : cubitus varus | 9 years       | 6 months            | +           | - + - + + |
| 6        | 30           | R.   | Ununited fracture medial epicondyle | 10 years      | 18 months           | +           | - + - + + |
| 7        | 23           | R.   | Fracture lateral condyle of humerus | 10 years      | 2 years              | +           | - + - + + |
| 8        | 19           | L.   | Old elbow injury with osteo-arthritis | 13 years      | 14 months           | +           | - + - + + |
| 9        | 25           | R.   | Ununited fracture of lateral condyle | 14 years      | 5 months            | +           | - + - + + |
| 10       | 21           | R.   | Fracture neck of radius : head excised | 15 years      | 1 month             | +           | - + - + + |
| 11       | 20           | R.   | Old supracondylar fracture of humerus | 24-26 years   | 1 month             | +           | - + - + + |
| 12       | 31           | R.   | Fracture lower end of humerus | 30 years      | 7 months            | +           | - + - + + |
| 13       | 37           | R.   | Ununited fracture of lateral condyle : cubitus varus | 30 years | 2 years | +           | - + - + + |
| 14       | 36           | R.   | Old fracture : osteo-arthritis of elbow : cubitus varus | 44 years | 6 months | +           | - + - + + |
| 15       | 53           | L.   | Tubercle of elbow | 11 years | 9 months | +           | - + - + + |
| 16       | 28           | L.   | Arthritis of elbow | 6 months | +           | +           | - + - + + |
| 17       | 21           | R.   | Arthritis of elbow | 2 years | +           | +           | - + - + + |
| 18       | 39           | R.   | Arthritis of elbow | 1 month | +           | +           | - + - + + |
| 19       | 39           | R.   | Arthritis of elbow | 18 months | +           | +           | - + - + + |
| 20       | 44           | R.   | Arthritis of elbow | 2 years | +           | +           | - + - + + |
| 21       | 26           | L.   | Dislocated nerve | 4 days | +           | +           | - + - + + |
| 22       | 49           | L.   | Congenital cubitus varus : recurrent dislocation | 4 months | +           | +           | - + - + + |
| 23       | 40           | L.   | Slight congenital cubitus varus : pressure upon nerve | 9 weeks | +           | +           | - + - + + |
| 24       | 37           | L.   | Pressure upon nerve | 4 months | +           | +           | - + - + + |
| 25       | 35           | L.   | Pressure upon nerve | 3 months | +           | +           | - + - + + |
| 26       | 51           | L.   | Injury followed by cellulitis | 2 years | +           | +           | - + - + + |

T = Tingling
P = Pain
N = Numbness
Wa = Wasting
We = Weakness
C = Affected by cold

The symptoms may be either sensory or motor, or both. The most common complaints are tingling (20 cases) and/or numbness (19 cases) in the sensory distribution of the ulnar nerve. Weakness of the affected hand is also a common complaint (15 cases). The weakness is frequently described as general weakness of the limb, and in cases of tardy ulnar palsy the patient may complain that his grip is poor and that he is unable to lift heavy weights. This disability appears to be the combined result of the old bony injury and the weakness of the hand. More intelligent patients complain of difficulty in perform-
ing fine movements, e.g. one patient (Case 14) stated that for many years he had been unable to write legibly, and always used a typewriter. Wasting of the intrinsic muscles of the hand was noted by only 9 patients, although objective evidence of wasting was present in 17.

### TABLE

| Condition of Nerve | Immediate Result | Late Result | Damage to Medial Cutaneous Nerve | Disposal | Complications |
|--------------------|------------------|-------------|---------------------------------|----------|--------------|
| Adherent and in scar| Improved         | ...         | Nil                             | To Con. Depot | Spasm of biceps |
| Adherent and flattened| Improved         | ...         | Nil                             | To Con. Depot | Stiff elbow   |
| Slightly thickened | Marked improvement| 2 4/12 years. Excellent| Nil                             | Work as engineer | Nil          |
| Dislocated in front of groove | Improved | ... | Nil | To Con. Depot | Nil          |
| and adherent | Improved | ... | Nil | To duty | Nil          |
| Hard neuroma, adherent | Improved | ... | Nil | To Con. Depot | Swelling of elbow |
| Fusiform adherent neuroma | I.S.Q. | ... | Nil | nil | Nil          |
| Flattened, adherent and very vascular | I.S.Q. | Improved | 2 years. Excellent | To duty | nil          |
|Injected and slightly adherent | I.S.Q. | Improved | ... | Slight | nil          |
| Swollen soft lateral neuroma | I.S.Q. | 2 9/12 years. Ulnar, very good. Medial cutaneous, improved | nil | To Con. Depot | nil          |
| Subcutaneous in front of elbow: neuroma: kinked | 3 months. Still I.S.Q. | nil | Slight | nil | Functional |
| Normal Flattened: oedematous: adherent | I.S.Q. | Marked improvement | nil | To unit | nil          |
| Flattened: adherent: acutely angulated | Improved | ... | Slight | To duty | Nil          |
| Soft, flat neuroma | Improved | 1 4/12 years. I.S.Q. | Slight | To Con. Depot | nil          |
| Soft neuroma: not adherent | Improved | 6 months. Still improving | Slight | nil | Nil          |
| Soft, fusiform neuroma | Improved | 10/12 years. Improved | nil | To duty (police-man) | nil          |
| Adherent: thickened: contracted | I.S.Q. | 6 months. Still improving | nil | To duty | nil          |
| Slightly swollen: adherent | I.S.Q. | 1 1/2 years. Slight improving | nil | To work as boiler-man | nil          |
| Firm neuroma | Improved | 20/12 years. Excellent | nil | Category E | nil          |
| Thickenened: adherent | Improved | nil | nil | To work (bus-driver) | nil          |
| Over epicondyle: slight neuroma | I.S.Q. | nil | nil | To work (Post Office) | nil          |
| Adherent: injected | Improved | nil | nil | To duty | nil          |
| Slightly thickened | Improved | nil | nil | To Con. Depot | nil          |
| Neuroma distal to ulnar groove | I.S.Q. | nil | nil | Category E | nil          |
| Normal | Improved | nil | nil | Did not return to work | Primary atypical pneumonia |
| Slightly scarred | I.S.Q. | nil | nil | | Functional |

Pain of ulnar distribution is a rare complaint (4 of the 26 cases). Approximately half the patients complained either that the affected hand was colder than its fellow, or that exposure to cold aggravated their symptoms. All the patients were questioned about sweating, but only 1 (Case 9) complained of excessive sweating in the affected hand.

Objective findings are those of ulnar palsy of varying degrees of severity. Wasting and weakness of the muscles innervated by the ulnar nerve are observed in a high proportion of cases, but it is rare for the condition to cause total paralysis in any one muscle. The wasting

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usually appears first in the muscles supplied by the terminal branches of the nerve, i.e. the first dorsal interosseous and the adductor pollicis (Figs. 5 and 6). Another early sign is that when the hands are at rest the little finger tends to drift away from the other digits, and to be held in slight flexion (Fig. 6). The majority of cases (22 out of 26) show objective evidence of interference with the function of sensory nerve fibres. In mild cases there is hypæsthesia and hypalgesia, with impairment of two-point discrimination; but all gradations may be observed from this to complete loss of all modalities of sensation in the autonomous territory of the ulnar nerve. Vasomotor disorders are found in a minority of cases; there may be cyanosis and coldness of the little finger and hypothenar area. Sometimes the whole hand is objectively colder than the normal hand. Elsewhere it has been shown that in this type of nerve lesion, reflex vasomotor responses in the little finger are unaffected (Richards, 1944). In one case (Case 9) spontaneous excessive sweating was observed in the territory of the ulnar nerve; in the remainder sweat secretion was clinically normal.

**Medial Cutaneous Nerve of the Forearm.**—The medial cutaneous nerve of the forearm divides in the arm and its anterior and posterior divisions pass distally in front of the medial epicondyle. There is considerable variation in the exact position of the branches, but one or other is usually encountered during the operation of anterior transposition of the ulnar nerve. Not infrequently the posterior branch is found to pass directly over the prominence of the medial epicondyle, and pressure upon the nerve in this position may account for the pre-operative finding of diminished sensation over the inner side of the forearm in some cases of ulnar neuritis.

**Treatment**

All the cases were operated upon, the ulnar nerve being transposed to the front of the elbow. Details of the operative technique have been described elsewhere (Learmonth, 1942). The incision passes behind the medial epicondyle, the ulnar nerve is freed from its groove and, after division of the flexor-pronator muscle group, placed deep to these muscles beside the median nerve. Twenty-four of the cases have had this operation performed. The two exceptions (Cases 15 and 16) were the original cases in the series, and were operated upon before the present technique was devised, by the method described by Sir Harold Stiles (1922).

After operation the affected limb is usually kept in plaster for 3 weeks, with the elbow flexed to 90°. Thereafter active movement is encouraged, and 10-14 days later the patient may leave hospital.
Fig. 1.—Case 10. Photograph to show cubitus valgus and scar of operative incision passing in front of medial epicondyle.

Fig. 2.—Case 10. Radiograph to show ununited fracture of lateral humeral condyle and distortion of elbow-joint.

Fig. 3.—Case 7. Radiograph to show ununited fracture of medial epicondyle.

Fig. 4.—Case 19. Radiograph to show arthritis of elbow without history of previous trauma.
Fig. 5.—Case 18. Photograph to show wasting of right first dorsal interosseous muscle.

Fig. 6.—Case 24. Photograph to show wasting of interossei and slight flexion and abduction of little finger.
Since the operation notes have been written by several assistants, a certain lack of uniformity in the description of the nerve is inevitable. In 10 cases the presence of a neuroma is mentioned, in 14 the nerve is recorded as abnormal in some respect (adherent, kinked, inflamed, etc.), and in only 2 cases was the external appearance of the nerve considered to be normal. These findings indicate that the presence of a neuroma is not a necessary accompaniment of symptoms referable to the nerve, and the term "traumatic ulnar neuritis" is probably as accurate as the alternative "traumatic ulnar neuroma" suggested by Riddoch. In the present series there is no correlation between the presence of an actual neuroma and either the duration or the severity of symptoms. Two patients had had a previous operation upon the nerve.

**Case 10.**—L. H., age 21 years, sustained an injury to the right elbow at the age of seven. At the age of twelve he developed typical symptoms of ulnar neuritis, and anterior transposition of the nerve was performed. This relieved his symptoms until he joined the army. After five months' training he again developed symptoms of ulnar neuritis. The nature of his fracture and the state of his arm are shown in Figs. 1 and 2. An operation scar was present anterior to the medial epicondyle, and the ulnar nerve was palpable lying subcutaneously deep to the scar. At the second operation the nerve was found in a tunnel of subcutaneous tissue. It was swollen into a fusiform neuroma, and was acutely angulated at both ends of its abnormal course, at the upper end over the medial intermuscular septum and at the lower end over the fascia between the two heads of flexor carpi ulnaris. The septum and fascia were excised, and the nerve was placed deep to the flexor-pronator origin. This relieved the symptoms referable to the ulnar nerve, but later he had trouble from hyperaesthesia in the distribution of the medial cutaneous nerve of the forearm. More than two years after operation he has "little if any sensory or motor disturbance of the ulnar distribution," but "marked sensitivity in the region of the medial epicondyle posteriorly."*

**Case 9.**—B. R., age 25 years, fractured his left arm at the age of twelve. Apart from the initial symptoms due to the fracture, he had no complaints until fourteen months before admission. He then developed "burning pain" down the inner side of the left forearm and in the 4th and 5th digits. Four months previous to admission to this unit, an operation on the nerve had been performed elsewhere, which did not relieve his symptoms. In view of the severity of his symptoms the nerve was re-explored; it was found to be within the groove, where it was densely adherent and swollen to form a very firm lateral neuroma. The nerve was transposed and placed deep

* I am indebted to Major G. D. Rowley, R.A.M.C., for this report.
to the flexor-pronator muscles. The immediate result of the operation was disappointing.

These two cases illustrate the importance of attention to certain technical details in the operation:—(1) Adequate mobilisation of the nerve above and below the epicondyle; (2) excision of the medial intermuscular septum and, if need be, the fascia in the flexor-pronator muscles; and (3) placement of the nerve preferably in a natural intermuscular plane.

**Results**

At the time of discharge from hospital, an assessment of the immediate result is made. In the majority of cases the immediate result is most gratifying. Although there are no available statistics, undoubtedly the chief improvement is diminution in the amount of tingling. At the time of discharge from hospital, 16 patients stated that there was a definite improvement in their condition, while the remainder, although unwilling to admit of immediate improvement, agreed that they were certainly no worse. At this time objective signs of improvement are not apparent. A complication which has been observed in some cases is a tendency for spasm of the biceps to restrict extension of the elbow; this can usually be overcome by encouragement and active exercises. Operative interference with the branches of the medial cutaneous nerve may result in a very unpleasant hyperesthesia over the inner side of the forearm. This is particularly liable to happen when an incision passing in front of the medial epicondyle is used (see Case 10 above). It was for this reason that a posterior incision (Fig. 7) was used in the present series. All patients have been questioned regarding hyperæsthesia, and the forearm has been carefully tested for any disturbance of sensation in the territory of the medial cutaneous nerve. With the exception of Case 10, none of the patients complained of hyperæsthesia, but several on direct questioning mentioned numbness over the point of the elbow. When sensation is tested after operation, a small area of anaesthesia over the olecranon and posterior to the distal portion of the scar of the operation wound is frequently found, but this does not constitute a severe disability. A scar passing behind the medial epicondyle is not subject to pressure when the elbow is resting upon the edge of a table or similar structure.

Only half the cases have been followed beyond the immediate post-operative period. The longest “follow-up” has been 2½ years. Eight cases have shown definite improvement both subjectively and objectively; 1 patient (Case 19) with a severe lesion has shown some objective improvement, although he states he has noted no change in the condition of his hand; 3 cases are not improved but are certainly no worse. In the normal course of events the neuritis tends to be progressive, so that even if symptoms are merely arrested the result may be considered as not unsatisfactory. The remaining case is that mentioned above (No. 10), in which there was improvement in the ulnar
neuritis but hyperæsthesia in the territory of the medial cutaneous nerve of the forearm. There is no doubt that the best results are obtained in those patients who are operated upon shortly after the onset of symptoms; patients with a long history do not do so well. The general statement that a patient will regain what he has lost in the previous year is probably true only when applied to the early case of traumatic ulnar neuritis. Of the 20 Service patients, 9 are known to have returned to some form of duty, 8 were discharged to Army Convalescent Depots and their disposal thereafter is uncertain, and 3 were discharged as physically unfit for any form of military service. The 6 civilians, with one exception, returned to their former employment.

SUMMARY

If correctly performed, anterior transposition of the ulnar nerve is a satisfactory operation for traumatic ulnar neuritis. Immediate subjective improvement may be expected. The late results are more variable, and vary with the duration of symptoms before operation. At best the patient may expect to regain what he has lost in the previous year, at worst the progress of his lesion will be arrested.

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