

TRAUMATIC ULNAR NEURITIS

WITH ESPECIAL REFERENCE TO THE LATE OR TARDY ULNAR PARALYSIS

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THE lesions in which a disturbance of the normal relation between the ulnar nerve and its nerve bed exists may be grouped under the general heading of "Traumatic Neuritis." In considering lesions of the ulnar nerve under this classification, gross injuries may be excluded and attention confined to those cases in which trauma in the region of the elbow has resulted in the gradual onset of a neuritis.

By virtue of its location behind the elbow-joint, the ulnar nerve is subject to many potential disadvantages. Owing to its short course in that location, the nerve is slightly stretched with each motion of flexion but intrinsic elasticity and mobility allow it to undergo these momentary changes without suffering any damage. This compensatory mechanism may be disturbed if the nerve itself is traumatized or if the bed on which it lies be distorted in any way. Under such circumstances, a neuritis is induced by a repetition of normal movements—movements which otherwise would produce no untoward effect.

Exaggerated mobility, an anomaly which exists in a certain unknown number of individuals where the hypermobile nerve slips forward on the epicondyle, may also affect the ulnar nerve adversely. If the dislocation becomes complete and occurs with every movement of flexion, the nerve is almost certain to undergo some damage and a "friction neuritis" be sustained. Platt has distinguished the following clinical groups in this series of lesions and has outlined them as follow :

(1) *Primary neuritis:*

- (a) Following simple contusions
- (b) Complicating:
 - (i) Internal epicondylar fractures
 - (ii) Supracondylar fractures
 - (iii) Dislocation of the elbow

(2) *Secondary neuritis:*

- (a) Complicating:
 - (i) Fractures of the lower end of the humerus
 - (ii) Dislocations of the elbow-joint

(3) *Delayed neuritis:*

- (a) With resultant late ulnar palsy as the sequel of external condylar fractures
- (b) Following recurrent dislocation of the nerve. It is with this third group of so-called delayed neuritis with the late ulnar palsy that we have to do.

It is believed that Duchenne was familiar with the condition, but as far as can be definitely ascertained, it was first described by Panas, in 1878. He described the lesion in an individual twelve and one-half years after his original injury about the elbow. Broca and Mouchet, in 1899, presented a most comprehensive investigation of the subject in the form of a study of the nerve lesions complicating certain fractures of the lower end of the humerus. Mouchet himself, in 1898, in an earlier paper, had drawn attention to this delayed type of ulnar nerve lesion and had realized that the injury which preceded it was almost invariably a fracture of the external epicondyle of the humerus. Since that time, Mouchet has made several valuable additions to this subject. Prior to 1900, cases were reported by Bowlby, Weber, Guillemain and Mailly and to this period belongs the first of Mouchet's illuminating contributions. More recently, Platt has reviewed the literature and presented several cases of late ulnar paralysis successfully treated by the method of anterior transplantation of the nerve.

Pathogenesis.—In Mouchet's opinion, the classical late ulnar nerve lesion is unlikely to be associated with other varieties of humerus fracture other than those of the external condyle because the development of the paralysis is determined primarily by the existence of a gross cubitus valgus deformity. Now this deformity, in an extreme degree, is a characteristic sequel of the complete external condylar fracture and no other, although an increase in the carrying-angle is not infrequently present after supracondylar fractures or internal condylar fractures. It may be said that the scrutinizing of the radiographs of cases reported in the last decade bears out the accuracy of Mouchet's conception, that the late ulnar nerve lesion is ordinarily a sequel of fractures of the external condyle.

The initial injury is sustained in early life and usually between the ages of two and ten years. In the typical case, the fracture involves the external condyle of the humerus with the line of cleavage running obliquely into the elbow-joint. This is a familiar fracture in children and one which gives rise to difficulty owing to the tendency of the large fragment to be turned on its axis by the pull of the extensor attachments. It appears to be the rule for the fracture to unite by fibrous tissue only. In many cases, the functional result as regards joint function and mobility is fairly satisfactory. The cubitus valgus usually manifests itself at a comparatively early stage but often excites little or no comment at the time. In adult life, the distortion is always conspicuous and is due to the irregular epiphyseal growth being added to the initial displacement already present in the condyle. There is what may be termed a "latent period" in this condition, for, in about 75 per cent. of the recorded cases, the interval between the initial injury and the onset of the first signs of nerve involvement is not less than ten years.

Latent periods of thirty years are not uncommon and in the case herein reported the intervening time was twenty years. As a rule, during this time no change in the elbow is noted other than the steady increase in the degree of the deformity which reaches its maximum with the cessation of growth of the epiphyses. The cubitus valgus is a striking deformity and with the distortion of the lower end of the humerus gives a false impression of over-growth of the internal condylar region. It is this appearance which has so

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often been responsible for the erroneous clinical diagnosis of "old fracture of the internal epicondyle." The ulnar groove is found to be relatively shallow and in it the tender, thickened nerve trunk appears to lie in an unusually exposed and superficial position.

Neuropathology.—Grossly, the nerve trunk is swollen, often irregularly, along a portion of its course. This thickening may extend as far as two inches proximally and distally to the ulnar groove. In the early stages of compression, the nerve is soft, succulent and hyperæmic in appearance and may contain lymph between its bundles. In the later stages, it becomes firmer from the overgrowth of fibrous tissue and local induration may become more marked with the formation of a spindle-shaped neuroma.

On microscopical examination, the picture of a chronic interstitial neuritis may be seen. The peri- and endoneural sheaths show a greater or less degree of infiltration with round cells and proliferation of the connective tissue and endothelial cells. The vessels are congested and their walls filled with cells of various kinds, plasma cells, lymphocytes and polymorphonuclears predominating. As one passes to the later stage of the process, connective-tissue overgrowth assumes the chief rôle, and the cellular infiltration becomes less marked. The nerve fibres themselves may be pressed upon by the lymphocytic infiltration or the overgrowth of the fibrous tissue and undergo changes similar to those of a parenchymatous neuritis. Fortunately, however, even though there is degeneration of the medullary sheaths of the nerves, the axones tend to persist, and thus the function is rapidly restored once the inflammatory products are completely removed.

Symptomatology.—The late neuritis of the ulnar nerve does not differ in symptomatology from the other forms of progressive neuritis. The symptoms arise insidiously and progress steadily. The neurological symptoms in the initial phase will vary with different individuals. As is usual, with compression, the motor fibres are more vulnerable than the sensory fibres and for that reason motor symptoms dominate the clinical picture and often precede any evidence of sensory involvement. Usually there is an atrophic paralysis of gradual development with changes in the electrical excitability corresponding to the degree and duration of the muscle degeneration. The sensory symptoms, both subjective and objective, may be very slight and when present are typically along the course of the ulnar nerve distribution. Even in the advanced cases, the anæsthesia is of the epicritic type, the protopathic sensibility being well-preserved. The objective signs progress from those of an incomplete nerve block to evidence of a complete interruption whence paresis and atrophy of the hand musculature are soon manifest.

In the absence of pain, this scarcely perceptible disturbance of tactile sensibility may be overlooked and lead to the suspicion of progressive muscular atrophy, and especially so since the wasting of the small muscles of the hand is slowly progressive. Here, however, the absence of fibrillary twitchings and the strict limitation of the atrophy to the ulnar nerve distribution, together with the disturbances of sensibility, should be enough to make the diagnosis clear.

With interruption of the ulnar nerve conduction at the elbow, a well-recognized picture will be seen as follows:

(1) Analgesia or loss of protopathic sensation of the fifth finger and the ulnar border of the palm, dorsal and palmar, but seldom of the ring finger; anæsthesia to light touch (loss of epicritic sensation) of the ulnar side of the dorsum of the wrist and palm, of the dorsal and palmar aspects of the hand and of the little and ring fingers.

(2) (a) Paralysis of the flexor carpi ulnaris causing weakness in flexion and in ulnar adduction of the wrist.

(b) Paralysis of the inner half of the flexor profundus digitorum, with resultant weakened hand-grasp, especially in the ring and little fingers.

(c) Paralysis of the two inner lumbricales, all of the interossei and hence loss of adduction and abduction of the fingers, with flexion of the last two phalanges in each finger and hyperextension of the metacarpo-phalangeal joint, giving the "claw-hand." The interosseous spaces become very evident as a result of atrophy of these muscles.

(d) Paralysis of the short muscles of the fifth finger; of the inner group of the short thumb muscles (adductor transversus and adductor obliquus) and the deep portion of the flexor pollicis brevis and palmaris brevis.

Treatment.—The treatment will have to satisfy the two canons of the ideal neurolysis: First, the course of the nerve must be shortened, and secondly, the nerve must not be placed where scar tissue will reform and compress it. It is obvious that the only treatment indicated to relieve the condition is surgical interference in an endeavor to free the nerve of compression in the medial epicondylar groove. Mouchet, in his article in 1914, outlined four methods of procedure as being worthy of consideration. The first method was merely a simple freeing of the nerve from its bed and was performed by Potherot, in 1897, in Mouchet's first case. This type of intervention is open to serious question since by merely freeing the connective tissue about the neural groove without any other procedure one invites the formation of more scar tissue and the prime purpose of the operation is defeated. The second method consisted in the gouging out of a posterior condylar groove and placing the ulnar nerve in this newly formed channel. This procedure is criticized for two reasons: first, because it is unwise to replace the nerve in a freshly prepared bed where fibro-osseous scar tissue will form without expecting more compression of the nerve and further trouble; secondly, the course of the nerve is not shortened to any appreciable degree. A third method, which has not been widely used and which sought to correct the cubitus valgus at the same time as the nerve compression, was a supra-condylar osteotomy of the lower end of the humerus with the removal of a triangular wedge. The fourth method, and the one which has much to recommend it not only because it satisfies the postulates of a neurolysis but also because of its relative simplicity, is that of transplantation of the ulnar nerve from the ulnar groove anteriorly to the medial epicondyle. This method has proven uniformly successful.

CASE REPORT.—E. P., a white German housewife, aged twenty-two years, was admitted to the Surgical Service of Dr. John F. Connors at the Harlem Hospital Sep-

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tember 30, 1931, with the complaint of progressive weakness of the right hand, contracture of the fingers and diminished sensation of the fourth and fifth fingers of eight months' duration. In January, 1931, she noticed for the first time that she could not fully extend the fourth and fifth fingers and that power and grip in those members were becoming increasingly weaker. This loss of power was especially noticeable when she attempted to

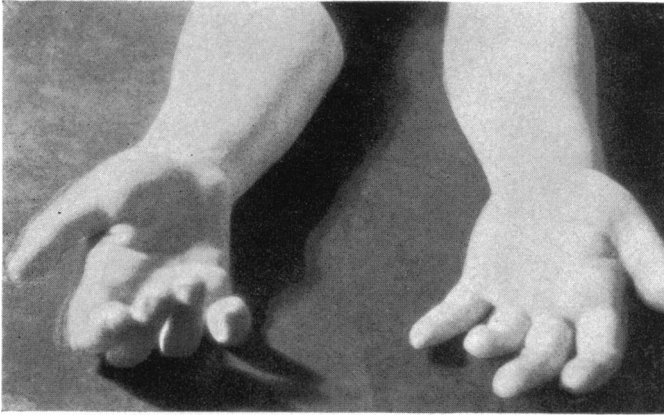


FIG. 1.—Photograph taken prior to operation showing the marked degree of cubitus valgus, contracture of the fingers and atrophy of the intrinsic musculature of the hand. (Photograph taken October 1, 1931.)

do her housework and tried to lift objects with that hand. She states that the weakness has persisted longer than the anæsthesia and the contracture; in fact, it was the sensation of numbness and tingling in the fingers that brought her to the hospital for relief. There has never been any swelling or pain. Her past history is irrelevant except for an injury she received in the region of her right elbow at the age of two years and for which she



FIG. 2.—Photograph showing dorsal aspect of the right hand and the extent of contracture of the fingers as compared with the normal hand.

was treated in a surgical clinic in Germany (1911). She was a healthy young woman with a marked cubitus valgus deformity of the right elbow and atrophy and contracture of the last two fingers of the right hand. (Figs. 1 and 2.) The hand shows the typical picture of the lesion resulting from pressure on the ulnar nerve at the elbow with characteristic analgesia and anæsthesia of the fourth and fifth fingers; weakened hand grip owing to a partial paralysis of the flexor profundus digitorum; hyperextension of the

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metacarpo-phalangeal joints with the "claw-hand"; loss of the power to abduct and adduct the fingers with atrophy of the interossei.

Laboratory findings.—Temperature on admission, 99.0; pulse: 80; urinalysis: negative; blood Wassermann: negative; hæmoglobin: 90 per cent.; red blood-cells: 4,650,000; white blood-cells: 10,200; 80 per cent. polymorphonuclear leucocytes.

Radiographical findings reported an old fracture of the external condyle with a marked cubitus valgus deformity. (Figs. 3 and 4.) A photograph was also taken of the affected hand to show the extent of the atrophy of the intrinsic hand musculature. (Fig. 5.)

Despite the marked degree of deformity present at the elbow the flexion and extension were remarkably good.

A pre-operative diagnosis of tardy ulnar paralysis was made and operation decided upon in order to free the nerve and transplant it. October 1, 1931, operation was performed as follows: A seven-inch incision was made over the medial epicondyle extending

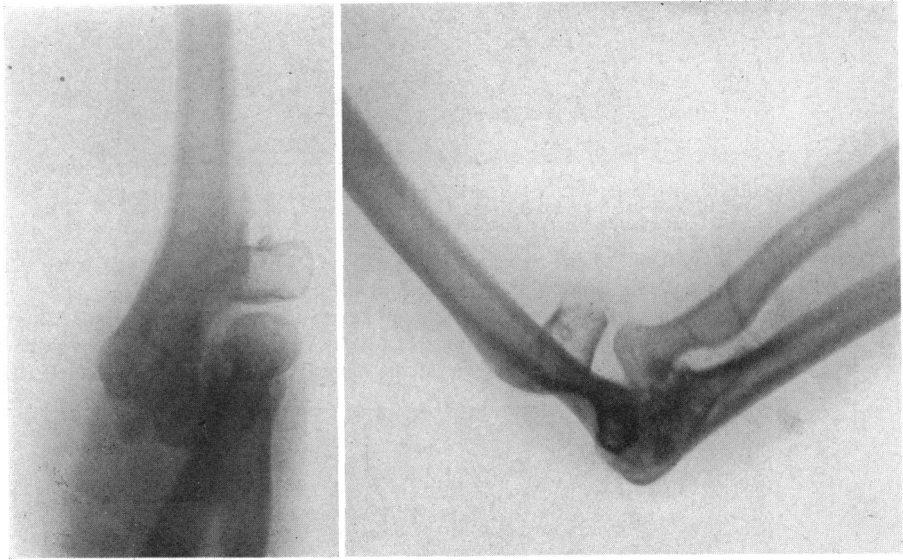


FIG. 3.

FIG. 4.

FIGS. 3 and 4.—Radiographs of the affected extremity showing the characteristic picture of an old fracture of the external condyle of the humerus with a partial rotation of the fragment. The original trauma causing the fracture occurred twenty years prior to the development of symptoms of ulnar palsy.

about three and one-half inches above and below that point. The soft tissues were divided and all bleeding points secured. The ulnar nerve was seen in its usual place and located at a point where it entered the ulnar groove of the medial epicondyle. A tape was then placed about the nerve trunk. On following the nerve along its course, a firm band of fibrous tissue was seen, causing the nerve to be adherent to the groove of the epicondyle. This was freed and the nerve trunk observed to be enlarged to about twice the normal diameter. At this point, for about one inch, the nerve was seen to be red, injected and somewhat more succulent in appearance. It was freed from the groove and brought anteriorly to rest upon the common origins of the flexors of the forearm. The arm was then extended to full extension and the nerve found to be loose and freely movable. For this reason it was not deemed advisable to divide the flexor carpi ulnaris. In order to prevent dislocation of the nerve, a tunnel was fashioned from the deep layer of the superficial fascia of the forearm and the nerve enclosed within this. The super-

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ficial fascia was then brought together with No. 0 plain catgut and the skin edges closed with one continuous horsehair suture.

Owing to the fact that the patient was four months' pregnant, the operation was performed under local anæsthesia using 1 per cent. novocaine to infiltrate.

Her post-operative course was entirely satisfactory and she was discharged from the hospital on her third post-operative day. An inspection of the wound at that time

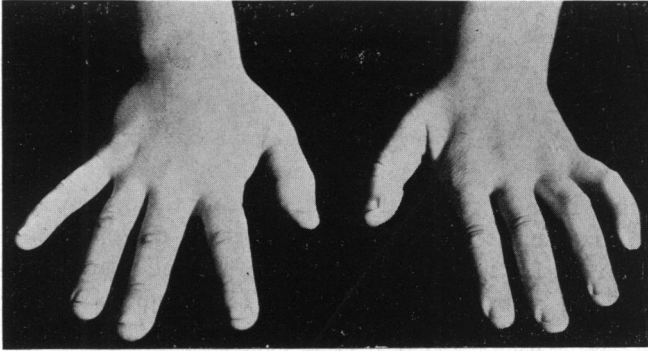


FIG. 5.—Photograph taken on November 23, 1931, on the fifty-third day after the anterior transplantation of the ulnar nerve. The claw-like appearance of the hand has largely disappeared, the interosseous spaces are not so prominent and complete sensation has returned to the ring finger.

showed the suture line to be intact and without infection. She was seen in the follow-up clinic on the ninth post-operative day and at that time the sutures were removed, the wound having healed by primary union.

She was seen October 14, 1931, and a note made that "the claw-like appearance of the hand had decreased somewhat. The patient states that there has been some return

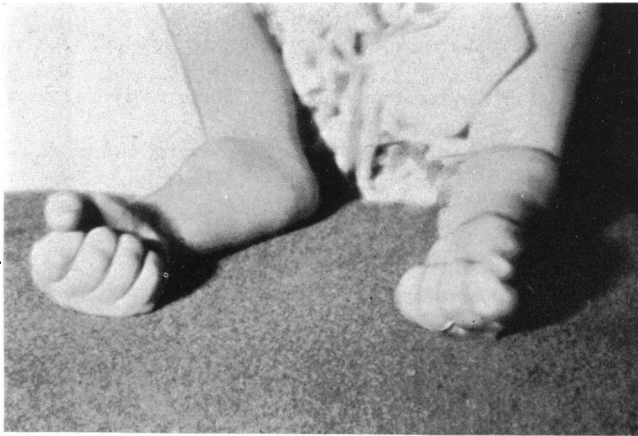


FIG. 6.—Post-operative photograph taken to demonstrate the increase in power to flex fingers and the grip present after transplantation of the ulnar nerve. At the present time, there is little difference in power in the two hands. (Photograph taken December 21, 1931.)

of power in the affected hand." Slow muscle stimulation by means of the sinusoidal current was started.

November 6, 1931, the following note was made: "Sensation has returned to the fourth finger. The grip has returned in her hand so that she can now do her housework without difficulty. The interosseous spaces are not so prominent, indicating some return

in size of the interossei muscles. The claw-like appearance has largely disappeared. There is still a sensation of numbness in the fifth finger but the patient thinks that this is less than prior to her operation. There is still a prominence in the web-space between the thumb and the index finger."

At the time of her last visit, November 23, 1931, the hand presented objectively the same picture as that reported on November 6. She has been given sinusoidal treatments three times weekly and advised to use her hand as much as possible. This régime will continue for at least six months.

The striking feature in the post-operative course has been the diminution in the contracture of the hand and the rapidity of the return of power in that member.

CONCLUSIONS.—(1) The lesions in which a disturbance of the normal relation between the ulnar nerve and its nerve bed exists may be grouped under the general heading of "traumatic neuritis." The clinical entity of late ulnar palsy is then to be regarded as being within this group.

(2) The condition is not common but is easily diagnosed in the light of a history of an old fracture about the elbow followed years later by increasing weakness and atrophy of the hand. The original fracture is almost invariably a fracture of the external condyle of the humerus which was sustained in childhood.

(3) Of all the methods of surgical intervention, that of transplantation of the ulnar nerve is by far the simplest and has given the most striking results.

(4) In the case herein reported, the original fracture occurred twenty years before the development of symptoms and definite objective and subjective improvement was manifest as early as two weeks following the anterior transplantation.

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