

The neural atrophy of the muscles of the hand, without sensory disturbances : a further study of compression neuritis of the thenar branch of the median nerve and the deep palmar branch of the ulnar nerve / by J. Ramsay Hunt.

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The Neural Atrophy of the Muscles of the Hand, without Sensory Disturbances

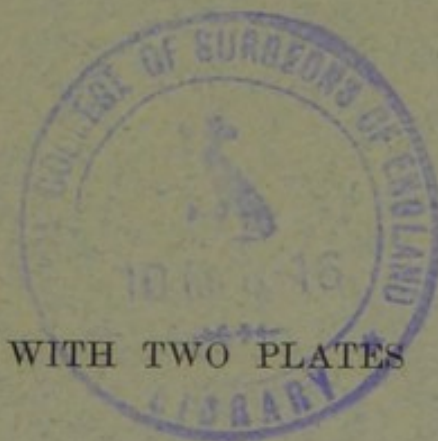
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A Further Study of Compression Neuritis of the Thenar Branch of
the Median Nerve and the Deep Palmar Branch of the Ulnar Nerve

BY

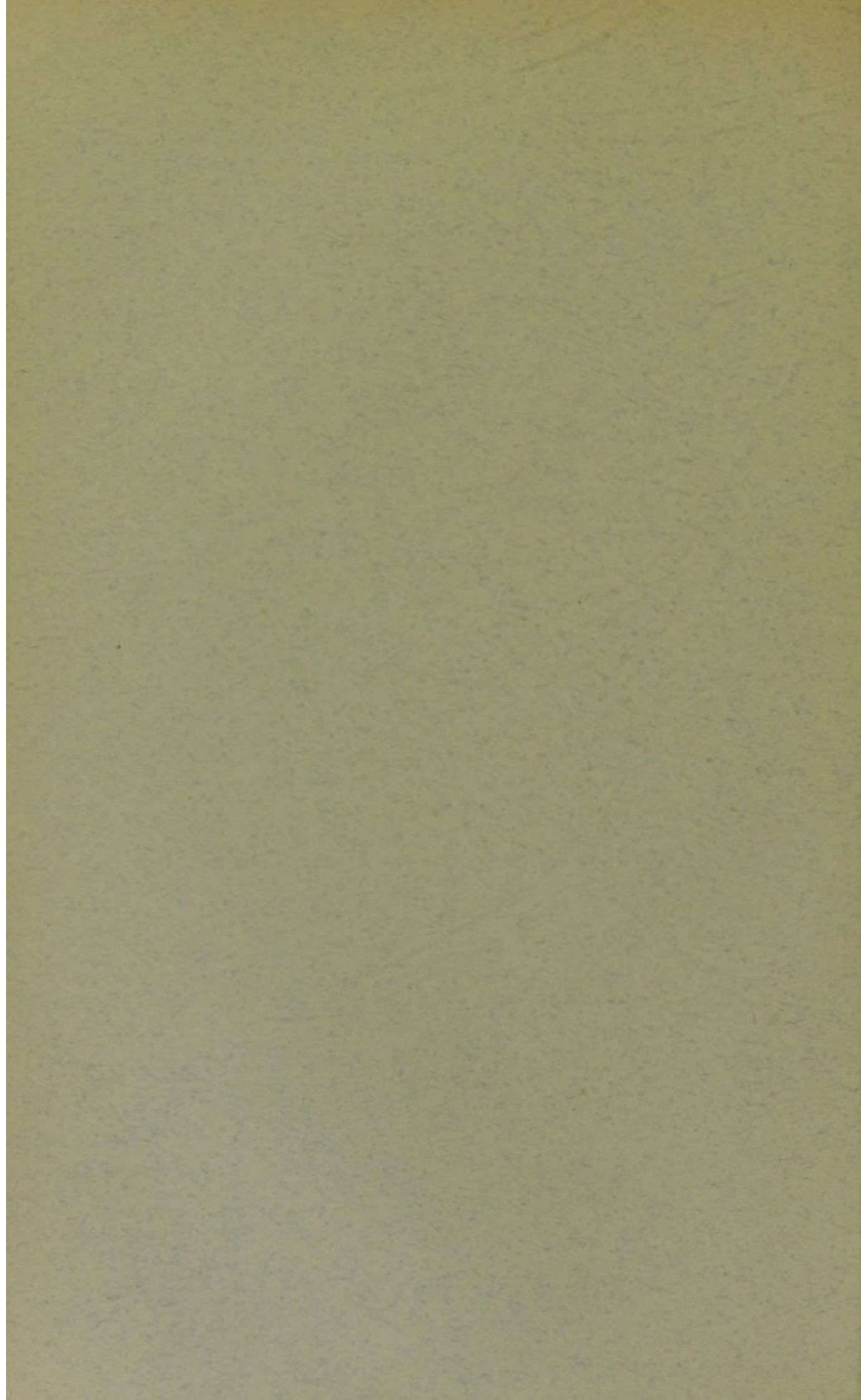
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WITH TWO PLATES

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THE NEURAL ATROPHY OF THE MUSCLES OF THE HAND, WITHOUT SENSORY DISTURBANCES.¹

A FURTHER STUDY OF COMPRESSION NEURITIS OF THE THENAR BRANCH OF THE MEDIAN NERVE AND THE DEEP PALMAR BRANCH OF THE ULNAR NERVE.

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(With Plates 3 and 4.)

ATROPHIC paralysis of the small muscles of the hand occupies a position of peculiar importance in symptomatology, because of the great variety of pathological conditions in which it may occur as an important and often early symptom. It may follow involvement of the spinal cord, the anterior roots, the brachial plexus, and of the ulnar and median nerve. As a rule, the associated sensory disturbances or the absence of sensory symptoms play an important and often determining rôle in the topographical localisation of the lesion, indicating its neural, plexus, radicular, or medullary origin, as the case may be.

The types of neural atrophy of the hand to which I shall refer have already been described in previous communications,² and are

¹ Read at a meeting of the New York Neurological Society, Jan. 1914.

² Ramsay Hunt, "Occupation Neuritis of the Deep Palmar Branch of the Ulnar Nerve," *Journ. of Nerv. and Ment. Dis.*, 1909, and "The Thenar and Hypothenar Types of Neural Atrophy of the Hand," *Am. Jour. of the Med. Sci.*, 1911, Feb.

characterised by a strictly neural distribution with complete absence of those disturbances of sensibility which usually accompany lesions of the median and ulnar nerves. For this reason they may resemble more or less closely certain of the myelopathies and myopathies beginning in the small muscles of the thenar, hypothenar, or interosseous regions of the hand.

This peculiar form of neural atrophy results from a neuritis or compression of purely motor branches of the ulnar and median nerves, and may be divided into a *thenar* and *hypothenar* type.

In the *thenar group* the atrophy is limited to the muscles of the thenar eminence supplied by the median nerve, and is the result of compression of the thenar branch as it passes beneath the anterior annular ligament of the wrist.

The *hypothenar group* is characterised by paralysis with atrophy of all the small muscles of the hand supplied by the ulnar nerve, and results from compression of the deep volar branch as it passes between the tendons of origin of the short abductor and the short flexor of the little finger.

Both of the compressed nerves are purely motor in character, which explains the occurrence of neural atrophy without disturbances of sensibility in their respective distributions.

In my previous papers, the separation of these two types of neural atrophy from the other forms of occupation palsy was discussed in detail. In the present communication I wish to emphasise more particularly the points of differentiation from certain of the spinal atrophies of the *Aran-Duchenne type*.

CASE I.

A Typical Case of the Hypothenar Type of Neural Atrophy without Sensory Disturbances.

Patient is a man, 32 years of age. His occupation consists of "cutting, pressing, and ironing clothes." There is no history of lues, and he is moderate in the use of alcohol.

He was referred to the Vanderbilt Clinic, Department of Nervous Diseases, in November 1910, on account of weakness and atrophy of the muscles of the right hand. The weakness was first noticed about six months previously, and the atrophy had gradually followed. He has had no pain and no parasthesiæ

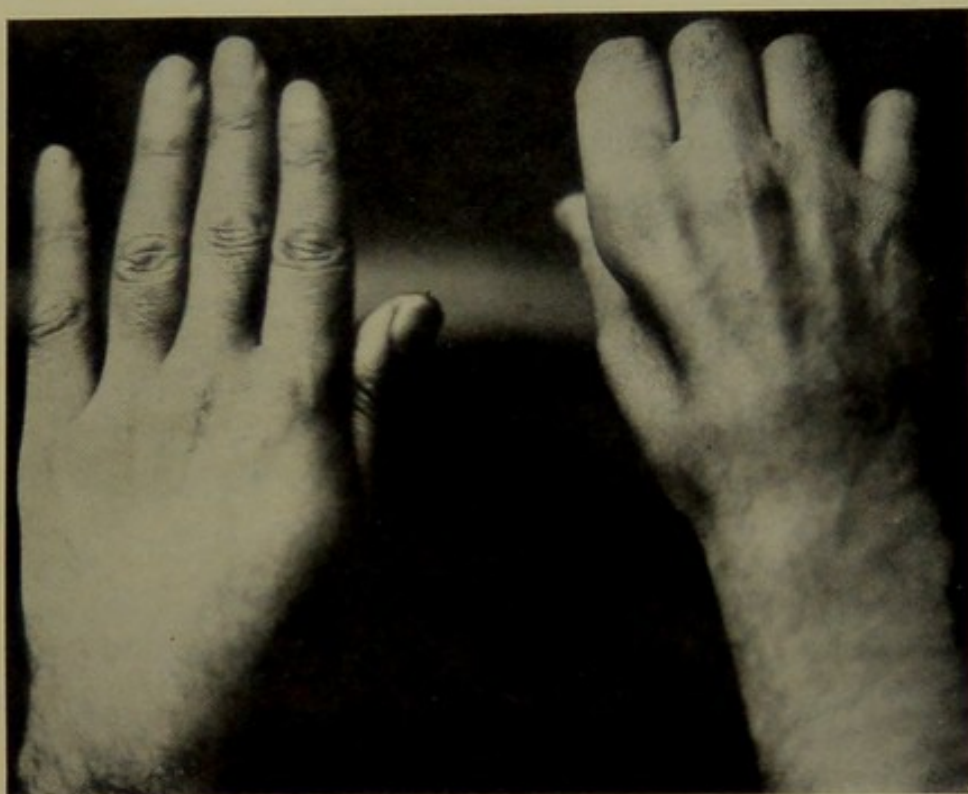


FIG. 1, CASE I.—The Hypothenar Type of Neural Atrophy without Sensory Disturbances. Posterior View, showing Atrophy of Interossei and Inability to Extend the Fingers. Compression Neuritis of the Deep Palmar Nerve.



FIG. 2, CASE I.—Hypothenar Type. Palmar Aspect, showing Atrophy of Hypothenar and Interossei. Note Prominence of the Thenar and the Sharp Border formed by the External Head of Flexor Brevis Pollicis. Compression Neuritis of Deep Palmar Branch.



in the hand, and has continued his occupation, but not without great difficulty and inconvenience.

Physical Examination, November 1913.—The right hand is the seat of paralysis and atrophy, which is strictly limited to the ulnar distribution of the small muscles of the hand, *i.e.*, the *hypothenar interossei* and the *adductor pollicis*. The general appearance of the hand suggests the *main en griffe*, with extension of the basal and flexion of the middle and distal flanges (Fig. 1). There is distinct prominence of all the metacarpal bones, with marked wasting on the palmar aspect of the hand and flattening of the hypothenar, which is in marked contrast to the thenar group, which stands out prominently and is well preserved (see Fig. 2). There is complete paralysis of the abductor, opponens, and flexor brevis minimi digiti, the interossei, and the adductor pollicis. The functions of the flexor carpi ulnaris and of the palmaris brevis are preserved. An effort to abduct the little finger produces the typical contraction of the *palmaris brevis* (see Fig. 3); pressure over the pisiform bone also produces the usual contraction of this muscle. The movements of the thenar muscles and those of the forearm and upper arm are normal. No fibrillary twitchings were noted at any time.

The objective sensibility of the hand is normal to touch, pain, and temperature. Digital pressure of the ulnar nerve in the groove at the bend of the elbow produces the usual tingling sensation, which is a little more active in the paralysed than in the unaffected hand. There is no tenderness of the nerve trunks.

Electrical Reactions.—Faradic and galvanic stimulation of the ulnar nerve at the elbow produces contractions in the flexor carpi ulnaris and in the palmaris brevis, but no response in the intrinsic muscles of the hand supplied by the ulnar nerve. Direct faradic stimulation of the hypothenar group, interossei, and adductor pollicis produces no contractions; direct galvanic stimulation of these muscles elicits a slow vermicular response with reversal of the polar formula (complete reactions of degeneration). The muscles of the thenar region supplied by the median nerve (abductor, opponens, and flexor brevis pollicis) yield normal electrical reactions.

The general physical examination is negative. The man shows good muscular development without signs of atrophy or weakness.

Pupils are equal and react promptly to light and accommodation.

There is no tremor of the hands. Both knee jerks and both Achilles jerks are present and equal. The arm reflexes (biceps, triceps, and supinators) are normal and of equal intensity on the two sides. The plantar, abdominal, and cremaster reflexes are normal.

There is no lead-line on the gums. The urine is free from albumen and sugar. The Wassermann reaction of the blood is negative. The X-ray for cervical rib is negative.

Diagnosis.—The *hypothenar type* of neural atrophy without disturbances of sensibility; compression neuritis of the deep volar branch of the ulnar nerve.

Remarks on the Hypothenar Type.

Including those previously reported six cases of this type have come under my personal observation, all of which were unilateral and identical in symptomatology with the case just recorded. In all there was a complete paralysis of the intrinsic muscles of the hand supplied by the ulnar nerve, *without sensory disturbances*. In two of the cases in which this symptom was investigated the function of the *palmaris brevis* muscles was preserved. This peculiarity is explained by the anatomical distribution; the filament supplying this small subcutaneous muscle is given off from the superficial palmar branch of the ulnar nerve, and so escapes injury in the compression of the deep palmar branch.

Complete reactions of degeneration were observed in all of the cases, strictly limited to the ulnar distribution in the hand.

The seat of the lesion in this hypothenar group may be localised with practical certainty. As the functions of the flexor carpi ulnaris, the palmaris brevis, and of the sensory branches are preserved, the compression must take place at a lower level, viz., the deep palmar branch. And as all the muscles supplied by this nerve are paralysed, the injury must occur before the nerve is broken up into its various muscular branches. This short section of the nerve trunk corresponds to its passage between the tendons of origin of the *abductor minimi digiti* and the *flexor brevis minimi digiti*, sometimes piercing the latter structure. Immediately after its passage between these two muscles it comes in close relationship to the hook-like process of the unciform bone.

The degree of neural atrophy varies with the duration of the paralysis. If the case is recent and is seen in the early stage,

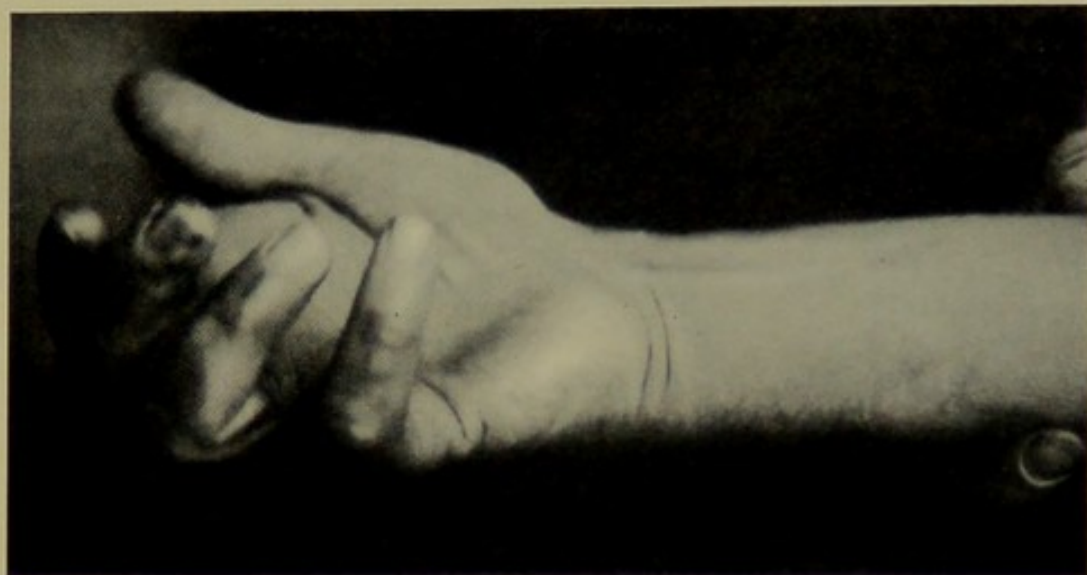


FIG. 3, CASE I.—Hypothenar Type; showing Ulnar Flexion of the Wrist and Wrinkling of Skin over the Base of Hypothenar due to Contraction of the *Palmaris Brevis* Muscle.

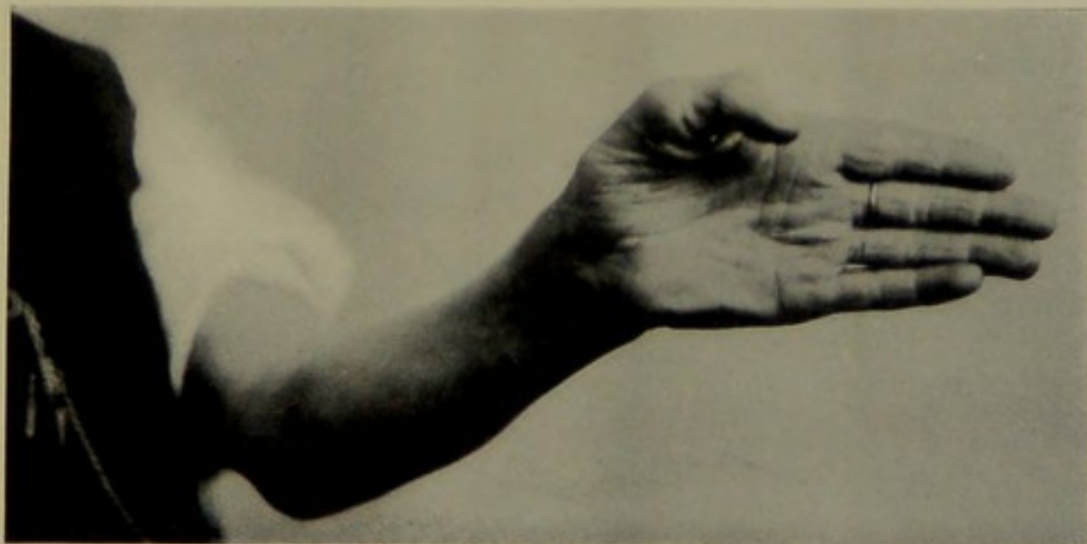


FIG. 4, CASE II.—The Thenar Type of Neural Atrophy without Sensory Disturbances; showing Atrophy Limited to the Median Innervation of the Thenar Eminence; the *Abductor*, *Opponens*, and *Flexor Brevis Pollicis*. Compression Neuritis of the Thenar Nerve.



FIG. 5, CASE II.—The Thenar Type. Lateral Aspect, showing Atrophy of Thenar Eminence and Sharp Edge of the Metacarpal Bone.



wasting of the muscles is but slightly marked, but gradually atrophy supervenes, and at this period may simulate a progressive tendency. It, however, does not progress beyond the limits of the ulnar distribution. The thenar eminence of the median innervation always stands out sharply defined in the otherwise atrophic hand.

CASE II.

The Thenar Type of Neural Atrophy without Disturbances of Sensibility.

A man, aged 49, was admitted to the Neurological Division of the Vanderbilt Clinic in March 1913, with weakness and atrophy of the muscles of the ball of the left thumb.

He denies lues, and is moderate in the use of alcohol. His occupation has been the same for some years, and consists in doing the general cleaning work of a large store, which includes sweeping, washing, and scrubbing floors, polishing brasses, and other work of a similar rough character. On an average he works from ten to twelve hours a day. There has been no exposure to lead intoxication, and there is no evidence of the lead-line on the gums.

Six months previously he states that the right thumb was injured by a blow from a heavy bar of iron, which caused some pain and swelling of both joints. He continued his work, however, but doing as much as possible with the left hand. Thus a great deal of work which had previously been performed with the right hand was done by the left hand.

The history of his malady is as follows:—

About five weeks before coming under observation, he noticed while working that the movements of the left thumb were weak, and that he was unable to use this member as effectually as before. This localised weakness appeared to increase for the next two or three days, since which time it has remained stationary. There was at no time the slightest evidence of pain or paræsthesia in the affected hand. The disease was one purely of weakness, with no other subjective symptoms in the left upper extremity.

Physical Examination, March 25th, 1913.—The left hand shows beginning atrophy of the muscles of the thenar eminence corresponding to the abductor pollicis and the opponens pollicis. No fibrillary twitchings are observed. There is a total paralysis

of these muscles, and a decided weakness in the movements of the flexor brevis pollicis. All the other intrinsic muscles of the left hand are perfectly normal in volume and in function. There is complete preservation of the function of the adductor pollicis.

Electrical Reactions.—Strong faradic and galvanic stimulation of the median nerve fails to produce any contraction in the paralysed movements of the thenar eminence.

Direct faradism of the left thenar region elicits no response in the abductor or opponens pollicis. The inner portion of the flexor brevis pollicis and of the adductor pollicis yields good contractions.

Direct galvanism produces a slow vermicular contraction of the paralysed muscles (abductor and opponens pollicis and external portion of the flexor brevis pollicis) with reversal of the polar formula. Quick, normal contractions of the inner head of the flexor brevis pollicis and adductor pollicis are elicitable. All other intrinsic muscles of the left hand, the interossei, and those of the hypothenar give normal electrical responses.

The objective sensibility of the left hand and fingers is normal to touch, pain, and temperature. There is no tenderness along the course of the median nerve or where it passes beneath the annular ligament.

The Right Hand.—The phalangeal joints of the right thumb are still enlarged and swollen, the result of trauma some months previously, but are free from pain and tenderness. All the intrinsic muscles of the hand are normal in function.

General Examination.—A careful study of the general musculature of the body was made for evidences of weakness, atrophy, or fibrillary twitchings, with negative results. The muscles of the forearm, upper arm, and shoulder girdle are well developed and normal. The spinal column is normal in movements and contour.

The pupils are unequal, right is larger than the left. They do not respond to light. Reaction to accommodation is absent on the right, active on the left.

The tendon reflexes of both upper extremities (*supinator*, *biceps* and *triceps* jerks) are of normal intensity, and are equal on the two sides.

The masseter reflex is present. Both knee jerks are present and active, and equal on the two sides. The Achilles jerks are present and equal. The plantar reflex shows a flexor response on both sides. The abdominal and cremaster reflexes are normal.

The general sensation of the body is normal except in the mammary region, where spots of analgesia and hypalgesia are present.

Heart is negative. Urine: no albumen; no sugar.

Note.—On inquiry, the patient states that at rare intervals he has had occasional lancinating pains in the lower extremities. These are infrequent and not at all severe.

There is no vesical trouble, no dysarthria, no crisis, and no paræsthesia.

Re-examination, 24th November 1913.—

The thenar atrophy on the left side is more pronounced, so that a distinct scooped-out appearance is produced, limited on the outer side by the border of the first metacarpal bone, and on the inner side by the internal head of the flexor brevis pollicis (Figs. 4 and 5). The paralysis and atrophy as well as the reactions of degeneration are strictly limited to the distribution of the thenar branch of the median nerve. No fibrillations have been noted at any time. The other muscles of the left hand are normal in function and in electrical reactions. The musculature of the right hand and both forearms and upper arms is normal in function and volume.

The objective sensibility of the left hand and fingers is normal.

The pupils are unequal, the right is greater than the left. Both are rigid to light, and the left only responds to accommodation.

The arm jerks are all present and equal. The knee jerks are present and unequal, the right being a little less than the left. The Achilles jerks are equal. On plantar stimulation there is a flexor response on both sides.

Patient has occasional lancinating pains in legs, not severe or frequent, but typical in character.

The sphincters are normal. The mammary zone shows areas of analgesia and hypalgesia.

Examination, January 1914.—In spite of advice to the contrary, the patient persists in his occupation, working about twelve hours a day.

The atrophy of the left thenar is still present, and is limited strictly to the thenar distribution of the median nerve.

Electrical reactions of degeneration are still present, and are limited to the median distribution of the thenar eminence. The function, appearance, and electrical responses of the other intrinsic

muscles of the left hand are all normal, including the *adductor pollicis* and the inner head of the *flexor brevis pollicis*. No fibrillations. Sensibility in the median distribution remains normal.

Pupillary responses are as noted at previous examinations.

Responses of the upper extremities are present, and equal on both sides. Knee jerks are present and unequal, the left is less active than the right. The Achilles jerks are present and equal. The plantar reflexes are normal. The abdominal and cremasteric reflexes are normal. Wassermann reaction is negative. Spinal puncture not performed. X-ray examination for cervical rib is negative.

Diagnosis.—Incipient tabes and the thenar type of neural atrophy.

Remarks on the Thenar Type.

Including those previously described, four cases of this type have come under my observation, in two of which the atrophy was unilateral and in two it was bilateral. In all four cases, including those in which the atrophy was bilateral, the clinical features were identical, viz., paralysis with atrophy of the muscles of the thenar eminence innervated by the median nerve, with reactions of degeneration and complete preservation of sensibility in the distribution of the median nerve. Fibrillary twitchings were absent, and a central affection was excluded. One of these cases made a complete recovery, one a considerable improvement, and in one the atrophy has persisted and remained stationary over a period of nineteen years, while one case has been under observation for a year and has not progressed.

The symptoms in this group of cases are purely motor in character and are strictly limited to the thenar distribution of the median nerve, and can only be interpreted as resulting from a lesion of the thenar branch of the median as it passes beneath the anterior annular ligament of the wrist. This theory of compression by the annular ligament, which I expressed some years ago,¹ would seem to have received confirmation from a recent pathological study by Marie and Foix,² in which compression neuritis

¹ "Compression Neuritis of the Thenar Branch of the Median Nerve: A well-defined Clinical Type of Atrophy of the Hand," *Transactions of the American Neurological Association*, 1909.

² "Atrophie isolée de l'eminence thenar d'origine nevritique. Role du ligament annulaire dans la pathogenie de la lesion," *Revue Neurologique*, 1913, xxi., Nov. 30, p. 647.

of the median nerve was found localised beneath the anterior annular ligament of the wrist in a case of double thenar atrophy.

The neural atrophy in the thenar as in the hypothenar group comes on gradually, following in the wake of the paralysis, and in this way a certain progressive tendency may be manifested in the earlier months, which may be very suggestive of a beginning spinal atrophy of the Aran-Duchenne type. There are, however, no fibrillary twitchings, and the atrophy and reactions of degeneration are strictly limited to the median distribution of the thenar eminence. (Abductor, opponens, and the outer head of the flexor brevis pollicis.)

Remarks on Diagnosis.

The differentiation of the thenar and hypothenar types of neural atrophy of the hand from the other groups of compression neuritis, professional palsies and occupation atrophies occurring in the hand, have been discussed at length in my previous studies of this subject. Briefly stated, the essential points of difference are, the absence of sensory symptoms in the affected neural distribution and the complete paralysis of all the intrinsic muscles of the hand supplied by the thenar nerve (thenar type) and the deep palmar nerve (hypothenar type).

A complete paralysis in an entire neural distribution with degenerative reactions would rule out conclusively those forms of occupation palsy which have been ascribed to degeneration of the peripheral motor terminals by muscular compression (Gessler),¹ as well as those professional atrophies assumed to be of myositic or myopathic origin.

Certain types of spinal atrophy beginning in the small muscles of the hand may cause uncertainty in diagnosis in the earlier stage when atrophy is just beginning. But the absence of a sharply defined limitation to a neural distribution and the progressive tendency, the presence of fibrillary twitchings and the later involvement of the other muscles of the forearm, with alterations of the tendon reflexes, serve very effectually to indicate its medullary origin.

¹ "Eine eigenartige form von Progressive Muskel Atrophie bei Gold-Polirinnen." Med. Correspondenz, *Blatt. des Wurtemberg, Arzt. Land., Vereins*, Bd. lxvi., No. 36.

In a recent study of this subject Marie and Foix¹ have described a curious type of spinal atrophy affecting the intrinsic muscles of the hand, which remains strictly limited to this region and shows no tendency to progress to the other muscle groups of the upper extremity. This affection is extremely slow in its evolution, the atrophy gradually increasing over a period of years. In the two recorded cases with autopsy, the atrophy of the small muscles of the hand was diffuse, involving chiefly the thenar but also the hypothenar and interosseous region of the hand. The electrical reactions of degeneration were present in the atrophic muscles. In both cases clinical and pathological evidences of syphilis were present.

The pathological lesions underlying this curiously limited and non-progressive atrophy of the hand were found in a corresponding focal atrophy of the anterior horn. The grey matter and cellular structures of the anterior horn were found shrunk and atrophic in a small area of the cord corresponding in level to the 8th cervical segment, and encroaching slightly upon the adjacent 7th cervical and 1st dorsal segments. The cause of this focal wasting of the anterior horn or *tephro-malacia-anterior*, as it has been termed by the authors, is an endo-periarteritis of the arterioles nourishing the affected region, which diminishes the calibre of the vessels, with a consequent gradual shrinking of the grey matter. As the vessels were not thrombosed, the gradual and insidious wasting of the hand muscles was caused by the slow diminution of the blood supply in this restricted area.

Such a clinical picture may from its non-progressive course resemble very closely the thenar and hypothenar types of neural atrophy. In the neural atrophy, however, the paralysis is more rapid in its development and from the first occupies the complete neural distribution of the compressed nerves.

Complete reactions of degeneration are also present at an early period, likewise including the entire distribution of the compressed nerves.

As the paralysed muscles gradually undergo atrophy, the limitation of the wasting to the distribution of the compressed nerves is even more apparent. In the thenar type the atrophic

¹ "L'atrophie isolée non progressive des petits muscles de la main. *Tephro-malacia-anterior*." Marie et Foix, *Nouv. Iconographie de la Salpêtrière*, 1912, xxv., p. 353.

area presents a punched-out appearance, due to the well-defined border of the *internal head* of the *flexor brevis pollicis*, while in the hypothenar type a veritable *main en griffe* may develop, with complete preservation of the rounded prominence of the thenar eminence.

While admitting that focal medullary affection, such as the *tephro-malacia-anterior*, may simulate rather closely such a neural picture, the difficulty in diagnosis is more theoretical than real; so that in the thenar case with incipient tabes, reported in this paper, I would exclude the *tephro-malacia-anterior*, as well as the more diffuse forms of spinal atrophy, even in the presence of syphilis, for the reasons stated above.

The persistence of the thenar atrophy in these cases is not without interest, and by no means excludes the neural origin. In one of my cases it had lasted through a period of nineteen years. An explanation of this is to be found in the slight degree of disability produced by the thenar palsy, so that the occupation is continued which had originally caused the compression. Under those conditions, the causative factor not being removed, regeneration of the nerve does not take place.

The same may be true of the hypothenar type, but in my experience the disability being greater in this group of cases, the occupation is usually abandoned, thus relieving the nerves from further compression, and permitting regeneration to take place.

As the prelude to treatment, therefore, the particular movements of the hand instrumental in the production of the compression should be interdicted.

It is possible that with advancing years the annular ligament may become more rigid and less elastic, and thus render compression of the thenar nerve more likely in the thenar cases. Under these circumstances, surgical relief of pressure might be given consideration.

Concluding Remarks.

Atrophic paralysis of the intrinsic muscles of the hand, *without disturbances of sensibility*, may be of *myopathic*, *myelopathic*, or *neural* origin.

Neural atrophy of the hand may occur as two well-defined clinical groups, both due to a compression lesion of a motor branch of the median and ulnar nerves respectively.

The *hypothelar type*: This term indicating the seat of the compression lesion at the base of the hypothelar eminence and its relationship to the ulnar nerve (compression neuritis of the deep palmar nerve).

The *thelar type*: This also indicating the seat of the compression at the base of the thenar eminence, and its relationship to the median nerve (compression neuritis of the thenar nerve).
