Claw-Hand Caused by Paralysis of the Intrinsic Muscles

A SIMPLE SURGICAL PROCEDURE FOR ITS CORRECTION

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Lesions of the ulnar nerve, or of both the median and ulnar nerves, result in claw deformities of the fingers. In this condition there is hyperextension of the metacarpophalangeal joints and flexion of the interphalangeal joints caused by loss of the function of the intrinsic muscles which, normally, extend the interphalangeal and flex the metacarpophalangeal joints. The loss of the flexor function of the interossei causes loss of lateral motion and usually results in the muscle imbalance known as claw-hand. It is true that the extrinsic muscles are able to compensate for the loss of the intrinsic muscles if hyper-extension of the metacarpophalangeal joints is prevented 6. In this condition the long extensors can produce full extension of the interphalangeal joints, and the long flexors can produce complete flexion of the metacarpophalangeal joints.

Although the intrinsic function of flexion and extension of the fingers can be performed by the extrinsic muscles, this compensation does not apply to the extensors which carry out the lateral motion of the fingers.

Patients with a single lesion of the ulnar nerve or of both median and ulnar nerves, in

Fig. 1: Longitudinal incisions over the flexor tendons on the volar aspect of the hand.
Fig. 2-A: After the synovial membrane and proximal pulley are opened and the flexor tendons are repaired, a flap with a distal base is cut from the volar tissues of the metacarpophalangeal joint.
Fig. 2-B: The flap is advanced proximally to obtain the desired shortening, limiting extension at the metacarpophalangeal joint to 160 degrees. The flap is sutured with thick silk thread No. 2.
<table>
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<tr>
<th>Case No.</th>
<th>Diagnosis</th>
<th>Age (Years)</th>
<th>Type of Claw-Hand</th>
<th>Treatment</th>
<th>Length of Follow-up (Months)</th>
<th>Type of Work Patients Are Doing at Present, and Results</th>
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<td>1</td>
<td>Section of the ulnar nerve at the hand.</td>
<td>30</td>
<td>Light clawing of the fourth and fifth fingers.</td>
<td>Neurorrhaphy and capsuloplasty in one-stage operation.</td>
<td>8</td>
<td>Car spare-parts dealer; excellent result.</td>
<td>6 mos.; no recurrence.</td>
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<tr>
<td>2</td>
<td>Lesion of the ulnar and median nerves at the wrist.</td>
<td>13</td>
<td>Clawing of the last three fingers (fifth finger was amputated).</td>
<td>Capsuloplasty of claw fingers.</td>
<td>13</td>
<td>Student; excellent result.</td>
<td>10 mos.; no recurrence.</td>
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<td>3</td>
<td>Section of the ulnar nerve at the wrist.</td>
<td>15</td>
<td>Serious clawing of the fourth and fifth fingers with important trophic complications. No stiffness at the interphalangeal joints.</td>
<td>Capsuloplasty of claw fingers.</td>
<td>5</td>
<td>Cup-washer at a bar. Result was good even though partial recidivation of the clawing of the fifth finger occurred because the capsule had not been reduced tightly enough. Great improvement in the trophic lesions.</td>
<td>3 mos.; slight recurrence of the clawing in the little finger.</td>
</tr>
<tr>
<td>4</td>
<td>Section of the ulnar and median nerves at the wrist.</td>
<td>13</td>
<td>Serious clawing condition in four fingers with stiffness of the proximal interphalangeal joints.</td>
<td>Preoperative elastic traction; capsuloplasty.</td>
<td>6</td>
<td>Student. Good result; 15 degrees of flexion in the proximal interphalangeal joints remained.</td>
<td>3 mos.; partial correction of the clawing.</td>
</tr>
<tr>
<td>5</td>
<td>Section of the ulnar nerve at the wrist.</td>
<td>42</td>
<td>Clawing of the fourth and fifth fingers.</td>
<td>Neurorrhaphy and capsuloplasty in one-stage operation.</td>
<td>7</td>
<td>Carpenter; excellent result.</td>
<td>5 mos.; no recurrence.</td>
</tr>
<tr>
<td>6</td>
<td>Section of the ulnar nerve at the wrist.</td>
<td>6</td>
<td>Light clawing of the fourth and fifth fingers.</td>
<td>Neurorrhaphy, capsuloplasty, and transplantation of the extensor digiti proprius of the index to the first dorsal interosseous in one-stage operation.</td>
<td>4</td>
<td>Complete correction of the clawing with excellent active abduction in the index finger.</td>
<td>3 mos.; no recurrence.</td>
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<tr>
<td>7</td>
<td>Section of the ulnar nerve at the elbow.</td>
<td>14</td>
<td>Serious clawing of the third, fourth, and fifth fingers with some stiffness of the finger joints.</td>
<td>Preoperative elastic traction; capsuloplasty.</td>
<td>9</td>
<td>Partial correction of the clawing because of stiffness in the joints. However, the patient can use the hand to do kitchen work.</td>
<td>6 mos.; partial correction of 20 degrees with traction; no recurrence.</td>
</tr>
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</table>
Figs. 3-A and 3-B: A year and a half before these photographs were made, this patient experienced a deep electrical burn of the hand and forearm, resulting in complete paralysis of the intrinsic muscles. Amputation of the little finger was necessary.

Fig. 3-C: Finger opposition was restored by a transplantation of the flexor sublimis. Complete finger flexion and extension was obtained and a useful hand resulted.

Fig. 4-A: Ulnar nerve paralysis resulting from a wound of the forearm. Nerve suture was done, but no recovery of intrinsic muscle function had been obtained two years later.

Fig. 4-B: Complete digital extension was possible after capsuloplasty.

whom claw-hand symptoms are absent, are not unusual. These patients are found to have a congenitally tight volar capsule of the metacarpophalangeal joint. This shortening of the capsule prevents hyperextension.

To obtain correction of the claw-hand it is necessary to limit the extension of the
metacarpophalangeal joints. The operations described for the correction of palsy of the intrinsic muscles will accomplish this. Howard’s procedure of bone-block of the metacarpophalangeal joints stabilizes these joints and permits the action of the extrinsic tendons.

With this in mind, a simpler method was sought to balance the joint. The bone-block technique demands time for consolidation. Bunnell’s operation, although its results are excellent when performed early, is always a procedure of importance. However, it is a procedure of tendon transplantation and the condition of claw-hand does not necessarily require a tendon transplantation for its correction. This has been demonstrated by the good results obtained in patients by tenodesis or by Bunnell’s operation in which the superficial flexor tendons are fixed by adhesions in the forearm. In Fowler’s procedure of extensor transplantation, the extensor indicis proprius and the extensor digiti quinti are split into two strands; a slip is passed through each interosseus space anterior to the transverse metacarpal ligament and is inserted into the aponeurosis. Because of the shortness of the tendons that are used, this procedure is difficult.

The author has devised a simple procedure, quickly performed, for correcting intrinsic claw-hand, which consists in shortening the volar capsule of the metacarpophalangeal joints.

Capsuloplasty is performed through longitudinal incisions over the flexor tendons (Fig. 1). A short flap with a distal base is cut from the volar tissues of the metacarpophalangeal joints (the fibers of the transverse metacarpal ligament, the glenoid fibrocartilage, and the volar capsule). This flap is drawn proximally, enough to obtain the desired shortening, and is sutured with silk thread, to produce a flexion of 160 degrees (Figs. 2-A and 2-B). The opening of the synovial membrane which surrounds the flexor tendons is essential for the performance of the operation. The proximal pulley at the metacarpal-joint level must be opened. After surgery the fingers are splinted in slight flexion for thirty days. The stitches are removed after eight days, and movement is begun at the interphalangeal joints in order to free the adhesions which develop in the flexor tendons as a result of the surgery. Early hyperextension of the metacarpophalangeal joints must be avoided.

We had excellent results in our seven patients (Figs. 3-A through 5-C). As in all compensatory operations for palsy of the intrinsic muscles, the best results are obtained
in patients whose joints have not yet become stiff. The procedure can be completed with a tendon transplantation, if necessary, to obtain abduction of the index finger.

There are several indications for this surgery:
1. When the intrinsic muscles do not recover after a neurorrhaphy;
2. In long-standing lesions of the nerves of the hand when fibrosis has already involved the muscles;
3. In lesions of the nerves of the hand which are considered irreparable because of the degree of the extension;
4. In claw-hand resulting from destruction of the intrinsic muscles by trauma, infections, and other causes;
5. In muscular paralysis of central origin.

In most patients when the intrinsic muscles fail to recover their power after a neurorrhaphy, a compensatory operation is indicated. The simplicity of the operation which has been described and the fact that the paralyzed intrinsic muscles rarely recover their original power after the nerves have been sutured, lead us to suggest that the capsuloplasty procedure should be performed at the time that the neurorrhaphy is done. This is especially true when there is a serious claw-hand deformity, extensive destruction of important nerves, nerve lesions of long standing, or similar conditions. By this method early use of the hand is possible while healing is taking place, and stiffness in the proximal interphalangeal joint is avoided.

Ideally, this operation should be performed on a patient before the proximal interphalangeal joints have become stiff. This is true of all methods of surgery to correct this deformity. If stiffness exists, it must be relieved as much as possible by means of elastic traction, and good passive mobility secured before the operation. After capsuloplasty, the metacarpophalangeal joints should be maintained in slight flexion in plaster for five weeks. Recently we have used an even simpler method to shorten the volar capsule of the metacarpophalangeal joint. A transverse incision is made in the capsule at the joint. The contact surfaces are scraped and the edges of the capsule are overlapped slightly and sutured.

CONCLUSIONS

1. Claw-hand caused by palsy of the intrinsic muscles is corrected when slight flexion of the metacarpophalangeal joints is obtained.
2. The way to obtain this correction is to shorten the volar tissues of the joints.
3. Patients who have nerve lesions but do not have claw-hand are found to have a congenitally tight volar capsule of the metacarpophalangeal joints which prevents hyperextension.
4. The procedure can be performed at the same time as the neurorrhaphy if the surgeon considers it necessary.
5. The correction of the claw-hand should be obtained without tendon transplantation since the tendons may be necessary for tendon transfers.

REFERENCES

3. Howard, L. D.: Cited by Bunnell.1

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