The isolated digital cord in Dupuytren’s contracture: Anatomy and clinical significance

This article describes the isolated occurrence of Dupuytren’s pathologic fascial cords within digits of the hand. Thirty-seven cords were found in 32 patients with nearly half (46.2%) occurring in digits other than the small finger. Almost all patients (97.3%) had other clinical evidence of Dupuytren’s disease. Cords were either single (83.8%) or double (16.2%) and originated from the periosseum at the base of the proximal phalanx in conjunction with adjacent ligaments and intrinsic tendons. They proceed in an oblique direction to displace and then cross the neurovascular bundles before inserting on the bone and/or flexor tendon sheath of the middle phalanx. The average loss of extension of the proximal interphalangeal joint that resulted from these cords was 46°, and surgical excision of the involved cords resulted in an average improvement of 24° (53%). (J HAND SURG 10A:118-24. 1985.)

James W. Strickland, M.D., and Robert L. Bassett, M.D., Indianapolis, Ind., and Downey and Los Angeles, Calif.

Surgeons involved in the management of Dupuytren’s contracture have long been aware of occasional fascial cords that arise from and terminate entirely within the digit with no proximal fascial attachments. Previous articles have found that cords may arise from the musculotendinous junction of the abductor digiti minimi and attach distally to bone and tendon sheath in the middle phalanx, which produces a deformity of the proximal interphalangeal (PIP) joint of the small finger. Little additional information exists regarding the presence of similar cords in other digits, and descriptions of the anatomy and clinical importance of these cords are sparse. This article describes our experience with single and double digital cords that involve all fingers, with an emphasis on the pathologic anatomy and performance of the affected digits before and after fasciectomy.

Anatomic considerations

Dupuytren’s disease has been described as the development of pathologic nodules and cords in normal fascia. The cords that arise from the fascia of the palm and digits are infiltrated with contractile myofibroblasts, which may produce contractures of the metacarpophalangeal (MP) and PIP joints with occasional involvement of the distal interphalangeal (DIP) joint. Dupuytren’s cords that arise from and terminate entirely within a finger have been paid little attention in the literature, although several somewhat varied descriptions of isolated digital cords that have usually involved the ulnar aspect of the small finger have been published.

McFarlane has provided an excellent description of three pathologic cords in Dupuytren’s disease that may result in flexion contractures of the PIP joint: (1) The central cord, which is the midline distal extension of the pretendinous cord, attaches to bone and the flexor tendon sheath of the middle phalanx. (2) The lateral cord, which represents the diseased lateral digital sheath of Gosset and Thomine, arises from the superficial fascia on either side of the finger and is intimately adherent to the skin throughout its course. It attaches to the tendon sheath over the middle phalanx through fibers of Grayson’s ligament. (3) The spiral cord, which is also described by Mason, is a lateral continuation of the pretendinous cord. It proceeds distally to attach to the flexor tendon sheath and bone of...
the middle phalanx and passes beneath the neurovascular bundle in the proximal portion of the digit, delivering the nerve and vessel to lateral and palmar termini. Distally, the spiral cord displaces the neurovascular bundle centrally and then passes over it in the distal portion of the proximal phalanx to render the neurovascular structures lateral and dorsal. McFarlane has described the musculocutaneous junction of an intrinsic muscle (usually the abductor digiti minimi) and the base of the proximal third of the proximal phalanx as sites of origin of the spiral cord. He also found that contractures of the PIP joint resulted from spiral or lateral cords within a digit without evidence of Dupuytren’s disease elsewhere.

Thomine has described the retrovascular band as a thickening of digital fascia that arises proximally from the natatory ligaments, pretendinous band, and deep fascial plane, and that is in direct contact with the digital skin in a position dorsal and lateral to the neurovascular bundle. It divides into several fascial planes and ultimately inserts into the fibrous flexor tendon sheath at the PIP joint. The neurovascular bundle remains palmar to the retrovascular band throughout the digit.

Turbiana and Thomine have described the abductor digitii minimi band. It is a constant medial band that stretches between the digital fascia of the proximal phalanx and the hypothenar aponeurosis. It lies superficial to the neurovascular bundle and is closely adherent to the tendon of the abductor digitii minimi.

Gosset has described the lateral fascia as the lateral digital sheath. He states that it originates from the pretendinous band, the peritendinous septae of Legueu and Juvara, which adhere to the capsule of the MP joint, and the natatory ligament. These fibers travel along the lateral aspect of the proximal phalanx and insert at the PIP joint level and may continue over the lateral aspect of the middle phalanx to insert on the DIP joint. En route, these fibers cross palmar to the neurovascular bundle.

Stack has described the palmar fascia based on dissection of fetal hands, and his anatomic descriptions are similar to those of McFarlane except that Stack pictures the fascia as occurring in layers over muscles, tendons, and nerves rather than in bands. He describes a deep fascial layer (aponeurosis), which is called the “anterior interosseous fascia,” as lying dorsal to the lumbricals and palmar to the interossei. He felt that this fascial layer was continuous distally with Cleland’s ligaments or the digital band. He also described contractures of the PIP joint from the fibers of the superficial layer spreading from the natatory ligaments distally into the fingers.

Kanavel et al. described the deep layer of the digital fascia as being attached to the bone close to the attachments of the vaginal sheath in the aponeurotic expansion of the extensor tendon in the area of the insertion of the interossei and lumbral tendons. They have also documented flexion contractures of the PIP joint that arise from disease of the digital fascia alone, but did not discuss that anatomy.
six double cords and 31 single cords. The distribution of single cords included four index, four long, six ring, and 17 small fingers. One double cord was found in the index, long, and ring fingers and three were found in the small finger. There were 10 radial cords and 21 ulnar cords in the single cord group, and distribution for the total group included digital cord involvement of five index fingers (13.5%), five long fingers (13.5%), seven ring fingers (19%), and 20 small fingers (54.4%) (Fig. 2).

The youngest patient was 24 years old, and the oldest was 78 years old. The average age for this group was 55.8 years with a median age of 57 years. All patients except one had evidence of Dupuytren’s disease in other portions of the same or opposite hand. Twenty-nine patients (87%) had involvement of the same hand with 12 (42%) having palmar involvement only and 17 (59%) having palm and digital findings of Dupuytren’s disease. Twenty-three patients (70%) had involvement of the opposite hand with six (26%) having palmar involvement only and 17 (74%) having palm and digital disease. Three patients (9%) with isolated digital cords had no other Dupuytren’s involvement of the affected hand (Fig. 3), and one patient (3%) had no other discernible disease of either hand.

The average loss of extension of the PIP joint in the digits that were affected by isolated digital cords was 46°. Five patients (14%) had less than 30° of contracture with an average loss of 16° of extension. Twenty-two patients (59%) had an extension deficit of 30° to 59° with an average loss of 40.5°. Ten patients (27%) had an extension loss of more than 60° with an average loss in this group of 75°. Patients with single cord involvement showed an average loss of extension of 43.7° while those with double cords averaged a loss of extension of 58° (Fig. 4). There was no significant difference in loss of extension of the PIP joint for single radial or ulnar cords. Four (10%) of the digits had involvement of the DIP joint with losses of extension ranging from 5° to 40° for an average of 25°.

Technique and results of fasciectomy

All digits that contained isolated digital cords were subject to surgical fasciectomy. Exploration of the offending fascia demonstrated at least a partial periosteal origin from the base of the proximal phalanx in each instance. The fascia was dissected distally while care was taken to protect the underlying neurovascular bundle, and excision was completed by removal of the cord insertion from the periosteum and flexor tendon sheath of the middle phalanx and occasionally the distal phalanx. Seventeen of the 37 fingers (46%) required

Anatomy of the digital cord

The cords in this study had a consistent anatomic position with respect to origin, relationship to the neurovascular bundles, and insertion (Fig. 1). They began at the base of the proximal phalanges, with fibers emanating principally from the periosteum and from the intrinsic muscle-tendon insertion or the lateral tendon to varying degrees. The cord proceeded distally from a position dorsal to the neurovascular bundle in an oblique direction to cross palmar to the bundle in the distal portion of the proximal phalanx. The cord continued on to insert into the flexor tendon sheath or the periosteum of the middle phalanx. In its course, the cord consistently displaced the neurovascular bundle to the midline before crossing palmar to it, and it could be separated from the nerve and vessels at the time of excision. Lateral fibers that extended from the cord to the digital skin or to the lateral fascia were always found throughout the proximal phalanx. Double cords had identical origins on each side of the phalangeal base and merged at or just proximal to the PIP joint to share a common middle phalangeal insertion. Occasional insertional fibers that crossed the DIP joint were encountered. No proximal fascial connections were identified in any of the affected digits.

Methods and material

All patients in this study were managed under the direction of the senior author. There were 33 hands in 32 patients with 37 isolated digital cords. The study included 25 men and seven women with 21 involved fingers on the right hand and 16 on the left. There were

Fig. 2. The distribution of single (base of finger) and double (distal phalanx) cords in the digits in this study.

The Journal of HAND SURGERY
Fig. 3. A, An isolated ulnar digital cord of the left ring finger in a 64-year-old man. Preoperative palpable extent of the cord is seen. B, Same digit at surgery with the cord stained with methylene blue and a rubber marker indicating the course of the neurovascular bundle. Note the central displacement of the bundle proximal to the point at which it is crossed by the cord near the PIP joint.

Checkrein ligament release of the PIP joint to achieve full digital extension. On several occasions, small attached segments of bone were removed with the fascia to confirm the bony origin of the cord. In each case, microscopic examination verified the intimate proximity of the fibromatosis and periosteum (Fig. 5).

Early motion and prolonged intermittent extension splinting were used after the operation, and the average follow-up in this series was 13 months. The results of the excision of isolated digital cords are shown in Table I. The average postoperative loss of extension of the PIP joint was 22°, which represents a 24° (53%) improvement over the preoperative contracture. The range of postoperative extension loss in those joints that required checkrein ligament release was from 30° to 95° with an average of 53°. All patients with an extension loss of 60° or more underwent joint release, and the average postoperative extension loss in those digits was 35.4°, which represents a 17.6° (33%) improvement over the preoperative state.

Complications in this study included one digit that underwent substantial skin necrosis with secondary flexor tendon involvement, which resulted in the need for arthrodesis of the PIP joint. Digital arteries were...
lacerated in three patients, with arterial repair carried out in one. No patients in this study needed additional surgical procedures because of recurrence of the disease. There were no digital nerve lacerations. Of the 37 digits with isolated cords that were surgically managed, 32 were improved, three were not improved, and two were deemed to be worse.

Discussion

The presence of Dupuytren’s contracture isolated to the finger has been described almost exclusively with regard to the hypothenar cord on the ulnar side of the small finger. McFarlane’s9 studies of the pathologic patterns of the digital fascia indicate that the cord may arise from the musculotendinous junction of an intrinsic muscle (usually the abductor digiti minimi) or from the bone at the base of the proximal phalanx, and may attach distally to bone and tendon sheath in the middle phalanx, which produces deformity in the PIP joint. Little additional information exists on cords in digits other than the small finger. We have found that in addition to isolated single cords in other digits, there are occasionally double digital cords that converge for a common insertion and produce the same clinical manifestations (Fig. 6).

Despite the variations in previous descriptions of the location of Dupuytren’s fascia within a digit, all the cases presented here had a similar pathologic anatomy. A bony origin at the base of the proximal phalanx has been a consistent finding, although additional fibers emanating from the adjacent intrinsic muscle-tendon insertion or from the lateral tendon have often been present. A microscopic pathologic examination of excised material has confirmed the periosteal origins of the cords. The term “spiral cord” would not seem applicable to these digital fascial accumulations because their course is a predictably oblique one that proceeds from a position lateral and dorsal to the neurovascular bundle to a central and palmar relationship at the insertion of the cord. The neurovascular bundle is consistently displaced to the midline in the proximal

Table 1. Results of excision of isolated digital cords

<table>
<thead>
<tr>
<th>Group</th>
<th>No. (%)</th>
<th>Extension loss</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°-29°</td>
<td>5 (14%)</td>
<td>16°</td>
<td>14°</td>
<td>+2° (13%)</td>
<td></td>
</tr>
<tr>
<td>30°-59°</td>
<td>22 (59%)</td>
<td>40.5°</td>
<td>14.5°</td>
<td>+26° (64%)</td>
<td></td>
</tr>
<tr>
<td>60°+</td>
<td>10 (27%)</td>
<td>75°</td>
<td>43°</td>
<td>+32° (43%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>46°</td>
<td>22°</td>
<td>+24° (53%)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5. Low-power photomicrograph of the bony origin of an isolated digital cord. Note the intimate relationship between fascial fibers and the dark-stained periosteal line. (Courtesy of William Wahle, M.D., Department of Pathology, St. Vincent Hospital, Indianapolis, Ind.)
half of the proximal phalanx and has never been found to cross palmar to the cord or wrap around it. In our cases, the neurovascular structures did not pass through the cord, and lateral fibers that passed from the cord to the lateral digital fascia were consistently encountered and were varied in number and intensity.

The isolated digital cords that are described here are probably analogous to those observed and described by other authors, although previous emphasis has been on the presence of such cords on the ulnar aspect of the small finger. While the cord is probably similar to the hypothenar cord that is described by McFarlane and Tubiana and Thomine or to the lateral digital sheath of Gosset, we have found that the origin is predominantly from periosteum with contributions from adjacent structures. In addition, we can find no previous description of double cords that originate within a digit without proximal palmar connections.

The number of cases of isolated digital cord that we have accumulated since we became aware of the condition some 10 years ago suggests that its occurrence is not uncommon in patients afflicted with Dupuytren's contracture. Of clinical import is the observation that these cords are often difficult to palpate and have been discovered when a finger with a flexion contracture of the PIP joint was explored during excision of other Dupuytren's fascia. While the ulnar cord of the small finger is a recognized cause of residual or recurrent contracture of that digit, isolated cords in other digits may be overlooked despite the middle joint deformities that they create. The presence of flexion contractures of the PIP joint in the absence of a history of trauma should arouse suspicion about the presence of an isolated digital Dupuytren's cord, particularly when evidence of myofibrosis exists elsewhere.

It is generally agreed that correction of flexion deformities at the PIP joint in Dupuytren's contracture is often difficult to achieve during surgery and to maintain after surgery. It had been our impression that improvement in function of the PIP joint that results from surgical excision of the isolated digital cords was better than the results that were achieved at that joint level after more extensive palmar-digital fascial excisions. However, when the results of this group are compared with those we previously reported for classic Dupuytren's surgery, there was no meaningful difference. Little long-term information regarding the performance of fingers after excision of isolated digital cords is available, and therefore, we cannot document any clear-cut difference in the postoperative performance of
digits that are affected by these cords when compared with those emanating from the palm.

Conclusion

We have concluded that isolated digital cords without proximal palmar connections occur frequently in Dupuytren's disease. While the ulnar side of the small finger is the most frequent site of occurrence, the pathologic cords may arise in any digit and have been found to have either a single or double configuration. A bony origin at the base of the proximal phalanx was consistently found, and the cords have an oblique course that crosses palmar to the neurovascular bundle and inserts into the middle phalangeal bone and tendon sheath. The cords described here inevitably produced deformities in flexion of the PIP joint, and surgical ablation yielded results similar to those after the excision of the more frequently occurring Dupuytren's palmar-digital cords.

REFERENCES