Dupuytren’s contracture is a relatively common disorder that is characterized by a progressive fibrosis and thickening of the palmar fascia; in long-standing or severe disease, it can result in shortening and thickening of the ligaments and joint and skin contractures.1,2 Treatment options include both surgical and conservative modalities. Surgical options include either fascioteomies (limited open or percutaneous), in which the cord is simply divided, or fascioteomies, in which the diseased fascia is excised.1,3-5 The main advantages of fascioteomies are the lower incidences of nerve injury, flare reaction, and reflex sympathetic dystrophy as well as decreased recovery time.3,6 Needle percutaneous fascioteomies can be performed in the office setting and usually permit return to normal manual activities within a week. Needle percutaneous fascioteomies are gaining popularity due to the growing demand for a fast recovery, a low complication rate, and minimal invasiveness, which allows both hands to be treated on consecutive days if necessary. Chen et al7 also showed that this is a cost-effective procedure compared with open procedures. The main disadvantage is a higher recurrence rate compared with limited open fascioteomies and fascioteomies, with recurrence occurring more rapidly.6 Moreover, the procedure is better indicated for contractures that do not include severe skin shortage or capsular shrinkage of the proximal interphalangeal (PIP) joint.8 The procedure has been outlined in varying detail.8,9

The current authors describe a novel technique using ultrasound as an adjunct to percutaneous fascioteomy for Dupuytren’s contracture. The technique is based on their original work on Dupuytren’s contracture and ultrasound mapping of neurovascular structures of the hand.

**MATERIALS AND METHODS**

The authors prospectively followed up on 48 patients with Dupuytren’s contracture who underwent closed percutaneous ultrasound-guided fascioteomy. The contracture was unilateral in 30 cases and bilateral in 18 cases. Sixty-six hands (90 fingers) were included in the study cohort.

All patients were carefully evaluated before the procedure. A detailed history regarding comorbidities and the use of anticoagulant medications was obtained. Expectations were explained as possible improvement up to 90° of combined metacar-
pophalangeal (MCP) and PIP contracture, and up to 50% improvement of PIP contracture. The total passive extension deficits as well as the passive extension deficits of the MCP, PIP, and distal interphalangeal (DIP) joints were recorded (Figures 1-2) and categorized according to the Tubiana classification (Table). In addition, patients’ motion can be photographed or recorded on video for future analyses. Moreover, total flexion deficit is assessed by measuring the distance from the distal palm crease to the pulps of the fingers while making a fist. Sensitivity was tested using Semmes-Weinstein monofilaments.

After thorough clinical evaluation, the procedure was explained to the patient, including the importance of cooperation during surgical manipulations. The patient should be able to report paresthesias or numbness and avoid sudden movements. Potential complications (ie, skin tear, nerve or tendon injury) and the importance of following a postoperative care protocol were clearly explained, and written informed consent was obtained.

### Surgical Technique

Needle percutaneous fasciectomy can be performed in an office setting. There is no need for sedation or use of a tourniquet. Fasciectomy (needlestick sites) portals are planned and marked with a sterile marker-pen (Figure 3). The patient’s hand was placed, palm up, on the evaluation table. Using an S-MSK series ultrasound machine (SonoSite Inc, Bothell, Washington) in Doppler mode and a 6-MHz hockey stick transducer, the arterial supply of the palm is evaluated and recorded. The position of the superficial palmar arch is identified via Doppler and recorded on the skin using an indelible skin marker (Figure 4). The depth of the vascular supply is also noted. Through continued use of the Doppler, the common palmar digital arteries and the proper palmar digital arteries are identified and superficially marked from the arch to the PIP joint of the respective fingers (Figures 5-6). Distal analysis is performed if the Dupuytren’s cord extends past the PIP joint. Ultrasound evaluation is used to identify the location of the common palmar digital nerves and the proper palmar digital nerves. Displacement of neurovascular structures associated with spiral cords is noted and marked. Portals may be used proximal or distal to an identified spiral cord.

Subsequently, the palm and fingers are surgically prepped using chlorhexidine solution. Superficial pinpoint aliquots of 1% lidocaine are intermittently injected over the premarked portals.

### Table

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<th>Tubiana Classification for Dupuytren’s Contracture</th>
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Figure 1: Preoperative palmar view of the hand. Note the cord over the fourth metacarpophalangeal joint and the resulting contracture of the ring finger.

Figure 2: Preoperative sagittal view of the hand showing the amount of the metacarpophalangeal extension deficit.

Figure 3: Fasciectomy (needlestick sites) portals are planned and marked with a sterile marker-pen.

Figure 4: The position of the superficial palmar arch is identified via Doppler image and recorded on the skin using an indelible skin marker.

Figure 5: Doppler image of the digital artery with metacarpal on both sides.

Figure 6: Ultrasound image showing identification of a Dupuytren’s nodule.
portals using a 30-gauge needle (Figure 7). A fraction of a milliliter should be used with each injection. The aim is to anesthetize only the skin over the cord, not the deeper digital nerves. Due to its unique nerve supply, needleling of the cord does not typically elicit pain. Then, a sterile, short (0.7-inch), 19-gauge hollow needle is inserted perpendicular to the long axis of the cord fibers through anesthetic puncture sites. As the surgeon progresses into the finger, a short (0.75-inch), 22-gauge needle can be used. Using the digital nerve skin tracings as a guide, the needle is advanced to a depth of a few millimeters and carefully swept back and forth in a transverse orientation, cutting the fibrotic bands (Figure 8). The fascia should feel crisp or crunchy (gristle-like) when being cut.

Simultaneous passive cord tension is applied by holding the finger in extension during the procedure, making the targeted cords more prominent and confirming contracture release. This process is repeated along the involved digit until optimal extension is attained. During the dissection of the fascial fibers, flexor tendons should be slack to reduce the risk of injury. Pressure on the fingertips should be avoided. The patient should be repositioned and the PIP joint correction rate was 80% (range, 10°-26°) and the MCP joint correction rate was 45° (range, 20°-55°). MCP joints was found at a mean of 19 months postoperatively (range, 8-22 months). Recurrence for MCP joints was noted. Twelve of 12 recurrences had residual deformity of the MCP/IP joints, whereas 4 recurrences had no residual deformity after closed fasciotomy. Recurrence for PIP joints was evident at a mean of 14 months postoperatively (range, 3-32 months).

**RESULTS**

Mean follow-up was 26 months (range, 12-32 months). The immediate postoperative average MCP joint correction was 45° (range, 20°-55°) and the average PIP correction was 35° (range, 15°-45°). The MCP joint correction rate was 80% and the PIP joint correction rate was 65.6%. At the latest follow-up, a mean contracture of 10° in MCP joints and 25° in PIP joints was noted. Twelve of 66 hands (18.2%) needed reoperation for recurrence of contracture. Eight of the 12 recurrences had residual deformity of the MCP/IP joints, whereas 4 recurrences had no residual deformity after closed fasciotomy. Recurrence for PIP joints was evident at a mean of 14 months postoperatively (range, 8-22 months). Recurrence for MCP joints was found at a mean of 19 months postoperatively (range, 10-26 months). On follow-up, the authors decided to perform an open procedure rather than repeat a percutaneous fasciotomy.

There was no instance of postoperative neurovascular dysfunction. Two fingers went numb during the procedure, but this resolved once the anesthetic had worn off. Hematoma formation was evident in 7 hands (10.6%). Hemostasis was obtained with pressure. A light gauze wrap or small adhesive bandages were applied to the needle sites. Ice and elevation were recommended for the first 2 days postoperatively, but passive and active motions were allowed immediately (Figures 9-10). Bandages were usually removed the second postoperative day.

There was only 1 case of skin breakdown necessitating...
early abandonment of the procedure. Skin scars developed in 6 hands or fingers (6.67%). In these cases, longer protection of the wound was recommended, depending on the size and location of the tear. The authors routinely recommended splinting of the hand after the procedure. Two types of splints were offered. A daytime dynamic splint was recommended to help release residual contractures of the joints (Figure 11). This splint is most beneficial for the PIP joints. Patients were instructed to use it for 30-minute intervals 3 times a day. Static extension (night) splints were also recommended. They could typically be hand-based. Patients were instructed to use them for up to 3 months. Generally, patients had no postoperative restrictions other than to avoid submerging their hands for 48 hours.

**Discussion**

Dupuytren’s contracture is a relatively common disorder that is characterized by a progressive fibrosis and thickening of the palmar fascia; in longstanding or severe disease, it can result in shortening and thickening of the ligaments and joint and skin contractures.\(^1\)\(^2\) Multiple etiologic factors can induce a pathognomonic fibroblastic proliferation and disorderly collagen deposition with fascial thickening and local formation of nodules and cords.\(^1\)\(^2\)

Historically, both conservative and surgical treatment modalities have been presented. Conservative measures include continuous slow skeletal traction, dimethyl sulfoxide, vitamin E, allopurinol, physical therapy, ultrasound therapy, glucocorticoid injections, interferon, and splinting but are considered unsuccessful.\(^4\)\(^10\) Prophylactic external beam radiation therapy can prevent progression and provide symptomatic benefit for patients with mild to moderate flexion deformities.\(^11\)

Collagenase *Clostridium histolyticum* (CCH) injections were previously limited to patients with severe contractures or early stages (Tubiana stages I and II) of the disease.\(^12\) Risks of allergic reaction, skin tearing, immune response, and tendon injury were thought to be the major drawbacks of collagenase injections. However, a recent study evaluating the long-term efficacy and safety of CCH after the third year of a 5-year non-treatment follow-up (Collagenase Option for Reduction of Dupuytren Long-Term Evaluation of Safety Study [CORDLESS Study]) found that most successfully treated joints had a contracture well below the threshold for surgical intervention 3 years after treatment.\(^13\) Moreover, the recurrence rate, which is comparable to that of other standard treatments, and the absence of long-term adverse events 3 years after initial treatment indicate that CCH is effective and safe for Dupuytren’s contracture. The CORDLESS Study also found that, among successfully treated joints, recurrence rates were lower than nondurable response rates among partially corrected joints. Most important, the investigators did not identify new long-term or serious adverse events attributed to CCH during follow-up.\(^13\)

Therefore, CCH injections should likely be considered primary treatment before proceeding to surgical intervention.

Surgical options include either fasciectomy (limited open or percutaneous), in which the cord is simply divided, or fasciectomies, in which the diseased fascia is excised.\(^1\)\(^3\)\(^5\) Selection of the operative procedure is basically related to the severity of the disease and patient preference. Increasingly, patients express preference for avoiding formal surgery for Dupuytren’s contracture. The Tubiana grading system\(^14\) involves the amount of total passive extension deficit, which is the sum of the passive extension deficits of the MCP, PIP, and DIP joints (Table). It is generally thought that percutaneous needle fasciectomy is most appropriate for elderly patients with relatively mild contractures (Tubiana stages I and II), especially with only an MCP deficit. Patients who need a stick or a palmar support to walk and those who have associated pathologies (ie, arthrosis, short life expectancy) could benefit from this technique.\(^6\) Relative indications may include patients willing to accept a higher risk of recurrence in the context of lower complication rates, faster recovery times, and minimal invasiveness.\(^5\) Eaton\(^7\) presented 4 basic requirements for the procedure: (1) contracture due to (2) a palpable cord lying beneath (3) redundant skin in (4) a cooperative patient. Other indications are more controversial; the presence of algodystrophy or patients who are active and cannot take sick leave are included in this group.\(^9\)

However, percutaneous fasciectomies should not be attempted in the absence of a palpable cord and should not be expected to correct longitudinally inadequate skin or scars.\(^6\) Although debatable, infiltrating disease, inaccessible multiple cords, postsurgical digital recurrences in young adults, and severe and long-term digital disease causing the stiffness of the PIP joint have been reported as clear contraindications.\(^9\)

This technique is also less effective for contractures not resulting from Dupuytren’s disease or for patients with constitutionally treatment-resistant disease. van Rijssen et al\(^8\) showed that percutaneous needle fasciectomy is not as effective as limited open fasciectomy for Tubiana stages III and IV; thus, these cases should be considered relative contraindications. Debate continues regarding whether use of anticoagulant drugs is a contraindication\(^15\) or...
actually a relative indication for the procedure compared with limited open fasciectomy or fasciectomy.\textsuperscript{8,9}

Percutaneous needle fasciotomy is a safe, minimally invasive procedure.\textsuperscript{3,6,9} Recurrence of the disease is the most common postoperative complication.\textsuperscript{16} Surgeons should be aware that the recurrence rate is higher than that of open procedures; thus, percutaneous needle fasciotomy is best limited to the elderly, who want simple treatment without extensive wounds.

Damage to digital neurovascular structures is another potential complication.\textsuperscript{6,16} However, careful preoperative ultrasound mapping of the cords can diminish the possibilities of accidental lesions.

Skin tears and subsequent flexor tendon lesions are also possible.\textsuperscript{3,6} They usually occur in and adjacent to flexion creases at the PIP joint and the base of the finger. Thus, skin creases are best avoided during portal planning because of the proximity of the flexor sheath and the likelihood of skin tear. Once a tear develops, further attempts at passive extension are likely to propagate it and thus are best avoided. Allowing a skin tear to heal and then resuming needle aponeurotomy is a reasonable course of action in these cases.

**CONCLUSION**

The authors have presented a technique involving ultrasound-guided percutaneous needle fasciotomy for Dupuytren’s contracture. This straightforward technique combines the advantages of a minimally invasive procedure with the increased safety of ultrasound mapping of the digital neurovascular bundles. Reducing the small but significant risk of postoperative finger numbness with preoperative ultrasound mapping is reasonable in their view. Ultrasound mapping does increase costs but is favorably received by patients because it likely reduces their surgical risk without adding discomfort.

**REFERENCES**