SUBSPECIALTY PROCEDURES

PERCUTANEOUS NEEDLE FASCIOTOMY FOR DUPUYTREN CONTRACTURE

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Abstract

Background: Percutaneous needle fasciotomy (PNF) is a minimally invasive treatment option for mild to moderate Dupuytren contractures in the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints, and the procedure requires limited resources. Multiple contractures can be treated during the same session, and the treatment is considerably easier for the patient and requires a minimum of rehabilitation compared with limited fasciectomy¹.

Description: PNF can be performed in a regular outpatient clinic in most cases. With the patient in a reclined position, the cord of the contracted joint is tensioned by passive extension and is divided percutaneously with a 25-gauge needle under local anesthesia. The immediate treatment effect in terms of reduction of the contracture is readily assessed, and PNF can be performed at additional levels if needed.

Alternatives:

- Collagenase *Clostridium histolyticum* (CCH; Xiaflex).
- Total or partial fasciectomy.
- Dermofasciectomy.
- Amputation (in severe cases after multiple other procedures).

Rationale: Local treatment with injection of CCH (Xiaflex) in the Dupuytren cord enables rupture of the cord similar to that after PNF². Both CCH and PNF are minimally invasive treatments with obvious advantages compared with open surgery³, and they seem to have the same intermediate-term outcome⁴⁻⁶. However, CCH treatment is considerably more expensive than PNF and requires 2 visits by the patient to the outpatient clinic instead of 1⁷. CCH has also been reported to have more complications than PNF^{2,8}. Furthermore, multiple (>4) joint contractures⁹ can be treated by PNF at the same time. In the author's experience, even bilateral contractures can be treated at the same session if requested by the patient. As the number of patients treated with CCH and PNF has increased, there has been a corresponding decrease in more invasive procedures¹⁰; however, open surgery will probably always remain an option in more severe cases or as a secondary procedure after recurrence.

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Introductory Statement

Percutaneous needle fasciotomy (PNF) is a safe, simple, and inexpensive method for treating mild to moderate Dupuytren contractures with a palpable cord and an extension deficit in the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints.

Indications & Contraindications

Indications

- A palpable Dupuytren cord with a concomitant extension deficit in a patient who actively seeks treatment for the condition.
- A passive extension deficit of $\geq 20^\circ$ in the MCP joint and/or a passive extension deficit of $\geq 30^\circ$ in the PIP joint (universal indications for any treatment of Dupuytren contracture are absent in the literature, but collagenase *Clostridium histolyticum* [CCH] treatment has been used for contractures of $\geq 20^\circ$).
- Anticoagulant therapy and recurrent contracture are not contraindications to PNF.

Contraindications

- Secondary joint changes in the PIP joint, e.g., capsular shrinkage, indicating the need for more invasive treatment.
- Local symptoms from diseased subcutaneous tissue, e.g., painful nodules within a cord, in a patient who is suitable for more invasive treatment.
- Lack of patient compliance.

Step-by-Step Description of Procedure

PNF at the MCP Joint

Dupuytren cords at the MCP joint are generally easier to treat, with less risk of damage to the adjacent nerves and tendons, than those in the PIP joint. The surgeon is advised to gain experience of the method at the MCP joint level prior to starting with the PIP joint, and to ensure that the modified technique for the PIP joint described in the next section is used.

Step 1: The Setup

For most patients, perform PNF in a regular outpatient office after local disinfection of the skin.

- Place the patient in a reclining position, with the affected hand positioned on a separate table.
- Perform local disinfection of the skin.
- The surgeon should be positioned so that the nondominant hand keeps the affected finger extended throughout the procedure (Fig. 1).
- Using a 3-mL syringe, mix 1 mL of methylprednisolone (or equivalent corticosteroid) with 2 mL of 2% mepivacaine (or equivalent).
- Fit a 25-gauge needle (preferably one that is 1 in [2.54 cm] long since it will provide better directional and depth control) to the syringe.

Fig. 1

Fig. 1 An intraoperative photograph showing the setup for PNF. The patient's hand is resting on a separate table, the skin over the cord has been disinfected, and the finger to be treated is firmly extended by the surgeon's nondominant hand.

Step 2: Choice of Cord Level for PNF and Anesthesia

Choose the puncture site at the thinnest part of the cord and avoid skin creases to minimize the risk of skin ruptures (Fig. 2).

- Choose the puncture site at the thinnest part of the cord and avoid skin creases.
- Inject a small volume subcutaneously volar to the cord, retract the needle, and wait for the local anesthetic to take effect (Figs. 3-A and 3-B).
- Pass the needle through the cord at the same puncture site while tensioning the cord by passively extending the finger. Note the loss of resistance when the needle passes through the cord dorsally. Inject a slightly larger volume (Fig. 3-C), retract the needle (Fig. 3-D), and wait for the local anesthetic to take effect (Fig. 3-E).

Fig. 2

Fig. 3-A

Fig. 3-B

Fig. 3-C

Fig. 3-D

Fig. 3-E

Fig. 2 The puncture site should avoid skin creases to decrease the risk of skin ruptures (even though they are not to be feared).

Figs. 3-A through 3-I Schematic and detailed sequential illustration of PNF. FDS = flexor digitorum superficialis, and FDP = flexor digitorum profundus. **Figs. 3-A and 3-B** Administration of anesthesia. **Figs. 3-A** Inject a small volume subcutaneously volar to the cord. **Fig. 3-B** Retract the needle and wait for the local anesthetic to take effect.

Figs. 3-C, 3-D, and 3-E Repeat administration of anesthesia. **Fig. 3-C** Inject a slightly larger volume. **Fig. 3-D** Retract the needle. **Fig. 3-E** Wait for the local anesthetic to take effect.

Step 3: Perforating the Cord

Ensure that the finger to be treated is firmly extended throughout the procedure so that the cord is tensioned.

- Make sure that the involved finger is firmly extended so that the cord is tensioned. This increases the resistance to the needle in the cord and enhances the loss of resistance as the needle passes through the cord, thus preventing damage to the flexor tendons. Using the same puncture site in the skin, angle the needle in a different direction (Video 1, Fig. 3-F).
- Pass the needle through the cord (Fig. 3-G). An obvious loss of resistance should be felt when the needle passes dorsally. If this loss of resistance is difficult to detect, increase the tension of the cord by applying more force to extend the finger passively.
- Retract the needle to the level of the skin (Fig. 3-H), angle the needle in yet another direction, and perforate the cord again (Fig. 3-I).

Fig. 3-F

Fig. 3-G

Fig. 3-H

Fig. 3-I

Figs. 3-F, 3-G, and 3-H Perforation of the cord. **Fig. 3-F** Using the same puncture site in the skin, angle the needle in a different direction. **Fig. 3-G** Pass the needle through the cord. **Fig. 3-H** Retract the needle to the level of the skin.

Fig. 3-I Angle the needle in yet another direction and perforate the cord again.

Video 1 Percutaneous needle fasciotomy. To provide the view for the surgeon, the finger is extended by an assistant surgeon. Normally, the finger to be treated is extended by the nondominant hand of the surgeon while the dominant hand works the syringe and needle.

Step 4: Rupture of the Cord and Extension of the Joint

The effectiveness of PNF is usually obvious when the cord ruptures.

- Keep perforating the cord in different directions in a fan-shaped pattern in a transverse plane until the cord ruptures. This rupture is either felt or heard as the joint starts to straighten.
- Remove the needle, place a sterile dressing over the puncture site, and extend the finger firmly to a hyperextension of at least 10°. Show the resulting full passive extension to the patient and place a bandage on the puncture site.

Step 5: Post-Treatment Instructions

There is usually no need for regular hand therapy, and routine follow-up visits after PNF are rarely indicated for a patient with appropriate instructions to return in case of any complications.

- Regular therapy and routine follow-up visits are not usually necessary.
- Consider the use of a night splint if there is an obvious discrepancy between the active and passive extension of the MCP joint. Secondary joint contractures can usually be overcome (Fig. 4). The splint should be volar with straight fingers and should be used for a maximum of 3 months or until the joint is completely straightened. This is usually not needed for simple MCP contractures.
- Instruct the patient to stretch any residual extension deficit by using the other hand. Encourage the patient to use the hand immediately and to integrate daily stretching during his or her spare time, e.g., while riding a bus or watching television, for at least 2 months.
- Inform the patient about the risk of recurrence and ensure that the patient knows how to renew contact if this should occur.

Fig. 4

Fig. 4 Figs. 4-A through 4-D An illustration of a joint contraction secondary to a Dupuytren contracture, and its correction over time. **Fig. 4-A** The maximum active extension in a patient with a severe MCP contracture before PNF. **Fig. 4-B** The maximum active extension immediately after PNF. **Fig. 4-C** The maximum passive extension at the same time. **Fig. 4-D** To overcome these secondary changes to the joint, the patient was provided with a night splint for 3 months. The photograph shows the active extension 1 year after PNF.

PNF at the PIP Joint

The risk of injury to the neurovascular bundle and the flexor tendons increases at the PIP level. As in all other Dupuytren contracture treatments, the PIP joint is considerably more difficult to treat, and other procedures such as limited fasciectomy should be considered when the cord is thick and/or secondary joint changes are anticipated. PNF could, however, be a reasonable option in the presence of a thin, superficial cord. In contrast to the central peritendinous cord at the MCP joint level, cords that engage the PIP joints are usually located in an ulnar or radial position to the cord, i.e., close to the neurovascular bundle. The following modification to the method described above is therefore recommended.

- Carefully instruct the patient to report any paresthesia in the finger during the procedure, especially when the needle is inserted in different directions to divide the cord.
- Use only a minimal volume of local anesthetic subcutaneously between the intended puncture site and the cord; anesthesia of the digital nerve should be avoided. If repeated needling is required, test sensitivity to touch in the fingertip occasionally to ensure intact nerve function and abort the procedure if the patient reports a digital nerve block.
- Perform PNF as described above. Tension the cord maximally and change direction when the needle has passed through the cord. If possible, choose a dorsolateral angle away from the neurovascular bundle and flexor tendons.
- When the cord starts to rupture, inject a larger volume of local anesthetic and retract the needle. Wait until satisfactory local anesthesia takes effect and perform the extension maneuver. Do not continue to insert the needle.
- A volar night splint with straight fingers for 3 months is usually required for PIP contractures.

Results

The results of PNF have shown an excellent rate of reduction of the contracture, and a majority (79%) of the patients retained a straight joint after 2 years¹¹. Dupuytren contracture is, however, notorious for recurrence, regardless of treatment method. One study on 1,013 fingers treated with PNF and followed for a median of 3 years showed a recurrence rate of 48%¹². Another randomized controlled trial between PNF and limited fasciectomy indicated a recurrence rate of 21.8% in the PNF group compared with 5.3% in the limited fasciectomy group using standard definitions of recurrence¹³, and even higher recurrence rates have been reported¹⁴. However, PNF is a simple procedure that can be performed repeatedly, and 53% of the patients with recurrence in the latter study chose another PNF procedure.

Patient-reported outcome measures have shown a significant improvement in a disease-specific questionnaire, the Unité Rhumatologique des Affections de la Main (URAM), in a general upper extremity questionnaire (Quick-DASH [an abbreviated version of the Disabilities of the Arm, Shoulder and Hand questionnaire]), and with visual analog scales, indicating that most patients are very satisfied with the method^{4,6,11}.

Older patients (>55 years) seem to have a better outcome in terms of a lower rate of recurrence compared with younger patients¹³.

Pitfalls & Challenges

- Skin ruptures (Fig. 5) are common (5% to 38%)^{6,15} and should not be feared. If a skin rupture occurs, show it to the patient and reassure him or her that this is a well-known complication that will heal by secondary intention within approximately 2 weeks. Do not attempt any other closure of the skin, regardless of the size of the rupture. Apply a compressive dressing and instruct the patient to remove it the next day and to wash the skin rupture with soap and water before applying a simple bandage and continue to do so until healing. If there are doubts about compliance with these recommendations, ensure that the patient is scheduled to have the wound checked in approximately 2 days.
- Nerve injuries are rare complications (<0.5%)^{8,16} that occur almost exclusively at the PIP joint level. Use a minimal amount of local anesthetic in the PIP joint and instruct the patient to report any paresthesia so that the risk of damage to the digital nerves is reduced.
- Tendon injuries have been reported but at a very low rate (<0.05%)⁸.

Fig. 5

Fig. 5 An example of skin ruptures after PNF. These wounds healed uneventfully within 2 weeks.

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