Danger zones for nerve injuries in percutaneous needle fasciotomy

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Background

Percutaneous Needle Fasciotomy (PNF) is being accepted as a minimally invasive alternative in the treatment of selected Dupuytren’s cases. Cords causing MCPI and PIPI contracture are divided with needle bevels oscillated through the skin under focal local anesthesia. 

Advantages: quick procedure, quick recovery, minimal morbidity and systemic risks, minimal costs.

Good candidates: isolated cords, elderly patients, patients requiring quick recovery.

Disadvantages: highest recurrence rate (40-60% at 3 yrs), risk of tendon damage, risk of nerve damage (up to 1-2%)

Digital nerves anatomy and Dupuytren’s:
- Digital nerves displaced by spiral cords
- Common digital nerves crossing between tendons and cords in the palm

AIMS: identify points in which digital nerves cross the course of pretendinous bands of the palmar aponeurosis superficially to flexor tendons (“danger zones”)

Methods

Six fresh frozen below-elbow specimens were examined. The bi-styloid line was marked, and the longitudinal diameters of the palm were measured as the distance between this line in correspondence with the palmaris longus tendon and the third web space. The palmar skin was excised exposing the palmar aponeurosis. The quadrangular structure of the palmar aponeurosis was demarcated, between the distal margin of the carpal tunnel, the distal margin of Skoog’s transverse fibers, and the external margins of the pretendinous bands to the index and little fingers. The proximal margin of Skoog’s fibers was also identified. Measurements of this area were acquired. The relative position of the pretendinous bands to the tendons was examined. The aponeurosis was then elevated proximal to distal, providing access to the flexor tendons and the neurovascular bundles. The common and proper digital nerves were examined to identify if and where crossings over the flexor tendons or with the pretendinous bands occurred. The distance of the crossing points and the distal margin of the carpal tunnel was measured.

Results

Dimensions of the hands and of the quadrangular area of the palmar aponeurosis

- Index radial and little finger ulnar DN's along the outer boundaries of the palmar aponeurosis
- The common DN to index and middle fingers runs between the respective tendons, not crossing longitudinal fibers
- The common DN to ring and little fingers originates from the ulnar nerve lateral to the little finger flexors and moves to their radial side proximally to the transverse fibers. It crosses tendons deeply and longitudinal fibers superficially mid-way between the distal margin of the carpal tunnel and the transverse fibers (a).
- The common DN to middle and ring fingers less predictably crosses the flexors of the middle finger distal to the carpal tunnel (b). In one case this crossing did not occur. The 3rd ray pretendinous band does not exactly lie above the tendons, and the crossing with the band can be more distal.

Discussion

Two “danger zones” for nerve injuries identified within the quadrangular area of the palmar aponeurosis, at risk in proximal pretendinous cords PNF
- common DN to the little and ring fingers crossing the longitudinal fibers of the 5th ray, constant (a)
- common DN to the middle and ring fingers, less predictable (b)

PNF in the 1st web space should be safe if performed within and at some distance from the lines of the distal margin of the FPB and the radial margin of the index finger.

Use of focal subdermal injections of tiny (0.1ml) amounts of local anesthetic at needling ports that does not anesthetize nerves, along with constant monitoring for nerve symptoms is required to minimize the risk of nerve damage.