

Arthroscopic Tenovagotomy and Ganglion Excision of the Flexor Carpi Radialis Fibro-Osseous Tendon Sheath

Jerone T. Landström, MD

Abstract: The treatment of flexor carpi radialis (FCR) tendon stenosing tenosynovitis recalcitrant to nonsurgical intervention has been open or blind tenovagotomy of the volar trapezial fibro-osseous sheath of the FCR tendon. The surgical literature has not reported arthroscopic tenovagotomy of the FCR fibro-osseous tendon sheath with or without associated ganglia. This report describes a technique of arthroscopic tenovagotomy for stenosing tenosynovitis of the FCR tendon at the trapezial fibro-osseous sheath with or without excision of any associated ganglion through a not previously described new volar radial trapezial arthroscopic portal.

Key Words: arthroscopy, flexor carpi radialis fibro-osseous tendon sheath stenosis, tenovagotomy, ganglia excision

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TECHNIQUE

The extremity was placed on an arm board in a semisupinated position. Local anesthetic field block was accomplished using 1% lidocaine with epinephrine mixed 1:1 with 0.5% marcaine with epinephrine injected with a small-gauge needle with or without intravenous sedation. The anesthetic solution was injected into the volar areas of the radial wrist, thumb basilar soft tissues, scapho-trapezial joint, and trapezial-metacarpal joint (TMJ). Then, with or without use of tourniquet, the surgeon sits near the ulnar side of the wrist (Fig. 1). Using a sterile surgical pen, a 1.0 cm volar transverse incision centered over the flexor carpi radialis (FCR) tendon just proximal to the palm glabrous skin or more proximal for associated



FIGURE 2. Volar radial wrist and volar 1R trapezial arthroscopic access incisions.

ganglia tracking proximally was marked out that can be extended with a z-plasty extension for an open conversion of the procedure (Fig. 2). A small dissecting scissor was used to dissect directly over the FCR tendon and ulnar to or through an accessory abductor pollicis longus tendon if present.¹ Then, the volar forearm fascia overlying the FCR tendon is divided proximally and distally,



FIGURE 1. Surgical positioning.



FIGURE 3. Arthroscope advanced to the proximal margin of the trapezial fibro-osseous tunnel transilluminating the volar trapezial zone.

From the Pacific Hand Surgery Center, Tamuning, Guam.

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Address correspondence and reprint requests to Jerone T. Landström, MD, Pacific Hand Surgery Center, Tamuning 96913, Guam. E-mail: jonathan.scovner@wolterskluwer.com.

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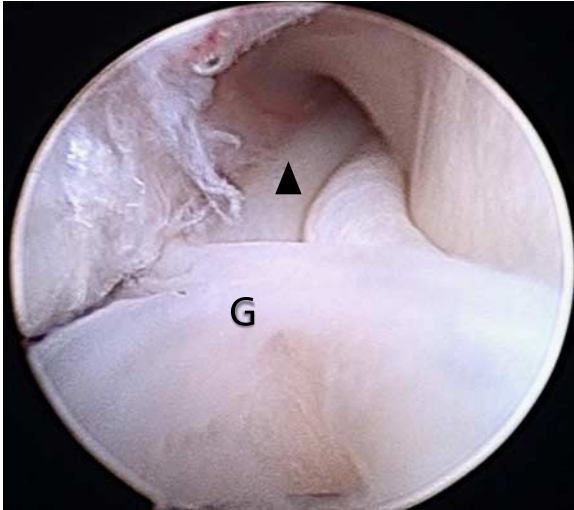


FIGURE 4. Fibro-osseous tunnel with flexor carpi radialis tendon (arrowhead) and ganglion (G).

exposing the FCR tendon remaining radial to the palmar cutaneous nerve and ulnar volar to the wrist deep and superficial branches of the radial artery. Then, the abductor pollicis brevis and the opponens pollicis fascia-muscle soft tissues are split in the FCR volar mid-sagittal plane, exposing the FCR tendon as it courses volar to the scaphoid tubercle and then transitions dorsally to the fibro-osseous FCR tendon sheath at the volar trapezium. Small retractors may be used to laterally retract soft tissues to facilitate insertion of a



FIGURE 6. Ronguer inserted into the trapezial fibro-osseous tunnel to excise calcified sheath, ganglion, or saucerize a prominent trapezial crest.

2.7 mm 30-degree short arthroscope or preferably a smaller arthroscope directed along the volar FCR tendon surface without use of irrigation fluid with or without an attached cannula, allowing visualizing the volar FCR tendon in zone-4 of the carpus. If used, the retractors may be removed, and the scope is advanced distally up to the proximal FCR fibro-osseous tunnel (Fig. 3). All cases revealed stenosis of the FCR fibro-osseous tunnel, preventing engagement or advancement of a 1.0 mm thick probe into the FCR fibro-osseous tunnel. In the cases with associated ganglia of the FCR tendon sheath, ganglia appeared to originate from the stenotic FCR fibro-osseous tunnel with concomitant attritional fraying of the FCR tendon or and the associated sheath (Fig. 4). Using arthroscopic guidance, a flat Arthro-Lok 4.0 mm mini-meniscus blade (Beaver-Visitec International Inc., Waltham, MA) attached to a nondisposable handle was then inserted volar-ulnar and nearly parallel to the arthroscope and advanced with one of the blade

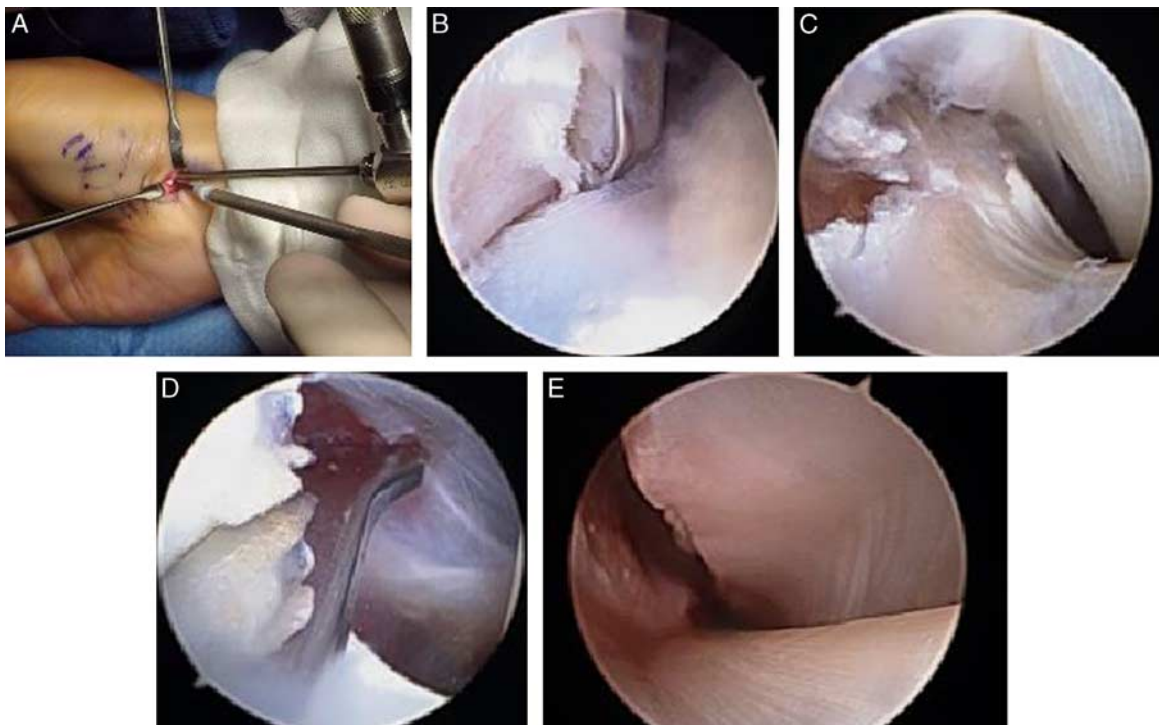


FIGURE 5. A, Insertion of Arthro-Lok blade ulnar to arthroscope. B, Engagement of the fibro-osseous tunnel with a mini-meniscus blade. C, Division of the flexor carpi radialis fibro-osseous tunnel. D, Probe in divided leaves of the fibro-osseous tunnel. E, Decompressed fibro-osseous tunnel with flexor carpi radialis tendon.



FIGURE 7. Volar radial wrist and volar trapezial arthroscopic portal access.

limbs engaged in between the volar-ular fibro-osseous tendon sheath and the more posterior FCR tendon (Fig. 5A). It is necessary that the Beaver blade is inserted volar-ular to the volar-radial located trapezial crest to avoid abutment against a prominent trapezial crest. Otherwise, tenovagotomy will not be possible due to the trapezial crest bony obstruction to the mini-meniscus blade. Once the mini-meniscus blade was inserted and arthroscopic visualization confirmed that there was no adjacent neurovascular or tendons within the division zone, the blade was advanced from proximal to distal using arthroscopic guidance to completely divide the FCR tendon fibro-osseous sheath at the level of the trapezium. This released the FCR tendon from the stenotic fibro-osseous sheath at the trapezium (Figs. 5B–E) and the FCR tendon in all cases changed from a posterior tethered trapezial anatomic position to a slightly anterior position due to the volar proximal scaphoid tubercle displacing the FCR tendon anteriorly.² After complete division of the FCR tendon fibro-osseous sheath, the mini-meniscus blade was removed and an arthroscopic probe was used to mobilize the FCR tendon at the fibro-osseous sheath, confirming that the FCR tendon was not tethered by adhesions or anomalous slips in the fibro-osseous tunnel.^{3,4} If a prominent trapezial encasing crest or a ganglion is unable to be cleared through the single proximal wrist portal using either a 2.0 mm arthroscopic rongeur (Fig. 6) and/or an arthroscopic debrider, then a distal volar



FIGURE 8. Volar 1R trapezial-metacarpal joint access intubated with a 2.5 mm debrider for ganglion ablation.

accessory arthroscopic access is achieved localized over the volar 1R (V1R) TMJ. This V1R TMJ arthroscopic access is created through a 3.0 mm skin incision over the volar ulnar trapezium 5.0 mm volar ulnar to the established V1R TMJ arthroscopic access.⁵ This V1R TMJ incision is just distal to the FCR tendon fibro-osseous sheath and is ~1.5 cm distal to the distal volar wrist skin crease and remains over the mid-sagittal plane of the FCR tendon. Using blunt dissection to laterally displace soft tissues deep to the skin, the FCR tendon, the distal margin of the trapezial FCR fibrous sheath, and the deeper TMJ volar joint capsule are easily reached in <10 mm depth. This approach creates a volar distal access for the insertion of an additional arthroscopic portal for instrumentation that can be interchanged with the wrist arthroscopic portal to treat pathology at the trapezial fibro-osseous sheath or the volar TMJ (Fig. 7). This V1R TMJ access is an anatomically safe zone and does not enter the domain of critical neurovascular and other tendinous structures.^{5–10} Through the V1R TMJ access, a 2.0 mm arthroscopic rongeur and/or a 2.5 mm arthroscopic debrider and/or a 2.0 mm arthroscopic spherical burr may be used to fully clear a ganglion and/or used to excise a calcified fibro-osseous FCR tendon sheath or saucerize a prominent trapezial crest (Fig. 8, Video 1, Supplemental Digital Content 1, <http://links.lww.com/BTH/A99>). The wrist skin wound was approximated with a 6-0 absorbable suture in an interrupted intradermal buried plastic technique, followed by application of skin glue, and bioocclusive water-resistant dressing. If a V1R TMJ accessory arthroscopic access was used, then this wound is approximated with skin glue and bioocclusive water-resistant dressing. After wound approximation(s), volar-based removable wrist-hand splints were applied to allow patient removal for personal hygiene. Splints were used during activities of daily living for 2 weeks postoperatively and then discontinued (Fig. 9). After splint removal, a home exercise program was instructed and performed for each patient in the clinic to restore normal active range of motion of the wrist. Referral to a hand therapist to achieve maximal medical improvement may be necessary, but was not required in this report.

CASE REPORT

Four cases of FCR tendon fibro-osseous sheath stenosis recalcitrant to medical treatment were each treated by the mini-invasive arthroscopic technique. Three cases had associated symptomatic ganglia and one case had an occult-associated symptomatic ganglion originating from the FCR fibro-osseous tunnel that was diagnosed by preoperative noncontrast magnetic resonance imaging. All patients were treated by arthroscopic mini-invasive tenovagotomy of the trapezial fibro-osseous sheath of the FCR tendon, followed by arthroscopic ganglion excision if a ganglion was present. These patients were treated by a single hand surgeon and followed over a 1- to 3-year period. The trapezial crest did not fully encircle the FCR tendon in any case and the FCR tendon fibro-osseous sheath at the level of the trapezium had an average length of 1.0 cm. In all cases, the FCR tendon sheath stenosis was isolated to the fibro-osseous sheath of the trapezium. The FCR tendon did not have tethering adhesions and did not insert into the trapezial fibro-osseous sheath in any of the cases. There were no complications and the postoperative pain in all cases anecdotally was noted to be less in comparison to the larger incisions used in an open technique. There have been no recurrent symptoms of FCR stenosing tenosynovitis or ganglia over the duration of this study.

DISCUSSION

To better understand the anatomy, etiology, and surgical treatment for FCR tendon sheath stenosing tenosynovitis with or without associated ganglia, a Medline literature search from 1968 to 2020 was carried out using the GRADE (Newcastle-Ottawa Scale and the Grading of Recommendations Assessment, Development and Evaluation) tool to obtain the best quality of studies. This review



FIGURE 9. Appearance of wounds and active range of motion 2 weeks postoperatively.

elucidated the unique anatomy of the FCR tendon at the trapezium, listed various etiologies for stenosing tenosynovitis with or without associated ganglia, and reported surgical techniques in the treatment of stenosis of the FCR tendon fibro-osseous tendon sheath with or without associated ganglia.^{1,2,11–18} None of the studies specifically ascribed ganglion caused by stenosis of the FCR tendon fibro-osseous tendon sheath. Instead, the published reports attributed the cause of radial volar wrist ganglia to volar joint capsular disruption, arthritic intercarpal joints, or carpal interosseous ganglia. Human cadaveric studies of the FCR tendon sheath anatomy have revealed that the FCR tendon has a true synovial sheath at the trapezial fibro-osseous tunnel zone of the flexor tendon sheath and that the FCR tendon has the greatest size to volume ratio at the rigid fibro-osseous sheath at the level of the trapezium.^{2,4} The FCR tendon not only has the least amount sheath volume at the trapezial zone but the tendon may also be

constrained by a volar radial-based trapezial crest.² The published surgical literature describes both open and blind mini-invasive techniques for FCR tendon tenovagotomy of the fibro-osseous sheath causing symptomatic stenosing tenosynovitis.^{11–15} However, these studies do not describe arthroscopic excision of ganglion secondary to FCR tendon fibro-osseous tendon sheath stenosis at the level of the trapezium. Instead, these studies describe arthroscopic excision of a palmar and radial wrist ganglia not associated with the FCR tendon fibro-osseous sheath.^{11–15} In contrast, this report describes a mini-invasive arthroscopic technique to treat FCR fibro-osseous tendon sheath stenosing tenosynovitis and ganglia excision that can be facilitated using a newly defined VIR TMJ. The described techniques in this report allows arthroscopic visualization to confirm complete release of the FCR fibro-osseous tendon sheath, identifies and allows arthroscopic treatment of TMJ ganglia that have tract along the FCR

tendon sheath, identifies and allows treatment of FCR tendon adhesion or anomalous FCR tendon insertions at the FCR fibro-osseous sheath that may lead to persistent pain symptoms, and identifies associated tendon sheath ganglia. This minimal invasive technique of arthroscopic visualization of the FCR fibro-osseous tendon sheath likely improves surgical safety by assuring that no neurovascular or tendon soft tissues are in the plane of surgical division of the tendon sheath. In addition, this technique may also reduce the incidence of residual or recurrent pain symptoms by visualizing incomplete FCR fibro-osseous tendon sheath division or unrecognized associated ganglia.

All the cases in this study had FCR tendon stenosing tenosynovitis of the fibrous sheath when there were associated symptomatic ganglia. It was noted that the presence of an associated narrow deep trapezoidal sulcus with a prominent trapezoidal crest was irrelevant when the entire fibro-osseous tunnel sheath was divided. If there is a residual ganglion or/and a prominent trapezoidal crest that is encasing the FCR tendon, then use of the described accessory arthroscopic volar trapezoidal access (V1R TMJ) or an open technique may be necessary to saucerize a prominent trapezoidal crest to achieve complete decompression of the stenotic trapezoidal fibro-osseous sheath and to completely remove an associated ganglion.

CONCLUSIONS

The unique FCR tendon fibro-osseous anatomy at the volar trapezium resulted in symptomatic FCR stenosing tenosynovitis at the trapezoidal fibro-osseous sheath and resulted in the formation of symptomatic associated ganglion cysts. Treatment of symptomatic FCR tenosynovitis with or without associated ganglion cysts by arthroscopic mini-invasive technique with or without use of a newly defined volar trapezoidal arthroscopic access (V1R TMJ) has the following advantages over the open and blind operative technique: visualizes an anatomically restricted area, confirms complete tenovagotomy of the FCR trapezoidal fibro-osseous sheath, assesses for residual FCR tendon adhesions in the trapezoidal fibro-osseous sheath that may cause persistent pain after tenovagotomy, and identifies and treats associated ganglia.

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