



Ultrasound-Guided Partial Release of Transverse Carpal Ligament in Severe Carpal Tunnel Syndrome Using a Curved Needle

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Abstract

Keywords

- carpal tunnel syndrome
- transverse carpal ligament
- partial release

Ultrasound (US) is an excellent tool for diagnosis and management of carpal tunnel syndrome (CTS). Severe, recalcitrant CTS is an indication for complete release of the transverse carpal ligament (TCL). However, complete TCL release may be associated with postprocedural pillar pain. US-guided partial division of the TCL using a curved needle can be a safe and effective technique for reducing the tensile compression onto the median nerve while mitigating the occurrence of pillar pain.

Introduction

Severe carpal tunnel syndrome (CTS) with median nerve cross-sectional area greater than 15 mm² at the tunnel inlet and sensorimotor deficit is an indication for complete release of the transverse carpal ligament (TCL) or the flexor retinaculum.¹ While open surgical and endoscopic release of the TCL are associated with relatively more tissue damage and complications, ultrasound (US) guided carpal tunnel release (CTR) using a commercial grade thread or cutting devices allows for a safer approach.² However, complete release of the TCL is associated with postprocedural pillar pain described as deep-seated pain in the heel of the palm with tenderness over thenar and hypothenar eminences, most frequently seen 6 to 12 weeks after CTR.³ This debilitating complication can be mitigated by partial release of the TCL with a curved needle under US guidance.

Technique

Mapping of Longitudinal and Transverse Safe Zones

Safe zones are areas of entry into the carpal tunnel devoid of neurovascular bundles. The longitudinal safe zone (►Fig. 1) is between the distal limit of the TCL and the superficial palmar arch, while the transverse safe zone (►Fig. 2) is between the medial margin of the median nerve and the lateral margin of the ulnar artery. Contraindications for CTR include longitudinal safe zone of less than 2 mm or transverse safe zone of 0 mm.⁴

Percutaneous Needle Entry into the Carpal Tunnel

A 3-cm-long 21-gauge hypodermic needle is bent at its midpoint using artery forceps giving it a smooth curve angled at 30 degrees with the horizontal plane with the needle bevel facing downward. After injecting the skin with local anesthetic (1% lignocaine), the curved needle is

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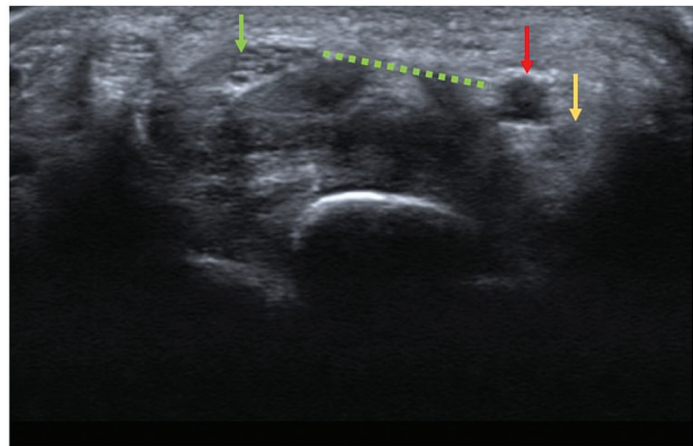
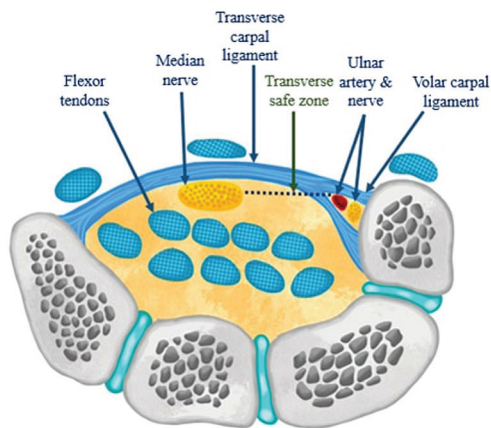


Fig. 1 Transverse schematic and ultrasound image at the level of carpal tunnel inlet showing the transverse safe zone (green arrow: median nerve; dotted green line: transverse safe zone; red arrow: ulnar artery; yellow arrow: ulnar nerve).

inserted through the skin of the palm and placed underneath the TCL above the flexor tendons under US guidance (**Fig. 3A**) after hydrodissection with 1% lignocaine. The needle position is then confirmed in the mid-part of the transverse safe zone.

Partial Release of Transverse Carpal Ligament

The hub of the curved needle is pushed in a downward direction causing upward motion of the needle tip, which then abuts the deep fibers of the TCL (**Fig. 3B**). Subsequent to-and-fro movement of the needle leads to release of the deep TCL fibers. This process is repeated until there is graded division of the deeper two-thirds thickness of the TCL with intact superficial one-third fibers (**Fig. 3C**), which is confirmed in the transverse plane (**Fig. 3D**).

Postprocedure Care

Rest is provided to the affected wrist with a wrist brace for 2 days, and heavy hand grips are avoided. The patient is instructed to perform range-of-motion (ROM) exercises of the fingers after the day of the procedure with no flexion or extension at the wrist.

Postprocedure Follow-up

Follow-up is conducted after 6 weeks and improvement is assessed using the postprocedural visual analog scale (VAS) and the Boston Carpal Tunnel Questionnaire (BCTQ).

Discussion

Severe CTS is managed by complete transection of the TCL by open surgical, endoscopic, or US-guided techniques. However, this can lead to postprocedural pillar pain, which has various etiologies including neurogenic (damage to the palmar cutaneous and thenar branch of the median nerve and the Berrettini branch), biomechanical (mechanical disruption of the carpal tunnel), and inflammatory (tissue disruption and edema).³ Partial release of the TCL is effective in significantly reducing the neuro-pathic pain in severe CTS by decreasing tensile compression onto the median nerve with single needle entry point under continuous US guidance. While Lee et al achieved successful clinical outcomes with release of the superficial fibers of the TCL, our institutional experience suggests dividing the deeper fibers to prevent potential injury to

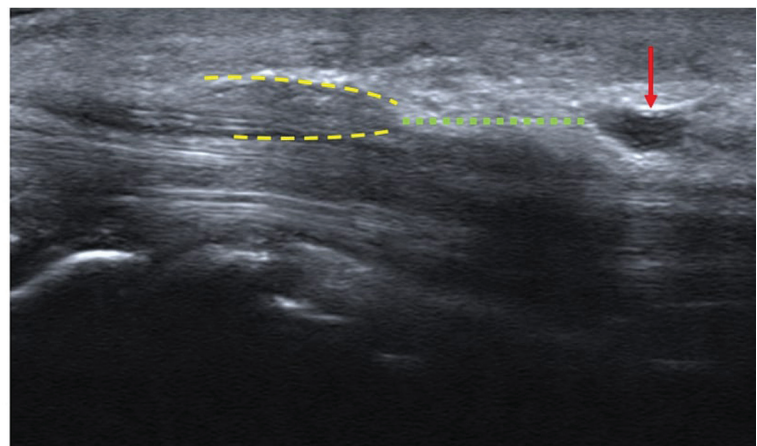
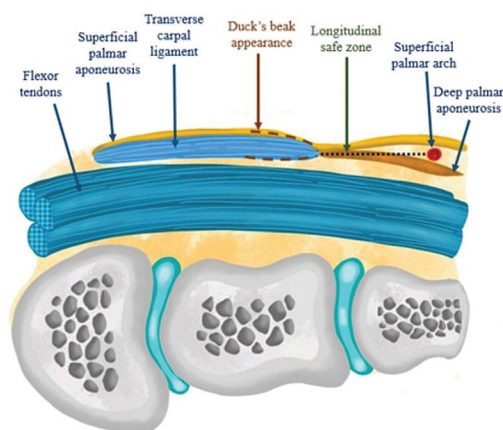


Fig. 2 Longitudinal schematic and ultrasound image of the carpal tunnel showing the longitudinal safe zone and duck's beak appearance of the convergence of the distal transverse carpal ligament and the superficial palmar aponeurosis (dotted yellow lines: duck's beak; dotted green line: longitudinal safe zone; red arrow: superficial palmar arch).

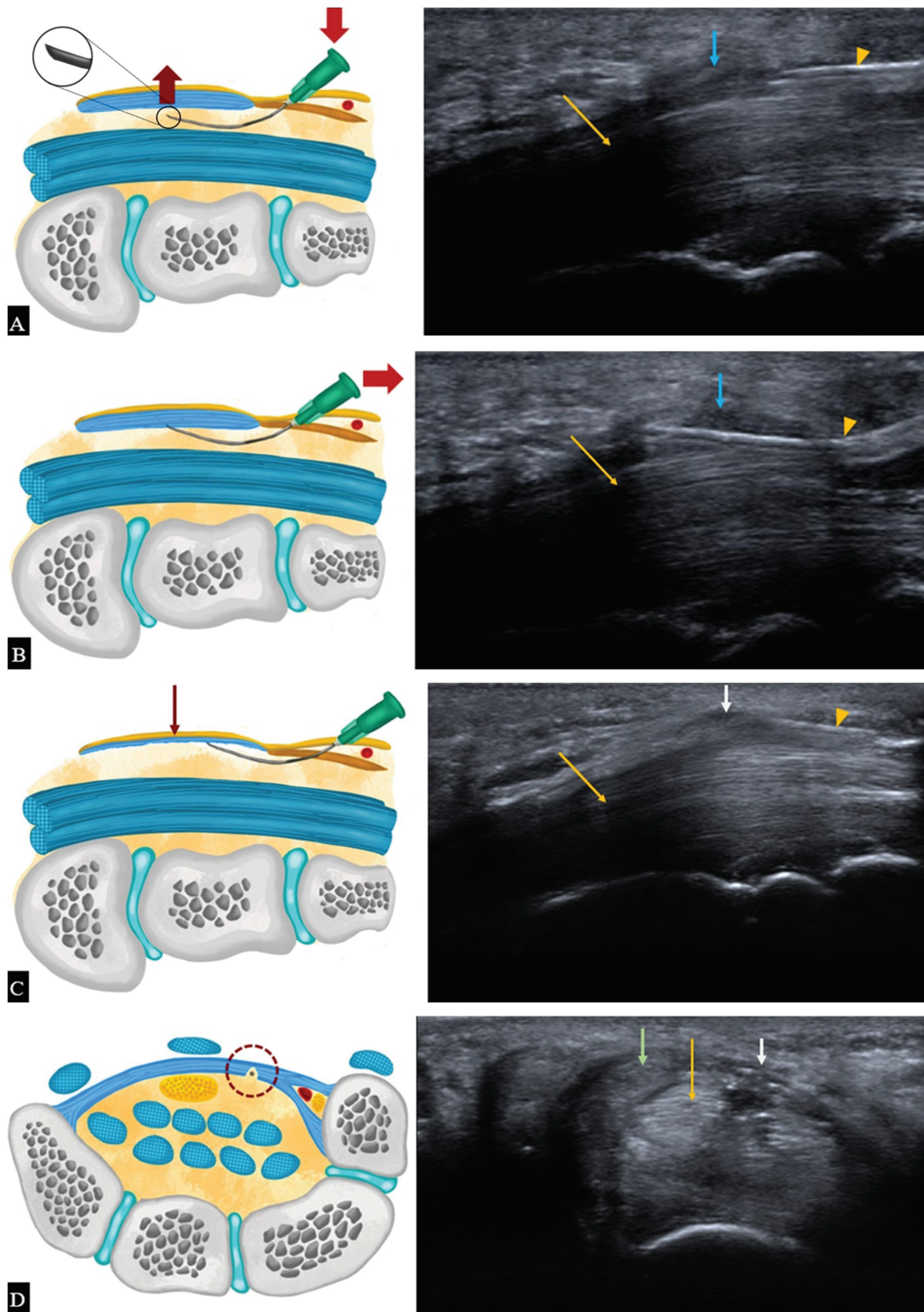


Fig. 3 Schematic and ultrasound images of partial transverse carpal ligament (TCL) release using a curved needle. (A) Needle entry through the longitudinal safe zone with direction of needle motion (inset shows needle bevel facing downward). (B) Needle tip abutting deep the TCL fibers. (C) Graded division of deep two-thirds fibers of the TCL. (D) Confirmation of partial TCL transection in the mid-part of transverse safe zone (*thick red arrows*: needle movement direction; *yellow arrow*: flexor tendons; *yellow arrowhead*: needle; *blue arrow*: intact TCL; *white arrow*: partially transected TCL; *green arrow*: median nerve).

the palmar cutaneous and thenar branches of the median nerve and the Berrettini branch.⁵ Partial CTR using this technique was performed in a cohort of 10 patients with severe CTS at our institution (preprocedural VAS score of 7–9 and BCTQ score of 47–51) with a significant reduction in postprocedural VAS score (0–1) and BCTQ score (11–13) at 6 weeks of follow-up, resolution of sensorimotor deficit (s), and no complaints of pillar pain. Complications such as injury to the median nerve or ulnar artery can occur in case of narrow safe zones. The probability of not achieving an adequate clinical outcome can occur in cases of chronic, marked thickening of the TCL and thrombosed persistent median artery.

Conclusion

US-guided partial release of the TCL using curved needle is a safe and effective treatment for severe CTS while mitigating the probability of pillar pain.

Note

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Conflict of Interest

None declared.

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