

Technical Note

A mini-incision carpal tunnel release technique to prevent pillar pain: A technical note

Julio Morán-Morán¹ , José Ramón Mérida-Velasco² , Emilio Bartolomé del Valle³ ,
Jorge Murillo-González²

¹Clinic of Orthopedic Surgery and Traumatology, University General Hospital "Gregorio Marañón", Madrid, Spain

²Department of Anatomy and Embryology, Complutense University of Madrid, School of Medicine, Madrid, Spain

³Retired from Hospital Nuestra Señora del Rosario, Madrid, Spain

ARTICLE INFO

Article history:

Submitted March 28, 2020

Received in revised form

May 20, 2020

Last revision received

October 15, 2020

Accepted December 12, 2020

Keywords:

Carpal tunnel syndrome

Carpal tunnel release

Mini-incision approach

Pillar pain

ORCID iDs of the authors:

J.M.-M. 0000-0003-3128-9460;

J.R.M.-V. 0000-0002-8778-501X;

E.B.d.V. 0000-0001-8356-268X;

J.M.G. 0000-0002-3455-2378.

Corresponding Author:

Jorge Murillo-González

jmurillo@ucm.es



Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

ABSTRACT

Pillar pain represents one of the most common complications of classic open carpal tunnel release (CTR). This complication causes a sense of discomfort worse than the compression syndrome itself. We, herein, introduce a new treatment method for CTR through a mini-incision, which allows subcutaneously cutting the transverse carpal ligament (TCL) and releasing the median nerve without neurovascular complications. This mini-incision approach can allow the direct visualization and preservation of the thenar motor branch in those rare cases where it has an aberrant origin. For the past 10 years, we have consecutively performed this technique in the surgical treatment of 318 patients with the diagnosis of primary CTS, without developing any neurovascular and tendon injuries as well as pillar pain.

Introduction

The classic open carpal tunnel release (CTR) with a long incision is associated with some complications. The most frequent is scar tenderness (incidence ranges from 19 to 61%) (1), whereas the most feared is pillar pain (2). The patients who suffer from these complications cannot return to their normal activities for weeks or months (3). Scar tenderness can be tolerated by the patient, but pillar pain can be unbearable. Pillar pain was defined as a deep-seated ache or pain over the thenar or hypothenar region or both (4). For some unknown reason, a sensation of allodynia (normal touch becomes pain) emerges, causing symptoms that are experienced by the patient as something worse than the compression syndrome itself. It has been proposed that this complication may be due to a technical defect; an injury of small sensorial branches from the ulnar and median nerves or neuromas maybe present in the subcutaneous tissue (2, 5). The true incidence of pillar pain is not clear. Some surgeons previously suggested that most pillar pain would disappear within 6 months (6). Povlsen and Tegnell (7) monitored the incidence of pillar pain after open release for three years. They found incidences of 41% at 1 month, 25% at 3 months, 6% at 12 months, and 6% at 36 months.

To attempt performing CTR without complications, several mini-incision approaches have been defined.

Bai et al. proposed a new mini-incision approach with satisfactory surgical outcomes, low postoperative complications including pillar pain, and a good appearance (8).

This study aims to introduce a new method to perform CTR through a mini-incision approach, similar to that of Bai et al. (8), but with some advantages. This new method allows release of the median nerve and is intended to avoid pillar pain complication.

Surgical technique

The proposed method for carrying out the CTR has been performed by the same surgeon in our institution and was executed in 318 patients diagnosed with primary CTS between 2009 and 2018.

All patients were operated under pneumatic tourniquet with loupe magnification. To delimit the incision, 4 lines were drawn: a line for the wrist's distal fold of flexion, the line of Kaplan, a line that borders the thenar eminence, and a line that borders the hypothenar eminence. In this way, an area in the form of an hourglass is defined. This space is divided into two equal halves, one proximal and one distal, selecting the distal half. In this small area, a 1.5 cm longitudinal line is drawn, equidistant to the 4 lines that delimit it. The skin is incised 1.5 cm and opened deepening to the superficial palmar fascia with a number 15 scalpel (Figure 1). The superficial palmar fascia and the underlying fibrous tissue are carefully incised. Once the flexor retinaculum has been perforated and we are inside the carpal tunnel, we change the scalpel for scissors with blunt tips (Metzenbaum). A horizontal dissection of the virtual space between the superficial palmar fascia and the subcutaneous tissue as well as below the flexor retinaculum is carried out (Figure 2). This allows to release possible adhesions before dividing the flexor retinaculum. The critical point comes



Figure 1. Anterior view of the right hand. The incision designs



Figure 2. Anterior view of the right hand. Horizontal dissection of the virtual space between the superficial palmar fascia and the subcutaneous tissue

HIGHLIGHTS

- Minimisation of the injury of the palmar cutaneous branches of the median and ulnar nerves, since the skin of the pillar is not affected.
- The direct visualisation of the distal part of the transverse carpal ligament, avoiding the possibility of incomplete opening.
- The control by direct visualisation of the superficial palmar arterial arch.
- The direct visualisation and protection of the thenar motor branch in those rare cases where it originates from the ulnar side of the median nerve and crosses his anterior side perpendicular to the incision of the flexor retinaculum (2.1%).
- The postoperative period had no case of pillar pain.

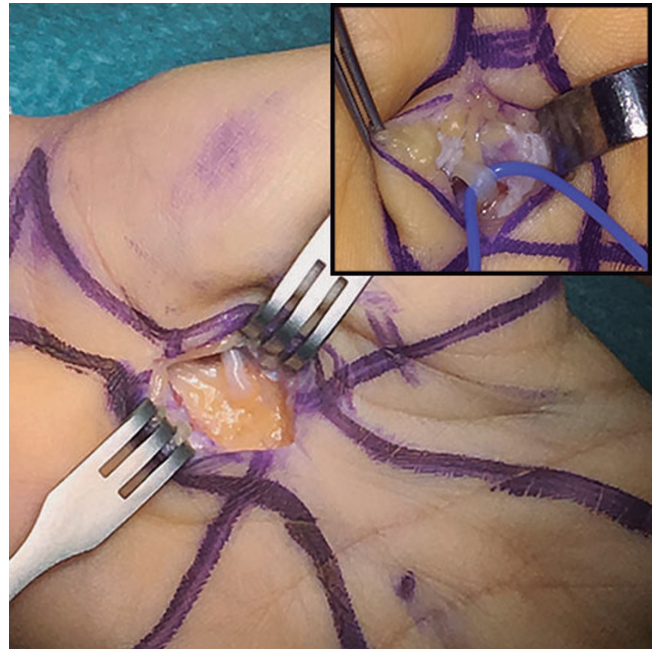


Figure 3. Anterior view of the left hand. Anomalous origin of the thenar motor branch of median nerve arising from the ulnar side and crossing anteriorly. Inset correspond to the thenar motor branch over the blue cord

when we open the branches of the scissors enough to accommodate the flexor retinaculum between them. Without closing the scissors, surgeons apply direct pressure from distal to proximal approaching their hand to that of the patients'. Special care has to be made not to direct the scissors in a radial or ulnar direction. The pressure of sharp edges on a tense fibrous structure divides it as if it were a paper. The opening of the tunnel is verified, and the indemnity and mobility of the recently released median nerve are also verified. The wound is closed with 3 or 4 mattress points. A compressive dressing of the hand and wrist is carried out. Post-operative finger exercises are started on the same day. There was rapid wound recovery with minimal postoperative pain and scarring. After 10-12 days, the stitches are removed, and a return to normal life is recommended progressively. The patients were assessed at regular intervals after surgery (3 months, 6 months, and 12 months) for hand functions and subjective symptoms, in particular pillar pain. The mean follow-up was 12 months. Pillar pain was evaluated using the application of direct pressure or pinching force on the thenar and hypothenar regions (9). When evaluating pillar pain, application of thenar/hypothenar pressure was negative at every interval in 100% of patients.

Discussion

In the last two decades, there have been attempts to perform CTR without complications, leading to the development of different endoscopic techniques and several mini-incision approaches.

In practical terms, the choice of open or endoscopic technique remains based on surgeon preference, his or her experience, and the dexterity of the technique, taking into account that there are no significant differences between these approaches, with respect to work reinsertion and complications, but the learning curve is longer in the endoscopic technique (5).

Bai et al. compared a new mini-incision approach with the conventional one (8). They revealed that patients with the mini-incision approach have satisfactory surgical outcomes, low postoperative com-

plications including pillar pain, and good wound appearance. At the 12-month follow-up, no patients showed wound or pillar pain.

Here, we propose a distal mini-incision approach, similar to that of Bai et al. (8), but with some advantages. Our mini-incision, as Bai's, is located over the distal part of the transverse carpal ligament (TCL), avoiding the "heel" of the palm. This is the site where conventional incisions seem to cause pillar pain. This location minimizes the injury of the palmar cutaneous branches of the median and ulnar nerves, as the skin of the pillar is not affected. With respect to one proximal mini-incision (over the TCL), the proposed distal mini-incision is associated with less incision-related morbidity (10). In addition, the proposed distal mini-incision coincides with the safe zone for carpal tunnel surgery proposed by Özcanlı et al. (11).

The main differences between the mini-incision approach proposed by us and the one proposed by Bai et al. (8) are as follows: 1) No specific instruments are required (Bai's technique requires a special metallic guide). This allows our technique to be accessible in any operating room and 2) direct vision of the carpal tunnel and its structures is improved: there is no interference with any type of added instruments.

Our novel approach allows: 1) direct visualization of the distal part of the TCL, avoiding the possibility of incomplete opening, as this is the area most frequently involved in the CTS and the most difficult to open; 2) direct visualization, when it exists, of a muscle overlying the distal TCL; 3) control by direct visualization of the superficial palmar arterial arch; and 4) direct visualization and protection of the thenar motor branch in those rare cases where it originates from the ulnar side of the median nerve and crosses its anterior side perpendicular to the incision of the flexor retinaculum (Figure 3). This variation, with an incidence of 2.1% (12), entails a greater risk of injuring the thenar motor branch during the CTR procedures when the branch passes unnoticed. In 13-18.2% of hands, we observe the presence of a muscle overlying the distal TCL (12, 13). This muscle has an anomalous origin of thenar (in 85% of cases) or hypothenar muscles (14, 15). In 93% of cases, it has been reported that an anomalous course of the thenar motor branch was associated with this anomalous muscle (14). During CTR, routine dissection of the recurrent motor branch is unnecessary. However, the presence of a muscle spanning the distal margin of the TCL should serve as a warning sign for potential thenar motor branch variant. Transection of the TCL should not proceed until the motor branch is identified (14).

Conclusion

Our mini-incision CTR technique allows cutting the TCL and releasing median nerve, without complication of pillar pain.

Informed Consent: Informed consent was obtained from the patients.

Author Contributions: Concept - J.M.-M., J.M.-G.; Design - J.M.-M., J.M.-G.; Supervision - J.M.-M., J.R.M.-V., E.B.d.V., J.M.G.; Data Collection and/or Processing - J.M.-M.; Analysis and/or Interpretation - J.M.-M., J.R.M.-V., J.M.-G.; Literature Review - J.M.G.; Writing - J.M.G.; Critical Review - J.M.-M., J.R.M.-V., E.B.d.V., J.M.G.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: This work was supported by grant number 143/2017 from the Complutense University of Madrid.

References

1. Kluge W, Simpson RG, Nicol AC. Late complications after open carpal tunnel decompression. *J Hand Surg Br* 1996; 21: 205-7. [\[Crossref\]](#)
2. Ludlow KS, Merla JL, Cox JA, Hurst LN. Pillar pain as a postoperative complication of carpal tunnel release: a review of the literature. *J Hand Ther* 1997; 10: 277-82. [\[Crossref\]](#)
3. Alizadeh K, Lahiji F, Phalsaphy M. Safety of carpal tunnel release with a short incision. A cadaver study. *Acta Orthop Belg* 2006; 72: 415-9.
4. Yung PS, Hung LK, Tong CW, Ho PC. Carpal tunnel release with a limited palmar incision: clinical results and pillar pain at 18 months follow-up. *Hand Surg* 2005; 10: 29-35. [\[Crossref\]](#)
5. MacKenney-Carrasco E, Sous-Sánchez E. Tratamiento quirúrgico del síndrome del túnel carpiano. *Arthros* 2014; 10: 5-13.
6. Halikis MN, Taleisnik J, Szabo RM. Compression neuropathies of the upper extremity. Chapman MW, ed. *Chapman's Orthopaedic Surgery*. Philadelphia: Lippincott Williams & Wilkins; 2001: pp. 1560-61.
7. Povlsen B, Tegnell I. Incidence and natural history of touch allodynia after open carpal tunnel release. *Scand J Plast Reconstr Surg Hand Surg* 1996; 30: 221-5. [\[Crossref\]](#)
8. Bai J, Kong L, Zhao H, et al. Carpal tunnel release with a new mini-incision approach versus a conventional approach, a retrospective cohort study. *Int J Surg* 2018; 52: 105-9. [\[Crossref\]](#)
9. Wilson KM. Double incision open technique for carpal tunnel release: an alternative to endoscopic release. *J Hand Surg Am* 1994; 19: 907-12. [\[Crossref\]](#)
10. Bal E, Pişkin A, Ada S, Ademoğlu Y, Toros T, Kayalar M. Comparison between two mini incision techniques utilized in carpal tunnel release. *Acta Orthop Traumatol Turc* 2008; 42: 234-7. [\[Crossref\]](#)
11. Özcanlı H, Coşkun NK, Cengiz M, Oğuz N, Sindel M. Definition of a safe-zone in open carpal tunnel surgery: A cadaver study. *Surg Radiol Anat* 2010; 32: 203-6. [\[Crossref\]](#)
12. Henry BM, Zwinczewska H, Roy J, et al. The prevalence of anatomical variations of the median nerve in the carpal tunnel: a systematic review and meta-analysis. *PLoS One* 2015; 10: e0136477. [\[Crossref\]](#)
13. Jegal M, Woo SJ, Lee HI, Shim JW, Shin WJ, Park MJ. Anatomical relationships between muscles overlying distal transverse carpal ligament and thenar motor branch of the median nerve. *Clin Orthop Surg* 2018; 10: 89-93. [\[Crossref\]](#)
14. Green DP, Morgan JP. Correlation between muscle morphology of the transverse carpal ligament and branching pattern of the motor branch of median nerve. *J Hand Surg Am* 2008; 33: 1505-11. [\[Crossref\]](#)
15. Hollevoet N, Barbaix E, D'herde K, Vanhove W, Verdonk R. Muscle fibres crossing the line of incision used in carpal tunnel decompression. *J Hand Surg Eur* 2010; 35: 115-9. [\[Crossref\]](#)