



Technical Note

Minimally invasive carpal tunnel release: A clinical case study and surgical technique

Sunton Wongsiri^a, Peem Sarasombath^b, Wongthawat Liawrungrueang^{c,*}^a Department of Orthopaedics, Faculty of Medicine, Prince of Songkla University, Hat Yai, Thailand^b Department of Orthopaedics, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand^c Department of Orthopaedics, School of Medicine, University of Phayao, Phayao, Thailand

ARTICLE INFO

Keywords:

Carpal tunnel syndrome
 Single limited incision
 Carpal tunnel release
 Surgical technique
 Minimally invasive carpal tunnel release

ABSTRACT

Introduction and importance: Carpal tunnel syndrome (CTS) is the most prevalent type of median nerve entrapment neuropathy. CTR surgery with a single limited incision is becoming more widely accepted. A better recovery, less pillar pain, less scarring, and an earlier return to work are the key benefits of single limited incision. This study provides an inquiry report on the surgical method, surgical advice, and outcomes of single limited incision minimally invasive carpal tunnel release for CTS.

Case presentation: A 60-year-old female developed carpal tunnel syndrome (CTS). Patient received minimally invasive carpal tunnel release using single limited incision following the failure non operative treatment and the patient was able to return to work with excellent 1-year outcomes. The patient was extremely satisfied with this operative technique.

Clinical discussion: This case highlights a successful outcome of a minimal invasive surgery in CTS. Visual efficiency during surgery and full transverse carpal ligament release are both improved with this technique which requires only a single limited incision. The transverse carpal ligament is totally released with this approach. During the operation, median nerves and superficial palmar arches are not injured.

Conclusion: This technique has been shown to be effective and safe for minimal invasive surgery. This technique could be of interest to surgeons performing minimal invasive surgery who treat CTS.

1. Introduction

Carpal tunnel syndrome (CTS) is the most prevalent type of median nerve entrapment neuropathy. In the general population, it is found in 3–5% of cases [1,2]. Mild symptoms may initially be managed with non-operative treatment. If symptoms such as muscle weakness, decreased handgrip strength, or drooping become more frequent or persistent, surgical treatment may be necessary [2,3]. In 20% of people with the disease, surgery is required [4]. When conservative treatment fails, a surgeon can perform an open carpal tunnel release (CTR). Currently, it is acknowledged that surgical management is more successful than non-operative treatment [1,5]. CTR surgery with a single limited or small incision is becoming more widely accepted [4,6,7]. A better recovery, less pillar pain, less scarring, and an earlier return to work are the key benefits of single limited incision [1,7]. This study provides an inquiry report on the surgical method, surgical advice, and outcomes of single limited incision minimally invasive carpal tunnel

release for CTS. This work has been reported in accordance with SCARE criteria [8].

2. Case presentation

A 60-year-old female patient complained of numbness in her right thumb, index and middle fingers including a decrease in her grip strength, which had started 9 months before. She was no underlying disease, previous surgery or history of hand injury. She did not smoke, consume alcohol, or use recreational drugs. Physical examination found her initial vital signs, mental state and hand function to be normal. She had previously received non-operative treatment including a night wrist splint and oral medication. During a comprehensive physical examination, the Tinel sign was detected. Both the Phalen test and the Durkan compression were positive. Electrophysiological testing revealed that CTS of the left wrist to be the underlying condition. On the plain film radiograph, there were no visible defects or deformities. We decided a

* Corresponding author.

E-mail address: mint11871@hotmail.com (W. Liawrungrueang).<https://doi.org/10.1016/j.amsu.2022.104950>

Received 8 September 2022; Received in revised form 25 October 2022; Accepted 12 November 2022

Available online 17 November 2022

2049-0801/© 2022 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

single limited incision for CTR was most appropriate and the patient agreed to this surgical technique. Indications for surgery in this patient were a diagnosis of CTS with thenar muscle atrophy and severe median nerve entrapment neuropathy. Following an explanation of the surgical options, the patient decided on minimally invasive carpal tunnel release using single limited incision following the failure non operative treatment with a neutral wrist splint at night and medication. Limited incision carpal tunnel release can be carried out either under local or general regional anesthesia using a tourniquet to regulate hemostasis. Using the landmark provided by Kaplan's cardinal line, the surface anatomy of the hand and wrist were identified, and the incision was made. The surface anatomy landmark and deep structure of the hand and wrist are shown in Fig. 1. The line between the middle and ring fingers along the wrist crease determined the incision direction. A 1.5–2.0 cm incision was made distally from the wrist crease to achieve a limited incision carpal tunnel release (Fig. 2A). Senn retractors were used to retract the palmaris longus tendon and the transverse carpal ligament which were then visible at the base. Metzenbaum scissors were used to provide a gap between the palmaris longus tendon and palmar aponeurosis as a working space. Then the Metzenbaum scissors were used to expand the space for insertion of the carpal tunnel retractor (Fig. 2B). The carpal tunnel retractor was placed in the area between and under the palmaris longus tendon and the palmar aponeurosis. From the bottom, the transverse carpal ligament's fiber could be seen. The soft tissue around the working area was visible and could be protected. The transverse carpal ligament was incised longitudinally at the top with a scalpel to make a long groove to act as a cutting guide and to reduce transverse carpal ligament prominence. The transverse carpal ligament was then cut at the distal end to allow entry, and the fibrous tissue from the median nerve and the transverse carpal ligament were separated using a freer (Metzenbaum) scissors (Fig. 2C). The transverse carpal ligament could be seen under the carpal tunnel retractor (Fig. 3A). The transverse carpal ligament was cut from distal to proximal following the groove with the transverse carpal ligament cutting blade pressed straight until the antebrachial fascia was 2.0–3.0 cm proximal to the wrist crease (Fig. 3B). This described technique reduced the risk of median nerve injury because the surgeon used a scalpel or scissors to cut the transverse carpal ligament while protecting the median nerve with a McDonald or freer. Finally, complete release was verified by direct visual observation using a probe or a freer. The transverse carpal ligament could be clearly seen through the limited incision (Fig. 3C). Nylon 4–0 vertical mattress sutures were used to closure the wound. A compression bandage was used after the surgical incision was closed. A graphic presentation of this surgical technique is shown in Fig. 4. All of operation's steps were

performed by experienced surgeon (WL and SW). Following the use of this technique, the patient had no postoperative complications. She was able to undertake light-duty activity after three days. The sutures were removed on the seventh day, and she was able to return to work after two weeks. The patient was asymptomatic and normal function at the 1 year follow-up. The patient was extremely satisfied with treatment and could improve her symptoms.

3. Discussion

CTS is a frequently observed nerve entrapment condition, found particularly in an aging population. Numbness, tingling, and discomfort in the hand are all signs of CTS, especially in cases where the median nerve is affected [1,9]. The symptoms are usually most severe at night, but in a person with a physically active job, they might also be present throughout the day. Driving or carrying a book, newspaper, or phone can increase the severity of the symptoms. Appropriate therapy can stop this condition from progressing and causing lifelong impairment [3,4]. Although many individuals require surgery, conservative treatment may be adequate in some cases. When surgery is indicated, either open or endoscopic surgery may be used. By splitting the transverse carpal ligament and the antebrachial fascia, both approaches aim to relieve pressure on the median nerve at the wrist [9]. When conservative treatment fails, the surgeon can perform an open CTR. Surgical management is now recognized to be more effective than non-surgical treatment [1,7].

Standard conventional open surgery is a routine procedure that includes a 5–7 cm incision and results in effective CTR; however, postoperative wound complications are more common with that method than with minimally invasive carpal tunnel surgery [7,10]. Wound infection, inflammation, wound dehiscence, and painful scarring are the most frequent wound consequences of open surgery. Several new minimally invasive surgical procedures have been developed and are currently “competing” for the title of most effective method of CTR. Surgeons have modified various approaches to minimize wound problems, painful scars, and other complications [1,10]. The limited incision carpal tunnel release approach and technique has been shown to have increased the efficacy compared to the standard incision of open release for CTS and has proven both practical and productive [1,3,10]. Minimally invasive carpal tunnel surgery has been developed to enhance vision and is a key surgical technique for complete release.

Clear visualization and thorough release are essential components of a successful CTR. The use of particular methods and tools has improved transverse carpal ligament cutting and visualization [1,11]. With

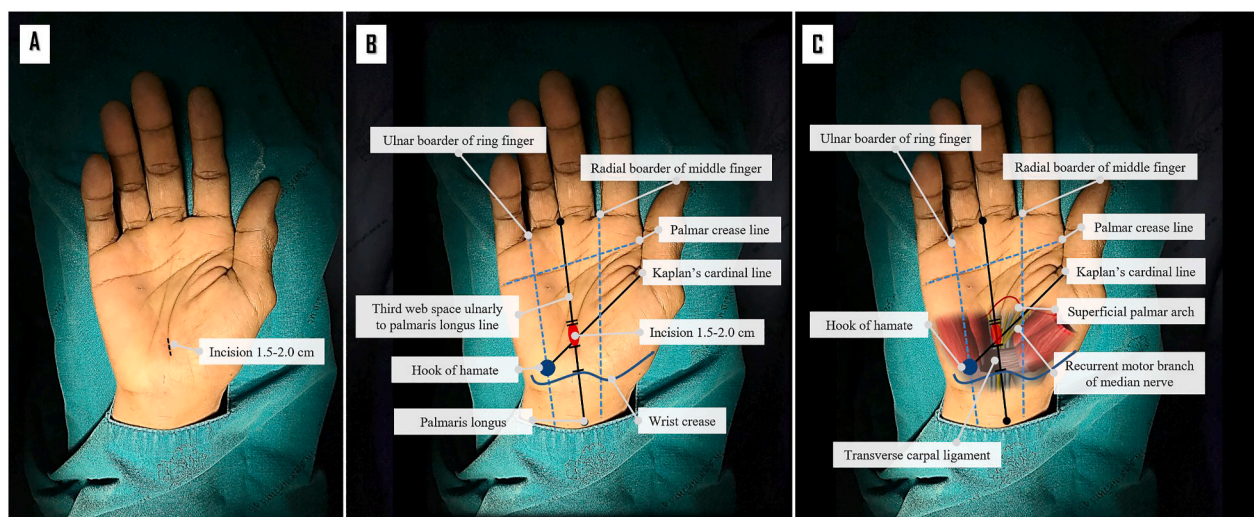


Fig. 1. The limited incision (A), surface anatomy landmarks of hand and wrist (B), demonstration of the deep structure of the carpal tunnel area (C).

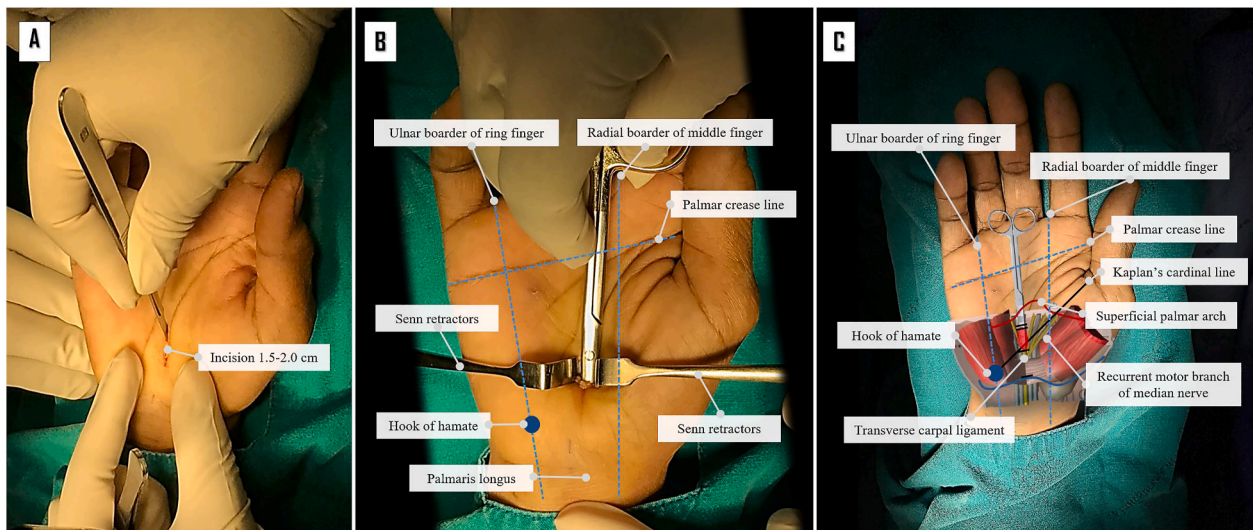


Fig. 2. 1.5–2.0 cm. incision created (A), Metzenbaum scissors created working space (B), separation of the median nerve and transverse carpal ligament using freer (Metzenbaum) scissors (C).

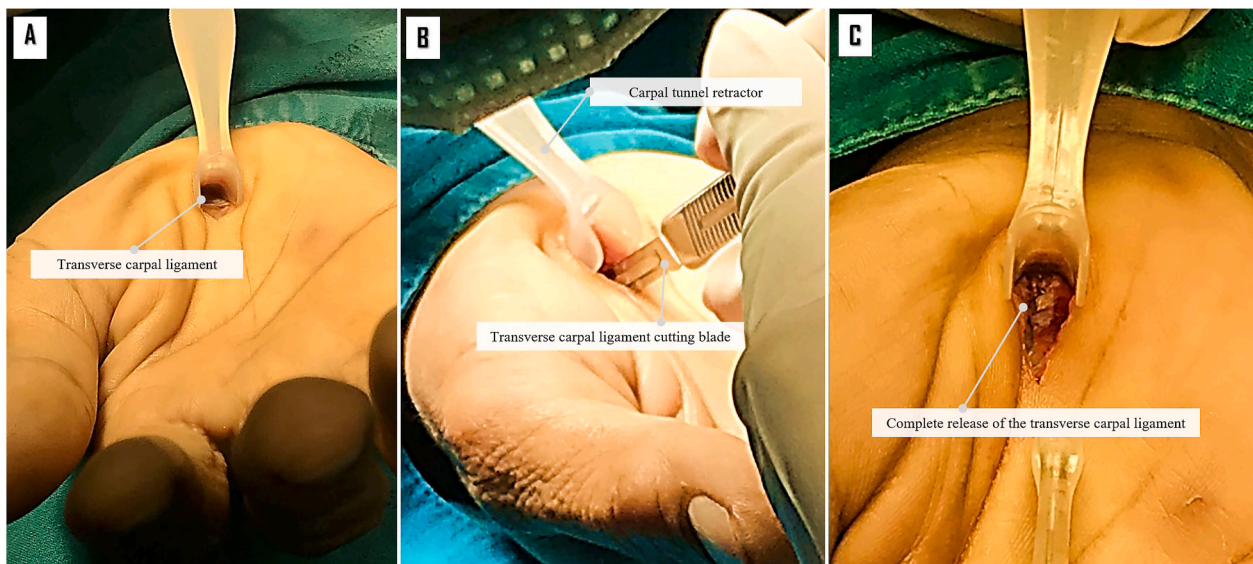


Fig. 3. Transverse carpal ligament before cutting (A), transverse carpal ligament cutting blade pressed straight until the antebrachial fascia was 2.0–3.0 cm proximal to the wrist crease (B), verification of transverse carpal ligament after cutting (C).

tailored designs for CTS, the visual enhancement makes it easier to avoid having the blade damage structural elements. Current minimally invasive carpal tunnel surgery procedures, such as mini-open surgery, keyhole surgery and endoscopic surgery, have had fewer wound problems and have allowed patients to return to work sooner than open surgery [1,10,11]. Minimally invasive carpal tunnel surgery does, however, have other risks, such as recurring events and partial release. However, as reported in our previous study [3], limited incision carpal tunnel release in cadaveric live surgery done by highly experienced hand surgeons was effective in achieving a complete cut of the transverse carpal ligament without injury to the recurrent branch of the median nerve or superficial palmar arches. The limited incision technique has been shown to be effective and safe for MIS. We believe that our technique could be of interest to surgeons performing MIS who treat CTS.

4. Conclusion

CTR surgery with a single limited or small incision is becoming more

widely accepted as it involves less scarring, less pillar pain, rapid recovery, and an earlier return to work, key benefits of a single limited incision. This surgical technique could be considered an option for the MIS.

Ethical approval

This study has been waived ethical approved for this clinical case study by the ethical committees in accordance with the declaration of Helsinki.

Funding

No particular grant was given to this research by any funding organizations in the public, private, or nonprofit sectors.

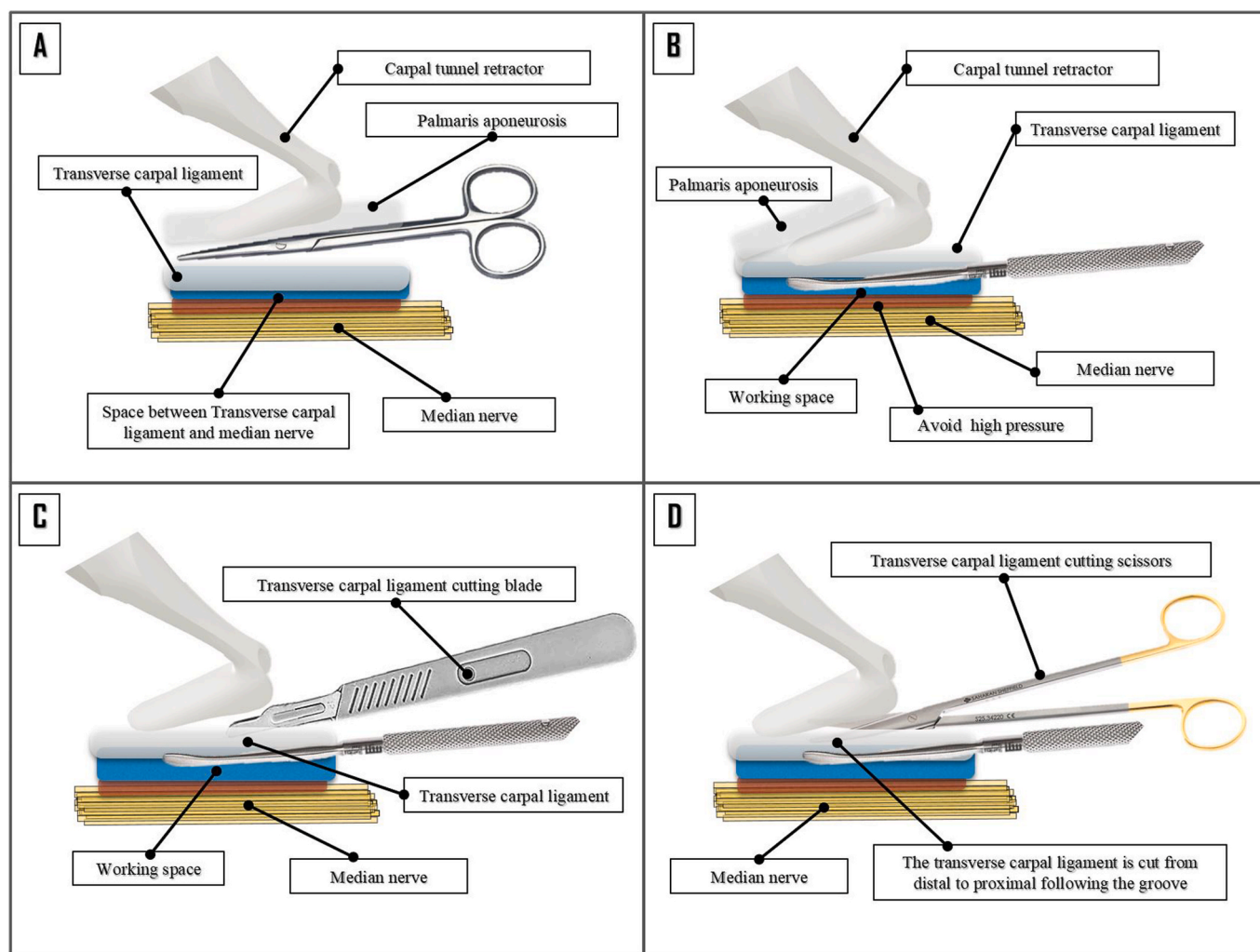


Fig. 4. Using Metzenbaum scissors to create a superior space (A), transverse carpal ligament and median nerve separated with a freer (B), a No.15 cutting blade (C) or small scissors (D) with protecting the median nerve by McDonald or freer is pushed straight to cut the transverse carpal ligament from distal to proximal along the groove until the antebrachial fascia is 2–2.5 cm proximal to the wrist crease.

Author contribution

Sunton Wongsiri: Writing- original draft, Visualization, Data curation.

Peem Sarasombath: Resources, Data curation, Writing-review & editing.

Wongthawat Liawrungrueang: Writing- original draft, Conceptualization, Methodology, Visualization, Writing-review & editing and revision the final version for publication.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in Chief of this journal upon request.

Registration of research studies

None.

Guarantor

Sunton Wongsiri, M.D. and Wongthawat Liawrungrueang, M.D.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104950>

References

- [1] S. Wongsiri, W. Liawrungrueang, Minimally invasive carpal tunnel release (CTR) using the Wongsiri technique with MiniSURE, *Adv. Orthop.* 2020 (2020), 6273723, <https://doi.org/10.1155/2020/6273723>.
- [2] L. Padua, D. Coraci, C. Erra, C. Pazzaglia, I. Paolasso, C. Loreti, et al., Carpal tunnel syndrome: clinical features, diagnosis, and management, *Lancet Neurol.* 15 (2016) 1273–1284, [https://doi.org/10.1016/S1474-4422\(16\)30231-9](https://doi.org/10.1016/S1474-4422(16)30231-9).
- [3] W. Liawrungrueang, S. Wongsiri, Effectiveness of surgical treatment in carpal tunnel syndrome mini-incision using MIS-CTS kits: a cadaveric study, *Adv. Orthop.* 2020 (2020), 8278054, <https://doi.org/10.1155/2020/8278054>.
- [4] M. Fajardo, S.H. Kim, R.M. Szabo, Incidence of carpal tunnel release: trends and implications within the United States ambulatory care setting, *J. Hand Surg.* Hand 37 (2012) 1599–1605, <https://doi.org/10.1016/j.jhssa.2012.04.035>.

- [5] L. Wang, Guiding treatment for carpal tunnel syndrome, *Phys. Med. Rehabil. Clin* 29 (2018) 751–760, <https://doi.org/10.1016/j.pmr.2018.06.009>.
- [6] K.K. Teh, E.S. Ng, D.S.K. Choon, Mini open carpal tunnel release using Knifelight: evaluation of the safety and effectiveness of using a single wrist incision (cadaveric study), *J. Hand Surg.* 34 (2009) 506–510, <https://doi.org/10.1177/1753193408100962>.
- [7] K. Mardanpour, M. Rahbar, S. Mardanpour, Functional outcomes of 300 carpal tunnel release: 1.5 cm longitudinal mini-incision, *Asian J. Neurosurg.* 14 (2019) 693–697, https://doi.org/10.4103/ajns.AJNS_31_17.
- [8] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, SCARE Group, The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020) 226–230, <https://doi.org/10.1016/j.ijsu.2020.10.034>.
- [9] R.J.P.M. Scholten, A. Mink van der Molen, B.M.J. Uitdehaag, L.M. Bouter, H.C. W. de Vet, Surgical treatment options for carpal tunnel syndrome, *Cochrane Database Syst. Rev.* (2007) CD003905, <https://doi.org/10.1002/14651858.CD003905.pub3>.
- [10] S. Gaba, S. Bhogsha, O. Singh, Limited incision carpal tunnel release, *Indian J. Orthop.* 51 (2017) 192–198, <https://doi.org/10.4103/0019-5413.201700>.
- [11] W. Liawrungrueang, S. Wongsiri, S. Chatpun, Carpal tunnel surgery using a wireless endoscopic visualization instrument: a cadaveric study, *J Hand Surg. Asian Pac.* 26 (2021) 359–363, <https://doi.org/10.1142/S2424835521500326>.