EDITOR'S CHOICE

Hand Allodynia, Lack of Finger Flexion, and the Need for Carpal Tunnel Release

Francisco del Piñal, MD, Dr Med*

Purpose The clinical features of classic carpal tunnel syndrome are well known. However, some patients who may respond equally well to carpal tunnel release (CTR) display atypical signs and symptoms. The chief differential features are allodynia (painful dysesthesias), lack of finger flexion, and, on examination, pain on passive finger flexion. The goal of the study was to present the clinical features, increase awareness, facilitate accurate diagnosis, and report the outcomes after surgery.

Methods Thirty-five hands, from 22 patients with the main features of allodynia and lack of full finger flexion, were gathered in the period 2014–2021. The other common complaints included sleeping disturbances (20 patients), hand swelling (31 hands), and shoulder pain on the same side as the hand problem with limited range of motion (30 sides). The Tinel or Phalen signs were obscured by the pain. However, pain with passive flexion of the fingers was universally present. All the patients were treated with carpal tunnel release through a mini-incision approach: four patients had a trigger finger, which was treated concomitantly in six hands, and one patient underwent contralateral CTR for carpal tunnel syndrome with a more standard presentation.

Results At a minimum of 6 months of follow-up (mean, 22 months; range, 6–60 months), the pain decreased by 7.5 ± 1.9 points on the Numerical Rating Scale, which ranges from 0 to 10. The pulp-to-palm distance improved from 3.7 to 0.3 cm. The mean Disabilities of the Arm, Shoulder, and Hand score decreased from 67 to 20. The mean Single-Assessment Numeric Evaluation score for the whole group was 9.7 ± 0.6.

Conclusions Hand allodynia and lack of finger flexion may be indications of median neuropathy in the carpal canal, which responds to CTR. Awareness of this condition is important because the uncharacteristic clinical presentation may not be considered an indication for surgery that can be beneficial. *(J Hand Surg Am. 2023;48(4):370–376. Copyright © 2023 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Atypical carpal tunnel syndrome, CRPS, irritative carpal tunnel syndrome, reflex sympathetic dystrophy, Sudeck.

Additional Material at jhandsurg.org

*From the *Hand Surgeon, Private Practice, Madrid, Spain.*

Received for publication September 14, 2022; accepted in revised form January 12, 2023.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Corresponding author: Francisco del Piñal, MD, Dr Med, Calle Serrano 58-1B, E-28001-Madrid, Spain; e-mail: drpinal@drpinal.com or pacopinal@gmail.com.

0363-5023/23/4804-0006$36.00/0
https://doi.org/10.1016/j.jhsa.2023.01.001

CARPAL TUNNEL SYNDROME (CTS), one of the most common diagnoses that hand surgeons make, lacks a diagnostic gold standard. According to McCabe,[1] most hand surgeons come up with a diagnosis of CTS using a so-called "fast and frugal heuristic" process, ie, based on experience and empiricism. He suggested the Bayesian approach, in which decisions are based on the probability that the

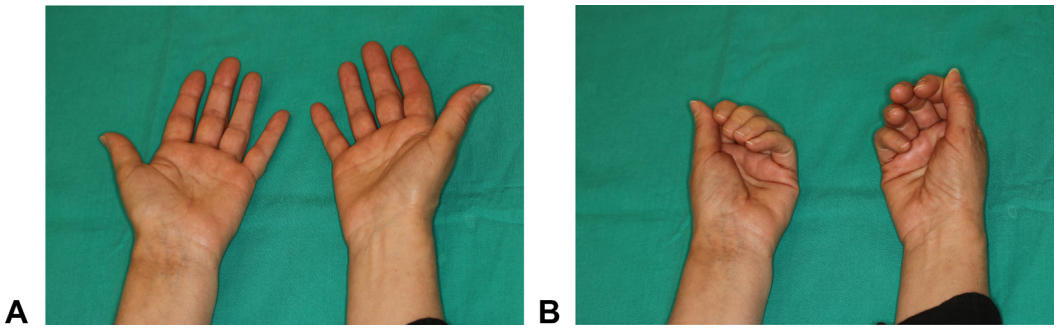

FIGURE 1: Preoperative extension and flexion in one patient of the study (patient 12).

patient has a given condition. To help with this diagnostic process, Graham et al[2] and Graham[3] devised a six-item questionnaire (Carpal Tunnel Syndrome 6), with the output being the probability of CTS. The most recent clinical practice guidelines by the American Academy of Orthopaedic Surgeons[4] may still not have the expected acceptance by surgeons.[5]

Allodynia (burning and painful dysesthesias) and lack of finger flexion have not been associated with CTS, except in the setting of complex regional pain syndrome (CRPS) in patients with so-called irritative CTS.[6–8] Nonetheless, these complaints are common in patients who respond to CTR, despite never having experienced any trauma, even to a mild extent, and are labeled as CRPS (Fig. 1). In the absence of a typical presentation of CTS, patients may not be offered surgery that could be beneficial.

With the purpose of increasing awareness of this condition, the goal of the study was to present the clinical findings and outcomes of surgery in a consecutive series of patients with the aforementioned symptoms.

PATIENTS AND METHODS

During the period 2014–2021, 22 patients reporting allodynia in the hand and lacking full finger flexion for an average of 14 ± 10 months (range, 1–36 months) were treated. None had been diagnosed with CRPS at referral. The symptoms started spontaneously and were not related to trauma.

It was difficult to precisely define the patients' painful sensations. These were a mixture of spontaneous unpleasant sensations (dysesthesias), dysesthesias with pain (painful dysesthesias), and predominately, a burning sensation, all of which could be produced by nonpainful stimuli such as touch or air (allodynia).[9,10]

There were 16 women and 6 men, aged 44–89 years (average, 71 years; median, 76 years). Thirteen patients had bilateral symptoms, and nine unilateral (five dominant and four nondominant). Two patients had been diagnosed with polymyalgia rheumatica and were on steroids. All the patients were on different protocols to control their pain (opioids, gabapentinoids, and nonsteroidal anti-inflammatory drugs, etc). Nineteen patients were denied surgery elsewhere because their confusing clinical presentation was considered either a risk factor for "dystrophic exacerbation" or to be caused by an intercurrent condition. This included 12 patients with moderate or severe CTS, determined by electrodiagnostic studies (EDSs). Seventeen patients were active, retired people, and three were workers (a salesperson, a self-employed businessman, and a cleaner), two of whom were on sick leave. One patient, having had three consecutive EDSs interpreted as normal, was labeled as a malingerer and was on sick leave because they were diagnosed with anxiety. No other comorbidities were noted.

All the patients underwent physical examination by the author, a full-time hand surgeon with more than 30 years of experience. This included a standard physical examination as well as tests for CTS and other nerve compressions. The pulp-to-palm distance (PPD) was measured in centimeters. Passive flexion of the fingers was universally painful, and, therefore, it was impossible to accurately measure the passive range of motion. Nevertheless, the joints were stressed gently to verify whether stiffness was rigid, yielded partially, or supple. The patients were asked whether they had increased symptoms or limitations while abducting or internally rotating their arms.

The patients diagrammed their upper-extremity pain and allodynia and indicated if they had extension proximal to the hand.[7] In addition, they were asked to rate their painful dysesthesias and sense of swelling on the Numerical Rating Scale, wherein 0 indicates no or minimum and 10 indicates

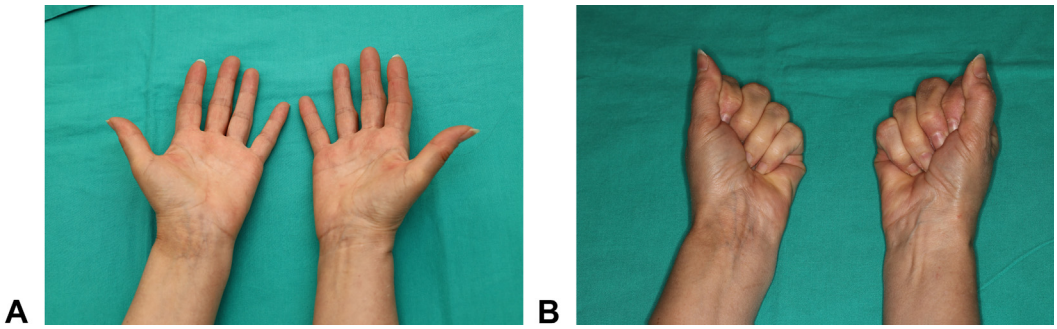

FIGURE 2: Patient 12, as shown in Figure 1, 26 months after surgery.

unbearable or maximum.[11] All the patients completed the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire before surgery.[12]

Electrodiagnostic study results were not available in all the patients at referral (19 of 22 patients), and 2 patients declined once they were informed that these were not essential for surgery. The results were normal in 2 limbs, showing mild involvement of the median nerve in the carpal canal in 4 hands, moderate involvement in 12 hands, and severe involvement in 13 hands.

A mini-incision approach to the median nerve was performed, and the median nerve was visually inspected. In the same operation, the first extensor compartment was released in three patients, and trigger fingers were released open or percutaneously in six hands. Patient 8 underwent contralateral CTR for CTS with a more conventional presentation. After the surgery, nonsteroidal anti-inflammatory drugs were prescribed as an analgesic for use as required (rarely for more than a couple of days). Furthermore, after the surgery, self-performed active and assisted exercises were advised. Formal physical therapy was not instituted, except in three patients. Two patients achieved full range of motion (Fig. 2). However, the other patient, who was diagnosed with remitting seronegative symmetrical synovitis with pitting edema syndrome 1 year after the surgery, only achieved full flexion after low doses of steroids had been prescribed by a rheumatologist.

Our institution (private practice) holds a certificate (ie, ISO 9001:2015) with the registration number 202880/A/001/UK/SP, which guarantees that data collection, management of data, and informed consent comply with regulation 2016/679 of the European Parliament. All procedures were performed in accordance with the Helsinki Declaration of 1975 (2008 revision). All the patients were cognizant of the treatment aims and understood the risks and possible benefits. All the patients gave informed consent. This study was approved by the Ethical Committee of Hospital Clínico, Universidad Complutense, Madrid.

Outcome assessment

The patients were followed up at regular intervals and eventually discharged but never before 6 months after the surgery. Apart from inquiring about their symptoms and recording the DASH scores, the patients were asked to rate their satisfaction with the operation using the Single-Assessment Numeric Evaluation.[13] All data pertinent to the series are included in Table S1 (available online on the *Journal's* website at www.jhandsurg.org).

Statistical analysis

Because variables did not follow a normal distribution, nonparametric tests were used. The Wilcoxon test was used to analyze the differences between the preoperative and postoperative pain, allodynia, swelling, PPD, and DASH. *P* values less than .05 were considered statistically significant.

RESULTS

At the latest follow-up (6−60 months; mean, 22 months), two patients had died of unrelated causes, and one with severe depression, after being diagnosed with amyotrophic lateral sclerosis, was unwilling to undergo follow-up. Their last recorded data were used for this study.

Clinical findings

Before the surgery, the inability to make a full fist was universal, as was allodynia. However, the painful dysesthesias were in a glove distribution in 30 hands and mainly in the ulnar nerve territory in 2 hands (1 in the little finger only). Neither of the latter two hands had neither a positive result on the elbow flexion test nor clinical examination findings consistent with ulnar nerve compression.

TABLE 1. Summary of Clinical Findings With Percentages

	Number of Hands (n = 35)	Percentage
Symptoms		
Inability to make a full fist	35	100
Painful dysesthesias	35	100
Glove distribution	30	86
Median distribution	3	9
Ulnar distribution	2	6
Sleeping disturbances*	32	91
Proximal radiation	32	91
Hand swelling	31	89
Limited shoulder motion or pain	30	86
Finger stiffness: moderate to severe	11	31
Thenar atrophy	4	11
Provocative Maneuvers		
Painful passive finger flexion	35	100
Tinel†	35	100
Phalen, Durkan	35	100
Painful trigger points	18	51
Pronator maneuvers	5	14
Elbow flexion test	2	6

*Patients 6 and 10 (3 hands) were on sleeping pills.
†The Tinel test over the median nerve elicited shocking pain in all directions in most cases.

In Table 1, the most prominent complaints and clinical findings are summarized with their percentages.

Outcomes of surgery

No gross abnormalities were detected during the surgeries. No nerve was seen to be deformed, and florid synovitis was not observed in the carpal canal in any of the cases. One patient underwent epineurotomy for the release of a somewhat-scarred median nerve epineurium.

A summary of the results is presented in Table 2. The pain and allodynia decreased from 8 ± 1.6 to 0.5 ± 1.1 ($P < .05$) at the latest follow-up. It should be stressed that the improvement was nearly immediate in all the patients, except in one patient, who complained of dysesthesias for six months in one of the operated hands (case 6L).

TABLE 2. Outcomes of Surgery

	Preoperative	Postoperative
Painful dysesthesias (0–10)	8.0 ± 1.6	0.5 ± 1.1*
PPD (cm)	3.7 ± 2	0.3 ± 0.8*
Swelling (0–10)	7.5 ± 2.2	0.6 ± 1.0*
DASH	67 ± 14	20 ± 11*
Satisfaction (0–10)	—	9.7 ± 0.6

*$P < .05$.

The PPD improved from 3.7 to 0.3 cm ($P < .05$) at the latest follow-up; most patients were able to achieve a full fist in the operating room. The exceptions were patient 5, with severe osteoarthritis, who experienced only modest improvement, and patients 1 and 12, with finger stiffness, in whom it took several months of physical therapy to reach their final range of motion. Another patient (patient 18) improved but did not achieve full range of motion until after she was started on low doses of steroids for a rheumatic condition that was diagnosed later. The DASH score improved from 67 to 20 ($P < .05$).

In seven out of 30 sides, the patients reported that they were fully recovered from their shoulder pain and limitation of motion, and in another 19 shoulders, they reported that there was improvement after the operation. One patient noticed dramatic improvement for three months but recurrence of the limitations. Patient 18, diagnosed with remitting seronegative symmetrical synovitis with pitting edema syndrome, had less improvement.

The patients rated their general outcome on the Single-Assessment Numeric Evaluation scale as an average of 9.7 (range, 8–10; median, 10).

Two of the three workers, including the patient labeled as a malingerer, who had been on sick leave for 18 and 14 months returned to work three months after CTR.

DISCUSSION

In this study, the triad of hand allodynia, inability to make a full fist, and elicitation of pain by passive flexion of the fingers were universal in a group of patients who responded to CTR. None of the symptoms are observed in the usual presentation of CTS.[2–4,14,15] The other misleading complaints were painful limitation of shoulder motion (30 of 35 shoulders), hand swelling (31 of 35 hands), and the presence of glove or ulnar dysesthesias (32 of 35 hands) or proximal radiation (32 or 35 hands). Some

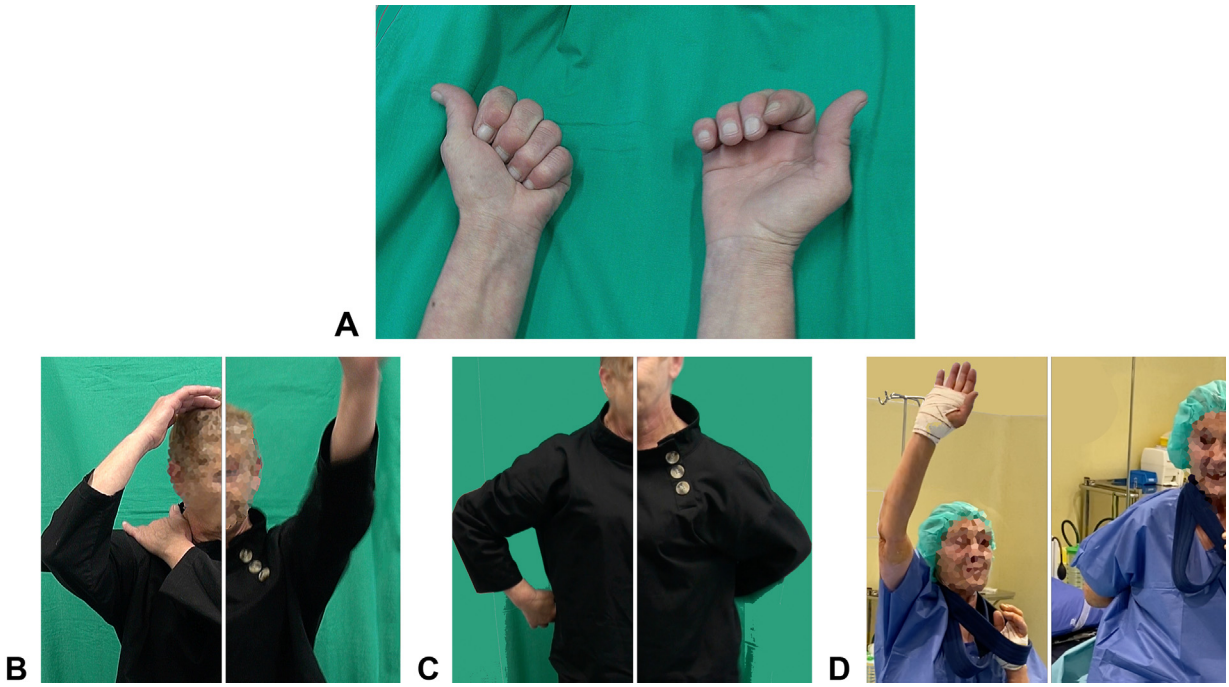

FIGURE 3: Patient 8. Right side: irritative carpal tunnel syndrome, left side: standard CTS. **A** The patient is attempting to clench both the fists in this preoperative view. **B, C** Preoperative images showing maximal shoulder abduction and internal rotation (the patient pointed to the location of her pain on the right side). Note no shoulder involvement on the left side. **D** Immediately after bilateral CTR under local anesthesia, full shoulder motion was recovered on the right side. With the patient's permission, the full video was submitted to *JHS*.

of these complaints have been associated with CTS but are not typical.[2–4,14–20]

Prior to consultation, 19 patients in this study were not offered surgery on the basis of their bizarre complaints and the risk of dystrophic exacerbations after intervention. This is not surprising because the symptoms and signs of these patients were very similar to those presented by patients diagnosed with CRPS. The CRPS severity score was pathologic (more than 4) in all the patients (average, 6; range, 4–8.5), although none had sustained a traumatic episode to trigger CRPS. Previous studies have shown that up to 10% of patients with CRPS could not recall any type of trauma.[21–25] It is well-known that surgery is often not contemplated in the CRPS scenario, or only exceptionally contemplated when a neurophysiologically proven nociceptive focus, which has to have responded before surgery to a sympatholytic block, is identified.[10,26–31]

Adding to the confusion at the time of diagnosis, the results of the Tinel and Phalen or Durkan provocative tests were difficult to interpret. For example, rarely did Tinel's produce distal paresthesias, but electric-shocking pain was noted in all directions. Several patients also had a positive Tinel sign in the forearm over the pronator teres. Trigger points in the epicondyle, pronator teres, or biceps were also frequently elicited. Two-point discrimination was particularly inconsistent and uncomfortable because of allodynia. Finally, sleep disturbance, another crucial complaint in patients with CTS, is also frequently seen in CRPS. Altogether, these imprecisions may have contributed to the barring of these patients from undergoing CTR despite positive EDS results in many.

The results of simple CTR were satisfactory in the current study. The fact that such different conditions respond to the release of the transverse carpal ligament challenges the concept of CTS as a completely consistent entity. The findings of this study open the discussion of whether we are dealing with the same condition as CTS or a different one. Certainly, the parallels between the patients in the current study and those with CRPS are striking.

This study is a case series with limitations. Although some may consider that any observational study is flawed, randomization is impossible in a new condition and pointless when the outcomes of the intervention are dramatic.[32,33] Furthermore, the patients acted as their control group because most were self-referrals because of unsatisfactory care. Observational studies are strengthened by single observers;

however, this also may have been a cause of bias and poor generalizability. Nevertheless, validated patient-reported questionnaires (DASH) were administered, and objective measurements for the assessment of results (PPD) were used. Finally, although subjective, pain, rated on a scale of 0−10, is still considered the gold standard for reporting results for any painful conditions.[34]

Another weakness is that, as stated, the pathophysiologic basis for the observations remains unknown. The coexistence of different forms of stenosing tenovaginitis seems coincidental. Admittedly, this may have contributed to the lack of finger flexion (due to pain or kinesiophobia) in 6 hands. However, the incidence is within the norm in this population,and it was not present in the remaining 29 hands.[35] However, the similarities with CRPS suggest a different pathophysiology from the compressive scenario of idiopathic CTS, although this could be the case. The lack of nerve gliding may have been a contributing factor because burning pain and painful dysesthesias occur in neurodesis after CTR or in other circumstances where a nerve is stuck.[36−42] This may also explain the frequent shoulder involvement and improvement in the range of motion immediately after CTR, which is also quite common in patients with CRPS. There is no clear explanation as to why paresthesias become painful in some patients (irritative CTS) whereas others with nerve compression may evolve to have full thenar atrophy and narrowing of the median nerve, even in the same patient (patient 8).

The association between irritative CTS and painful limitation of shoulder motion and the response to CTR is puzzling. In this study, this association was recorded as a yes or no answer; yet, the preoperative functional limitations were severe in some cases. Several patients had underlying pathologic findings, as detected using magnetic resonance imaging or ultrasound; however, their complaints were resolved immediately after CTR (Fig. 3 and Video 1 [available online on the *Journal*'s website at www.jhandsurg.org]). The study was not intended to prove whether CTR is an answer to some types of shoulder pathology in the elderly however, it does deserve further scrutiny.

REFERENCES

1. McCabe SJ. Diagnosis of carpal tunnel syndrome. *J Hand Surg Am*. 2010;35(4):646−648.
2. Graham B, Regehr G, Naglie G, Wright JG. Development and validation of diagnostic criteria for carpal tunnel syndrome. *J Hand Surg Am*. 2006;31(6):919−924.
3. Graham B. The value added by electrodiagnostic testing in the diagnosis of carpal tunnel syndrome. *J Bone Joint Surg Am*. 2008;90(12):2587−2593.
4. American Academy of Orthopaedic Surgeons. Management of Carpal Tunnel Syndrome Evidence-Based Clinical Practice Guideline. 2016. Accessed September 22, 2022. https://www.aaos.org/globalassets/quality-and-practice-resources/carpal-tunnel/management-of-carpal-tunnel-syndrome-7-31-19.pdf
5. Billig JI, Sears ED. Utilization of diagnostic testing for carpal tunnel syndrome: a survey of the American Society for Surgery of the Hand. *J Hand Surg Am*. 2022;47(1):11−18.
6. Del Piñal F. Reflex sympathetic dystrophy (RSD)/CRPS/Sudeck does not exist. *Ezine (IFSSH)*. 2019;9(3):22−31.
7. Del Piñal F. Outcomes of carpal tunnel release in complex regional pain syndrome/reflex sympathetic dystrophy/Sudeck disease patients. *Plast Reconstr Surg*. 2022;150(1):93−101.
8. Del Piñal F. Diagnosis and outcomes of 225 consecutive cases of CRPS of the hand. *Plast Reconstr Surg*. In press.
9. Birch R. The diagnosis of neuropathic pain after injury to a nerve. In: Birch R, ed. *Peripheral Nerve Injuries: A Clinical Guide*. Springer-Verlag; 2013:184−191.
10. Koman AL, Smith BP, SmithTL. A practical guide for complex regional pain syndrome in the acute stage and late stage. In: Wolfe SW, Pederson WC, Kozin SH, et al, eds. *Green's Operative Hand Surgery*. 8th ed. Churchill Livingstone; 2021:2005−2035.
11. Farrar JT, Young JP Jr, LaMoreaux L, Werth JL, Poole MR. Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. *Pain*. 2001;94(2):149−158.
12. Rosales RS, Delgado EB, de la Lastra-Bosch ID. Evaluation of the Spanish version of the DASH and carpal tunnel syndrome health-related quality-of-life instruments: cross-cultural adaptation process and reliability. *J Hand Surg Am*. 2002;27(2):334−343.
13. Gire JD, Koltsov JC, Segovia NA, Kenney DE, Yao J, Ladd AL. Single Assessment Numeric Evaluation (SANE) in hand surgery: does a one-question outcome instrument compare favorably? *J Hand Surg Am*. 2020;45(7):589−596.
14. Levine DW, Simmons BP, Koris MJ, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *J Bone Joint Surg Am*. 1993;75(11):1585−1592.
15. Graham B. *The Development of Diagnostic Criteria for Carpal Tunnel Syndrome*. Dissertation. University of Toronto; 2003:114−115.
16. Crymble B. Brachial neuralgia and the carpal tunnel syndrome. *Br Med J*. 1968;3;(5616):470−471.
17. Cherington M. Proximal pain in carpal tunnel syndrome. *Arch Surg*. 1974;108(1):69.
18. Stevens JC, Smith BE, Weaver AL, Bosch EP, Deen HG Jr, Wilkens JA. Symptoms of 100 patients with electromyographically verified carpal tunnel syndrome. *Muscle Nerve*. 1999;22(10):1448−1456.
19. Burke DT, Burke MA, Bell R, Stewart GW, Mehdi RS, Kim HJ. Subjective swelling: a new sign for carpal tunnel syndrome. *Am J Phys Med Rehabil*. 1999;78(6):504−508.
20. Katz JN, Stirrat CR. A self-administered hand diagram for the diagnosis of carpal tunnel syndrome. *J Hand Surg Am*. 1990;15(2):360−363.
21. Zyluk A. A new clinical severity scoring system for reflex sympathetic dystrophy of the upper limb. *J Hand Surg Br*. 2003;28(3):238−241.
22. Żyluk A, Mosiejczuk H. A comparison of the accuracy of two sets of diagnostic criteria in the early detection of complex regional pain syndrome following surgical treatment of distal radial fractures. *J Hand Surg Eur Vol*. 2013;38(6):609−615.
23. Veldman PH, Reynen HM, Arntz IE, Goris RJ. Signs and symptoms of reflex sympathetic dystrophy: prospective study of 829 patients. *Lancet*. 1993;342(8878):1012−1016.
24. Schwartzman RJ, Erwin KL, Alexander GM. The natural history of complex regional pain syndrome. *Clin J Pain*. 2009;25(4):273−280.

25. Ott S, Maihöfner C. Signs and symptoms in 1,043 patients with complex regional pain syndrome. *J Pain*. 2018;19(6):599–611.
26. Noordenbos W, Wall PD. Implications of the failure of nerve resection and graft to cure chronic pain produced by nerve lesions. *J Neurol Neurosurg Psychiatry*. 1981;44(12):1068–1073.
27. Patterson RW, Li Z, Smith BP, Smith TL, Koman LA. Complex regional pain syndrome of the upper extremity. *J Hand Surg Am*. 2011;36(9):1553–1562.
28. Birklein F, O'Neill D, Schlereth T. Complex regional pain syndrome: an optimistic perspective. *Neurology*. 2015;84(1):89–96.
29. Bruehl S. Complex regional pain syndrome. *BMJ*. 2015;351:h2730.
30. Goebel A, Turner-Stokes LF. *Complex Regional Pain Syndrome in Adults. In: UK Guidelines for Diagnosis, Referral and Management in Primary and Secondary Care*. 2nd edition. London: Royal College of Physicians; 2018.
31. Shim H, Rose J, Halle S, Shekane P. Complex regional pain syndrome: a narrative review for the practising clinician. *Br J Anaesth*. 2019;123(2):e424–e433.
32. Black N. Why we need observational studies to evaluate the effectiveness of health care. *BMJ*. 1996;312(7040):1215–1218.
33. Landewé R, Van Der Heijde D. Primer: challenges in randomized and observational studies. *Nat Clin Pract Rheumatol*. 2007;3(11):661–666.
34. Dworkin RH, Turk DC, Farrar JT, et al. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2005;113(1-2):9–19.
35. Wessel LE, Fufa DT, Boyer MI, Calfee RP. Epidemiology of carpal tunnel syndrome in patients with single versus multiple trigger digits. *J Hand Surg Am*. 2013;38(1):49–55.
36. McLellan DL. Letter: longitudinal sliding of median nerve during hand movements: a contributory factor in entrapment neuropathy? *Lancet*. 1975;1(7907):633–634.
37. Wilgis EF, Murphy R. The significance of longitudinal excursion in peripheral nerves. *Hand Clin*. 1986;2(4):761–766.
38. Hunter JM. Recurrent carpal tunnel syndrome, epineural fibrous fixation, and traction neuropathy. *Hand Clin*. 1991;7(3):491–504.
39. Jones NF, Shaw WW, Katz RG, Angeles L. Circumferential wrapping of a flap around a scarred peripheral nerve for salvage of end-stage traction neuritis. *J Hand Surg Am*. 1997;22(3):527–535.
40. Montgomery AS, Birch R, Malone A. Sciatic neurostenalgia: caused by total hip arthroplasty, cured by late neurolysis. *J Bone Joint Surg Br*. 2005;87(3):410–411.
41. Jones NF, Ahn HC, Eo S. Revision surgery for persistent and recurrent carpal tunnel syndrome and for failed carpal tunnel release. *Plast Reconstr Surg*. 2012;129(3):683–692.
42. Laing TA, Sierakowski A, Elliot D. Management of painful scar-tethered cutaneous nerves of the upper limb. *Hand Surg Rehabil*. 2017;36(3):208–214.