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Return to work following ultrasound guided thread carpal tunnel release versus open carpal tunnel release: a comparative study

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Abstract

A retrospective review of hospital employees at a single employer institution who underwent ultrasound guided thread carpal tunnel release (TCTR) or open carpal tunnel release (OCTR) between January 2018 and August 2020 was performed to ascertain differences in return-to-work status. Patient age, sex, occupation, handedness, severity of carpal tunnel syndrome, prior treatments and surgical outcomes were reviewed. A total of 18 patients underwent TCTR and 17 patients underwent OCTR. The TCTR group averaged 12 days to return to work without restrictions, as opposed to 33 days for the OCTR group. Resolution of symptoms was afforded in all patients without any complications regardless of surgical technique. While both TCTR and OCTR were effective, our data indicates that TCTR resulted in a shorter return to work.

Level of evidence: III

Keywords

Return to work, thread carpal tunnel release, open carpal tunnel release

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Introduction

Open carpal tunnel release (OCTR) has been considered the gold standard for surgical management of carpal tunnel syndrome (CTS). Endoscopic carpal tunnel release (ECTR) was introduced to reduce recovery time with smaller incisions and has been compared extensively with OCTR (Sayegh and Strauch, 2015). Newer ultrasound-guided techniques have enabled thread carpal tunnel release (TCTR), which requires no incisions, and to date, these have been gaining in popularity (Guo et al., 2015, 2017; Lieby et al., 2021; Schrier et al., 2020).

There are few if any comparative studies of TCTR to OCTR, and when comparisons are made, prior reports of each are often compared. The purpose of this study was to retrospectively compare the return-to-work times of hospital employees with CTS who underwent TCTR or OCTR at a single employer institution.

Methods

Study design

A retrospective review of hospital employees at a single employer institution who underwent TCTR or OCTR between January 2018 and August 2020 performed by the senior authors of the study was conducted. AYS, ATB and PCR are considered expert hand surgeons with experience in carpal tunnel release (CTR) of Level 5 expertise (Tang and Giddins, 2016) and JSB a Level 5 expert in ultrasound-guided procedures. Patient demographics including age, sex, occupation and handedness were obtained. Occupation was stratified as healthcare professional (physician/surgeon, physician assistant, nurse practitioner or nurse), desk worker (administrative staff, information technologist, secretary, etc.) and manual labourer (cafeteria worker, custodian, maintenance, housekeeper, etc.). Severity of CTS was characterized by nerve conduction studies and electromyography (EMG) as mild,

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moderate or severe (Stevens, 1997). Prior treatments with splinting and/or corticosteroid injections were noted.

Surgical variables evaluated were usage of intravenous sedation and procedure time (start of surgery to dressings application), in addition to success of surgery, defined by resolution of paraesthesia, improvement of strength and sensation and a decrease in nocturnal awakening, which were reported for all patients at first follow-up 1 to 2 weeks after surgery and at 52 weeks after surgery as 'improvement', 'no improvement' or 'worse'. Inclusion criteria for the study consisted of adult patients (age of at least 18 years) employed full-time by the institution who underwent TCTR or OCTR for CTS based on clinical examination and electrodiagnostic studies. Patients were excluded if they had concomitant health issues preventing them from full-time employment prior to surgery, were employed part-time, planned to retire after surgery, had same-day bilateral carpal tunnel surgery or who underwent additional procedures during the same anaesthetic event for other hand pathologies.

Return to work was based on several factors, including wound healing (i.e. need to maintain sutures until skin healing), occupation, patient desire and surgeon recommendation. Ultimately for all patients in this study, the Occupational Health unit decided return-to-work status based on the above factors. For patients who underwent surgery on both hands, return to work was calculated based on the later surgery.

Surgical technique

Ultrasound Guided TCTR was developed by Guo et al. (2015) and later modified (Guo et al., 2017). The method as described by Schrier et al. (2020) was utilized in the current study (Figure 1). The procedure is typically performed under local anaesthesia, but intravenous sedation is administered when requested by the patient. A 3.8 cm 25-gauge needle with 1% lidocaine without epinephrine is directed under ultrasound guidance palmar to the superficial palmar arch and under the distal transverse carpal ligament. Under ultrasound guidance as well, a pre-bent Tuohy needle is introduced into the palm proximal to the superficial palmar arch and under the distal transverse carpal ligament. Position is verified in the longitudinal and transverse axes, ensuring that the needle is in the carpal canal and not Guyon's canal. A cutting thread, specifically Loop & Shear of 228 micron diameter (Ridge & Crest Company, Monterey Park, CA, USA), is placed through the Tuohy needle and the needle is removed, leaving the cutting wire beneath the transverse carpal ligament. Accessing the same entrance needle hole in the palm, the Tuohy needle is straightened and reintroduced and passed under ultrasound guidance palmar to the transverse carpal ligament and exits at the same place that the previous needle exited. The distal thread end is passed distally through the Touhy needle and the needle is removed. The path of the thread is checked with ultrasound to ensure that is it above and below the transverse carpal ligament, and that the superficial palmar arch, recurrent motor branch of the median nerve and potential Berrettini branch (Stancić et al., 1999) are not within the cutting path of the looped wire. The thread's handles are pulled to and fro with gentle pressure, dividing the transverse carpal ligament. Pressure is then applied for haemostasis and the recurrent motor branch is tested by having the patient touch the small finger to the thumb. Two small bandages are placed, and compressive dressings applied for 24 hours after surgery. The patient is instructed to engage in activity as tolerated (See Supplementary Video 1).

OCTR is performed using local anaesthetic with or without intravenous sedation, based on patient and surgeon (AYS, ATB, PCR) preference, which has been well-described (Maldonado et al., 2021). The typical length of incision is 2 cm.

Statistical analysis

Independent samples *t*-tests were conducted for comparisons of age, procedure time and return to work. Fisher's exact tests were conducted for comparisons of sex, side of surgery, intravenous sedation and success of surgery. Freeman–Halton's extensions were conducted for comparisons of occupation, EMG and prior treatment. A p-value less than 0.05 was considered statistically significant.

Results

A total of 35 patients met inclusion criteria of the study; of these, 18 underwent TCTR and 17 underwent OCTR. Table 1 shows the demographics of the two groups, demonstrating no significance between cohorts with respect to demographics, CTS severity and surgical variables.

Overall, the TCTR cohort had a significantly shorter average return to work than the OCTR cohort, 12 days opposed to 33 days ($p < 0.001$). Of the TCTR patients, 61% were able to go back to work within 1 week of surgery and 78% within 2 weeks.

When TCTR patients were stratified by occupation, healthcare professionals required an average of 14 days to return to work, desk workers required

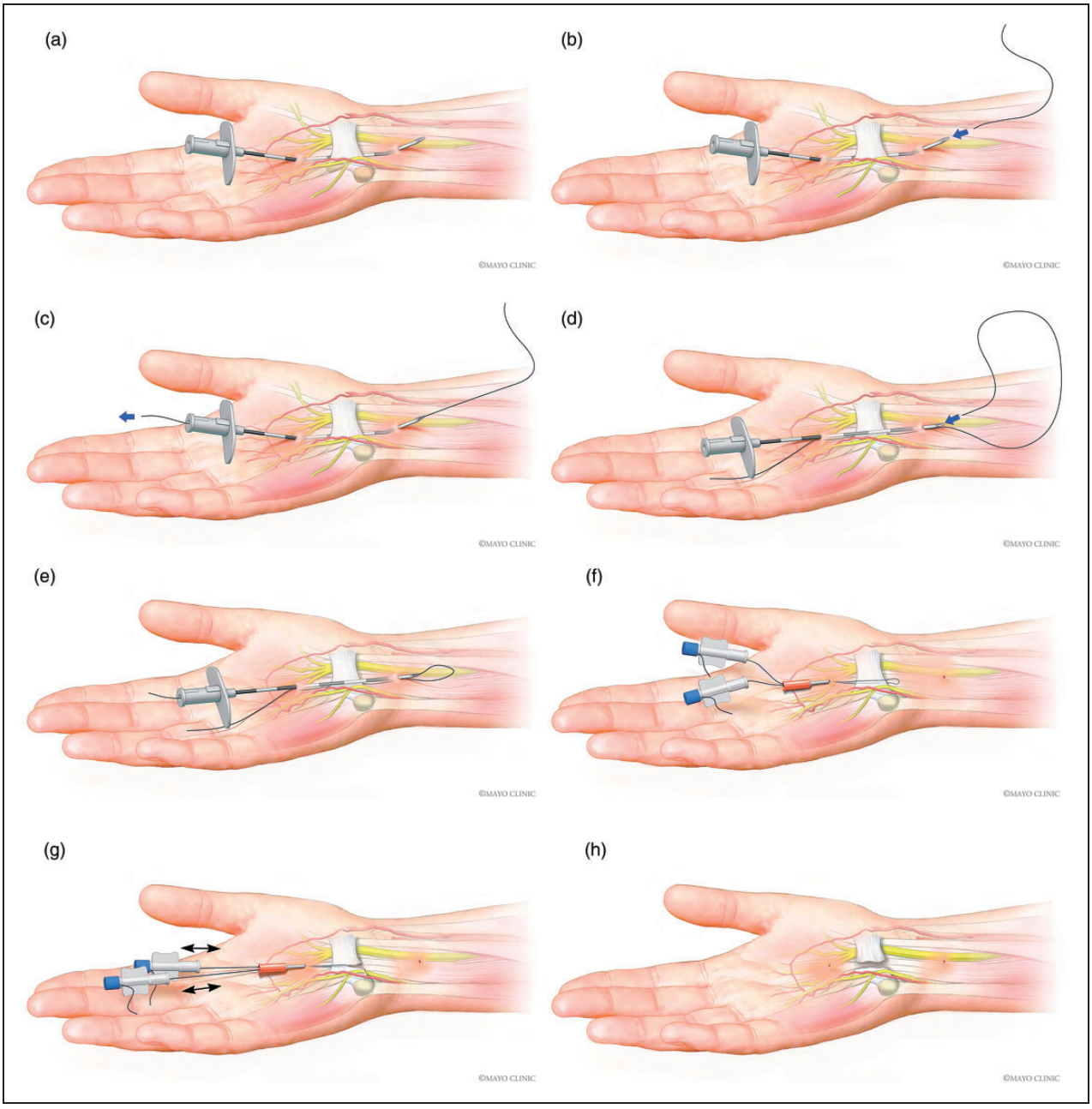

Figure 1. Ultrasound-guided thread carpal tunnel release technique. (a) After hydro-dissection, a Tuohy needle passes the first needle under the transverse carpal ligament. (b, c) The thread is inserted in the needle, after which the latter is removed. (d, e) After the second needle pass superficial to the transverse carpal ligament, the thread is looped. (f) Two Luer lock tip handles secure the thread while a plastic tube prevents laceration at the skin site during transection. (g, h) The ligament is divided using a bimanual sawing motion. (With permission of the Mayo Foundation).

5.7 days and manual labourers required 22 days. When OCTR patients were stratified by occupation, healthcare professionals required an average of 29 days to return to work, desk workers required 37 days and manual labourers required 29 days. Stratification by occupation precluded meaningful statistical comparison because of small sample sizes.

Discussion

It has been reported that TCTR may allow for a faster return to work without sacrificing resolution of symptoms than traditional OCTR and ECTR (Burnham et al., 2021; Guo et al., 2015, 2017; Schrier et al., 2020). The current study sought to control for employer differences by analysing patients from a single employer in a hospital system with guidelines

Table 1. Patient demographics and carpal tunnel syndrome variables.

	Thread release	Open release	
n	18 patients	17 patients	
Age	52.1 yr (35–76)	47.3 yr (22–58)	$P = 0.14$
Female	72.2%	88.2%	$P = 0.40$
Occupation	38.9% healthcare	23.5% healthcare	$P = 0.58$
	38.9% desk	41.2% desk	
	22.2% manual labor	35.3% manual labor	
Dominant hand	35.3%	64.7%	$P = 0.17$
Electromyography	38.4% mild	30.8% mild	$P = 0.89$
	15.4% moderate	23.1% moderate	
	46.2% severe	46.2% severe	
Splinting/corticosteroid injections	22.2% neither	5.9% neither	$P = 0.24$
	38.9% either	29.4% either	
	38.9% both	64.7% both	
Intravenous sedation	33.3%	58.8%	$P = 0.18$
Procedure time	15.9 min (10–28)	16.7 min (12–32)	$P = 0.64$
Success of surgery	100%	100%	$P > 0.999$

for returning to work determined by occupational health with input from the surgeon and patient. In this study, we found that TCTR patients returned to work more than 2 weeks faster on average than OCTR patients, and all but 4 of the 18 TCTR patients went back to work within 2 weeks. All of the patients had successful treatment of CTS and no patient in either group had to return to the operating room for revisions or complications.

Return to work data following OCTR and ECTR is well-documented. Cowan et al. (2012) reported return to modified duty following OCTR after an average of 12 days and full duty after 19 days. De Kesel et al. (2008) found a stark difference in return to work following OCTR for those with social security insurance as opposed to workers' compensation, with an average of 32 days off for social security claims and 49 for workers' compensation claims. Parot-Schinkel et al. (2011) stated a median sick leave of 60 days following OCTR that was impacted by simultaneous intervention for other upper extremity disorders, patient belief in an occupational cause and 'blue-collar' occupation. A further study calculated average work incapacity of 34 days for both OCTR and ECTR in which work-related features were more impactful than personal and surgical factors (Newington et al., 2019). Taken together, these studies indicate that it is difficult to discern the actual duration of time off work needed following OCTR and ECTR without standardization for occupation and employer.

The ability to return to work is an individualized determination that is often a combination of patient safety, wound healing, occupation type (hand involvement, job satisfaction, etc.), patient expectations (secondary gain issues, anxiety, etc.), patient needs (financial matters, job security, etc.), surgeon recommendations and employer guidelines. It is therefore difficult to compare return to work for occupations that have different functional requirements of the hand, variable compensation-based benefits and diverse employers. This explains the highly heterogenous recommendations in the literature for return to work following carpal tunnel surgery, which are reported to be 7 to 30 days for desk-based duties, 15 to 60 days for repetitive light manual duties and 30 to 90 days for heavy manual duties (Newington et al., 2018). A controlled work setting and defined return-to-work criteria would permit a more accurate comparison of the ability of a surgical technique to return patients to their pre-operative levels of function. The current study focuses on a single employer with clearly delineated return to work guidelines that allowed for improved comparison of return to work after carpal tunnel surgery. Additionally, as the return to work was retrospectively reviewed, surgeon bias based on technique was mitigated.

We recognize limitations inherent to this retrospective study. There may be an intrinsic bias for the surgeons to anecdotally specify a predetermined

amount of time off work based on occupation or surgical technique. However, return to work data was not consistent in either the TCTR or OCTR group, illustrating that predetermined time off work was not present. Another limitation is defining return to work, as return to full duty is dependent upon the patient's understanding of what constitutes acceptable activity, and employer requirements may also be inconsistent. To mitigate this, the occupational health department, with input from the surgeon and patient, was relied on for this decision in the patients of this study. A third limitation is lack of randomization; unrecognized bias may have been introduced by surgeon opinions and lack of equipoise. A retrospective cohort design allowed us to view time off work as it was and gave us a true view of how return to work was determined. Finally, comparison of TCTR with other minimally invasive techniques, such as ECTR, were not included as the latter was not performed by the surgeons of this study. The data of this study is important to design and execute a future prospective randomized study in which return to work is dictated by the patient, not the surgeon, while protecting patient safety.

These limitations notwithstanding, the findings of this study demonstrate a likely faster return to work for patients who undergo TCTR instead of OCTR at our institution. While a formal cost analysis was not performed, the costs of OCTR and TCTR were relatively similar. The OCTRs used surgical instrument sets that were processed and sterilized, whereas the TCTRs utilized disposable kits. Each TCTR also required an ultrasound machine and a non-surgeon assistant to run it (who could come from the operating room personnel), but the extra institutional and societal cost of TCTR could be reduced by an earlier return to work.

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Ethical approval Ethical approval for this study was obtained from the Mayo Clinic Institutional Review Board (20-008746).

Informed consent Written informed consent was obtained from all subjects before the study.

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References

Burnham RS, Loh EY, Rambaransingh B, Roberts SL, Agur AM, Playfair LD. A controlled trial evaluating the safety and effectiveness of ultrasound-guided looped thread carpal tunnel release. Hand (NY). 2021, 16: 73–80.

Cowan J, Makanji H, Mudgal C, Jupiter J, Ring D. Determinants of return to work after carpal tunnel release. J Hand Surg Am. 2012, 37: 18–27.

De Kesel R, Donceel P, De Smet L. Factors influencing return to work after surgical treatment for carpal tunnel syndrome. Occup Med (Lond). 2008, 58: 187–90.

Guo D, Guo D, Guo J, Schmidt SC, Lytie RM. Clinical study of the modified thread carpal tunnel release. Hand (NY). 2017, 12: 453–60.

Guo D, Tang Y, Ji Y, Sun T, Guo J, Guo D. Non-scalpel technique for minimally invasive surgery: percutaneously looped thread transection of the transverse carpal ligament. Hand (NY). 2015, 10: 40–8.

Leiby BM, Beckman JP, Joseph AE. Long-term clinical results of carpal tunnel release using ultrasound guidance. Hand (NY). Epub ahead of print 29 January 2021. DOI: 10.1177/1558944720988080.

Maldonado AA, Pulos N, Rhee PC, Shin AY. Five wrist operations that give the best results. Plast Reconstr Surg. 2021, 147: 295e–302e.

Newington L, Francis K, Ntani G, Warwick D, Adams J, Walker-Bone K. Return to work recommendations after carpal tunnel release: a survey of UK hand surgeons and hand therapists. J Hand Surg Eur. 2018, 43: 875–8.

Parot-Schinkel E, Roquelaure Y, Ha C et al. Factors affecting return to work after carpal tunnel syndrome surgery in a large French cohort. Arch Phys Med Rehabil. 2011, 92: 1863–9.

Sayegh ET, Strauch RJ. Open versus endoscopic carpal tunnel release: a meta-analysis of randomized controlled trials. Clin Orthop Relat Res. 2015, 473: 1120–32.

Schrier VJMM, Shin AY, Brault JS. An incision-less ultrasound-guided carpal tunnel release technique. Tech Hand Up Extrem Surg. 2020, 25: 14–9.

Stancić MF, Mićović V, Potocnjak M. The anatomy of the Berrettini branch: implications for carpal tunnel release. J Neurosurg. 1999, 91: 1027–30.

Stevens JC. AAEM minimonograph #26: the electrodiagnosis of carpal tunnel syndrome. Muscle Nerve. 1997, 20: 1477–86.

Tang JB, Giddins G. Why and how to report surgeons' levels of expertise. J Hand Surg Eur. 2016, 41: 365–6.