Decreased Rate of Complications in Carpal Tunnel Release with Hand Fellowship Training

Santosh J. Mathen¹ Naveed N. Nosrati² Gregory A. Merrell¹

¹The Indiana Hand to Shoulder Center, Indianapolis, Indiana, United States

²Division of Plastic Surgery, Indiana University, Indianapolis, Indiana, United States

Address for correspondence Naveed N. Nosrati, MD, Division of Plastic Surgery, Indiana University, 545 Barnhill Dr, EH 232, Indianapolis, IN 46202, United States (e-mail: nnosrati@iupui.edu).

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Abstract

Purpose In many procedures, both high case volumes and fellowship training have been shown to improve outcomes. One of the most common procedures performed by hand surgeons, the carpal tunnel release (CTR) is also performed by several other specialties without specialty training in a hand fellowship. This study analyzed the effect that hand fellowship training has on outcomes of CTRs.

Materials and Methods Using the American Board of Orthopedic Surgeons (ABOS) Part II candidates' case list submissions, a database was created for all open and endoscopic CTRs. Surgeon training, demographics, technique, and complications were recorded. Complications were then categorized and broken down by technique. Results were then analyzed for statistical significance.

Results A total of 29,916 cases were identified. Hand fellowship-trained surgeons performed six times more CTRs at 31 cases per surgeon compared with five for non-hand fellowship-trained surgeons. They also improved outcomes in rates of infection, wound dehiscence, and overall complications. Rates of nerve injury or recurrence showed no statistical difference. This held true for the open release subset. Endoscopically, fellowship-trained surgeons had only improved rates of overall complications.

Conclusion Surgeons undergoing additional hand fellowship training may show improved outcomes in the surgical treatment of carpal tunnel syndrome. However, no effect was seen on nerve injury or recurrence of symptoms.

Keywords

- hand fellowship
- carpal tunnel release
- median nerve

Introduction

Many factors may affect the outcome of a surgery. Traditionally, the effects of patient characteristics and disease pathology have been analyzed. However, recently more attention has been paid on the surgeons influence. In several procedures, it has been well established that surgeons who perform the procedure more frequently have lower complication rates.^{1–4} Further, fellowship-trained surgeons have been shown to improve outcomes in selected procedures.^{5,6}

Carpal tunnel syndrome is the most common peripheral nerve entrapment syndrome affecting approximately 5% of the population.⁷ In 2006, there were more than 500,000

carpal tunnel releases (CTR) performed in the United States in the ambulatory setting.⁸ As such, this procedure is performed by many different specialties besides fellowship-trained hand surgeons.

The purpose of this study is to examine the effect of hand fellowship training on outcomes of transverse carpal ligament release. This is investigated under the hypothesis that surgical complication rates following CTR will be higher for nonhand fellowship-trained surgeons. These include typical postoperative complications such as infection or hematoma, as well as more specific complications of recurrence and nerve injury. The null hypothesis is that there will be no difference in outcomes between the levels of training.

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Materials and Methods

A database was created from the American Board of Orthopedic Surgeons (ABOS) Part II candidates' case list submissions. This list is created from submissions by candidate orthopedic surgeons in their first year of practice. All cases from a defined 6-month period of April to September are recorded and submitted. Complications are self-reported but verified and notarized by the hospital/surgery center. Inclusions criteria for the database consisted of current procedural terminology (CPT) codes for open and endoscopic CTR (29848, 64721, 64722, 64835, 64836, and 15740) as the primary and only procedure from 2004 to 2013. From the list of cases, hand fellowship training of surgeon, patient's age and sex, CTR technique, and complications were recorded. Specifically, complications related directly to the procedure itself classified as surgical complications, including hematoma, infection, nerve injury, wound dehiscence, and recurrence. Complications unrelated to surgical technique such as those classified as medical or anesthetic were excluded from the study. Results were then compiled, and statistical analysis was performed. For larger sample sizes, a two-tailed

chi-square analysis was performed with a Yates correction. On smaller sample sizes, n value of complications less than 5, Fisher's exact test was applied for the comparison. Three groups were created for analysis: overall, open release, and endoscopic release.

Results

There were 29,916 cases identified and included in the study. No differences in patient demographics were seen between the two groups. Fellowship-trained surgeons performed statistically significantly more CTRs ($p < 0.0001$). Eight hundred and 56 hand fellowship-trained surgeons performed 19,412 for an average of 31 cases per surgeon. There were 10,504 cases performed by 2,348 nonfellowship-trained surgeons for an average of 5 cases each. Of these, 432 cases were performed endoscopically by nonfellowship-trained surgeons and 3,851 by fellowship trained. Overall complications are summarized in ►Table 1. Complications for open release are summarized in ►Table 2. Complications for endoscopic releases are summarized in ►Table 3.

Table 1 Total complications

	Hand fellowship trained % (19,412)	Nonhand fellowship trained % (10,504)	p-Value
Infection	0.5 (102)	0.8 (80)	0.02
Hematoma/seroma	0.02 (3)	0.03 (3)	0.74
Wound dehiscence	0.9 (170)	1.7 (183)	< 0.01
Nerve injury	0.4 (71)	0.3 (34)	0.63
Recurrence	0.2 (41)	0.2 (21)	0.94
Unspecified	0.1 (34)	0.9 (99)	< 0.01
Overall complications	2.2 (427)	4.0 (420)	< 0.01

Table 2 Complications for open carpal tunnel release

	Hand fellowship trained % (15,561)	Nonhand fellowship trained % (10,072)	p-Value
Infection	0.5 (73)	0.7 (74)	0.01
Hematoma/seroma	0.02 (3)	0.03 (3)	0.91
Wound dehiscence	1.0 (160)	1.8 (180)	< 0.01
Nerve injury	0.3 (47)	0.3 (28)	0.82
Recurrence	0.2 (33)	0.2 (20)	0.93
Unspecified	0.04 (6)	0.9 (94)	< 0.01
Overall complications	2.1 (322)	4.0 (399)	< 0.01

Table 3 Complications for endoscopic carpal tunnel release

	Hand fellowship trained % (3,851)	Nonhand fellowship trained % (432)	p-Value
Infection	0.8 (29)	1.4 (6)	0.16
Hematoma/seroma	0.0 (0)	0.0 (0)	1.0
Wound dehiscence	0.3 (10)	0.7 (3)	0.14
Nerve injury	0.6 (24)	1.4 (6)	0.12
Recurrence	0.2 (8)	0.0 (0)	1.0
Unspecified	0.8 (29)	1.4 (6)	0.16
Overall complications	2.7 (105)	4.9 (21)	0.02

Discussion

Previous studies have analyzed the effect of specialized fellowship training on surgical outcomes. In general, these studies have shown improved outcomes with further specialization. In a similar manner, multiple studies have investigated the relationship of case volume with outcomes and found a positive correlation. Often, these studies focus on technically demanding procedures such as pancreaticoduodenectomy, radical prostatectomy, or carotid endarterectomy.⁹⁻¹¹

CTR is one of the more common procedures performed by a hand surgeon. It is typically performed in an ambulatory setting, often without an anesthesiologist. CTR is a relatively straightforward procedure and is performed by a range of specialties. Because of the prevalence of the disease and ubiquity of providers, specialized fellowship training has not been considered as a prerequisite to performing the procedure.

Upon analyzing the effect of fellowship training of CTR, it was found that the specialized training may provide improved outcomes for the patient, rejecting the null hypothesis. Significant differences were noted in infection and wound dehiscence rates as well as overall complications. Recurrence rate though was not affected, nor was the major complication of nerve injury.

Other studies that have noted improvement in outcomes with specialty training have speculated on the cause of the improvement. Many of the studies are oncologic specialties with an outcome of cancer clearance or recurrence. One indicated that improvement may be related to improved overall management of the malignancy using more updated protocols and medications.¹² Another study noted that fellowship-trained colorectal surgeons use different intraoperative techniques such as a stapled anastomosis or change of gloves between different sections of the case, possibly contributing to their lower recurrence rates. The fellowship-trained surgeons also had a higher rate of initial clearance, indicating they may be more astute at identifying adequate margins.¹³

A limitation of the study was that it was only performed on surgeons with a base training in orthopedic surgery in the early phases of their career. Other specialties were not included. However, by focusing on one specialty, it limits the amount of variability within a study to just the additional training of a hand fellowship. Assessing surgeons early in their career also allows a clearer picture of the direct effect of a hand fellowship. As a surgeon progresses in their career, they may limit which procedures they perform. Thus a study including more senior surgeons may be altered by self-selection of the surgeon as well as further experience gained beyond residency or fellowship training.

Use of a large database also presents its own limitation. The accuracy of cases and complications cannot be independently verified, though cases are verified by the institution or hospital and are accurate to the best of their knowledge. Further, complications are self-reported and must occur within the time frame of case collection. This may cause underreporting of certain complications that can take longer to present, such as recurrence. However, because

both arms of the study (fellowship trained and nonfellowship trained) were extracted from this database, the same limitation applies to both. This decreases the likelihood that the limitation will affect one arm greater than the other.

While fellowship training is not necessary to perform a CTR, it may improve outcomes. A study in 2008 documented a group of residents' incision location for their first CTR. Some incisions were close to correct, whereas others showed tremendous room for improvement.¹⁴ This study provides support that fellowship training may decrease the overall complication rate for CTR.

Conflict of Interest

None.

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