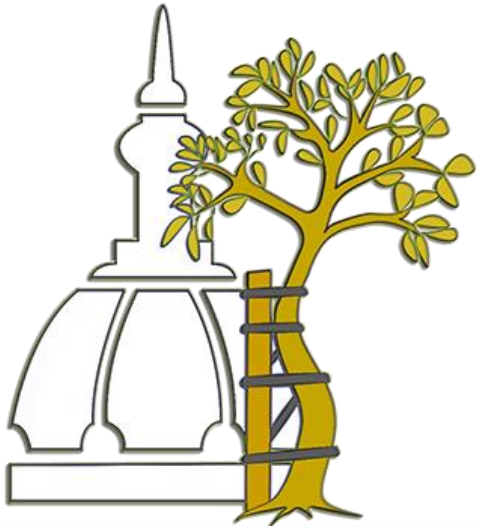

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MEDICINE

Postoperative Complications in Diabetic Patients: Endoscopic vs. Open Carpal Tunnel Treatment

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Disclosures

I (and/or my co-authors) have nothing to disclose.

Purpose

- Carpal tunnel syndrome (CTS) is the most common cause of compression neuropathy. The economic impact of CTS has been estimated to approach $5 billion per year.

- Though most patients with CTS are managed nonoperatively, surgical treatment via carpal tunnel release (CTR) is associated with excellent outcomes and provides an economic benefit of $1.5 billion per year.

- Strong evidence from randomized-controlled trials has shown the efficacy of surgical release in comparison to nonsurgical options such as corticosteroid injection. Most research has found largely comparable outcomes between open CTR (OCTR) and ECTR.

Purpose

- The 2023 AAOS Clinical Practices Guidelines for the management of carpal tunnel syndrome state that a surgeon “might consider using endoscopic carpal tunnel release based on possible short-term benefits” but that there is “limited evidence” to support this. Limited data exist regarding outcomes in T2DM patients undergoing carpal tunnel release (CTR).

- Type 2 diabetes mellitus (T2DM) is a known risk factor for CTS. Patients with T2DM often face higher postoperative complication rates.

- We are aware of no studies that have evaluated the outcomes of ECTR and OCTR within this patient population. This study compares complication rates between endoscopic CTR (ECTR) and open CTR (OCTR) in patients with T2DM.

Methods

- A retrospective cohort analysis was performed using the Research Network dataset within the TriNetX database (TriNetX LLC, Cambridge, MA, USA).

- The TriNetX Research Network dataset comprises a global network of 78 healthcare organizations (HCOs) and over 110 million unique patients.

- Both inpatient and outpatient clinical, prescription, and laboratory data are available in TriNetX and are obtained through the participating HCOs' electronic medical record systems.

- This study was reviewed by our institution's institutional review board and deemed to be exempt from review (IRB00386952), as no patient-identifying information was used.

Methods

- Current Procedural Terminology (CPT) and International Classification of Diseases (ICD)-10 codes were used to identify patients with T2DM who underwent primary OCTR or ECTR.

- Exclusion criteria were the following: age less than 18 years, diagnosis of type 1 diabetes mellitus, and previous carpal tunnel release.

- Of 67,225 patients who met the inclusion criteria, 25,288 were male (38%) and 39,297 were female (58%). There were 17,792 (26%) patients in the ECTR cohort and 49,433 (74%) patients in the OCTR cohort.

- Patient age, sex, comorbidities contained within the Elixhauser Comorbidity Index, metformin use, insulin use, BMI > 40, and hemoglobin A1c were recorded.

Methods

- Primary outcomes for this study were 6-week wound infection, 6-week wound dehiscence, and intraoperative median nerve injury.

- Intraoperative nerve injury was defined as a median nerve injury ICD-10 code charted either on the day of the patient's CTR or within 6 weeks postoperatively in order to capture partial nerve injuries that may not have been noticed immediately postoperatively. All complications were assessed via ICD and CPT codes.

- Demographic data, medical comorbidities, and complication rates were analyzed. A 1:1 propensity-score match was performed to calculate risk ratios and 95% confidence intervals of postoperative median nerve injury, 6-week wound dehiscence, and 6-week wound infection.

- These variables were chosen because they have been identified in previous studies as factors that contribute to postoperative complications after CTR.

Results

- After matching, the ECTR cohort had significantly higher rates of liver disease (11.8% vs 10.6%, P = <.001), and patients with a BMI > 40 (10.5% vs 9.5%, P = .001), but significantly lower rates of fluid and electrolyte disorders (14.8% vs 15.9%, P = .003), than the OCTR cohort.

- All other comorbidities and demographics were well matched between cohorts (Table 2). Using matched analysis, risk ratios (RRs) and 95% confidence intervals (CIs) of median nerve injury, 6-week wound dehiscence, and 6-week wound infection were observed between cohorts.

- Univariate Analysis: The overall rates of wound dehiscence, infection and nerve injury for patients undergoing CTS without a diagnosis of T2DM were 0.50% (971/194,742 patients), 1.26% (2445/194,742) and 1.12% (2184/194,742), respectively.

Results

- By comparison, overall rates of wound dehiscence, infection, and nerve injury for patients undergoing CTS *with* a diagnosis of T2DM were 0.63% (425/67,225), 1.7% (1,129/67,225), and 0.24% (160/67,225), respectively.

- Prior to propensity-score matching, univariate analysis revealed that the ECTR cohort had significantly lower rates of 6-week wound infection, 6-week wound dehiscence, and intraoperative nerve injury (all $P < .001$) than the OCTR cohort

Unmatched Outcomes	ECTR (n = 17,792)		OCTR (n = 49,433)		P value
	Incidence	%	Incidence	%	
Wound infection	185	1.04	944	1.91	<0.001
Median nerve injury	21	0.12	139	0.28	<0.001
Wound dehiscence	63	0.35	362	0.73	<0.001

Unmatched Postoperative Outcomes of Patients With Type 2 Diabetes Mellitus Who Underwent Endoscopic Versus Open CTR
Significant values in **bold** ($P < .05$).
ECTR; Endoscopic carpal tunnel release, OCTR, open carpal tunnel release.

Results

- Propensity-Score Matching: After propensity-score matching, the ECTR cohort had significantly lower rates of 6-week wound infection, 6-week wound dehiscence, and intraoperative nerve injury (all P < .001) than the OCTR cohort.

- The ECTR cohort had a significantly smaller RR of 6-week wound infection (RR 0.57, 95% CI 0.48–0.69; P < .001), 6-week wound dehiscence (RR 0.48, 95% CI 0.36–0.65; P < .001), and intraoperative median nerve injury (RR 0.42, 95% CI 0.25–0.70; P < .001) when compared to the OCTR cohort.

Matched Outcomes (n = 17,792) - Based on the Endoscopic cohort								
Unmatched Outcomes	T2DM Endoscopic CTR (n = 17,792)		T2DM Open CTR (n = 17,792)		Risk Ratio	95% Confidence Interval	**P value**	
	Incidence	%	Incidence	%				
Wound infection	185	1.04	323	1.82	0.57	0.48–0.69	<0.001	
Median nerve injury	21	0.12	50	0.28	0.42	0.25–0.70	<0.001	
Wound dehiscence	63	0.35	131	0.74	0.48	0.36–0.65	<0.001	

Matched Postoperative Outcomes of Patients With Type 2 Diabetes Mellitus Who Underwent Endoscopic Versus Open Carpal Tunnel Release

Conclusion

- In our analysis of T2DM patients undergoing CTR, ECTR yielded significantly lower rates of wound infection, wound dehiscence, and nerve injury within 6-weeks post-surgery, reducing the risk by 43%, 52%, and 58%, respectively.

- Our study finds that ECTR may be preferable to OCTR for individuals with T2DM undergoing CTR, showing notably reduced risk of wound infection, wound dehiscence, and median nerve injury in the first 6 weeks after surgery.

- In addition to preoperative glycemic control, adopting ECTR in this patient population may lead to improved CTR outcomes for patients with T2DM.

References

- Aboonq MS. Pathophysiology of carpal tunnel syndrome. Neurosci Riyadh Saudi Arab. 2015;20(1):4-9.
- Hubbard ZS, Law TY, Rosas S, Jernigan SC, Chim H. Economic benefit of carpal tunnel release in the Medicare patient population. Neurosurg Focus. 2018;44(5):E16. doi:10.3171/2018.1.FOCUS17802
- American Academy of Orthopaedic Surgeons. Management of Carpal Tunnel Syndrome: Evidence-Based Clinical Practice Guideline. OthoGuidelines. Published February 29, 2016. Accessed October 9, 2023. http://www.orthoguidelines.org/
- van Dijk MAJ, Reitsma JB, Fischer JC, Sanders GTB. Indications for requesting laboratory tests for concurrent diseases in patients with carpal tunnel syndrome: a systematic review. Clin Chem. 2003;49(9):1437-1444. doi:10.1373/49.9.1437
- Jarvik JG, Comstock BA, Kliot M, et al. Surgery versus non-surgical therapy for carpal tunnel syndrome: a randomised parallel-group trial. Lancet Lond Engl. 2009;374(9695):1074-1081. doi:10.1016/S0140-6736(09)61517-8
- Hulkkonen S, Lampainen K, Auvinen J, Miettunen J, Karppinen J, Ryhänen J. Incidence and operations of median, ulnar and radial entrapment neuropathies in Finland: a nationwide register study. J Hand Surg Eur Vol. 2020;45(3):226-230. doi:10.1177/1753193419886741
- American Medical Association. CPT (Current Procedural Terminology). Published online 2023 1995.