Clinical Epidemiology

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Incidence of Carpal Tunnel Syndrome Requiring Surgery May Increase in Patients Treated with Trigger Finger Release: A Retrospective Cohort Study

Hsin-Han Hsieh[1], Wen-Tien Wu[1,2], Jui-Tien Shih[3], Jen-Hung Wang[4], Kuang-Ting Yeh[1,2]

[1]School of Medicine, Tzu Chi University, Hualien, Taiwan; [2]Department of Orthopedics, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan; [3]Department of Orthopaedic Surgery, Taoyuan Armed Forces General Hospital, Taoyuan City, Taiwan; [4]Department of Medical Research, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan

Correspondence: Kuang-Ting Yeh, Department of Orthopedics, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 707, Section 3, Chung-Yang Road, Hualien, 970473, Taiwan, Email micrograft@tzuchi.com.tw

Purpose: The correlation between carpal tunnel syndrome (CTS) surgery and trigger finger (TF) surgery is unclear; we conducted this nationwide population-based study to assess the development of severe CTS requiring surgery after TF surgery.

Patients and Methods: This retrospective cohort study used the data of patients diagnosed as having TF between January 1, 2001, and December 31, 2017, and they were divided into two comparative groups. Patients who underwent surgical release within 1 year of diagnosis were included in the TF-OP group, and those who did not undergo TF release during the same period were included in the TF-NOP group. The primary outcome was the new incidence of CTS release (CTR), and data on the related risk factors were collected for analysis.

Results: A total of 8232 patients each were enrolled into the TF-OP and TF-NOP groups and were 1:1 propensity score matched (mean patient age, 54.7 ± 10.1 years; mean follow-up duration, 6.58 years). The incidence rate of CTR was 1.1 per 1000 person-years in the TF-OP group and 0.7 per 1000 person-years in the TF-NOP group. The adjusted hazard ratio of TF surgery was 1.51. The factors significantly correlated with an increased incidence of CTR were age, female sex, diabetes mellitus, and chronic renal failure. In subgroup analysis, patients aged >65 years and female patients in the TF-OP group were still at significantly higher risks of CTR than were their counterparts in the TF-NOP subgroups. The cumulative incidence of CTR after TF surgery linearly increased with time in both groups.

Conclusion: Patients undergoing TF release may have a higher incidence of CTR 1 year later, especially women and patients aged >65 years. Diabetes mellitus and chronic renal failure may be risk factors.

Keywords: trigger finger release, nationwide cohort study, subgroup analysis, diabetes mellitus, chronic renal failure

Introduction

Trigger finger (TF) and carpal tunnel syndrome (CTS) are two of the most common disorders that result in hand functional disability. TF has a prevalence of approximately 2%,[1] and it involves the disruption of the gliding mechanism of the interphalangeal and metacarpophalangeal joints due to mismatched sizes of the flexor tendons and first annular pulleys (A1 pulleys) of the thumb and fingers, impairing finger flexion.[2] The incidence and severity of TF are higher among patients with comorbidities such as rheumatoid arthritis, diabetes mellitus, and connective tissue disorders such as mucopolysaccharidosis.[2] A surgical technique known as A1 pulley release is a treatment option for patients refractory to conservative management (eg, splinting or injections), who have severe functional disability.[3] Gil et al[3] suggested that a patient with TF should receive three steroid injections before undergoing surgical release to ensure clinical and cost effectiveness. However, surgical management such as A1 pulley release may result in complications including digital nerve injury, incomplete pulley release, flexor tendon laceration after percutaneous release,[4] synovial fistula, bowstring injury, deep space infection, and scar tenderness[5,6] after open release. CTS affects wrist function through median nerve compression. Patients with CTS might experience median nerve paresthesia or hand pain. In severe cases, wrist motor function is compromised.[7] Severe CTS that cannot be managed with conservative treatment requires surgical release of the transverse carpal ligament.[8]

Received: 29 July 2022
Accepted: 22 September 2022
Published: 29 September 2022

The correlation between the incidence of CTS and that of TF is not completely understood; most studies have focused on the incidence TF after the surgical release of CTS.[9–12] Karalezli et al conducted a cadaveric study and concluded that patients may be predisposed to the development of TF because of the increased friction caused by changes in the entrance angle of the flexor tendons into the A1 pulley after transection of the transverse carpal ligament.[13] In an ultrasound study, Lee et al also indicated that more volar migration of the flexor tendons after the surgical release of CTS may induce a pathogenetic mechanism such as bowstringing, leading to TF.[14] Considering the similar pathophysiological mechanism between TF and CTS, CTS that requires surgical treatment may develop after the surgical release of TF, but few studies have investigated the relationship between TF and CTS. In 2017, Lin et al discovered that carpal tunnel release surgery caused a 3.63-fold higher risk of the development of TF than that in the control group.[15] Thus, we conducted this nationwide cohort study to investigate the incidence of CTS requiring surgical release after open TF release and the related risk factors.

Materials and Methods

This study was approved by the Research Ethics Committee of Hualien Tzu Chi Hospital (approval number: IRB108-242-C). The requirement for informed consent was waived by the ethics committee because of the retrospective nature of the study and because all data including personal basic information and detailed medical records were encrypted. Taiwan's National Health Insurance Research Database, which is maintained by the National Health Insurance Administration, Ministry of Health and Welfare, and managed by the National Health Research Institutes, was accessed to retrieve data on patients with TF (ICD-9-CM code: 727.03; ICD-10-CM code: M65.3). We enrolled patients with incident TF between January 1, 2001, and December 31, 2017.

Individuals aged <20 years and patients who had a diagnosis of TF or CTS before their TF diagnosis index date were excluded. We divided the patients into two groups: the severe TF group and nonsevere TF group. The severe TF group comprised patients with TF that was treated surgically (surgery code: 64081C) within the first year after the diagnosis, and the nonsevere TF group comprised patients with TF that was not treated surgically in the first year after diagnosis. To avoid indication bias, we performed 1:1 propensity score matching (PSM) to match patients in the nonsevere TF group to those in the severe TF group (Figure 1) by age, gender, and the medical comorbidities listed in Table S1. The primary outcome of this study was the incidence of severe CTS that was diagnosed on the basis of the positive results of clinical

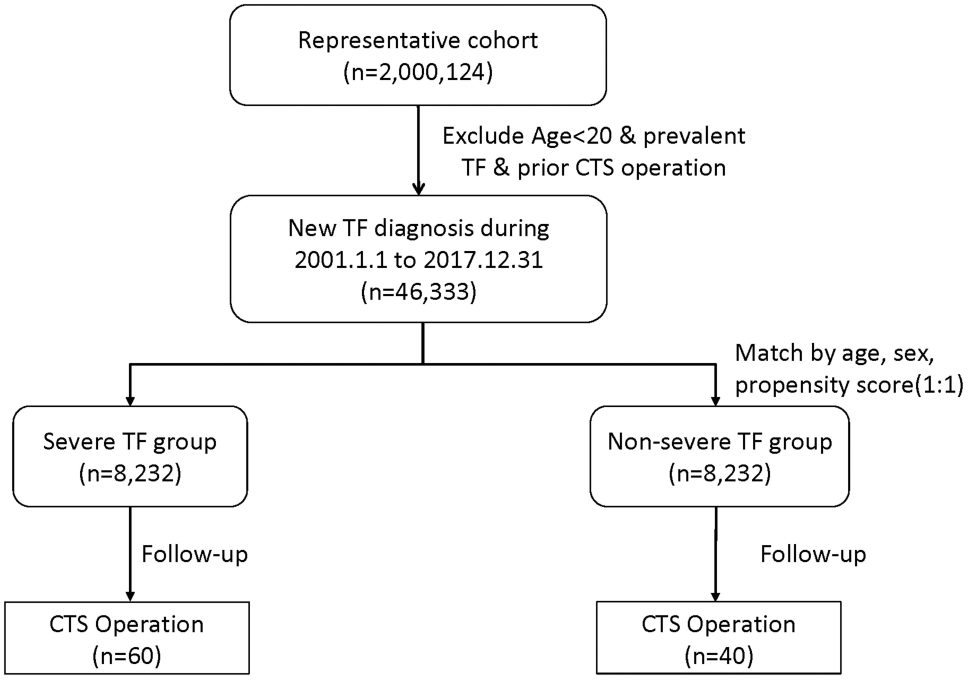

Figure 1 The study flow chart.

examination and an electrophysiological study and that required surgical release (CTR; *International Classification of Diseases, Ninth Revision, Clinical Modification* [*ICD-9-CM*] code: 354.0 or *ICD-10-CM* code: G56.00, G56.01, G56.02, and surgery code: 83006C).

The data were analyzed using SAS version 9.4 and Stata version 16 (SAS Institute, Cary, NC, USA). Continuous variables are expressed as means and standard deviations, whereas categorical variables are expressed as numbers and percentages. Continuous variables were compared through Student's *t*-tests, whereas categorical variables were compared through chi-squared or Fisher's exact tests. Logistic regression was adopted to evaluate the factors associated with CTR. A p value of <0.05 was considered statistically significant.

Results

Using 1:1 PSM by age, sex, and comorbidities, we allocated 8232 patients each to the severe TF and nonsevere TF groups (Table 1). The mean patient age was 54.7 ± 10.1 years, and 84.5% of the patients were aged <65 years. The study population comprised 4261 male and 12,203 female patients. The mean follow-up duration was 6.6 ± 4.2 years (Table 1). The incidence of CTR was 1.1 per 1000 person-years in the severe TF group and 0.7 per 1000 person-years in the nonsevere TF group (Table 2). According to a multivariate Cox proportional-hazards model adjusted for the baseline characteristics listed in Table 1, the adjusted hazard ratio (aHR) of the severe TF and nonsevere TF groups was

Table 1 Demographics Among the Patients with Trigger Finger Receiving Surgery in 1 Year After Diagnosis as Severe TF Group and Those Who Did Not Receive Surgery in 1 Year After Diagnosis as Non-Severe TF Group by 1:1 Propensity Score Matching Method

	Severe TF	Non-Severe TF	Total	p-value
N	8232	8232	16,464	
Age	54.7±10.0	54.7±10.1	54.7±10.1	0.91
Age Group	-	-	-	0.98
<65 y/o	6957 (84.5%)	6953 (84.5%)	13,910 (84.5%)	
≧65 y/o	1275 (15.5%)	1279 (15.5%)	2554 (15.5%)	
Gender	-	-	-	0.63
Male	2117 (25.7%)	2144 (26.0%)	4261 (25.9%)	
Female	6115 (74.3%)	6088 (74.0%)	12,203 (74.1%)	
HTN (%)	2202 (26.8%)	2213 (26.9%)	4415 (26.8%)	0.85
DM (%)	1515 (18.4%)	1551 (18.8%)	3066 (18.6%)	0.47
Hyperlipidemia (%)	1585 (19.3%)	1598 (19.4%)	3183 (19.3%)	0.80
CAD (%)	556 (6.8%)	585 (7.1%)	1141 (6.9%)	0.37
CVA (%)	171 (2.1%)	205 (2.5%)	376 (2.3%)	0.08
Chronic liver disease (%)	532 (6.5%)	575 (7.0%)	1107 (6.7%)	0.18
Chronic renal failure (%)	102 (1.2%)	129 (1.6%)	231 (1.4%)	0.07
Depression (%)	230 (2.8%)	262 (3.2%)	492 (3.0%)	0.14
RA (%)	107 (1.3%)	112 (1.4%)	219 (1.3%)	0.73
Follow-up time (years)	6.7±4.3	6.5±4.2	6.6±4.2	< 0.01*

Notes: Data are presented as N or mean ± standard deviation. *p < 0.05 was considered statistically significant after test.
Abbreviations: TF, trigger finger; HTN, hypertension; DM, diabetes; CAD, coronary artery disease; CVA, cerebrovascular accident; RA, rheumatoid arthritis.

Table 2 The Risk of Subsequent Severe Carpal Tunnel Syndrome That Required Surgical Release (CTR) Among the Patients with Severe and Non-Severe Trigger Finger (TF)

	TF	
	Severe	**Non-Severe**
Patient numbers	8232	8232
CTR	60	40
Person-years	53,204	55,082
Incidence rate[a]	1.1	0.7
Univariate model		
Crude HR (95% CI)	1.53 (1.03–2.29)	1 (Ref.)
p-value	0.04*	
Multivariate model[b]		
aHR (95% CI)	1.51 (1.01–2.26)	1 (Ref.)
p-value	0.04*	

Notes: [a]Per 1000 person-years. [b]Multivariate Cox proportional hazard regression model with adjustment for all baseline characteristics shown in Table 1.
Abbreviations: aHR, adjusted hazard ratio; CI, confidence interval; CTS, carpal tunnel syndrome, HR, hazard ratio; ref, reference; TF, trigger finger.

significant at 1.51 (p = 0.043; Table 2). The risk factors significantly correlated with a higher incidence of CTR were age, female sex, prior severe TF, diabetes mellitus, and chronic renal failure (Table 3). We divided all the patients into subgroups based on age (>65 years vs <65 years) and sex (male vs female). Patients aged >65 years in the severe TF group exhibited a significantly higher risk of CTR than did their counterparts in the nonsevere TF group (aHR = 1.55;

Table 3 The Risk Factors Associated with Subsequent Severe Carpal Tunnel Syndrome That Required Surgical Release Among the Patients with Trigger Finger (TF)

	HR (95% CI)	**p-value**
Age	0.97 (0.95, 0.99)	0.02*
Gender (Male vs Female)	0.39 (0.21, 0.71)	< 0.01*
TF (Severe vs Non-severe)	1.51 (1.01, 2.26)	0.04*
HTN vs None	0.80 (0.47, 1.36)	0.40
DM vs None	1.58 (1.10, 2.29)	< 0.01*
Hyperlipidemia vs None	0.79 (0.43, 1.45)	0.45
CAD vs None	1.15 (0.48, 2.73)	0.75
CVA vs None	1.68 (0.52, 5.45)	0.39
Chronic liver disease vs None	1.71 (0.90, 3.24)	0.10
Chronic renal failure vs None	4.56 (2.22, 9.36)	< 0.01*
Depression vs None	1.08 (0.34, 3.42)	0.89
RA vs None	0.69 (0.10, 4.93)	0.71

Notes: Data are presented as HR (95% CI). *p <0.05 was considered statistically significant after test.
Abbreviations: TF, trigger finger; HTN, hypertension; DM, diabetes; CAD, coronary artery disease; CVA, cerebrovascular accident; RA, rheumatoid arthritis.

Table 4 The Age and Gender Subgroup Analysis of Subsequent Severe Carpal Tunnel Syndrome That Required Surgical Release (CTR) Among the Patients with Severe and Non-Severe Trigger Finger

Variables	Crude HR[a] (95% CI)	p-value	Adjusted HR[a] (95% CI)	p-value	p for Interaction
Main model					
Severe TF	1.00		1.00		
Non-severe TF	1.53 (1.03–2.29)	0.04*	1.51 (1.01–2.26)	0.04*	
Age					0.764
< 65 y/o					
Severe TF	1.00		1.00		
Non-severe TF	1.98 (0.36, 10.79)	0.43	2.01 (0.37, 11.01)	0.42	
≧65 y/o					
Severe TF	1.00		1.00		
Non-severe TF	1.63 (1.21, 2.21)	< 0.01*	1.55 (1.14, 2.10)	0.01*	
Gender					0.764
Male					
Severe TF	1.00		1.00		
Non-severe TF	1.03 (0.33, 3.21)	0.95	0.99 (0.32, 3.11)	1.00	
Female					
Severe TF	1.00		1.00		
Non-severe TF	1.62 (1.06, 2.49)	0.03*	1.60 (1.04, 2.46)	0.03*	

Notes: [a]Cox's proportional hazards model. *p <0.05 was considered statistically significant after test.
Abbreviations: CI, confidence interval; HR, hazard Ratio; TF, trigger finger.

95% confidence interval [CI]: 1.14–2.10; p = 0.005; aHR = 1.60; 95% CI: 1.04–2.46; p = 0.031, respectively; Table 4). The cumulative incidence of CTR was significantly higher in the severe TF group than in the nonsevere TF groups (Figure 2).

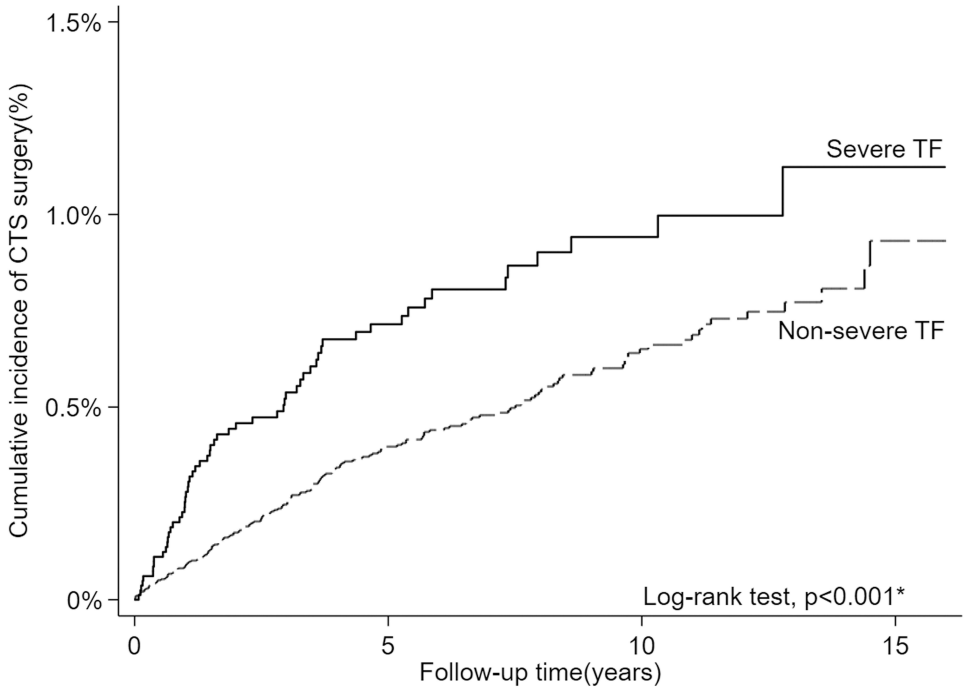

Figure 2 The proportion of subsequent carpal tunnel requiring surgical release of the TF-OP group and the TF-NOP group. *A value of p < 0.05 was considered statistically significant after test.

Discussion

Our results indicate that the incidence of CTR increased after postoperative year 1 among patients receiving release surgery within 1 year after the diagnosis of TF, particularly women and patients aged >65 years. Studies have reported that carpal tunnel release may be a risk factor for TF.[9–23] Raducha et al[24] reported that ipsilateral TF occurred in 6.83% of patients undergoing carpal tunnel release; by contrast, the incidence of contralateral TF was only 2.7%. TF results from fibrocartilaginous metaplasia of the gliding tendon–pulley interface.[25] CTS has a similar pathophysiological mechanism to TF. CTS often results from fibrous hypertrophy of the synovial flexor sheath.[26] The flexor tendon passes through the carpal tunnel and is located distal to the finger pulleys; thus, the tendon and pulley may influence each other during wrist or finger motion or after local release surgery. This similar pathogenesis may explain the development of CTS concomitant with TF. A pathophysiological model proposed in 2004 suggested that CTS is the consequence of noninflammatory thickening and fibrosis of the subsynovial connective tissue in the carpal tunnel.[27] Hosseini-Farid et al[28] also reported that the shear contributed by the tendon and subsynovial tissue excursion is related to CTS. TF release may alter tendon excursion forces, increasing the likelihood of CTS development.[22] A genome-wide association study in the UK Biobank prospective cohort also discovered that the DIRC3 locus on chromosome 2 may be significantly associated with both CTS and TF and suggested a model in which IGF-1 may be a driver of both diseases.[29] The genetic data support the similar pathophysiological mechanism between these two pathologies.

We discovered that diabetes mellitus and chronic renal failure were significant risk factors for CTS requiring surgery among patients with TF (Table 3). Geoghegan et al[16] noted that diabetes mellitus, previous musculoskeletal diseases, and female sex are risk factors for CTS. Otsubo et al[17] reported that 90% of patients who require long-term dialysis experience CTS, possibly because of amyloid deposition in the carpal tunnel. An increase in β-2-microglobulin levels in patients undergoing long-term hemodialysis may result in secondary amyloidosis, leading to CTS.[22] Patients with diabetes mellitus may also experience chronic renal failure induced by hemodynamic or metabolic pathways.[23] Both of these conditions can directly or indirectly contribute to neuropathies such as CTS. Peripheral edema is common among patients with diabetes mellitus or chronic renal failure and may cause flexor tenosynovitis, thereby leading to median nerve compression within the carpal tunnel.

Sex and age are common predictors of CTS.[18–20] Becker et al[18] determined female sex, age, and obesity to be risk factors for CTS. Moghtaderi et al[20] also discovered female sex to be a risk factor for CTS. In the subgroup analysis in this study, we observed that patients who underwent TF surgery were more likely to develop CTS requiring surgery than were those who did not, even among the subgroups of female patients and patients aged >65 years. Alteration of the gliding mechanism of the flexor tendon after TF release may influence the space of the median nerve in the carpal tunnel and cause further compression of the nerve among patients at a high risk of CTS. For patients with risk factors for TF and CTS, flexor tendon rehabilitation and living or working condition adjustments may be critical after TF surgery.

Our study has some limitations. First, we did not include detailed data on the related symptoms, such as pain, paresthesia, or the degree of muscle atrophy, or the detailed electrophysiological findings because Taiwan's National Health Insurance Research Database does not include these data; these factors may have some influence on the development of severe CTS. Second, although we demonstrated the correlation of severe TF that required surgical release with the development of severe CTS that required CTR, we did not include patients with CTS who did not undergo surgery as a less-severe group, which would be a linking point between the groups analyzed in this study. Third, we could not assess patients' working conditions, which may affect the incidence of CTS and TF. Despite these limitations, our study still elucidated the incidence of CTR at 1 year after surgery for severe TF. Because our study was a longitudinal nationwide cohort study and we applied PSM, our results are robust. Alteration of distal flexor tendon motion and gliding caused by A1 pulley incision may influence the proximal flexor tendon and further affect the carpal tunnel, thereby causing CTS. The findings deepen our understanding of the relationship between TF and CTS in the Taiwanese population and support a model of shared pathophysiology between TF and CTS. We will investigate the rehabilitation programs and adjustments for living or working conditions that may be beneficial after surgery for severe TF to prevent further complication, and we will also examine the molecular-level and genetic correlations between the pathologies and their surgical interventions.

Conclusion

Severe TF (requiring surgery within 1 year) may be associated with an accelerated onset of severe CTS (requiring surgery), especially in women and patients older than 65 years, compared with nonsevere TF (not requiring surgery within 1 year). Diabetes mellitus and chronic renal failure may be additional risk factors. The study findings inform clinicians of future pathologies and complications in patients with TF and may be helpful in the patient management and consultation. Preventive protocols should be developed for patients requiring surgery for severe TF who are at high risk for further complications.

Acknowledgments

This manuscript was edited by Wallace Academic Editing.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Moore JS. Flexor tendon entrapment of the digits (trigger finger and trigger thumb). *J Occup Environ Med*. 2000;42(5):526–545. doi:10.1097/00043764-200005000-00012
2. David M, Rangaraju M, Raine A. Acquired triggering of the fingers and thumb in adults. *BMJ*. 2017;359:j5285. doi:10.1136/bmj.j5285
3. Gil JA, Hresko AM, Weiss AC. Current Concepts in the Management of Trigger Finger in Adults. *J Am Acad Orthop Surg*. 2020;28(15):e642–e650. doi:10.5435/JAAOS-D-19-00614
4. Ryzewicz M, Wolf JM. Trigger digits: principles, management, and complications. *J Hand Surg Am*. 2006;31(1):135–146. doi:10.1016/j.jhsa.2005.10.013
5. Will R, Lubahn J. Complications of open trigger finger release. *J Hand Surg Am*. 2010;35(4):594–596. doi:10.1016/j.jhsa.2009.12.040
6. Everding NG, Bishop GB, Belyea CM, Soong MC. Risk factors for complications of open trigger finger release. *Hand*. 2015;10(2):297–300. doi:10.1007/s11552-014-9716-9
7. Bland JD. Carpal tunnel syndrome. *BMJ*. 2007;335(7615):343–346. doi:10.1136/bmj.39282.623553.AD
8. Wang L. Guiding treatment for carpal tunnel syndrome. *Phys Med Rehabil Clin N Am*. 2018;29(4):751–760. doi:10.1016/j.pmr.2018.06.009
9. Lee HI, Lee JK, Yoon S, et al. Carpal tunnel release can be a risk factor for trigger finger: national health insurance data analysis. *Int Orthop*. 2022;46(4):867–873. doi:10.1007/s00264-022-05312-5
10. Ashmead D, Okada H, Macknin J, Naalt SV, Staff I, Wollstein R. Trigger fingers after open carpal tunnel release. *Plast Surg*. 2020;28(4):192–195. doi:10.1177/2292550320928554
11. Zhang D, Collins J, Earp BE, Blazar P. Relationship of carpal tunnel release and new onset trigger finger. *J Hand Surg Am*. 2019;44(1):28–34. doi:10.1016/j.jhsa.2018.10.003
12. Lin FY, Wu CI, Cheng HT. Coincidence or complication? A systematic review of trigger digit after carpal tunnel release. *J Plast Surg Hand Surg*. 2018;52(2):67–73. doi:10.1080/2000656X.2017.1345751
13. Karalezli N, Kütahya H, Güleç A, Toker S, Karabörk H, Ogun TC. Transverse carpal ligament and forearm fascia release for the treatment of carpal tunnel syndrome change the entrance angle of flexor tendons to the A1 pulley: the relationship between carpal tunnel surgery and trigger finger occurrence. *ScientificWorldJournal*. 2013;2013:630617. doi:10.1155/2013/630617
14. Lee SK, Bae KW, Choy WS. The relationship of trigger finger and flexor tendon volar migration after carpal tunnel release. *J Hand Surg Eur Vol*. 2014;39(7):694–698. doi:10.1177/1753193413479506
15. Lin FY, Manrique OJ, Lin CL, Cheng HT. Incidence of trigger digits following carpal tunnel release: a nationwide, population-based retrospective cohort study. *Medicine*. 2017;96(27):e7355. doi:10.1097/MD.0000000000007355
16. Geoghegan JM, Clark DI, Bainbridge LC, Smith C, Hubbard R. Risk factors in carpal tunnel syndrome. *J Hand Surg Br*. 2004;29(4):315–320. doi:10.1016/j.jhsb.2004.02.009
17. Otsubo S, Kimata N, Okutsu I, et al. Characteristics of dialysis-related amyloidosis in patients on haemodialysis therapy for more than 30 years. *Nephrol Dial Transplant*. 2009;24(5):1593–1598. doi:10.1093/ndt/gfn706
18. Becker J, Nora DB, Gomes I, et al. An evaluation of gender, obesity, age and diabetes mellitus as risk factors for carpal tunnel syndrome. *Clin Neurophysiol*. 2002;113(9):1429–1434. doi:10.1016/s1388-2457(02)00201-8
19. Westenberg RF, Oflazoglu K, de Planque CA, Jupiter JB, Eberlin KR, Chen NC. Revision carpal tunnel release: risk factors and rate of secondary surgery. *Plast Reconstr Surg*. 2020;145(5):1204–1214. doi:10.1097/PRS.0000000000006742
20. Moghtaderi A, Izadi S, Sharafadinzadeh N. An evaluation of gender, body mass index, wrist circumference and wrist ratio as independent risk factors for carpal tunnel syndrome. *Acta Neurol Scand*. 2005;112(6):375–379. doi:10.1111/j.1600-0404.2005.00528.x
21. Lim CY, Ong KO. Various musculoskeletal manifestations of chronic renal insufficiency. *Clin Radiol*. 2013;68(7):e397–e411. doi:10.1016/j.crad.2013.01.025
22. Toth-Manikowski S, Atta MG. Diabetic kidney disease: pathophysiology and therapeutic targets. *J Diabetes Res*. 2015;2015:697010. doi:10.1155/2015/697010
23. Raducha JE, Jiang W, Kahan L, Dove JH, Cochran C, Weiss AC. Rates of and risk factors for trigger finger after open carpal tunnel release. *J Wrist Surg*. 2021;10(5):413–417. doi:10.1055/s-0041-1730343
24. Shafaee-Khanghah Y, Akbari H, Bagheri N. Prevalence of carpal tunnel release as a risk factor of trigger finger. *World J Plast Surg*. 2020;9(2):174–178. doi:10.29252/wjps.9.2.174

25. Makkouk AH, Oetgen ME, Swigart CR, Dodds SD. Trigger finger: etiology, evaluation, and treatment. *Curr Rev Musculoskelet Med*. 2008;1(2):92–96. doi:10.1007/s12178-007-9012-1
26. Aboonq MS. Pathophysiology of carpal tunnel syndrome. *Neurosciences*. 2015;20(1):4–9.
27. Ettema AM, Amadio PC, Zhao C, Wold LE, An KN. A histological and immunohistochemical study of the subsynovial connective tissue in idiopathic carpal tunnel syndrome. *J Bone Joint Surg Am*. 2004;86(7):1458–1466. doi:10.2106/00004623-200407000-00014
28. Hosseini-Farid M, Schrier VJMM, Starlinger J, Zhao C, Amadio PC. Carpal tunnel syndrome treatment and the subsequent alterations in tendon and connective tissue dynamics. *Clin Biomech*. 2021;88:105440. doi:10.1016/j.clinbiomech.2021.105440
29. Patel B, Kleeman SO, Neavin D, et al. Shared genetic susceptibility between trigger finger and carpal tunnel syndrome: a genome-wide association study. *Lancet Rheumatol*. 2022;4(8):e556–e565. doi:10.1016/S2665-9913(22)00180-1