

Surgical Trigger Finger Release Is Associated With New-Onset Dupuytren Contracture in the Short-Term Postoperative Period: A Matched Analysis

HAND

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Abstract

Background: This article compares the rates and time-to-development of new-onset Dupuytren disease in patients with trigger finger treated by steroid injection, surgical release, or both. **Methods:** PearlDiver's Mariner 30 database was queried to identify patients with trigger finger between January 2010 and June 2019. One-to-one exact matching based on baseline patient demographics allowed us to create 4 identical groups defined by the type of trigger finger intervention received. **Results:** The matched population analyzed in this study consisted of 85 944 patients who were equally represented in the steroid injection cohort (n = 21 486, 25.00%), surgical release cohort (n = 21 486, 25.00%), steroids prior to surgery cohort (n = 21 486, 25.00%), and no intervention (control) cohort (n = 21 486, 25.00%). A new Dupuytren diagnosis after trigger finger treatment occurred in 1 in 128 patients overall, 1 in 156 patients treated with steroid injection, and 1 in 126 patients treated with surgical release. Trigger fingers treated by steroid injection only had the lowest rates of Dupuytren disease overall (n = 137, 0.64%, $P = .0424$) and treatment with fasciectomy (n = 14, 0.07%, $P < .0005$). In all, 171 patients in the surgery cohort developed Dupuytren disease 1 year after undergoing surgical trigger finger release. Furthermore, this cohort had the highest rates of fasciectomy (n = 55, 0.26%, $P < .0005$) and the lowest rates of no intervention (n = 103, 0.48%, $P = .0471$). Trigger fingers managed by surgical release developed Dupuytren disease (mean, 56.11 days; SD, 80.93 days, log-rank $P = .02$) and underwent fasciectomy (mean, 49.74 days; SD, 62.27 days; log-rank $P < .0005$) more quickly than all other cohorts. **Conclusions:** Patients solely undergoing surgical release of their trigger finger had significantly higher odds and expedited rate of developing new-onset Dupuytren disease overall and undergoing subsequent treatment by fasciectomy compared with trigger fingers managed by other interventions.

Keywords: Dupuytren disease, Dupuytren contracture, stenosing tenosynovitis, trigger finger

Introduction

Trigger finger, or stenosing tenosynovitis, and Dupuytren disease are 2 of the most common clinical presentations encountered by hand surgeons.¹ Trigger finger is estimated to affect 2.2% to 17% of the general and diabetes populations, respectively.^{2,3} Tendon entrapment can cause painful catching, which may require passive manipulation of the digit into extension.³ The treatment approach may initially involve noninvasive therapies, such as non-steroidal anti-inflammatory drugs, splinting, and corticosteroid injections.^{1,3} Surgical procedures aim to release the hypertrophied pulley by open, percutaneous, or endoscopic methods.^{1,3}

Dupuytren disease is the most common heritable disorder involving connective tissues, with the prevalence ranging from 0.2% to 30% depending on ethnic background and geographic location.^{4,5} Palmar nodules are the earliest sign

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of disease and may progress to form fascial cords, which can cause flexion contractures of the metacarpophalangeal and/or proximal interphalangeal joints.⁴ Dupuytren contracture is the end result of this disease progression and accounts for less than one-fifth of all patients with Dupuytren disease.⁴ Although there are no curative treatments for Dupuytren disease, primary treatment options of Dupuytren contracture range from release of soft tissues, via collagenase injection or percutaneous needle fasciotomy, to excision, via fasciectomy or dermatofasciectomy.⁴

There is some overlap in the risk factors for development of Dupuytren disease and trigger finger, such as manual labor and diabetes mellitus.^{4,6} Presently, much of the research conducted has been to identify risk factors of these pathologies independently. Although a clear linking etiologic process has yet to be identified, recent literature has suggested there may be a significant association between these 2 conditions.⁶

In our patient population, we noticed a proportion of previously undiagnosed patients developing Dupuytren contractures (in the same digit) in the postoperative period following surgical trigger finger release (STFR). To our knowledge, no studies have evaluated the risk of developing Dupuytren contracture based on management of patients with trigger fingers. Studies of this nature may aid in risk-benefit conversations with patients and could provide a basis for critical decision making when approaching treatment of trigger fingers. We compared Dupuytren disease risk in trigger finger patients treated with steroid injections and/or surgical release and those not receiving any intervention. We quantify the potential contribution of patient-specific clinical profiles and explore how time to contracture is impacted by trigger finger intervention type.

Methods

Data Source

This study followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines and was approved by the Rush University Medical Center Institutional Review Board with a waiver of patient's informed consent, as the nature of this analysis posed minimal risk to participating patients, and the data were presented in aggregate to minimize any risk of loss of confidentiality of medical data. PearlDiver's Mariner 30, an all-payer claims database containing more than 30 million distinct patients nationally from 2010 through the second quarter of 2019, was retrospectively analyzed in this cohort study.⁷ This database is updated on a quarterly basis and contains deidentified and Health Insurance Portability and Accountability Act-compliant patient information, which includes commercial, Medicare, Medicaid, government, and cash payer types from facility, physician, ancillary services,

and pharmacies encompassing all of the United States and its territories.⁷

Study Cohort

International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10) diagnostic codes were used to identify all patients diagnosed with trigger finger(s) (Supplemental Table 1). Patients with a diagnosis of Dupuytren disease prior to their trigger finger diagnosis and those aged 17 years or younger were excluded from our study (Figure 1).

In a similar manner, ICD-9 and ICD-10 diagnostic and Current Procedural Terminology (CPT) codes were used to stratify patients into 4 respective groups based on their trigger finger management: steroid cohort (CPT-20550), surgical release cohort (CPT-26055), steroids and surgical release cohort (CPT-20550 and CPT-26055), and no treatment (control) cohort. Patients in the steroid cohort were identified by the presence of codes for both trigger finger and steroid injection at the same time. In a similar way, patients of the remaining cohorts were identified by their trigger finger diagnosis concurrently being coded with the respective intervention they received.

Comorbidities

As previously described, comorbidity status was defined by the presence of ICD-9 and ICD-10 diagnostic codes within 1 year prior to their trigger finger diagnosis. The Centers for Disease Control and Prevention interpretation of body mass index (BMI) was used to identify patients as being underweight (BMI, <19 kg/m²), normal weight (BMI, 19-24 kg/m²), overweight (BMI, 25-29.9 kg/m²), class 1 obesity (BMI, 30-34.9 kg/m²), class 2 obesity (BMI, 35-39.9 kg/m²), or class 3 obesity (BMI, 40 kg/m² or more).^{8,9} The following comorbidities were included in our study: type 2 diabetes mellitus,^{10,11} hypertension,¹² hyperlipidemia,¹² HIV,¹³ epilepsy,^{11,14,15} alcoholism,^{11,16} active smoking,^{9,17} rheumatoid arthritis,¹⁸ osteoarthritis,¹⁹ frozen shoulder,²⁰ rock climbing,²¹ and vibration exposure.^{9,22} These comorbidities were decided based on prior literature identifying any risk factor or association for the development of Dupuytren disease (Supplemental Table 2).

Outcome Definition

The primary aim of this study was to assess the future development of Dupuytren disease (ICD-9-D-7286 or ICD-10-D-M720) within 1 year of their trigger finger diagnosis or intervention. More specifically, the steroid injection cohort was followed for the development of Dupuytren disease 1 year after they received their steroid injection. The surgical release and steroids prior to surgery cohorts were

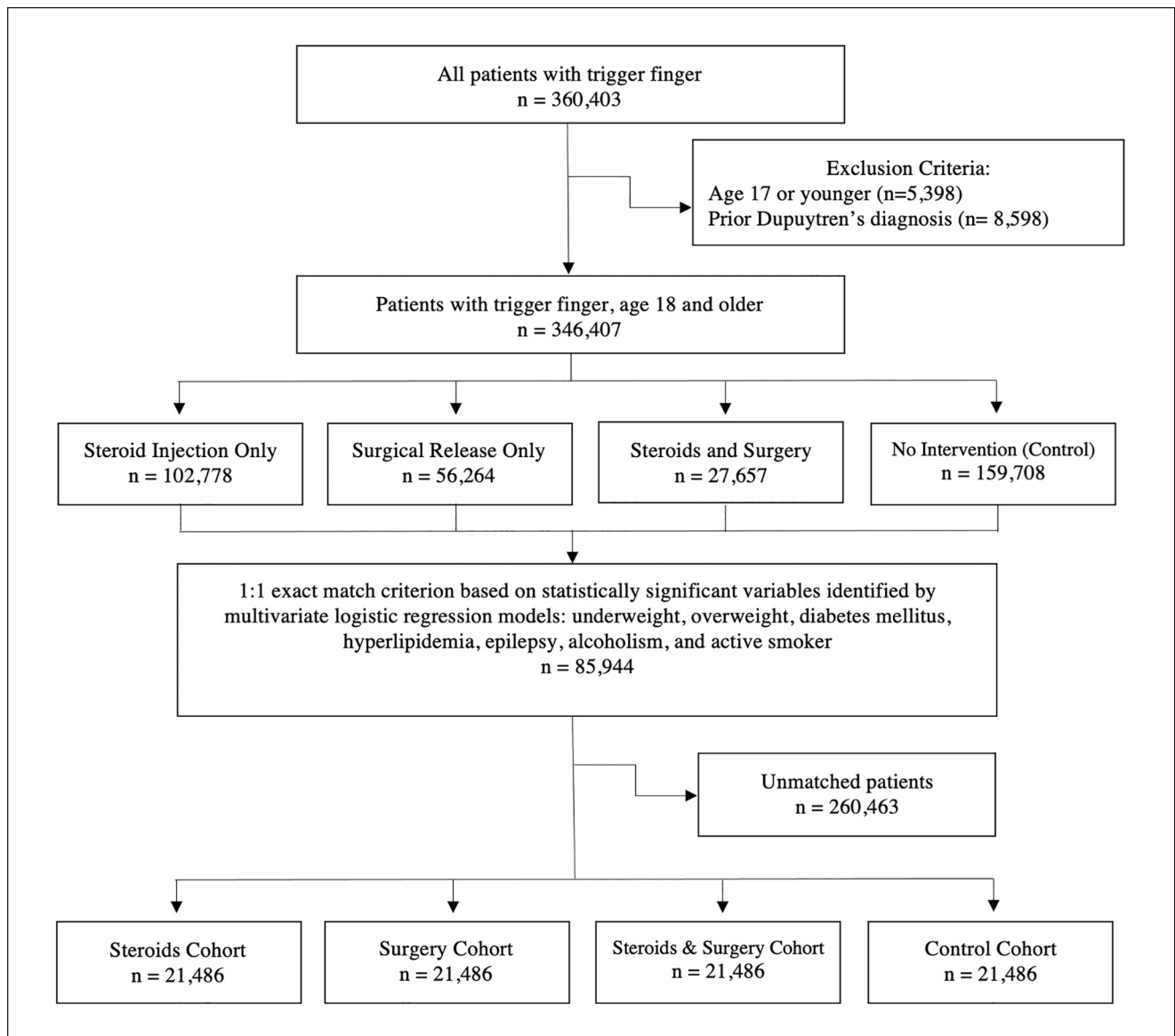


Figure 1. Patient selection flow chart.

both followed for the development of Dupuytren disease 1 year after they underwent STFR. Patients in the no intervention cohort were followed for 1 year after their trigger finger diagnosis.

Our outcomes were further divided based on the intervention received after their Dupuytren diagnosis (Supplemental Table 3):

- Collagenase (CPT-20527 or CPT-26341);
- Fasciotomy (ICD-9-P-8212, CPT-26040 or CPT-26045);
- Fasciectomy (ICD-9-P-8235, CPT-26121, CPT-26123 or CPT-26125);
- No intervention.

The secondary aim of this study was to investigate and compare each cohort's time-to-development of these aforementioned complications.

Statistical Analysis

Descriptive statistics were calculated for the total population's age, sex, BMI, and comorbidities and compared between the 4 cohorts: steroid, surgical release, steroid and surgery, and control. Multivariate logistic regression models were constructed to identify any association between specific comorbidities and each outcome of interest. Hosmer-Lemeshow goodness of fit (GOF) test was used to assess each model's fitting behavior. The Hosmer-Lemeshow

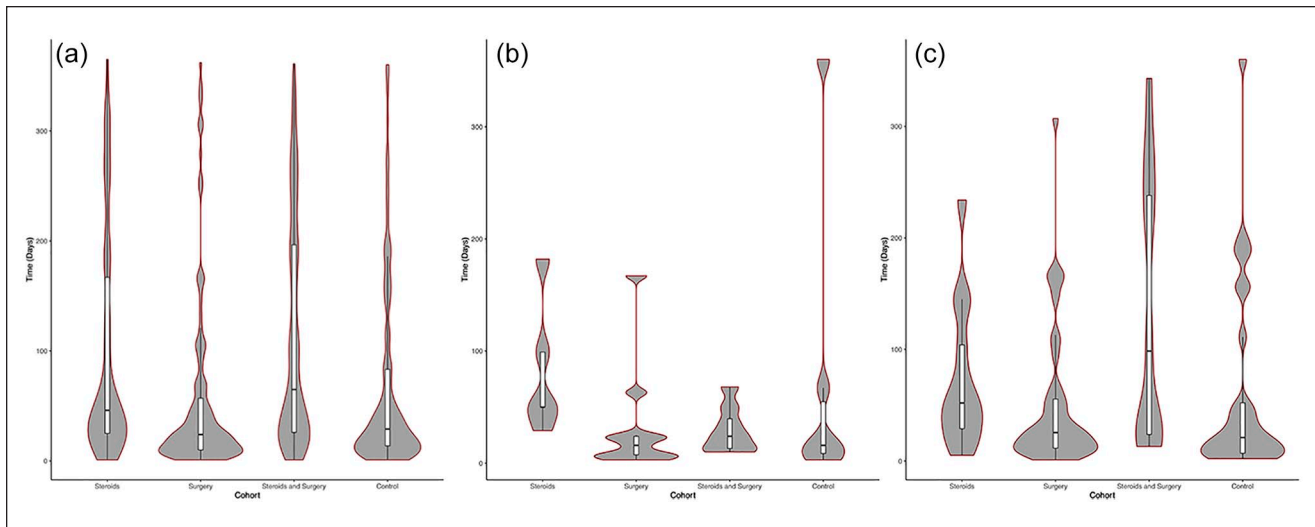


Figure 2. (a-c) Violin plots with boxplot overlay of time between trigger finger intervention and overall Dupuytren contracture (a), fasciotomy (b), and fasciectomy (c) among the matched population. Each violin spans the 98% quantile with its width proportional to the number of patients experiencing the complication at each given point in time. The boxplots within each violin denote the 95% confidence interval with the solid line representing the median time-to-complication.

GOF test χ^2 P values were collected for each model; any P value greater than .05 indicates a good logistic regression model fit. Any comorbidity in these models with a P value of .05 or less was deemed statistically significant and was used as our match criterion.

To mitigate the effect of these potentially confounding variables, patients in each cohort were then exactly matched in a one-to-one fashion based on the models' statistically significant variables. χ^2 tests, Fisher exact test, and odds ratios (OR) with 95% confidence intervals (95% CI) were then calculated to compare the categorical variables between cohorts in the matched population. Violin plots were created to visualize the distribution of timing to complications between cohorts. In addition, Kaplan-Meier event models were constructed to simultaneously investigate the effect of each trigger finger intervention on the time-to-development of new-onset Dupuytren disease. A log-rank P value of .05 or less is indicative of a statistically significant model, meaning the time-to-development of complications significantly differs between cohorts. Statistical analysis was performed using R statistical software (version 3.6.0, 2019).

Results

Between January 2010 and June 2019, 360403 patients with trigger finger were identified. Following exclusion of patients aged 17 years or younger ($n = 5398$) and prior Dupuytren diagnosis ($n = 8598$), 346407 trigger finger patients were eligible, of which 102778 were treated with steroid injections, 56264 with surgical release, 27657 with both steroid injections and surgical release, and 159708

with no intervention (Figure 1). Patient characteristics and comorbidity status for the unmatched population can be seen in Supplemental Table 4. History of diabetes mellitus, hyperlipidemia, epilepsy, alcoholism, active smoker, underweight, and overweight were found to be statistically significant on multivariate analysis (Supplemental Table 5).

The exact-matched population analyzed in this study contained 85944 patients who were equally represented in the steroid ($n = 21486$, 25.00%), surgical release ($n = 21486$, 25.00%), steroids and surgical release ($n = 21486$, 25.00%), and control ($n = 21486$, 25.00%) cohorts. Each cohort consisted of exactly 66.49% women and 33.51% men with 86.51% of patients being between the ages of 45 and 74 years. Comorbidities were also equally represented, with hyperlipidemia ($n = 10934$, 50.89%) and diabetes mellitus ($n = 6060$, 28.20%) most commonly occurring.

A new Dupuytren diagnosis after trigger finger treatment occurred in 1 of 128 patients overall. The number of *days*-to-development of Dupuytren disease overall (mean, 56.11 days; SD, 80.93 days; log-rank $P = .02$) and *days*-to-undergoing fasciectomy (mean, 49.74 days; SD, 62.27 days; log-rank $P < .005$) were found to be significantly less in the surgical release cohort compared with all other groups (Figures 2 and 3; Supplemental Table 6). The days-to-undergoing collagenase and fasciotomy did not significantly differ (Figure 2, Supplemental Table 6).

Steroid Cohort

Trigger fingers managed with steroid injection had significantly lower *rates* of overall Dupuytren disease ($n = 137$, 0.64%, $P = .0424$) and fasciectomy ($n = 14$, 0.07%, $P <$

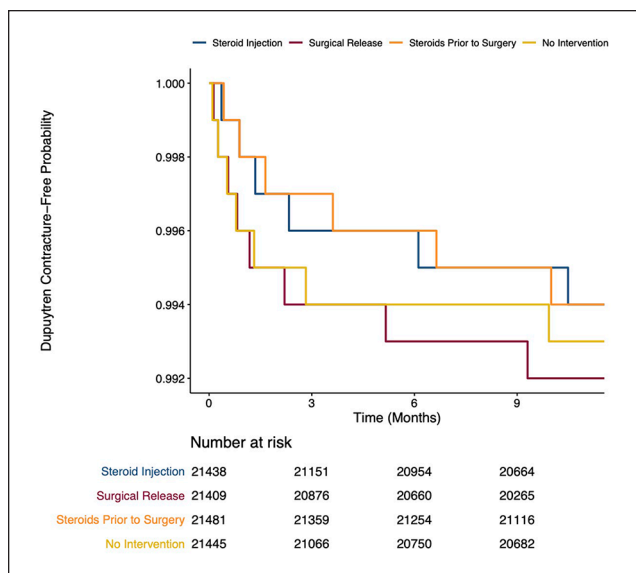


Figure 3. Kaplan-Meier plot for the development of Dupuytren contracture occurring 1 year after the treatment of trigger finger among the matched population.

.0005) compared with all other cohorts. Furthermore, the steroid cohort had significantly lower odds of Dupuytren disease (OR, 0.747; 95% CI: 0.60-0.93) and fasciectomy (OR, 0.451; 95% CI, 0.24-0.85) compared with the control cohort.

Surgery Cohort

Patients in the surgical release cohort who developed Dupuytren disease had significantly higher rates of fasciectomy (n = 55, 0.26%, P < .0005) and lower rates of no intervention (n = 103, 0.48%, P = .0471) than all other cohorts. The surgical release cohort had significantly lower odds of developing Dupuytren disease (OR, 0.709; 95% CI, 0.55-0.91) within 1 year postoperatively compared with the control group. Conversely, STFR carried significantly higher odds of undergoing fasciectomy (OR, 1.776; 95% CI, 1.14-2.76) compared with the control cohort.

Steroids Prior to Surgery Cohort

There was no significant difference in developing Dupuytren disease in trigger fingers treated with steroid injections prior to surgery. In addition, there was no significant difference between the rates or odds of Dupuytren disease managed with collagenase or fasciotomy regardless of the trigger finger intervention (Tables 1 and 2).

Discussion

Hand surgeons routinely care for patients with trigger finger and Dupuytren disease. Despite this frequency, prior

literature on the interrelatedness of these conditions is sparse, with only a few studies concurrently examining these disease processes.^{6,23,24} In the limited published data, a total of 50 patients were found to have both pathologies, suggesting that an association may exist.²³⁻²⁵

This is the first study attempting to demystify the risk and timing of developing new-onset Dupuytren disease after various trigger finger interventions. Approximately 0.78% of our total matched population developed new-onset Dupuytren disease, most commonly treated with fasciectomy. This intervention coincides with published Dupuytren management.²⁶⁻³⁰ Although this is a low percentage, it is statistically significant and correlates with our anecdotal clinical experience.

Patients undergoing STFR had a significantly higher rate of subsequent Dupuytren disease requiring fasciectomy compared with patients receiving other interventions (0.26% STFR vs 0.07% steroids vs 0.18% steroids and surgery vs 0.14% control). In addition, patients undergoing STFR developed Dupuytren disease more rapidly than patients receiving other interventions. These patients underwent fasciectomy, on average, within 50 days of STFR.

The STFR is considered a minor hand surgery with a short recovery. To experience the subsequent untoward outcome of a Dupuytren disease requiring fasciectomy is devastating for both the patient and the surgeon. Thus, this is an important subgroup for practicing hand surgeons to fully understand. Do the postoperative inflammatory changes and associated healing elicit a rapid progression to Dupuytren disease? Do these patients carry the genetic predisposition for Dupuytren disease, or is this a Dupuytren-like phenomenon? If these patients never had STFR, would they have ultimately developed Dupuytren disease? These are important questions yet to be answered in the body of hand surgery literature.

We propose 2 possible explanations to this phenomenon. The first is that this patient group carries the genetic predisposition for Dupuytren disease, and that the surgical intervention in a high-risk area (adjacent to palmar fascia) expedites the disease appearance. There is some suggestion that physiologic changes are present even prior to clinical evidence of Dupuytren disease.^{4,31} It has been reported that the tissues of susceptible patients contain an abnormal abundance of type III collagen and that surgical trauma may trigger Dupuytren disease.^{4,31,32} This may support the “genetic” theory that the cohort of patients identified in this study were susceptible to Dupuytren disease preoperatively.

The second explanation is that this patient group does not carry the genetic predisposition, but rather that the STFR elicits a “Dupuytren-like” phenomenon. Based on our anecdotal experience, we feel this theory is less likely. In our patients who have suffered this untoward outcome, most are of Northern European descent, and some, when prompted and with some digging, have identified a

Table 1. Descriptive Characteristics and Rates of Complications Occurring Within 1 Year of Undergoing Trigger Finger Interventions Among the Matched Population.

Characteristic	Total matched population n = 85 944	Steroid injection cohort n = 21 486	Surgical release cohort n = 21 486	Steroids + surgical release cohort n = 21 486	Control cohort n = 21 486	P value
Age, No. (%)						
18-24	104 (0.12)		26 (0.12)			>.999
25-34	736 (0.86)		184 (0.86)			
35-44	3660 (4.26)		915 (4.26)			
45-54	18 096 (21.06)		4524 (21.06)			
55-64	30 308 (35.26)		7577 (35.26)			
65-74	26 724 (31.09)		6681 (31.09)			
≥75	6316 (7.35)		1579 (7.35)			
Sex, No. (%)						
Female	57 148 (66.49)		14,87 (66.49)			>.999
Male	28 796 (33.51)		7199 (33.51)			
Trigger finger hand laterality, No. (%)						
Right	16 920 (19.69)		4230 (19.69)			>.999
Left	18 108 (21.07)		4527 (21.07)			
Bilateral	26 272 (30.57)		6568 (30.57)			
Unspecified	24 644 (28.67)		6161 (28.67)			
Body mass index, No. (%)						
Underweight (<19 kg/m ²)	412 (0.48)		103 (0.48)			>.999
Overweight (25-29.9 kg/m ²)	7808 (9.08)		1952 (9.08)			>.999
Comorbidities, No. (%)						
Diabetes mellitus	24 240 (28.20)		6060 (28.20)			>.999
Hyperlipidemia	43 736 (50.89)		10934 (50.89)			>.999
Epilepsy	400 (0.47)		100 (0.47)			>.999
Alcoholism	1524 (1.77)		381 (1.77)			>.999
Active smoker	4700 (5.47)		1175 (5.47)			>.999
Complications, No. (%)						
Dupuytren contracture	672 (0.78)	137 (0.64)	171 (0.80)	181 (0.84)	183 (0.85)	.04238*
No intervention	496 (0.58)	117 (0.54)	103 (0.48)	131 (0.61)	145 (0.67)	.04708*
Collagenase	9 (0.01)	1 (0.00)	2 (0.01)	2 (0.01)	4 (0.02)	.6539
Fasciotomy	34 (0.04)	5 (0.02)	12 (0.06)	11 (0.05)	6 (0.03)	.2349
Fasciectomy	139 (0.16)	14 (0.07)	55 (0.26)	39 (0.18)	31 (0.14)	<.0005*

*Statistically significant value ($P < .05$).

Table 2. Odds Ratios of Complications Occurring Within 1 Year of Receiving Trigger Finger Interventions Among the Matched Population Compared With the Control Cohort.

Complication	Steroid injection cohort, OR (95% CI)	Surgical release cohort, OR (95% CI)	Steroids + surgical release cohort, OR (95% CI)
Dupuytren contracture	0.747 (0.60-0.93)	0.934 (0.76-1.15)	0.989 (0.80-1.22)
No intervention	0.806 (0.63-1.03)	0.709 (0.55-0.91)	0.903 (0.71-1.14)
Collagenase	0.250 (0.03-2.24)	0.500 (0.09-2.73)	0.500 (0.09-2.73)
Fasciotomy	0.833 (0.25-2.73)	2.001 (0.75-5.33)	1.834 (0.68-4.96)
Fasciectomy	0.451 (0.24-0.85)	1.776 (1.14-2.76)	1.259 (0.79-2.02)

Note. OR = odds ratio; CI = confidence interval.

previously unknown family history of Dupuytren disease. A few, on closer inspection, were found to have possible knuckle pads without other evidence of disease.

Why did the patients in this reported cohort develop Dupuytren disease so rapidly? This contradicts the accepted natural history of Dupuytren disease, which slowly

progresses over many years.^{26,33,34} A large population-based survey estimated that the average time between patients noticing their first hand symptom to seeking medical evaluation was 23.1 months.²⁶ Another study states Dupuytren disease developed on average 8.7 years after receiving a diagnosis of Dupuytren nodules.³⁵ Based on this knowledge, it would be unusual for asymptomatic patients to rapidly develop contractures within a 1-year follow-up period. It would be even more unusual for these patients to require fasciectomy only 1.5 months after STFR. Although it cannot be proven, this report suggests that STFR can expedite the development of Dupuytren disease or Dupuytren-like phenomenon.

In this study, patients with trigger finger receiving steroid injections were least likely to develop Dupuytren disease. There may be a protective effect due to the inherent anti-inflammatory properties of corticosteroids. Elliot et al reported 3 cases of Dupuytren disease after STFR,³⁶ and several studies have independently discussed the inflammatory response and subsequent pathogenesis of both trigger finger and Dupuytren disease.^{9,31,35,37-40} In the case of trigger finger, repetitive compressive loads are thought to induce fibrocartilaginous metaplasia and a subsequent size discrepancy between a digit's flexor tendon and pulley system.^{3,35,37,38} Similarly, excessive proliferation of fibroblasts, transformation into myofibroblasts, and collagen production within the palmar and digital fascial systems are thought to occur as Dupuytren disease progresses from nodules to pathologic cords.^{4,9,39,40} Although the inflammatory response has been researched independently, no large population studies have examined a possible connection between the pathogenesis of these 2 conditions. Interestingly, the steroid plus surgery cohort did not demonstrate this protective effect. Thus, the surgical intervention likely overpowered any potential benefits of steroid intervention. This information may, especially with more follow-up studies, encourage hand surgeons to attempt multiple steroid injections prior to considering STFR.

Although the retrospective nature of the study is a limitation, as retrospective studies may not allow for the full control of selection bias in the use of different interventions for different patients, the large sample size functions as a notable strength of the study. Furthermore, administrative data allow access to more medical visits nationwide and longitudinal tracking of these patients through distinct identifiers based on a standardized coding system. Other important limitations in the use of these data must be considered. Selection bias may have occurred as our final patient population consisted of more women than men, which coincides with prior findings of women being more susceptible to trigger finger.³ Our patient population may not fully represent those at risk of Dupuytren disease as Dupuytren disease is more common in men.⁹ Prior literature has suggested that obesity is a protective factor for Dupuytren disease⁴¹;

however, our multivariate logistic regression models indicated obesity did not influence the future development of Dupuytren disease. In addition, primary administrative data do not provide enough specific details on the severity of disease states and patient-reported outcome scores, or allow for standardization of treatment protocols or surgeon technique and experience, which may mask certain confounding factors. We excluded over 8000 patients who contained a Dupuytren diagnosis prior to their trigger finger diagnosis. However, there is still potential for patients to unknowingly have an asymptomatic or mild form of Dupuytren disease for which they did not seek medical attention. In addition, the ICD-9 and ICD-10 codes used to define Dupuytren disease may also be used by clinicians when describing nodules or milder disease forms. To mitigate this, we included collagenase injection and manipulation, fasciotomy, and fasciectomy as outcomes in our study. We believe the addition of these outcomes allows us to infer that patients undergoing any of these interventions had some degree of Dupuytren disease and further strengthens the validity of our results.

Despite these limitations, this study provides valuable information to the clinical practice of hand surgery by specifying the risk and timing of the development of new-onset Dupuytren disease among patients with trigger finger. This knowledge may help guide surgeons in clinical decision making and perioperative patient counseling. In our clinical experience, there is a subset of previously undiagnosed patients with Dupuytren disease who have STFR, followed by the rapid development of Dupuytren disease. It is our practice to caution patients about subsequent Dupuytren flare or contracture after STFR if there is *any suggestion* that they may have a genetic susceptibility to Dupuytren disease (family history, knuckle pads, etc). It is our belief that these patients have genetic predisposition and that this is not a Dupuytren-like phenomenon. Without accessible or affordable genetic testing, we cannot prove our hypothesis.

In our experience, this subset of patients is quite dismayed at the new Dupuytren diagnosis and the necessary intervention that follows. Intervention that perhaps would have been unnecessary had the Dupuytren susceptibility not been "awakened" by surgical intervention. We hope this article provokes interest that may lead to further clarification of the association of these diseases.

Conclusion

Patients undergoing surgical trigger finger release had significantly higher odds and expedited rate of developing new-onset Dupuytren disease. They underwent subsequent treatment by fasciectomy significantly more than patients with trigger finger managed by other interventions. This may inform clinical decision making for hand surgeons.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

The Rush University Medical Center Institutional Review Board approved this study with a waiver of patient informed consent, as the nature of this analysis posed minimal risk to participating patients and the data were presented in aggregate to minimize any risk of loss of confidentiality of medical data.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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