SCIENTIFIC ARTICLE

Factors Causing Prolonged Postoperative Symptoms Despite Absence of Complications After A1 Pulley Release for Trigger Finger

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Purpose This study aimed to investigate the incidence and prognostic factors for prolonged postoperative symptoms after open A1 pulley release in patients with trigger finger, despite absence of any complications.

Methods We reviewed 109 patients (78 single-finger involvement, 31 multiple-finger involvement) who underwent open A1 pulley release for trigger finger from 2010 to 2016, with 8 weeks or longer postsurgical follow-up and without postoperative complications. The group had 16 men and 93 women, with mean age of 56 years (range, 21−81 years), and average follow-up period of 24.8 weeks (range, 8.0−127.4 weeks). Prolonged postoperative symptoms were defined as symptoms persisting for longer than 8 weeks after surgery. Factors analyzed for delay in recovery included duration of preoperative symptoms; number of preoperative local corticosteroid injections; preoperative flexion contracture of proximal interphalangeal (PIP) joint; multiplicity of trigger finger lesions; occupation; presence of type 2 diabetes mellitus, other hand disorders like carpal tunnel syndrome, de Quervain disease, or Dupuytren contracture; and fraying or partial tear of the flexor tendon.

Results Twenty-six fingers (19.3%) showed prolonged postoperative symptoms, with mean time until complete relief being 14.0 ± 6.4 weeks (range, 9−34 weeks). Risk factors associated with prolonged postoperative symptoms included duration of preoperative symptoms, preoperative flexion contracture of the PIP joint, and fraying or partial tear of the flexor tendon.

Conclusions Physicians should consider the duration of preoperative symptoms and preoperative flexion contracture of the PIP joint when deciding timing of surgery for trigger finger patients. In addition, they should explain to patients with a positive history of these factors and in whom flexor tendon injury is found during surgery about the possibility of prolonged postoperative symptoms. *(J Hand Surg Am. 2019;44(4):338.e1-e6. Copyright © 2019 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Prognostic IV.

Key words Trigger finger, open A1 pulley release, risk factor, prolonged postoperative symptoms.

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TRIGGER FINGER IS CAUSED BY an imbalance between the diameter of the flexor tendon and the A1 pulley, through which the flexor tendon passes. It is a common hand disorder with a prevalence rate of 2.6% in the general population.[1,2] Surgical treatment is used for trigger finger if nonsurgical treatment fails. Open A1 pulley release has a success rate of 90% to 100%.[3−7]

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Although open A1 pulley release is simple and usually produces satisfactory results, the length of time before recovery after this procedure varies among patients.[5–8] A long recovery period can delay the patient's return to normal life and work and cause patient dissatisfaction. Complications such as hematoma, infection, and digital nerve injury are the most common reasons for delayed recovery.[6,9,10] However, some patients complain of discomfort for a long period of time, even in the absence of a clear complication. Psychosocial factors, especially depression, are generally accepted as the reason for variation in pain intensity and disability after minor hand surgery, including trigger finger or carpal tunnel syndrome.[11–13] Nevertheless, several reports indicate that the patient's demographic and pathophysiological factors also affect the outcome after A1 pulley release.[5,6,8,14] The present study aimed to investigate the incidence and prognostic factors for prolonged postoperative symptoms such as pain or discomfort, and limitation of range of motion (ROM) in patients who did not appear to develop any complications after open A1 pulley release.

MATERIALS AND METHODS

Patient demographics

This study was approved by our institutional review board. Patients who underwent open A1 pulley release for trigger finger between 2010 and 2016 were retrospectively analyzed. Open A1 pulley release was performed when nonsurgical treatment such as activity modification, nonsteroidal anti-inflammatory drugs, and local steroid injection failed and when the patient desired definitive symptom relief. Between 2010 and 2016, 220 patients (162 patients with single-finger involvement, 58 patients with multiple-finger involvement) underwent open A1 pulley release. Only patients with a complete office note in the electronic medical record system were eligible for the study. Patients excluded from the study were those who underwent open A1 pulley release for trigger thumb (40 fingers),[5,14] had degenerative osteoarthritis (9 fingers), inflammatory arthritis (6 fingers), workers' compensation claims (4 fingers), or depressive disorders (2 fingers), wound infection or delayed wound healing (3 fingers), or hematoma (2 fingers). In addition, patients who were not monitored for longer than 8 weeks (39 fingers) or whose symptoms were not completely relieved (6 fingers) were also excluded. A total of 109 patients (78 patients with single-finger involvement, 31 patients with multiple-finger involvement) were ultimately included in this study.

Preoperative, intraoperative, and postoperative evaluation

Demographic data including the patients' age, sex, dominant hand, occupation, duration of preoperative symptoms, and number of local steroid injections received before surgery were recorded. The patients were examined by the operating surgeon (D.W.C.) for snapping, locking, the presence of multiple trigger fingers, and preoperative flexion contracture of the proximal interphalangeal (PIP) joint, ROM of the PIP joint, and other hand disorders (carpal tunnel syndrome, Dupuytren contracture, de Quervain disease). The first onset of trigger finger was defined as the time at which pain and/or catching corresponding to Green's classification grade I occurred.[15] Multiple trigger fingers were defined as having symptoms of trigger finger in other fingers at the time of the outpatient visit. In cases of multiple-finger involvement, to minimize bias, only 1 finger for each patient was analyzed. Occupations were classified based on work-related physical strain.[5,16] Pain levels were measured on a visual analog scale. Joint ROM was measured using a goniometer.

Follow-up was performed at 2, 4, 8, and 12 weeks after surgery. During follow-up, the patients were examined for pain, tenderness, swelling, limitation in ROM, snapping, locking, and other postoperative complications. All patients began self-supervised rehabilitation 2 days after surgery. Patients with stiffness and limited ROM for longer than 4 weeks began physical therapy. Postoperative monitoring was discontinued after the patient's symptoms were completely relieved and continued if the patient had pain, tenderness, ROM limitation, swelling, or other postoperative complications. Complete symptom relief was defined as the absence of snapping or locking and pain and complete recovery of ROM. Delayed symptom relief was defined as persistence of any of these symptoms for longer than 8 weeks after surgery.[5,14]

Surgical technique

Most patients underwent surgery under a brachial plexus block, but patients in whom the block failed were operated on under general anesthesia, using a pneumatic tourniquet. All surgeries were performed by a single surgeon using surgical loupes magnification. Multiple trigger fingers were treated simultaneously under the same anesthetic. A transverse incision, measuring 0.7 to 1.0 cm in length, was made just distal to the distal palmar crease, and the A1 pulley was incised longitudinally through this incision. In cases of severe tenosynovitis, defined as a presence of a hypertrophied and fluid-filled tendon

sheath, or ganglion cysts, surgery was performed through an incision greater than 1 cm. The palmar aponeurosis pulley, as described by Manske and Lesker,[17] located proximal to the A1 pulley was also opened. A mosquito clamp was used to pull out the flexor tendon, and the finger was flexed and extended to check for fraying or partial tearing of the flexor tendon. Trimming was performed if the flexor tendon was damaged, and any ganglion cysts or severe tenosynovitis present was removed. The wound was sutured using a nonabsorbable 4-0 monofilament suture following irrigation and dressed using cotton and elastic bandages immediately after completion of the surgery. No orthoses were applied after surgery.

Statistical analysis

A power analysis indicated that a sample comprising 21 patients who had postoperative symptoms longer than 8 weeks and 88 patients who had a symptom relief within 8 weeks would provide more than 85% statistical power (minimum, 88%), with α of 0.05, for 4 main predictors (duration of preoperative symptoms, number of preoperative local steroid injections, preoperative flexion contracture of the PIP joint, flexor tendon injury). The Spearman correlation analysis was used to identify the relationship between duration of symptoms after surgery and various factors including age, duration of preoperative symptoms, and number of preoperative local corticosteroid injections. The Fisher exact test was performed to identify the relationship between prolonged post-operative symptoms and various factors including sex, multiple trigger fingers, preoperative flexion contracture of PIP joint, presence of ganglion cyst or tendon injury, and concomitant disease (type 2 diabetes, carpal tunnel syndrome, Dupuytren contracture, de Quervain disease). Multivariable logistic regression analysis was used to identify the risk of prolonged postoperative symptoms according to various factors that were found to be significant in the correlation analyses. Statistical significance was set at P less than .005 after adjustment by Bonferroni correction.

RESULTS

The mean time from surgery to complete symptom relief was 6.3 ± 4.8 weeks (range, 3−34 weeks). Of the 109 fingers that were operated, 21 fingers (19.3%) showed delayed symptom relief, and their mean time until complete symptom relief was 14.0 ± 6.4 weeks (range, 9−34 weeks).

All patients were divided into a delayed group (group 1), and a nondelayed group (group II) for comparison. Group I had a significantly longer duration of preoperative symptoms, a higher number of preoperative local steroid injections, a preoperative flexion contracture of the PIP joint, and a higher proportion of flexor tendon injury than group II (Table 1). The visual analog scale did not differ significantly between the 2 groups at the last follow-up.

The time until symptom relief significantly correlated with the duration of preoperative symptoms and the number of preoperative local steroid injections ($P < .001$, correlation coefficient of Spearman; 0.434 and $P < .001$, correlation coefficient of Spearman, 0.392, respectively), which were themselves highly correlated. Prolonged postoperative symptoms significantly correlated with flexor tendon injury and preoperative flexion contracture of the PIP joint ($P = .002$ and $P = .004$, respectively).

In the multivariable logistic regression analysis, the following risk factors were associated with delayed symptom relief: flexor tendon injury, preoperative symptom duration, and flexion contracture of the PIP joint (Table 2).

DISCUSSION

The aim of this study was to investigate the incidence of prolonged postoperative symptoms among patients who underwent open A1 pulley release for trigger finger and to identify prognostic factors associated with prolonged postoperative symptoms. We found that the rate of prolonged postoperative symptoms after A1 pulley release was relatively high at 19.3%. Because patients who achieved complete symptom relief before 8 weeks and thus did not visit the outpatient clinic for 8 weeks were excluded, the rate of prolonged postoperative symptoms might actually be lower if these patients were included. We found that the duration of preoperative symptoms, preoperative flexion contracture of the PIP joint, and flexor tendon injury were predictors of prolonged postoperative symptoms. Our findings are important because they may allow surgeons to predict delayed postoperative symptom relief in patients with trigger finger.

It is generally accepted that longstanding trigger finger sometimes leads to flexion contracture of the PIP joint. Chronic inflammation of the flexor tendon induces enlargement of the tendon at the A1 pulley. If this condition continues for a long time, the flexor digitorum superficialis becomes shortened and, subsequently, flexion contracture of the PIP joint occurs.[18−20] La Viet et al[21] performed open A1 pulley release in addition to ulnar superficialis slip

TABLE 1. Comparison of Demographic Characteristics Between Patients Who Had a Prolonged Postoperative Symptoms and Those Who Had Symptom Relief Within 8 Weeks

	Group I* (n = 21)	Group II† (n = 88)	*P* Value
Sex (female, %)	19 (90.5%)	74 (84.1%)	.53
Age (y)	57.0 ± 8.8	55.6 ± 11.3	.58
Multiple trigger finger	4 (19.0%)	27 (30.7%)	.42
Occupation (Unemployed/office/light manual/heavy manual)	1/12/5/3	18/47/19/4	.075
Duration of preoperative symptoms			
Mo	28.6 ± 19.2	14.4 ± 11.6	< .001‡
Y	2.38 ± 1.60	1.20 ± 0.97	
CTS (%)	9 (42.9%)	16 (18.2%)	.022
Type II diabetes (%)	11 (52.4%)	19 (21.6%)	.007
Number of local steroid injection	2.6 ± 1.3	1.2 ± 1.3	< .001‡
PIP joint contracture (%)	8 (38.1%)	9 (7.4%)	.004‡
Flexor tendon injury	7 (33.3%)	5 (5.7%)	.002‡
Duration until symptom relief (weeks)	14.0 ± 6.4	4.5 ± 1.2	< .001‡

CTS, carpal tunnel syndrome.
*Group I, patients who had a delayed symptom relief.
†Group II, patients who had symptom relief within 8 wk.
‡Statistically significant ($P < .005$).

resection, in patients with trigger finger and flexion contracture of the PIP joint and reported that these patients must be monitored for postoperative maintenance of ROM for a longer period of time than those without flexion contracture. Similarly, in our study, patients with flexion contracture of the PIP joint required a longer time until complete symptom relief than those without, and preoperative flexion contracture of the PIP joint was identified as a predictor of prolonged postoperative symptoms.

Although previous studies have reported trigger finger developing after laceration of the flexor tendon,[22,23] there have been few reports describing tendon fraying or partial tears associated with trigger finger without any trauma. Lee et al[8] reported on patients with tendon fraying who underwent open A1 pulley release. They pointed to the impact of stress on the tendon owing to occupational activities, old age, needle injury due to local steroid injections, and local infiltration of the flexor tendon by steroids as possible causes of tendon fraying. Although they did not report functional outcomes of patients with tendon fraying, they suggested that tendon fraying might be responsible for the discomfort that continues in some patients with a complete release. In our study, there was an association between fraying or partial tear of the flexor tendon and prolonged postoperative symptoms, but this was of unclear magnitude. Fraying or partial tear of the flexor tendon is a possible cause of delayed postoperative symptom relief.

Cakmak et al[5] monitored patients who underwent open A1 pulley release and reported that the length of the recovery period varies among patients and that the postoperative symptom duration was shorter for patients with trigger thumb relative to other types of trigger finger. Furthermore, Moriya et al,[14] in their comparison of trigger thumb and other types of trigger finger, reported that patients with trigger thumbs required a shorter period until complete symptom relief than those with triggering of the fingers. They concluded that patients with trigger thumb experience discomfort earlier, visit physicians sooner, and the disease duration before surgery affects postoperative symptom relief. In our study, patients with prolonged postoperative symptoms had a longer duration of preoperative symptoms, and longer duration of preoperative symptoms was identified as a predictor of prolonged postoperative symptoms.

This study was limited by its retrospective design. A prospective study will be necessary to identify the risk factors for prolonged postoperative symptoms. Another limitation was that the cohort was small. Our statistical analysis considered a limited number of factors owing to the small number of patients who showed prolonged postoperative symptoms. We

TABLE 2. Logistic Regression Analysis for Predicting Delayed Symptom Relief Following Open A1 Pulley Release for Trigger Finger

Variables	Univariable					Multivariable				
	β Coefficient	*P* Value	Exp(B)	95% CI for Exp(B)		β Coefficient	*P* Value	Exp(B)	95% CI for Exp(B)	
				Lower	Upper				Lower	Upper
Preoperative symptom duration (y)	−0.762	.001*	0.467	0.302	0.722	−0.677	0.004*	0.467	0.320	0.807
Number of steroid injections	−0.712	.001*	0.491	0.337	0.714	NS	NS	NS	NS	NS
Flexor tendon injury	−2.116	.001*	0.120	0.034	0.433	−1.773	.019*	0.170	0.039	0.744
Preoperative flexion contracture of PIP joint	−1.687	.003*	0.185	0.060	0.567	−1.764	.009*	0.171	0.046	0.642
Constant						3.230	< .001*	25.929		

95% CI, 95% confidence interval; Exp(B), exponentiation of the β coefficient.
*Indicates statistical significance ($P < .05$).

think that a large cohort study is necessary to evaluate all factors affecting prolonged postoperative symptoms. A third limitation is that the duration of delayed symptom relief was not clearly defined for patients who did not develop postoperative complications. Nevertheless, we determined the length of the symptom relief period to be 8 weeks based on the mean length of the symptom relief period of 6 weeks reported from previous literature.[5,11] A fourth limitation was that, because the first onset of symptoms was determined based on patient recall, it is impossible to accurately identify symptom onset. The study did not include a test to identify pain catastrophizing behavior, which may affect the outcome of the hand minor surgery. Because this study was retrospective, we tried to account for this by excluding any patient who was diagnosed as having depressive disorder.

In this study, we identified 3 factors, duration of preoperative symptoms, preoperative flexion contracture, and flexor tendon injury, that are related to prolonged postoperative symptoms after A1 pulley release of trigger finger. We recommend physicians consider the preoperative flexion contracture of the PIP joint and duration of preoperative symptoms when deciding the timing of surgical intervention for trigger finger patients and to explain to the patients with a positive history of these factors and in whom flexor tendon injury is found during surgery about the possibility of prolonged postoperative symptoms.

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