Ann Med Res

Current issue list available at AnnMedRes

Annals of Medical Research

journal page: www.annalsmedres.org

Is the effectiveness of ultrasound-guided percutaneous release therapy in trigger finger treatment affected by the stage of the disease?

Bunyamin Ari[a,*], Mehmet Akcicek[b], Tarık Altunkilic[a], Serdar Deniz[c]

[a] *Turgut Ozal University, Faculty of Medicine, Department of Orthopedics and Traumatology, Malatya, Türkiye*
[b] *Turgut Ozal University, Faculty of Medicine, Department of Radiology, Malatya, Türkiye*
[c] *Turgut Ozal University, Malatya Training and Research Hospital, Department of Public Health, Malatya, Türkiye*

ARTICLE INFO

Keywords:
Trigger finger
Ultrasound-guided
Percutaneous surgery

Received: Jan 28, 2022
Accepted: Jun 08, 2022
Available Online: 25.07.2022

DOI:
10.5455/annalsmedres.2022.01.031

Abstract

Aim: Trigger finger is a type of tenosynovitis that causes pain and dysfunction in the hand and fingers, especially in middle-aged people.We aimed to evaluate the effectiveness of ultrasound-guided (USG) percutaneous release for trigger finger according to the disease stage.

Materials and Methods: USG percutaneous release was performed on 52 fingers of 52 patients who met the inclusion criteria. The patients with Quinnell stages 1 and 2 were grouped as group 1, and those with stages 3 and 4 were grouped as group 2. After treatment, our patients were followed up by measuring their pain with the visual analog scale (VAS) on the 7th day, during the 1st month, at the 6th month control visit and recording the time of the patient's return to work.

Results: In the analysis of the results from group 1 and group 2 together, there was a meaningful relationship between grade and VAS score. The mean of all four VAS scores in the second group was statistically significantly higher than in the first group ($p < 0.001$). In the comparison of the time to return to work according to grade, group 1 returned to work earlier than group 2 (1.67 ± 0.77 and 2.09 ± 0.83, respectively), but this difference was not statistically significant.

Conclusion: The percutaneous release procedure, which is performed carefully after the location of the lesion has been precisely determined and marked by USG, is the preferred method, especially in the Quinnell stages 1and 2 of the disease.

Introduction

Trigger finger (TF) is a type of tenosynovitis that causes pain and dysfunction in the hand and fingers, especially in middle aged people [1–3]. It does not seem common disorder, with a lifetime prevalence of 2% [4]. It is characterized by disruption of the flexor tendon and tendon sheath relationship at the distal level of the metacarpal bone, that is, thickening of the tendon sheath and the A1 pulley in that area (fibrocartilaginous metaplasia, etc.), and sometimes nodulization of the tendon with narrowing of the lumen [5]. Flexion or sometimes extension contracture may develop in the joint as a result of repetitive forceful finger movements, together with the sensation of snagging and pain. Local and systemic anti-inflammatory agents, local anesthetic, and steroid injections are the main initial treatments [6,7]. When these initial procedures are insufficient and unsuccessful, or when cases recur, classical surgery is an option. Although the results of open surgical intervention are generally good, it is disadvantageous compared to percutaneous release due to reasons such as infection, scar tissue, and patients' fear of surgery [1,7,8]. While there are many studies in the literature on USG percutaneous release, there are no data about its effectiveness at different stages of the disease. In this study, we aimed to evaluate the efficacy of USG percutaneous surgery for TF according to the stages of the disease.

Materials and Methods

Fifty-two patients aged 18 years and older who were diagnosed with TF in our hospital between 2015 and 2017 were included in the study, and the study data were reviewed retrospectively from the patients' medical records. All the patients were informed about the procedure, and informed consent was obtained from the patients to be included in the study. All procedures in the study complied with the

*Corresponding author:
Email address: bunyamin.ari@ozal.edu.tr (Bunyamin Ari)

ethical standards of the Declaration of Helsinki. Approval was obtained from clinical research ethics committee (ref. 2021/13 decision number). The inclusion criteria were patients who had previously been treated conservatively but not cured, who had not been treated with percutaneous release, without a history of chronic disease (diabetes, rheumatoid arthritis, etc.), and no anticoagulant use. The exclusion criteria were patients under 18 years of age, patients with previous percutaneous release, patients with a history of chronic disease, and patients with anticoagulant use. The patients' age, gender, affected side, preoperative Quinnell grade (9) (Table 1), trigger, previous steroid injection history, and medical illness history (e.g., diabetes mellitus and rheumatoid arthritis) were recorded. Because of the limitation of movement in Quinnell stage 3-4, patients with Quinnell stages 1 and 2 were grouped as group 1, and those with stage 3 and 4 were grouped as group 2. After the intervention, the patients were asked to measure their pain on a visual analog scale (VAS) on the 7th day, the 1st month, and the 6th month control. The time of their return to full activity was also recorded.

Surgical procedure

A radiologist with more than five years of experience performed the percutaneous release under local anesthesia using a 21G injector tip, under the conditions of the interventional radiology suite, with maximum attention to sterility. After the lesion site was determined with USG with a 13 Mhz probe (The MyLab™9 eXP Ultrasound, Genova, Italy), the needle was inserted through the metacarpophalangeal joint at a 60 degree angle with the opening of the finger plane facing distal. A local anesthetic of 1 cc 1% lidocaine (Cetanes vial/Turkey) was administered after the oval opening of the injector tip was inserted subcutaneously parallel to the tendon. After waiting for one minute for anesthesia, the needle was turned 90 degrees to the cutting position, the needle was moved several times in the direction of the arrows, and the A1 pulley was cut longitudinally (Figures 1 and 2). After cutting, the finger movements were checked actively and passively, and it was confirmed that the movements could be performed easily. Following the intervention, no splint was applied, the need for elevation was described to the patients, and an oral analgesic (Non-steroidal anti-inflammatory drug) was prescribed for use when necessary. The patients were sent home on the same day. Intermittent cold application for six hours was explained to the patients to reduce inflammation in the operation area.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) 22.0 software (SPSS Inc., Chicago, IL, United States). The categorical variables were described in frequencies and percentages, and the continuous variables were expressed in medians. The normality of distributions was assessed with the Kolmogorov-Smirnov test. The t-test was used when comparing two means, and the analysis of variance in repeated measurements was used when comparing averages of more than two measurements. Two-way analysis of variance was used in repeated measurements to determine the factors affecting these measurements. Pearson correlation analysis was used to evaluate the relationship between the continuous variables. As a result of the analysis, $p < 0.05$ was considered significant. In our study, the minimum sample size was calculated as 46 for a medium (0.5) effect size, 95% confidence interval, and 80% power.

Table 1. Quinnell classification.

Grade	Clinical Findings
0	No triggering, but mild crepitus
I	No triggering, but uneven movement of finger
II	Actively correctable triggering
III	Passively correctable triggering
IV	The finger is locked

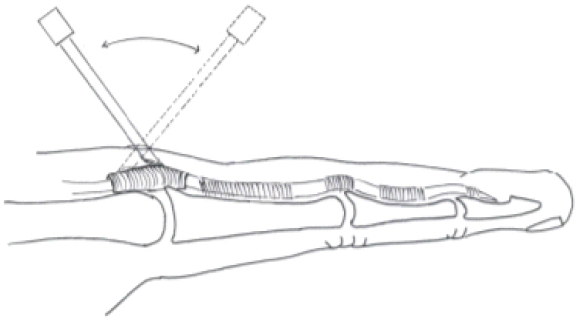

Figure 1. Position of the needle in percutaneous release.

Results

Thirty-two (61.5%) patients were female. The patients were followed for an average of 10.58 months (6–24 months). The patients' data are shown in Table 2. The mean age of the study group was 45.62 ± 10.64, the mean duration of complaints was 2.10 ± 1.00 day/week/month, and the most frequent Quinnell stage was grade 3 (n:22, %42.31).

When the correlation of continuous variables with each other was evaluated, each VAS score had a strong and positive correlation with the other VAS scores ($p < 0.01$) (Table 3, Figure 3).

However, there was no correlation between age, duration of complaints, time to return to work, and the VAS scores ($p > 0.05$). There was a weak and positive correlation (r

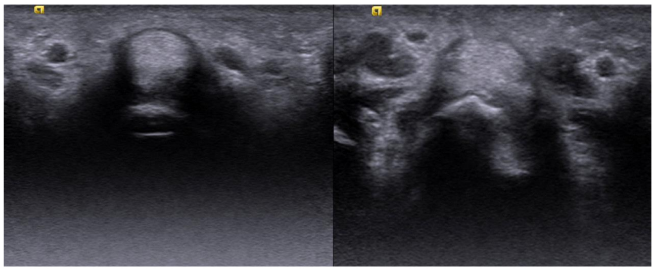

Figure 2. USG transverse view of the cut A1 pulp before and after treatment.

Table 2. Distribution of categorical variables.

		Frequency	Percent
Sex	Female	32	61.5
	Male	20	38.5
Side	Right	34	65.4
	Left	18	34.6
Grade	1	2	3.85
	2	16	30.77
	3	22	42.31
	4	12	23.08

		Female	Male	
Involved Finger	1	11	7	34.6
	2	9	5	26.9
	3	5	4	17.3
	4	5	2	13.4
	5	2	2	7.6

	Mean	Std. Deviation	Minimum	Maximum
Age	45.62	10.64	22.00	62.00
Duration of the complaints	2.10	1.00	1.00	4.00
Follow up period	10.58	4.86	6.00	24.00
Time to return to work	1.94	.83	1.00	3.00

Table 3. Comparison of pre- and post-operative VAS scores.

	Mean	Deviation	F	p
Pre-op	6.27	1.21	1018.773	<0.001
Post-op 7th day	3.71	.80		
Post-op 1st month	1.79	.80		
Post-op 6th month	0.65	0.79		

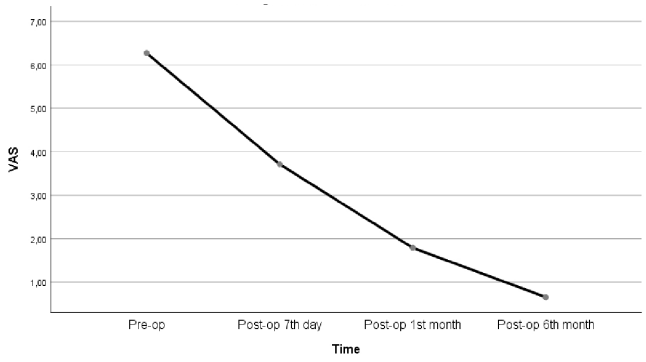

Figure 3. Change in VAS score over time.

= 0.284, p > 0.05) only between the follow-up time and the pre-operative VAS score (Table 4).

Gender had no effect on the VAS scores (Table 5, Figure 4. The pre-operative, post-operative 7th day, and the post-operative 1- and 6-month VAS scores were similar in the women and the men (p < 0.05).

Groups 1 and 2 were evaluated together, and there was a meaningful relationship between Quinnell stage and the

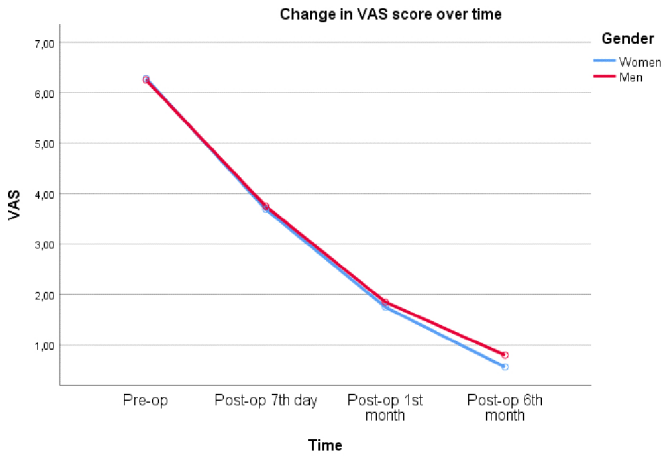

Figure 4. Change in VAS score over time according to gender.

VAS scores. This relationship was effective for all four VAS scores (Table 6, Figure 5). The mean of each of the four VAS scores in the second group consisting of stages 3 and 4 was statistically significantly higher than in group 1 (stages 1 and 2) (p < 0.001).

In the comparison of return to work times according to stage, group 1 returned to work earlier than group 2 (1.67 ± 0.77 and 2.09 ± 0.83, respectively). However, this difference was not statistically significant (Table 7; p = 0.080).

Recurrence was observed in two patients after their six-month follow-up. Both patients were Quinnell stage 4, and we treated them to the recurrence with the mini open A1 pulley release method. Apart from these two patients,

Table 4. Pearson correlations of continuous variables.

N=52	Age	Complaint duration (day)	Follow-up time (month)	Return time to work (day)	Pre-op VAS	Post-op 7th day VAS	Post-op 1st month day VAS	Post-op 6th month VAS
Age	1							
Complaint duration (day)	-.033	1						
Follow-up time (month)	-.159	.073	1					
Return time to work (day)	-.078	- .065	.140	1				
Pre-op	-.070	- .022	.284*	.232	1			
Post-op 7th day	.021	.036	.170	- .055	.772**	1		
Post-op 1st month	.108	.026	.082	.100	.568**	.699**	1	
Post-op 6th month	.035	.018	.053	- .121	.594**	.615**	.782**	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 5. Pre-op and post-op VAS by gender.

	Sex	Mean	Std. Deviation	F	p
Pre-op	Female	6.28	1.20	0.491	0.617
	Male	6.25	1.25		
Post-op 7th day	Female	3.69	0.82		
	Male	3.75	0.79		
Post-op 1st month	Female	1.75	0.80		
	Male	1.85	0.81		
Post-op 6th month	Female	0.56	0.72		
	Male	0.80	0.89		

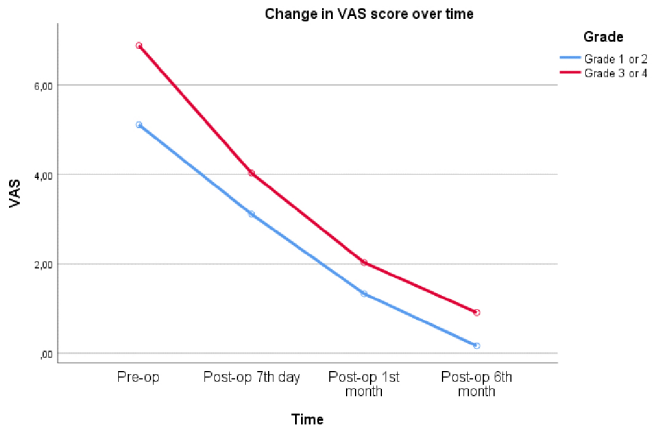

Figure 5. Change in VAS score over time according to grade.

none of the patients had vessel, nerve, or tendon damage.

Discussion

Numerous conservative modalities have been reported in TF therapy as initial treatments, including corticosteroid injections, oral or injectable non-steroidal anti-inflammatory drugs, and immobilization using various orthoses [6,7,10]. McKee et al. conducted a retrospective case series analysis of 343 TF patients treated with observation alone (i.e., without splinting or steroid injections). They reported that 52% of the cases in the 8th month and around 90% in the first year recovered spontaneously [7]. There is weak evidence that night splints and non-injection non-operative treatments provide improvement [11]. All patients in our study had not benefited from conservative treatment. We found that the percutaneous release procedure with USG was more effective in the early stages of trigger finger disease and the complication rate was quite low. Steroid injections are another effective method for treating TF [12]. Shultz et al. found that a high number of diseased fingers or high severity of the disease increased the response to steroids. By contrast, steroid injection was reported to be an appropriate first-line treatment for patients presenting with mild triggering (Quinnell stages 1 and 2), and the success of the steroid injection was significantly lower at the first month when there was more severe triggering (Quinnell stages 3 and 4) or more than one affected finger. They included 99 fingers of 69 patients in their study [13]. Hamidreza Tajik et al., in their study with 60 patients, stated that they achieved more successful results with splinting after cortisone injection [14]. However, steroid injections do not always provide effective treatment and can have unexpected side effects (such as spontaneous flexor tendon rupture, spontaneous pulley rupture, impaired circulation in the fingers, and necrotizing fasciitis) [15,16]. In a study including 81 pa-

Table 6. Pre-op and post-op VAS scores according to grades.

	Group†	Mean Std.	Deviation	t	p
Pre-op	Group 1	5.11	.32	11.596	<0.001
	Group 2	6.88	1.04		
Post-op 7th day	Group 1	3.11	0.32		
	Group 2	4.03	0.80		
Post-op 1st month	Group 1	1.33	0.69		
	Group 2	2.03	0.76		
Post-op 6th month	Group 1	0.17	0.38		
	Group 2	0.91	0.83		

†:Group 1: Grade 1 or 2, Group 2: Grade 3 or 4.

Table 7. Time to return to work according to grade.

	Grade †	N	Mean	Std. Deviation	t	p
Time to return to work	Group 1	18	1.67	.77	1.787	0.080
	Group 2	34	2.09	.83		

†.Group 1: Grade 1 or 2, Group 2: Grade 3 or 4.

tients, steroid injection and open surgery were compared, although the pain incidence of open surgery in the first week was higher, there was less recurrence at the 12-week follow-up [17]. After visual fixation of an A1 pulley using a mini incision, cutting it longitudinally and releasing the tendon is a classic surgical intervention. The open A1 pulley release procedure has a success rate of between 90% and 100% [18,19]. Knystautas et al., in their study with 17 patients, found Patients assessment of pain (VAS) decreased and hand function (QuickDASH) results in their study for trigger finger [20]. However, this procedure requires opening the skin and tissue and closing it with sutures, even if there is a small incision, and it is open to all the complications of open surgery (2,8). Baek et al. in their study of 109 patients, reported that although open A1 pulley release was an effective procedure, complaints such as locking and pain continued until eight weeks after surgery [18]. Continuous triggering after isolated A1 pulley release is rare; the reason may be due to the palmar aponeurosis pulley or the flexor digitorum superficialis tendon, and it may require additional surgery, which may lead to partial cutting of the A2 pulley [21]. In addition, the possibility of developing post-surgical infection is high in elderly patients and patients who undergo open surgery in the early period after an injection [22]. These problems are not encountered in percutaneous surgery [23]. The percutaneous release technique, popularized by Eastwood et al. in 1992, has become widespread in recent years [8]. Xie et al. in a study with 89 fingers of 76 patients, compared open surgical intervention with the percutaneous release procedure and found no significant difference between them. As a result, they recommended the percutaneous release procedure as a safe and effective treatment alternative to open surgery [24]. Similarly, Ghazy et al. applied percutaneous release to 23 trigger fingers of 20 patients and reported that the results of percutaneous treatment would be a safe, simple and effective alternative to open surgical release [25]. Some authors argue that although the clinical results of percutaneous release are good, the A1 pulley may not be completely cut with this method, and there is a high probability of injury to the tendon longitudinally, which is a disadvantage [2,26]. In our study, we applied percutaneous release with USG to avoid possible complications in all cases. Studies on the effectiveness and safety of percutaneous release have been increasing. For example, Guo et al. demonstrated the effectiveness of the percutaneous USG release technique. They reported a near-perfect result with their technique and noted that percutaneous interventions rarely had complications such as digital nerve damage, incomplete release, and tendon injury [27]. Gulabi et al. similarly reported that the percutaneous release procedure improved complaints by 90% and that there were complications including 10% scar sensitivity, temporary hypoesthesia, and tendon lacerations [28]. We did not detect such complications in our study. Some authors recommend not using percutaneous technique on the first and second fingers to avoid digital nerve injury, but the results of cadaver studies have shown that digital nerve injury was not caused by this method clinically [26,29]. Conversely, some authors have argued that blind percutaneous release of the first finger is safe and reliable in the treatment of TF disease [30,31]. In our study, we performed a surgical procedure for any affected finger. Some studies have reported that performing percutaneous procedures and injections with USG increases the safety and efficiency of the procedures [32]. Karina et al. concluded in their cadaver study that percutaneous release with USG can avoid complicated problems, such as flexor tendon lacerations, potential damage to neurovascular structures, and incomplete cutting of the A1 pulley [33]. We cut the A1 pulley completely or almost completely with USG and caused minimal or no tendon dam-

age. However, we suggest that after the recovery of finger motion clinically and functionally, the longitudinal injury of the flexor tendon does not have any functional significance; it is not a disadvantage if the A1 pulley is not completely cut and a small part remains, and it will not cause any problems in terms of tendon functions. In the literature, studies have shown treatment success reaching 80% with minimal complications, in line with our study [34]. Ricardo et al. In their study consisting of 46 cases, they reported that percutaneous release with USG, with a statistically significant decrease in pain and improvement in function, triggered a complete recovery in all patients [35]. Percutaneous release under ultrasound guidance is a safe procedure for definitive treatment of the disease in an outpatient setting [36]. USG-guided release of the A1 pulp in the TF is possible with a 21 gauge (0.8 mm) needle. The procedure is fast, painless, risk-free and low-cost, and satisfactory results are obtained in most cases [34]. It has been argued that percutaneous treatment of TF with USG has less loss of working days and better cosmetic results than the open surgical technique, and it is a promising method that represents excellent results without the treatment of major complications in TF [37]. We found no complications apart from two recurrence cases during the study, and we did not detect any complications such as digital nerve, vascular, or tendon injuries. Although there are many studies in the literature on percutaneous release with USG, no study has been conducted on its effectiveness for different stages of TF. In our study, we found that gender had no effect on VAS, that there was a significant decrease in VAS in all patients in the postoperative 1st month, and the procedure performed in group 1 (Quinnell stages 1 and 2) was more effective than in group 2 (Quinnell stages 3 and 4). The time to return to work was significantly shortened in group 1, but this was not statistically significant. The small number of patients, the inhomogeneity of the groups and a single-center study were the limiting factors of our study. Studies with larger patient populations and more homogeneous groups are needed for generalizable results.

Conclusion

In our study of the percutaneous release procedure, patient satisfaction and clinical results were good, complications were uncommon, and the patients returned to work in a short time. Percutaneous release, which is performed carefully after the location of the lesion has been precisely determined and marked by ultrasound assistance, is a method that can be preferred, especially in the early stages of the disease.

Acknowledgments

Thanks to scribendi for native proof reading.

Ethics approval

Ethical approval for this study was obtained from the Turgut Özal University Clinical Research Ethics Committee.

References

1. Ertem K, İnan M, Coşkun H, Bora A. The Results of Treatment of Patients with Trigger Finger Released by Minimal Open Surgery. J İnönü Univ Fac Med. 2003;10(1):11-3.
2. Ertürk C, Altay MA, Kalender AM. Mini-open trigger finger release. J Med Investig. 2009;7(3):141-4.
3. Kiliç BA, Kiter AE, Selçuk Y. [The effect of percutaneous trigger finger release on normal anatomic structures and long-term results of the procedure]. Acta Orthop Traumatol Turc. 2002;36(3):256-8.
4. Hansen RL, Søndergaard M, Lange J. Open Surgery Versus Ultrasound-Guided Corticosteroid Injection for Trigger Finger: A Randomized Controlled Trial With 1-Year Follow-up. J Hand Surg. May 2017;42(5):359-66.
5. Sampson SP, Badalamente MA, Hurst LC, Seidman J. Pathobiology of the human A1 pulley in trigger finger. J Hand Surg. July 1991;16(4):714-21.
6. Drijkoningen T, van Berckel M, Becker SJE, Ring DC, Mudgal CS. Night Splinting for Idiopathic Trigger Digits. HAND. September 2018;13(5):558-62.
7. McKee D, Lalonde J, Lalonde D. How Many Trigger Fingers Resolve Spontaneously Without Any Treatment? Plast Surg. February 2018;26(1):52-4.
8. Eastwood DM, Gupta KJ, Johnson DP. Percutaneous release of the trigger finger: An office procedure. J Hand Surg. January 1992;17(1):114-7.
9. Quinnell RC. Conservative management of trigger finger. The Practitioner. February 1980;224(1340):187-90.
10. Gil JA, Hresko AM, Weiss A-PC. Current Concepts in the Management of Trigger Finger in Adults. J Am Acad Orthop Surg. June 10, 2020;28(15):e642-50.
11. Amirfeyz R, McNinch R, Watts A, Rodrigues J, Davis TRC, Glassey N, vd. Evidence-based management of adult trigger digits. J Hand Surg Eur Vol. June 2017;42(5):473-80.
12. Shakeel H, Ahmad TS. Steroid Injection Versus NSAID Injection for Trigger Finger: A Comparative Study of Early Outcomes. J Hand Surg. July 2012;37(7):1319-23.
13. Shultz KJ, Kittinger JL, Czerwinski WL, Weber RA. Outcomes of Corticosteroid Treatment for Trigger Finger by Stage. Plast Reconstr Surg. October 2018;142(4):983-90.
14. Tajik, Hamidreza, et al. "The effects of adding splint use to corticosteroid injection for the treatment of trigger finger: A randomized controlled trial." Musculoskeletal Care (2022).
15. Ma S, Wang C, Li J, Zhang Z, Yu Y, Lv F. Efficacy of Corticosteroid Injection for Treatment of Trigger Finger: A Meta-Analysis of Randomized Controlled Trials. J Invest Surg. July 04, 2019;32(5):433-41.
16. Tulipan J, Lutsky K, Beredjiklian P. Transient Vasospastic Response Following the Injection of Corticosteroid into the Hand. Bull Hosp Jt Dis 2013. May 2017;75(3):217-9.
17. Fiorini HJ, Tamaoki MJ, Lenza M, Gomes dos Santos JB, Faloppa F, Belloti J carlos. Surgery for trigger finger. Cochrane Musculoskeletal Group, editör. Cochrane Database Syst Rev. February 20, 2018;2:1-154.
18. Baek JH, Chung DW, Lee JH. Factors Causing Prolonged Postoperative Symptoms Despite Absence of Complications After A1 Pulley Release for Trigger Finger. J Hand Surg. April 2019;44(4):338.e1-338.e6.
19. Bruijnzeel H, Neuhaus V, Fostvedt S, Jupiter JB, Mudgal CS, Ring DC. Adverse Events of Open A1 Pulley Release for Idiopathic Trigger Finger. J Hand Surg. August 2012;37(8):1650-6.
20. Knystautas, Saulius, Karolis Varkalys, and Ernest Zacharevskij. "Early outcomes of open surgical treatment of stenosing tenosynovitis." 2. Karolina Grinkevičiūtė, Chairwoman of the Organising Committee (2022): 210.
21. Strigelli V, Mingarelli L, Fioravanti G, Merendi G, Merolli A, Fanfani F, vd. Open Surgery for Trigger Finger Required Combined a1-a2 Pulley Release. A Retrospective Study on 1305 Case. Tech Hand Up Extrem Surg. September 2019;23(3):115-21.
22. Ng WKY, Olmscheid N, Worhacz K, Sietsema D, Edwards S. Steroid Injection and Open Trigger Finger Release Outcomes: A Retrospective Review of 999 Digits. HAND. May 2020;15(3):399-406.
23. Weiss ND, Richter MB. Percutaneous Release of Trigger Digits. Am J Orthop Belle Mead NJ. August 2017;46(4):E263-7.
24. Xie P, Zhang Q, Zheng G, Liu D, Miao H, Zhang W, vd. Stenosing tenosynovitis: Evaluation of percutaneous release with a specially designed needle vs. open surgery. Orthop. March 2019;48(3):202-6.

25. Ghazy, A. S., Bayoumy, E. M., & Ali, E. E. (2022). Evaluation of percutaneous release of trigger finger. Benha Journal of Applied Sciences, 7(2), 79-82.
26. Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, Cohen MS. Green's operative hand surgery. 2017.
27. Guo D, McCool L, Senk A, Tonkin B, Guo J, Lytie RM, vd. Minimally invasive thread trigger digit release: a preliminary report on 34 digits of the adult hands. J Hand Surg Eur Vol. November 2018;43(9):942-7.
28. Gulabi D, Cecen GS, Bekler HI, Saglam F, Tanju N. Re: Gulabi D, Cecen GS, Bekler HI, Saglam F and Tanju N. A study of 60 patients with percutaneous trigger finger releases: clinical and ultrasonographic findings. J Hand Surg Eur. 2014, 39: 699-703. J Hand Surg Eur Vol. January 2015;40(1):103-4.
29. Bain GI, Turnbull J, Charles MN, Roth JH, Richards RS. Percutaneous A1 pulley release: A cadaveric study. J Hand Surg. September 1995;20(5):781-4.
30. Aslanturk O, Yilmaz O, Ari B, Canbay A, Kavak H. Complications after the percutaneous release of trigger thumb in adults. Ann Med Res. 2020;27(9):2665-8.
31. Onta, P. R., Thapa, P., Thapa, U. J., Sapkota, K., & Ranjeet, N. (2021). Result of Percutaneous Release of Trigger Thumb: A Prospective Study. Nepal Journal of Medical Sciences, 6(2), 46-50.
32. Wilson CDJ, Scully MWF, Rawlings CJM. Evolving Role of Ultrasound in Therapeutic Injections of the Upper Extremity. Orthopedics. November 2015;38(11):e1017-24.
33. Paulius KL, Maguina P. Ultrasound-Assisted Percutaneous Trigger Finger Release: Is it Safe? HAND. March 2009;4(1):35-7.
34. Lapègue F, André A, Meyrignac O, Pasquier-Bernachot E, Dupré P, Brun C, vd. US-guided Percutaneous Release of the Trigger Finger by Using a 21-gauge Needle: A Prospective Study of 60 Cases. Radiology. August 2016;280(2):493-9.
35. Colberg RE, Pantuosco J, Fleisig G, Drogosz M. Ultrasound-Guided Microinvasive Trigger Finger Release Technique Combined With Three Tests to Confirm a Complete Release. Am J Phys Med Rehabil. December 2020;99(12):1150-6.
36. Rajeswaran G, Lee JC, Eckersley R, Katsarma E, Healy JC. Ultrasound-guided percutaneous release of the annular pulley in trigger digit. Eur Radiol. September 2009;19(9):2232-7.
37. Nikolaou VS, Malahias M-A, Kaseta M-K, Sourlas I, Babis GC. Comparative clinical study of ultrasound-guided A1 pulley release vs open surgical intervention in the treatment of trigger finger. World J Orthop. 2017;8(2):163.