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Long-term outcomes of percutaneous release technique or open for trigger finger in diabetic patients

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ABSTRACT

Aims: Trigger finger is seen more often in diabetic patients and can lead to more serious postoperative complications compared to non-diabetic patients. The aim of this study was to compare the outcomes of open and percutaneous release techniques in diabetic patients.

Methods: This retrospective study included 62 patients who met the study criteria. Of these patients, 32 underwent open release surgery and 30 underwent percutaneous release with an 18-gauge needle. The patients were evaluated retrospectively in respect of the data on first presentation preoperatively and at postoperative follow-up examinations at 3 weeks, 6 months and 1 year. A retrospective examination was made of the demographic data, Visual Analog Scale (VAS) scores preoperatively, at 6 and 12 months postoperatively, recurrence rates at the end of 6 months and 1 year, the Quinnell grading scale at the end of 1 year, wound site infection, tendon damage and neurovascular complications. VAS scores and the Quinnell grading scale were used for clinical evaluation.

Results: The data of a total of 62 patients were statistically analyzed in the study, with 32 (51.6%) in the Open group and 30 (48.4%) in the Percutaneous group. The mean age of the patients was 58.97±7.51 (min-max: 45-72) years. The distributions of trigger finger and Quinnell grading system scores were statistically similar between the groups (P=0.974, P=0.279, respectively). The recurrent triggering rate at the 6th and 12th month was significantly higher in the Percutaneous group (P=0.049, P=0.049, respectively). The average return to work duration in the Percutaneous group (1.70±0.75) was significantly shorter than that in the Open group (3.88±1.21) (P<0.001). Pre-op, Post-op 6th and 12th month VAS scores did not significantly differ between the groups (P=0.466, P=0.356, P=0.175, respectively).

Conclusion: Although satisfactory results were obtained with both percutaneous and open release techniques in the patients with diabetes in this study, the percutaneous release technique was seen to be a method which can be easily performed in an outpatient setting and had fewer complications.

Keywords: Trigger finger, percutaneous, diabetic patients, open surgery, Quinnell grading

INTRODUCTION

Stenosing tenosynovitis which is known as trigger finger (TF) is one of the most frequently seen pathologies of the hand, which causes locking of the finger, swelling, pain and restricted movement. Although the thumb is usually affected, it is also seen in other fingers.[1] The primary cause of TF is thickening of the A1 pulley and entrapment of the flexor tendon by this.[2] TF is seen at a frequency of 2.1% in the non-diabetic healthy population and more often in females aged >30 years, but the lifetime risk in the diabetic population increases up to 8%.[3] The primary treatment option in mild cases with fewer symptoms is conservative treatment, whereas in advanced cases with severe symptoms, different surgical treatments for A1 pulley release are applied.[4]

Many different surgical techniques have been reported and the current most commonly used techniques are open surgery,[5] ultrasound-guided percutaneous release[6,7] and percutaneous release without ultrasound guidance.[8] Complications such as swelling, contracture, pain and infection have been reported at rates of approximately 8% -25% following open release[9] and it has been stated that the incision scar and associated pain can last for months.[10] The percutaneous release technique can be easily performed, provides early functional healing, excellent patient satisfaction and is lower cost.[11,12]

Elssayed et al.[13] reported excellent results at the rate of 97% in a study of patients with TF treated with percutaneous release and no complications such as

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nerve or tendon injury or infection were encountered. It has been stated that the risk of infection development, wound scar and recurrence is 3-fold greater in diabetic patients compared to non-diabetic patients.[14]

The aim of this study was to compare the efficacy of open and percutaneous release techniques in patients with diabetes and to compare the clinical outcomes. The hypothesis of the study was that the recurrence of TF would be lower in patients undergoing open release compared to those undergoing percutaneous release, but there would be more complications.

METHODS

The study was carried out with the permission of Hitit University Non-interventional Reseearches Ethics Committee (Date: 03.07.2023, Decision No: 2023/09). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. From a total of 118 patients who presented at the Orthopedics Department of Hitit University and Van Training and Research Hospital between February 2018 and February 2022, this retrospective study included 62 patients who met the study criteria. Of these patients, 32 underwent open release surgery (Group 1) and 30 underwent percutaneous release with an 18-gauge needle (Group 2). All the patients included in the study were aged >18 years, were diabetic, had not responded to at least one month of conservative treatment and were followed up for a minimum of 1 year.

Patients were excluded from the study if they were aged <18 years, not diabetic, had a history of surgery on the same hand, had hypothyroidism, rheumatoid arthritis, tenosynovitis with infection and were using anticoagulants.

The patients were evaluated retrospectively in respect of the data on first presentation preoperatively and at postoperative follow-up examinations at 3 weeks, 6 months and 1 year.

A retrospective examination was made of the demographic data, Visual Analog Scale (VAS) scores preoperatively and at 6 and 12 months postoperatively, recurrence rates at the end of 6 months and 1 year, the Quinnell grading scale at the end of 1 year, wound site infection, tendon damage and neurovascular complications. VAS scores and the Quinnell grading scale were used for clinical evaluation. According to the Quinnell scale, the severity of triggering was evaluated from grades 0-4. Pain was evaluated using the VAS, which measures the severity of pain from 0 (no pain) to 10 (intolerable pain).

Surgical Technique

Open technique: All the open surgery operations were performed in the operating theatre. Throughout the procedure, a pneumatic tourniquet was applied at 250 mmHg pressure. Local anesthesia was provided with an injection of 2% lidocaine. An incision approximately 15 mm wide was performed over the A1 pulley in all the fingers. Blunt dissection was advanced, then with direct imaging, the A1 pulley was cut longitudinally and the range of movement was checked by the finger being moved into flexion and extension. Following irrigation and hemostasis the wound was closed with 4-0 nylon sutures.

Percutaneous technique: All the percutaneous release procedures were performed in an Outpatient Polyclinic room. The surface landmarks were determined as described by Froimson et al.[15] and Fiorini et al.[16] Local anesthesia was provided by infiltration of a 2% lidocaine solution around the nodule from the distal palmar surface of the affected finger using an 18-gauge needle. Then a 18 hypodermic needle was placed at the proximal edge of the A1 pulley and making flexion and extension movements of the finger the needle was seen to move in the same directions and was confirmed to be within the tendon (**Figure 1**). With the sharp edge of the needle, the pulley was cut longitudinally from proximal to distal until a click was felt. To confirm that the pulley had been completely cut, the patient was instructed to move the finger in flexion and extension. Following the procedure, the symptoms of pain and catching should be relieved immediately. If the symptoms were not relieved, the procedure was repeated.

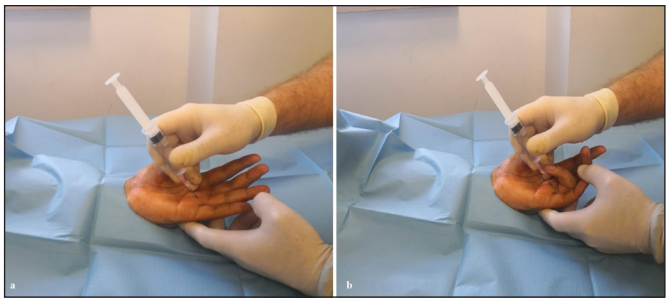

Figure 1. (a) 18 gauge hypodermic needle was placed at the proximal edge of the A1 pulley and (b) clinical picture showing release of A1 pulley

Statistical Analysis

The SPSS software (Version 22, Inc., Chicago, IL, USA, Program license: Hitit University) was used for statistical analyses. The open-source "ggplot2" library in R program was utilized for graph plotting.

Descriptive statistics of categorical variables were reported using numbers and percentages (%), while descriptive statistics of numerical variables were reported as mean ± standard deviation (SD). Normality assumption of numerical data was examined using the Shapiro-Wilk test and graphical approaches (Histogram and Q-Q plot). The assumption of homogeneity of variances was examined using the Levene's test. Relationship investigations between categorical variables were conducted using the chi-square test or Fisher's exact test depending on the sample sizes in cross-tabulation cells. For the comparison of numerical data between independent two groups, the parametric assumption was met, and thus the Student's t-test was employed. For the comparison of more than two related numerical variables, the parametric assumption was satisfied, and therefore the Repeated Measures ANOVA test was used. Following the statistically significant Repeated Measures ANOVA test, Bonferroni post-hoc tests were utilized to determine the time points where the differences occurred. A significance level of P <0.05 was considered statistically significant.

RESULTS

The data of a total of 62 patients were statistically analyzed in the study with 32 (51.6%) in the Open group and 30 (48.4%) in the Percutaneous group. Among the patients, 25.8% (n=16) were male and 74.2% (n=46) were female. The mean age of the patients was 58.97±7.51 (min-max: 45-72) years. The average follow-up duration for all patients was 13.1±1.19 (12-16) months and the average return to work duration was 2.82±1.48 (1-7) weeks.

Statistical findings regarding the comparison of demographic and clinical characteristics between research groups are presented in Table 1. The distributions of gender ratios and sides were statistically similar between the groups (P=0.881, P=0.193, respectively). The distributions of trigger finger and Quinnell grading system scores were statistically similar between the groups (P=0.974, P=0.279, respectively). The recurrent triggering rate at the 6th and 12th month was significantly higher in the Percutaneous group (P=0.049, P=0.049, respectively). The mean ages and follow-up durations did not significantly differ between the groups (P=0.267, P=0.850, respectively). The average return to work duration in the Percutaneous group (1.70±0.75) was significantly shorter than that in the Open group (3.88±1.21) (P<0.001).

Table 1. Statistical findings for the comparison of demographic and clinical characteristics of the patients between study groups

	Groups		P values
	Open (n=32)	Percutaneous (n=30)	
Gender			0.881[a]
Male	8 (25%)	8 (26.7%)	
Female	24 (75%)	22 (73.3%)	
Side			0.193[a]
Right	15 (46.9%)	19 (63.3%)	
Left	17 (53.1%)	11 (36.7%)	
Trigger digit			0.974[a]
Thumb	13 (40.6%)	12 (40%)	
Index	8 (25%)	7 (23.3%)	
Middle	5 (15.6%)	6 (20%)	
Ring	6 (18.8%)	5 (16.7%)	
Recurrent triggering (6 months)			0.049[b]
No	32 (100%)	26 (86.7%)	
Yes	0 (0%)	4 (13.3%)	
Recurrent triggering (12 months)			0.049[b]
No	31 (96.9%)	24 (80%)	
Yes	1 (3.1%)	6 (20%)	
Quinnell grading system (post 12. Months)			0.279[b]
0	24 (75%)	18 (60%)	
1	7 (21.9%)	8 (26.7%)	
3	1 (3.1%)	4 (13.3%)	
Age	60±7.89	57.87±7.04	0.267[c]
Follow-up time (month)	13.13±1.23	13.07±1.17	0.850[c]
Return to work (week)	3.88±1.21	1.70±0.75	<0.001[c]

[a]Chi-square test with n (%), [b]Fisher exact test with n (%), [c]Student's t-test with mean±standard deviation (SD)

Statistical findings regarding the between-group and within-group comparisons of VAS scores are presented in Table 2. Significant decreases in VAS scores were observed at all time points in both groups (P<0.001, P<0.001, respectively). Pre-op, Post-op 6th and 12th month VAS scores did not significantly differ between the groups (P=0.466, P=0.356, P=0.175, respectively). A line graph showing the changes in between-group and within-group VAS scores is presented in Figure 2.

Table 2. Statistical results for the between-group and within-group comparison of VAS scores at different time points.

Groups	VAS			P values (within)	Post-hoc P values
	Pre-op	Post-op 6. month	Post-op 12. month		
Open (n=32)	7.38±0.71	1.88±0.75	0.84±1.05	<0.001[d]	1-2: <0.001 1-3: <0.001 2-3: <0.001
Percutaneous (n=30)	7.5±0.63	2.07±0.87	1.3±1.53	<0.001[d]	1-2: <0.001 1-3: <0.001 2-3: <0.001
P values (between)	0.466[c]	0.356[c]	0.175[c]		

[c]Student's t-test with mean±standard deviation (SD), [d]Repeated Measures ANOVA followed by Bonferroni post-hoc test with mean±SD

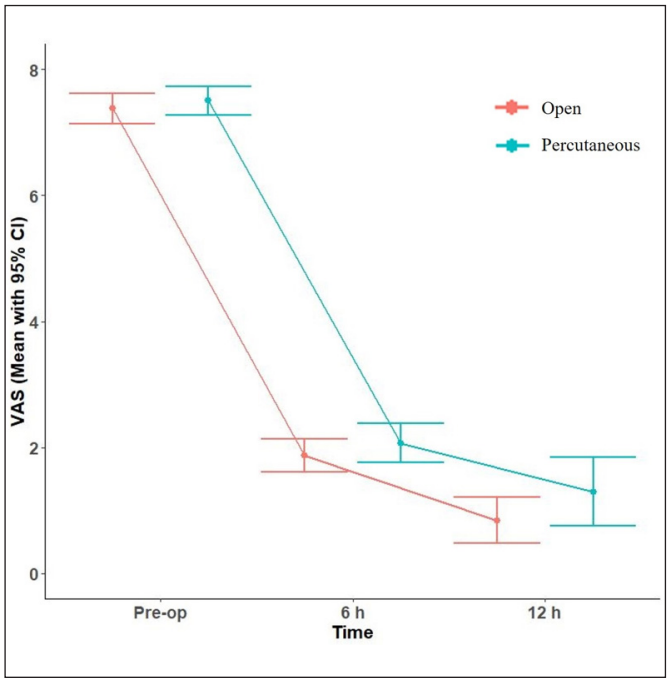

Figure 2. Mean and 95% confidence interval graphs showing the time-dependent variation of repeated measures of VAS scores.

Statistical findings regarding the distributions of complication rates between the groups are presented in Table 3. The rate of scar occurrence was significantly higher in the Open group (P=0.024). The rates of infection and tendon injury were similarly distributed between the groups (P=0.238, P=0.607, respectively). Vascular injury was not observed in either group.

Table 3. Statistical findings for the comparison of complication rates between study groups

		Groups		P values
		Open (n=32)	Percutaneous (n=30)	
Scar	No	26 (81.3%)	30 (100%)	0.024[b]
	Yes	6 (18.7%)	0 (0%)	
Infection	No	29 (90.6%)	30 (100%)	0.238[b]
	Yes	3 (9.4%)	0 (0%)	
Tendon injury	No	31 (96.9%)	28 (93.3%)	0.607[b]
	Yes	1 (3.1%)	2 (6.7%)	
Vascular injury	No	32 (100%)	30 (100%)	-
	Yes	-	-	

bFisher exact test with n (%)

Statistical findings regarding the relationship between trigger finger positions and Quinnell grading system scores are presented in Table 4. No significant relationship was found between trigger finger positions and Quinnell grading system scores in both groups (P=0.631, P=0.952, respectively). A bar graph showing the distributions of Quinnell grading system scores based on trigger finger positions between the research groups is presented in Figure 3.

Table 4. Statistical findings for the relationship between Trigger digit and Quinnell grading system between study groups

Groups	Trigger digit	Quinnell grading system (post 12. months)				P values
		0	1	3	Total	
Open (n=32)						0.631[b]
	Thumb	9 (69.2%)	4 (30.8%)	0 (0%)	13	
	Index	7 (87.5%)	1 (12.5%)	0 (0%)	8	
	Middle	3 (60%)	1 (20%)	1 (20%)	5	
	Ring	5 (83.3%)	1 (16.7%)	0 (0%)	6	
Percutaneous (n=30)						0.952[b]
	Thumb	8 (66.7%)	2 (16.7%)	2 (16.7%)	12	
	Index	4 (57.1%)	2 (28.6%)	1 (14.3%)	7	
	Middle	3 (50%)	2 (33.3%)	1 (16.7%)	6	
	Ring	3 (60%)	2 (40%)	0 (0%)	5	

[b]Fisher exact test with n (%)

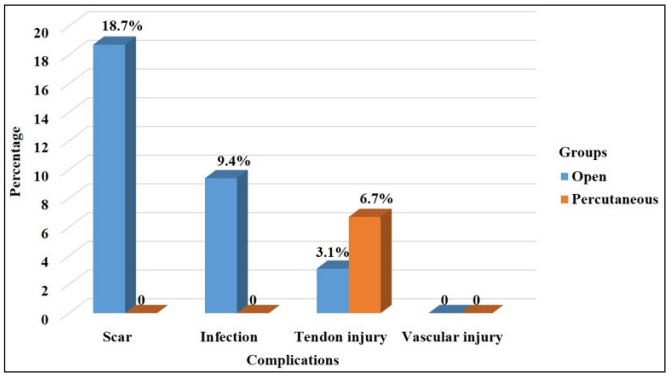

Figure 3. A bar graph showing the distributions of complication rates among the research groups

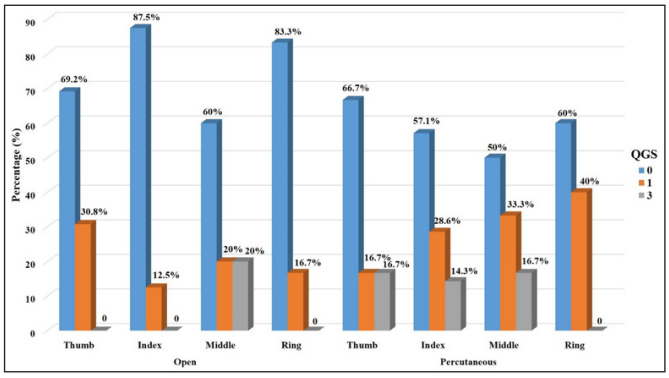

Figure 4. A bar graph showing the distributions of Quinnell grading system scores among the research groups based on fingers.

DISCUSSION

Trigger finger is seen more often in patients with diabetes and can lead to more serious postoperative complications compared to non-diabetic patients. Although there are various surgical treatment options in the treatment of trigger finger (TF), including open release and percutaneous release with and without ultrasound guidance, the optimal surgical treatment remains a matter of debate. Following TF open surgery, complications such as wound scar and associated pain, infection and reflex sympathetic dystrophy may be seen and cause morbidity. As the incidence of the

above-mentioned complications is increased in diabetic patients, DM has been shown to be a poor prognostic factor for surgery.[17] Percutaneous release techniques are applied to reduce all these complications. Instruments such as specially designed knives and hypodermic needles of different sizes are used in percutaneous release procedures. An 18 hypodermic needle was used in this study. To the best of our knowledge, there is no previous study in the literature that has compared open and percutaneous release techniques in diabetic patients and analyzed the complications in the long term.

In a study of diabetic and non-diabetic patients by Huang et al.[14] percutaneous release was performed on 48 diabetic patients and the long-term complications were reported to be persistent pain in the finger in 15 (25%) patients and recurrent TF in 9 (15%). At the end of the first year of another study of 39 patients, there was reported to be recurrent TF in 5 patients.[18] Similarly in the current study, recurrent TF was seen in 6 patients at the end of the first year in the group that underwent open release. In the group applied with the percutaneous release technique, problems such as insufficient release and tendon injuries were reported. In a study of a series of 42 patients, it was stated that there was incomplete release in 3 (6.79%) patients and tendon laceration developed in 6 (13.95%). Tendon injuries were reported at the rate of 6% in a cadaver study that analyzed complications after percutaneous release.[19] Lacerations developing in the tendon can result in rupture in the long term. In the current study, although superficial tendon laceration was seen in 2 (6.7%) patients in the percutaneous group and in 1 (3.1%) patient in the open group, tendon rupture was not observed in any patient at the end of 1 year.

Mishra et al.[20] performed percutaneous release with a hypodermic needle and reported that there was no recurrent TF at the end of the follow-up period of the study, complications were lower in comparison with open surgery and success was obtained at the rate of 95%. In the current study, the success of the release following the A1 pulley incision was confirmed in the percutaneous group by the absence of intraoperative triggering in all the cases and the rate of recurrent TF in the percutaneous group was seen to be similar to that of the above-mentioned studies.

When the percutaneous release technique is performed blind, neurovascular damage is another important complication that can occur. In a study performed with percutaneous release by Alper et al.[18] hypoesthesia was determined in 7 patients. No neurovascular complications were observed in either group in the current study. This difference was thought to be due to the different distribution of thumb and index fingers within the groups and that the nerve in these fingers is closer to the tissue. Previous studies of diabetic patients have reported worse clinical results in respect of recurrent TF rates and patient satisfaction.[21,22] Similarly in the current study, a significantly higher rate of scarring and associated pain was determined in the open group compared to the percutaneous group.

In a prospective study by Gilbert et al.[23] open and percutaneous release techniques were performed on a series of 100 patients, with success reported at the rate of 100% in the percutaneous technique and 98% in the open technique. Permanent pain associated with the formation of excessive scarring was reported in 1 patient in the open group and recurrent TF in 1 patient. The mean time of return to work was reported to be 3.9 days in the percutaneous group and 7.9 days in the open group. Similarly in the current study, the return to work of patients in the percutaneous group was significantly shorter than in the open group.

At the end of the first year of the current study, the VAS scores were found to be mean 1.3 in the percutaneous group and 0.8 in the open group (**Figure 2**). Quinnells grade 0 was determined in 75% of the patients in the open group and in 60% of the percutaneous group at the end of the first year. Scarring developed in 6 patients in the open group and no scar was seen in any patient in the percutaneous group. The patients who developed scarring received physiotherapy and NSAID treatment and there was no requirement for additional surgery.

Limitations of this study can be considered to be the retrospective design of the study and the relatively low number of patients.

CONCLUSION

Although satisfactory results were obtained with both percutaneous and open release techniques in the patients with diabetes in this study, the percutaneous release technique was seen to be a method which can be easily performed in an outpatient setting and had fewer complications. In addition to the negligible recurrence rate of the percutaneous technique compared to open release, it also has the significant advantages of lower cost, an earlier return to work and fewer complaints of pain associated with scarring.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Hitit University Non-interventional Researches Ethics Committee (Date: 03.07.2023, Decision No: 2023/09).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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