Original Article

Clinical Study Between Percutaneous Ultrasound-Guided Release and Open Classic Surgery in Treating Multiple Trigger Fingers

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Abstract

Background: A trigger finger is recognized as the most common hand tendinopathies that reduce functional ability. The present study compares the clinical outcomes of open classic release surgery with ultrasound-guided percutaneous surgery in cases of multiple finger involvement.

Materials and Methods: A cohort study has been performed from March 2019 to December 2020 by participating 34 trigger finger patients with multiple involvements. These patients were treated using classical open release and ultrasound-guided percutaneous release methods and both methods were compared in patients. The pain severity and functional ability obtained from the quick disabilities of the arm, shoulder, and hand (Quick-DASH) test scores were compared.

Results: The pain intensity in the classical open surgery patients was not significantly different from the ultrasound-guided group, and a one-month follow-up showed that the pain intensity in the ultrasound-guided patients was significantly less than in the other group ($P = 0.02$). Besides, no significant difference was observed between the functional abilities before and after the one-month follow-up. Indeed, the two groups had the same situations. Also, the recovery time in the ultrasound-guided percutaneous release group was significantly faster than in the other group. These cases had statistical differences as $P = 0.001$ and $P < 0.001$, respectively. The surgical release was 100% successful in both groups. The patients' satisfaction rates in the ultrasound-guided and open classic surgery treatment methods were 94.1 and 76.4%, respectively.

Conclusions: Classical open release and ultrasound-guided percutaneous surgery could successfully treat multiple trigger fingers. However, ultrasound-guided percutaneous surgery provided faster recovery and less pain intensity than the other method.

Keywords: Flexor tendon entrapment, snapping finger, trigger finger, ultrasonography

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Introduction

Stenosing tenosynovitis of the flexor tendons that manifest by locking and snapping are called trigger fingers. This disease occurs due to an imbalance between the size of the flexor tendon and the tendon sheath and is characterized by pain and catching as the patient flexes and extends digits.[1,2] The A1 pulley thickening in the palm area is due to abrasion of the flexor tendon during continuous flexion and extension movements. Trigger finger occurs secondary to inflammation and retinacular sheath hypertrophy with subsequent restriction of the flexor tendons.[3] This procedure eventually causes clinical symptoms. In this case, the diagnosis is often carried out through a clinical examination. In mild cases, conservative treatment includes the use of physiotherapy, oral anti-inflammatory drugs, and corticosteroid injections. Also, severe cases are often treated by open surgical resection. The

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success rate in this technique is approximately from 83% to 98%.[1,2]

Although open surgery is recognized as a standard treatment, it has several side effects, such as scarring the operation site, infection, and nerve damage. The percutaneous release is a modified open classic surgery with benefits such as less scarring and faster rehabilitation. Complications of this method are mostly related to nerve and tendon damage.[4-7]

Ultrasonography is a portable imaging modality that assesses the musculoskeletal system. It is easily employed in the operating room to treat various hand diseases such as corticosteroid injection in carpal tunnel syndrome (CTS) and De Quervain's tenosynovitis.[8-10] In this regard, the probability of injury in the percutaneous release surgery is higher than in the other method. This issue is due to the proximity of the neurovascular to the deep flexor tendon and its location.[8] Therefore, this study aimed to compare the efficacy and complications of the two methods of trigger finger treatment with classical open surgery versus ultrasound-guided percutaneous release.

Materials and Methods

A cohort study has been accomplished from March 2019 to December 2020. In this case, the study participants were patients with trigger finger involvement in two or more fingers who did not respond to conservative treatment in the last trimester and thus were candidates for surgical release. A total of 34 patients with idiopathic multiple trigger digits referred to the hand clinic were enrolled for the study. Inclusion criteria were multi-digit involvement with two or more digits and severe case grades III and IV (triggering, passive; demonstrable catching requiring passive extension or inability to flex actively or contracture; demonstrable catching, with a fixed flexion proximal interphalangeal (PIP) joint contracture) based on the severity of trigger fingers.[9]

The participants were included in the study with a simple sampling method proposed by Nikolaou *et al*.[10] This procedure has been performed based on the study power of 80% (Z = 1.96), P of 8.2, and effect size of 3 for patients' primary functional outcome based on quick disabilities of the arm, shoulder, and hand (DASH) score, with 10% of follow-up loss. These patients were divided into two groups and homogeneous from the sex and age viewpoints. Also, the number of fingers was 17 in these groups, and then they were compared. In addition, patients under 18 years have a history of corticosteroid injection in recent months, history of surgery on hand flexor tendons, and inflammatory systemic and rheumatic diseases. But diabetic patients and people with CTS participated in the study. All patients were given full explanations of the study objectives. Also, informed consent was obtained from each patient. This study was conducted under the supervision of the ethics committee of Shahid Beheshti University of Medical Sciences (Iran).

Patients in the classical open surgery group underwent local anesthesia using lidocaine 2% injection after tourniquet clamping. Then, the A1 pulley release was performed after an incision in the palm (15–20 mm). Afterward, the patient's movements were checked during flexion and extension surgery to ensure complete release. Patients were sutured with 4-0 nylon sutures after homeostasis. After ten days, the sutures were removed.

Similarly, patients in the ultrasound-guided percutaneous release group underwent local anesthesia. Before release, the surrounding neurovascular of the tendon sheath and the A1 pulley were identified by ultrasound. This procedure has been carried out using a portable grayscale ultrasound device (frequency of 5.7 MHz, 5–13 MHz, Linear Array, A6 Portable Ultrasonic Diagnostic System, Siemens medical solutions USA (made in Korea) anatomical position of flexor tendon). (CONMED's CTS Relief Kit® USA) was located using a 2 mm incision in the palm [Figure 1]. Finally, it was sutured. Acetaminophen 500 mg/q12 h was prescribed for all patients in the two groups. All patients had the same rehabilitation method, and they were allowed to start moving as much as possible after the operation. In patients with concomitant CTS, the surgical release was performed simultaneously with a specific device to the endoscopic release of CTS were done simultaneously with trigger finger release. Also, the same frequency distribution was considered for these patients in the two groups.

In addition, patients were examined based on pain intensity after ten days and one month of surgery. This process has been accomplished using the visual analog scale (VAS) scoring system. In this system, the scores of 100 and zero were devoted to the maximum and no pain cases, respectively. In this procedure, several items were recorded, including the duration of analgesic use and the time to return to daily activities. Besides, patients were assessed for functional ability according to the standard quick disabilities of the arm, shoulder, and hand score (Q-DASH) questionnaire before and after one month. Also, the satisfaction level has been

Figure 1: (CONMED's CTS Relief Kit® USA) knife instrument used for percutaneous release

evaluated based on the procedure suggested by Patel *et al*.[11] This classification is implemented considering two groups: (I) satisfactory, excellent, and good (No pain, cured, or minimal symptoms) and (II) unsatisfactory, fair, and poor (painful, the patient needed open surgery or had significant symptoms).[11]

The Chi-square (x2) statistical test was considered to perform statistical analysis and compare qualitative variables. Also, an independent t-test and a repeated measure test were employed to analyze quantitative variables. The analysis process was carried out using SPSS Statistics Version 16. In this study, the significance level was set to $P < 0.05$.

Results

Demographic data in the studied patients had no statistically significant difference [Table 1]. The pain intensity of patients in the group undergoing classical open surgery immediately after surgery was not significantly different from the ultrasound-guided group. But a one-month follow-up showed that the pain intensity in the ultrasound-guided patients was significantly less than in the other group ($P = 0.02$). Besides, functional ability before and after the one-month follow-up was not significantly different in these two groups. The analysis process has been performed based on the Q-DASH score questionnaire [Table 2]. Also, the analgesia duration in the ultrasound-guided percutaneous release group was significantly less than in the surgical release group. In addition, the return period to daily activity and recovery in the ultrasound-guided percutaneous release group was significantly faster than in the open surgical release group. These cases had statistically significant differences as $P = 0.001$ and $P < 0.001$, respectively. Nerve and tendon damage was not observed in the patients of both groups. Also, the surgical release was 100% successful in both cases. Excellent and good satisfaction with ultrasound-guided treatment was 94.1%. The overall satisfaction rate in patients in the other group was 76.4%. Four patients on the open surgical release were dissatisfied due to surgical scars and postoperative pain. So that patients' satisfaction had statistically significant differences as $P = 0.04$. In a case treated under ultrasound-guided group, the unsatisfaction was reported due to concomitant diabetic neuropathy [Table 2].

Table 1: Comparison of demographic between two groups

Variables	Open classic release ($n=17$)	Ultrasonography guide ($n=17$)	*P*
Age (years)	53.5±6.9	54.4±7.3	0.9
Sex (M/F)	7/10	5/12	0.08
Numbers of digits	2.3±0.4	2.4±0.5	0.7
Concomitant CTS	6 (35.3%)	5 (29.5%)	0.4
Diabetic patients	4 (23.5%)	5 (29.5%)	0.3

CTS: Carpal tunnel syndrome

Discussion

Nowadays, ultrasonography is widely used in treating tendinopathies of the wrist and hand. Also, ultrasound enables an accurate static and dynamic evaluation of the trigger finger. This imaging method has several features, including low risk, portability, and high efficiency in diagnosing musculoskeletal structures. Thus, this approach can help perform hand surgeries.[12-16] The findings showed that the final results of the classical open treatment and ultrasound-guided percutaneous release groups were not significantly different. However, patients with multiple involvements (two or more fingers) in the open surgery method had more pain intensity, and their recovery period was longer than in the percutaneous release method. Nikolaou *et al*.[10] studied 32 patients with trigger fingers and treated them with the ultrasound-guided percutaneous release. Their results were in agreement with the present study. Indeed, patients experienced faster recovery and less pain intensity. Percutaneous release surgery has been successful in all cases. In this study, patients' functional ability based on Quick-DASH test scores in the percutaneous release surgery was better than in the other group.[10] However, the present study showed that the final score was not significantly different. A better score was obtained in the ultrasound-guided percutaneous release group. Also, the findings demonstrated that the patients' pain intensity reduction was one of the benefits of ultrasound percutaneous release in

Table 2: Comparison of clinical findings between two groups

Variables	Open classic release $n=17$	Ultrasonography guide $n=17$	*P*
Pain after the operation (VAS score)	42.1±9.2	45.8±7.8	0.2
Pain in 10 days (VAS score)	37±5.6	25.3±2.7	0.001*
Pain after a month (VAS score)	14.5±5.6	10.7±3.7	0.02*
Q-DASH score before	50.3±5.07	49.5±2.87	0.5
Q-DASH score after	14.5±1.9	12.7±1.8	0.6
Days of analgesic consumption	13.7±2.7	7.05±1.5	<0.001*
Return to previous activity	21.2±5.8	15.4±2.5	0.001*
Satisfactory Excellent	13 (76.4%)	16 (94.1%)	0.04*
Good			
Unsatisfactory	4 (23.6%)	1 (5.9%)	
Fair			
Poor			

*Significant difference. VAS: Visual analog scale, Q-DASH: Quick disabilities of the arm, shoulder, and hand score

multiple trigger fingers during the recovery period. Indeed, this approach significantly reduced the need for analgesia and induced the early return to the primary activity. Similarly, based on Nikolaou *et al*.[10] study, the need for painkillers significantly decreased in the ultrasound percutaneous release. Also, the mean of return to normal activities in the ultrasound percutaneous release was 4.5 days versus 17.8 days on the open surgical release.[10] In our study, the recovery period and time taken to return to the primary activity on using the ultrasound percutaneous release were significantly less than patients treated under open surgical release.

Although percutaneous release has many advantages, the risk of neurovascular bundles is very high due to the blindness in this method. Also, there is a possibility of incomplete A1 release in this case (16 17). In the thumb, index finger, and little finger, the risk of nerve damage increases with percutaneous release surgery. It is due to the very close proximity of the digital nerve to the flexor tendon. Also, the injury risk increases with multiple finger involvement.[17,18]

In addition, the percutaneous release studies demonstrated the probability of longitudinal rupture in the tendon.[17,18] Ultrasound-guided percutaneous A1 release has first been reported by Evin Bar and Jou *et al*.[8] to overcome the problems caused by the percutaneous release. Also, Lee *et al*.[19] studied 20 patients with trigger fingers and multiple finger involvement. They found that ultrasound-guided percutaneous release significantly reduced the pain severity in patients. In this case, the patients' pain severity after two and four weeks of surgery was lower than in the other case. Also, patients' satisfaction was 100%, and they were not faced with any side effects.[19] In the present study, patients' satisfaction was nearly 95% for percutaneous one, while patients' satisfaction with the open surgery technique was reduced due to multiple scars on the surgical site and pain in patients. In addition, Paulius *et al*.[20] found that the surgical procedure of ultrasound-guided percutaneous release in the cadaver had a possibility of flexor tendon damage and incomplete release by 17 and 83%, respectively. Our study on the multiple triggers finger involvement revealed that percutaneous release is better than open surgical, especially in these patients. In a recent study by Colberg *et al*.,[21] the outcomes of patients treated with an ultrasound-guided trigger finger release technique using an Surgical Blade NO.18 were quite successful and induced a significant reduction in pain and improvement in the function of patients after A1 release. In the previous study, the ultrasonography guide was less successful than clinical studies, while the present study showed 100% success without any complications. One of the reasons for the lack of success in the study of Paulius *et al*.[20] was the use of a cadaver. In other words, there was no vascular diagnosis and dynamic imaging, and thus the success rate of ultrasound-guided percutaneous release has reduced. Based on a new study by Yang *et al*.[22] in 60 digits on unembalmed cadavers show that ultrasound-guided percutaneous A1 pulley release by autotomy is a safe and effective technique. Also in similar findings by White *et al*.,[3] ultrasound-guided percutaneous release of the A1 pulley is an effective procedure that induced short-term resolution of trigger finger and rapid recovery. In our study, the most effects of ultrasound-guided percutaneous release in multiple trigger fingers in a short-term period of patient's recovery especially in pain severity but functional outcomes were not different. The rate of ultrasound-guided percutaneous release in a study by Pan *et al*.[23] was 100% complete release in one time compared to the blind group in single involvement. Besides that, in our study, excellent and good satisfaction with ultrasound-guided treatment was (94.1%.) better than the open surgical release in multiple involvements (76.4%).

Limitations

Several limitations in the present study were the study power and small sample size. These limitations were due to the selection of patients with multiple digit involvement. The cost-effective procedure was not investigated because of covering all costs by the deputy of research of Shahid Beheshti University of Medical Sciences.

Conclusions

The findings demonstrated that the classical open percussion and the ultrasound-guided percutaneous surgery were successful approaches in treating multiple trigger fingers. But ultrasound-guided percutaneous surgery indicated faster recovery and less pain intensity than the other method.

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Ethical issues

The study was confirmed by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.RETECH.REC.1399.942).

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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