Original Article

Comparison of Trigger Finger Treatment with Open Surgery and Percutaneous Release by Blade Probe with or without Corticosteroid Injection: A Randomized Clinical Trial

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Objective: The aim of this study was to compare the effectiveness, results, and complications resulting from treatment of trigger finger with open surgery and with percutaneous release by blade probe with or without cortisone injection.

Materials and Methods: One hundred and twenty-two patients representing a total of 150 fingers were randomly assigned to one of three treatment groups. Patient were >18 years old with a trigger on any finger of either hand (type II-IV) and a minimum follow-up time of 6 months. Outcome measures included cures, recurrences and failures, pain scores, total active motion [TAM], and complications.

Results: Fifty-three fingers received open surgery, 49 received percutaneous release, and 48 received percutaneous release with cortisone injection. Successful cure was achieved with all three methods in all cases with no difference in TAM, no recurrences, no nerve injury, and no infections. Topical pain and articular pain were significantly lower in the percutaneous release with cortisone injection group during the first month, topical pain slightly increased in the fourth month, and then decrease by six months. Visual Analogue Scale [VAS] scores were <1 in all groups one month after treatment.

Conclusion: Both percutaneous techniques as well as open surgery resulted in similar therapeutic efficacy with no difference in complications. The cortisone injection groups had better postoperative pain scores in the first month, but all groups had the same score after 6 months.

Keywords: Trigger finger, Trigger digit, Open trigger surgery, Percutaneous trigger surgery, Trigger thumb, Percutaneous release trigger digit

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Trigger finger is a common problem affecting hand function. Symptoms include pain, edema, limitation of finger movement, and a triggering sensation which continues until the deformity is fixed[1]. The condition occurs when the gliding movement of the tendon is blocked by the osteofibrous canal of the A1 pulley. There is no consensus about the true cause and the etiology remains unknown[2], although synovial proliferation and fibrosis of the flexor tendon sheath and changes in the flexor tendon and its sheath, described by Notta[3], and nodule formation in the intratendinous fibers, demonstrated by Hueston and Wilson[4], have been identified as triggering factors.

Quinnell[2] classified trigger finger during flexion and extension into five types: normal movement (Type 0), uneven movement (Type I), actively correctable (Type II), passively correctable (Type III), and fixed deformity (Type IV).

After conservative treatment has failed, open surgery, the main treatment option, has achieved a high rate of success; however, some complications can

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occur, e.g., painful scarring, infection, nerve injury, and recurrence of the disease[5,6]. In 1958, Lorthioir[7] described treatment by delicate tenotomy. Other authors have reported good results using percutaneous release of the A1 pulley by needle and special small knife[8-14], although there have been some failures and recurrences due to incomplete tendon entrapment release with that method. Over the past decade, percutaneous release of trigger finger has been widely used as it has the advantages of being a relatively easy operation and providing high levels of patient satisfaction. This randomized clinical trial was conducted to compare the results of different methods in terms of cure, relapse rate, failure rate, topical pain, articular pain, total active motion [TAM], and complication rate.

Materials and Methods

From December 2014 to September 2016, 122 patients representing a total of 150 trigger fingers were treated at the Outpatient Orthopaedic Department and were included in this study. Inclusion criteria were >18 years old, no previous surgery of the affected finger, classified as Quinnell[2] types II-IV but not type I, congenital trigger finger, rheumatoid arthritis, and a history of tendon injury of the hand and forearm. This research project was approved by the Ethics Research Committee. Written informed consent was obtained from all participants.

Each of the three groups consisted of 50 fingers. The calculated size of each group was 43 fingers per group based on a β-value of 80% and an α significance statistic of 5%. The roll of a six-sided die was used to randomize the treatment method: sides one and six received the percutaneous release by blade probe treatment, sides three and four received the percutaneous release by blade probe with cortisone injection, and sides two and five received open surgery. The treatment method for each finger was prepared by personnel not involved in the research. Group membership results were placed in sealed envelopes numbered 1 to 150. No project participants had prior knowledge of their treatment method. The study participants' fingers submitted to treatment were numbered and each finger received its own order number. In the operating room before the start off treatment the envelope for that finger was opened and the participant was informed of the type of treatment by assistant physician. This procedure was repeated for each of the 150 envelopes. In this manner, the treatment received by each finger was randomized. The treatment for all patients was done by the same orthopaedic physician.

Surgical techniques

The two types of blade probe used in these surgeries was developed from a dental instrument by Dr. Vijitpornkul. The Vijitpornkul blade probe A has one angled sharp cutting end and one blunt test end; the Vijitpornkul blade probe B has two angled sharp cutting ends (Figure 1). The blade probe is not registered as intellectual property. Fibrosis of the flexor tendon sheath and the A1 pulley can be accomplished treated by releasing and recutting until successful release is achieved which can be tested using the blunt end of Probe A.

Percutaneous release by blade probe consists of releasing the adhesion and fibrosis flexor tendon sheath proximal to the A1 pulley and release of the A1 pulley using the sharp end of a Vijitpornkul blade probe. The completeness of the release can be tested using the blunt end of the probe A. A complete release is indicated by normal active movement of the affected finger. No triggering was seen following the operation in any of the patients (Figure 2). Timing of the duration of the surgery begins when the instrument penetrates skin and ends with the complete release of the tendon and removal of the instrument.

Percutaneous release using a blade probe with cortisone injection included an injection of 1 ml of triamcinolone acetate 10 mg within the osteofibrous canal. The procedure for release of the fibrosis flexor tendon sheath and A1 pulley is same as for percutaneous release without cortisone injection. Timing of the duration of the surgery begins with the injection of triamcinolone acetate and ends with the complete release of the tendon and removal of the instrument.

Open surgery consists of a 1.5 to 2 cm incision

Figure 1. Dr. Vijitpornkul Blade Probe A and Blade Probe B.

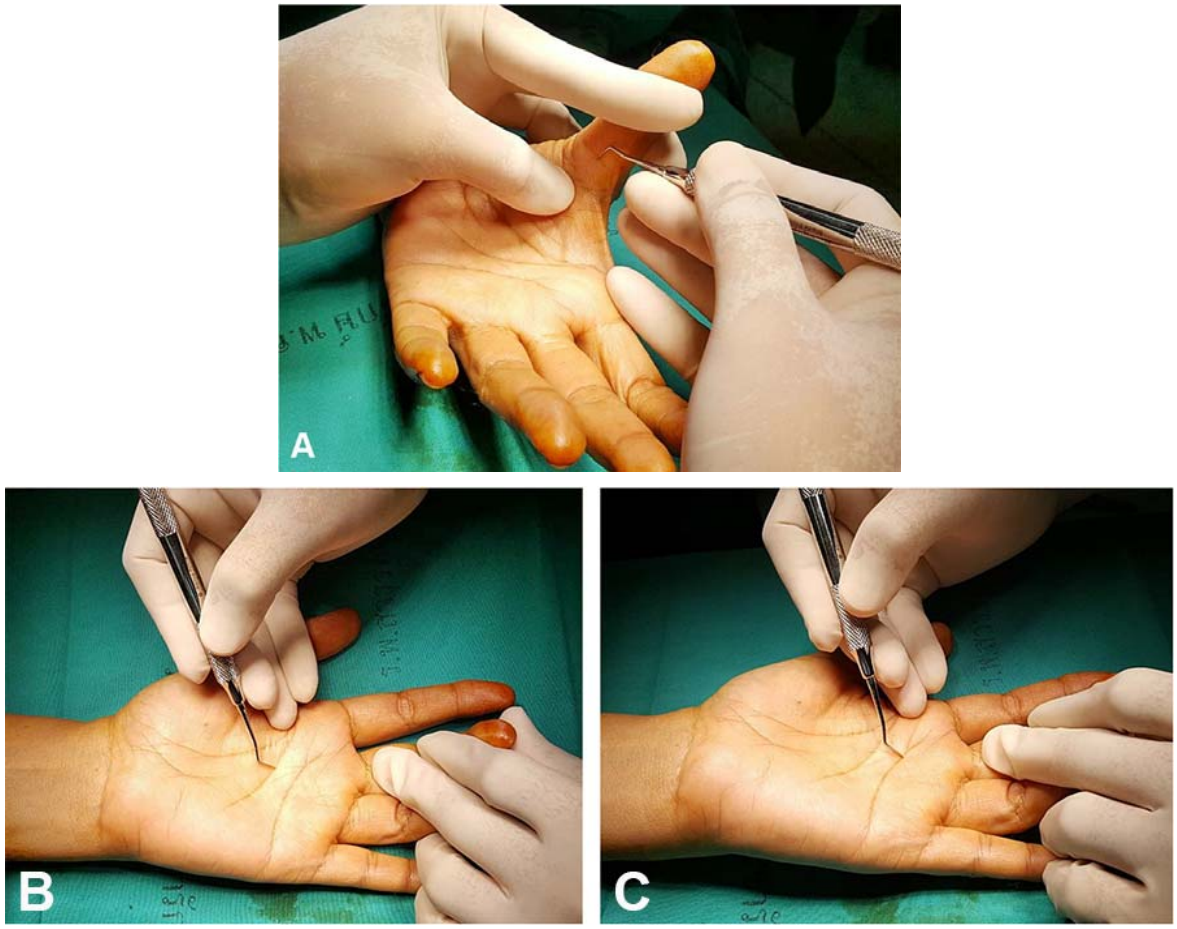

Figure 2. Percutaneous release with a blade probe. A) Release of the A1 pulley by cutting the end of the thumb in an abducted position, B) Release of the fibrosis flexor tendon sheath by cutting at the proximal end of the middle finger, C) Release of the A1 pulley by cutting at the proximal end of the middle finger.

at the palmar skin fold transverse to the axis of the finger followed by subcutaneous dissection and longitudinal opening of the A1 pulley and fibrosis of the flexor tendon sheath[5]. Timing of the duration of the surgery begins with the skin incision and ends with the suturing of the skin after the operation is completed.

After surgery, the patients were prospectively assessed at 1, 2 weeks and at 1, 2, 4, and 6 months by an independent examiner who recorded treatment outcomes as cured (total remission at 6 months), relapse (return of the blockage within 6 months), or failure (blockage maintained after treatment). Complications of treatment, infection, digital nerve injury, and total lesion of the flexor tendon were also recorded as were topical pain (pain at the site of the procedure) and articular pain (pain at the IP joint of thumb or at the PIP joint of the finger) by VAS score (range 0 to 10). Measurement of total active motion [TAM] was done with a goniometer at the dorsal region of the finger using the method advocated by the Committee for Tendon Lesion of the International Federation of Societies of Hand Surgery[15].

Statistical methods

Analysis of variance [ANOVA] was used to compare numerical variables. For categorical variables, we used Pearson's Chi-square test. For all tests, an α-value of 5% was used, with $p<0.05$ indicating statistical significance. All analyses were performed using SPSS 17.0 for windows.

We analyzed the homogeneity of participants in terms of gender, presence of diabetes, age, and duration of the disease as of the date they committed

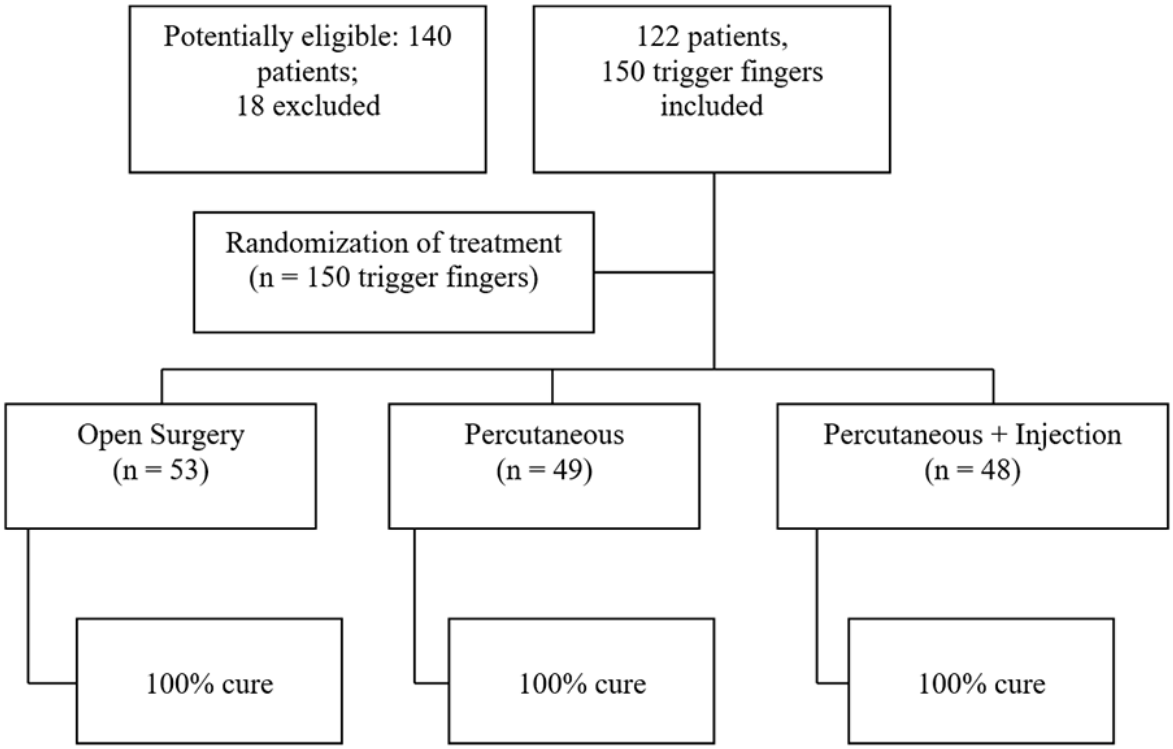

Figure 3. Flowchart of the intervention and results.

Table 1. Epidemiological data: gender, presence of diabetes, age, duration of disease, and grade of disease

	Treatment method			*p*-value*
	Open surgery (n = 53)	Percutaneous (n = 49)	Percutaneous + Injection (n = 48)	
Gender				0.619
Male	7	6	9	
Female	46	43	39	
Diabetes				0.118
No	35	41	34	
Yes	18	8	14	
Age (years)	53.29	52.73	52.90	0.256
Duration (months)	8.47	7.29	10.23	0.386
Type of trigger finger				0.906
Type II	13	11	8	
Type III	15	15	15	
Type IV	25	23	25	

* Chi-square test
n = number of patients per group

to the study protocol. Pearson's Chi-square test was used to identify links among the categorical variables gender and presence of diabetes. ANOVA was used to identify associations among numeric variables, gender,

and duration of disease as of the date of committing to the study protocol. We used ANOVA for analysis of the frequency of complaints of pain after treatment, both at the site of the procedure and at the IP joint of the fingers, and for analysis of the duration of the procedure and the change in movement of the fingers before and after treatment. Parson's Chi-square test was used to compare cure rates among treatment groups.

Results

The three groups were homogeneous in terms of age, comorbidity, gender, time of onset of trigger finger and classification[2] (Table 1) as well as movement of the finger (TAM) (Table 4). There was significant difference among the groups for average duration of surgery (Table 2) and for mean VAS score of pain (Table 3).

All three treatment methods resulted in complete cure for all patients; there were no relapses and no failures were observed. There were no complications such as infection, digital nerve injury, or total lesion of flexor tendon injury in any of the treatment groups.

The mean operative time was shorter in the percutaneous release group (p = 0.000**) (Table 2).

Table 2. Average duration of the procedure: open surgery, percutaneous, percutaneous with injection

	Treatment method			*p*-value*
	Open surgery (n = 53)	Percutaneous (n = 49)	Percutaneous + Injection (n = 48)	
Average duration (min)	7.68	5.53	6.73	0.000**

* ANOVA, ** Statistically significant (p<0.05)

Table 3. Mean VAS score for topical pain and for joint pain at 1 and 2 weeks and at 1, 2, 4 and 6 months after treatment

	Treatment method			*p*-value*
	Open surgery (n = 53)	Percutaneous (n = 49)	Percutaneous + Injection (n = 48)	
1 week				
Topical pain	2.32	2.08	0.96	0.000**
Joint pain	1.50	1.14	0.50	0.005**
2 weeks				
Topical pain	1.59	1.29	0.52	0.000**
Joint pain	0.86	0.29	0.23	0.002**
1 month				
Topical pain	0.98	0.96	0.31	0.010**
Joint pain	0.75	0.55	0.15	0.010**
2 months				
Topical pain	0.54	0.57	0.33	0.459
Joint pain	0.36	0.55	0.17	0.125
4 months				
Topical pain	0.25	0.18	0.81	0.007**
Joint pain	0.39	0.18	0.23	0.373
6 months				
Topical pain	0.07	0.12	0.29	0.153
Joint pain	0.16	0.08	0.25	0.519

*ANOVA **Statistically significant (p<0.05)

Table 4. Movement of the finger assessment by total active motion (TAM) values

	Treatment method			*p*-value*
	Open surgery (n = 53)	Percutaneous (n = 49)	Percutaneous + Injection (n = 48)	
Before	170.71	144.67	155.08	0.132
1 month	198.32	181.65	194.48	0.338
2 months	208.68	186.84	201.58	0.176
4 months	217.05	191.02	203.46	0.096
6 months	220.79	195.31	204.71	0.099

*ANOVA

The postoperative mean VAS score of topical pain was lower in the percutaneous release with cortisone injection group at 1 week ($p = 0.000$**), 2 weeks ($p = 0.000$**), and 1 month ($p = 0.010$) but there was an increase in pain in that group at 4 months ($p = 0.007$), although the mean VAS score remained <1. At 6 months, topical pain was not different among the groups (Table 3). The mean VAS score for articular pain in the percutaneous release with cortisone injection group was significantly lower than the other two groups at 1 week ($p = 0.005$), 2 weeks ($p = 0.002$) and 1 month ($p = 0.010$); after that, the there was no significant difference in mean VAS score among the groups (Table 3).

Discussion

After failure of conservative treatment of trigger finger, surgical treatment by open release of the A1 pulley has reported success rates of up to 100%[1]. Reported complications of open surgery include infection, digital nerve injury, painful scar, joint contracture, and recurrence of trigger finger[16].

Percutaneous release was first performed in 1958 and was successful without complications[7]. Reports of anatomic study of a variety of thumb pulley systems and percutaneous releases in cadaveric studies have indicated that it is a safe procedure for thumb, index, middle, ring and little fingers[13,17,18]. Melissa Arief[19] reported that percutaneous trigger finger release demonstrated a greater rate of success for diabetic trigger fingers than standard corticosteroid injection alone, with no complications in either group. There have been many reports of percutaneous release using a variety of surgical instruments and methods with good results and few complications[11,12,20,21,23]. Ha et al[24] used a custom hooked blade to perform percutaneous surgery and reported effective results. Jongjirasiri[11] described the anatomic landmark of the proximal edge of the A1 pulley that relates to the knuckle line perpendicular to the palm, and reported 314 digits were treated by percutaneous release using a full handle knife 15° and 92.9% achieved complete resolution of symptoms at 6 weeks with few complications. Bamroongshawgasame[20] reported that treatment of 160 trigger fingers with open surgery had a success rate of 100% compared with 98.75% for percutaneous release trigger finger using a full handle knife 45° at the 8 week follow-up.

The present study used Vijitpornkul blade probe A and blade probe B that together have three types of sharp cutting ends and one blunt test end. Fibrosis of the flexor tendon sheath and A1 pulley can be released and recutting until the release is complete which can be safety tested using the blunt end of the probe to insure normal movement of the finger has been achieved. All cases in the percutaneous release without cortisone injection group were cured, just as in the cortisone injection group and the open surgery group. Accuracy of treatment and skill of the surgeon may be a major factor in these results. Percutaneous release with or without cortisone can cure all cases without complications, the same as open surgery, but with less topical pain and joint pain through the 6 months follow-up period. Percutaneous release of trigger finger with cortisone injection has lower topical pain and articular pain than open surgery. It also has lower pain than percutaneous release without cortisone in the first month. Corticosteroid can reduce the pain and inflammation resulting from the treatment procedure with no complications, although it does have a slight rise in topical pain (VAS score <1) in the fourth month. It is possible that the rise in pain in the fourth month is the result of the initial reduction in pain soon

after surgery encouraging premature over-use of hand. Pain improves again up to the 6 months follow-up.

Although there is no difference in complications or total active motion of the finger, the significantly shorter operative procedure and lower pain after treatment suggest that percutaneous release of trigger finger with or without cortisone injection provides better results than the surgical alternative.

The limitation of this study was that all patients were treated by a single orthopedic surgeon which may have introduced bias; however, having only one surgeon helps insure that physician skill level was not a factor.

Conclusion

Percutaneous release with or without cortisone injection have good therapeutic efficacy similar to that of open surgery with no difference in complications. Percutaneous release with cortisone injection provides better postoperative topical pain and articular pain relief, although topical pain may temporarily increase in the fourth month. Pain is resolved with all three methods after six months.

What is already known on this topic?

Previous studies have shown that trigger finger release by the percutaneous technique using a variety of instruments and methods, e.g., an 18 gauge needle, custom hooked blade, and special small knife, provide good results with few complications, but there have been some failures.

What this study adds?

This study demonstrates that percutaneous release using a Vijitpornkul blade probe with or without cortisone injection has a therapeutic efficacy similar to that of open surgery with no difference in complications. It requires less operating time and provides better postoperative topical pain and articular pain relief during the first month, with all pain being resolved by six months.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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