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SURVEY

Percutaneous Release, Open Surgery, or Corticosteroid Injection, Which Is the Best Treatment Method for Trigger Digits?

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Abstract

Background Percutaneous A1 pulley release surgery for trigger digit (finger or thumb) has gained popularity in recent decades. Although many studies have reported the failure rate and complications of percutaneous release for trigger digit, the best treatment for trigger digit remains unclear.

Questions/purposes Our aim was to identify the relative risk of treatment failure, level of satisfaction, and frequency of complications, comparing percutaneous release with open surgery or corticosteroid injections for adult patients with trigger digits.

Methods We searched PubMed, Embase, and the Cochrane Library for randomized controlled trials (RCTs), comparing percutaneous release with open surgery or corticosteroid injections. Seven RCTs involving 676 patients were identified. Methodologic quality was assessed by the Detsky quality scale. After data extraction, we compared results using a fixed meta-analysis model.

Results There were no differences in the failure rate (risk ratio [RR] = 0.93; 95% CI, 0.14–6.25) and complication frequency (RR = 0.83; 95% CI, 0.15–4.72) between patients undergoing percutaneous release and open surgery. Patients treated with percutaneous release had fewer failures (RR = 0.07; 95% CI, 0.02–0.21) and a greater level of satisfaction (RR = 2.01; 95% CI, 1.62–2.48) compared with the patients treated with corticosteroid injections. We found no difference in complication frequency between percutaneous release and corticosteroid injection (RR = 3.19; 95% CI, 0.51–19.91).

Conclusions The frequencies of treatment failure and complications were no different between percutaneous release surgery and open surgery for trigger digit in adults. Patients treated with percutaneous releases were less likely to have treatment failure than patients treated with corticosteroid injections.

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Introduction

Trigger digit is caused by a size mismatch between the volume of the flexor tendon sheath and its contents and may result in painful triggering, clicking with finger or thumb movement, and secondary contracture at the proximal interphalangeal joint. The goal of treatment consists of reestablishing an undisturbed, full ROM in the involved digits.

There are various methods for treatment of trigger digits including corticosteroid injections in or around the flexor tendon sheath [10], or percutaneous [17] or open surgical release [26] of the A1 pulley. Corticosteroid injections often are recommended as the first line of treatment [20]. However, injections can result in a 33% relapse within 1 year [1]. Open trigger surgery is the standard technique [26] and traditionally consists of open A1 pulley release in which the pulley is completely observed and dissected. The results of open A1 pulley release generally are excellent. Turowski et al. [30], in a group of 59 patients treated by various surgeons, reported 97% complete resolution of triggering with no complications such as infection, bowstringing, or digital nerve injury.

Lorthioir [17] first described a percutaneous method of trigger finger release using a fine tenotome in 1958. Since then, several percutaneous surgeries, using various instruments and methods have been described with good results and few complications [8, 13, 22, 23, 29, 32, 33]. Although the technique of percutaneous release surgery has become common in the last 20 years [7, 8, 13, 16, 18], the best treatment of trigger digit remains unknown.

In this meta-analysis, we sought to use evidence from randomized controlled trials (RCTs) to identify the risk ratio (RR) of treatment failure, the level of satisfaction, and the frequency of complications, comparing percutaneous release with open surgery or corticosteroid injections for adult patients with trigger digits.

Materials and Methods

We searched PubMed, Embase, and Cochrane library for literature published up to October 2012. The following key words were used in the searches: ((trigger finger) OR (trigger thumb) OR (trigger digit) OR (stenosing tenosynovitis)) AND ((percutaneous release) OR percutaneous OR (subcutaneous release) OR subcutaneous). No language restriction was applied. With use of our search strategy 199 titles were identified.

Two investigators (JW and CCL) independently reviewed all 199 titles, abstracts, and the full texts of articles. We included only RCTs or quasiRCTs, comparing percutaneous release surgery with open surgery or corticosteroid injections. QuasiRCTs are those in which randomization is inadequately concealed (ie, patients are allocated according to known characteristics such as date of birth, day of presentation, or hospital chart number). We excluded the following types of articles: letters, review articles, those including children, case reports, cadaveric studies, and other articles that were not relevant to the topic (Fig. 1). One study was excluded, as it was a brief citation from another included study in this meta-analysis [5]. Disagreement was resolved by consensus or a third author (JGZ). These exclusions left seven RCTs involving 676 patients included in this meta-analysis [2, 9, 12, 14, 19, 28, 34]. There were six RCTs [2, 9, 14, 19, 28, 34] and one quasiRCT [12]. Among the seven eligible trials, three [2, 12, 14] compared percutaneous release with open release surgery, and three [9, 19, 34] compared percutaneous release with corticosteroid injections. Sato et al. [28] compared the three approaches. The sample size across the studies ranged from 36 to 160 (Table 1).

The methodologic qualities of the included trials were assessed independently by two reviewers (JW and JGZ). Disagreements were resolved by discussions to achieve consensus. We used the quality scale described by Detsky et al. [11] for randomized controlled trials to assess the methodologic quality of the included trials. This scale is more suitable for evaluating the quality of reporting of surgical trials because it requires users to consider blinding of outcome assessors rather than blinding of those providing treatment or blinding of patients, both of whom are difficult to blind in most surgical trials [4]. The Detsky quality scale evaluates randomization, description of outcome measures, inclusion and exclusion criteria, and descriptions of therapies and statistics. The mean Detsky score was 14.9 across included trials (range, 13–18)

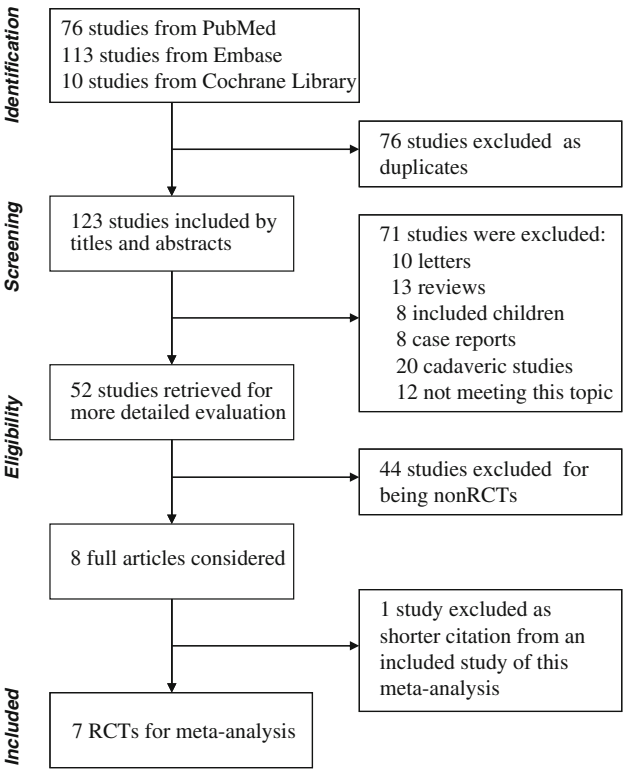

Fig. 1 A flow diagram summarizes the selection of studies, including numbers and reasons for excluding certain studies. RCT = randomized controlled trial.

Table 1. Characteristics of included studies

Study	Methods		Populations				Interventions	Outcomes	Followup (months)
	Year	Type	Number of patients (E/C)	Age (years) (E/C)	Sites	Inclusion/exclusion criteria	E versus C	Effectiveness and safety	
Percutaneous versus open surgery									
Gilberts et al. [14]	2001	RCT	54/46	62/60	Digit	Inclusion: > 18 years and with trigger digit symptoms for at least 1 month. Exclusion: active rheumatoid arthritis, other active connective tissue diseases, or previous surgery on the affected digit	PR (18-g needle) versus OS	Operation time; failed procedures; return to work; recovery of motor function; satisfaction rate; duration of postoperative pain; complications	3
Dierks et al. [12]	2008	QRCT	20/16	62/64	Finger	Exclusion: patients with a trigger thumb, more than one trigger finger, previous operations, or diseases possibly influencing pain scores or hand function or any joint extension lag	PR (#15 blade) versus OS	Grip strength; pain; active ROM; time of surgery; complications; cost	3
Bamroongshawga-same [2]	2010	RCT	80/80	49/46	Digit	Inclusion: nonsurgical treatment for 3 months, at least one local steroid injection, no active osteoarthritis of the affected hand, and Green Grades 2–4 trigger digit	PR (full-handle knife 45°) versus OS	Operative time; failed procedures; complications; satisfaction scores; pain scores; extensions and flexion; complications	2
Sato et al. [28]	2012	RCT	45/56	54/53	Finger	Inclusion: patients with trigger finger symptoms, ≥ 15 years old, no previous treatment, Quinnell Grades 2–4. Exclusion: type 1 trigger finger.	PR (40 × 12 needle) versus OS	Cure rate; relapse; failed procedures; topical pain; articular pain; total active motion; complications	6
Percutaneous release versus corticosteroid injection									
Maneerit et al. [19]	2003	RCT	65/60	51/53	Thumb	Inclusion: idiopathic adult; Quinnell Grades 2–4; patients with diabetes were included; Exclusion: a history of trauma or carpal tunnel syndrome	PR (18-g needle) with SI versus CI (1 mL triamcinolone)	Satisfaction rate; failed procedures; pain scores; the quantity of paracetamol requirement of patients; complications	23
Chao et al. [9]	2009	RCT	46/47	48/49	Thumb	Inclusion: idiopathic adult trigger thumbs with Quinnell Grades 3–5; Exclusion: patient with rheumatoid arthritis, diabetes mellitus, or chronic systemic disease	PR (miniscalpel needle) versus CI (1 mL triamcinolone, 10 mg/mL)	Satisfaction rate; complications	12
Zyluk and Jagielski [34]	2011	RCT	46/59	55/58	Digit	Inclusion: patients diagnosed based on clinical symptoms and signs, tenderness at the base of the affected digit, or complete locking	PR (19-g needle) versus CI (1 mL betamethasone)	Failed procedures; pain scores; total grip strength; Froimson grade; active ROM; complications;	6
Sato et al. [28]	2012	RCT	45/49	54/55	Finger	Inclusion: patients with trigger finger symptoms, ≥ 15 years old, no previous treatment, Quinnell Grades 2–4. Exclusion: type 1 trigger finger.	PR (40 × 12 needle) versus CI (2 mL methylprednisolone, 40 mg/mL)	Cure rate; relapse; failed procedures; topical pain; articular pain; total active motion; complications	6

RCT = randomized controlled trial; QRCT = quasirandomized controlled trial; PR = percutaneous release; CI = corticosteroid injection; OS = open surgery; E = experimental group involved in percutaneous release; C = control group including open surgery or steroid injection.

Table 2. Methodologic quality of included studies

Study	Adequate randomization	Allocation concealment	Assessor blinding	Similar baseline	Rate of drop-out	Detsky scores†
Gilberts et al. [14]	Yes	Yes	No	Yes	Unclear	16
Maneerit et al. [19]	Unclear	Unclear	Unclear	Yes	1.7%	14
Dierks et al. [12]	Partial*	Unclear	Unclear	Unclear	Unclear	14
Chao et al. [9]	Yes	Yes	Unclear	Yes	4.1%	18
Bamroongshawgasame [2]	Unclear	Unclear	Unclear	Yes	Unclear	13
Zyluk and Jagielski [34]	Yes	Yes	Yes	Yes	17%	15
Sato et al. [28]	Yes	Yes	Unclear	Yes	Unclear	14

* Partial randomization (ie, patients are allocated according to known characteristics such as date of birth, day of presentation, or hospital chart number); †Detsky quality score is used to assess the methodologic quality of randomized controlled trials (maximum, 21 scores).

(Table 2). Randomization and allocation concealment were considered adequate in four trials and were performed by means of sealed envelopes [9, 14, 28, 34]. The baselines were similar regarding the most important prognostic indicators in six trials [2, 9, 14, 19, 28, 34], and one trial [12] was unclear. Only one trial [34] reported that the outcome assessor was blinded to the intervention. Loss to followup rates ranged between 1.7% and 17%.

The following data were extracted: participant characteristics, number of trigger fingers or thumbs, inclusion and exclusion criteria, intervention details, and followup time. Although we extracted the data of a single injection for the corticosteroid injection group, a few patients with a second injection in trials also were included. The primary outcomes were number of posttreatment failures, patient satisfaction rate, and complications. Failure was defined as recurrence of symptoms or minimal improvement in symptoms requiring further surgeries or injections. Information regarding complications was extracted, including infection, vascular injury, flexor tendon injury, digital nerve injury, excessive release or adhesions-related reduction of flexion, and hematomas. Incomplete trigger release requiring further treatment was considered a failed procedure rather than a complication in this meta-analysis. Other outcomes, such as the pain scores, grip strength, active ROM, operative time, and cost were omitted because they were not consistently available in the source studies. In addition, we extracted only the data within 6 months from the time of treatment to ensure a similar time of outcome assessment.

Dichotomous variables were presented as risk ratios (RR) with 95% CI. If considered appropriate, results of comparable groups of trials will be pooled. Initially, we used a fixed-effect model and 95% CI with the significance level set at $p = 0.05$. Homogeneity across the studies was assessed with the I^2 test. Heterogeneity was considered present if the I^2 value was greater than 50%. We then used a random-effects Mantel-Haenszel model when there was statistical or graphic evidence of heterogeneity. RevMan 5.1 software (Cochrane IMS, Oxford, UK) was used for data analysis.

Percutaneous release was compared with open surgery in four studies [2, 12, 14, 28]. Of the 397 patients from these four studies, 199 were randomly assigned to the percutaneous release group, and 198 were assigned to the open surgery group. The followups across the studies ranged from 2 to 6 months. Three trials [2, 14, 28] reported the failed procedure occurred in one of 179 patients (0.56%) with percutaneous release and in one of 182 patients (0.55%) with open surgery. Four trials [2, 12, 14, 28] reported the complications occurred in two of 199 patients (1.0%) with percutaneous release and in two of 198 patients (1.0%) with open surgery.

Four trials [9, 19, 28, 34] compared percutaneous release with corticosteroid injections, and enrolled 417 patients; 202 of the patients were assigned to the percutaneous release group and 215 were assigned to the corticosteroid injection group. Three trials [19, 28, 34] reported the failed procedure occurred in two of 156 patients (1.28%) in the percutaneous release group, while also occurring in 45 of 168 patients (26.8%) in the corticosteroid injection group. Postoperative satisfaction rate was reported in two trials [8, 18]; the rates were 91.89% (102 of 111) in the percutaneous release group and 45.79% (49 of 107) in the corticosteroid injection group. The complication rates were 1.5% (three of 202) in the percutaneous release group and 0% (0 of 215) in the corticosteroid injection group [9, 19, 28, 34].

Results

There were no differences in the frequency of treatment failure (RR = 0.93; 95% CI, 0.14–6.25; p = 0.94) (Fig. 2) or complications (RR = 0.83; 95% CI, 0.15–4.72; p = 0.84) (Fig. 3) between patients undergoing percutaneous release and open surgery.

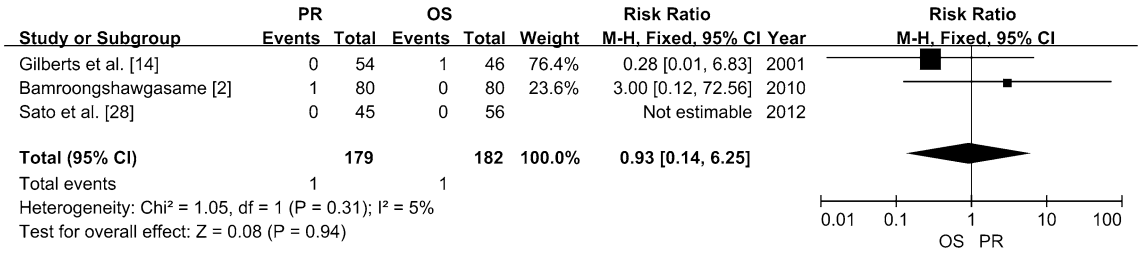

Fig. 2 The results show that there is no great difference in the failed procedure between percutaneous release and open surgery. PR = percutaneous release; OS = open surgery; Z = p value of weighted test for the overall effect; df = degrees of freedom; I^2 = test statistic.

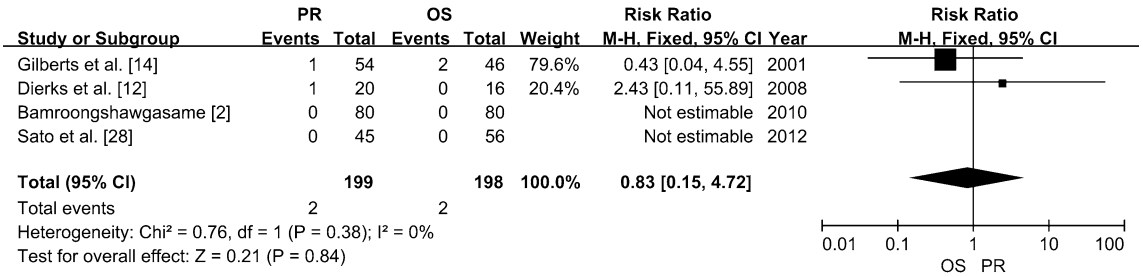

Fig. 3 The results show that there is no great difference in complications between percutaneous release and open surgery. PR = percutaneous release; OS = open surgery; Z = p value of weighted test for the overall effect; df = degrees of freedom; I^2 = test statistic.

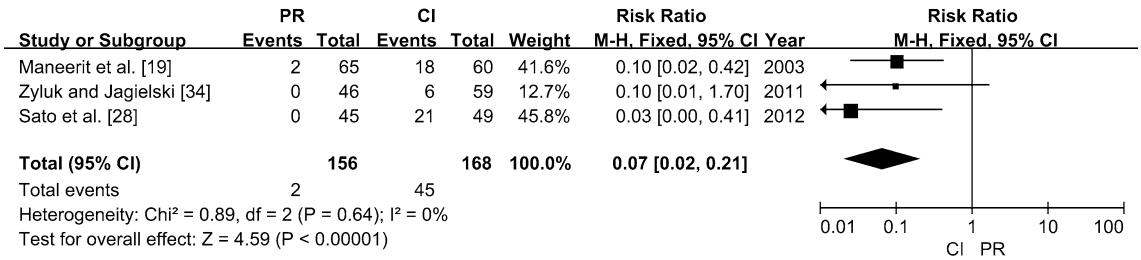

Fig. 4 The results show that there is substantial difference in the failed procedure between percutaneous release and corticosteroid injection. PR = percutaneous release; Z = p value of weighted test for overall effect; RR = risk ratios; df = degrees of freedom; I^2 = test statistic.

Fewer patients who underwent percutaneous release experienced treatment failure compared with patients who received corticosteroid injections (RR = 0.07; 95% CI, 0.02–0.21; $p < 0.001$) (Fig. 4). The test for heterogeneity showed that no important heterogeneity existed across the four studies ($p = 0.64$; $I^2 = 0\%$). Patient satisfaction was higher in the percutaneous release group than in the corticosteroid injection group (RR = 2.01; 95% CI, 1.62–2.48; $p < 0.001$) (Fig. 5). There was little heterogeneity on that endpoint as well ($p = 0.74$; $I^2 = 0\%$). We identified no significant difference in the complication rates of the two procedures (RR = 3.19; 95% CI 0.51–19.91; $p = 0.21$) (Fig. 6). A summary of the meta-analyses is detailed in Table 3.

Discussion

Several instruments have been advocated for the percutaneous procedure, including the hypodermic needle [13, 19, 23, 28, 34], tenotome [17], blade [12], and specially designed knives and needle-knives [2, 9, 32]. Although all of these techniques produce good functional outcomes, the best treatment of trigger digit remains unknown. In this context, we therefore performed a meta-analysis of RCTs comparing percutaneous release with open surgery or corticosteroid injections to compare the risk of treatment failure, the levels of patient satisfaction, and the frequency of complications.

We acknowledge limitations of our meta-analysis. First, although only RCTs and quasiRCTs were considered for inclusion, study quality varied among the studies that met our inclusion criteria. Potential sources of bias in these trials included inadequate methods to conceal random allocation, lack of blinding, and an unclear loss of followup. Second, patients with trigger fingers and thumbs were included in this meta-analysis. Two trials [9, 19] studied only patients with trigger thumb, and the risk of operative complications, however, may be different among

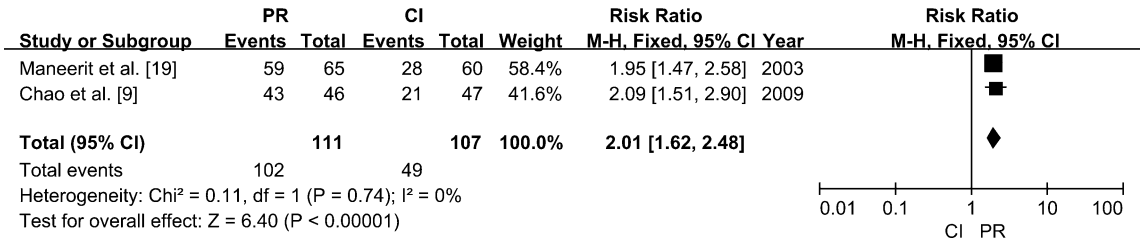

Fig. 5 The results show that there is substantial difference in patient satisfaction between percutaneous release and corticosteroid injection. PR = percutaneous release; Z = p value of weighted test for overall effect; RR = risk ratios; df = degrees of freedom; I^2 = test statistic.

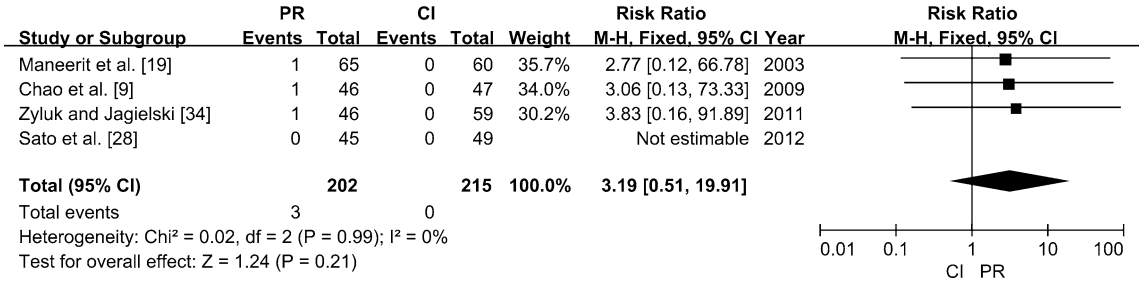

Fig. 6 The results show that the difference of complication rate is trivial between percutaneous release and corticosteroid injection. PR = percutaneous release; Z = p value of weighted test for overall effect; RR = risk ratios; df = degrees of freedom; I^2 = test statistic.

Table 3. Summary of the meta-analyses

Analysis item	Number of studies	Heterogeneity		Analysis model	Statistical method	Risk ratio (95% CI)	p value
		I^2	p value				
Percutaneous release versus open surgery							
Failed procedure	3	5%	0.31	Fixed-effects	Mantel-Haenszel	0.93 (0.14, 6.25)	0.94
Complication rate	4	0%	0.38	Fixed-effects	Mantel-Haenszel	0.83 (0.15, 4.72)	0.84
Percutaneous release versus corticosteroid injection							
Failed procedure	3	0%	0.64	Fixed-effects	Mantel-Haenszel	0.07 (0.02, 0.21)	< 0.001
Patient satisfaction	2	0%	0.74	Fixed-effects	Mantel-Haenszel	2.01 (1.62, 2.48)	< 0.001
Complication rate	4	0%	0.99	Fixed-effects	Mantel-Haenszel	3.19 (0.51, 19.91)	0.21

fingers and thumbs. The thumb is at highest risk for digital nerve injury because the radial digital nerve courses subcutaneously over the A1 pulley [6, 15], although there were no digital nerve injuries in any of the included studies. Third, Maneerit et al. [19] compared percutaneous release and steroid injection with steroid injection, which could augment the efficacy of percutaneous release [31]. Fourth, we extracted the outcomes after a single injection for the corticosteroid injection group. Ten patients underwent second injections 1 week after the first injections [9], which could have modified the total results. Fifth, the indications for treatment, an actual instrument type of percutaneous release and the drug type of steroid injection, varied. The percutaneous release instruments included a blade, needle, miniscalpel needle, and a full-handle knife at 45°, and the steroid injection drugs involved triamcinolone, betamethasone, and methylprednisolone. Some differences may exist among those instruments and/or steroids [25]. We did not assess the relative outcomes in subgroups for a stratified analysis.

Open surgical release of the A1 pulley has been performed for more than 100 years. It has a high rate of success with minimal morbidity and recurrence and therefore is considered the gold standard [26]. Even so, there is a relative paucity of published data regarding the success of open surgical release, with success being achieved, variably, in 60% to 97% of patients treated with that approach [21, 27, 30]. Furthermore, open trigger finger release is thought to be a low-risk procedure by many practitioners. For the percutaneous technique, a potential disadvantage is the limited visibility, as one could cause damage to either nerve or tendon. Many hand surgeons are

hesitant to release the A1 pulley of digits percutaneously owing to its close proximity to the digital nerve [31]. That is why many surgeons choose open surgery or steroid injections alone for trigger digits. Carrozzella et al. [6] reported that the radial digital nerve of the thumb at the level of the metacarpophalangeal crease is only 1.15 mm anterior to the radial sesamoid bone and 2.19 mm below the dermis, which can act as a cutting board to transect the digital nerve. Our meta-analysis identified four RCTs that compared percutaneous release and open surgery for trigger digits. The data suggest open methods of A1 pulley release are similar to percutaneous release in terms of failure rate and frequency of complications. Percutaneous release may offer advantages in terms of operative time and expense, although these endpoints were beyond the scope of this study.

Steroid injection with local anesthetics into the flexor tendon sheath is commonly offered to patients with trigger finger as a first-line treatment [20]. Various injection techniques have been used to treat trigger finger [26]; however, a diminished response to injection has been associated consistently with an increased duration of symptoms, usually more than 4 to 6 months, and an increasing number of injections [24]. In addition, there is a 33% risk of recurrence within 1 year [1]. Benson and Ptaszek [3] reported 60% of patients achieved pain relief from one injection. Of those treated with a second injection, 36% were asymptomatic at 3 months. Six patients were injected a third time, none of whom had long-term relief. Our meta-analysis of RCTs suggests percutaneous release is a reasonable alternative for patients with trigger digits when compared with one injection of corticosteroid, as it appears to have a lower failure rate without an increased risk of complications.

Future research in this area should include RCTs performed with appropriate methods to limit bias, including concealed randomization, larger sample sizes, objective outcome measures, and blinded outcome assessments.

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