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Meta-Analysis

Comparison of postoperative outcomes between open surgical release and ultrasound guided percutaneous release of trigger finger: a systematic review and meta-analysis

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ABSTRACT

Trigger finger is a hand condition that can be treated surgically through an open procedure or ultrasound (US)-guided percutaneous release. While similar techniques differ in invasiveness, recovery time, and complication rates, our research aims to compare the clinical outcomes of both techniques, focusing on pain relief, functional recovery, and patient satisfaction. A literature search was conducted in PubMed and the Cochrane Library. Six reviewers screened titles and abstracts, resolving conflicts with a seventh, and assessed full texts for eligibility. Included studies involved adult patients treated surgically for trigger finger with reported postoperative outcomes. Data was extracted using a standardised sheet capturing study details, demographics, management approaches, outcomes, and statistical methods. Eleven studies comparing open and US-guided release were included. Pooled analysis of six studies showed no significant difference in postoperative pain visual analogue scale (VAS) score [MD: 0.04 (-0.27, 0.34), p=0.80], with substantial heterogeneity (I^2=74%). Q-DASH analysis from three studies also showed no significant difference in functional outcomes [MD:-0.06 (-2.24, 2.13), p=0.96], with heterogeneity (I^2=79%) resolved through sensitivity analysis. Patient satisfaction was initially similar between groups, but after removing one study, open surgery showed significantly lower odds of satisfaction compared to US-guided release [OR: 0.23 (0.08, 0.64), p=0.005]. Our meta-analysis suggests that US-guided trigger finger release appears to provide similar pain relief and functional recovery as open surgery, with greater patient satisfaction. However, study heterogeneity calls for more high-quality research to confirm these findings.

Keywords: Trigger finger, A1 pulley release, Open release, Ultrasound guided release, Outcomes

INTRODUCTION

Trigger finger, or stenosing tenosynovitis, is characterised by thickening of the flexor tendon sheath resulting in pain, clicking, and locking of the affected hand finger.[1] If the A1 pulley is inflamed or contracted, it restricts tendon gliding and causes mechanical obstruction.[2,3] For refractory cases, treatment options run from conservative methods of stretching, corticosteroid injections to surgical procedures.[4-6] Two main approaches are used for surgical

release of the A1 pulley, which continues to be the definitive treatment for chronic symptoms: open surgical release and US-guided percutaneous release.[6] Though they seek to free the fingers for normal use and relief of pain, the methods vary in their strategy, complications, and likelihood of improvement.[6] Following trigger finger release, postoperative results are usually evaluated using many clinical criteria. These are range of motion (ROM); the disability of arm-shoulder-hand (DASH) score; pain-VAS; time to functional recovery; grip strength; pain relief and occurrence of complications, including stiffness, infection, or nerve damage.[7,8] Satisfaction and return to normal activities among patient-reported results are also very important measures of surgical success outcomes.[7] Though open release is generally considered reasonable, it does require cuts that might raise the risk of scarring, infection, and delayed healing.[8] Conversely, guided percutaneous release done under US guidance is a minimally invasive approach designed to reduce tissue trauma and speed healing.[9]

US guidance in trigger finger release represents a promising alternative to regular open surgery.[9] US-guided release offers exact A1 pulley targeting by giving real-time visualisation of the tendon and neighbouring structures while also lowering the chances of accidental nerve or tendon damage.[10] Furthermore, this method is typically related to smaller surgical scars, less postoperative discomfort, and swifter recovery.[10] Still, worries about its long-term effectiveness, learning curve, and possibility of incomplete release exist, hence more comparison studies of these two methods are required.[10]

This systematic review seeks to assess and compare the post-operative outcomes of US-aided trigger finger release with those from open surgery by evaluating clinical parameters including overall functional recovery, ROM, pain levels, and complication rates. Knowing the benefits and constraints of both techniques will help surgeons choose the most suitable treatment depending on individual patient considerations, thereby ideally improving surgical results for trigger finger patients.

METHODS

Registration and reporting

This systematic review has been registered in the international prospective register of systematic reviews (PROSPERO) (ID: CRD420251152764). It is being reported according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement.

Literature search strategy

A comprehensive literature search was conducted in the PubMed database and Cochrane library, with no timeline restrictions applied. The search strategy combined medical subject headings (MeSH) and free text words related to the concepts of "trigger finger", tendon "stenosing tenosynovitis", surgical management terms like surgery, release, "trigger finger release", TFR, "A1 pulley release", and outcomes related terms like "outcomes", "complications."

An example search strategy for PubMed is provided: ("trigger finger" OR "stenosing tenosynovitis") AND (Surgery OR release OR "trigger finger release" OR TFR OR "A1 pulley release") AND (Outcomes OR Complication).

Screening and selection of studies

Search results were uploaded into the Rayyan.ai software to facilitate screening. Initially, six independent reviewers blindly screened all titles and abstracts, with conflicts resolved by a seventh reviewer. Full texts of all potentially eligible studies were then retrieved and independently assessed for eligibility by the same six reviewers, with two authors independently and blindly assessing each paper. Reasons for excluding studies during the full-text review phase were documented. Any duplicate studies identified were removed using the deduplication feature in Rayyan.ai. The complete study selection process was summarised using a PRISMA flow diagram (Figure 1).

Study eligibility criteria

This review included randomised controlled trials, cohort studies, case-control studies, and prospective or retrospective observational studies published in the English language, without any time restrictions, that reported on adult human participants diagnosed with trigger finger and management surgically with post operative outcomes reported, including assessment tools, assessment timeframes, duration of follow up and the report of any complications.

Studies were excluded if they involved patients under 18 years of age, did not report outcomes relevant to our objectives, or focused on conservatively managed trigger fingers. Additionally, review articles, case reports, editorials, commentaries, and letters; studies published in languages other than English; research involving traumatic injuries, cadaveric specimens, or animal models; and duplicate publications of the same study were also excluded.

Data extraction

A standardised data extraction sheet was used by the reviewers to independently extract relevant data from the included studies. Data from each article has been extracted by two independent reviewers, any discrepancies during the data extraction process were resolved through discussion with a third reviewer. Data items extracted included study characteristics (authors, year of publication, country, study design, sample size, study period), patient characteristics (age, sex, comorbidities),

classification/grade of severity of triggering if applicable, management approaches (open surgical release, percutaneous US guided release), reported outcomes (pain scores, functional outcomes, ROM, patient satisfaction), statistical methods used for data analysis, reported effect estimates with confidence intervals, study conclusions, limitations, as well as recommendations provided by the authors.

Quality assessment and risk of bias

For observational studies, the Newcastle-Ottawa scale (NOS) was utilised by two independent reviewers to evaluate the risk of bias across four domains: selection of study groups, comparability of groups, ascertainment of exposure/outcome, and outcome assessment. Studies were categorised as low quality (0-3), moderate quality (4-6), or high quality (7-9) based on their NOS scores (Supplementary Table 1). For randomised controlled trials, the ROB II tool was utilised to evaluate the risk of bias across five domains: bias arising from the randomisation process, bias due to deviations from intended intervention, bias due to missing outcome data, bias in measurement of the outcome, bias on selection of the reported result (Figure 1). Any disagreements between reviewers during the quality assessment process were resolved through discussion with a third reviewer to reach a consensus rating.

Statistical analysis

Cochrane review manager 5.3 was used to perform a meta-analysis of the selected studies. For dichotomous outcomes, the pooled OR with 95% CI is given among groups. While mean difference (MD) was used for continuous outcomes. Random mode was used to reduce heterogeneity. The heterogeneity assumption was checked using the I2 test. A leave-one-out sensitivity test was applied to solve any resulting heterogeneity. In terms of values, we interpreted the I-square as follows: not significant for 0-40%, moderate heterogeneity for 30-60%, and substantial heterogeneity for 50-90%, following the Cochrane handbook chapter nine.

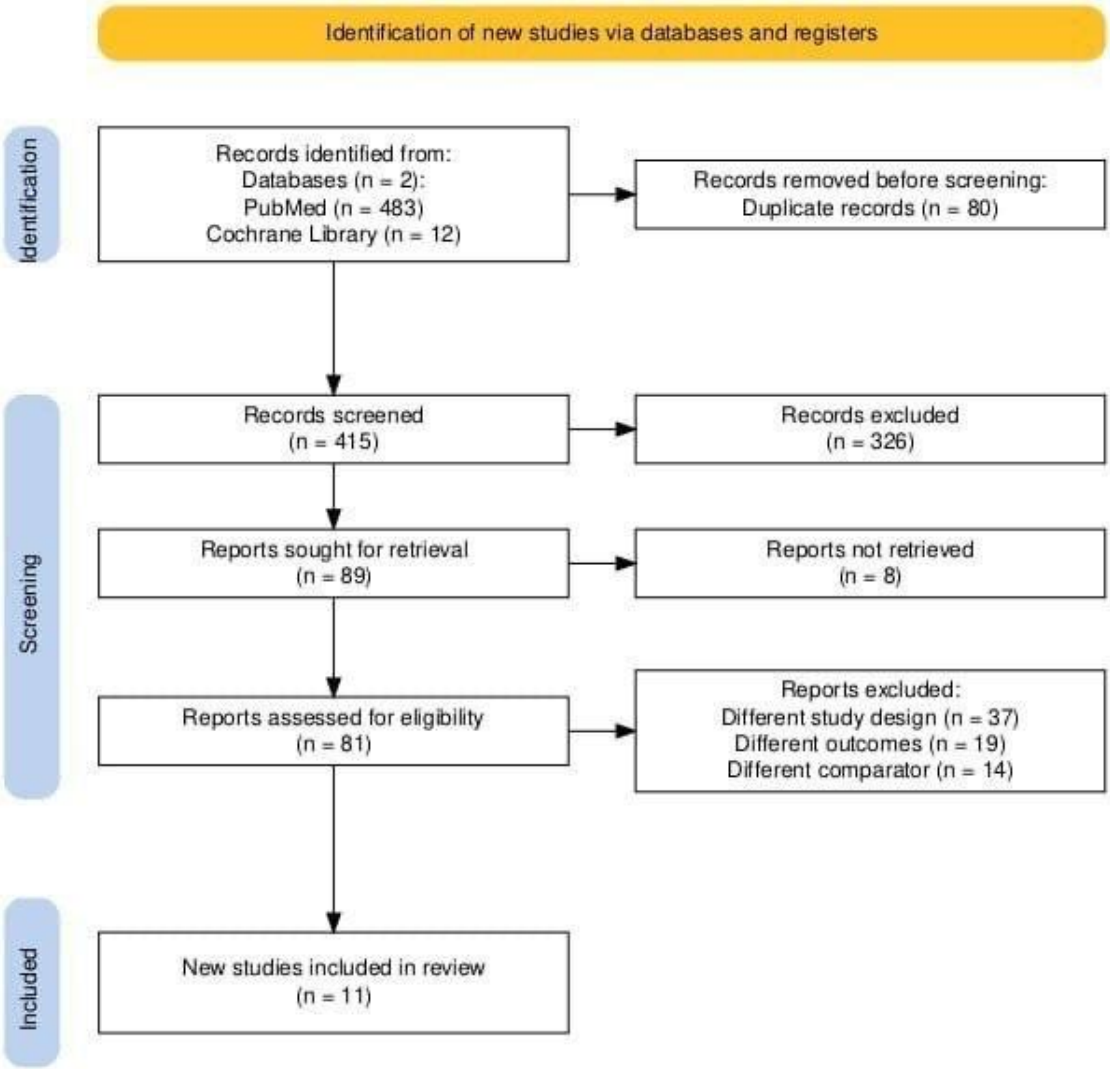

Figure 1: PRISMA flow diagram illustrating the systematic review process.

*The diagram outlines the number of records identified, screened, excluded, assessed for eligibility, and included.

RESULTS

Characteristics of included studies

Eleven articles comparing the efficacy and safety of open classic versus USG guide release were included in our study. The summary characteristics and baseline features of the included studies are listed in supplementary (Table 2 and 3).

Clinical outcomes

VAS score

The mean difference in VAS score has been investigated between open classic versus percutaneous Ultrasonography guide release across 6 studies. The pooled mean difference indicated Ultrasonography guide release had a higher VAS score compared to open classic release [MD: 0.04 (-0.27, 0.34) with 95% CI] in which the results were not statistically significant (p=0.80) (Figure 2). The sensitivity analysis revealed significant heterogeneity (I2=74%, p=0.002) that is not resolved and only decreased after omitting Lee et al by the leave-one-out test (I2=70%) with no statistically significant difference [MD: -0.07 (-0.37, 0.23) with 95% CI, p=0.66] (Figure 3).

The funnel plot of VAS score appeared relatively symmetrical with no major signs of publication bias, but the number of studies is small to make definitive conclusions. The studies are clustered near the pooled effect size, suggesting consistent findings (Figure 4).

Q-DASH score

Mean difference in Q-DASH score has been investigated between open classic versus USG guide release across 3 studies. Pooled mean difference indicated open classic release had lower Q-DASH score compared to USG guide release [MD: -0.06 (-2.24, 2.13) with 95% CI] in which the results were not statistically significant (p=0.96) (Figure 5). Sensitivity analysis revealed significant heterogeneity (I2=79%, p=0.008) that is resolved after omitting Yavari et al by the leave-one-out test (I2=0%) with no statistically significant difference [MD: -2.35 (-1.02, 0.30) with 95% CI, p=0.13] (Figure 6).[11] The funnel plot of Q-DASH score did not demonstrate obvious asymmetry, though the small number and low precision of included studies limit acute assessment of publication bias (Figure 7).

Satisfaction rate

The pooled results indicated that patients in open classic release group had a lower odd of satisfaction compared to the USG guide release group [OR: 0.44 (0.10, 1.84) with 95% CI]. However, the results were not statistically significant (p=0.26) (Figure 8). The sensitivity analysis revealed moderate heterogeneity (I2=60%, p=0.01) that decreased after omitting Nikolaou et al by the leave-one-out test (I2=0%) with statistically significant difference [OR: 0.23(0.08, 0.64) with 95% CI, p=0.005] (Figure 9).[10] The funnel plot of satisfaction rate is showed some asymmetry, with more studies clustered on the left side of the null line. However, the limited number and low precision of included studies restrict reliable assessment of publication bias (Figure 10).

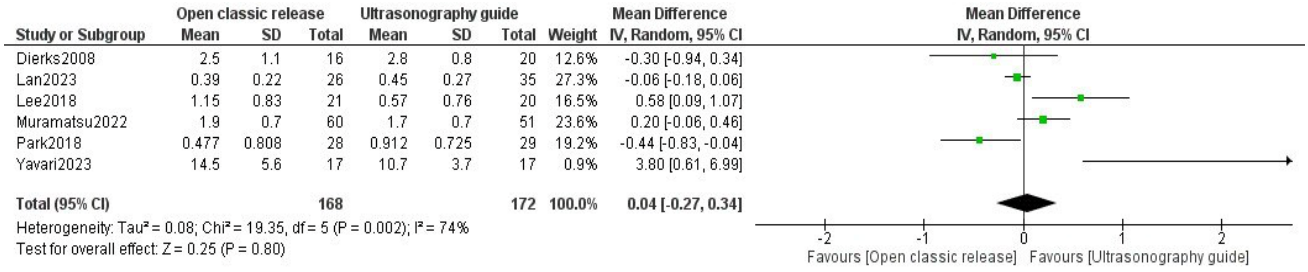

Figure 2: Forest plot comparing postoperative pain (measured by VAS) between US-guided and open trigger finger release across six studies.

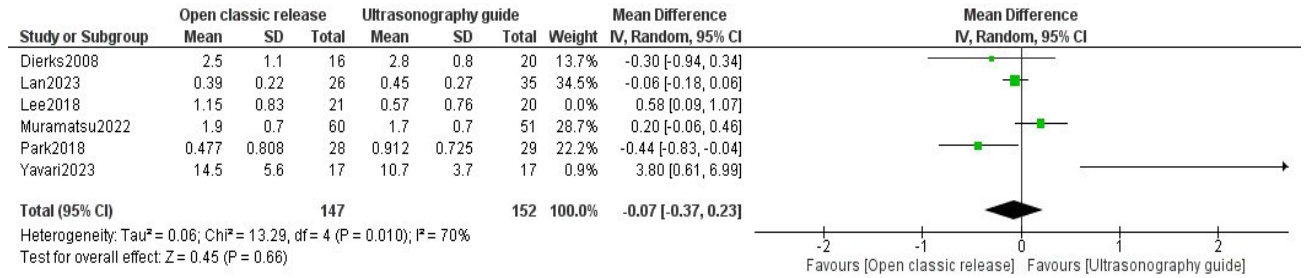

Figure 3: Sensitivity analysis of postoperative pain (measured by VAS) between US-guided and open trigger finger release across six studies.

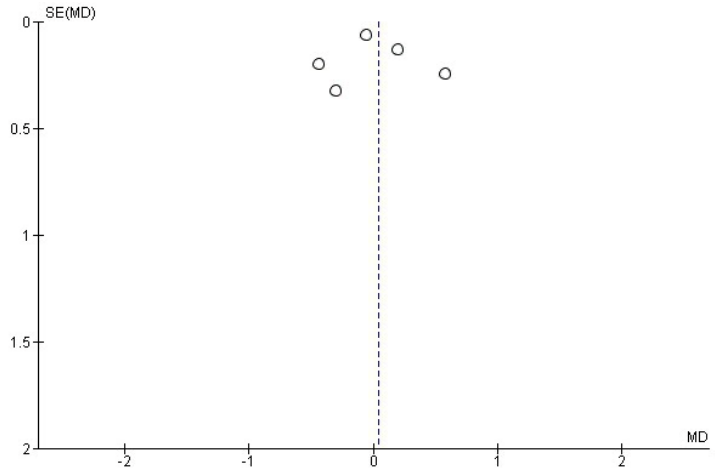

Figure 4: Funnel plot of postoperative pain (measured by VAS) between US-guided and open trigger finger release across six studies.

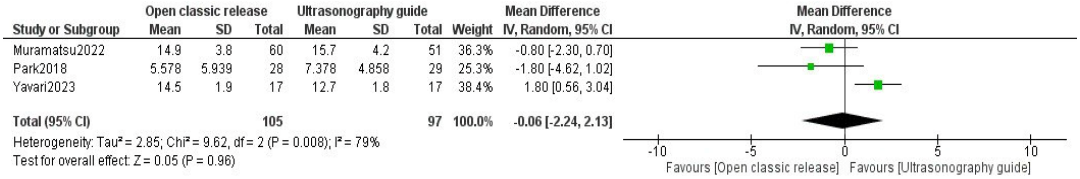

Figure 5: Forest plot comparing functional outcomes between the two techniques measured by the Q-DASH score.

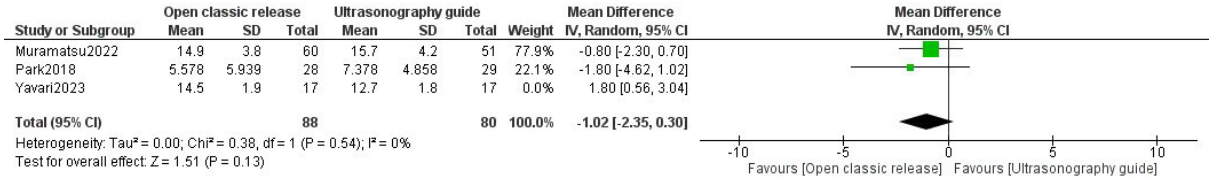

Figure 6: Sensitivity analysis of functional outcomes between the two techniques measured by the Q-DASH score.

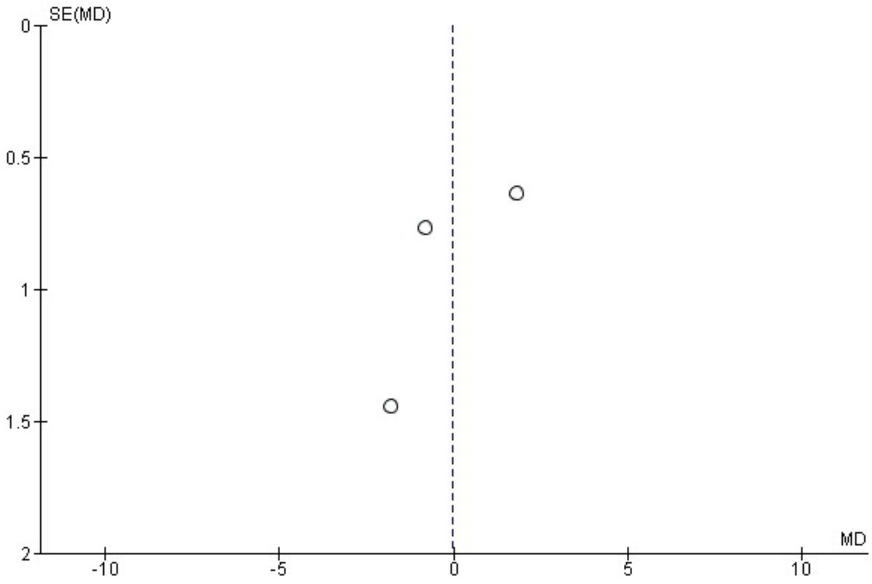

Figure 7: Funnel plot of functional outcomes between the two techniques measured by the Q-DASH score.

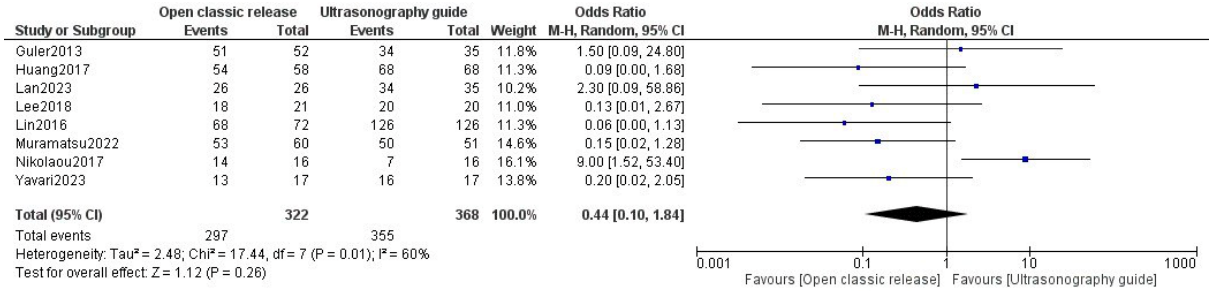

Figure 8: Forest plot displaying patient satisfaction rates after open versus US-guided trigger finger release.

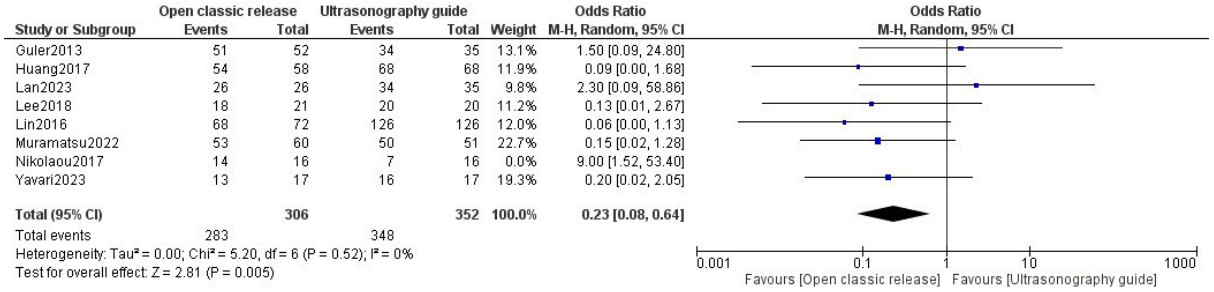

Figure 9: Sensitivity analysis of patient satisfaction rates after open versus US-guided trigger finger release.

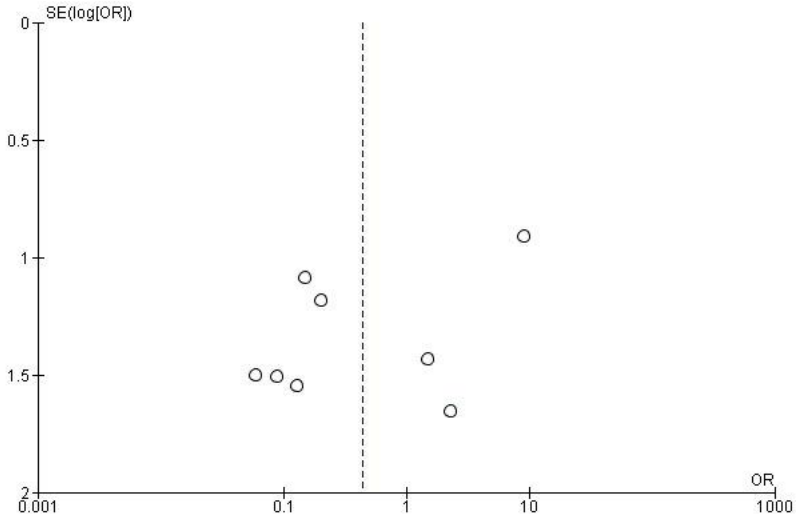

Figure 10: Funnel plot of patient satisfaction rates after open versus US-guided trigger finger release.

DISCUSSION

In this study, we pool eleven articles comparing the outcomes of trigger finger release by open classic release versus US guided release. VAS was analyzed through 6 of the included studies as a tool of post-operative pain measuring scale. The analysis showed that patients who underwent US-guided release scored higher than those who underwent open classic release, yet these results were statistically insignificant (p=0.80), with significant heterogeneity. One of the most recent included studies for this analysis by Yavari et al explained that pain severity immediately postoperatively was not of a significant difference between both groups, yet after a one-month follow-up, a significant difference was noticed with less pain among the US guided group.[11] In the same study, they also denoted that the duration of needing analgesia postoperatively was much less in patients who underwent US-guided compared to the other group which supports the argument whether a noticeable difference was noticed when it comes to pain after the procedure. Almost all the studies included agreed that there was no significant difference or supported the same observation of pain improvement. Across the eleven included studies, three of them assessed functionality post-procedure using the Q-DASH score. In comparison between both groups, the analysis showed that although the open surgical release had better functionality post-procedure, as Q-DASH score

was lower compared with the US-guided release, it is not of a much statistically significant (p=0.96). One of the largest studies that was included in this analysis included 111 patients with a total of 138 operated fingers showed that in comparison to blinded release, US-guided dose did not have a statistically significant difference.[12] The same result was supported by Yavari et al as well, where they compared US-guided release to open surgical release.[11]

Another important factor to consider is patient satisfaction, but as it does not have a unified measuring tool, statistically, there was not much of a significant difference as per our analysis of 8 of the included studies. However, individually, most of these studies did report better patient satisfaction, favoring US-guided release over the open classic surgical release.[10-13] Across the literature, even those papers that studied the satisfaction post-blind percutaneous release had better satisfaction rates.[13] This considers thinking about the similarities between both approaches, which both are following minimally invasive rather than the classic surgical release with incision.

Nevertheless, sensitivity analysis indicated variability in certain results, especially Q-DASH scores, which was addressed by excluding a particular study. Notably, satisfaction rates initially displayed no substantial difference; however, following sensitivity analysis, US-guided release correlated with increased patient satisfaction. These results indicate that although both methods yield similar results, patient preference and experience might lean towards US guidance in specific situations. Additional high-quality research is necessary to verify these trends and inform clinical decision-making.

Limitations

This review has several limitations. First, study designs were heterogeneous, including RCTs and observational studies, as RCTs alone did not provide sufficient data for all outcomes. Second, trigger finger severity/ grade was inconsistently reported, preventing stratified analysis based on condition severity. Third, postoperative outcome assessment time points and follow up intervals were often unspecified, which may affect the accuracy and comparability of the results.

CONCLUSION

This systematic review aimed to assess the efficacy and safety of open classic release in comparison to ultrasound-guided release across multiple studies, focusing on VAS scores, Q-DASH scores, and patient satisfaction rates. The results showed no statistical significance differences between the two techniques when reviewing the VAS scores and Q-DASH scores. Even though the pooled results for VAS scores favoured ultrasound-guided release and the Q-DASH scores marginally favoured open classic release, neither result showed any statistical significance. Persisting after sensitivity analysis, both analyses exhibited substantial heterogeneity; however, some reduction was observed when specific studies were omitted. When reviewing the pooled analysis for patient satisfaction rates, it initially showed no statistically significant difference between the two techniques. However, after omitting one study, (Nikolaou et al), sensitivity analysis revealed a statistically significant difference emerged, favouring US-guided release. All in all, despite this review highlighting potential trends favouring US-guided release in certain outcomes, lack of consistent statistically significant results and presence of heterogeneity limits the ability to draw conclusive outcomes.

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Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Donati D, Ricci V, Boccolari P, Flavio O, Fabio V, Ondřej N, et al. From diagnosis to rehabilitation of trigger finger: a narrative review. BMC Musculoskelet Disord. 2024;25(1):1061-72.
2. Makkouk AH, Oetgen ME, Swigart CR, Dodds SD. Trigger finger: etiology, evaluation, and treatment. Curr Rev Musculoskelet Med. 2008;1(2):92-96.
3. Welman T, Young K, Larkin J, Maxim DH. Trigger finger from ocean rowing: an observational study. Hand (N Y). 2022;17(2):254-60.
4. Patrinely JR, Johnson SP, Drolet BC. Trigger finger corticosteroid injection with and without local anesthetic: a randomized, double-blind controlled trial. Hand (N Y). 2021;16:619-623.
5. Ferrara PE, Codazza S, Maccauro G, Gianfranco Z, Giorgio F, Gianpaolo R. Physical therapies for the conservative treatment of the trigger finger: a narrative review. Orthop Rev (Pavia). 2020;12(1):8680-7.
6. Lewis J, Seidel H, Shi L, Jennifer W, Jason S. National benchmarks for the efficacy of trigger finger and the risk factors associated with failure. JAAOS Glob Res Rev. 2023;7(2):e22.00198.
7. Saito T, Nakamichi R, Nakahara R, Keiichiro N, Toshifumi O. The effectiveness of rehabilitation after open surgical release for trigger finger: a prospective, randomized, controlled study. J Clin Med. 2023;12(22):7187-97.
8. Atthakomol P, Manosroi W, Sathiraleela K, Nutthapong T, Treephum D, Atithep T, et al. Prognostic factors related to recurrence of trigger finger after open surgical release in adults. J Plast Reconstr Aesthet Surg. 2023;83:352-7.
9. Cromheecke M, Bogaert S, Dejonghe M, De Keyzer PB, Mares O, Goubau J, et al. Ultrasound-guided trigger finger release with a minimally invasive knife: a retrospective analysis of 297 releases. Hand Surg Rehabil. 2025;44:102081-8.
10. Nikolaou VS, Malahias MA, Kaseta MK, Ioannis S, George CB. 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):163-9.
11. Yavari M, Modaresi SM, Hassanpour SE, Seyed MM, Ali T. Clinical study between percutaneous ultrasound-guided release and open classic surgery in treating multiple trigger fingers. Adv Biomed Res. 2023;12:88-94.
12. Muramatsu K, Rayel MF, Arcinue J. A comparison of blinded versus ultrasound-guided limited-open trigger finger release using the Yasunaga knife. J Hand Surg Asian Pac Vol. 2022;27:124-9.
13. Lin CJ, Huang HK, Wang ST, Yi-Chao H, Chien-Lin L, Jung-Pan W. Open versus percutaneous release for trigger digits: reversal between short-term and long-term outcomes. J Chin Med Assoc. 2016;79(6):340-4.

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APPENDIX

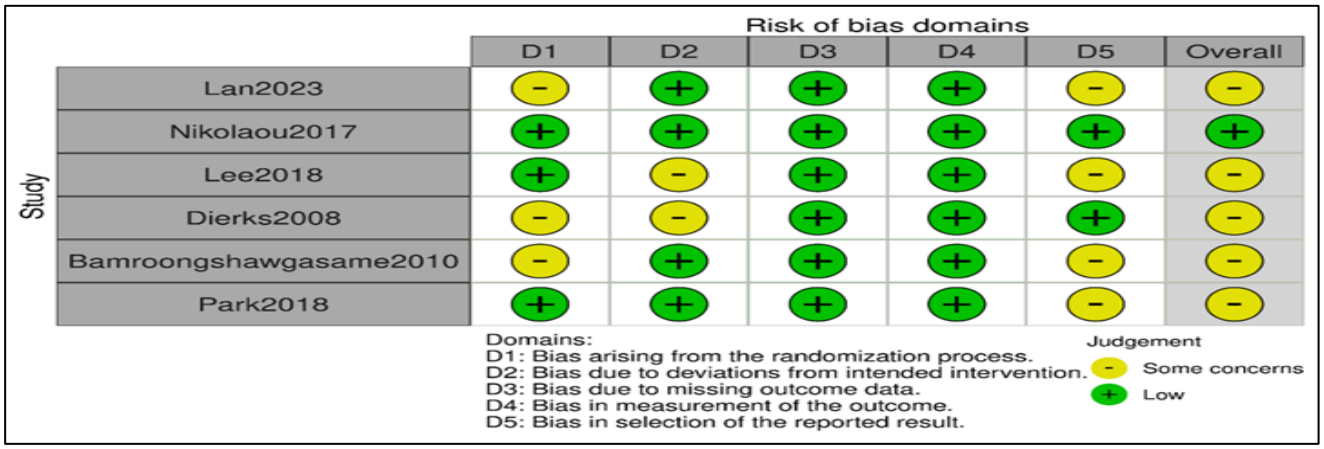

Figure 1: Quality assessment of included randomised clinical trials by ROB II tool.

Table 1: Quality assessment of included papers by NOS scale.

Studies	Selection	Comparability	Outcome	Total score
Muramatsu et al, 2022[12]	3	0	3	6 (Moderate Quality)
Yavari et al, 2023[11]	3	1	3	7 (High Quality)
Guler 2013	3	0	3	6 (Moderate Quality)
Lin et al, 2016[13]	3	0	3	6 (Moderate Quality)
Huang 2017	3	0	3	6 (Moderate Quality)

Table 2: Summary of characteristics of included studies.

Studies	Primary outcome
Lan 2023	VAS scores of the two groups significantly decreased after treatment, but there was no significant difference between the two groups.
Yavari et al, 2023[11]	The pain intensity in the ultrasound-guided patients was significantly less than in the other group, and the recovery time was significantly faster.
Nikolaou et al, 2017[10]	The ultrasound-guided percutaneous release showed significantly lower pain, faster recovery and better cosmetic outcomes.
Lee 2018	Triggering had disappeared in all patients who underwent USG-guided release, whereas three patients who underwent blind release required revision surgery. VAS score was significantly different between groups.
Guler 2013	A total of 98.1% of patients in the open pulley release group and 97.1% of patients in the percutaneous release group were satisfied with treatment.
Lin et al, 2016[13]	The short-term satisfaction was significantly better in the percutaneous release group, whereas the long-term satisfaction rates were better in the open-release group, but not statistically significant.
Dierks 2008	Overall, 100% success in terms of grip strength, active range of motion of the proximal interphalangeal joint, and residual pain was obtained in both groups. Mean operation time was significantly longer with the open technique.
Huang 2017	Short-term complications were more common in the open release group. Long-term complications were higher in the percutaneous group.
Muramatsu et al, 2022[12]	Residual triggering occurred in six patients in the blinded group but resolved in all US-guided patients. Both groups showed significant VAS and Q-DASH improvements. Patient satisfaction was higher in the US-guided group.
Bamroongshawgasame 2010	Mean operative time, range of motion, satisfaction score, and pain score were not significantly different between the groups.
Park 2018	Bowstringing was significantly increased at 12 weeks after surgery in both groups, and the mean value of the open release group was significantly greater than that of the percutaneous group. The clinical outcomes of each cohort improved significantly, with no difference between the groups at final follow-up.

Table 3: Baseline data of included studies.

Studies	Groups	Participants	Age (in years)	Male	Digits	Symptoms duration
Lan 2023	Open classic release	32	51.58±13.74	7	32	4.08±4.22
	USG guide	40	53.24±12.87	11	40	4.16±3.73
Yavari et al, 2023[11]	Open classic release	17	53.5±6.9	7	2.3±0.4	NA
	USG guide	17	54.4±7.3	5	2.4±0.5	NA
Nikolaou et al, 2017[10]	Open classic release	16	NA	NA	NA	NA
	USG guide	16	NA	NA	NA	NA
Lee 2018	Open release	21	58.9 (26-88)	5	25	NA
	Percutaneous release	20	56.1 (22-87)	6	23	NA
Guler 2013	Open release	52	56.6±9	10	NA	6.8±4.5
	Percutaneous release	35	53.6±10.6	7	NA	4.3±3.1
Lin et al, 2016[13]	Open release	55	58.8 (range, 25-83)	17	72	9.4 (range, 4-30)
	Percutaneous release	98	59.6 (range, 26-87)	33	126	8.8 (range, 4-24)
Dierks 2008	Open release	16	64±13	7	NA	NA
	Percutaneous release	20	62±10	9	NA	NA
Huang 2017	Open classic release	49	Age, mean (range), 57.8 (43-81)	16	58	13.1 (4-40)
	USG guide	58	59.7 (45-85) range	21	68	12.9 (4-35)
Muramatsu et al, 2022[12]	Open classic release	60	68.3 (43-85) range	33	76	40.8 (12-480)
	USG guide	51	67.7 (44-87) range	17	62	30.7 (12-96)
Bamroongshawgasame 2010	Open release	70	range 24-76 (46.2)	30	80	NA
	Percutaneous release	72	22-72 (48.6)	28	80	NA
Park 2018	Open release	28	55.1 (20-72)	10	31	17.0 (3-60)
	Percutaneous release	29	53.4 (41-74)	9	34	14.4 (3-60)