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Surgical Treatment Outcome of de Quervain's Disease: A Systematic Review and Meta-analysis

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Background: Surgical release of the extensor retinaculum is performed as a treatment for de Quervain's (DQ) disease when conservative treatment fails. In the literature, there is no consensus about the effectiveness of a surgical release in patients with DQ, the complication rate, or which type of incision is superior. Therefore, a systematic review and meta-analysis were conducted.
Methods: A systematic search was performed in Embase, Medline Ovid, Web of Science Core Collection, Cochrane, and Google Scholar. Articles regarding surgical treatment of DQ disease that reported outcome and complications were included. We extracted exact values of visual analog scale scores and percentages of patients who experienced pain at follow-up. Complications assessed were (sub) luxation, superficial radial nerve injuries, wound infections, and scar problems.
Results: Twenty-one studies with a total of 939 patients were included. Five percent of these patients (95% CI 1%–18%) did not show complete remission of pain at follow-up. When pooled, the mean reduction in visual analog scale scores was 5.7 (95% CI 5.3–6.1) on a 0–10 scale. No difference in outcome between different types of surgery or incisions was seen. Based on the meta-analysis, the pooled complication rate was 11% (95% CI 5%–22%).
Conclusions: Five percent of patients still have residual pain after surgical release of the first extensor compartment. Surgery type, as well as the type of incision, did not affect outcome or complication. Thus, surgical release of the extensor retinaculum for DQ disease is an effective treatment, regardless of the type of surgery.
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INTRODUCTION

De Quervain's (DQ) disease is a stenosis tenovaginitis of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) in the first extensor compartment. The pathophysiology of DQ is a thickening of the tendon sheath induced by mucopolysaccharide accumulation, which results from degeneration rather than from inflammation.[1] The risk factors for developing DQ are female gender, age between 35–55 years, pregnancy, and repetitive manual work.[2–4]

The first choice of treatment is splinting combined with a corticosteroid injection in or around the first extensor compartment.[5–7] When conservative treatment fails, surgical release of the first extensor compartment is indicated. The surgical outcome depends on releasing the complete sheath and identifying the subcompartment that separates the EPB and APL, which is present in 40% of the population.[8] Complications of the procedure include injury to the superficial radial nerve (RSN), volar subluxation, and scar hypertrophy. However, there is no consensus about the complication rate in the literature.

Several different techniques for the surgical release are described: open release, endoscopic release, elongation of the extensor retinaculum, and partial resection of the extensor retinaculum. In addition, various incision types are described for the open release: transverse, oblique,

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and longitudinal. All modifications strive to obtain the best possible pain relief with the lowest complication rate, especially protecting the superficial radial nerve. However, until today, it is unclear if any of the different techniques is superior.

Therefore, a systematic review and meta-analysis were conducted describing the pain reduction and complication rate after surgical release of the first extensor compartment in DQ. Secondarily, we will assess to what extent these surgical outcome measures are related to the type of surgical release.

Takeaways

Question: To describe the pain reduction and complication rate after surgical release in patients with de Quervain's disease. To assess to what extent these surgical outcome measures are related to the type of surgical release.

Findings: Twenty-one studies with a total of 939 patients are included. Five percent of these patients did not show complete remission of pain at follow-up. Based on the meta-analysis, the pooled complication rate was 11% (95% CI 5%–22%). No difference in outcome between different types of surgery or incisions was seen.

Meaning: Surgical release of the extensor retinaculum for Quervain's disease is an effective treatment, regardless of the type of surgery.

METHODS

A systematic search was performed in April 2020. The strings that were used to search in seven different databases (Embase, Medline Ovid, Web of Science Core Collection, Scopus, Med publisher, Cochrane Central Register of Trials, and Google Scholar) are listed in Supplemental Digital Content 1. (**See appendix 1, Supplemental Digital Content 1,** which shows the strings that were used to search in seven different databases. **http://links.lww.com/PRSGO/C19**.) Two reviewers individually performed a selection of the articles based on title and abstract that were identified with our search. All differences in the selection of the two reviewers were finally agreed upon during discussion. All selected articles were secondarily assessed on full text. Studies were included when reporting pain reduction or complications following surgery for DQ disease. Case reports, reviews, and expert opinions were excluded as well as articles not written in English. Studies on specific patient populations (eg, children or pregnant women) were also excluded to obtain a homogenous population for our analysis. The strength of evidence was assessed using the Classification of Strength of evidence by Jovell and Navarro-Rubio, in which articles were given a level (I–IX) for the type of study and number of patients.[9] Furthermore, the risk of bias was assessed by the NIH Risk of Bias tool. (**See appendix 2, Supplemental Digital Content 2,** which shows risk of bias assessment according to the NIH risk of bias tool. **http://links.lww.com/PRSGO/C20**.)

Data Extraction

We collected all reports of pain. Where available, we collected preoperative and postoperative visual analog scale (VAS) pain scores. If these were not available, we collected reports of residual pain. The VAS score is a pain rating scale to measure pain intensity, with zero being no pain and 10 being the worst pain possible. We calculated change scores and sampling variance for all reports of preoperative and postoperative VAS scores. When SDs were not reported, they were calculated based on the method described by Hozo et al.[10] Secondly, all complications were collected when reported. When nerve injury was reported as a complication, this was considered permanent if the complication was still present at the end of the study.

Statistical Analysis

We performed a meta-analysis using a random-effects model with logit transformation on the prevalence of cumulative complications in each study and using linear random-effects models to estimate the pooled gain in VAS scores. In this analysis, studies were weighted using the inverse weighting method, in which larger studies contribute more to the pooled estimate. We also used these models to test whether subgroups showed significantly better results. Confidence intervals for the prevalence of complications were obtained by a procedure first given in Clopper and Pearson.[11] We followed the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines.[12] All analyses were performed with R and specifically the Metafor package.[13] A P value below 0.05 was categorized as statistically significant.

RESULTS

Study Characteristics

The search produced a total of 910 unique articles. After applying the exclusion criteria, 21 articles were selected (Fig. 1). The studies were conducted in 15 different countries (Table 1). The included articles were randomized controlled trials, noncontrolled clinical series, and nonrandomized controlled retrospective trials published between September 1998 and November 2019. The number of patients in the reported studies varied between 10 and 106.

With the exception of four randomized controlled trials, the strength of the evidence was "poor," according to the classification of strength of evidence by Jovell and Navarro-Rubio.[9] As scored with the NIH risk of bias tool, the risk of bias was average. (**See appendix 2, Supplemental Digital Content 2, http://links.lww.com/PRSGO/C20**.) No articles were excluded based on the quality assessment or risk of bias.

Patient and Operation Characteristics

The articles included 939 patients. Some patients underwent bilateral surgery, resulting in a total of 963 operated hands. Different surgical procedures were performed, as depicted in Table 1. The different surgical techniques were open release, endoscopic release, Z-plasty, pulley reconstruction, Le Viet, omegaplasty,

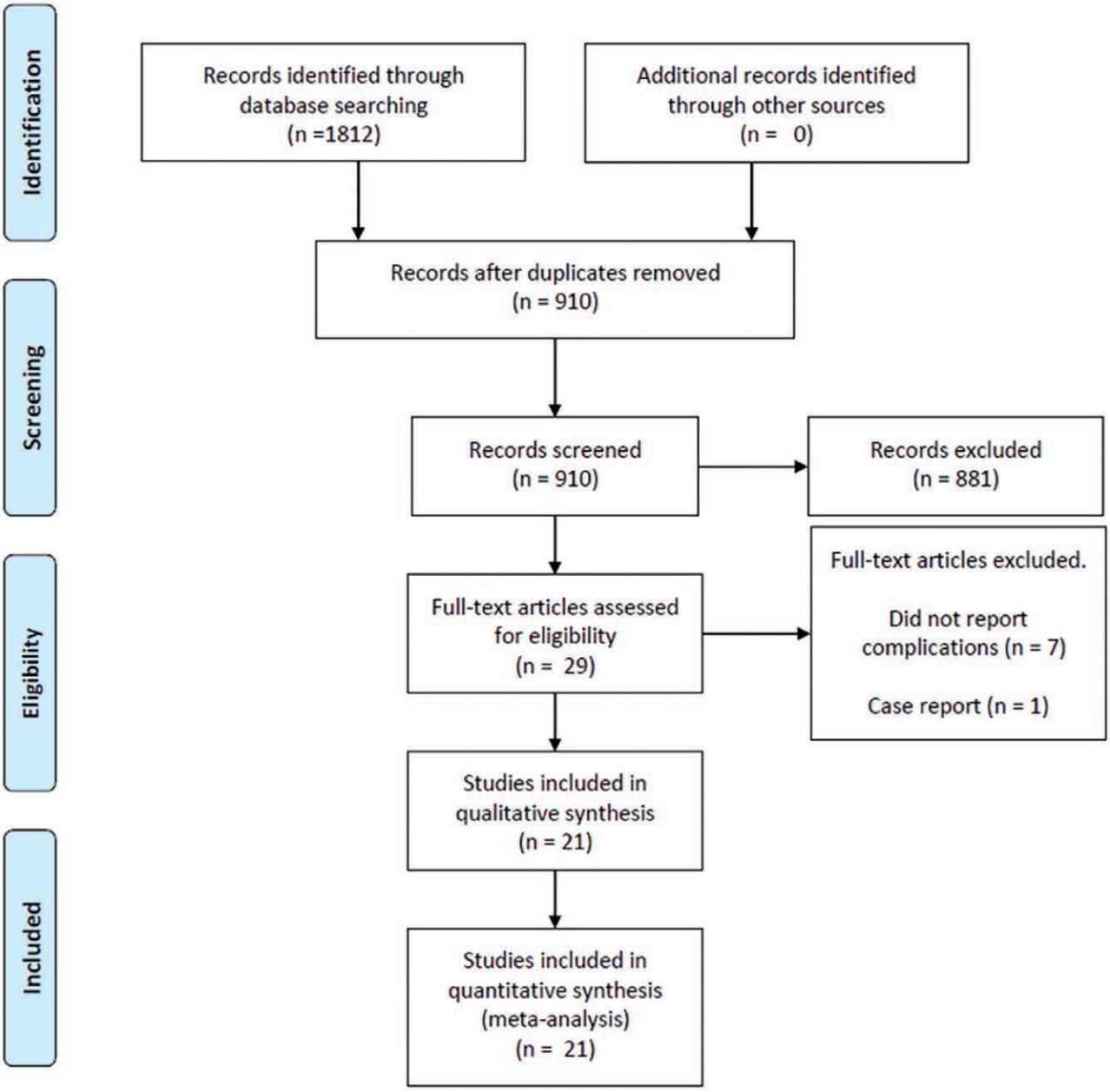


Fig. 1. Flow chart of study selection.

passive gliding, different types of lengthening of the retinaculum, and resection of a part of the retinaculum. The types of incision reported were transverse (n = 14), longitudinal (n = 4), and oblique (n = 3) (Fig. 2). Two articles did not report the incision type.[25,30]

Pain Reduction

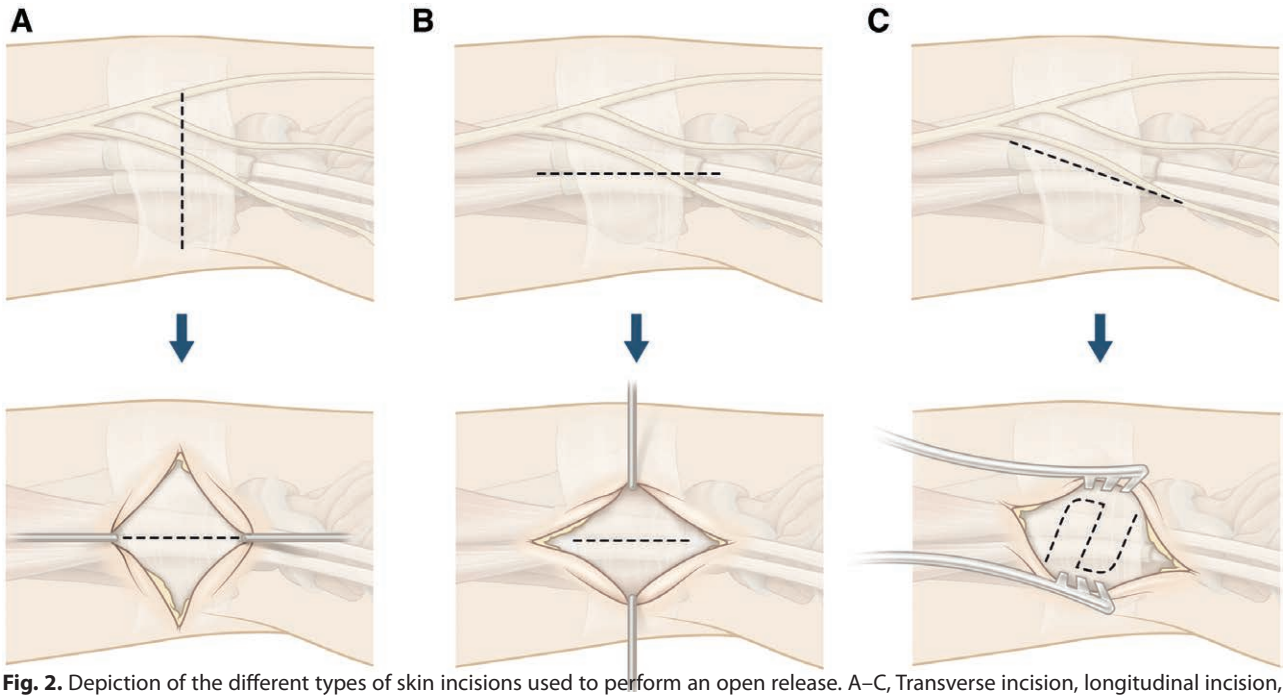
Twelve studies reported on pain reduction and residual pain. Pooled data showed that 5% (95% CI 1%–18%) of the patients still experienced pain at follow-up (Fig. 3). There were not enough studies eligible for a meta-analysis comparing different types of surgery or incision types.

Postoperative VAS scores are reported in 13 articles. However, only seven articles also reported a preoperative VAS score. When pooled, the reduction in VAS scores is 5.7 (95% CI 5.3–6.1) (Fig. 4). The best VAS score of zero postoperatively was reported in both the Z-plasty group and the open release group in the study by Kim et al.[19] The worst VAS score postoperatively (4.35) was obtained in Kumar[18] in a population of 24 patients who underwent an open release with a transverse skin incision. Only a meta-analysis comparing open versus endoscopic surgery was possible, showing no differences ($P = 0.27$) between the two groups (Fig. 4).

Table 1. Study Characteristics

Authors	Year	Study Type	Country	Operation Type	Skin Incision	Strength of Evidence
Abrisham et al[14]	2011	RCT	Oman	Open release	Longitudinal versus transverse	Good
Kang et al[15]	2013	RCT	South Korea	Open versus endoscopic	Longitudinal versus two portal	Good
Acar and Memik[16]	2019	Nonrandomized controlled trial	Turkey	Open release	Transverse	Good to fair
Gu[17]	2019	RCT	China	Endoscopic versus open	Two portal versus transverse	Good to fair
Kumar[18]	2015	RCT	India	Open release	Longitudinal versus transverse	Good to fair
Kim et al[19]	2019	Retrospective observational cohort	South Korea	Simple release versus Z-plasty	Oblique	Fair
Kang et al[20]	2011	Retrospective observational cohort	South Korea	Open versus endoscopic	Transverse versus two portal	Fair
Perno-Ioanna[21]	2016	Retrospective observational cohort	Switzerland	Stepwise incision of retinaculum, two flaps are sutured together	Oblique	Fair
Altay et al[22]	2011	Prospective clinical series	Turkey	Partial resection extensor retinaculum	Transverse	Poor
Apimonbutr[23]	2001	Prospective clinical series	Thailand	Passive gliding	Transverse	Poor
Bakhach[24]	2018	Prospective clinical series	Lebanon	Omegaplasty	Transverse	Poor
Bashir[25]	2019	Cross sectional study	Pakistan	Open release	Unknown	Poor
El Rassi et al[26]	2009	Prospective clinical series	France	Lengthening of the first dorsal compartment (without disruption of continuity)	Transverse	Poor
Garçon et al[27]	2018	Prospective clinical series	France	Le Viet	Transverse	Poor
Lee et al[28]	2014	Retrospective clinical series	South Korea	Open release	Transverse	Poor
Karakaplan et al[29]	2018	Retrospective clinical series	Turkey	Endoscopic	One portal	Poor
Ta et al[30]	1999	Retrospective clinical series	USA	Open release	Unknown	Poor
Littler et al[31]	2002	Retrospective clinical series	USA	EPB released, the sheath is reapproximated over the APL	Transverse	Poor
Renson et al[32]	2018	Retrospective clinical series	Belgium	Pulley reconstruction	Transverse	Poor
Scheller et al[33]	2008	Prospective clinical series	Germany	Decompression of both tendons, partial resection of extensor ligament without reconstruction	Longitudinal	Poor
Van der Wijk et al[34]	2015	Retrospective clinical series	Belgium	Pulley reconstruction	Transverse	Poor
Yuasa and Kiyoshige[35]	1998	Prospective clinical series	Japan	Decompression of only the EPB subcompartment (in patients with a septum)	Transverse	Poor

The articles are ordered according to the strength of evidence.



AQ7 **Fig. 2.** Depiction of the different types of skin incisions used to perform an open release. A–C, Transverse incision, longitudinal incision, and an oblique incision. Reprinted with permission from Esser Masterclass.

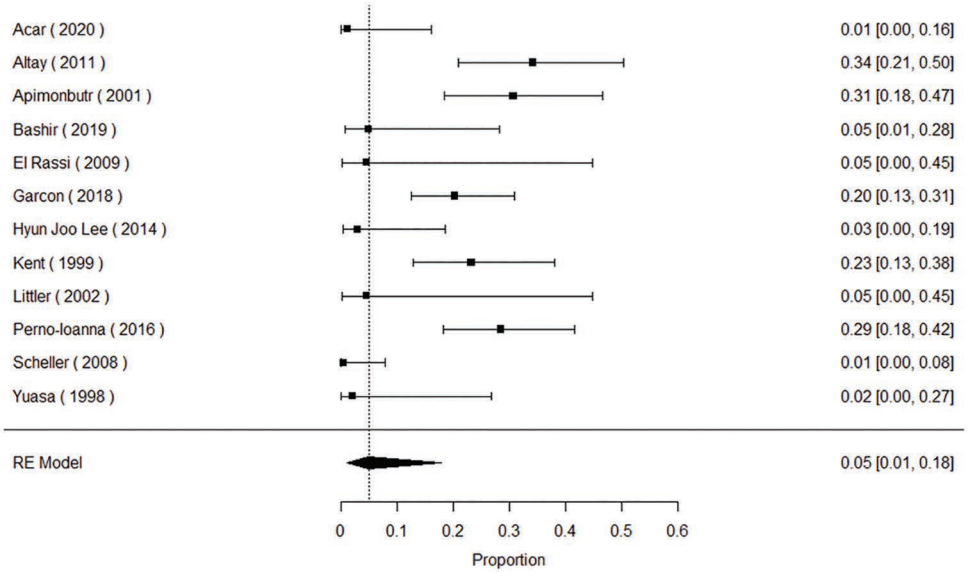


Fig. 3. Residual pain at follow-up. This figure depicts the proportion and 95% CI of the patients who had pain at the follow-up measurement. Only articles that included pain as a complication are included. The black squares denote the proportion of patients that still had residual pain at follow-up. The lines represent the 95% CI. The black diamond displays the overall proportion and 95% CI.

Complications

A total of 160 complications were reported in the studies (Table 2). The complications described are superficial radial nerve injuries, vein injuries, subluxations, scar problems, and residual pain.

Based on our meta-analysis, the pooled prevalence of the complications is 11% (95% CI 5%–22% Fig. 5). The meta-analysis showed that the prevalence of complications was not different between incision types. An overview of the division of subgroups of complications is depicted in Table 2. Fifteen articles described a total of 53 nerve injuries as a complication, resulting in a prevalence of 0.03 (95% CI 0.01–0.06). In the study by Abrisham et al,[14] no nerve injuries were reported in the longitudinal incision group, whereas in the transverse group, three nerve injuries were found. These three nerve injuries were not cured at the end of the study. All other studies did not describe the duration of nerve injuries. In addition, two

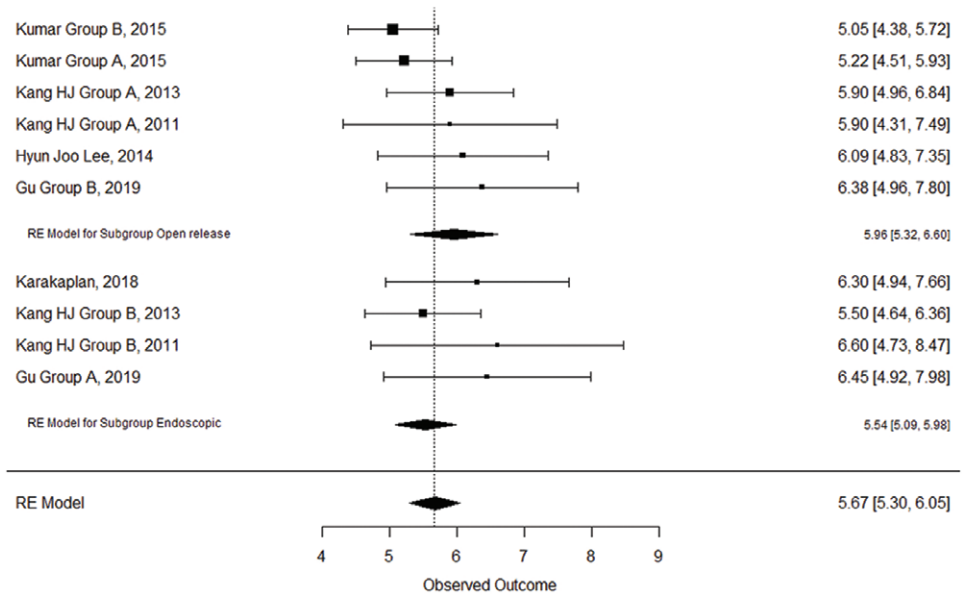


Fig. 4. VAS pain scores after open or endoscopic surgery. This figure depicts the mean and 95% CI decrease in VAS separate for open or endoscopic surgery. The lowest diamond depicts the overall mean decrease in VAS; the upper two diamonds depict the mean decrease in VAS after open or endoscopic release.

Table 2. Complications for Each Subgroup

Authors	Surgical Procedure	Year	Hands (n)	Patient Population (n)	Complications	Nerve Injuries	Type of Complications Reported
Abrisham et al Group A[14]	Open – longitudinal	2011	54	54	9%	0%	5 hypertrophic scars
Kang et al Group A[15]	Open – longitudinal	2013	25	25	36%	36%	9 transient nerve damage
Kumar Group A[18]	Open – longitudinal	2015	24	24	4%	0%	1 hypertrophic scar
Scheller et al[33]	Open – longitudinal	2008	94	94	6%	4%	1 wound infection, 1 delayed healing, 4 transient nerve lesions
Abrisham et al Group B[14]	Open – transverse	2011	52	52	25%	6%	3 nerve damage, 5 vein damage, 5 hypertropic scars
Acar and Memik[16]	Open – transverse	2019	42	42	0%	0%	None reported
Gu et al Group B[17]	Open – transverse	2019	21	21	0%	0%	None reported
Kumar Group B[18]	Open – transverse	2015	24	24	50%	13%	5 hypertrophic scar, 1 subluxation, 3 vein injury, 3 nerve injury
Kang et al Group A[20]	Open – transverse	2011	26	25	56%	20%	3 scar tenderness, 5 transient nerve injuries, 6 unsightly scars
Altay et al[22]	Open – transverse	2011	42	38	5%	0%	1 superficial wound infection, 1 delayed wound healing
Apimonbutr and Budhraja[23]	Open – transverse	2001	40	39	67%	15%	12 mild pain, 8 swelling, 6 paresthesia
Bakhach et al[24]	Open – transverse	2018	29	25	16%	8%	2 hematoma, 2 transient nerve injuries
El Rassi et al[26]	Open – transverse	2009	12	10	0%	0%	None reported
Garçon et al[27]	Open – transverse	2018	80	74	24%	0%	2 scar adherence, 3 painful scars, 10 cases of CRPS
Lee et al[28]	Open – transverse	2014	33	33	0%	0%	None reported
Littler et al[31]	Open – transverse	2002	11	10	0%	0%	None reported
Renson et al[32]	Open – transverse	2018	10	10	80%	0%	2 synovitis, 6 minor residual migration
Van der Wijk et al[34]	Open – transverse	2015	48	45	7%	2%	2 patients clicking, 1 numbness sensory area radial nerve
Yuasa and Kiyoshige[35]	Open – transverse	1998	22	22	0%	0%	None reported
Kim et al Group A[19]	Open – oblique	2019	38	38	18%	5%	2 subluxation, 3 pain, 2 transient sensory change
Kim et al Group B[19]	Open – oblique	2019	36	36	6%	6%	2 transient sensory change
Perno-Ioanna and Papaloïzos[21]	Open – oblique	2016	56	56	21%	5%	9 temporary dysesthesia, 3 long term changes in sensibility, 9 sore first extensor compartment
Bashir[25]	Open	2019	20	20	10%	5%	1 pain, 1 transient parenthesis
Kang et al Group B[15]	Endoscopic – two portal	2013	27	27	11%	11%	3 transient nerve damage
Gu et al Group A[17]	Endoscopic – two portal	2019	20	20	0%	0%	None reported
Kang et al Group B[20]	Endoscopic – two portal	2011	24	22	0%	0%	None reported
Karakaplan et al[29]	Endoscopic – one portal	2018	10	10	30%	20%	1 scar tenderness, 2 transient paresthesia
Ta et al[30]	Unknown	1999	43	43	9%	2%	1 radial sensory nerve, 1 painful scar, 2 recurrent symptoms

The cumulative complications denote all complications that were reported by the individual studies, including nerve complications. The articles are ordered according to type of surgical procedure.

articles reported hypertrophic scars as a complication. In the study of Kumar,[18] one hypertrophic scar occurred in the longitudinal incision group and five in the transverse incision group. In the study of Abrisham et al,[14] in both the longitudinal and the transverse incision group, five hypertrophic scars were reported.

Four articles described a total of five reoperations. In the study by Kumar,[18] one patient had a neuroma excision reoperation because of a painful neuroma. In the study by Renson et al,[32] one patient required reoperation because of fibrosing stenosis, another patient because of synovitis, and one patient because of recurrent instability of the EPB and the APL, resulting in a (sub)luxation of these tendons.

DISCUSSION

Since previous studies have not shown superiority of a single type of incision for DQ disease, we conducted a meta-analysis to assess the pain reduction and complication rate after surgical release of the first extensor compartment in patients with DQ. No difference in outcome and complication rate for the type of surgical treatment for DQ disease was found. The reduction of pain was not significantly different between the open and the endoscopic procedure. Due to limited data, no comparison between the other surgical procedures could be performed. In the total group, complete pain relief was reported in 95% of the patients, which leads to 5% with residual pain.

Despite high success rates, some patients still have residual pain. These high success rates are comparable to the open release of trigger fingers. Namely, Makkouk et al[36] reported a success rate of 90%–100% and a complication rate of 3%. Residual pain can be a result of incomplete release; as described, one should carefully decompress the first compartment and actively search if there is a

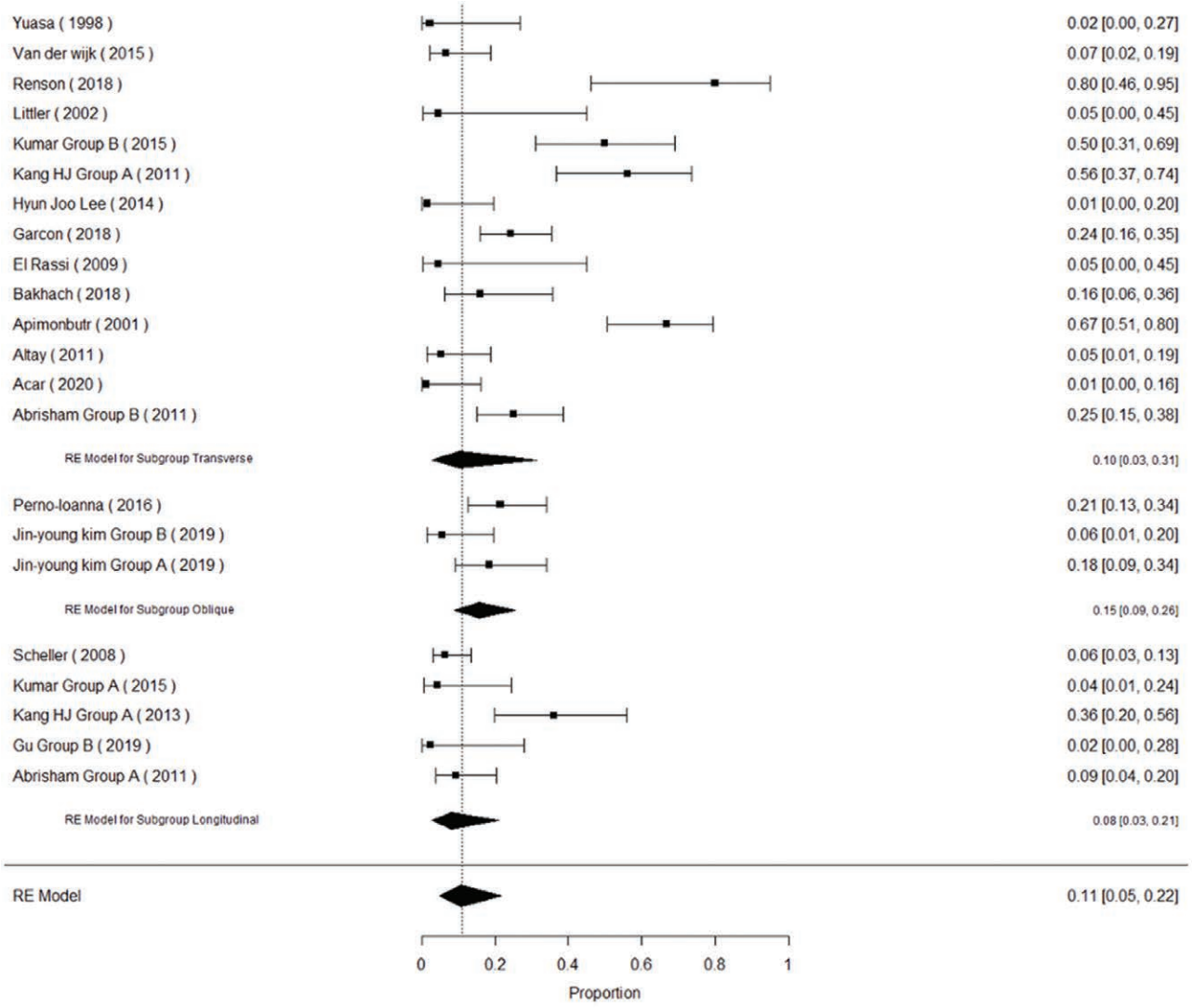


Fig. 5. Forest plot for the complication rate and 95% CI for each type of skin incision. The lowest diamond depicts the overall complication rate; the three upper diamonds depict the complication rate for transverse, oblique, and longitudinal incisions. There is no significant difference between the complication rates.

subcompartment that separates the EPB and APL, which is present in 40% of the population.[8] Identifying and treating this compartment is decisive to the success of the surgery. Other factors of influence can be carpometacarpal joint deformities, luxation or subluxation of EPB and APL, or chronic irritation of the RSN. Wartenberg syndrome is associated with DQ in 20%–50% of the cases, which implicates a connection between these two diseases.[37] A possible connection between DQ and Wartenberg is that inflammation mediators induce neuritis of the RSN after prolonged exposure during the sterile inflammation of the first compartment.[37] This would make a case for earlier surgical treatment on patients with DQ disease to prevent neuritis of the RSN by prolonged exposure of inflammation by tenosynovitis.

Reported complication rates for surgical release of DQ disease range from 0% to 50%.[18,28] Our meta-analysis showed an overall complication rate of 11%. Injury to the RSN was the most common in 3% of all patients who underwent surgery for DQ; however, only 0.3% was reported as permanent. The vast majority of the studies did not report the duration of nerve problems; therefore, we could not assess if these nerve complications were transient or permanent. Only one study mentioned a permanent RSN complication in three patients. Furthermore, no objective measures were presented for RSN injury; therefore, no clear statement concerning the permanent damage could be made. Often authors mention that in specific types of incisions, the RSN is more at risk; however, this meta-analysis showed no significant difference between the direction of the skin incision: transverse, oblique, and longitudinal.

Our meta-analysis also showed no difference in pain reduction between an endoscopic surgical release and an open release. This is in line with those reported in previous studies.[15,17] Furthermore, Kang et al[15] described

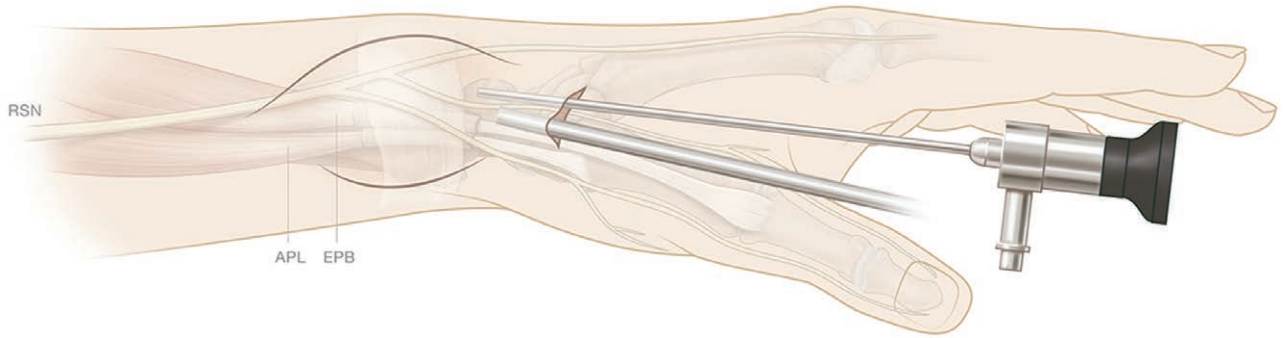


Fig. 6. One-portal endoscopic release. A 2-cm transverse incision is made just proximal to the carpometacarpal joint.[29] Reprinted with permission from Esser Masterclass.

no difference in surgery duration between an endoscopic procedure and an open release. Nonetheless, Kang et al[15] and Gu et al[17] suggested other benefits of operating endoscopically, namely that it minimizes the risk of RSN injury, tendon injury, and adhesion of subcutaneous tissue around the incision. In turn, the reduction in scar adhesion results in greater scar satisfaction compared with an open release.[15] However, the nerve injuries were transient for both the endoscopic and open releases, and no neuroma occurred. In addition, although a significant difference was found in scar satisfaction between the two groups based on the measurement scales, this was a slight difference.[17] Therefore, there may be doubts about whether it is clinically relevant to operate endoscopically rather than operating open because no surgical procedure is superior to the other in terms of pain.

Of the studies that performed an endoscopic release, we included two types: the one-portal release[29] and the two-portal release.[15,17,20] Of the one-portal release (Fig. 6), it is suggested that it is even more effective in preventing RSN injuries. Given the anatomical course of the RSN, one portal distal to the radial styloid process would be safer compared with a second portal proximal to the radial styloid process (Fig. 7).[29] However, we were not able to corroborate this in our meta-analysis.

In addition, also other techniques were used in the included articles, such as a Z-plasty of the retinaculum[19] (Fig. 8) and a pulley reconstruction of the first compartment[32] (Fig. 9). These techniques consist of creating a flap over the first compartment to prevent (sub)luxation of the tendons. However, due to the limited number of articles describing these techniques, no comparison could be made of the effect on pain reduction between these techniques and an open release.

This systematic review has several strengths and limitations. A major strength is a search in seven databases by an experienced medical librarian; therefore, it is unlikely that any articles were missed. However, the quality of the included studies is highly dependent on the study design. Most articles are noncontrolled clinical series, which assess new surgical techniques. Accordingly, those studies have low sample sizes, and these factors combined automatically resulted in "poor" quality in all quality assessment tools. We decided not to exclude any articles based on the quality assessment because, despite possible poor study design, we believe the follow-up and reporting of complications are reliable. Besides this, the aim of this review is to describe the pain reduction and complication rate; so the primary research question is not a comparison. Therefore, we also accepted nonrandomized controlled retrospective trials. Furthermore, the number of studies describing the

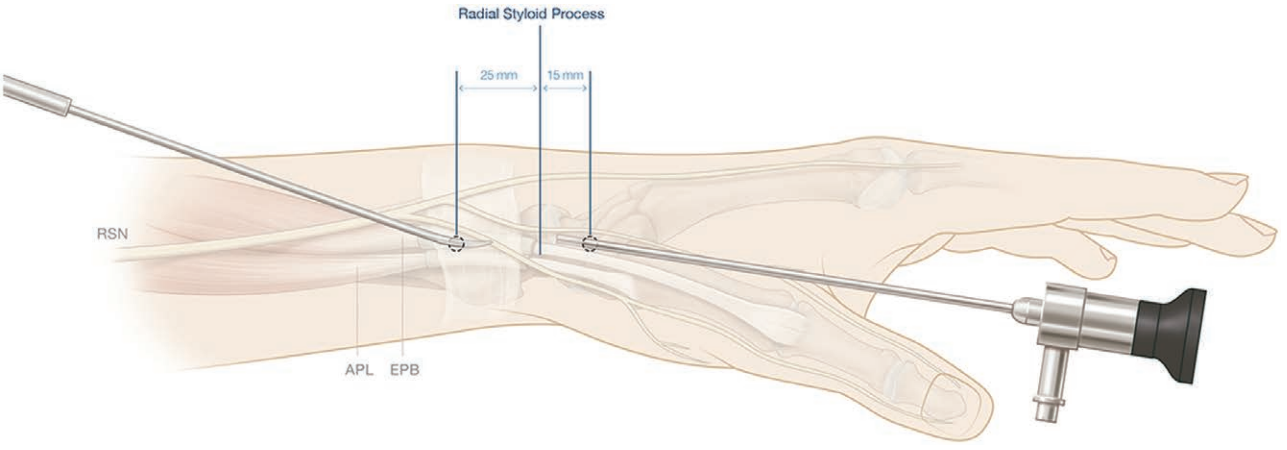


Fig. 7. Two-portal endoscopic release. The two incisions for the portals are made 1.5 cm distal to the radial styloid process and the other 2.5 cm proximal to the radial styloid process.[17] Reprinted with permission from Esser Masterclass.

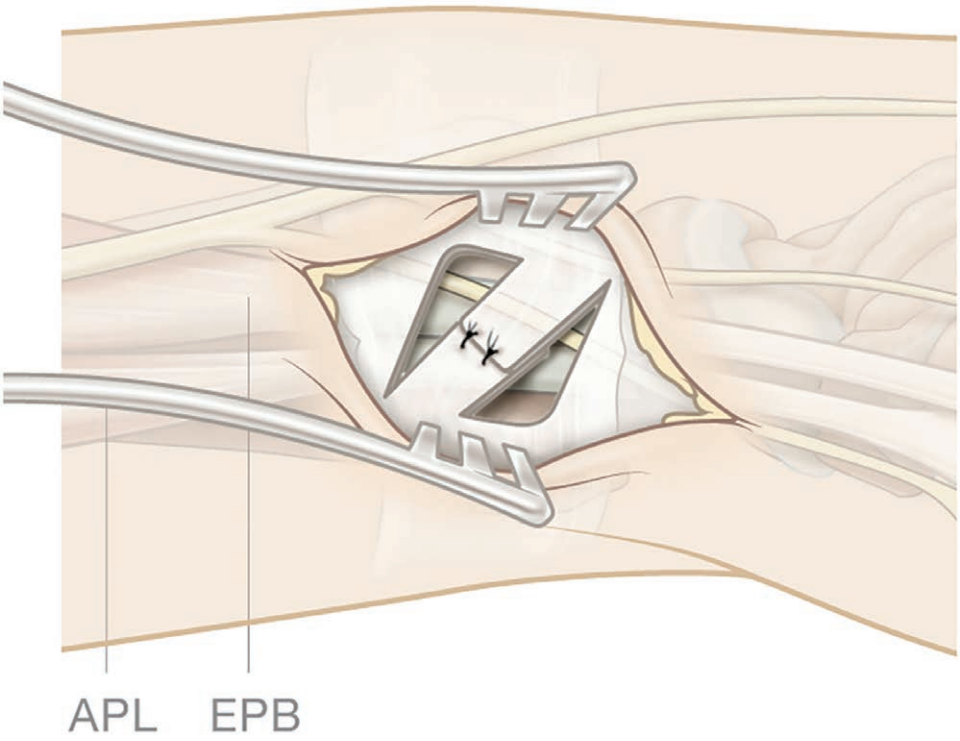


Fig. 8. Z-plasty. First, an oblique incision is made to release the first extensor compartment. Subsequently, the distal ulnar based flap and the proximal radial based flap are sutured together. Reprinted with permission from Esser Masterclass.

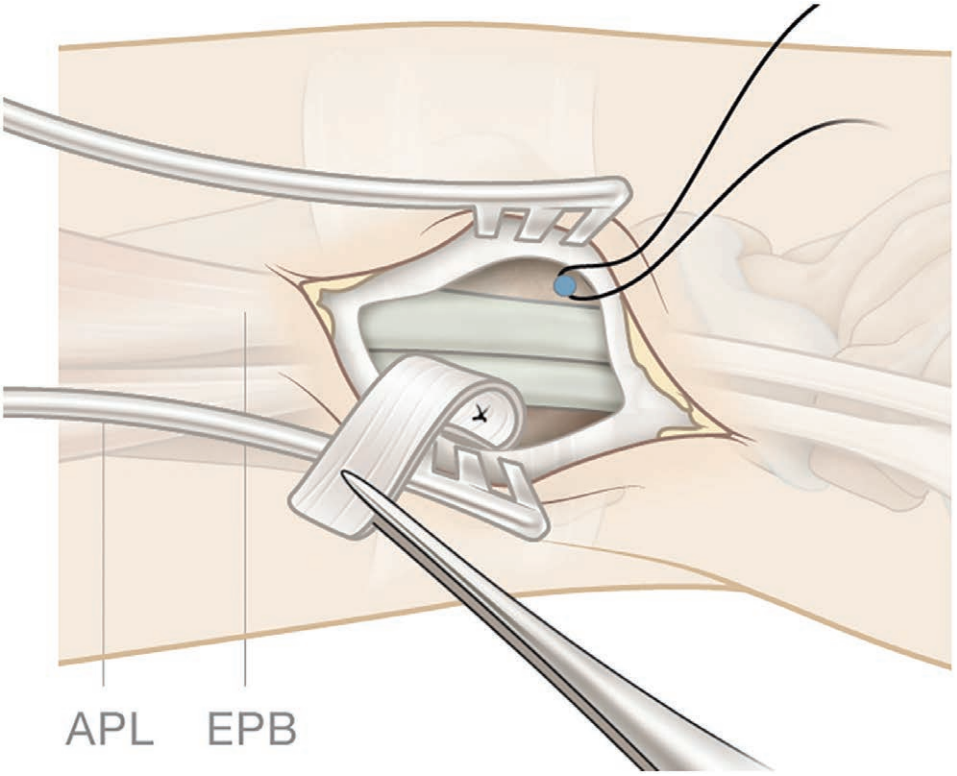


Fig. 9. Pulley reconstruction of the first compartment. A transverse incision is made to release the first extensor compartment. The extensor retinaculum is harvested to obtain a graft of 0.8 cm by 2 cm. Before the anchors are inserted to fix the graft, the bone is predrilled with a 1.3-mm drill bit. Subsequently, the graft is first anchored on the volar side of the abductor pollicis longus and the extensor pollicis brevis. The second anchor is placed dorsally.[34] Reprinted with permission from Esser Masterclass.

complications and pain reduction after surgery for DQ disease is limited. By also including nonrandomized studies, we were able to include far more data into our meta-analysis and provided better estimates for our primary outcomes. For this reason, no articles were excluded.

A limitation was high heterogeneity in surgical technique and patient populations. The ethnicity of the patients may influence complications, in particular wound healing. The studies conducted in Oman and India stood out because of a high rate of hypertrophic scars.[14,18] Furthermore, the inclusion and exclusion criteria of the studies were different. Some studies excluded patients with carpometacarpal osteoarthritis and bilateral DQ disease,[14,17,19,23] whereas others included these patients.[21–24,27,28,32,33] Besides this, prior conservative treatment was also not always reported.[27,31,32] Only the study by Bakhach et al[24] reported the number of corticosteroid injections before surgery for each subject. Three of the 25 patients failed for conservative treatment after one injection, four patients after two injections, and five after three injections. In addition, Garçon et al[27] and Kim et al[19] reported a mean of two steroid injections before surgery. However, the question remains what the percentage of patients is who undergo surgery for DQ disease after prior conservative treatment, especially since a previous systematic review by Rowland et al[38] about the effect of corticosteroid injections for DQ showed a significant improvement with regard to pain and hand function. Future research could study (1) which percentage of patients chooses to undergo surgical release after (failed) conservative treatment and (2) what the effect of prior conservative treatment is on the outcomes of surgical release.

CONCLUSIONS

In conclusion, the surgical release of the first extensor compartment is an effective procedure that results in a significant reduction of pain (95%) but also has a substantial complication rate of 11%. Secondly, surgical type and direction of skin incision do not correlate with the outcome in reduction of pain and complication rate.

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