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Distal Pole Resection of the Scaphoid for the Treatment of Scaphotrapeziotrapezoid Osteoarthritis

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Abstract

Background: Distal pole resection of the scaphoid is one of the surgical techniques applied for the treatment of painful scaphotrapeziotrapezoid osteoarthritis (STT-OA). **Methods:** In this retrospective study, we evaluated midterm outcomes in a consecutive series of patients who underwent distal pole resection of the scaphoid: 13 patients (15 wrists) with a mean follow-up of 4.1 years. We examined objective functional and patient-reported outcome measures. In addition, we assessed the degree of dorsal intercalated segment instability (DISI) and postoperative complications. **Results:** All patients scored within a normal range on objective functional and patient-reported outcome measures. We observed a mild postoperative DISI deformity with an average lunocapitate angle of 22° (range, 0°-44°), which did not correlate with pain scores. In the opposite wrists, with and without STT-OA, the average lunocapitate angle was 6° (range, 0°-20°). **Conclusions:** According to this study, midterm results for distal pole resection of the scaphoid are satisfactory.

Keywords: distal pole resection, scaphoid, scaphotrapeziotrapezoid osteoarthritis, STT osteoarthritis, scaphoid nonunion, midterm outcomes

Introduction

Resection of the distal pole of the scaphoid is one of the surgical techniques applied for the treatment of isolated scaphotrapeziotrapezoid osteoarthritis (STT-OA)[8] and for nonunion of fractures in the distal part of the scaphoid.[5,12,13,16,17] Isolated STT-OA is a potentially painful condition of the wrist, of which the etiology is still largely unknown.[20,23] The surgical treatment most used for symptomatic STT-OA is STT arthrodesis,[18,23] yet this technique is associated with a high risk of nonunion[9,23] among other complications.

For painful nonunions of the distal part of the scaphoid, proximal row carpectomy,[2,21] scaphoid excision and intercarpal arthrodesis,[19] and a pyrocarbon implant[11] are established salvage techniques. However, these techniques are associated with a considerable loss of function.

An alternative technique could be the resection of the distal pole of the scaphoid. With this technique, the distal part of the scaphoid (in total about one-fourth of the scaphoid) is removed. As an option, a tendon interposition may be placed in the remaining space. Technically, this is a simple procedure with few possible complications and a short downtime for the patient. Moreover, if this technique fails, the abovementioned salvage techniques could still be employed. Distal pole resection is usually performed by open surgery, but arthroscopic techniques have also been described.[4,5,8,15]

Potentially, however, resection of the distal pole of the scaphoid could cause the development of dorsal intercalated segment instability (DISI) deformity of the wrist or worsening of the DISI deformity if already present before surgery.[13] In addition, very few studies report on the outcome of this treatment for STT-OA[8,14] or nonunion of fractures of the distal part of the scaphoid.[5,12,13,16,17] The purpose of this study is to evaluate the midterm outcomes in a consecutive series of patients with STT-OA, using the following hypothesis: distal pole resection of the scaphoid is a good alternative for STT arthrodesis in the treatment of isolated STT-OA, with obvious advantages: easier technique, less downtime for patient, better range of motion (ROM), and less complications.

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Methods

Patients

We conducted a retrospective cohort study and examined the medical records of consecutive patients who were treated with a distal pole resection between 2004 and 2012 at the VU University Medical Center (VUmc) and The Hand Clinic. The study was approved by the VUmc medical ethical committee. Eligible candidates (with a total of 31 treated wrists) were identified and, if contact data could be traced, were invited by letter and telephone to participate in the study.

Outcome Measures

After participants gave their informed consent, they were invited to the outpatient clinic, where functional outcome measurements, a radiograph of both wrists, and completed questionnaires were obtained. Functional outcome measurements were assessed by a hand therapist and included ROM of the wrist, grip strength, and key, 3-point, and 2-point pinch. Active ROM was measured in extension-flexion, radial-ulnar deviation, and pronation-supination using a hydraulic hand-held goniometer. Grip strength was measured in kilograms using an analog Jamar hand dynamometer (Sammons-Preston Rolyan, Bolingbrook, Canada) at positions 1 to 5. Key, 3-point, and 2-point pinch were measured in kilograms using a hydraulic pinch gauge (B&L Engineering, Santa Ana, California). For each outcome, the average of 3 repeated measurements was obtained. Patient-reported outcomes were evaluated using a visual analog scale (VAS) for pain, usability, and independence and with the Quick Disabilities of the Arm, Shoulder, and Hand Dutch Language Version (Q-DASH-DLV) and the Michigan Hand Questionnaire (MHQ), Dutch version. In the evaluation of pain, usability, and independence, the VAS ranged from no pain (0) to worst imaginable pain (10), from maximal usability (0) to unusable (10), and from maximal independence (0) to maximal dependence (10), respectively. For all these measures, patients were asked to report their condition during the week prior to their visit to the outpatient clinic. The MHQ contains the following scales: overall hand function, activities of daily living, pain, work performance, aesthetics, and patient satisfaction with hand function.[3] All items are answered using a 5-point scale ranging from "strongly disagree" to "strongly agree." The total raw score is converted into a score ranging from 0 to 100. A higher score implies a better health outcome. The Q-DASH is a shortened version of the DASH questionnaire, which is a scoring system for disability of the upper extremity.[1] The questionnaire contains 2 optional modules on work and instrument and sports. The scores range from 0 (no disability) to 100 (complete disability). Radiographs were taken in posteroanterior and lateral view; using the latter, we measured the lunocapitate (LC) angle.

Statistical Analyses

Continuous outcomes are presented as mean ± SD. We used the Pearson correlation coefficient to assess the correlation between variables. Differences between groups were calculated using independent t test. Statistical significance was accepted for $P < .05$.

Operative Technique

A longitudinal incision is made over the anatomic snuffbox, just dorsally from the first extensor compartment; care is taken not to damage the radial artery and branches of the ramus superficialis of the radial nerve. The STT capsule is opened and carefully the distal one-fourth of the scaphoid is resected using an osteotome, leaving the STT ligaments intact as much as possible. At this point, a tendon can be harvested which, rolled-up like an anchovies, is placed in the remaining space. The capsule and the skin are then closed using absorbable sutures.

In 6 cases, the palmaris longus was used; in 1 case, the abductor pollicis longus was used; in 1 case, the flexor carpi radialis (FCR) was used; and in 6 cases, the space was left empty. Postoperative immobilization consisted of a plaster forearm cast worn for 1 to 5 weeks. In our series, 4 cases were immobilized for 1 week, 1 for 12 days, 4 for 2 weeks, 2 for 4 weeks, 1 for 5 weeks, and in 1 case, no plaster cast was used. In 2 cases, the postoperative regimen was unknown.

Results

Study Participation

Between 2004 and 2012, 31 wrists were treated with distal pole excision of the scaphoid for painful STT-OA, of which 13 were lost to follow-up. After the initial inclusion of 18 wrists, 3 wrists were excluded: 2 due to wrist fractures after trauma and 1 due to ulnar sided complaints, which were not related to the initial operation. Table 1 presents the demographic data. In our group, 2 patients underwent the same type of surgery in both wrists, and 3 patients had undergone previous surgery in the treated wrist. In 8 cases, the opposite wrist showed radiological STT-OA; and in 1 case, there was a recent fracture of the distal radius.

Functional Outcome Measures

Extension and flexion averaged 62° (SD: 9°) and 74° (SD: 6°), while radial and ulnar deviation averaged 17° (SD: 4°) and 28° (SD: 6°), respectively.

Grip strength at positions 1 to 5, respectively, averaged 16.0 (SD: 8.5), 23.6 (SD: 12.6), 21.5 (SD: 12.4), 18.3 (SD: 10.0) and 15.6 (SD: 8.1) kg. Key, 3-point, and 2-point pinch averaged 6.7 (SD: 3.3), 6.3 (SD: 2.7), and 4.7 (SD: 1.8) kg, respectively.

Table 1. Demographic Data.

Wrist	Age (years)	M/F	D/ND	Indication	Follow-up (years)
1	59	F	ND	STT-OA	6.5
2	67	F	D	STT-OA	4.6
3	45	M	D	STT-OA	6.6
4[a]	70	F	D	STT-OA	4.3
5[a]	74	F	ND	STT-OA	0.5
6	58	F	D	STT-OA	7.5
7	62	F	ND	STT-OA	5.0
8	65	F	ND	STT-OA	3.7
9[b]	66	M	ND	STT-OA	3.3
10[b]	65	M	D	STT-OA	4.1
11	60	F	D	STT-OA	2.2
12	54	F	D	STT-OA	5.5
13	53	F	D	STT-OA	4.6
14	63	F	D	STT-OA	2.1
15	54	F	ND	STT-OA	1.7
Mean ± SD	61.0 ± 7.5	M = 3 (20%) F = 12 (80%)	D = 9 (60%) ND = 6 (40%)	STT-OA = 100%	4.1 ± 2.0

Note. M = male; F = female; D = dominant; ND = nondominant; STT-OA = scaphotrapeziotrapezoid osteoarthritis.
[a]One patient.
[b]One patient.

Table 2. Results of Patient-Reported Outcome Measures.

Wrist	Pain	Usability	Independence	Q-DASH general	Q-DASH work	Q-DASH sport/ instrumental	MHQ total score
1	5.6	0.0	0.0	4.5	0.0		85
2	0.6	0.6	0.4	59.1			57
3	1.1	1.2	0.3	6.8	6.3	6.3	84
4[a]	0.0	0.0	1.6	18.1[a]	0.0	31.3[a]	74
5[a]	1.8	2.9	1.6	[a]		[a]	
6	0.0	0.0	0.0	0			100
7	0.7	2.7	0.2	18.1	25.0	12.5	74
8	0.0	5.1	5.1	70.5			61
9[b]	3.5	5.3	2.5	47.7[b]			60
10[b]	3.5	5.3	2.5	[b]			
11	3.1	3.3	0.1	34.1			78
12	2.7	2.5	1.6	34.1			76
13	5.0	3.8	0.0	15.9	0.0		81
14	0.0	0.0	0.0	0.0		0.0	98
15	4.1	3.2	0.0	18.1	12.5		65
Mean ± SD	2.1 ± 1.9	2.4 ± 2.0	1.1 ± 1.5	25.2 ± 22.6	7.3 ± 10.0	12.5 ± 13.5	76.4 ± 13.5

Note. Q-DASH = Quick Disabilities of the Arm, Shoulder, and Hand; MHQ = Michigan Hand Questionnaire.
[a]One patient.
[b]One patient.

Patient-Reported Outcomes

Table 2 presents patient-reported outcomes. The Q-DASH module for work was completed by 6 patients while the Q-DASH module for sports and instruments was completed by 4 patients. For 2 patients, the Q-DASH and MHQ were calculated only once because they underwent a distal pole resection in both wrists. Reported pain averaged 2.1 (SD: 1.9)/10, usability 2.4 (SD: 2.0)/10, independence 1.1 (SD: 1.5)/10, MHQ 76.4 (SD: 13.5)/100, and Q-DASH 25.2 (SD: 22.6)/100. The optional modules on the Q-DASH for work and sport/instrumental averaged 7.3 (SD: 10) and 12.5 (SD: 13.5), respectively.

Radiographic Evaluation

A mild postoperative DISI deformity was observed in 13 wrists with an average LC angle of 22° (range, 0°-44°) on radiographic evaluation without a correlation with reported

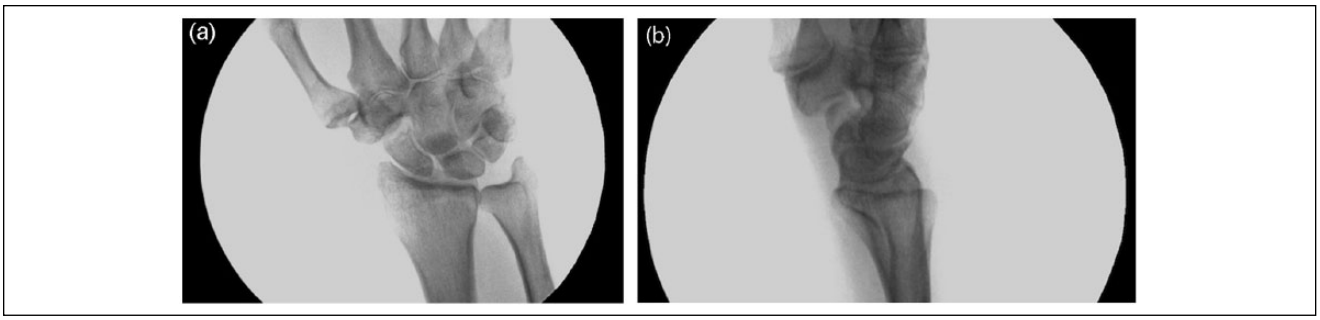

Figure 1. (a) Anteroposterior view of wrist treated with distal pole resection of the scaphoid at follow-up time. (b) Lateral view of the same wrist; the lunocapitate angle is clearly enlarged.

pain scores (Figure 1). The opposite untreated wrists displayed an LC angle of 6° (range, 0°-20°). In addition, there was no significant difference in LC angle between the group with a tendon interposition and the group without a tendon interposition ($P = .9$).

Complications

The only observed complication was a complex regional pain syndrome (CRPS) in one case. Yet this was in a patient who underwent a distal pole resection of the scaphoid and a carpal tunnel release in one session. She was referred to the pain specialist in our hospital who successfully treated her with medication.

Discussion

Since the introduction of distal pole resection of the scaphoid, only few studies have reported on the clinical outcome of this technique. Most studies report on the outcome of distal pole resection in patients with painful, longstanding distal scaphoid fracture nonunion.[5,12,13,16,17] In contrast, hardly any study reports on the outcome in the treatment of painful STT-OA using this technique.[8,14] Usually, the first choice for painful STT-OA, not responding to conservative therapy, is STT arthrodesis.[23] However, our study suggests that for the treatment of painful STT-OA, distal pole resection of the scaphoid can be an attractive alternative.

Several authors report satisfactory pain reduction (less than 2.5 on a 0-10 scale) after distal pole resection of the scaphoid.[8,12,14] In accordance with these studies, our patients reported an average pain score of 2.1 on a 0 to 10 scale. In general, STT arthrodesis also results in good pain relief, with only 5% of patients reporting mild postoperative pain.[22]

In the present study, wrist extension averaged 61°, which is comparable to previous studies, in which results ranged from 61° to 74°[8,16]; flexion averaged 74°, compared with 57° to 64° in the literature.[8,13,16] In a large study by Watson et al[22] evaluating 800 wrists treated with a STT arthrodesis, extension and flexion were reduced to 49° (74%) and 54° (79%), respectively. This study is known for exceptionally good, verified results, but in average daily practice, results in terms of ROM following a STT arthrodesis are less most of times. Radial deviation and ulnar deviation in our study, 17° and 28°, respectively, are about equal to the findings in the study by Garcia-Elias et al.[8] In STT arthrodesis, a comparable radial and ulnar deviation is reported with an average of 15° and 28°, respectively.[22] The conclusion that distal pole resection of the scaphoid leads to better postoperative ROM compared with STT fusion seems justified.

The results for grip strength are difficult to relate to other studies, as our study lacks preoperative measurements. Soejima et al,[17] Drac et al,[5] and Malerich et al[12] who performed distal pole resection in painful scaphoid nonunion, all report a significant improvement in grip strength, from 36% to 61% of the contralateral side preoperatively to 77% to 83% postoperatively. In patients with STT-OA, the contralateral side is not useful for comparison, as it is also affected most of times.

We found satisfactory results on the Q-DASH score, 25.2 (SD: 22.6), which are in line with the findings of Ruch and Papadonikolakis.[16]

There was only one complication in our study, ie, 1 case of CRPS, which fully recovered with treatment. In the study by Ruch and Papadonikolakis,[16] 1 patient had a symptomatic scaphoid fragment that had remained postoperatively and a superficial radial nerve neuritis, requiring subsequent excision of the bony remnant, neurolysis with nerve conduit wrapping, and excision of the posterior interosseous nerve. In the short-term follow-up study by Malerich et al,[13] 1 patient continued to have pain and required a wrist arthrodesis. In their longer follow-up study on the same patient cohort,[12] 1 additional patient required a proximal row carpectomy due to persistent wrist pain.

As anticipated, we saw a tendency toward a mild DISI stance on the lateral radiograph, but there was no relationship with the pain score. The significance of this radiological occurrence remains unclear and seems to have no clinical relevance so far.

Normally, the proximal row is subjected to a flexion moment on the radial side and an extension moment on the ulnar side. The equilibrium between those forces results in a neutral alignment of the lunate relative to the radius and capitate, with an LC angle approximating 0°. Shortening the scaphoid causes an alteration of this alignment due to bony geometry changes of the STT joint, resulting in a rotation of the whole proximal row into an abnormal extension.[6,7,10] In our retrospective study, a DISI deformity was seen in 13 wrists with an average LC angle of 22° (range, 0°-44°) postoperatively. Most interestingly, most of the contralateral wrists in our series, with or without STT-OA, did not display a DISI stance. Although STT-OA itself has been associated with a DISI deformity with a normal scapholunate angle,[20] the abovementioned finding suggests that (worsening of) the DISI pattern might be a consequence of the applied surgical technique in our patients. All studies reporting on distal pole resection of the scaphoid describe an increase of the radiolunate angle[5,8,12,13,16,17] postoperatively. In 3 studies,[8,16,14] this increase is reported to be statistically significant. Although patients do well on the short-term and midterm follow-up evaluations and the significance of these findings are unclear, they remain a cause of concern on the long term. Therefore, we now routinely perform a clenched fist lateral radiograph preoperatively. In case this shows the occurrence of a clear DISI stance compared with the radiograph of the unloaded situation, we nowadays refrain from a distal pole resection. Several techniques have been developed in attempt to stabilize the remaining scaphoid after distal pole resection, such as capsule interposition[13] or a pyrocarbon spacer.[11,14] The latter study reports a mean DISI of 8° postoperatively with good pain relief, but unfortunately there is no mention of complications or implant failure. Marcuzzi et al[14] report a significant increase in DISI in the resection only group and a nonsignificant increase in the implant group. In minor LC instability, Garcia-Elias proposes radioscaphoid capsulodesis with FCR interposition or tightening of the dorsal capsule.[6] We performed tendon interposition in 8 patients and did not find a difference in the severity of DISI between wrist with and without tendon interposition. Arthroscopic distal pole resection is said to be less traumatic to the STT ligaments, potentially causing less tendency toward the occurrence of instability. One study[4] reports good pain reduction in 13 wrists after arthroscopic distal pole resection of the scaphoid but does not report on postoperative DISI deformity. Another study[15] shows good clinical results in 8 wrists, which are comparable to those reported by Garcia-Elias and a postoperative DISI deformity of 34° (range, 26°-39°) so despite the utilization of a less invasive technique, the DISI stance was not less than after an open technique.

As mentioned before, the surgical treatment mostly used for treating symptomatic STT-OA is STT arthrodesis.[23] With this technique, the pain is greatly reduced and the grip strength is mostly preserved. However, drawbacks of this technique are the limited ROM and a range of complications associated with this option.[9,22] These include painful nonunions, De Quervain's stenosing tenosynovitis, radioscaphoid impingement, and pin-tract infections or other hardware-related complications.

A limitation of this study is the small sample size due to patients who were lost to follow-up. We see patients from a large geographic area, and some of our patients were not able or willing to travel to participate in this study. Another limitation is that our study is a retrospective study without preoperative objective, functional and patient-reported outcome measurements.

Nevertheless, our study shows that the results for distal pole resection of the scaphoid in the treatment of painful STT-OA are quite good. Furthermore, it is a simple technique without the need for any hardware, requiring only a short postoperative immobilization period. Still, a possible concern poses the occurrence of a DISI stance, although during our midterm follow-up period this did not seem to be clinically relevant. For now, this technique has our preference in the treatment of symptomatic STT-OA over STT fusion.

Careful preoperative radiological and clinical assessment of the midcarpal joint however seems warranted, as evidence of midcarpal degeneration and/or pain or especially a preexisting DISI deformity might be a relative contraindication for this technique. A longer follow-up of our patients is needed and ideally a randomized clinical trial to provide more finite conclusions.

Authors' Note

Merel J.-L. Berkhout and Yara Bachour contributed equally to this work.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. No animal models were used in this study.

Statement of Informed Consent

Informed consent was obtained from all participants included in this study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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