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Original Research

First Dorsal Compartment Release During Volar Approach for Distal Radius Fracture Fixation Reduces Symptoms in Patients With Pre-Existing De Quervain Disease



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Purpose: Release of the first dorsal compartment is a described technique during volar approach for distal radius fracture fixation. Our objective was to determine whether release of the first dorsal compartment during volar approach for distal radius fracture fixation impacted corresponding symptoms in pre-existing de Quervain disease.

Methods: A prospective, randomized cohort study was performed with patients grouped for release (release group) or no release (control group) of the first dorsal compartment during volar approach for distal radius fracture fixation. Inclusion required a confirmed diagnosis of de Quervain disease within the 12 months preceding a distal radius fracture.

Results: Patients in the release group were significantly less symptomatic than those in the control group at 3 and 6 months after surgery. Lateral pinch strength in the release group was significantly greater than that in the control group at 3 and 6 months after surgery.

Conclusions: The current results demonstrated a significantly greater reduction in de Quervain disease symptoms in the release group compared with the no release group during the short-term follow-up. This indicates that routine first dorsal compartment release during distal radius fracture fixation may expedite symptom relief in patients with de Quervain disease.

Type of study/level of evidence: Therapeutic I.

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Distal radius fractures (DRFs) have been increasing in incidence since 2000.¹ Furthermore, recent evidence demonstrated that the incidence of DRFs in older adults is increasing.² The older adult proportion of the world's population has been increasing at a faster rate than younger age groups, and this trend is forecasted to continue beyond the 2020s.³ This increasing elderly demographic is expected to yield a considerable increase in the incidence of DRF in the coming decades.⁴

De Quervain (DQ) disease is a tenosynovial inflammation of the first dorsal compartment (FDC). Although the pathoetiology of DQ

disease is not entirely understood, it is likely because of increased tendon friction within the FDC, resulting in a fibroblastic response and pain with subsequent dysfunction. Recent evidence suggests that DQ disease may be more common than previously reported because of the mechanisms involved in modern cellular phone use.^{5,6} When conservative treatment fails, surgical release of the FDC may be performed. In aggregate, this intervention has high rates of success in most patients.^{7,8}

Release of the FDC is a described technique during volar approach for DRF fixation.^{9,10} The intent of the release is to provide ample visualization and facilitate fracture mobilization to achieve anatomic reduction. Recent investigation concluded that surgically managed DRFs were over two times more likely to develop DQ disease compared with the general population.¹¹ Thus, it is important to understand the postoperative symptomology of

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patients with DQ disease following DRF fixation. It is currently unknown whether FDC release during DRF fixation has an influence on symptoms in patients with DQ disease.

Our objective was to determine whether release of the FDC during volar approach for DRF fixation impacted corresponding symptoms in pre-existing DQ disease.

Material and Methods

After obtaining institutional review board approval (#E20034), a prospective, randomized cohort study was performed from January 1, 2017 to December 31, 2019. All surgeries were performed by a single hand surgeon (GG) at a level-I trauma center.

Study parameters

Inclusion required each of the following factors: (1) acute presentation of (2) closed DRF in the dominant upper extremity with articular extension (3) in patients with a confirmed diagnosis of DQ disease within the 12 months preceding a DRF injury. Acute presentation was defined as an initial evaluation being within 3 weeks of injury. Radiography or a computed tomography scan was used to determine articular involvement in all DRFs. Hand dominance was provided by the patient and when necessary, confirmed by medical records. De Quervain diagnosis within the appropriate time interval was confirmed using medical records. Patients were excluded with chronic presentation of DRF, prior DRF, radiographic first carpometacarpal arthritis, or rheumatoid arthritis. All clinical and radiographic evaluations were confirmed by the single surgeon who performed the surgical treatment. There were no patients included in the study who were candidates for surgical release as treatment for DQ disease at the time of DRF fixation.

Grouping for analysis

Patients who qualified and consented to inclusion were randomized to release (release group) or no release (control group) of the FDC during volar approach DRF fixation. Patients were blinded to the intervention as the same skin incision was used for all patients. A power analysis was performed, requiring a final sample size of 23 patients in each group for 80% power to detect the incidence of persistent DQ disease based on the established population. The primary outcome of interest was persistent symptoms consistent with DQ disease at 3-month increments up to 1 year following DRF fixation. Complications collected were infection and subsequent surgery pertaining to the underlying DQ disease.

Surgical technique

The extended flexor carpi radialis approach was used in all cases, consistent with the previously reported technique.^{9,10} The skin was incised from the pole of the scaphoid, aiming obliquely across the wrist creases in a radial dart configuration, then extending approximately 8 cm proximally in line with the FCR tendon. The fibers of the FCR, which are inserted at the trapezial tunnel, were released to facilitate ulnar retraction of the FCR.¹² The brachioradialis tendon was identified proximally and then released with a stepwise cut. During closure, the brachioradialis was repaired and used as an anchor to reapproximate the pronator quadratus. Careful release of the radial septum was performed, being conscious of the underlying radial artery. In the release group, the FDC was released from proximal to distal across the dorsal aspect of the compartment. If present, additional tendon slips and compartments were identified and released. In the control group, no release of the FDC was performed. In all cases, the proximal radius fragment was pronated to expose the

Table 1

Case Characteristics Comparing Release and No Release of the First Dorsal Compartment during Volar Approach for Distal Radius Fracture Fixation

Factor	FDC Release		Statistical Outcome
	No	Yes	
N	23	24	
Patient age (y) [*]	58.7 (7.9)	58.1 (7.7)	<i>P</i> =.82
Gender			<i>P</i> =.87
Female	13 (56%)	13 (54%)	
Male	10 (44%)	11 (46%)	
Diabetes mellitus II			<i>P</i> =.47
No	12 (52%)	15 (63%)	
Yes	11 (48%)	9 (37%)	
Tobacco use			<i>P</i> =.92
No	16 (70%)	17 (71%)	
Yes	7 (30%)	7 (29%)	

^{*} Factors expressed as mean and standard deviation.

dorsal surface. Hematoma was evacuated, and the intrafocal surfaces were prepared for reduction. A fixed-angle volar locking plate was used for fixation in all cases. Closure followed the standard technique and was consistent between the groups. All cases were splinted and then initiated a standard early rehabilitation protocol at the same time point after surgery.

Statistical means

The data were analyzed using Excel (Microsoft). Patient variables and outcome data were expressed as mean and SD. Comparisons of outcome data between the groups were calculated using an unpaired Student *t* test. Significance was set as *P* value of <.05.

Results

Case characteristics

During the study period, 211 patients were treated with internal fixation for DRF through a volar approach. Fifty-seven patients (27.0%) met inclusion criteria, of which 10 (17.5%) were excluded, and 47 (82.5%) were included in the study. The most common reasons for exclusion were no prior DQ disease diagnosis and extra-articular fracture pattern.

Twenty-four (51.1%) patients were in the release group, and 23 (48.9%) patients were in the control group. There were 26 men and 21 women with a mean age of 58.4 years (± 7.8 , range: 38–71 years), and there was no significant difference in age (*P* =.82) or gender (*P* =.87) between the groups (Table 1). There were no significant differences between the groups for the proportion of diabetes mellitus type II (*P* =.47) and tobacco users (*P* =.92). All patients in both groups achieved fracture union without malunion or loss of reduction.

Clinical outcomes

Patients in the release group were significantly less symptomatic than those in the control group at 3 months (relative risk: 3.64, 95% confidence interval: 1.6–8.1, *P* <.001) and 6 months (relative risk: 1.44, 95% confidence interval: 1.0–2.1, *P* =.024) after surgery (Table 2). There was no difference in persistent symptoms between the groups at 9 and 12 months after surgery.

Lateral pinch strength in the release group was significantly greater than that in the control group at 3 months (3.9 vs 2.7 kg, *P* =.002) and 6 months (6.2 vs 4.8 kg, *P* =.023) after surgery. There

Table 2
Results Comparing Release and No Release of the First Dorsal Compartment during Volar Approach for Distal Radius Fracture Fixation

Factor	FDC Release		Statistical Outcome
	No	Yes	
N	23	24	
Lateral pinch strength*			
3 Mo postop	2.7 (1.1)	3.9 (1.4)	$P = .002$
6 Mo postop	4.8 (1.9)	6.2 (2.2)	$P = .023$
12 Mo postop	7.2 (2.6)	8.2 (2.5)	$P = .16$
DQ symptoms*			
3 Mo postop			$P < .001$
No	5 (22%)	19 (79%)	RR 3.64
Yes	18 (78%)	5 (21%)	CI (1.6–8.1)
6 Mo postop			$P = .024$
No	14 (61%)	21 (87%)	RR 1.44
Yes	9 (39%)	3 (13%)	CI (1.0–2.1)
9 Mo postop			$P = .28$
No	21 (91%)	24 (100%)	RR 0.19
Yes	2 (9%)	0 (0%)	CI (0.01–3.8)
12 Mo postop			$P = .98$
No	23 (100%)	24 (100%)	RR 0.960
Yes	0 (0%)	0 (0%)	CI (0.02–46.5)
Relief w/ additional treatment*			$P = .68$
Therapy at 3 mo postop			RR 1.2
No	9 (50%)	3 (60%)	CI (0.5–2.8)
Yes	9 (50%)	2 (40%)	$P = .18$
CSI at 6 mo postop			RR 0.17
No	2 (22%)	0 (0%)	CI (0.01–2.3)
Yes	7 (78%)	3 (100%)	-
FDC release at 9 mo postop			-
No	0 (0%)	0 (0%)	-
Yes	2 (8.7%)	0 (0%)	-
Complications			
Superficial infection			
No	20 (87%)	23 (96%)	RR 0.32
Yes	3 (13%)	1 (4%)	CI (0.04–2.9)

CSI, corticosteroid injection; FDC, surgical release of the first dorsal compartment.
* Expressed as mean and SD in kilograms, DQ symptoms following distal radius fracture fixation, DQ symptom relief following additional treatment, relative risk, and 95% confidence interval, additional treatment for persistent DQ symptoms.

was no difference in pinch strength between the groups at 12 months after surgery.

Complications

There was no significant difference in wound healing complications between the groups with three patients in the control group (13.0%) and one in the release group (4.2%), who were treated with oral antibiotics and local wound care for superficial surgical incision infections ($P = .31$).

All patients in the release group had resolution of symptoms by 9 months after surgery without revision surgery. There were two patients (8.7%) in the control group with persistent symptoms refractory to conservative management who received surgical FDC release at 9 months after surgery. At 12 months following the index DRF surgery, all patients in the control group had resolution of symptoms, including the two patients who underwent additional release surgery.

Discussion

Following DRF, patients with DQ disease were identified and then prospectively grouped for release or no release of the FDC during volar approach for DRF fixation. The results demonstrated a significantly greater reduction in DQ disease symptoms in the release group compared with the no release group during the short-term follow-up. This investigation is unique, without precedent to our knowledge. Carroll et al¹¹ provided an understanding of

the commonality of DQ disease diagnosis following DRF. Surgically managed DRFs were over twice as likely and conservatively managed DRFs were over four times as likely to develop DQ disease compared with the general population. Our findings indicate that routine FDC release during DRF fixation may expedite symptom relief in patients with DQ disease.

Release of the FDC during volar approach for DRF fixation was initially described by Orbay et al⁹ as a component of the extended flexor carpi radialis approach. The intended advantage is to further mobilize the fractured fragments and provide greater visualization to facilitate anatomic reduction. Release of the FDC is also recommended for patients with DQ disease who have failed conservative management.^{7,8} Compartment release decompresses the tendons and should be performed along the length of the sheath. De Quervain cases commonly have anatomical variants with multiple compartments or tendon slips. These variants have been cited as potentially causative for the development of DQ disease. Thus, identification of these variants and complete release is necessary to reduce the risk of symptom recurrence. Larsen et al⁸ aggregated evidence supporting open surgical release across numerous reports, with radial sensory nerve insult being the most common complication. Furthermore, although a longitudinal incision may be preferred, cognizance of the radial nerve is critical. Although there is evidence that endoscopic FDC release may expedite symptom relief and reduce the risk of nerve insult, open release remains most common.

We acknowledge the limitations of the current work. Although all included patients had a recent diagnosis of DQ disease, treatments prior to the injury may not have been consistent and thus are a potential confounder. Furthermore, patients experiencing persistent symptoms received standardized treatment at established time points, which may confound the analysis at later time points. There is potential for diagnostic and reporting errors, and the severity of DQ disease may impact the results. This is a single institution study that unintentionally excluded those patients who were diagnosed and treated for DQ disease at other institutions. All release surgeries were performed by a single surgeon, which homogenizes the groups for release technique. Furthermore, the single surgeon design standardizes the approach and fixation, which may reduce the risk of surgical confounders. There may be an unintended consequence of reduced visualization and suboptimal fracture reduction in the no release group. Although the sample is relatively small for DRF investigation, the groups were formed prospectively and then randomized for the treatment. Also contributing are the qualifier of pre-existing DQ disease and the DRF characteristics. Outside of FDC release, the remainder of the surgical approach was consistent between the groups, and the fixation construct was chosen and applied in a standardized fashion. Furthermore, the technique of release was consistent within the release group, with anatomical variants being noted and addressed. Future investigation may compare series with and without DQ disease to further elucidate the impact of FDC release during volar fixation of DRF.

In conclusion, the current results demonstrated a significantly greater reduction in DQ disease symptoms in the release group compared with the no release group during the short-term follow-up. This indicates that routine FDC release during DRF fixation may expedite symptom relief in patients with DQ disease.

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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