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Original Research

No Difference in Reintervention at 1-Year Between Ultrasound-Guided versus Blind Dorsal Carpal Ganglion Aspiration

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Purpose: The purpose of this retrospective comparative study was to compare the efficacy of dorsal carpal ganglion aspiration in patients who underwent either "blind" (using surface anatomy alone) or ultrasound-guided (US-guided) aspiration.
Methods: Outcome measures were conducted during the coronavirus disease 2019 pandemic via telephone for a minimum of 12 months after aspiration, with efficacy defined by reintervention with either repeat aspiration or surgical excision.
Results: Data are reported for 141 patients (46 blind; 95 US-guided) at an average of 28 months (range, 12–55 months) from aspiration. Reintervention was not significantly different based on the mode of aspiration—26% and 24% for blind aspiration and US-guided, respectively. Patient-perceived recurrence was higher at 65% for the entire cohort. Patients who received steroid injection at the time of aspiration perceived lower rates of recurrence—44% versus 77% for patients who received a steroid injection and patients who did not, respectively.
Conclusions: This study found no significant difference between blind or US-guided aspiration in reintervention at a minimum of 1-year follow-up. Patients who received steroids at the time of aspiration perceived lower rates of recurrence.
Type of study/level of evidence: Therapeutic III.

Wrist ganglions are the most common soft tissue mass of the wrist, with up to 70% of wrist ganglions arising dorsally from the scapholunate ligament.[1] Symptomatic patients are diagnosed via history and physical examination when large or by ultrasound (US) or magnetic resonance imaging when not apparent by physical examination. Patients seek treatment when these ganglions become associated with pain, weakness, increase in size, or interfere with activities.[1,2] Aspiration may be offered before surgical excision. Treatment is largely driven by patient and physician preference. US guidance has gained popularity because it allows for real-time visualization of the needle and surrounding structures during aspiration—potentially ensuring more safe and complete aspiration. However, limited literature exists comparing the efficacy of dorsal carpal ganglion (DCG) aspiration with and without US guidance. Recurrence rates after aspiration and surgical excision are variable across studies depending on the definition used for recurrence (return of symptoms, confirmatory examination, or reintervention) and the duration of follow-up.[3] A meta-analysis by Head et al[3] reported a mean recurrence rate of 59% after aspiration and 21% for open surgical excision with a mean reported time to follow-up of 32 months.

Dias et al[4] compared treatment with observation, aspiration, or surgical excision in a prospective investigation of 236 patients with a mean follow-up duration of 70 months. Of the patients treated with observation alone, 42% had spontaneous resolution of the untreated DCG. The recurrence rates after aspiration or surgical excision were 58% and 39%, respectively. Significantly higher

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patient satisfaction was observed after aspiration (83%) and surgical excision (81%) compared with no treatment (53%) even when there was recurrence of the DCG.

Zeidenberg et al[5] reported on patient satisfaction and outcomes for US-guided ganglion aspiration. Of the dorsal ganglions, 4 (22%) of the 18 patients reported a perceived recurrence of the cyst. Patient satisfaction was high and was inversely related to the recurrence of the cyst. In a small series of 52 patients, Kurkis et al[6] compared US-guided versus blind aspiration of volar and dorsal ganglia of the wrist. Although underpowered, they found a similar rate of recurrence between blind and US-guided aspirations (74% and 69%, respectively). As mentioned, one challenge to the synthesis of the existing literature on the recurrence of DCG after aspiration is the variable definition of recurrence. In many cases, it is determined based on patient-perceived symptomatology, and in a few cases, recurrence is confirmed objectively by either diagnostic imaging, physical examination, or the need for reintervention (by cyst aspiration or excision).

The purpose of this investigation was to determine whether a difference exists in the objective outcome of reintervention at a minimum of 1 year after blind or US-guided DCG aspiration. This outcome measure was chosen to capture clinically relevant cyst recurrence that better replicates recurrence rates in a clinical setting. Secondary aims included a comparison of patient-perceived ganglion recurrence of symptoms, pain severity, patient-rated outcomes, and patient satisfaction. We tested the null hypothesis that there would be no difference in the rate of reintervention or patient-rated outcomes based on the mode of aspiration.

Materials and Methods

The results were presented in accordance with Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[7] This retrospective comparative study included patients with DCGs diagnosed by either physical examination or US who underwent either blind (using surface anatomy alone) or US-guided aspiration. Selection of treatment by blind aspiration or US guidance was determined by the referring provider based on patient and physician preference as well as size (ie, smaller ganglions were more likely to be treated by US guidance). Protocol approval was obtained from the Hospital for Special Surgery institutional review board, and informed verbal consent was obtained from all individual participants included in the study. Two clinical databases (EPIC electronic medical record and the institution Radiology Information System) from a single institution were queried for eligible patients between January 1, 2016, and December 31, 2019, based on the International Classification of Diseases 10th Revision (M67.43 or M67.431 or M67.432 or M.67.439) and Current Procedural Terminology codes (20612 and 20605 with addition of 76942). All patients aged 18–75 years presenting with a primary, simple DCG at our institution were eligible for inclusion. Patients who received previous wrist ganglion treatment (aspiration and excision), completed previous wrist surgery, had a history of fracture or ligamentous tear of the wrist or wrist instability, and had acquired or congenital abnormalities of wrist motion or function were excluded. Details regarding the aspiration procedure including cyst size and whether concomitant steroid injection was performed were also collected via chart review.

The primary outcome measure of reintervention was defined by either repeat aspiration or surgical excision. Secondary outcome measures, including patient-perceived ganglion recurrence (yes/no), patient-reported *Quick* Disabilities of the Arm, Shoulder, and Hand (*Quick*DASH) scores, numeric rating scale pain severity in the dorsum of the affected hand, and two patient satisfaction questions on a 5-point Likert scale (How satisfied are you with the treatment you received for your wrist? And How satisfied are you with the current status of your wrist?), were all collected by a telephonic questionnaire at a minimum of 12 months after aspiration.

Pain severity, patient-reported *Quick*DASH scores, recurrence rates, and patient satisfaction were analyzed by the method of aspiration. Data were analyzed using open-source statistical software. An a priori power analysis was conducted using the rates of perceived recurrence rather than reintervention, as the rates of reintervention were not consistently reported in the literature. The power analysis assumed that 22% perceived recurrence rate for DCG after US-guided aspiration—taken from the study by Zeidenberg et al[5]—and 58% perceived recurrence rate after blind aspiration—taken from the study by Dias et al.[4] This showed that 56 total participants—28 per group—were needed to be able to detect a 36% difference between recurrence rates between US-guided versus blind injections with 80% statistical power. The 36% was achieved by 58% (blind recurrence rate) and 22% (US recurrence rate). Probability values of $\leq$.05 reached statistical significance. Pearson's chi-square test was used for categorical variables, and a *t* test was used for continuous data. Stratified analyses were conducted to investigate the association between the mode of aspiration and the rates of reintervention and patient-perceived recurrence after stratifying by steroid injection at the time of aspiration. Homogeneity between the stratified odds ratios was tested using a chi-square test of homogeneity. If odds ratios were not significantly different, they were pooled to calculate Mantel–Haenszel adjusted odds ratio. The significance of the adjusted odds ratio was tested using the Cochran–Mantel–Haesnzel test. A 5% level of significance was used to evaluate the significance of associations, ie, the *P* value of <.05 was considered significant.

Results

Patient characteristics

A total of 294 eligible patients were identified via chart review, of which 213 received a US-guided aspiration. Patients were contacted via telephone or email up to three times until they either completed or opted out of the study. Of the 294 eligible patients, 141 completed the study, 95 of whom received a US-guided aspiration (Table 1). No differences existed in the response rates between the blind or US-guided group (P =.06). Patients who completed the study tended to have a shorter time since aspiration (28 ± 12 months) than those who did not (35 ± 13 months) (P <.001). Cyst dimensions tended to be larger in the blind group, ranging from 0.8 × 0.8 cm to 3 × 3 cm, compared with 0.2 cm in diameter to 2 × 3 cm in the US-guided group.

Rates of reintervention, patient-perceived recurrence, and patient-reported outcomes

No significant differences existed in the rate of reintervention or patient-reported perceived recurrence by the mode of aspiration (P =.81 and P >.99, respectively). Similarly, no differences existed in the rate of reintervention or perceived recurrence by the mode of aspiration after stratifying by steroid injection (P =.75 and P =.34, respectively). Overall, patients who received a steroid injection reported significantly lower rates of perceived recurrence (44% vs 77%, respectively, P <.001) but not reintervention than those who did not (P =.27; Table 2).

Table 1
Demographic Data by the Mode of Aspiration

Demographic	Blind ($n = 46$)	US-Guided ($n = 95$)	*P* Value
Age (mean, y ± SD)	40 ± 13.8	35 ± 12.4	.04
Sex			
Female	30 (65%)	58 (61%)	.63
Cyst on right hand	27 (57%)	49 (52%)	.43
Steroid injection	16 (35%)	76 (80%)	<.001
Time to follow-up (mean, mo ± SD)	25 ± 8.9	30 ± 12.9	.02

Table 2
Outcome Measures by the Mode of Aspiration

Characteristic	Blind ($n = 46$)	US-Guided ($n = 95$)	*P* Value
Rate of reintervention	12 (26%)	23 (24%)	.81
Rate of perceived recurrence	30 (65%)	62 (65%)	>.99
NRS pain severity (range)	1.43 (0–7)	1.21 (0–7)	.53
*Quick*DASH (range)	11.26 (0–54.55)	10.24 (0–79.55)	.65

NRS, numeric rating scale.

Patient satisfaction

Most patients were satisfied with the treatment they received. Therefore, 78% of the patients who underwent blind aspiration were satisfied or very satisfied with their treatment compared with 72% of the patients who underwent US-guided aspiration (Fig. 1). In addition, 77% of the patients who did not undergo reintervention for their cyst were satisfied or very satisfied with their treatment compared with 65% of the patients who did undergo reintervention (Fig. 2). Approximately 33% of the patients remained unsatisfied or very unsatisfied with the current status of their wrist.

Subanalysis of larger-sized DCGs by the mode of aspiration

Given the larger average size of cysts in the blind group, subanalysis excluding the smallest cysts was performed. The smallest cysts in the blind group were 8 mm at the largest dimension—therefore, a subanalysis, including cysts at least 8 mm at the largest dimension was conducted. Of the 84 patients for whom dimensions were available, 61 were in the US-guided group. After excluding cysts <8 mm at the largest dimension, 23 blind and 41 US-guided were included in this subanalysis. No significant differences were still found in the rate of reintervention by the mode of aspiration in this subanalysis, with 35% reintervention for blind and 20% for US-guided aspiration, respectively ($P = .20$). Similarly, no differences existed in the rates of patient-reported perceived recurrence by the mode of aspiration, average pain level, or mean *Quick*DASH score or satisfaction.

Discussion

This study investigated whether US-guided aspiration of DCG cysts results in different rates of reintervention and patient-rated outcomes compared with blind aspiration based on surface anatomy alone and found no difference. Using reintervention as the primary outcome, 26% of the patients in the blind and 24% of the patients in the US-guided aspiration groups underwent either repeat aspiration or surgical excision at a minimum of 1 year (mean 28 months) follow-up. Despite finding an overall rate of reintervention of just 25%, 65% of the patients reported that they perceived their cyst to be recurrent and 33% reported being unsatisfied or very unsatisfied with the current status of their wrist. Similarly, rates of perceived recurrence and satisfaction did not differ by aspiration mode. Notably, patients receiving a steroid injection at the time of aspiration reported a significantly lower rate of perceived recurrence, irrespective of the mode of aspiration.

The rate of reintervention (by repeat aspiration or surgical excision) was our primary outcome measure. Although the rate of recurrence is used more frequently in the literature, there remains inconsistency with the definition of recurrence as either objective recurrence by radiographic or physical examination versus patient-perceived recurrence. As a result, we included the patient's perceived rate of recurrence as a secondary outcome and found that our results align with the reports in previous literature where the rates of 58% to 74% recurrence after aspiration have been reported.[4,6] Similar to the study by Kurkis et al,[6] our larger, more appropriately powered series found no difference in neither reintervention nor perceived recurrence between blind and US-guided aspiration. Regarding the finding that patients who received steroids were less likely to report recurrence than those who did not receive steroids, this has not been previously reported on in the literature. Unfortunately, because this was not our primary outcome and steroid use was not standardized in our cohort, a meaningful conclusion is limited, although a potential source for further investigation.

Our study also reported on secondary outcomes that similarly showed no significant differences in patient-reported outcomes via *Quick*DASH and numeric rating scale pain severity or in patient satisfaction based on the mode of aspiration. Previous literature suggests that patient satisfaction is not correlated to the degree of symptom resolution but rather the extent of intervention and speed of DCG resolution.[4] We found that patients who did not receive a reintervention were more satisfied than patients who underwent reintervention.

This retrospective study has several limitations. First, treatment by blind or US-guided aspiration was not randomized, but rather, left to patient and provider preference. This likely resulted in selection bias, with more occult and more small cysts being treated by US-guided aspiration. Our subanalysis of larger cysts, although limited in number, did not find any differences in outcome by size. Second, this study was limited to telephonic follow-up and did not include clinical examination (study performed during the coronavirus disease 2019 pandemic). However, our outcome reporting is consistent with previous literature that variably defined failure of aspiration to include reintervention and patient-perceived recurrence. Furthermore, using direct patient contact had the advantage of capturing the reintervention and patient-rated outcomes even if the patient left our hospital system for later treatment. Such patients were likely lost to follow-up in previous studies, which could contribute to the heterogeneity in recurrence rates in the literature. Third, this study was performed during the coronavirus disease 2019 pandemic, during which elective procedures at this institution were paused. As a result, some patients who otherwise may have received reintervention for their ganglion may have delayed treatment. This may have reduced the rate of reintervention found in this study. Fourth, this study was powered to detect a 36% difference based on an a priori power analysis using the existing literature. Given that we only found a 2% difference in the rate of reintervention—26% for blind and 24% for US-guided aspiration, respectively—we were underpowered to detect this small difference. Additionally, although we found that steroid injection was associated with lower

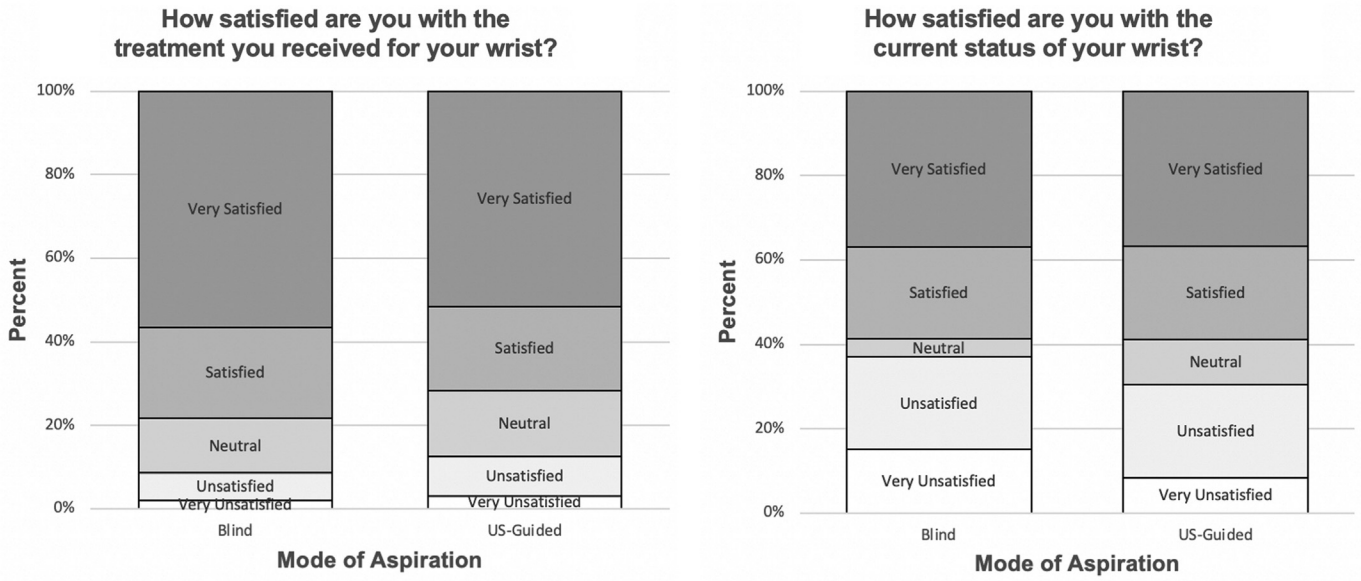

Figure 1. Patient satisfaction by mode of aspiration. A total of 78% of the patients who underwent blind aspiration were satisfied or very satisfied with their treatment compared with 72% of the patients who underwent US-guided aspiration. Approximately 33% of the patients remained unsatisfied or very unsatisfied with the current status of their wrist.

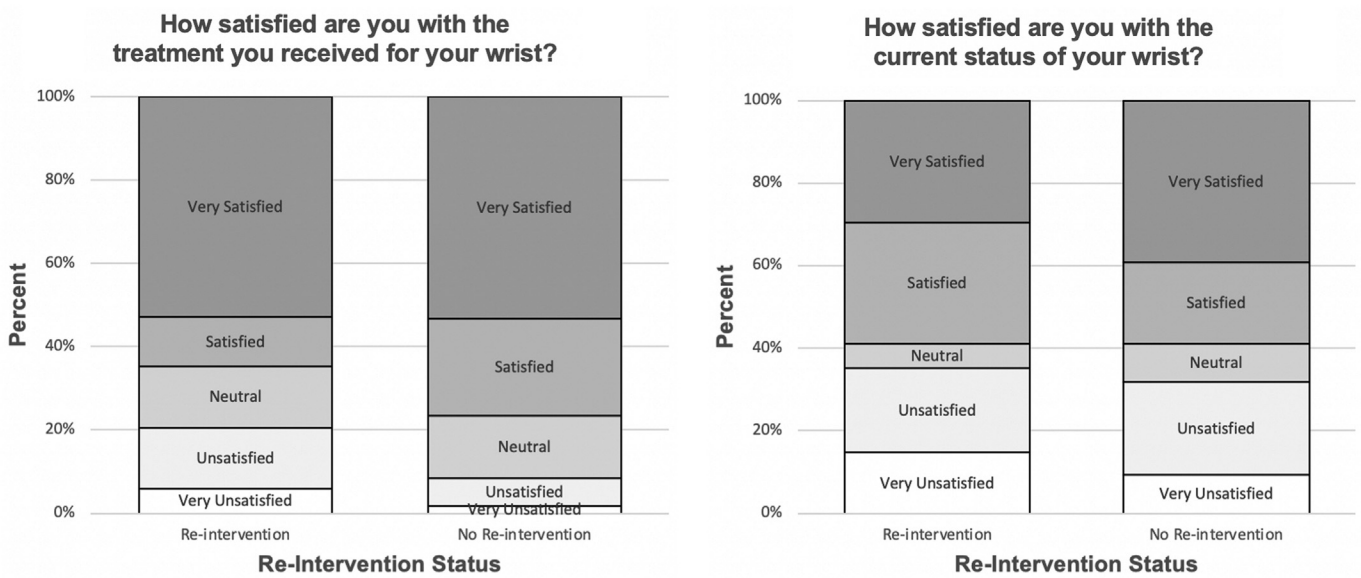

Figure 2. Patient satisfaction by reintervention status. A total of 77% of the patients who did not undergo reintervention for their cyst were satisfied or very satisfied with their treatment compared with 65% of the patients who did undergo reintervention. Approximately 33% of the patients remained unsatisfied or very unsatisfied with the current status of their wrist.

patient-perceived recurrence, the study was not powered to evaluate for this difference. Previous investigations have not reported on the differences in wrist ganglion recurrence based on steroid injection, and this warrants further investigation. Although the response rates for both modes of aspiration were similar, our study was limited by a response rate of 48%. Since patients who completed the survey had a shorter time since aspiration, this may have decreased the rate of reintervention in this study.

This study found no difference in the rate of reintervention, patient-perceived recurrence, or patient-rated outcomes at a mean of 28 months after blind versus US-guided DCG aspiration. This suggests that the decision to use US guidance should be made based on clinical factors relating to the ability to perform aspiration, such as cyst size, not because blind aspiration is less efficacious. Ultrasound guidance remains important both for diagnostic and therapeutic purposes particularly in occult cysts; however, it carries additional costs. Hence, patients should be counseled regarding its use and predicted outcomes. Based on these findings, up to 65% of the patients report recurrent symptoms, and roughly 25% of the patients will develop symptoms substantial enough to warrant reintervention in the first 2 years after treatment, regardless of the mode of aspiration. Further investigation of the impact of concomitant steroid

injection with ganglion excision on patient outcomes is warranted.

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