SCIENTIFIC ARTICLE

Arthroscopic Versus Open Dorsal Ganglion Excision: A Prospective, Randomized Comparison of Rates of Recurrence and of Residual Pain

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Purpose The purpose of this study was to compare the postoperative rates of ganglion recurrence between arthroscopic and open techniques of dorsal ganglion (DG) excision.

Methods A total of 72 patients had either arthroscopic or open excision of a primary, simple DG by 1 of 2 senior hand surgeons. Three prospective postoperative assessments were performed. The first examination was performed at 5 to 7 days, the second at 4 to 8 weeks, and the third assessment was performed at a minimum of 1 year after surgery. Percentages of ganglion recurrence at the second and third assessments were recorded.

Results Forty-one patients had arthroscopic excision, and 31 patients had open excision. Baseline patient age, gender, and surgical side were similar between the 2 groups. Recurrence of the DG at the second postoperative assessment was 1 of 41 patients in the arthroscopic group and none in the open excision group, and, after a minimum of 12 months after excision, recurrence was 3 of 28 in the arthroscopic group and 2 of 23 in the open group.

Conclusions This study compares the rates of ganglion recurrence between arthroscopic and open DG excision. Our results demonstrate that at 12 months follow-up, the rates of recurrence with arthroscopic DG excision are comparable with and not superior to those of open excision. Our results suggest that additional long-term comparative studies are needed to accurately differentiate the efficacy of open and arthroscopic techniques. *(J Hand Surg 2008;33A:471–475. Copyright © 2008 by the American Society for Surgery of the Hand.)*

Type of study/level of evidence Therapeutic I

Key words Arthroscopic excision, dorsal ganglion, prospective, randomized, recurrence, wrist arthroscopy.

Dorsal ganglions (DGs) are one of the most frequent problems of the wrist. They represent benign soft tissue tumors that frequently remain asymptomatic. In most cases, diagnosis is based on history and physical examination.[1–3] Patients seek treatment when these ganglions become associated with pain, weakness, interference with activities, and an increase in size.[1–3] Other than observation, nonoperative treatment such as closed rupture, ganglion puncture, and needle aspiration is associated with relatively higher rates of recurrence as high as 78%.[4–6] Surgical treatment with either open or arthroscopic excision is therefore offered with a lower risk of recurrence. Whereas open excision has historically been the traditional method of surgical treatment,[1–3,7] arthroscopic excision has been suggested as a potentially more favorable alternative.[8–11]

Proponents of wrist arthroscopy proclaim an advantage of decreased postoperative pain, earlier return of functions, and a smaller incision.[8–12] Moreover, preliminary and subsequent studies have touted arthroscopic DG excision as having equal or lower rates of recurrence.[8–11,13,14] However, the results of arthroscopic versus open procedures have never been directly compared. The purpose of our study was to prospectively and randomly compare the rates of recurrence between arthroscopic and open DG excision. A secondary goal was to compare the percentages of patients with residual postoperative pain.

MATERIALS AND METHODS

The study was conducted at a single institution between May 2000 and November 2002. Approval was obtained from the human investigational review board. All patients

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Received for publication April 30, 2007; accepted in revised form January 9, 2008.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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0363-5023/08/33A04-0001$34.00/0
doi:10.1016/j.jhsa.2008.01.009

were evaluated and treated by 1 of 2 senior hand surgeons. Patients with a primary, simple DC with no underlying pathology of the wrist who sought surgical treatment were included in the study. Patients were excluded if they had prior ganglion treatment (rupture, puncture, aspiration, or excision), previous surgery, or a history of a fracture, ligamentous tear, or wrist instability. Patients with major medical problems, unacceptable anesthetic risks, acquired or congenital abnormalities of wrist function or motion, or a history of major psychosis, depression, or substance abuse who would therefore be unable to provide informed consent, were also excluded. Patients who agreed to participate in the study were randomly assigned to have open or arthroscopic excision. Randomization was performed at initial presentation by assigning odd-numbered medical record identifiers to the open excision group and even-numbered medical record identifiers to the arthroscopic excision group. Patient age, gender, surgical side, and workers' compensation were recorded upon entry into the study.

Sample Size

The target sample size was projected on the basis of the rates of recurrence as reported in the literature. Results of previous studies were highly variable for both arthroscopic and open techniques. Arthroscopic excision corresponded with a range of as low as 0 to as high as 7%,[8–11] and open techniques corresponded with a range of 2% to as high as 40%.[7,15–17] For the purposes of our study, we chose to base our target sample size on the lower end of the reported recurrence rates of arthroscopic excision given the recent claims of its superiority over open excision. We chose the average value for recurrence rates reported for open excision because the experience at our institution did not correspond with rates as high as 40%. Thus, this study was designed to have 80% power of detecting a difference of 13% between the recurrence rates of arthroscopic versus open surgery. A power analysis with an $\alpha = .05$ determined that a sample size of 72 patients was needed.

Forty-one patients had arthroscopic excision, and 31 patients had open excision. The mean age for the arthroscopic group was 34 years (range, 16–54 years), and the mean age for the open group was 36 years (range, 10–54 years) ($p = .559$). Twenty ganglions occurred on the right and 21 occurred on the left in the arthroscopic group, and 17 ganglions occurred on the right and 14 occurred on the left in the open group ($p = .611$). One patient in the study from the open excision group received medical coverage through workers' compensation ($p = .381$). The arthroscopic group was composed of 30 females and 11 males, and the open group was composed of 18 females and 13 males ($p = .178$).

Surgical Technique

Surgery was performed in either an ambulatory operatory center or an office operatory suite by 1 of 2 senior hand surgeons. Patients received either general anesthesia, forearm Bier block, or monitored anesthesia care (MAC) supplemented by a local block. A tourniquet and Esmarch bandage were used to exsanguinate the hand and forearm. The open technique consisted of a transverse skin incision approximately 2 to 3 cm in length. The ganglion was amputated at the base of the stalk with preservation of the scapholunate ligament but resection of a portion of the dorsal wrist capsule. The arthroscopic technique consisted of 2 stab incisions at the standard 3-4 and 4-5 portal sites with the shaver in the 3-4 portal and the arthroscope in the 4-5 portal. An arthroscopic shaver was used to debride the ganglion down to the level of the scapholunate ligament including the stalk (which was identified in all 41 surgical procedures) and its attachment to the capsule (Fig. 1). External palpation was used to confirm complete decompression of the ganglion. After both procedures, the wrist was splinted for 5 to 7 days.

Postoperative Follow-Up and Data Collection

The splint and sutures were removed at the first postoperative evaluation at 5 to 7 days, and active and passive range of motion was begun. A second postoperative examination was performed at 4 to 8 weeks. A third postoperative assessment was performed over the telephone at a minimum of 12 months, and patients were asked whether the ganglion looked the same as it did before surgery. In the arthroscopy group, 13 patients were lost to final follow-up, and in the open group, 8 patients were lost to final follow-up. These 2 postoperative time-points were chosen to delineate the recovery phase from a less well defined plateau phase. Residual pain was either present or absent and was specifically described as mild or occasional. Ganglion recurrence and the presence of residual pain at the second and third follow-up evluations were recorded using a binary yes/no database. Complications were recorded.

Data Analysis

Patient age and the number of complications were compared between the arthroscopic and open excision groups using the Student's *t*-test. Gender, surgical side, workers' compensation, percentage of attrition, ganglion recurrence, and residual pain were compared using the Pearson chi-squared test. Statistical significance was set at 95%.

RESULTS

At the second postoperative examination at 4 to 8 weeks, the arthroscopic group had 1 ganglion recurrence (1of 41, or 2%) that was subsequently treated with open excision. No patient in the open group had a ganglion recurrence at this second postoperative assessment ($p = .381$). Seven patients (17%) in the arthroscopic group reported residual pain, and 3 patients (3 of 31, or 10%) in the open group reported residual pain ($p = .369$).

At the third postoperative assessment, 13 patients (13 of 41, or 32%) in the arthroscopic group and 8 patients (8 of 31, or 26%) in the open group were lost to follow-up and

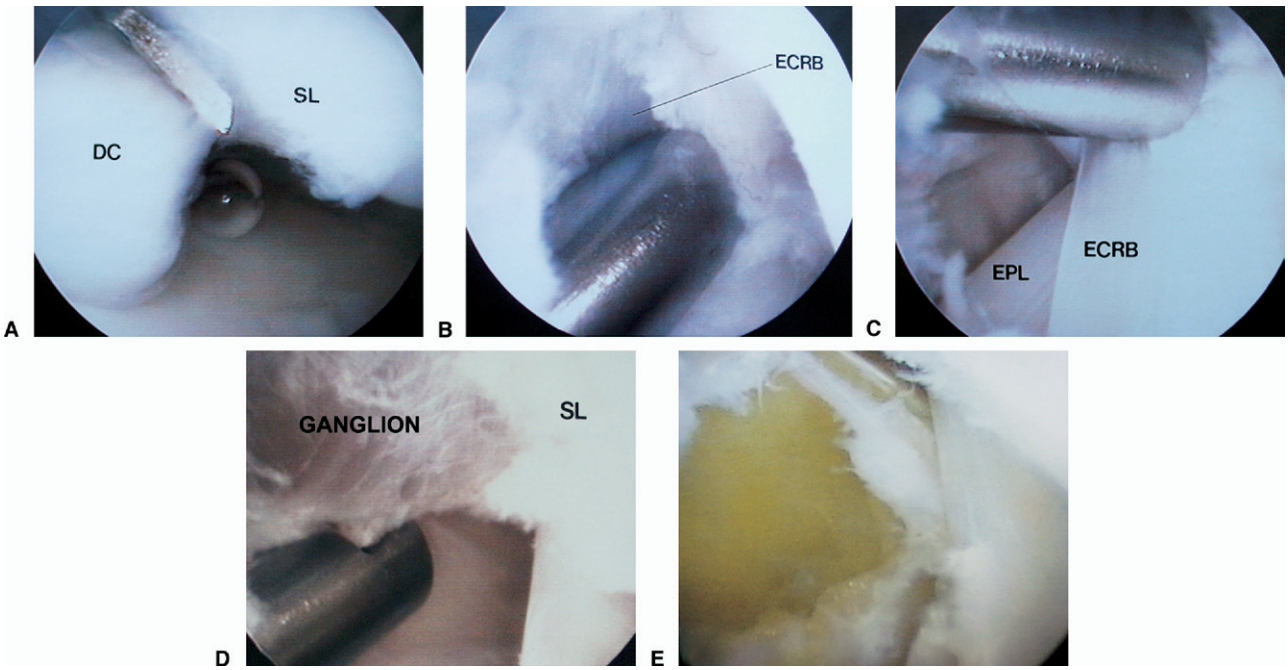

FIGURE 1: A The arthroscope is placed into the 4-5 portal and a shaver into the 3-4 portal with debridement of the capsule opposite the SL joint ligament. B Debridement continues visualizing the ECRB tendon. C Debridement of the capsule continues distally toward the very dorsal SL joint ligament exposing the ECRB and EPL tendons. D The ganglion is debrided with the shaver upon visualization. E After complete ganglion removal, the capsular defect at the site of the ganglion stalk is noted along with subcutaneous fat. DC, dorsal capsule; SL, scapholunate joint; ECRB, extensor carpi radialis brevis tendon; EPL, extensor pollicis longus tendon.

were unavailable for interview (p = .585). Three patients of the remaining 28 (11%) in the arthroscopic group and 2 patients of the remaining 23 (9%) in the open group reported ganglion recurrence (p = .809). Three patients (3 of 28, or 11%) in the arthroscopic group and 4 patients (4 of 23, or 17%) in the open group reported residual pain (p = .49).

The single case associated with workers' compensation had no postoperative problems with ganglion recurrence or wrist pain. This patient was back to full work after the second postoperative examination and reported no change in her ability to work after 1 year.

The arthroscopic group had 1 postoperative complication (1 of 41, or 2%) of neuropraxia of the superficial branch of the radial nerve, which improved after treatment with neurolysis. The open group had no postoperative complications (p = .381). Neither group had any postoperative hematomas, infections, wound problems, or complications related to anesthesia.

DISCUSSION

Excision of the DG is one of the most common procedures performed by hand surgeons. Fortunately, serious complications of surgical treatment are rare.[2,3,15] Recurrence of the ganglion is the most frequently reported failure of any form of treatment and is believed to result from inadequate excision of the stalk.[3–5,11,18]

The advent of wrist arthroscopy has provided surgeons with an alternative method of treatment for the symptomatic primary DG. Arthroscopic surgery offers advantages similar to those that have already been achieved for the larger joints of the body, namely the knee and shoulder. Its main appeal is that it is provides both a direct and "less invasive" view of the chondral surfaces of the wrist.[9,12] Its applications in hand and wrist surgery continue to expand with the development of new instruments and techniques. To date, most studies report favorable results with use of arthroscopy in treating triangular fibrocartilage complex injuries, intra-articular ligament tears associated with carpal instability, Kienböck's disease, and scaphoid and intra-articular distal radius fractures.[9,12]

Reports on use of arthroscopy in the treatment of DGs have also been favorable.[8–11,13,14] However, the results that have been published are based on unilateral analyses and do not directly compare arthroscopic and open techniques. In addition, a recent retrospective study reported a recurrence rate with arthroscopic excision as high as 30%,[19] which the authors attribute to lack of surgical experience. Nevertheless, the majority of these studies report a rate of ganglion recurrence between 0 and 7%.[8–11,13,14] In comparison, results of recurrence found in this study for both arthroscopic (2%) and open techniques (0) at the early postoperative assessment were similarly low and fell within

the range of these rates. Longer follow-up at a 12-month minimum revealed recurrence rates that fell notably higher and just outside this range. Interestingly, this study yielded recurrence rates for arthroscopic surgery that were higher than those for open surgery at both early and late follow-up, a finding that contradicts the espoused benefits of arthroscopy.[12] One reason for this slightly higher rate is that our technique did not include an additional midcarpal portal site, which indeed was recommended by Osterman[10] to rule out additional wrist pathology as a source of the ganglion especially when the stalk of the ganglion is not visible, which was not encountered in this study. However, routine use of midcarpal portals in arthroscopic ganglion excision is controversial.[20,21]

With regard to dorsal wrist ganglions, this study is novel in its prospective randomized design to compare 2 surgical treatment methods. The subjects who composed the 2 different study groups were similar with regard to age, gender, surgical site, and workers' compensation coverage, thus supporting the comparability of the 2 treatment groups with little influence from potentially confounding factors.

Alternatively, this study was overly simplistic in design with the measurement of only 2 dependent variables—rate of recurrence and residual pain. However, the targeted nature of the study was in fact intentional. The aim of this study was not to compare functional outcome but to compare efficacy of treatment. Most patients with primary DGs eventually seek surgical treatment with a desire to removal the ganglion. Although that includes the desire to address and alleviate any associated pain, weakness, or stiffness, the presence and severity of these symptoms are variable, making most indications for surgical excision relative.[22] Thus, for the purposes of this study, efficacy meant successful eradication of the ganglion.

Indeed, the problem of deficient data is not resolved by this straightforward study. First, it remains unclear exactly what is the true range of recurrence rates for the open procedure. Although recent studies on the arthroscopic procedure collectively provide us with a reasonable range of recurrence, the literature on open excision is sporadic, spans several decades of research methodology, and leaves us with a wide range of recurrence from 2% to upwards of 40%. Second, direct comparative functional outcome data is needed to distinguish the effects of arthroscopic versus open excision. Third, in this day of cost-saving discrimination in health care, it behooves us to obtain data that differentiates the economic impact between these 2 methods. Fourth, the final follow-up telephone survey may not accurately reflect the incidence of ganglion recurrence, which might be higher than reported by the patients if the recurrent ganglions are small in size. However, it is likely that this possibility is equal in both groups. Finally, the ongoing observation of variability in rates of recurrence within an acceptable yet sizable range of 0 to 11% also suggests that the exact causes of ganglion recurrence may in fact be more multifaceted than the straightforward concept of insufficient stalk removal. Potentially, the comparative measurement of these dependent variables could be incorporated into a double-blind randomized prospective and, in an ideal world, fully funded study.

Although sufficient power was achieved for the second postoperative visit, the study was also weakened by the loss to follow-up of 21 patients at the third postoperative assessment. Nevertheless, we believe that the findings of this study, though statistically inferior, remain clinically relevant. The reason is that the determination of power with specific regard to recurrence of DG was necessarily derived from a subjective, albeit reasonable, assignment of "expected" values based on the numbers gathered from previously published reports; but because this value assignment is similar to an educated guess, the underlying logic for power determination renders the process of power determination that was used for this particular study somewhat circular. Another reason we believe our findings maintain clinical relevance is that the percent of attrition between the 2 treatment groups remained comparable (13 of 41, or 32%, in the arthroscopic group and 8 of 31, or 26%, in the open group). Similarly, the trend of recurrence rate increase between the second and third time points were analogous and proportional. Finally, the fact that rates between the treatment groups were comparable at both the 4- and 8-week and the 12-month time points indicates that a much larger study size may indeed be necessary to detect with sufficient power a statistically significant difference. This has practical implications for the design and planning of a future study to be able to achieve the needed study size.

The reasons for the high attrition rates are unclear but may be related to ganglion recurrence. For example, patients with no ganglion recurrence and no financial incentive may feel incovenienced by the effort to return for follow-up where no problem exists. Alternatively, patients with ganglion recurrence are more likely to go elsewhere with hopes for definitive eradication. Thus, ascertaining these reasons may be helpful as well for future study.

Since its arrival and widespread application to the field of hand and wrist surgery, arthroscopy has proved vital for treating many challenging and previously untreatable wrist conditions. However, unlike these conditions, the simple, nontraumatic DG, when left alone, rarely, if ever, leads to chronic pain and dysfunction and may spontaneously regress in up to 50% of cases.[23] Thus, surgeons should continue to tailor the chosen treatment method to the specific goals of the patient. With ongoing data analysis, surgeons can better define the unique benefits of specific surgical techniques for DG excision and appropriately apply them to meet the specific needs of the patient. Although other patient-preferred benefits such as improved earlier return of motion may still exist, the results of our study suggest that the

technique of arthroscopic surgery does not achieve superior rates of ganglion recurrence.

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