Complications of Wrist Arthroscopy

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Purpose: To determine the incidence and nature of complications after arthroscopy of the wrist joint.

Methods: The outpatient records and surgical reports of 211 patients who had wrist joint arthroscopy were reviewed to determine type of procedure, type of anesthetic, portals used, and incidence and nature of postsurgical complications.

Results: We identified a total of 11 complications in our patient group (5.2%). Of these, 2 patients (0.9%) developed major complications and 9 patients (4.3%) developed minor complications. Five complications 45% were identified in the immediate postsurgical period and 6 (55%) were delayed complications. All of the minor complications resolved at latest follow-up evaluation with conservative care.

Conclusions: Wrist arthroscopy is a safe procedure with a low rate of major and minor complications. In spite of its limitations wrist arthroscopy remains an invaluable tool in the diagnosis and treatment of wrist joint disorders. (J Hand Surg 2004;29A:406–411. Copyright © 2004 by the American Society for Surgery of the Hand.)

Key words: Wrist, arthroscopy, complications.

Wrist arthroscopy has been used increasingly for the diagnosis and treatment of disorders of the wrist joint over the past 15 years.[1-3] Wrist arthroscopy is used commonly to evaluate and treat patients with tears of the triangular fibrocartilage complex (TFCC), dorsal ganglion cysts, articular fractures of the distal radius carpal fractures and carpal instability, and inflammatory arthritis of the radiocarpal joint among other pathologic conditions.[4-9] Complications arising from wrist arthroscopy are uncommon,[10] but the complication rate with this procedure is largely unknown because most of our knowledge originates from surveys, individual case reports, and cadaveric studies.[11-15] The purpose of this study was to determine the incidence and nature of complications associated with wrist arthroscopy.

Materials and Methods

We reviewed 210 consecutive wrist arthroscopy procedures performed over a 4-year period. The arthroscopic procedures were performed by 3 fellowship-trained orthopedic hand surgeons. The outpatient records and surgical reports of this group of patients were reviewed to determine type of procedure, type of anesthetic, portals used, and incidence and nature of intraoperative and postsurgical complications.

The group was composed of 108 women and 102 men with an average age of 39 years (range, 12–76 years). A general anesthetic was used in 158 patients (75%), a regional anesthetic (interscalene, axillary, or Bier block) in 42 patients (20%), and a combination of general and regional anesthetic in 10 patients (5%). All tourniquet pressures were maintained at 250 mm Hg but the tourniquet was not used routinely. The tourniquet was inflated in 157 patients

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(60%) and, when used, the average inflation time was 52 minutes.

All procedures were performed with the patients in the supine position and the extremity on a hand table. After induction of anesthesia a pneumatic tourniquet was placed in the proximal arm but not inflated routinely. After sterile prepping and draping the wrist was distracted with the use of an extremity traction device (Linvatec, Largo, FL). The hand was distracted using finger traps in the index and ring fingers with countertraction effected by strapping the arm to the base of the tower. Approximately 4.5 kg of distraction force was used in all cases. Before insertion of the arthroscope the radiocarpal joint was distended by injecting sterile saline into the joint. The arthroscopic portals were created by a longitudinal skin incision with an 11-blade knife followed by the soft tissue dissection with a hemostat and penetration of the joint capsule with the blunt trochar. Gravity inflow through the arthroscope combined with gravity outflow (plastic needle catheter) was used in all cases.

The following portals were used. The visualization portal (dorsal 3–4 portal) was placed between the tendons of the third and fourth dorsal extensor compartments 1 cm distal to Lister's tubercle. Similarly, the working portal (dorsal 5–6 portal) was placed between the tendons of the fifth and sixth dorsal extensor compartments at the level of the radiocarpal joint. The outflow portal (6R) was created by inserting an 18-gauge plastic needle (plastic needle catheter) just radial to the extensor carpi ulnaris (ECU) tendon at a level just distal to the ulnar head. A radial midcarpal portal was placed 1.0 cm distal and 0.5 cm ulnar to the dorsal 3–4 portal.

The 2.7-cm arthroscope was used routinely, with the 30° or 70° oblique lens as needed. When needed the 1.9-cm arthroscope was used as well. The diagnostic aspect of the arthroscopic procedure was performed first in the radiocarpal joint to evaluate the articular surfaces, the intercarpal ligaments, and the TFCC. Midcarpal joint arthroscopy was performed subsequently to evaluate the articular surfaces and the intercarpal relationships. When indicated joint debridement and synovectomy were performed using the 3.5-mm full-radius resector or a small-joint arthroscopic cautery probe (Oratec, Menlo Park, CA). Peripheral TFCC tears were repaired by using an outside-in technique using a meniscal repair kit to tie the knot on the wrist capsule with direct visualization to prevent injury to the dorsal sensory ulnar nerve. Electrothermal collagen shrinkage was performed using a specialized small-joint arthroscopic thermal probe (Oratec). Electrothermal collagen shrinkage was performed for grade I or II scapholunate interosseous ligament tears as classified by Geissler and colleagues.[16] The arthroscopic procedures are listed in Table 1.

Table 1. Arthroscopic Procedures

Arthroscopic Procedures	n
TFCC repair or debridement	62
Diagnostic arthroscopy	48
Synovectomy	29
Debridement or ECS of intercarpal ligament tears	27
TFCC repair or debridement and debridement or ECS of intercarpal ligament tears	17
Articular distal radius fracture ORIF	13
Ganglionectomy	6
Perilunate fracture-dislocation ORIF	2
Irrigation and debridement of septic arthritis	2
TFCC repair or debridement and synovectomy	2
Debridement or ECS of intercarpal ligament tears and synovectomy	1
Scaphoid fracture ORIF	1

Abbreviations: ECS, electrothermal collagen shrinkage; ORIF, Open reduction and internal fixation.

The arthroscopic procedures were divided according to the role of the arthroscopy at the time of surgical treatment by modifying the categories introduced by Nagle and Benson[17] Therapeutic procedures were classified as operative or adjunctive. Procedures were considered operative if the entire surgical procedure was performed arthroscopically—for example, arthroscopic debridement of a TFCC tear. An adjunctive procedure was defined as an arthroscopic procedure that was used to aid the performance of an open procedure—for example, intra-articular fractures of the distal radius. The purpose of making this distinction was to determine more accurately complications related to the arthroscopic procedure or open procedure. Any complication occurring after a procedure in which arthroscopy was used adjunctively was evaluated and assigned to either the arthroscopy or to the open procedure for which arthroscopy was used as an adjunct. A total of 159 procedures were defined as operative (76%) and 51 as adjunctive (24%).

An open procedure was performed in addition to the arthroscopy in 122 cases (58%). Of these procedures 56 (27%) included an arthrotomy (eg, an open repair of the scapholunate interosseous ligament) and 66 (31%) were associated procedures that did not involve the wrist joint (eg, carpal tunnel release)

Table 2. Open Procedures Involving Arthrotomy

Open Arthrotomy Procedures	n
Dorsal capsulodesis	11
Ganglionectomy	8
Scapholunate ligament repair/reconstruction	8
Radial styloidectomy	4
Ulnar styloidectomy	4
Open wafer procedure	4
ORIF perilunate dislocation	3
Radiocarpal arthrodesis	3
Lunotriquetral fusion	2
Proximal row carpectomy	2
Open TFCC repair	2
ORIF triquetrum nonunion	1
Hardware removal	1
ORIF distal radius	1
ORIF scaphoid fracture	1
Intercarpal fusion	1

Abbreviation: ORIF, open reduction and internal fixation.

(Tables 2, 3). Only 1 arthroscopic procedure in this series was converted to an open procedure because of difficulties in visualization (an arthroscopic ganglionectomy in which the stalk of the cyst could not be visualized).

Method of Assessment of Complications

Complications resulting from the arthroscopic procedures were classified according to a modification to the criteria for the assessment of complications after arthroscopy of the elbow joint.[18] Complications were tabulated and divided into major and minor. Major complications included (1) compartment syndrome, (2) permanent nerve injury, (3) postsurgical joint infection, (4) vascular injury, (5) reflex sympathetic dystrophy (RSD), (6) permanent wrist or finger stiffness, (7) any complication leading to repeat surgical intervention, and (8) tendon rupture. Minor complications included (1) transient nerve injury, (2) prolonged portal site drainage (longer than 5 days) or infection, (3) transient stiffness (stiffness present 3 months after surgery but resolved at the latest follow-up evaluation), and (4) extensor tendon irritation. Occasional scuffing of the cartilage occurred during several of the arthroscopic procedures. We do not believe that this scuffing led to any measurable deleterious effect in any of the patients' outcomes and thus it was not considered a complication. Each complication was further classified by Warhold and Ruth[12] into (1) complications related to traction and arm positioning, (2) complications related to establishment of portals, (3) procedure-specific complications, and (4) general arthroscopic complications.

In a manner similar to the analysis of complications after elbow arthroscopy [18] complications were further classified temporally into (1) those occurring during the procedure and identifiable in the immediate/early postsurgical period (nerve injury, vascular injury, joint infection, portal site infection/drainage) and (2) those occurring in a delayed fashion later in the postsurgical period (wrist and finger stiffness, RSD, extensor tendinitis). A minimum of 2 months of follow-up evaluation was considered necessary for the assessment of delayed complications[18]; therefore, patients with follow-up periods of less than 2 months (n = 7) were excluded from the assessment of delayed complications. All 210 procedures were considered in the evaluation of immediate/early complications; for the evaluation of delayed complications 203 patients were considered. The average follow-up period for patients in this group was 8 months (range, 3–66 months).

Results

We identified a total of 11 complications in our patient group (5.2%). Of these 2 patients (0.9%) developed major complications. One patient developed permanent wrist stiffness after an arthroscopic

Table 3. Associated Open Procedures

Associated Open Procedures	n
TFCC repair*	11
Tendon synovectomy	8
AIN/PIN neurectomy	6
First dorsal compartment release	6
CTR	5
Ulnar shortening osteotomy	5
External fixator placement	4
Hardware removal	4
Mass excisional biopsy	4
TFCC repair, CTR	2
AIN/PIN neurectomy, CTR	1
First dorsal compartment release, CTR	1
ICBG to distal radius	1
Osteotomy radius, PIN neurectomy	1
PIN neurectomy	1
Pisiform excision	1
Tenolysis	1
TFCC repair,* first dorsal compartment release	1
Trigger finger release	1
Ulnar nerve transposition	1
Ulnar shortening osteotomy, CTR	1

*Arthroscopic TFCC repairs involved a small incision on the ulnar aspect of the wrist to avoid damage to the dorsal ulnar sensory nerve at the time of knot tying.

Abbreviations: AIN, anterior interosseous nerve; CTR, carpal tunnel release; PIN, posterior interosseous nerve.

Table 4. Complications

Complications	Arthroscopic Procedure	Open Procedure
Major		
Permanent stiffness	Synovectomy	
Ganglion	TFCC debridement	
Minor		
Dorsal ulnar sensory neurapraxia	Synovectomy	Ulnar styloid nonunion excision
	TFCC debridement	Ulnar styloid nonunion excision
	TFCC repair	Repair*
Transient stiffness	LTIOL ligament debridement	
	Synovectomy	
Ulnar neurapraxia	TFCC debridement	
Portal site infection	Diagnostic arthroscopy	
Superficial burn	SLIOL and LTIOL debridement	
ECU tendinitis	ECS SLIOL	

*Arthroscopic TFCC repairs involved a small incision on the ulnar aspect of the wrist to avoid damage to the dorsal ulnar sensory nerve at the time of knot tying.

Abbreviations: ECS, electrothermal collagen shrinkage; LTIOL, lunotriquetral interosseous ligament; SLIOL, scapholunate interosseous ligament.

synovectomy. The patient was found to have significant functional disability secondary to the stiffness with an arc of motion of 25° of extension and 30° of flexion 1 year after the arthroscopic procedure. The second patient developed a ganglion over the 3–4 portal 3 months after arthroscopic TFCC tear debridement. The cyst became symptomatic and was surgically excised 1 year after the arthroscopic procedure. The patient remains asymptomatic 1 year after the open cyst excision. We identified no other major complications such as vascular injury, tendon laceration, compartment syndrome, joint infection, permanent nerve injury, or RSD.

The remaining 9 complications (4.3%) are classified as minor. These include 3 patients (1.4%) with transient superficial dorsal ulnar sensory neurapraxia, 2 patients (1%) with transient wrist and finger joint stiffness, 1 patient (0.05%) with an ulnar neurapraxia, 1 patient (0.05%) with a superficial portal site infection, 1 patient (0.05%) with first degree burns to the forearm due to contact with a hot arthroscopic distraction tower, and 1 patient (0.05%) with ECU tendinitis. The cases complicated by dorsal ulnar sensory neurapraxias were all associated with open procedures on the ulnar aspect of the wrist (2 after excision of a nonunited ulnar styloid, 1 after a TFCC repair). Of the patients who developed wrist or digital stiffness 1 had an arthroscopic synovectomy and the other had arthroscopic debridement of a partial lunotriquetral ligament tear. The remainder of the complications and associated procedures are outlined in Table 4.

All of the minor complications resolved at latest follow-up evaluation with conservative care. All of the patients with neurapraxias (3 with dorsal ulnar sensory deficit, 1 with ulnar nerve deficit) recovered complete nerve function at 3 to 4 months after surgery and did not require surgical intervention for treatment. For the patients with wrist and finger stiffness an occupational therapy protocol including range of motion exercises was helpful in re-establishing full range of motion at 4 to 6 months after surgery. The patient with the portal site infection was treated with oral antibiotics, which resulted in resolution of the infection and drainage 1 week after the onset of symptoms. The patient with the first-degree burn-also improved without permanent scarring with local skin care in the form of topical treatment with silver sulfadiazine cream (1%). Finally, the patient with ECU tendinitis improved with conservative care in the form of splinting and 1 corticosteroid injection into the tendon sheath.

All of the complications were identified in the surgical arthroscopic procedures and none in the adjunctive arthroscopic cases. According to the temporal classification of complications 5 (45%) were identified in the immediate postsurgical period and 6 (55%) were delayed complications. According to the Warhold and Ruth classification[12] 2 complications could be ascribed to problems related to traction and arm positioning (the first-degree burn, the ulnar nerve neurapraxia) 2 to the establishment of arthroscopic portals (the ganglion, the portal site infection), 4 to procedure-specific complications (the dorsal ulnar sensory neurapraxias, the ECU tendinitis caused by surgical dissection about the anatomic areas), and

the remaining 3 complications to general arthroscopic complications (wrist and finger stiffness in 3 patients).

Discussion

Complications after wrist arthroscopy are believed generally to be infrequent. The overall complication rate has been estimated at about 2% but this figure represents a gross approximation based on a review of studies with a small number of cases.[10,14] Despite the fact that wrist arthroscopy is a commonly performed procedure the exact incidence of postsurgical complications remains unknown.

Previous studies have documented a small incidence of complications after wrist arthroscopy. A study from members of the Arthroscopy Association of North America identified an overall complication rate of 0.56% in a survey of 395,566 arthroscopic procedures.[11] The study included only 121 wrist arthroscopies and the incidence and nature of complications caused by these procedures are not specified because of the small amount of wrist procedures compared with the number of arthroscopies in larger joints.

Nagle and Benson[17] evaluated their results after 84 wrist arthroscopies in 74 patients. They identified complications in 4 patients (5%) including 1 stitch abscess, 1 inclusion cyst, and 2 patients with mild sympathetic dystrophy. The patient with the inclusion cyst had surgical removal of the cyst 6 months after the arthroscopy. It is unclear from the report whether the inclusion cyst is similar to the ganglion identified in our series. DeSmet and colleagues[13] identified 2 complications in a series of 129 patients (2%) in a study of wrist arthroscopy. The 2 complications involved 1 tendon rupture over a K-wire and a superficial infection. Similarly, Hofmeister and colleagues[19] identified 1 complication in a series of 89 patients (1.2%) in a study evaluating the role of midcarpal arthroscopy in the diagnosis of wrist joint disorders. They identified a partial laceration to the extensor digitorum communis to the small finger that did not require surgical treatment. Many other complications have been described in small case series or case reports including septic arthritis,[20] carpal tunnel syndrome,[21] and posterior interosseous nerve injury.[22]

We identified only 2 major complications in a series of 210 patients (0.9%). One patient developed permanent, functionally disabling wrist stiffness after arthroscopic synovectomy and a second patient developed a ganglion over 1 of the portals that required surgical excision. The cause of the wrist stiffness is unclear but appear to be related to substantial postsurgical pain in the absence of any dystrophic changes. In addition to these major complications we observed minor complications in 9 other patients (4.3%) that resolved with observations or conservative treatment. The most common complication we encountered was dorsal ulnar sensory neurapraxia, all of which were seen in patients having open procedures on the ulnar aspect of the wrist. These neurapraxias occurred despite the fact that the nerve was identified and protected at the time of surgical dissection. Patients having similar procedures such as TFCC repairs and removal or fixation of nonunited ulnar styloid fractures should be warned about the possibility of neurapraxia.

The complication rate after wrist arthroscopy compares favorably with those described for other upper-extremity and foot and ankle anrthroscopies. Kelly et al[18] describe a major complication rate of 0.9% and a minor complication rate of 11% in their series of elbow arthroscopy. Weber and colleagues,[23] in a recent review of complications after shoulder arthroscopy, describe incidence rates of 5.9% to 9.5%. Ferkel et al[24] report an incidence of 9% in a review of arthroscopic procedures of the foot and ankle and state that most complications were minor and self-limited.

There are several limitations to this study. First, because of the relatively small size of the wrist joint arthroscopic procedures are often performed before or in concert with open procedures. For this reason there is a methodologic difficulty in determining whether any given complication occurred because of the arthroscopic procedure or because of the open procedure. For example, consider a case in which arthroscopy is used to determine the degree of articular degeneration before performing an open proximal row carpectomy.

The resultant limitation in motion after the carpectomy cannot reasonably be deemed a complication of the arthroscopic part of the procedure. To deal with this conceptual problem we classified the arthroscopic procedures into operative (if the surgical procedure was performed arthroscopically) or adjunctive (if the arthroscopic procedure was used to aid in the performance of an open procedure) using a modification of Nagle's classification.[17] Any complication occurring after a procedure in which the arthroscopy was considered adjunctive was evaluated and assigned arbitrarily to either the arthroscopy or the open procedure. This arbitrary assignment of the causality of the complications may have led to an

underestimation of the number of complications after the arthroscopic procedures. Nevertheless, we believe that our assessment of the incidence rate of complications is accurate and believe that this methodology is adequate in addressing concomitant open procedures as a confounding factor.

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