ARTHROSCOPIC FINDINGS IN WRISTS WITH SEVERE POST-TRAUMATIC PAIN DESPITE NORMAL STANDARD RADIOGRAPHS

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This study assessed the role of diagnostic arthroscopy following a wrist injury in patients with normal standard radiographs, an unclear clinical diagnosis and persistent severe pain at 4 to 12 weeks. Forty-three patients were included after conservative management had failed to improve their wrist pain so that a stability test could be performed satisfactorily and underwent arthroscopy within 12 weeks. Arthroscopy revealed recent pathology in 41 wrists, of which 17 had significant ligament lesions that might have benefited from acute repair. We conclude that patients with marked persistent post-traumatic symptoms despite conservative management are likely to have sustained ligament injuries despite normal radiographs. We therefore recommend that under these circumstances an arthroscopy is carried out within 4 weeks if the patient and surgeon wish to acutely repair significant ligament injuries.

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INTRODUCTION

The majority of patients with suspected carpal ligament injuries are not immediately referred for further diagnostic procedures (Angermann and Lohmann, 1993). This may be unfortunate since textbooks emphasize the importance of early diagnosis to enable direct repair of carpal ligament injuries (Garcia-Elias, 1999; Taleisnik and Linscheid, 1998). Clinical diagnosis in the acute stage can be difficult because of pain, and standard radiographic examinations are frequently normal even when there is serious ligament damage (Adolfsson, 1992, 1994; Dautel et al., 1993). It has been proposed that the later radiographic findings of carpal instability develop due to a progressive failure of injured ligaments (Linscheid et al., 1972). At this late stage secondary changes, including carpal malalignment, may preclude direct repair. Several studies suggest that wrist arthroscopy is the most accurate method for diagnosis of carpal ligament lesions (Adolfsson, 1992, 1994; Cooney, 1993; Dautel et al., 1993; Pederzini et al., 1992; Richards et al., 1997; Schädel-Höpfner et al., 2001; Schers and van Heusden, 1995). However, since the majority of patients with normal standard radiographs following a wrist injury probably have only partial soft tissue lesions which will probably heal spontaneously, it is not feasible to perform arthroscopy in every case. Guidelines to identify patients with carpal ligament injuries that merit further investigation are therefore needed.

The purpose of this retrospective study was to describe the arthroscopic findings in wrists with normal standard radiographs but severe symptoms in the acute and sub-acute stage following a wrist injury.

PATIENTS AND METHODS

A consecutive series of 43 patients, 26 men and 17 women with a mean age of 30 years (range, 14–51) underwent wrist arthroscopy because of marked persistent pain, reduced range of motion and swelling 1 to 12 weeks following a fall on an outstretched hand. All patients had normal standard repeat wrist radiographs. Patients with a history of previous injuries or pain in the same wrist were excluded. All patients had a clinical examination of the wrist and the findings were recorded prior to further investigation. Patients who had experienced a significant improvement in symptoms during the period between the fall and the clinical re-examination by the wrist surgeon, and in whom a completely normal clinical stability assessment of the radiocarpal, intracarpal and distal radioulnar joints was possible despite pain, were not examined by arthroscopy and were excluded. The 43 patients that were included in this series reported no, or only slight, improvement in their symptoms despite conservative treatment with wrist immobilization, non-steroid anti-inflammatory drugs and hand therapy. All had persistent swelling and a markedly reduced range of motion. At clinical examination points of maximum tenderness and presence of swelling, bruising and range of motion were recorded. Stability tests attempted included the scaphoid shift test (Watson et al., 1988), the ballottment test, the

mid-carpal shift test, assessments of translational and rotational stability of the radiocarpal joint and assessment of distal radioulnar joint stability.

Standard radiographic posterior–anterior and lateral wrist views had been taken of all the wrists at the initial examination. At the re-examination after referral, four projection views of the scaphoid were taken in order to exclude a fracture and assess the scapholunate joint. Measurements of carpal height, the scapholunate angle and radiolunatecapitate alignment were made. Stress views with radioulnar deviation and a clenched fist were impossible to perform due to pain. Nine patients were examined by magnetic resonance imaging (MRI) before the wrist arthroscopy, using standard equipment without contrast.

Arthroscopy was carried out under general anaesthesia within 12 weeks of the injury (mean, 6 weeks; range 2–12). Standard arthroscopy techniques were used and both the radiocarpal joint and the midcarpal space were examined using the 3 to 4, 6R and radial mid-carpal portals (Adolfsson, 1994; Povlsen and Peckett, 2001; Whipple et al., 1986). Ligamentous integrity was assessed with a probe and laxity by external manipulation. Scapholunate and lunate-triquetral (LT) stability were graded according to Adolfsson (1994) into four types. Type A were partial ligament injuries with no instability, type B had instability when stressed but less than 2 mm of gapping, type C could be stressed to separate by more than 2 mm and type D were permanently separated by more than 2 mm without stress. Lesions that did not exhibit fresh, torn edges of ligaments or cartilage, or concomitant bleeding were not regarded as relevant to the recent trauma and are not reported. All findings were recorded in an arthroscopy protocol.

RESULTS

All wrists had normal standard radiographs including scaphoid views. Clinical examinations revealed severe tenderness over the dorsum of the wrist and pain during movements in all patients. Clinical stability testing indicated instability of the DRUJ and injury of the triangular fibrocartilage complex (TFCC) in three patients and a peri-scaphoid soft tissue lesion with suspected scaphoid rotational instability in eight. In the remaining 32 patients the clinical examination was inconclusive because pain precluded accurate stability assessment. Points of maximum tenderness at palpation were found to be relatively reliable indicators of the injury location, since all patients with TFCC lesions were predominantly tender around the distal ulna and DRUJ, and maximum tenderness directly over the scapholunate joint was found in 18 out of 28 patients who had no intraarticular injury to the scapholunate interosseous ligament. The arthroscopies were carried out at a mean of 6 (range 2–12) weeks after the trauma in 28 right and 15 left wrists, and MRI scans without contrast were obtained prior to arthroscopy in nine cases. Only two patients had MRI findings that were confirmed at arthroscopy, and neither had an intrinsic ligament injury (Table 1). Five MRI-scans did not reveal any particular injury but at arthroscopy one total scapholunate ligament rupture, two TFCC 1B lesions and two partial ligament ruptures (one scapholunate, one radioscaphocapitate) were found (Table 1). One MRI report indicated a TFCC lesion that was not confirmed at arthroscopy when a partial lesion of the radioscaphocapitate ligament was seen. At arthroscopy only two of the 43 patients, despite all having normal radiographs, had no intraarticular injury. Twenty-four of the wrists had sustained partial lesions and 17 wrists had more severe injuries, including completely torn ligaments (Table 1). Seven of the 17 wrists with more extensive injuries had total scapholunate ruptures with marked instability (Fig 1) and 10 had TFCC lesions; two 1A, six 1B, one 1C and one 1D according to Palmer's classification (1989). Partial scapholunate ligament injury (Fig 2) was the most common finding among the partial lesions. Partial lesions of the radioscaphocapitate ligament was seen in six patients (Fig 3) and in three this was associated with scapholunate instability and capsular rupture and bleeding in the scapho-trapezium–trapezoid joint (Fig 4).

DISCUSSION

Most soft-tissue wrist injuries have a good prognosis, but occasionally a ligament injury occurs that leads to symptomatic carpal instability. The exact incidence of such lesions is unknown and there are presently no generally accepted guidelines for identifying patients who might benefit from early intervention. The present study demonstrates that a large proportion of patients with marked symptoms which are still present a few weeks after an injury may have sustained significant damage to the soft tissues. Thus the criteria used in this study for selection of patients for arthroscopy were valid in most cases, and they were also feasible. Furthermore, the high proportion of pathological findings indicates that arthroscopy is an acceptable diagnostic tool with high accuracy under these circumstances. The late consequences of the observed lesions are still largely unknown but, according to the literature, surgical repair within 4 weeks of injury could have been considered in up to one-third of our patients (Garcia-Elias, 1999; Lavernia et al., 1992; Ruby et al., 1987; Taleisnik and Linscheid, 1998).

Even though it is likely that early repair of torn ligaments would produce a better outcome than a late reconstruction, no study has yet clearly demonstrated the benefits of early intervention, or even if surgical

Table 1—Sex, age of patient, delay of arthroscopy, side and arthroscopic findings

Patient number	Sex	Age (years)	Injury age (weeks)	Injury side (L or R)	Injuries and ligament grading (-)
1	M	51	6	R	SL-lig.(B) + LT-lig.(A)
2	M	15	6	L	SL-lig.(B) + LT-lig.(A)
3	M	49	8	R	SL-lig.(B)
4	M	30	12	R	SL-lig.(B) + cartilage lesion-SL-J
5	M	39	12	L	SL-lig.(C) + cartilage lesion-SL-J
6	F	20	8	L	SL-lig.(B)
7	M	32	5	R	SL-lig.(A) + LT-lig.(A)
8	M	31	12	R	SL-lig.(B)
9	M	24	8	L	SL-lig.(B)
10	F	28	12	R	SL-lig.(A)
11	M	32	6	L	SL-lig.(C)
12	M	41	8	L	SL-lig.(A)
13	M	45	6	L	SL-lig.(B)
14	M	40	5	R	TFCC-1A + SL-lig.(A)
15	F	20	8	R	SL-lig.(C) + LT-lig.(A)
16	F	18	3	L	LT-lig.(A) + SRL-lig.
17	M	30	10	L	SL-lig.(B)
18	M	19	6	R	SL-lig.(B) + LT-lig.(A)
19	M	29	9	R	SL-lig.(B) + cartilage lesion-SL-J
20	F	29	5	R	TFCC-1A + SL-lig.(A)
21	F	29	3	R	SL-lig.(B) + LT-lig.(A) + RSC-lig.
22	M	36	9	L	TFCC-1B + SL-lig.(B) + LT-lig.(A)
23	F	27	3	R	LT-lig.(A) + SL-lig.(A) + SRL-lig.
24	F	19	2	L	SL-lig.(C) + STT-j capsule + RSC-lig.
25	F	26	2	R	Volar + dorsal capsular bleeding (SRL-lig.)
26	F	58	2	R	RSC-lig. + cartilage lesion-RS-J
27	M	52	2	R	SL-lig.(C) + STT-j capsule
28	M	43	1	R	SL-lig.(B) + RSC-lig.
29	M	25	3	R	SL-lig.(C) + STT-j capsule
30	F	31	3	R	TFCC-1B
31	F	34	2	R	TFCC-1B (DRU-J instability)
32	F	49	2	R	TFCC-1D (DRU-J instability)
33	F	42	12	L	TFCC-1B + RSC-lig. + RL-lig.
34	M	39	8	R	SL-lig.(B)
35	M	14	1	R	**Normal**
36	F	28	8	R	TFCC-1B
37	M	28	12	L	TFCC-1B
38	M	29	12	R	TFCC-1C
39	F	23	3	L	**Normal**
40	M	34	10	R	SL-lig.(C)
41	F	22	3	R	RSC-lig.
42	M	40	5	R	SL-lig.(B)
43	M	31	7	L	SL-lig.(B)
		Mean 30 years	Mean 6 weeks		

Abbreviations: -lig. = ligament, -J = joint, S = scapho, L = lunate, T = triquetrum, R = radius,U = ulnar, C = capitate, TFCC=triangular fibro cartilage complex, STT-J = scapho trapezium trapezoid joint, DRU-J = distal radio ulnar joint

repair at any stage is preferable to conservative treatment. In order to evaluate this it is important to establish the correct diagnosis in the acute stage. Non-invasive diagnostic methods would be preferable if they were sufficiently accurate, but unfortunately this is not the case and by far the most morphological abnormalities in post-traumatic and chronic cases are observed with arthroscopy (Adolfsson, 1992, 1994; Blazar et al., 2001; Cooney, 1993; Johnstone et al., 1997; Kelly and Stanley, 1990; North and Meyer, 1990; Pederzini et al., 1992; Povlsen and Peckett, 2001; Schers and van Heusden, 1995). However the clinical relevance of some of the arthroscopically diagnosed abnormalities is not fully understood.

Arthroscopy allows direct inspection of the intraarticular anatomy and some assessment of laxity and the structural quality of ligaments and cartilage. This is beneficial but the assessment is highly subjective and we believe that descriptive studies are needed to further evaluate the significance of the observed pathologies. As little is known about the natural history of many of the described lesions, exact diagnosis in the acute stages would be of great value. In the present study we used arthroscopic examination protocols to record the findings in order to standardize the procedure as much as possible. Signs of recent bleeding and fresh, torn edges of ligament and cartilage were considered to indicate acute lesions. Laxity between carpal bones during

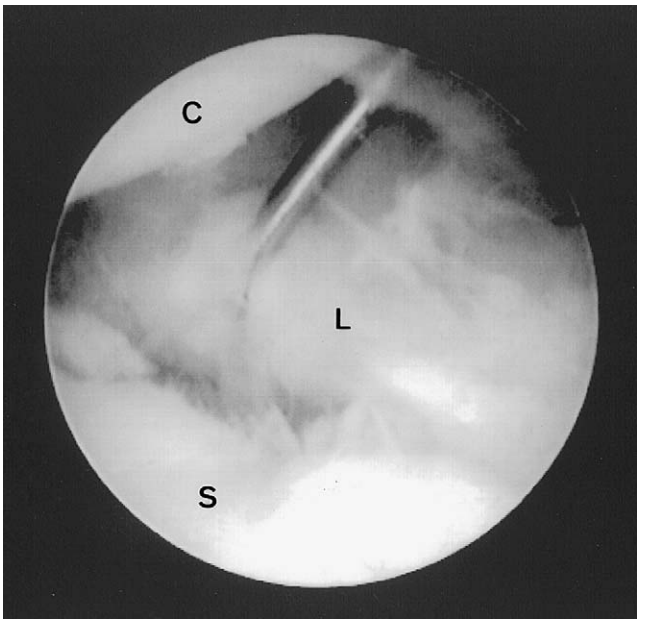

Fig 1 Arthroscopy through the mid-carpal radial portal shows the scapholunate joint opening up completely so the palmar edge of the radius can be inspected: L = lunate, S = scaphoid, R = radius.

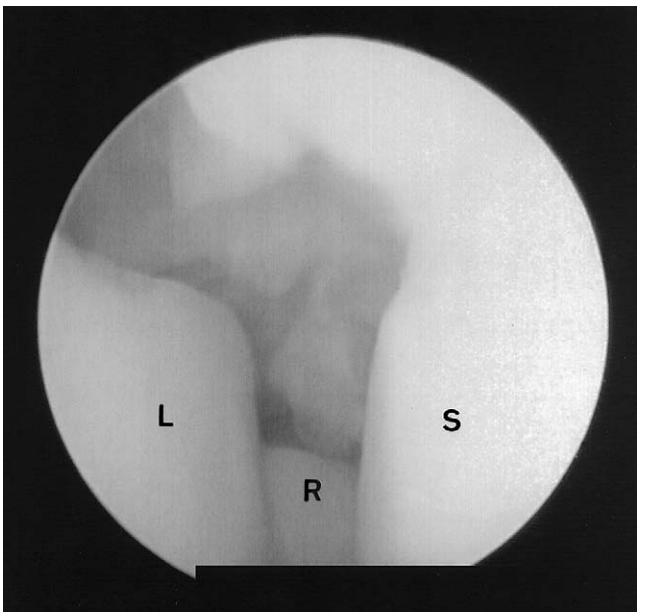

Fig 2 Arthroscopy through the mid-carpal radial portal showing the scapholunate joint "gapping" of less than 2 mm during probing. There are signs of cartilage contusion of both joint edges: L = lunate, S = scaphoid, C = capitate.

provocation was assessed according to previously published criteria (Adolfsson, 1994; Dautel et al., 1993) and increased laxity in combination with a stretched or partially torn ligament was considered a partial lesion. We believe that the recent trauma was

Fig 3 Bleeding in the space of Poirier and a partial rupture of the radioscaphocapitate-ligament in the left wrist. Scaphoid above, radius below, radioscaphocapitate to the right and long radio lunate ligament to the left.

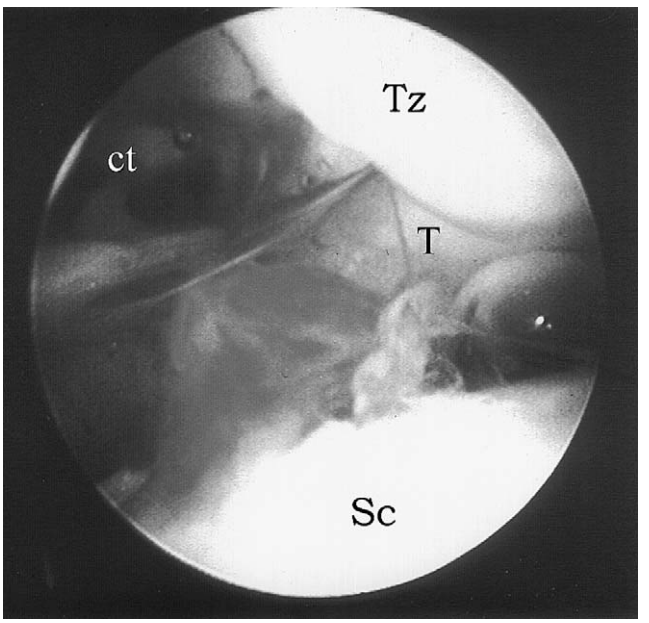

Fig 4 Complete, dorsal capsular rupture in the Scaphotrapezial–trapezoid joint of the right wrist. Distal pole of the scaphoid below, trapezoid top right. Bleeding, ruptured capsule with an air bubble is seen centrally and top left: Sc = scaphoid, T = trapezium, Tz = trapezoid, ct = capsular tear.

the probable cause of the observed lesions since no patient had a history of previous wrist problems and all were relatively young and had clinical symptoms

corresponding to the observed lesions and had increased laxity. Furthermore, only traumatic types of TFCC lesions were found (Palmer, 1989). We found scapholunate ligament lesions most frequently, though there were only seven complete injuries. This supports the view that this is the most common form of carpal instability and that the probable mechanism is a fall on a outstretched hand, causing a forced dorsiflexion (Weinzweig and Watson, 2001). In hyperextension injuries it has been suggested that a rupture of the scapholunate interosseous ligaments begins on its palmar aspect and that the palmar capsule and the radial collateral and scaphocapitate ligaments, as well as the distal ligaments which attach on the scaphoid tubercle, are injured before scapholunate instability can occur (Boabighi et al., 1993; Mayfield et al., 1980; Weinzweig and Watson, 2001). This concept could only partly be substantiated in the present study because bleeding and partial rupture of the radioscaphocapitate ligament and bleeding and capsular rupture in the scaphotrapezium–trapezoid joint were only observed in three of the seven patients with total scapholunate ligament rupture and bleeding in the palmar capsule was noted in only two patients with partial scapholunate ligament tears. Dautel et al. (1993) found ligament avulsion from the distal scaphoid pole in one of their patients with acute scapholunate injury. If this pattern of injuries is constantly occurring in acute, traumatic scapholunate instability, then a surgical repair should probably address the soft tissue damage in several locations, instead of simply reconstructing the interosseous ligament. This was also the conclusion of an experimental study (Boabighi et al. 1993). Scaphotrapezium–trapezoid joint capsular damage was not found in four of the seven patients with scapholunate instability, though it is possible that such damage may have been missed as the radial mid-carpal portal, which was used for inspection of the scaphotrapezium–trapezoid joint in this series does not allow good visualization of that area. Direct inspection through the scaphotrapezium–trapezoid portal might be considered in patients with acute scapholunate instability in future studies. It is also possible that the mechanism of injury was slightly different in these four patients and, created a different pattern of lesions. However, in these cases a longer time had elapsed before the arthroscopy which may have allowed traces of bleeding to disappear and incomplete healing of capsular ruptures and partial ligament tears, both of which would have made assessment more difficult. It thus appears that the arthroscopic examination should preferably be undertaken soon after the injury but, as not all patients with a wrist injury and normal radiographs need an arthroscopy, the criteria for selection of patients for early arthroscopy are unknown. Judging from the frequency of intraarticular pathology in this study, our criteria for selection appear justified. We believe that arthroscopy should be considered in patients with pronounced pain and dysfunction that show no sign of recovery after a few weeks, and that it should probably be performed within 3 or 4 weeks in order to enable a direct repair. Although it cannot be scientifically proven that such management would benefit the patient, early diagnosis and repair is propably preferable. Futhermore, identification of the injuries in the acute and sub-acute phases would help the understanding of the natural history and pathomechanics of carpal instability and allow better evaluation of treatment strategies.

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