The Clinical Outcome after Extra-Articular Colles Fractures with Simultaneous Moderate Scapholunate Dissociation

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Abstract

Background An increased scapholunate gap is sometimes seen in patients with a distal radial fracture. The question remains as to whether this represents a scapholunate ligament injury that requires treatment.

Questions/purposes We wished to examine the natural history of an increased scapholunate gap in patients following an extra-articular distal radial fracture.

Patients and Methods We reviewed 260 patients who had sustained a distal radial fracture at a mean of 6.2 (2.7–11.9) years previously and identified 12 extra-articular fractures with an increased gap between the lunate and scaphoid. The mean scapholunate gap was 2.6 (2.1–3.4) mm, and the mean scapholunate angle 62° (39°–90°). Controls were found among the remaining patients with extra-articular fractures. Selection criteria were same sex, age at fracture within 5 years, time between injury and review within 2 years, ulnar variance within 2 mm, and dorsal angulation within 5° of index patient. When more than one control fulfilled the criteria for an index patient, their values were averaged. In total there were 54 controls for the 12 index patients.

Results The mean difference between index patients and controls in wrist range of motion was 4%, in grip strength 5%, in visual analog scale (VAS) for pain 1 (on a scale from 1 to 100), in Quick-DASH (Disability of the Arm, Shoulder, and Hand) score 5, and in PRWE score 1. The study was calculated to have the power to detect a difference in Quick-DASH scores and in Patient-Rated Wrist Evaluation (PRWE) scores of 14.

Conclusions We conclude that at a mean follow up of 6.2 years following an extra-articular distal radial fracture, no surgical treatment is usually needed with a scapholunate gap of between 2.1–3.4 mm.

Level of Evidence III, Case control study

Keywords

- Colles
- dissociation
- fracture
- radial
- scapholunate
- wrist

It is well documented that patients with distal radial fracture some times also have an injury to the scapholunate (SL) ligament or frank SL dissociation.^{1–12} Akahane and coworkers¹ examined the posteroanterior (PA) radiographs of 96 patients who had sustained a distal radial fracture and

found a widened SL gap in 20%. However, when they employed the tangential PA view described by Moneim,¹³ which is a 30° hyperpronated, tangential PA view of the SL joint, this proportion increased to 53%. The reported prevalence varies between 5% and 38% when determined from standard PA

radiographs.^{4,9–12} The prevalence appears also to depend on the type of distal radial fracture.^{2,4,6,8}

There is still no agreement on what should be done when an increased scapholunate gap is detected in these patients. Some recommend immediate pinning of the scaphoid and lunate or exploration of and repair of any SL ligament tear,^{10,12} while others treat only the distal radius fracture.² The danger of development of a scapholunate advanced collapse (SLAC) pattern is emphasized by some authors.^{1,10} There are, however, few studies that document the medium- and long-term clinical consequences of untreated SL gap widening in association with a fracture of the distal radius. When there is residual wrist pain following this type of injury, it is difficult to determine the relative contributions of the distal radial fracture as compared with any associated SL ligament injury.

We recently reviewed 260 patients with dorsally displaced distal radial fractures.¹⁴ The purpose of the present report is to compare the clinical outcome among those patients who had an increased gap between the scaphoid and lunate at review with patients who did not in a case–control study. The study was approved by the regional medical ethics committee.

Patients and Methods

We reviewed 296 patients resident in the city of Trondheim or three adjoining municipalities who had been treated conservatively at St. Olav's University Hospital, Trondheim, Norway, for a distal radial fracture. Inclusion criteria were dorsal displacement of the distal fragment so that there was 5 degrees or less of remaining volar angulation; AO Type A¹⁵ (extra-articular) fracture; patient age at the time of fracture between 30 and 85 years; as well as a lack of history of any prior or subsequent injuries or conditions that could influence the function of the injured or contralateral wrist or hand from the case-notes or radiographs.

Grip strength was measured at the latest follow up with a Jamar dynamometer (A. Preston Corp., Clifton, NJ, USA). The median value of three attempts was noted. The values for strength in nondominant hands were increased^{16–19} by 10%. We measured the wrist range of motion and forearm supination and pronation with a goniometer. Range of motion of the wrist (ROM) was calculated by adding together the values for extension, flexion, ulnar deviation and radial deviation. Loss of grip strength and ROM were calculated as a percentage of that of the uninjured extremity.

Pain at rest, during daily activities, and during heavy work during the last week before review was recorded on a visual analog scale (VAS), where 0 denoted no pain and 100 the worst imaginable pain. Patients completed the Norwegian short version of the Disabilities of the Arm, Shoulder and Hand (Quick-DASH)^{20–22} and the Patient Rated Wrist Evaluation (PRWE)^{23,24} forms. The first consists of 11 questions related to pain and function in both upper extremities, and the PRWE consists of 15 questions on pain and function only in the injured wrist. Both are scored from 0 (best) to 100 (worst).

Fig. 1 Radiographs (a,b) at injury and (c,d) at final review 4 years later.

Both wrists were X-rayed in frontal and lateral projections with the forearm in pronation. Dorsal angulation of the distal fragment and radial inclination were measured in relation to the long axis of the radius. Volar angulation was given a negative value. Ulnar variance was measured as the difference in height on the anteroposterior (AP) X-ray view between the head of the ulna and the sigmoid notch and given a negative value when the ulna was shorter than the radius. The SL gap was measured at the flat surfaces of the joint (► **Fig. 1**). It was measured with a calibrated PAC system separately by two authors. When they disagreed, the distance was measured together until a consensus was reached. There were no inter or intra observer calculations. The gap was considered pathologic only when the distance between the two bones was 2 mm or more²⁵ and at the same time was obviously greater than in the opposite wrist and greater than the gap between the scaphoid and capitate and between the lunate and the triquetrum in the same wrist. The SL angle was determined by measuring the angle between the lunate axis and the scaphoid axis. The lunate axis was created by a line through the midpoints of the convex proximal and concave distal joint surfaces of the lunate. A line drawn down the long axis of the scaphoid connecting the tangents of the proximal and distal poles of the volar scaphoid on a

lateral X-ray image was considered the axis of the scaphoid (► **Fig. 1**).²⁶ All radiographs of the injured wrists were available at the time of the review of the patients and all the aforementioned measurements except the distance between the lunate and the scaphoid were noted. However, by the time of the present case-control study, the oldest radiographs had been destroyed and radiographs from the time of injury were missing for five patients. The SL gap at the time of injury was therefore not documented for these patients.

Controls were selected from the remaining patients for each index patient with an increased scapholunate gap at final review by the following criteria: same sex; age within 5 years; time between injury and review within 2 years; ulnar variance at review within 2 mm, and dorsal angulation at review within 5° of the index patient. When more than one control was found for an index patient, the data for all controls who fulfilled these criteria were averaged. Measurements for each index patient were compared with the average measurements of their controls. At the end of the study, the power of the data to detect differences between patients with an increased scapholunate gap and controls was calculated.

Results

Eight of the 296 reviewed patients were excluded because of incomplete data or because they turned out after all not to fulfil the inclusion criteria; four patients were excluded because they had suffered high-energy trauma; and 24 patients were excluded because they were found to have had other injuries or conditions of the fractured extremity. All 45 AO type C (intra-articular) fractures were also excluded.

There therefore remained 215 AO type A¹⁵ (extra-articular) fractures. A total of 12 were found to have an increased SL gap on the AP X-ray view taken at the time of the latest follow up. A total of 54 controls, varying between 1 and 12 controls for each index patient, were found. All were women.

The mean age of the 12 index patients was 66 (range 55–85) years at the time of fracture, and the time between injury and the latest review was 6.2 (2.7–11.9) years. The mean gap between the scaphoid and lunate at follow up was 2.6 mm (2.1–3.4 mm; SD 0.5) and the mean SL angle was 62° (39°–90°; SD 15). It was 60° or more in six wrists. Radiographs at the time of the initial injury were available for seven of the index patients. Four showed an increased SL gap (2.0–2.9 mm), and four showed an increased SL angle (62°–91°). Only one of the seven radiographs from the time of injury was normal in both these respects.

Baseline measurements for the index patients and the mean values for their controls were similar (► **Table 1**). There was considerable variation in the clinical outcome parameters between individual index patients and the corresponding mean values for their controls, but the average values for all index patients and all controls were very similar (► **Table 2**).

A power calculation using IBM SPSS SamplePower 3 showed that our data would be able to detect differences in

Table 1 Mean differences between baseline measurements among 12 women with increased SL gap and their individual controls

	Mean	Range	St. dev.
Age at review	0	–5 to 3	2
Age at fracture	0	–5 to 4	3
Years between fracture and review	0.2	–1.0 to 1.3	0.7
Ulnar variance at review (mm)	0	–2 to 2	1
Dorsal angulation at review (°)	1	–3 to 4	2
Radial inclination at review (°)	–1	–8 to 10	6
Radial length at review (mm)	0	–5 to 4	3

both QuickDASH and PRWE of 14 points or more when α was set to 0.05 and β to 0.80.

Discussion

Laulan et al⁴ diagnosed 29 isolated SL lesions in 102 distal radius fractures based on abnormal joint space widening and increased intracarpal angles. Pilný et al²⁷ reported that 16/75 patients showed radiographic signs of SL instability 3 years following a distal radial fracture, with SLAC wrist development in 13 patients. Bunker et al²⁸ reviewed 141 patients with distal radial fractures and found an abnormal SL angle in 39% of the patients. Forward et al² prospectively examined 51 patients with extra- and intra-articular distal radius fractures who were found to have an SL ligament tear

Table 2 Mean differences between outcome measurements among 12 women with increased scapholunate gap and their individual controls

	Mean	Range	St. dev.
QuickDASH	–5	–30 to 26	16
PRWE	–1	–35 to 25	16
Pain at rest (VAS)	1	–14 to 29	10
Pain on daily activities (VAS)	1	–24 to 29	12
Pain on heavy work (VAS)	2	–42 to 69	29
Loss of wrist range of motion (%)	4	–20 to 30	14
Loss of supination/pronation (%)	–1	–9 to 11	6
Loss of grip strength (%)	5	–15 to 39	14

Abbreviations: PRWE, Patient Rated Wrist Evaluation; QuickDASH, Short version of Disabilities of the Arm, Shoulder, and Hand questionnaire; VAS, visual analog score from 0 (best) to 100.

at the time of arthroscopy, which was left untreated. At the 1-year follow-up, the prevalence of subjective pain on examination was significantly greater in those patients with a Geissler grade 3 SL ligament tear (midcarpal step off, > 3 mm SL gap with probing) versus patients with none or a grade I or II ligament tear.

Our material is small but is the result of examining almost 300 patients clinically and radiographically. There is enormous variety among patients with distal radial fractures and among the fractures they sustain. A case-control study like the present, where cases are selected by similarity in age, gender, and fracture characteristics, is much more likely to detect differences in clinical outcome between those with and those without a concomitant increased SL gap than a randomized study is.

We excluded all patients with previous or later injuries to either arm in an attempt to rule out traumatic SL injuries unrelated to the distal radial fracture. We acknowledge, however, that we cannot rule out a pre-existing unilateral increased SL gap that was asymptomatic. Bilateral increased SL distance without a history of previous injury is not uncommon.²⁹ However, none of our index patients had an increased SL gap in the opposite wrist. In our patients radiographs were obtained of both wrists, and the distance between the scaphoid and the lunate was considered pathologic only when it was 2 mm or more, obviously greater than on the uninjured side, and obviously increased compared with the capitolunate and lunotriquetral intervals.

A possible confounder to our findings is that patients who later developed symptomatic SL dissociation may have undergone surgical treatment and were thus not included in this material, creating a possible selection bias. This is unlikely. No patients from the area from which these patients live underwent operation at a chronic stage at our hospital because they had developed clinical symptoms of scapholunate dissociation. For geographical reasons it is very unlikely that they have undergone operations elsewhere. Additional weaknesses of this study include the fact that the patients were not examined for clinical signs of SL instability. There was no investigation of the increased SL gap either by cineradiography, arthrography, magnetic resonance imaging (MRI), or arthroscopy to determine whether this indeed represented a partial or complete SL tear. Radiographs from the time of injury were missing for five of the patients.

Among our patients there was minimal difference between those who had an increased SL gap in addition to their distal radial fracture and those who did not. This is in accordance with the findings of Laulan and Bismuth.⁴ Power calculations showed that our study would be able to detect differences in both Quick-DASH and PRWE scores of 14 points between index patients and controls. Sorensen and coworkers³⁰ found that this was the minimal clinically important difference in these outcome measures.

We conclude that patients who have a moderately increased SL gap in addition to a Colles fracture do just as well as those without this additional injury without any additional surgical intervention.

Conflict of Interest

None

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