EDITOR'S CHOICE

Dorsal Scaphoid Subluxation on Sagittal Magnetic Resonance Imaging as a Marker for Scapholunate Ligament Tear

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Purpose To evaluate the diagnostic utility of scaphoid dorsal subluxation on magnetic resonance imaging (MRI) as a predictor of scapholunate interosseous ligament (SLIL) tears and compare this with radiographic findings.

Methods Thirty-six MRIs were retrospectively reviewed: 18 with known operative findings of complete Geissler IV SLIL tears that were surgically repaired, and 18 MRIs performed for ulnar-sided wrist pain but no SLIL tear. Dorsal subluxation of the scaphoid was measured on the sagittal MRI cut, which demonstrated the maximum subluxation. Independent samples *t* tests were used to compare radiographic measurements of scapholunate (SL) gap, SL angle, and capitolunate/third metacarpal-lunate angles between the SLIL tear and the control groups and to compare radiographic measurements between wrists that had dorsal subluxation of the scaphoid and wrists that did not have dorsal subluxation. Interrater reliability of subluxation measurements on lateral radiographs and on MRI were calculated using kappa coefficients.

Results Thirteen of 18 wrists with complete SLIL tears had greater than 10% dorsal subluxation of the scaphoid relative to the scaphoid facet. Average subluxation in this group was 34%. Four of 18 wrists with known SLIL tears had no subluxation. No wrists without SLIL tears (control group) had dorsal subluxation. The SL angle, capitolunate/third metacarpal-lunate angle and SL gap were greater in wrists that had dorsal subluxation of the scaphoid on MRI. Interrater reliability of measurements of dorsal subluxation of the scaphoid was superior on MRI than on lateral x-ray.

Conclusions An MRI demonstration of dorsal subluxation of the scaphoid, of as little as 10%, as a predictor of SLIL tear had a sensitivity of 72% and a specificity of 100%. The high positive predictive value indicates that the presence of dorsal subluxation accurately predicts SLIL tear. *(J Hand Surg Am. 2017;■(■):■−■. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Diagnostic II.

Key words Scapholunate interosseous ligament tear, scapholunate ligament, SLAC, wrist, MRI.

SCAPHOLUNATE INTEROSSEOUS LIGAMENT (SLIL) injuries represent some of the most common wrist injuries treated by hand surgeons. The anatomy, as well as clinical and radiographic findings, has been described for acute static, acute dynamic, and chronic injuries.[1−16] The radiographic findings for acute static injuries include a widened scapholunate (SL) interval with a gap greater than, or equal to, 3 mm

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and the ring sign, in which the scaphoid tubercle is projected as a ring because the scaphoid is flexed.[1] On the lateral view, the scaphoid assumes a flexed posture relative to the lunate, with resulting dorsal intercalated segment instability. Common radiographic markers to diagnose dorsal intercalated segment instability include SL angle (>70°), or the scaphocapitate or scaphoid-third metacarpal angle (> 15°−20°).[2] For dynamic instability, stress views may elicit similar findings on radial and ulnar deviation, clenched fist, or pencil grip views.[2] On clinical examination, patients will exhibit tenderness at the SL interval and have a positive scaphoid shift test.[17] However, clinical examination for SLIL pathology has a reported 48% sensitivity and 67% specificity using arthroscopic confirmation as the reference standard.[6]

Advanced imaging such as magnetic resonance imaging (MRI) may allow for a more detailed understanding of SL ligament injuries and associated anatomy. However, despite improvements in quality and resolution, current MRIs still have limitations in delineating the integrity of the SL ligament. Interpretation depends on imaging sequence protocols, magnet strength, and radiologist experience. Prior studies have found MRI examinations for SLIL tears to have an average of 71% sensitivity (range, 38%−88%) and 88% specificity (range, 46%−100%),[2,4,5,7,10,18] using arthroscopic confirmation as the reference standard. Individualized wrist coils for wrist MRI may help improve MRI quality, but this is not available at all institutions. In addition, MRIs allow for evaluation of the articular surface in high resolution. The condition of the articular cartilage is important when considering treatment for subacute injuries that begin to exhibit signs of a chronic injury with degenerative changes, or changes of scapholunate advanced collapse.[19]

The purpose of this study was to describe and evaluate MRI findings found in SL ligament injuries in comparison with plain radiographic findings. We hypothesized that wrists with complete SLIL tears are associated with dorsal subluxation of the scaphoid relative to the radius (scaphoid facet) and joint incongruity. Common radiographic markers of SLIL tears may not easily predict dorsal subluxation of the scaphoid. Magnetic resonance imaging may be a more accurate predictor of SLIL tears than radiographs and can serve as an important adjunct to the physical examination in confirming injury to the SL ligament.

MATERIALS AND METHODS

After institutional review board approval was received, a retrospective chart review of 36 MRIs was performed: 18 (16 men, 2 women) MRIs with known operative findings of complete Geissler IV SLIL tears surgically repaired, and 18 (16 men, 2 women) MRIs performed for ulnar-sided wrist pain but an intact SLIL, confirmed arthroscopically (control group) (Fig. 1A). Mean age in the complete Geissler IV SLIL tear group was 38 years (range, 19−64 years). Mean age in the control group was 39 years (range, 18−63 years). Consecutive cases were identified via a Current Procedural Terminology code search for SLIL Repair (25320) and TFCC (triangular fibrocartilage complex) Repair (29846) for the control group. Operative reports were then reviewed to confirm the surgical procedure performed. Magnetic resonance imaging studies were performed using a 3.0-Tesla magnet, using dedicated surface coils, with the wrist in a neutral position with respect to flexion, extension, and radial/ulnar deviation.

Dorsal subluxation of the scaphoid was measured on the sagittal MRI cut, which demonstrated the maximum subluxation (Fig. 1B, C). Cases were randomized between groups and the reviewers were blind to which group each case belonged. The 2 reviewers included a fellow (D.W.M.) in hand surgery and the senior author (M.G.C.). Independent samples *t* tests were used to compare radiographic measurements of SL gap, SL angle, and capitolunate/third metacarpal-lunate angles between the SLIL tear and the control groups and to compare radiographic measurements between wrists that had dorsal subluxation of the scaphoid and wrists that did not have dorsal subluxation. Interrater reliability of subluxation measurements on lateral radiographs and on MRI were calculated using kappa coefficients.

RESULTS

Thirteen of 18 wrists with complete Geissler IV SLIL tears had greater than 10% dorsal subluxation of the scaphoid relative to the scaphoid facet. Fourteen of these had greater than 1% subluxation. Average subluxation in this group was 34% (SD ± 21%; range, 10%−70%). Four of 18 wrists with known SLIL tears had no subluxation. None of the wrists without SLIL tears (control group) had dorsal subluxation ($P < .05$). Ten percent dorsal subluxation was used as a minimum cutoff marker for dorsal subluxation to eliminate decisions on whether very minimal amounts of subluxation were real.

On plain radiographs, scapholunate gap (3.9 mm vs 1.6 mm; $P < .05$), SL angle (86° vs 56°; $P < .05$) and capitolunate/third metacarpal-lunate angle (7° vs −13°;