Prevalence of Radioscaphocapitate Ligament Lesions and Correlation with Associated Pathologies: Volar Ganglion and Distal Radius Fracture

Tashin Khundkar1,2, Iain Elliott3, Elizabeth A. Ouellette4-5, Razvan Nicolescu6, Paul Clifford6.
1Wayne State University School of Medicine, Detroit, MI, USA, 2Max Biedermann Institute for Biomechanics, Miami, FL, USA, 3University of Florida, Gainesville, FL, USA, 4Physicians For The Hand, Miami, FL, USA, 5Florida International University Herbert Wertheim College of Medicine, Miami, FL, USA, 6University of Miami Miller School of Medicine, Miami, FL, USA.

Disclosures:
T. Khundkar: None. I. Elliott: None. E.A. Ouellette: 2; Auxxillium, Synthes. 3B; Stryker. R. Nicolescu: None. P. Clifford: None.

Introduction: Despite the growing recognition of the clinical importance of radiocarpal ligament pathology, there are very few studies that describe these ligaments aptly. Along with intrinsic carpal ligaments, extrinsic radiocarpal ligaments serve as secondary carpal stabilizers. One study, by Scheck et al., compared MRI findings on volar extrinsic ligaments with arthroscopic findings in 35 patients with refractory wrist pain. Arthroscopically, they observed full-thickness tears in 10% of Radioscaphocapitate ligaments (RSCL). Another study by Mak et al. evaluated 26 consecutively registered patients who underwent arthroscopy and MR arthrography and found radioscaphocapitate tears in 50% by MR arthrography and 31% by arthroscopy. This study further concluded that due to the increasing clinical significance ascribed to the extrinsic carpal ligaments, further work refining both imaging techniques and diagnostic criteria in the MRI evaluation of these structures is warranted. The aim of the current study is to report the incidence of RSCL pathology in cadaveric specimen by MRI before and after a simulated fall, and to comment on associated lesions such as the formation and disappearance of volar ganglion and occurrence of related distal radius fracture.

Methods: Forty-eight fresh frozen cadaveric arms were used for this study. All of the arms were transected 18cm proximal to the Lister’s tubercle. All 48 limbs were evaluated with MRI prior to testing. Biomechanical testing was undertaken to simulate a fall on an outstretched hand in different orientations. In the first set of 24 arms, eight were mounted perpendicular to the MTS tabletop, 8 were radially deviated 10-15°, and eight were ulnarly deviated 10-15°. All arms were mounted at 80° of wrist extension and full pronation. The second set of 24 arms received an external forearm rotation (torque force stimulation): twelve were externally rotated and 5N-m of torque applied, with six of the arms perpendicular to the MTS tabletop and the other six ulnarly deviated 10-15°. The last set of twelve arms were internally rotated and 5N-m of torque applied, with six of the arms perpendicular to the MTS tabletop and the other six radially deviated 10-15°. After loading onto the MTS machine, the arms were axially displaced 2.5cm at a compression rate of 5 cm/sec. Post Injury MRI scans were gathered using a 3 Tesla scanner. All findings were seen in at least two planes. A perforation was classified as a partial tear if the ligament was still intact in structure but had disrupted fibers. Full thickness tear of the ligament were classified as a complete tear.

Results: 76% (34/45) of the wrists had at least a partial RSCL tear, of which 18% (8/45) were complete and 58% (26/45) were partial. From the 19 wrists with volar ganglions, 74% had a partial RSCL tear while 21% had a complete tear and 0.05% was intact. After the simulated fall on outstretched hand, a decrease in the number of volar ganglions was observed, from 19 to 12. From the 12 wrists with volar ganglions post injury, 50% had a partial RSCL tear while 50% had a complete tear and 0% were intact. In wrists that had a distal radius fracture before simulated injury, 72% (8/11) had at least a partial RSCL tear_45% had a partial and 27% had a complete tear. After the simulated fall on outstretched hand, the number of distal radius fractures increased from 11 to 37. Of the wrists that had a distal radius fracture after simulated injury, 89% had at least a partial tear_27% had partial and 62% had complete tears.

Discussion: In comparison to the 10% complete RSCL tear reported by Scheck and colleagues in patients with refractory wrist pain, we find full thickness tears in 18% of our unaltered cadaveric specimens by MRI. A large number of the cadaveric wrists had at least a partial RSCL tear (76%), majority of which start along the long axis of the RSCL (Fig. 1) Volar ganglions were sometimes observed forming along these partial tears (74% of wrists with a volar ganglion also had a partial RSC tear). This finding is in accordance with the speculation that pre-existing joint pathology (including ligament injury) is the underlying cause of cyst formation. After the simulated fall on an outstretched hand, many of the partial tears progressed to complete tears (62%), where the longitudinal perforations progressed to transverse tears followed by full rupture of the ligament (Fig. 2A). Along with the progression to a complete tear, we observed the disappearance of volar ganglions after simulated injury. Furthermore, since the RSCL originates from the radial styloid, we note a high correlation of RSCL tear progression and distal radius fractures (Fig.2B).

Significance: An increased understanding of the prevalence of RSCL tears, along with pattern of rupture and associated pathologies is presented. Our findings highlight the importance of suturing the perforations in a cyst excision procedure and
might explain why cyst aspirations are associated with a higher rate of recurrence.

Acknowledgments: This work was performed at Max Biedermann Institute for Biomechanics, Miami, FL


Figure 1: Progression of association with RSC pathology before and after wrist tendon extubation. A: Volar ganglion and B: Distal radius fracture. Note the association of volar ganglion with partial RSC tears and the progression of complications with ankle sprain injury. In contrast, distal radius fractures correlate with complete rupture of the RSC.
Figure 2: MRI images of the knee with registration points and contour lines for comparison. A: Pre-operative MRI showing normal bone and tissue. B: Post-operative MRI with applied cartilage repair, showing improved bone density and cartilage quality.