Management of Intercarpal Ligament Injuries Associated with Distal Radius Fractures

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KEYWORDS

• Distal radius fracture • Intercarpal ligament • Scapholunate • Lunotriquetral

KEY POINTS

- There are reports of up to 69% prevalence of intercarpal ligament injury in the setting of distal radius fracture.
- High-grade scapholunate tears impart more long-term symptoms and disability than low-grade tears or lunotriquetral ligament injuries.
- The diagnosis requires a high index of suspicion and begins with radiography and may require advanced imaging such as computed tomography arthrography or MRI. Ultimately, arthroscopy remains the gold standard for diagnosis.
- Optimum management is controversial and should be directed toward ligamentous injuries that create static or dynamic instability or are found on advanced imaging/arthroscopy for clinical suspicion.

INTRODUCTION

Distal radius fractures (DRF) represent 14% of all extremity injuries.[1] These injuries are a common reason for presentation to medical services and are often caused by falling onto an outstretched hand when the wrist is extended, after high-velocity impacts such as those associated with motor vehicle accidents or after minimal trauma in the elderly population.[1–3]

The prevalence of ligamentous injury associated with fractures of the distal radius has been reported to be as high as 69% when partial injuries are included.[4] Injury to the scapholunate interosseous ligament (SLIL) has been reported to occur in 16% to 40% of patients[5–7] and injury to the lunotriquetral interosseous ligament (LTIL) in 8.5% to 15% of patients with distal radius fractures when evaluated arthroscopically.[5,7] Extension into the lunate facet[5] or greater than 2 mm in ulnar positive variance at the time of injury[8] were suggestive of an intercarpal ligament injury.

The SLIL, in conjunction with the LTIL, imparts stability to the proximal row of the carpus. An isolated, complete tear of the SLIL results in scapholunate instability[9–12] and can progress to a predictable pattern of posttraumatic wrist arthritis through a scapholunate advanced collapse pattern.[12] When associated with distal radius

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fractures, SLIL injury causes progressive deterioration of the intercarpal relationship.[8,13,14]

Multiple reports in the literature describe the types of distal radius fractures associated with intercarpal ligament injuries. Mudgal and Hastings proposed the pathomechanics of combined intercarpal ligamentous injuries and DRF through 2 potential mechanisms.[15] One mechanism is associated with a die-punch fracture and results in compression loading with shear stress across the SLIL. The other mechanism consists of a combination of tensile stress and compression stress at the SLIL resulting from a 4-part distal radius fracture. Mudgal and Jones, using plain radiographs only, described 10 cases of SLIL injury in the setting of 4-part intra-articular distal radius fractures.[16] These authors reported that injuries with die-punch fragments, dorsal comminution, and abnormal scapholunate angle intervals had a high likelihood of SLIL injury. Forward and colleagues[8] reported that grade III SLIL injuries can be associated with ulnar positive variance at the time of initial presentation of a distal radial fracture. These injuries could lead to scapholunate dissociation (SLD) at final follow-up, particularly in patients with intra-articular fractures.

Ogawa and colleagues[17] reported a series in which SLIL and LTIL injuries were present not only in severely comminuted intra-articular fractures but also in minimally displaced extra-articular fractures. Although Mudgal and Hastings[15] only considered intra-articular fractures, similar mechanisms would explain the occurrence of ligamentous injuries in extra-articular fractures.

The utility of standard radiographs in the diagnosis of SLIL injuries has been debated. Kwon and Baek[18] reported that the scapholunate interval was consistently greater in complete SLIL injuries compared with lower-grade injuries and in ulnar deviation compared with radial deviation. They concluded that a scapholunate interval of greater than 2 mm was satisfactory in diagnosing arthroscopy-confirmed Geisler III or IV SLIL injuries.[18] In a survey study of more than 200 surgeons, Gradl and colleagues[19] examined the interobserver reliability, sensitivity, and specificity of radiographs in diagnosing SLIL injuries in the setting of intra-articular distal radius fractures. Each true SLIL injury was confirmed using computed tomography (CT) arthrography or arthroscopy. The authors reported that radiographs are moderately reliable in diagnosing SLIL injuries in distal radius fractures and are better at ruling out these injuries than confirming their presence.[19]

In a comparative study between advanced imaging and radiography, Suzuki and colleagues[20] reported that coronal CT scans were the most effective in diagnosing an arthroscopically confirmed SLIL injury using measurements of the scapholunate interval. They further discussed the limited interobserver reliability of plain radiographs in measuring the scapholunate interval and that the reliability and accuracy improved with the use of CT scans preoperatively.

Some investigators use the standard use of CT arthrography as part of the diagnostic algorithm for patients with intra-articular distal radius fracture and radiographic signs of SLIL[21,22] Previous studies suggest that CT arthrography of the wrist can detect scapholunate and lunotriquetral ligament injury with a sensitivity of up to 94% and specificity of up to 95%.[19]

High-resolution magnetic resonance imaging (MRI) is now the advanced imaging modality of choice for evaluating the SLIL in most centers.[23] Reliable and accurate MRI diagnosis depends on multiple factors, such as the imaging protocol, the radiologist's experience, and whether the tear is complete or incomplete. MRI, with or without gadolinium injection, is reported to have an average of only 71% sensitivity, 88% specificity, and 84% accuracy in detecting SLIL tears.[24–31] Others have reported a sensitivity of 89% and a specificity of 100% for detecting SL ligament tears using 3 Tesla MRI.[32]

Arthroscopy remains the gold-standard diagnostic tool for determination of intra-articular pathology in the setting of distal radius fractures. SLIL and LTIL injuries are graded by the arthroscopy classification by Geissler (**Table 1**).[5]

Patients with SLIL injury and associated distal radius fractures may have worse wrist function than those with distal radius fracture alone if treated conservatively.[14] Complete SLIL injuries associated with distal radius fractures result in increased scapholunate joint pain and scapholunate dissociation.[8] Early diagnosis of these complete injuries facilitates reduction and repair and may lead to improved outcomes.[33]

SURGICAL TECHNIQUE

Preoperative Planning

The diagnosis of any intercarpal ligament injury begins with a thorough clinical examination. However, the diagnosis of acute ligamentous injury is difficult, especially when associated with a fracture of the distal radius. Fracture-associated pain and concomitant bony instabilities preclude provocative wrist ligament testing.[23] Intercarpal ligament injuries can be diagnosed by various modalities, including radiography, fluoroscopy, arthrography, MRI, and arthroscopy. Although wrist