Diagnosis and Treatment of Acute Lunotriquetral Ligament Injuries

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KEYWORDS

• Wrist • Ligament • Lunotriquetral • Intercarpal • Arthroscopy

KEY POINTS

- Lunotriquetral (LT) injuries are uncommon entities that require precise clinical evaluation with findings of point tenderness at or surrounding the LT interval.
- Radiographs show typically normal findings in cases of LT ligament injury.
- Diagnostic arthroscopy provides the most accurate means of accessing the LT joint.
- Treatment options for acute LT injury include immobilization, arthroscopic debridement, and direct open repair.

INTRODUCTION

Isolated lunotriquetral interosseous ligament (LTIL) injury is an uncommon and often missed diagnosis. The acute injury typically presents with normal findings on radiographs, and the physical findings can be confounded by other concomitant injuries on the ulnar side of the wrist. LT injury can be clinically encountered in athletes participating in high-energy/impact sports such as football, hockey, rugby, and basketball.[1] LT injury presents within a spectrum of severity, similar to scapholunate (SL) injuries, and injury can range from isolated membranous tears to frank dislocation. Several different mechanisms of injury have been described, including dorsally applied forces, ulnar positive variance, and perilunate/reverse perilunate injury patterns. Patients present complaining of ulnar-sided wrist pain and decreased grip strength. Successful treatment of LT injury is predicated on the proper index of suspicion, precise diagnosis, the chronicity with which the injury presents, and the assessment of the degree of carpal instability. For the specific treatment of acute LT injuries, options include steroid injection, immobilization, arthroscopic debridement, and open ligament repair. Chronically presenting injuries are managed with ligament reconstruction using tendon grafts, limited intercarpal fusions, and ulnar shortening.

PATHOMECHANICS

The LTIL stabilizes the LT joint.[2] The LTIL, like the SL ligament, is made up of 3 regions, a dorsal, membranous, and volar region. The volar region of the LTIL is the most stout and is considered the major constraint to LT motion. There are several extrinsic ligaments that help to further stabilize the LT relationship; these include the palmar radiolunotriquetral ligament and the dorsal radiocarpal ligament.

It is important to understand the triquetrum's role in carpal mechanics to understand the problems that develop after LT injury. The triquetrum links the distal carpal row to the proximal carpal role through its articulation with the hamate. During radial deviation, the scaphoid is pushed into

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flexion by the distal carpal row and pulls the lunate and triquetrum into flexion through an intact scapholunate interosseous ligament (SLIL). During ulnar deviation, the exerted extension force on the triquetrum pulls the rest of the proximal carpal row into extension through and intact LTIL. In radial and ulnar deviation, the motion of the proximal carpal row is the inverse of the distal carpal row; in radial deviation, the distal carpal row moves radially, extends, and supinates, whereas the proximal carpal row flexes and translates ulnarly. During ulnar deviation of the wrist, the distal carpal row moves ulnarly, flexes, and pronates, whereas the proximal carpal row extends and translates radially. The lunate, with its interosseous attachments to the SLIL and LTIL, tends to remain balanced because of the opposing forces between the 2 flanking bones (3). With disruption of either the SLIL or LTIL, the lunate is pulled in the direction of the intact ligament, palmar with an intact SLIL and dorsal with and intact LTIL. Over time this instability leads to attritional changes in the secondary stabilizers of the wrist, resulting in abnormal contact between the carpal bones; this may result in the development of a volar (or palmar) intercalated segment instability (VISI) deformity of the proximal row (43). A static VISI deformity implies disruption of the secondary ligamentous constraints of LT motion in addition to disruption of the LTIL.

A complete LT ligament tear alone is not sufficient to cause the carpus to assume a VISI stance. Sectioning of volar and dorsal LT ligaments results in a slight divergence of the triquetrum and lunate at extremes of wrist flexion and radial deviation, but VISI collapse is not apparent unless considerable compressive forces are applied.[2] Additional tears or attenuation of secondary restraints is necessary to result in a static carpal instability. Both palmar and dorsal carpal ligaments likely play a role as secondary restraints. Anatomic studies have implicated palmar ligament injury in the development of VISI in LT dissociation. Trumble and colleagues[3] created carpal collapse with division of the ulnar arcuate ligament, whereas Viegas and colleagues[4] and Ritt and colleagues[5,6] found the palmar LT ligament to be the thickest and strongest when tested to mechanical failure. The dorsal LT ligament serves mainly as a rotational constraint. LT ligament disruption leads to an increase in the moment arm of the flexor carpi ulnaris tendon that may contribute to additional clinical sequelae seen in patients.[7]

Sectioning of the dorsal radiocarpal and intercarpal ligament produces a static VISI stance following LT ligament injury.[5,6,8] Loss of dorsal ligament integrity allows the lunate to flex more easily in part by shifting the point of capitate contact palmar to the lunate axis of rotation. Although LT ligament dissociation can result in a VISI deformity, not all VISI deformities are the result of LT ligament injury. Carpal instability of the nondissociative type of the radiocarpal, midcarpal, or combined radiocarpal-midcarpal joints can also lead to VISI deformity.[9]

The language used in the description of LT ligament injuries should be precise; it is important to distinguish between dynamic and static forms of instability. LT ligament injuries with normal findings on conventional radiographs and dynamic instability (visible only under load) are classified as LT attenuations or tears. Fixed carpal collapse (VISI) on conventional radiographs represents static instability and is classified as LT ligament dissociation.

MECHANISM OF INJURY

Dorsally Applied Force

Weber postulated that isolated LT tears may occur when a dorsally applied force is applied to a palmarly flexed wrist.[10] The dorsal force can result in the dorsal LT interosseous fibers to fail, sparing the palmar radiolunotriquetral ligaments (Fig. 1). The integrity of this ligament tethers the palmar pole of the lunate, therein leading to an axis of palmarly directed flexion.

Perilunate Injury

The entity and mechanism of isolated LT ligament injury remains a topic of debate and is less well understood than SLIL injury. It is likely that multiple mechanisms play supporting causative roles. For example, perilunate dislocations occur when forces are applied to the thenar area with the wrist in a position of dorsiflexion and ulnar deviation.[11–15] The resulting intercarpal supination leads to a progressive injury pattern from a radial to ulnar direction (Fig. 2), following either a bony or purely

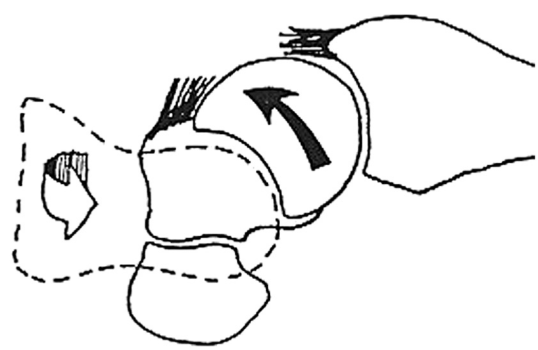

Fig. 1. Dorsal radiocarpal tear. (By permission of the Mayo Foundation for Medical Education and Research. All rights reserved.)