TECHNICAL NOTE

Lunotriquetral Ligament Repair Using Augmented Internal Brace

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Abstract

Lunotriquetral (LT) ligament tear, usually in combination with an adjacent carpal ligament injury, can result in complete LT dissociation and VISI (Volarflexed Intercalated Segment Instability). Operative techniques for the management of instability are highly variable with many described in literature, although there is little evidence to demonstrate the superiority of one definitive therapeutic technique of repair and reconstruction. In this paper, we discuss our proposed technique for performing LT ligament repair using an augmented internal brace, which addresses triquetral extension and lunate flexion. The internal brace construct also provides biomechanical superiority as it includes the augmentation of the ligament and capsule repair. We use figures and references from our case example to demonstrate this technique.

Level of evidence: V

Keywords: Berger flap, DISI, Ligament repair, Lunotriquetral , VISI

Introduction

The lunotriquetral (LT) ligament is an important interosseous carpal ligament providing stability to the proximal carpal bones. LT ligament tears are uncommon, unlike scapholunate joint instability, although they remain the second most common ligamentous cause of carpal instability after scapholunate ligament injury (1). A tear of the LT ligament, in combination with an adjacent carpal ligament injury, (usually the radiotriquetral ligament), can result in complete LT dissociation and VISI (Volarflexed Intercalated Segment Instability).

LT instability is commonly associated with high energy sports and injury often occurs following hyperextension of the wrist or wrist extension and radial deviation. This usually involves falling onto an outstretched hand and patients may complain of reduced grip strength and ongoing ulnar sided wrist pain (2,3). Isolated LT ligament injury rarely produces symptoms, due to the extrinsic carpal ligaments maintaining joint stability, and thus often goes undiagnosed. Symptomatic injury is therefore usually in conjunction with either injury of the dorsal radiotriquetral and/or volar radiolunate ligaments, resulting in LT dissociation. Chronic LT dissociation can lead to VISI and if unrecognised, may lead to functional impairment and post-traumatic arthritis (4,5).

Management Options

Operative techniques for the management of instability are highly variable with many described in literature. Traditionally, such injuries have been managed operatively with either ligament debridement and K-wire fixation or with open ligament repair. LT fusions are usually only reserved for chronic instability and carry a risk of nonunion. However, there is little evidence to demonstrate the superiority of one therapeutic technique of repair and reconstruction of wrist ligament injuries, with the majority of studies being of low level evidence (6). Subsequently, there is no current consensus regarding the gold standard management of isolated lunotriquetral ligament tears.

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In this paper, we describe a simple, safe and reproducible technique for performing LT ligament repair using interosseous sutures to create an augmented internal brace. Our technique aims at anatomic reconstruction of the LT ligament, the radiocarpal ligament and the capsule to achieve a robust trans-osseous repair. The whole repair is done through a single dorsal approach. This technique we recommend is for dynamic and static LT instability where the carpus remains reducible, and arthrosis is not present. The goal of the reconstruction is to repair the torn dorsal portion of the LT ligament and to address triquetral extension and lunate flexion. The internal brace construct provides biomechanical superiority too as it includes the augmentation of the ligament and capsule repair with the brace concept.

Indications

Symptomatic VISI
Absence of arthritis
Reducible carpus
Acute trauma

Contraindications

Completely incompetent volar LT ligament
Inflammatory arthritis
Previous and/or current infection,
Carpal arthrosis (SLAC wrist)
Irreducible carpus
Pre-existing hardware in the carpal bones
Large cystic changes in the carpal bones

Technical Note

We demonstrate this technique using images and radiographs with permission from our case example; a 21 year old lady with no past medical history, who presented to fracture clinic following fall onto a pronated wrist combined with volar flexion; one of the common mechanisms of isolated injuries (7). She had ulnar sided pain, worse with pronation and ulnar deviation, which led to decreased power grip. There was dorsal LT joint tenderness, ulnar deviation with pronation and axial compression elicited dynamic instability with a painful snap “catch up” clunk. On examination, there was positive LT shuck test, positive Kleinman’s shear test and positive lunotriquetral compression test. Pre-operative radiographs included in were suggestive of VISI, which was confirmed on MRI [Figure 1]. She was listed electively for operative repair using our technique described below.

The Technique

Approach

- A longitudinal incision is made in line with the 3rd metacarpal ray over the carpus
- The dorsal sensory branch of the ulnar and radial nerves should be identified and protected throughout.
- The extensor retinaculum is divided over the EPL distally to proximally, releasing it from the 3rd compartment.
- Ulnar flaps of the extensor retinaculum are created by dividing the septa which separate the 3rd through the 5th extensor compartments [Figure 2].

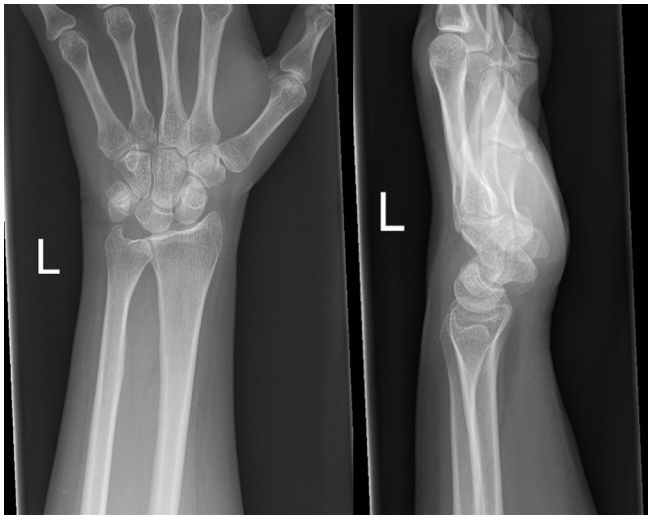

Figure 1. Pre-operative AP and lateral radiographs. On the lateral radiograph there is volar rotation and angulation of the lunate and the capitolunate angle, measuring approximately 50 degrees with an approximate scapholunate angle of 14 degrees, suggestive of VISI.

- The dorsal radiocarpal and intercarpal ligaments are identified and a ligament splitting capsulotomy is made (Berger’s Flap) [Figure 3]. (8)

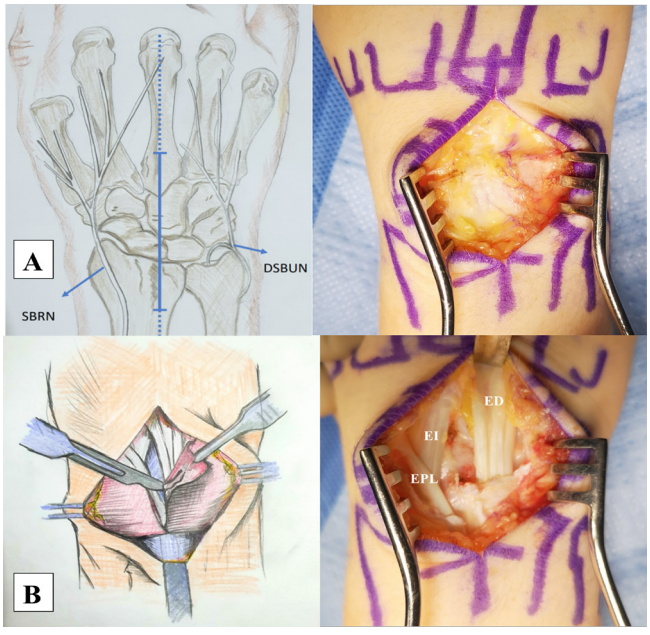

Figure 2. A: A longitudinal incision is made in line with the 3rd metacarpal ray over the carpus, avoiding the SBRN (sensory branch of the radial nerve) and the DSBUN (dorsal sensory branch of the ulnar nerve). B: Ulnar flaps of the extensor retinaculum are created by dividing the septa which separate the 3rd through the 5th extensor compartments. EPL ; extensor pollicis longus ; EI ; extensor indicis ; ED ; extensor digitorum.

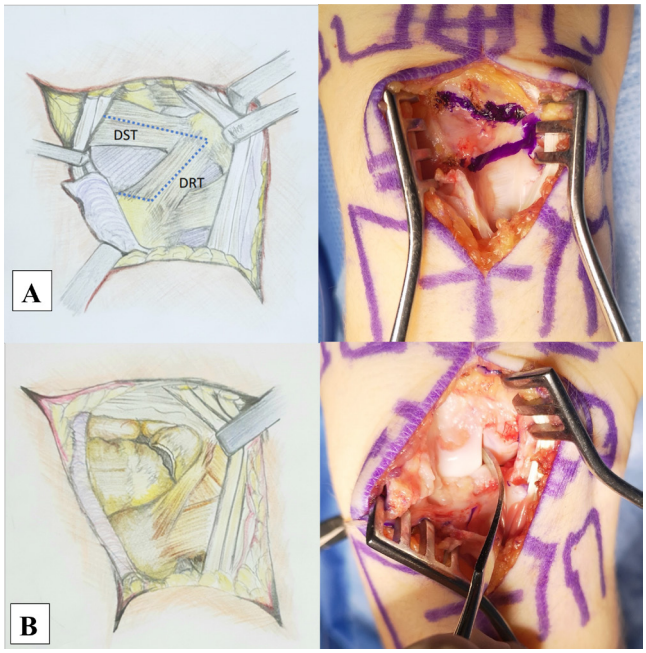

Figure 3. A: The dorsal radiocarpal and intercarpal ligaments are identified and a ligament splitting capsulotomy is made (Berger's Flap). DST : Dorsal scaphotriquetral ligament ; DRT : Dorsal radiotriquetral ligament. B: The dorsal component of the LT ligament must be inspected to determine if suitable to repair, as well as the articular surfaces of the midcarpal and radiocarpal joints.

- During capsule elevation, care must be taken not to dissect too deeply over the LT area. The dorsal LT ligament is closely related to the radiotriquetral ligament and is prone to injury during the capsulotomy if one dissects deeply too close to the lunate.

Repair

- The radiocarpal and midcarpal joint surfaces are exposed and examined for arthritic changes.
The dorsal LT ligaments are then thoroughly examined [Figure 3].
- The dorsal component of the LT ligament must be inspected to determine if suitable to repair. The articular surfaces of the midcarpal and radiocarpal joints should also be inspected.
- The volar portion of the LT joint is then examined, and the integrity of the volar LT ligament is indirectly inspected. If completely incompetent, a direct repair of the dorsal LT ligament is contraindicated, and ligament reconstruction should be undertaken.
- The intra articular step off of the LT articulation should also be assessed including the presence of a separate lunate facet with the hamate (Type II lunate).
- If the dorsal LT ligament is amenable to repair, a 2-0 fiberwire is used to repair the LT stump. The fiberwire and size 1.3 mm SutureTape are loaded into a 2.5mm push-lock anchor which is inserted into the Triquetrum.
- The SutureTape is loaded into a second 2.5mm push-lock anchor and inserted into the lunate, creating an augmented internal brace repair [Figure 4].
- The same fibre wire used to repair the LT is used to repair the Berger flap and the radiotriqeutral ligament. - The extensor retinaculum is then repaired.
- Post-operative radiographs are shown [Figure 5]. Dynamic fluoroscopy confirms the efficacy of repair [Video 1].

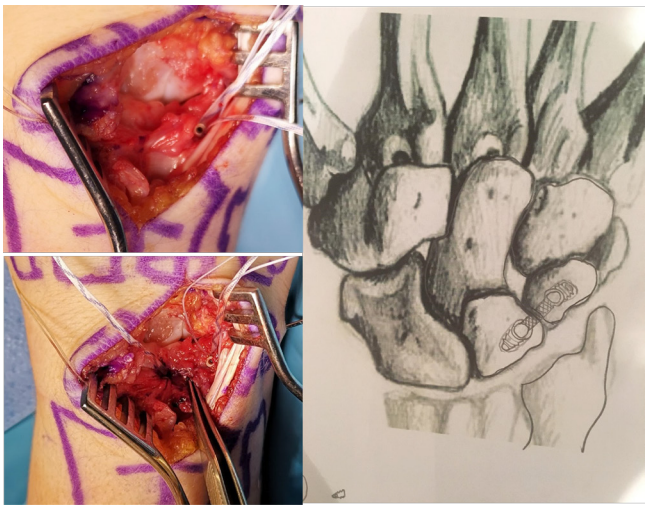

Figure 4. A 2-0 fiberwire is used to repair the LT stump. The fiberwire and size 1.3 mm SutureTape are loaded into a 2.5mm push-lock anchor which is inserted into the Triquetrum. The SutureTape is loaded into a second 2.5mm push-lock anchor and inserted into the lunate, creating an augmented internal brace repair (see right).

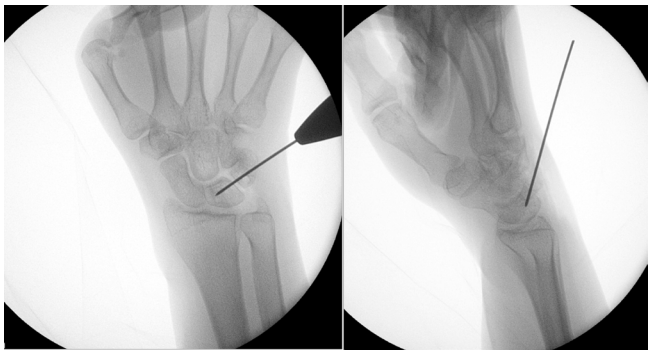

Figure 5. Post-operative radiographs.

Post-operative management

K-Wires and volar slab were used for immobilisation. At 4 weeks post op, K-wires were removed, the volar slab replaced with Futuro splint and Hand Therapy started. By 12 weeks, she had a DASH score of 10 with full grip power and a good range of movement. By 16 weeks, she had full supination and pronation, near full extension with improving flexion and strength and was discharged from hand therapy.
This technique provides a safe and reproducible method for LT ligament repair. In addition, the internal

brace used in this technique augments the ligament and capsule repair to provide further support compared with traditional methods described in literature. With no current gold standard agreed for LT ligament repair, we hope clinicians consider this technique before undertaking repair given its simplicity and conferred biomechanical benefits.

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Consent: Written informed consent was obtained from the patient for their anonymised information to be published in this article.

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