# The Management of Dorsal Radiocarpal Ligament Tears

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*The dorsal radiocarpal ligament (DRCL) has been implicated in both volar and dorsal intercalated segmental instabilities and has a role in midcarpal instability. Tears of the DRCL are more common than previously suspected. They are best seen through a volar radial portal and are amenable to arthroscopic repair. DRCL tears appear to be part of a spectrum of radial- and ulnar-sided carpal instability as evidenced by the frequent association with scapholunate and lunotriquetral ligament injuries as well as triangular fibrocartilage tears. Isolated DRCL tears can be solely responsible for wrist pain. The presence of an associated DRCL tear when seen in combination with a scapholunate, lunotriquetral, or triangular fibrocartilage tear connotes a greater degree and/or duration of carpal instability, and portends a poorer prognosis after treatment. Good results are obtained after arthroscopic repair of isolated DRCL tears. Results of DRCL repairs are less predictable when seen in combination with other types of carpal pathology. Recognition of this condition and further research into treatment methods is needed.*



Recent biomechanical studies have highlighted the importance of the dorsal radiocarpal ligament (DRCL) in maintaining carpal stability.[1–4] Injuries to the DRCL have been implicated in both volar and dorsal intercalated segmental instabilities.[5,6] It also plays a role in midcarpal instability.[7] Some investigators have recognized that the presence of a DRCL tear in association with a scapholunate interosseous ligament (SLIL) tear connotes a greater degree of carpal instability and advocate an open SLIL repair as compared with arthroscopic debridement.[8] What is lacking, however, is an understanding of the contribution of DRCL tears to the pathogenesis of wrist pain. Evaluation of the DRCL is an often neglected component of the arthroscopic examination of the wrist, which may be in part because it is difficult to assess through the standard dorsal portals.

In the absence of a scapholunate or lunotriquetral instability, an isolated tear of the DRCL can be a source of wrist pain. Good results can be obtained after arthroscopic repair of isolated DRCL tears.[9] This article describes the repair technique and outcomes in a series of 21 patients treated for tears of the DRCL.

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*1531-0914/05/0503-0007$30.00/0*
*doi:10.1016/j.jassh.2005.06.001*

## DRCL Repair Technique

An inside-out arthroscopic repair technique of the DRCL ligament was developed in 5 fresh-frozen cadaver arms. The repair was performed through a

volar-radial (VR) wrist arthroscopy portal, which allows a direct line of sight with the DRCL (Figure 1A).[10] A 2-cm longitudinal incision is made in the proximal wrist crease, exposing the flexor carpi radialis tendon sheath. The sheath is divided and the flexor carpi radialis tendon is retracted ulnarly. The radiocarpal joint space is identified with a 22-gauge needle and the joint is inflated with saline. A blunt trocar and cannula are introduced through the floor of the flexor carpi radialis sheath, which overlies the interligamentous sulcus between the radioscaphocapitate ligament and the long radiolunate ligament. A 2.7-mm 30° arthroscope is inserted through the cannula. A meniscus repair cannula then is inserted adjacent to the arthroscope. In a small wrist, the capsular intervals on either side of the long radiolunate ligament can be used. While visualizing the DRCL tear through the VR portal, a 2-0 absorbable suture on double-armed straight needles is introduced through the meniscal repair cannula. The needles are passed across the radiocarpal joint through the torn edge of the DRCL, exiting through the floor of the fourth extensor compartment (Figure 1B-E). One or 2 horizontal mattress sutures are inserted in this fashion. A small dorsal incision is made to retrieve the sutures before tying, to ensure there is no extensor tendon entrapment.

An outside-in repair technically is easier to perform and has been used more recently.[11] The repair is performed by spearing the radial side of the DRCL tear with a curved 21-gauge spinal needle placed through the 3/-,4 portal while viewing through the arthroscope, which is inserted in the VR portal. A 2-0 absorbable suture is threaded through the spinal needle and retrieved with a grasper or suture snare inserted through the 4/-,5 portal (Figure 2A-D). A curved hemostat is used to pull either end of the suture underneath the extensor tendons, and the knot is tied either at the 3/-,4 or 4/-,5 portal. The repair may be augmented with thermal shrinkage if the torn edge of the DRCL is voluminous (Figure 2E).

### *Personal Experience*

The VR portal has been used in 53 patients (56 wrists) since 1998. Additional pathology was evident in 24 of the patients that was not visible from any standard dorsal portal.[12] This included 21 patients with tears of the DRCL.

Eighteen of the patients had worker's compensation claims. Preoperative arthrograms (19) and/or magnetic resonance imaging (MRI) (6) failed to detect any of the DRCL tears. All patients failed conservative treatment with splinting, cortisone injections, and work restrictions. The mean follow-up period was 16 months, with 1 patient lost to follow-up evaluations at 4 weeks. Seven patients had either dynamic scapholunate instability or a scapholunate ligament tear. All patients were treated with a dorsal capsulodesis. Two of the 7 patients had a concomitant triangular fibrocartilage (TFC) or lunotriquetral interosseous ligament (LTIL) tear that were debrided.

Four patients had an isolated DRCL tear that was solely responsible for their wrist pain. These tears all were repaired arthroscopically (2 were augmented with thermal shrinkage). In the remaining 9 patients, the DRCL tears were seen in combination with other pathology (Table 1). This included 1 tear of the capitohamate ligament and 8 LTIL and/or TFC tears. One of these patients had a DRCL tear, lunotriquetral instability, and palmar midcarpal instability (MCI). Eight of these 9 patients underwent a specific treatment for the DRCL tear in addition to other procedures (6 underwent repairs and thermal shrinkage, 2 underwent thermal shrinkage alone). One patient underwent a TFC debridement and wafer resection of the distal ulna without a separate repair of the DRCL. Any associated nerve compression or tendonitis was treated at the same time (Table 2). Overall, the specific type of DRCL repair included 6 arthroscopic repairs, 5 arthroscopic repairs plus thermal shrinkage, and 2 cases of thermal shrinkage alone (in 2 patients who underwent a TFC debridement).

Patient outcomes are summarized in Table 3. Pain was graded as none, mild, moderate, or severe.[13] Preoperative and postoperative wrist motion was measured, but this was meaningful only for the isolated DRCL repairs because of the wide variety of procedures performed. Grip strength was compared with the contralateral side at the final follow-up evaluation. The numbers were too small to permit statistical analysis.

The 4 patients who underwent an isolated DRCL repair graded their pain as none or mild. No patient required pain medication and all patients had returned to their previous occupation without restriction. The preoperative and postoperative wrist motion was unchanged

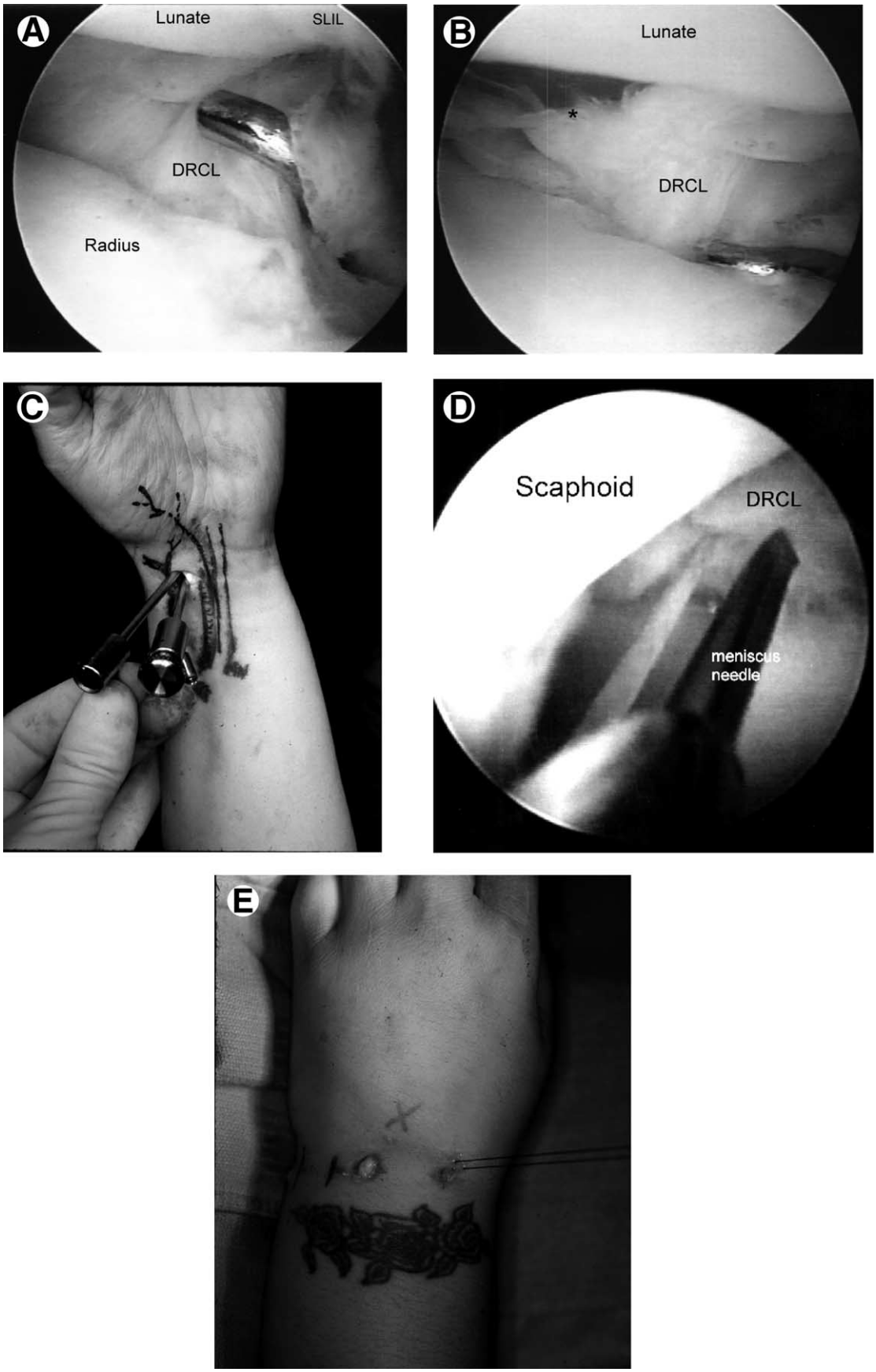


**FIGURE 1.** Inside-out 2-cannula DRCL repair. (A) View of an intact DRCL from the VR portal. The hook probe is in the 3/-,4 portal. (B) *DRCL tear. (C) Two-cannula repair technique. (D) Insertion of second suture with meniscal repair needle. (E) Suture exiting dorsally before tying. Reprinted from Arthroscopy, 18, Slutsky DJ, Arthroscopic repair of dorsal radiocarpal ligament tears, E49, 2002, with permission from *Arthroscopy Association of North America*.

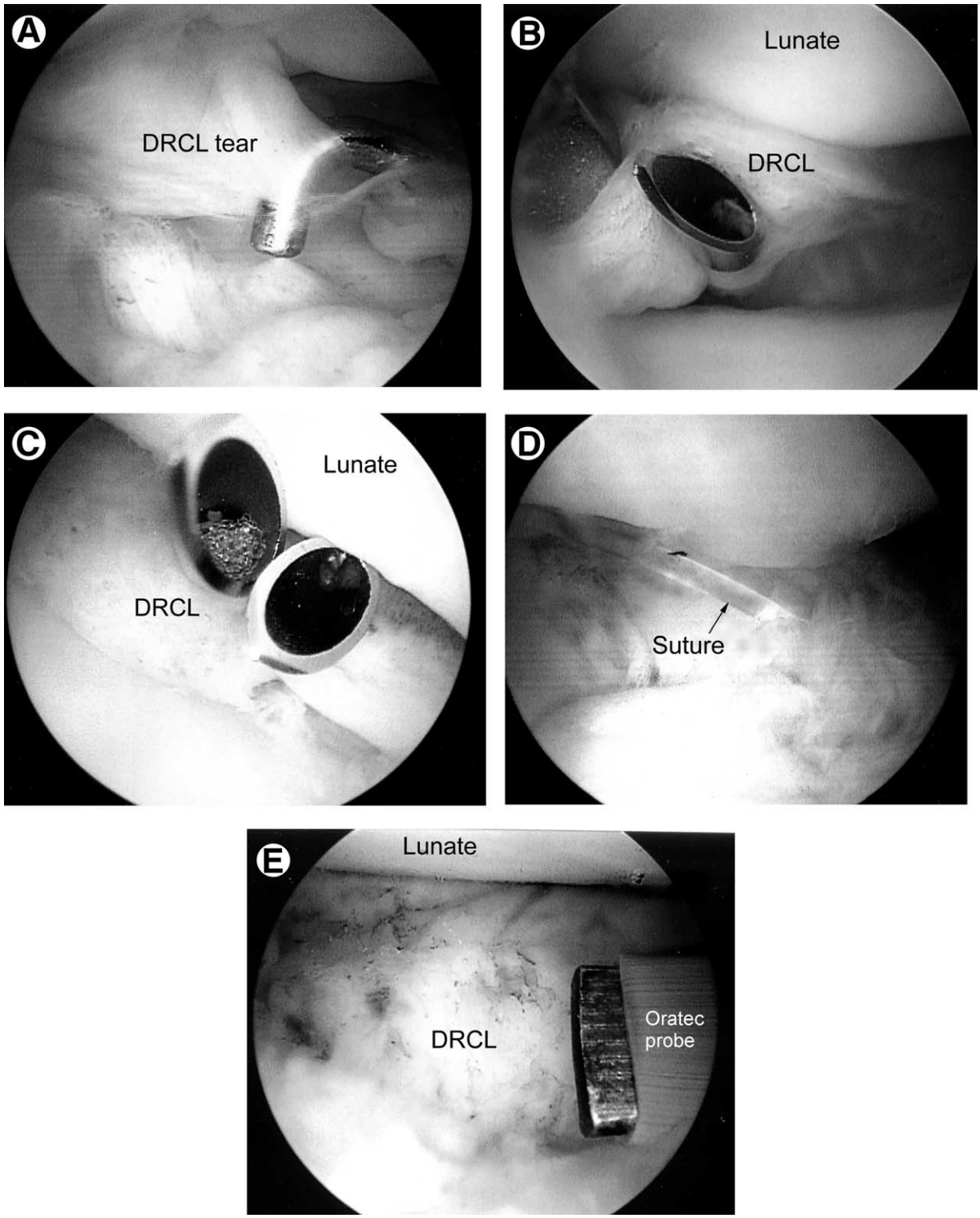


**FIGURE 2.** Outside-in DRCL repair technique. (A) Outside-in repair with DRCL tear. (B) Insertion of curved spinal needle through edge of the DRCL tear. (C) Insertion of second spinal needle. (D) Absorbable horizontal mattress suture before tying. (E) Repair augmented with thermal shrinkage after suture has been tied. Reprinted with permission from Slutsky DJ, Clinical Application of Volar Portals in Wrist Arthroscopy, Techniques in Hand and Upper Extremity Surgery, 2004, 8(4):229-238.

**TABLE 1**
**Associated Pathology/Conditions**

| Pathology/Conditions | Number |
|---|---|
| Dynamic scapholunate instability | 4 |
| Scapholunate tear partial/complete | 3 |
| LTIL ± TFC tear | 11 |
| Capitohamate ligament tear | 1 |
| Carpal tunnel syndrome | 3 |
| Cubital tunnel syndrome | 1 |
| DeQuervain's tenosynovitis | 1 |
| Ulnar MCI | 1 |

in 3 of these patients, with less than a 15% loss of motion in the fourth patient. Grip strengths were 90% to 130% of the opposite side.

Of the 8 patients who underwent specific treatment for the DRCL tear in addition to the other procedures, 2 patients graded their pain level as none or mild and returned to their previous occupation. The remaining 6 patients graded their pain as moderate, with 2 returning to full duty and 4 changing their occupation (Table 3).

A dorsal capsulodesis was performed in the 7 patients with scapholunate instability. Two of these patients graded their pain level as none or mild with both returning to full duty. Five of these patients graded their pain as moderate or severe with 1 patient returning to restricted work and 4 patients changing their occupation.

**TABLE 2**
**Other Procedures**

| Procedures | Number |
|---|---|
| Carpal tunnel release | 5 |
| Ulnar nerve transposition | 1 |
| First extensor compartment release | 1 |
| Ulnar shortening/wafer | 3 |

## Case Reports

### *Case 1*

The first patient in this series was a 26-year-old right-handed woman who was employed as a poker runner at a casino. She presented with a 2-year history of left dorsal wrist pain. Her examination showed tenderness over the proximal origin of the DRCL adjacent to Lister's tubercle, along with a 1-cm lesion that had the appearance of a dorsal wrist ganglion. Wrist radiographs and a double-row arthrogram were normal. After a failed 4-month course of cortisone injections and splinting the patient underwent wrist arthroscopy. The view from the volar portal showed a tear of the DRCL with synovitis. There was no evidence of a ganglion cyst. The DRCL tear was debrided using a full radius resector inserted through the 3,4 portal. Rehabilitation commenced after 1 week and the patient returned to her occupation.

At 6 months after surgery the patient complained of unremitting dorsal wrist pain. She continued to require the use of a wrist splint and analgesics. Repeat wrist arthroscopy was performed. The DRCL tear was unchanged in appearance, with persistent instability of the torn edge. The torn ligament edge was sutured to the dorsal capsule with a horizontal mattress suture using the inside-out technique as described. The patient then was placed in a below-elbow cast for 6 weeks before starting rehabilitation. At 5 months follow-up evaluation the patient was pain free and no longer required the use of a splint. She had normal wrist motion and she was working without limitation.

**TABLE 3**
**Patient Outcomes**

| Procedure | Pain Level | Work Status |
|---|---|---|
| Isolated DRCL repair = 4 | None or mild = 4 | full duty = 4 |
| DRCL repair ± LTIL pinning and/or TFC debridement/repair = 9 | None or mild = 2, chronic, moderate = 6, no follow-up evaluation = 1 | Changed occupation = 4, full duty = 4 |
| Capitohamate K-wire = 1 | Moderate = 1 | Changed occupation = 1 |
| Dorsal capsulodesis = 7 | None or mild = 2, chronic, moderate = 4, chronic, severe = 1 | Changed occupation = 4, restricted work = 1, full duty = 2 |

*Case 2*

A 42-year-old male police officer presented with a 1-year history of injury to his right wrist while grappling with a suspect. He developed recurring episodes of disabling wrist pain that became more frequent. He did not respond to splinting, cortisone injections, or activity modification over the next 3 years. A preoperative arthrogram was normal. An MRI showed increased signal intensity compatible with a TFC tear. At arthroscopy the patient was noted to have an isolated DRCL tear. The TFC was normal. He underwent an outside-in repair with capsular shrinkage. He was immobilized with a before elbow (BE) splint for 6 weeks, followed by rehabilitation. At 7 months the patient only had occasional minimal pain after forceful activity and he was performing his regular duties (Disabilities of the Arm, Shoulder, and Hand score, 15.8).

*Case 3*

A 44-year-old right-handed man who worked on the road crew for a rock band fell off a stage on 2 occasions during a performance. He developed chronic left wrist pain. Initial radiographs and arthrogram were normal. He had no carpal tenderness and a negative Watson test. Despite 3 years of conservative treatment he still complained of disabling pain. He had developed a lunate cyst on radiograph but an MRI showed no obvious avascular necrosis of the lunate. At arthroscopy an old DRCL tear and some chondromalacia of his lunate fossa were found. An outside-in DRCL repair and thermal shrinkage were performed followed by casting for 6 weeks. At 15 months he was pain free, with unrestricted use of his left hand (Disabilities of the Arm, Shoulder, and Hand score, 7.8).

## Discussion

It is difficult to detect a DRCL tear with nonsurgical methods. None of the DRCL tears in this series were identified with preoperative arthrography or MRI. A preoperative MRI in 1 patient with a DRCL tear was misinterpreted as representing a dorsal wrist ganglion (Figure 3). It is possible that a number of patients presenting with dorsal wrist pain may be misidentified as having dorsal wrist syndrome[14] or an occult dorsal wrist ganglion.

DRCL tears are seen poorly through an open approach. Although 7 patients who underwent a dorsal capsulodesis for scapholunate instability were found to have a DRCL tear during wrist arthroscopy, none of these tears could be identified through a dorsal capsulotomy. This partly may be because the capsular ligaments are best seen from within the wrist joint, or that the DRCL is divided during the surgical approach for a dorsal capsulodesis.

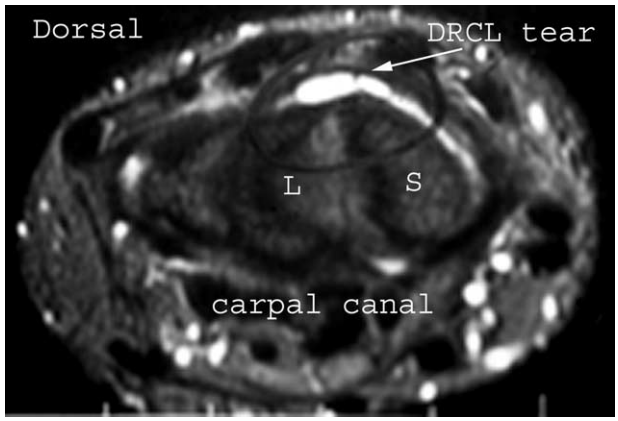


**FIGURE 3.** MRI showing a DRCL tear that was misidentified as a dorsal wrist ganglion. S, scaphoid; L, lunate.

It is difficult to assess the DRCL through the standard dorsal wrist arthroscopy portals. The torn edge of the DRCL tends to float up against the arthroscope while viewing through the 3/-,4 portal, which makes both identification of and repair of the DRCL tear cumbersome. The DRCL tear can be seen obliquely through the 1/-,2 or 6U portals, but visualization of the DRCL across the radiocarpal joint may be laborious in a tight or small wrist, especially if synovitis is present. Arthroscopic repair of the DRCL as described would be awkward. Wrist arthroscopy through a VR portal is the ideal way to assess the DRCL because of the straight line of sight.[10] The capsular ligaments are enclosed in an epiligamentous sheath,[15] hence the actual fibers of the DRCL are not always visible unless a tear is present (Slutsky and Slutsky, presented at the 55th Annual Meeting of the American Society for Surgery of the Hand, 2000).

Cadaver studies suggest that dynamic scaphoid instability results from an isolated injury to the SLIL without damage to the dorsal intercarpal and dorsal radial lunotriquetral (ie, the dorsal radiocarpal) ligaments.[2] I found the corollary to hold true in that 4 of 7 patients with dynamic scapholunate instability had a DRCL tear but an intact scapholu-

nate ligament. The diagnosis of dynamic carpal instability in these patients hinged on the demonstration of the abnormal kinematics and increased motion at the scapholunate joint. This easily allowed insertion of a 3-mm probe between the scaphoid and the lunate when viewed from the midcarpal joint (ie, Geissler grade III[16]) yet there was no apparent scapholunate ligament tear while probing from the radiocarpal joint. These patients were treated with a dorsal capsulodesis instead of a DRCL repair. The dorsal incision followed by the creation of a dorsal capsular checkrein to restrain palmar flexion of the scaphoid rendered any separate treatment of the DRCL tear unfeasible.

It is instructive to consider the wrist as having a number of primary and secondary stabilizers. The SLIL, LTIL, and the TFC are the primary stabilizers. The capsular ligaments including the radioscaphocapitate, radiolunotriquetral, ulnolunate, ulnotriquetral, dorsal radiocarpal, and dorsal intercarpal ligaments can be thought of as secondary stabilizers. A chronic tear of a primary stabilizer may culminate in the attenuation or tearing of the secondary stabilizer. This is seen in patients with long-standing triquetrolunate dissociation of more than 6 months' duration in whom arthroscopy often reveals fraying of the ulnolunate ligaments and ulnotriquetral ligaments.[17] In the current series there was a frequent association of a DRCL tear with either an SLIL or LTIL/TFC tear.

DRCL tears appear to be part of a spectrum of radial and ulnar-sided carpal instability as evidenced by the frequent association with SLIL, LTIL, and/or TFC tears. The DRCL tear may occur after or precede these injuries. The cause of wrist pain with isolated DRCL tears is not entirely clear. In nondissociative carpal instability the pain is believed to be caused by dynamic joint incongruity.[18] Chronic impingement of a detached ulnar sling on the triquetrum has been implicated as a cause of wrist pain.[19] It is plausible that impingement of the torn edge of the DRCL against the lunate can have a similar effect.

Repair of an isolated tear of a capsular ligament can alleviate wrist pain. This has been shown with repairs of ulnolunate ligament tears.[20,21] In the present study, all of the patients with an isolated DRCL tear had a favorable response to arthroscopic repair. Slater et al showed that the dorsal wrist ligaments have a constant blood supply (Slater and Laubach, presented at the 55th Annual Meeting of the American Society for Surgery of the Hand, 2000). The implication of their work is that tears of the DRCL have the potential to heal. This provides a rationale for arthroscopic repair of a DRCL tear. The DRCL repair as described may act through preventing impingement of the torn DRCL edge on the lunate or by normalizing carpal kinematics, but there is a lack of biomechanical data to support these theories. Although debridement may be an option for the DRCL tear, this failed to relieve the pain in the first patient in this series, and subsequently was not investigated as a treatment modality. Conservative measures including wrist immobilization, cortisone injections, and activity modification were also ineffective in this series of patients.

Injury to the DRCL also has been implicated in palmar MCI.[5] Sectioning the DRCL results in a volar intercalated segmental instability sag of the proximal carpal row,[7] which characteristically accompanies palmar MCI.[22] Palmar MCI was seen in 1 patient in the current series. He was noted to have a Geissler grade III instability of the lunotriquetral joint in combination with the DRCL tear. A DRCL repair and pinning of the lunotriquetral joint for 6 weeks improved his wrist pain, but did not correct the MCI. Soft-tissue repairs of the dorsal ligaments alone appear to be insufficient to correct this type of carpal instability. Goldfarb et al[13] reported on 1 patient with palmar MCI in whom a diffuse tear involving the dorsal ligaments was shown on a preoperative MRI. A repair of the dorsal ligaments failed to relieve the patient's symptoms and a midcarpal fusion ultimately was performed.

Through the use of a volar radial portal, it has been found that tears of the DRCL are much more common than previously suspected. Unrecognized DRCL tears may be a cause for treatment failures in patients with dorsal wrist pain. When combined with other wrist pathology its presence signifies a greater degree or longer duration of carpal instability, which in this study appeared to connote a worse prognosis with regard to treatment. The arthroscopist must be diligent in recognizing this condition but ongoing research into the ideal method of treatment is needed.

## REFERENCES


1. Mitsuyasu H, Patterson RM, Shah MA, Buford WL, Iwamoto Y, Viegas SF. The role of the dorsal intercarpal ligament in dynamic and static scapholunate instability. J Hand Surg 2004;29A:279-288.
2. Ruch DS, Smith BP. Arthroscopic and open management of dynamic scaphoid instability. Orthop Clin North Am 2001; 32:233-240, vii.
3. Short WH, Werner FW, Green JK, Weiner MM, Masaoka S. The effect of sectioning the dorsal radiocarpal ligament and insertion of a pressure sensor into the radiocarpal joint on scaphoid and lunate kinematics. J Hand Surg 2002; 27A:68-76.
4. Viegas SF, Yamaguchi S, Boyd NL, Patterson RM. The dorsal ligaments of the wrist: anatomy, mechanical properties, and function. J Hand Surg 1999;24A:456-468.
5. Horii E, Garcia-Elias M, An KN, Bishop AT, Cooney WP, Linscheid RL, et al. A kinematic study of luno-triquetral dissociations. J Hand Surg 1991;16A:355-362.
6. Moritomo H, Viegas SF, Elder KW, Nakamura K, Dasilva MF, Boyd NL, et al. Scaphoid nonunions: a 3-dimensional analysis of patterns of deformity. J Hand Surg 2000; 25A:520-528.
7. Viegas SF, Patterson RM, Peterson PD, Pogue DJ, Jenkins DK, Sweo TD, et al. Ulnar-sided perilunate instability: an anatomic and biomechanic study. J Hand Surg 1990;15A: 268-278.
8. Ruch DSPG. Wrist arthroscopy: ligamentous instability. Philadelphia: Churchill Livingstone, 1999.
9. Slutsky DJ. Arthroscopic repair of dorsal radiocarpal ligament tears. Arthroscopy 2002;18:E49.
10. Slutsky DJ. Wrist arthroscopy through a volar radial portal. Arthroscopy 2002;18:624-630.
11. Slutsky DJ. Volar portals in wrist arthroscopy. J Am Soc Surg Hand 2002;2:225-232.
12. Slutsky DJ. Clinical applications of volar portals in wrist arthroscopy. Tech Hand Upper Extrem Surg 2004;8: 229-238.
13. Goldfarb CA, Stern PJ, Kiefhaber TR. Palmar midcarpal instability: the results of treatment with 4-corner arthrodesis. J Hand Surg 2004;29A:258-263.
14. Watson HK, Weinzweig J. Physical examination of the wrist. Hand Clin 1997;13:17-34.
15. Berger RA. Arthroscopic anatomy of the wrist and distal radioulnar joint. Hand Clin 1999;15:393-413, vii.
16. Geissler WB, Freeland AE, Savoie FH, McIntyre LW, Whipple TL. Intracarpal soft-tissue lesions associated with an intra-articular fracture of the distal end of the radius. J Bone Joint Surg 1996;78A:357-365.
17. Zachee B, De Smet L, Fabry G. Frayed ulno-triquetral and ulno-lunate ligaments as an arthroscopic sign of longstanding triquetro-lunate ligament rupture. J Hand Surg 1994;19B: 570-571.
18. Bednar JM, Osterman AL. Carpal instability: evaluation and treatment. J Am Acad Orthop Surg 1993;1:10-17.
19. Watson HK, Weinzweig J. Triquetral impingement ligament tear (tilt). J Hand Surg 1999;24B:321-324.
20. Mooney JF, Poehling GG. Disruption of the ulnolunate ligament as a cause of chronic ulnar wrist pain. J Hand Surg 1991;16A:347-349.
21. Osterman A. Wrist arthroscopy: operative procedures. In: Green DP, Hotchkiss RM, Pederson WC, eds. Green's operative hand surgery. 1999;207-222.
22. Lichtman DM, Bruckner JD, Culp RW, Alexander CE. Palmar midcarpal instability: results of surgical reconstruction. J Hand Surg 1993;18A:307-315.