

Multimodality Approach to a Stener Lesion: Radiographic, Ultrasound, Magnetic Resonance Imaging, and Surgical Correlation

Jonathan Tresley, MD, Adam D. Singer, MD, Elizabeth A. Ouellette, MD, Jason Blachman, MD, and Paul D. Clifford, MD

Abstract

The ulnar collateral ligament (UCL) of the thumb metacarpophalangeal joint is a static stabilizer that may rupture from a hyperabduction injury. Although some UCL tears may heal with immobilization, outcomes are worse for Stener lesions, in which the proximal ligament stump slips out from beneath the adductor pollicis aponeurosis and is entrapped proximal and superficial to the aponeurosis, preventing primary healing.

We report the case of a patient with a Stener lesion with radiographic, ultrasound, and magnetic resonance imaging correlation, subsequently confirmed with intraoperative photographs. Physicians must be familiar with the regional anatomy to understand the injury pathogenesis and the need for surgical intervention to optimize patient outcomes.

In the literature, hyperabduction injuries to the thumb metacarpophalangeal (MCP) joint have been referred to interchangeably as *gamekeeper's thumb* and *skier's thumb*. Historically, though, gamekeeper's thumb was initially described in hunters with chronic injury to the ulnar collateral ligament (UCL),¹ and skier's thumb typically has been described as an acute hyperabduction injury of the UCL.²⁻⁵ The proximal portion of a torn UCL may retract with further abduction and displace dorsally, becoming entrapped by the adductor pollicis aponeurosis insertion, known as a *Stener lesion*.⁶

The first MCP joint is stabilized by static and dynamic structures that contribute in varying degrees in flexion and extension of the joint. The static stabilizers include the proper and accessory radial and UCLs, the palmar plate, and the dorsal capsule. The UCL originates at the dorsal ulnar aspect of the first metacarpal head at the metacarpal tubercle about 5 mm proximal to the articular surface. The UCL courses distally in the palmar direction to insert volar and proximal to the medial tubercle of the proximal phalanx about 3 mm distal to the articular surface.⁷ In flexion, the proper collateral ligament is taut and is the primary static stabilizer. In extension, the accessory collateral ligament, which inserts on the palmar plate, is taut and is the primary static stabilizer.⁸⁻¹¹

The dynamic stabilizers include the extrinsic muscles (flexor pollicis longus, extensor pollicis longus and brevis) and the intrinsic muscles (abductor pollicis brevis, adductor pollicis, flexor pollicis brevis) inserting on the thumb at the distal phalanx and proximal phalanx and at the base of the first metacarpal.⁸⁻¹⁰ The adductor pollicis originates from the volar third metacarpal, capitate, and hamate and has a dual insertion on the thumb.¹² There is a direct insertion onto the palmar proximal phalanx at the medial tubercle, distal and dorsal to the phalangeal insertion of the UCL. There is also a broad aponeurosis that inserts onto the extensor hood expansion, dorsal to the insertion of the UCL (Figures 1A-1C and 2A, 2B).^{7,8,13}

Take-Home Points

- Torn, displaced, and entrapped UCL is a Stener lesion.
- Hyperabduction injury with pain and joint laxity on examination.
- MRI and ultrasound are useful in evaluating UCL tears.
- Ultrasound offers dynamic evaluation.
- Must be treated appropriately to avoid pain, instability, and osteoarthritis.

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

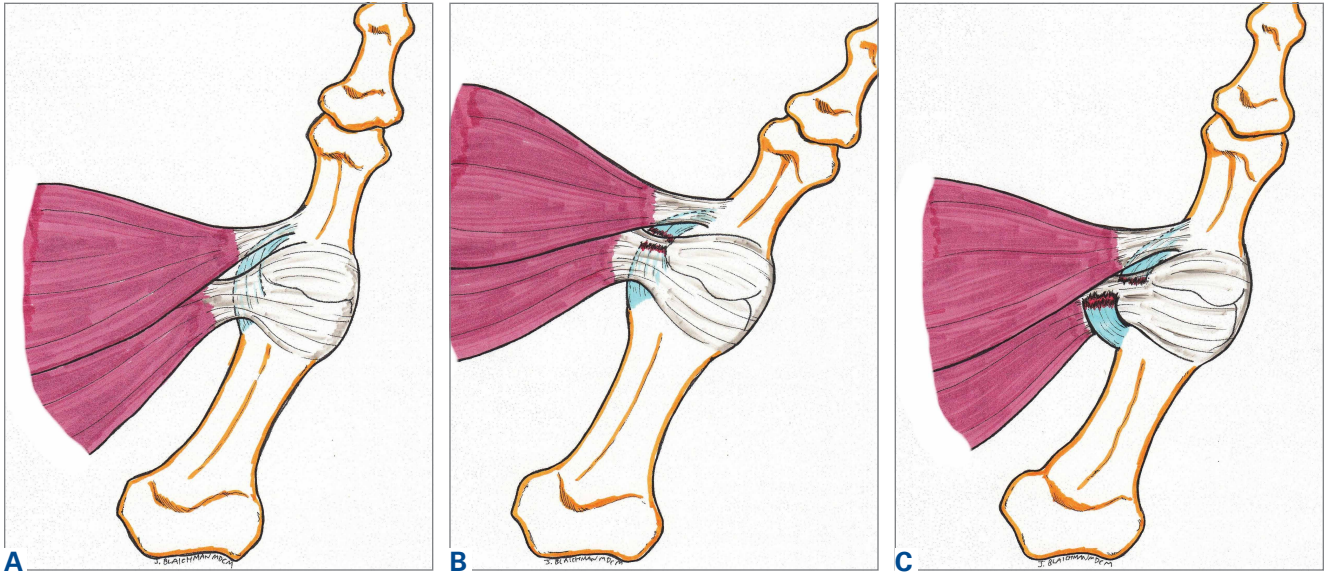


Figure 1. Line diagram of the mechanism of a Stener lesion. (A) Normal position of the ulnar collateral ligament (UCL) deep to the adductor insertion. (B) The UCL may tear with abduction force. If force continues, the proximal portion of the torn UCL may retract proximally from beneath the aponeurosis and (C) become entrapped superficially by the edge of the adductor aponeurosis on release of force.

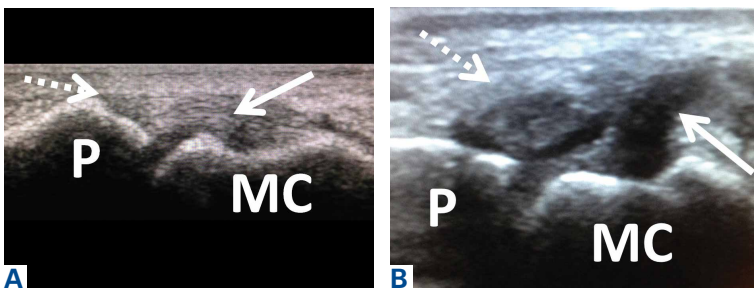


Figure 2. (A) Long-axis ultrasound of the thumb at the level of the first metacarpophalangeal (MCP) joint (P = phalanx; MC = metacarpal) in a normal asymptomatic patient shows the normal position of the ulnar collateral ligament (UCL; solid arrow) and adductor pollicis aponeurosis (dotted arrow). (B) Long axis ultrasound of the thumb at the level of the first MCP joint shows the torn UCL (solid arrow), flipped proximally and superficial to the adductor pollicis aponeurosis (dotted arrow).

We report the case of an acute hyperabduction injury of the thumb MCP joint with radiographic, ultrasound, and magnetic resonance imaging (MRI) findings consistent with a Stener lesion and subsequently confirmed with intraoperative photographs. The patient provided written informed consent for print and electronic publication of this case report.

Clinical Findings

A 33-year-old healthy man had persistent left hand pain and grip weakness after performing a handstand. He presented to the orthopedic hand clinic 20 days after injury, having failed nonoperative management (use of nonsteroidal anti-inflammatory drugs and soft thumb spica splint). Physical examination revealed soft-tissue swelling



Figure 3. Cropped (A) posteroanterior and (B) lateral plain radiographs of the hand show normal bony anatomy and mild soft-tissue swelling at the left thumb metacarpophalangeal joint.

and focal tenderness to palpation at the ulnar aspect of the thumb MCP joint. Despite bilateral first MCP joint laxity on varus and valgus stress without identification of a firm endpoint, pain was elicited only on valgus stress of the left first MCP joint. Given the laxity and the left thumb soft-tissue swelling with pain, plain radiographs, ultrasound, and MRI were used to evaluate for severity of presumed left thumb UCL injury.

Imaging Findings

Plain radiographs showed normal bony anatomy without fracture, normal joint space, and mild soft-tissue swelling at the left thumb MCP level (**Figures 3A, 3B**). Ultrasound confirmed a complete tear of the UCL, which was flipped in a proximal direction and projected dorsally in relation to the direct insertion of the adductor tendon (Figure 2B). MRI showed focal disruption of the UCL at the level of the left thumb MCP joint with associated MCP joint effusion (**Figures 4A-4F**). Low T1 signal intensity over the adductor aponeurosis at the level of the metacarpal head corresponded with the torn and proximally retracted UCL. There was associated bone marrow edema at the radial and volar aspects of the thumb metacarpal head and low-grade strain of the abductor pollicis brevis. The thumb flexor and extensor tendons appeared normal. Although possibly secondary to patient positioning, mild volar subluxation of the proximal phalanx in relation to the metacarpal head was queried.

Surgical Findings

Given laxity with pain at the UCL on stress testing, MRI and ultrasound findings, and continued pain and instability of the thumb with pinching and grasping during activities of daily living, the patient and orthopedic hand surgeon proceeded with surgical intervention. Preoperative examination under anesthesia confirmed significant laxity on valgus stress without a palpable endpoint (**Figures 5A, 5B**). During surgery, retraction of the extensor hood revealed the completely torn and displaced UCL, entrapped dorsally and proximally to the adductor aponeurosis, characteristic of a Stener lesion. After the primary repair of the UCL, the extensor hood was seen partially retracted in a normal location superficial to the normal deep position of the repaired UCL (**Figures 6A, 6B**).

Discussion

Hyperabduction injuries to the thumb may rupture the UCL of the MCP joint of the thumb or cause a bony avulsion of the base of the proximal phalanx. Injury to the UCL, most often at its distal portion,^{4,14,15} may result in a sprain or full-thickness tear of the ligament. Subsequently, the ligament may remain in situ, or the proximal segment may retract proximal to the adductor aponeurosis with continued abduction of the thumb. On release of the abduction force, the proximal UCL segment is displaced dorsally and proximally by the inferior aspect of the adductor aponeurosis. The UCL be-

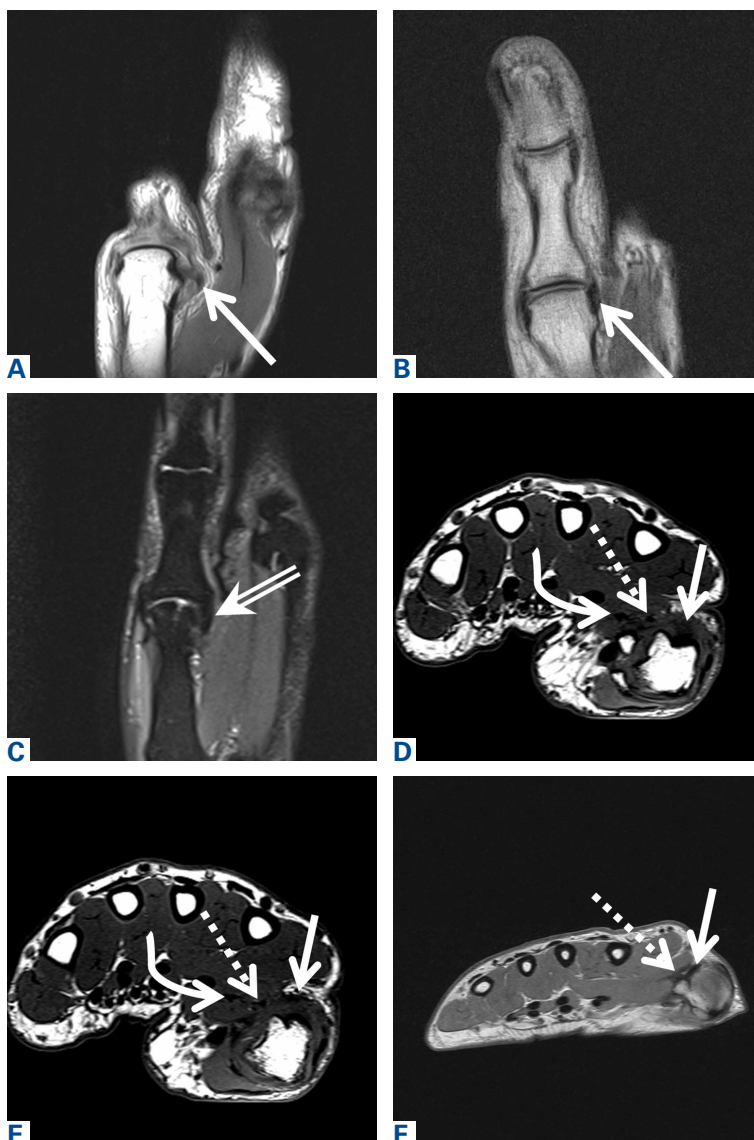


Figure 4. Magnetic resonance imaging. (A, D, E) Comparison images of the hand show a Stener lesion with (B, F) a normal ulnar collateral ligament (UCL) and (C) a chronic UCL tear. (A) Coronal proton-density image shows a completely torn UCL with proximal segment flipped proximally (solid arrow). (B) Coronal proton-density sequence in a normal comparison patient shows the uninjured UCL. (C) Coronal STIR (short tau inversion recovery) sequence in a different patient shows chronic thickening of the intact and scar-remodeled UCL (double arrow). (D, E) Two sequential axial T1-weighted images show dorsal position of the flipped UCL (solid arrow) in relation to the direct (curved arrow) and aponeurotic (dotted arrow) adductor pollicis insertions. (F) Axial proton-density sequence in a normal comparison patient shows the uninjured UCL (solid arrow) in relation to the adductor pollicis insertion (dotted arrow).

comes entrapped by the adductor aponeurosis and cannot reduce spontaneously.¹⁵ This displacement was initially described by Stener⁶ in 1962 and is referred to as a *Stener lesion* (Figures 1A-1C).

It is vital for the radiologist to identify a Stener lesion because a nondisplaced tear of the UCL is often treated nonsurgically, but UCL tears displaced more than 3 mm and Stener lesions usually must be operated on to avoid chronic instability, pain, and osteoarthritis.^{2-5,8,12-23}

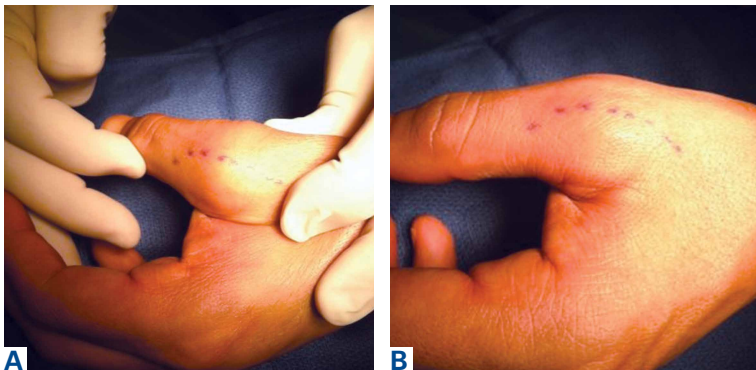


Figure 5. Examination under anesthesia confirms significant laxity at the first metacarpophalangeal joint without a perceptible endpoint (A) on valgus stress and (B) at rest.

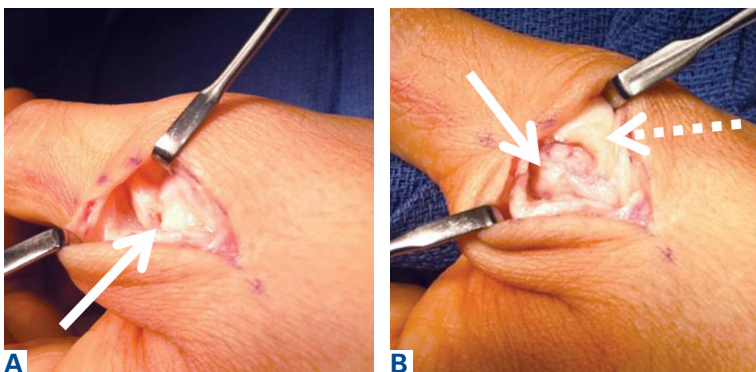


Figure 6. Intraoperative photographs. (A) Retraction of the extensor hood revealed a completely torn ulnar collateral ligament (UCL), displaced dorsal and proximal to the adductor aponeurosis (solid arrow). (B) After primary repair of the UCL (solid arrow), the extensor hood (dotted arrow) can be seen partially retracted in the normal location superficial to the normal deep position of the repaired UCL.



Figure 7. Plain radiograph shows a bony avulsion of the base of the first proximal phalanx at the distal ulnar collateral ligament insertion (arrow).

Sensitivity and specificity of MRI in evaluating UCL injuries are reported to be almost 100%, with resolution of 1 mm using current surface coils.²³ There are various UCL injury patterns, including partial tears, displaced and nondisplaced complete tears, and even complex injuries, such as an incomplete tear with the torn portion retracted as a Stener lesion.²² MRI is needed to establish the extent of injury, as 90% of complete tears that are displaced at least 3 mm, and all tears with retraction proximal and superficial to the aponeurosis (true Stener lesions), failed immobilization and required surgical treatment.²³

Although they vary in the literature, mean sensitivity and specificity of ultrasound in detecting UCL tears in level I studies have been reported as 76% and 81%, respectively.²⁴ When Melville and colleagues²¹ applied their ultrasound criteria—including absence of normal UCL fibers traversing the first MCP joint as well as heterogeneous mass-like tissue at least partially proximal to the apex of the metacarpal lateral tubercle—they were able to

distinguish displaced full-thickness tears from non-displaced full-thickness tears with 100% accuracy. Hergan and colleagues²⁵ found that the diagnostic accuracy of MRI was superior to that of ultrasound; while MRI accuracy was perfect, 12% of patients were incorrectly diagnosed with ultrasound, with false-positive or false-negative tendon-edge displacement. In our experience, ultrasound is uniquely useful in its ability to characterize the real-time dynamic interaction of the UCL with the adductor aponeurosis. It has been observed that passive flexion of the first interphalangeal joint moves the adductor aponeurosis in isolation, allowing differentiation from the subjacent UCL.²¹ Had a partial tear been in the differential diagnosis of our patient's Stener lesion, such a maneuver under ultrasound visualization would have solved the dilemma. In addition, ultrasound allows for comparison with the contralateral ligament at the time of examination should a diagnostic dilemma arise.

As many have reported both bony avulsion of the base of the proximal phalanx and concomitant inju-

ry to the UCL, identification of a bony avulsion does not exclude a ligamentous injury and the possibility of a Stener lesion (**Figure 7**).^{16,19} In one study, 14% of patients with injury to the UCL sustained a concomitant bony avulsion of the UCL insertion.²³ However, presence of the avulsion fragment did not alter management, and only those fragments involving more than 20% of the articular surface were considered true fractures and treated as such.

Conclusion

A Stener lesion—retraction of a completely torn UCL becoming entrapped dorsally and proximally to the adductor insertion—can cause pain, instability, and ultimately osteoarthritis if not treated appropriately. The orthopedic surgeon should have a high index of suspicion for a Stener lesion in the appropriate clinical scenario and consider all imaging modalities for diagnosis. Likewise, it is of utmost importance for the radiologist to identify imaging findings of a Stener lesion, as physical examination alone may be limited in its ability to characterize injury severity. Both MRI and ultrasound are useful in evaluating UCL tears, and ultrasound provides the additional benefit of dynamic visualization and comparison with the contralateral side.

Dr. Tresley is an Attending Radiologist, Advocate Health System, Chicago, Illinois. He was a resident at Jackson Memorial Hospital at the time the article was written. Dr. Singer is a Fellow, Department of Radiology, Emory University, Atlanta, Georgia. Dr. Ouellette is an Orthopedic Surgeon, University of Wisconsin, Madison, Wisconsin. Dr. Blachman is Clinical Instructor, Department of Radiology, University of British Columbia, Vancouver, British Columbia. Dr. Clifford is Associate Professor, Department of Diagnostic Radiology, Jackson Memorial Hospital, Miami, Florida.

Address correspondence to: Jonathan Tresley, MD, Department of Diagnostic Radiology, West Wing 279, Jackson Memorial Hospital, 1611 NW 12th Ave, Miami, FL 33136 (tel, 305-585-7500; fax, 305-585-5743; email, JTRadiology@gmail.com).

Am J Orthop. 2017;46(3):E195-E199. Copyright Frontline Medical Communications Inc. 2017. All rights reserved.

References

1. Campbell CS. Gamekeeper's thumb. *J Bone Joint Surg Br.* 1955;37(1):148-149.
2. Anderson D. Skier's thumb. *Aust Family Physician.* 2010; 39(8):575-577.
3. Heim D. The skier's thumb. *Acta Orthop Belg.* 1999;65(4):440-446.
4. Lohman M, Vasenius J, Kivisaari A, Kivisaari L. MR imaging in

- chronic rupture of the ulnar collateral ligament of the thumb. *Acta Radiol.* 2001;42(1):10-14.
5. Kundu N, Asfaw S, Polster J, Lohman R. The Stener lesion. *Eplasty.* 2012;12:ic11.
6. Stener B. Displacement of the ruptured ulnar collateral ligament of the metacarpophalangeal joint of the thumb. *J Bone Joint Surg Br.* 1962;44:869-879.
7. Carlson MG, Warner KK, Meyers KN, Hearn KA, Kok PL. Anatomy of the thumb metacarpophalangeal ulnar and radial collateral ligaments. *J Hand Surg Am.* 2012;37(10):2021-2026.
8. Heyman P. Injuries to the ulnar collateral ligament of the thumb metacarpophalangeal joint. *J Am Acad Orthop Surg.* 1997;5(4):224-229.
9. Minami A, An KN, Cooney WP 3rd, Linscheid RL, Chao EY. Ligamentous structures of the metacarpophalangeal joint: a quantitative anatomic study. *J Orthop Res.* 1984;1(4): 361-368.
10. Heyman P, Gelberman RH, Duncan K, Hipp JA. Injuries of the ulnar collateral ligament of the thumb metacarpophalangeal joint. Biomechanical and prospective clinical studies on the usefulness of valgus stress testing. *Clin Orthop Relat Res.* 1993;(292):165-171.
11. Patel S, Potty A, Taylor EJ, Sorene ED. Collateral ligament injuries of the metacarpophalangeal joint of the thumb: a treatment algorithm. *Strategies Trauma Limb Reconstr.* 2010;5(1):1-10.
12. O'Callaghan BI, Kohut G, Hoogewoud HM. Gamekeeper thumb: identification of the Stener lesion with US. *Radiology.* 1994;192(2):477-480.
13. Ebrahim FS, De Maeseneer M, Jager T, Marcellis S, Jamadar DA, Jacobson JA. US diagnosis of UCL tears of the thumb and Stener lesions: technique, pattern-based approach, and differential diagnosis. *Radiographics.* 2006;26(4):1007-1020.
14. Haramati N, Hiller N, Dowdle J, et al. MRI of the Stener lesion. *Skeletal Radiol.* 1995;24(7):515-518.
15. Shinohara T, Horii E, Majima M, et al. Sonographic diagnosis of acute injuries of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb. *J Clin Ultrasound.* 2007;35(2):73-77.
16. Giele H, Martin J. The two-level ulnar collateral ligament injury of the metacarpophalangeal joint of the thumb. *J Hand Surg Br.* 2003;28(1):92-93.
17. Kaplan SJ. The Stener lesion revisited: a case report. *J Hand Surg Am.* 1998;23(5):833-836.
18. Thirkannad S, Wolff TW. The "two fleck sign" for an occult Stener lesion. *J Hand Surg Eur Vol.* 2008;33(2):208-211.
19. Badawi RA, Hussain S, Compson JP. Two in one: a variant of the Stener lesion. *Injury.* 2002;33(4):379-380.
20. McKeon KE, Gelberman RH, Calfee RP. Ulnar collateral ligament injuries of the thumb: phalangeal translation during valgus stress in human cadavera. *J Bone Joint Surg Am.* 2013;95(10):881-887.
21. Melville D, Jacobson JA, Haase S, Brandon C, Brigido MK, Fessell D. Ultrasound of displaced ulnar collateral ligament tears of the thumb: the Stener lesion revisited. *Skeletal Radiol.* 2013;42(5):667-673.
22. Romano WM, Garvin G, Bhayana D, Chaudhary O. The spectrum of ulnar collateral ligament injuries as viewed on magnetic resonance imaging of the metacarpophalangeal joint of the thumb. *Can Assoc Radiol J.* 2003;54(4):243-248.
23. Milner CS, Manon-Matos Y, Thirkannad SM. Gamekeeper's thumb—a treatment-oriented magnetic resonance imaging classification. *J Hand Surg Am.* 2015;40(1):90-95.
24. Papandrea RF, Fowler T. Injury at the thumb UCL: is there a Stener lesion? *J Hand Surg Am.* 2008;33(10):1882-1884.
25. Hergan K, Mittler C, Oser W. Ulnar collateral ligament: differentiation of displaced and nondisplaced tears with US and MR imaging. *Radiology.* 1995;194(1):65-71.

This paper will be judged for the Resident Writer's Award.