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Eric X. Jiang

Michael Korn

Elizabeth A. King

Marnix van Holsbeeck

Case Report

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Entrapment of the index finger radial collateral ligament in the metacarpophalangeal joint: A case report

Eric X Jiang[1], Michael A Korn[1], Elizabeth A King[1] and Marnix van Holsbeeck[2]

Abstract

Introduction: Digital collateral ligament injuries are common hand injuries that can cause significant pain and functional impairment. Ultrasonography can be useful in the evaluation of these ligamentous injuries, as it is both cost-effective and allows for easy, dynamic evaluation during imaging.

Case report: We report a rare sonographic finding of an index finger radial collateral ligament injury that was found to have a flap of the ligament entrapped within the metacarpophalangeal joint, which to our knowledge has not been described previously. We correlate this finding with an intraoperative image of the entrapment of the collateral ligament. We also report on the novel application of superb microvascular imaging to aid in the diagnosis of digital collateral ligament injury.

Discussion: This particular injury pattern has not been reported in the literature previously and likely explains the patient's lack of improvement with nonoperative management. Our finding is similar to a Stener lesion seen in a thumb ulnar collateral ligament injury in which the ligament is unable to heal due to entrapment. In addition, using superb microvascular imaging (SMI), we were able to visualize hyperemia to surrounding structures and the ligament itself which suggested an acute injury.

Conclusion: We anticipate that this case report will provide sonographers with knowledge and images of this specific injury pattern to the digital collateral ligaments.

Keywords

Ultrasound, hand, collateral ligament injury, superb microvascular imaging

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Introduction

Digit collateral ligament (DCL) injuries are one of the most common orthopaedic injuries seen during the evaluation of upper extremity injuries, with over 1.3 million cases seen annually in the clinic setting.[1] The collateral ligaments of the proximal interphalangeal (PIP) joint of the digits are the most often injured, followed by the thumb metacarpophalangeal joint (MCPJ), and the MCPJ of the remaining digits.[1] In addition to pain and functional impairment, these injuries can cause instability of the digits in pinch weakness (with injuries to the index finger radial collateral ligament (RCL) and thumb ulnar collateral ligament (UCL)), decreased range of motion, and stiffness. More specifically, index finger RCL injuries are often underreported and missed, resulting in chronic laxity and early osteoarthritis when left untreated.[2,3]

Evaluation of DCL injuries begins with a history and physical exam by the treating provider in the clinic. The diagnosis can be made clinically if there is no endpoint to a stress maneuver or if there is a large

[1]Department of Orthopedic Surgery, Henry Ford Hospital, Detroit, MI, USA
[2]Department of Musculoskeletal Radiology, Henry Ford Hospital, Detroit, MI, USA

Corresponding author:
Eric X Jiang, Henry Ford Health System, 2799 W. Grand Blvd Detroit, MI 48202-3450, USA.
Email: exjresearch@gmail.com

discrepancy in digit deviation compared to the contralateral side. However, in the acute setting, joint swelling and pain often limit clinical evaluation. Thus, confirmatory diagnostic imaging is helpful when clinical suspicion is high.

Ultrasonography is one imaging modality that can be useful in the evaluation of ligamentous injuries of the hand. Although magnetic resonance imaging (MRI) has been shown to have higher specificity compared to ultrasound imaging, the latter is often ordered first, as it is usually faster and more cost-effective to obtain.[4] Ultrasound imaging yields excellent preliminary diagnostic information, especially of the collateral ligaments of the digits because of their superficial nature relative to the skin.[5] In addition, ultrasound allows for dynamic evaluation during imaging which cannot be assessed with MRI.[1,5] We report the ultrasound findings of an index finger metacarpophalangeal (MCP) RCL injury that was found to have a flap of the ligament entrapped within the MCPJ, which has not been described previously in the literature.

Case report

A 55-year-old, right hand dominant female presented to the orthopaedic surgery hand and upper extremity clinic after striking her right index finger on a door two weeks prior. Initial radiographs at the time of injury revealed no acute fracture of dislocation injuries. In the clinic, her exam was notable for moderate effusion of the PIP joint, tenderness over the radial and ulnar aspect of the joint and stable collaterals with radial and ulnar deviation with a 0–70° passive range of motion arc; her MCPJ was not significantly tender at this time and was not stressed. A sonographic examination of her index finger was ordered to evaluate for ligamentous injury, and the patient was instructed to return to the clinic after the study was completed. The patient returned to the clinic approximately three months after her initial injury and had persistent pain and swelling in her index finger – specifically increased swelling over the index finger MCPJ with decreased swelling of her PIP joint. She also complained of difficulty with pinch (turning a key) and grip (opening a bottle of water). On exam, she had significant tenderness along the RCL of her MCPJ with pain and laxity with ulnar deviation of the MCPJ at 30° of flexion compared to the contralateral side. Her MCP range of motion was 0–70°, and her PIP joint range of motion was 15–50°.

Sonographic examination with a 22MHz hockey stick transducer (Model i22LH8; Aplio™ i800 ultrasound system; Canon Medical Systems USA, Inc.) was performed at six weeks post-injury along the entire length of the right index finger on the dorsal, palmar, and radial/ulnar borders. Under both passive and active flexion and extension of the index finger, the following structures were examined: the flexor tendons, the decussation of the flexor tendons, the pulley system, the extensor tendons, the dorsal hood, the collateral ligaments, the lumbricals, and neurovascular structures. The RCL and UCL of the MCPJ were gently stressed to assess their integrity. On the radial aspect of MCPJ, a portion of the RCL was visualized to be wedged in between the metacarpal head and the base of the proximal phalanx suggesting entrapment within the joint; there was also evidence of detached articular cartilage from the metacarpal head visualized as a hyperechoic structure (Figure 1). On the dorsoradial aspect of the MCPJ, there was evidence of

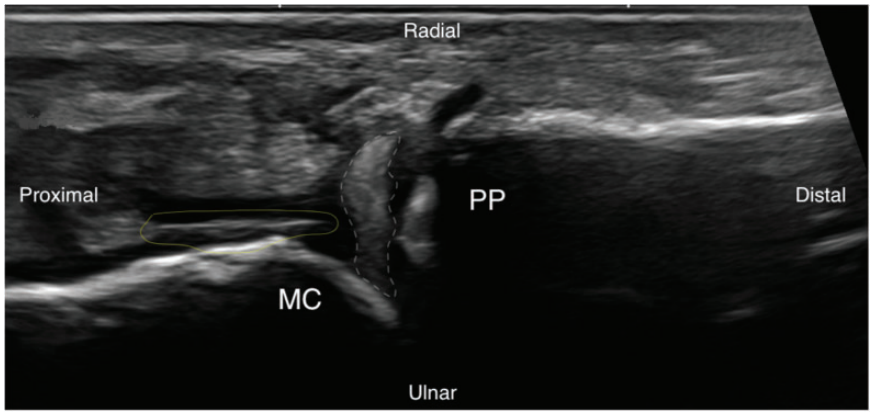

Figure 1. Long-axis sonogram of the MCPJ of the index finger (radial aspect). The entrapped limb of the radial collateral ligament (dotted white outline) is seen inside the MCPJ between the metacarpal head and base of the proximal phalanx. There is also evidence of articular cartilage injury with a small piece of cartilage (solid yellow outline) lying just radial to the metacarpal head.
MC: metacarpal head; PP: proximal phalanx base.

significant hyperemia of the joint capsule visualized with superb microvascular imaging (SMI),[6] suggesting injury to the capsule-collateral ligament complex (Figure 2). The flexor tendons and volar plate of the MCPJ were visualized to be intact with significant edema on the radial aspect of the joint (Figure 3).

Due to the debilitating nature of the patient's injuries and evidence of ligamentous injury on ultrasound imaging, the patient elected for operative repair of the RCL of her index finger. Intraoperatively, a limb of the proximal RCL was entrapped within the MCPJ and significant cartilage injury was visualized on the radial aspect of the metacarpal head which closely correlated with sonographic findings (Figure 4). The RCL appeared to be scarred to the capsule and needed to be subsequently sharply dissected and mobilized. The RCL remnant was then repaired using suture and a bone anchor to the base of the proximal phalanx. At three months postoperatively, the patient reported resolution of her pain and demonstrated a stable MCPJ on examination.

Discussion

Ultrasound imaging is an invaluable tool in the evaluation of hand and wrist pathologies, as it has the distinct advantage of being able to visualize structures under dynamic stress, which provides information regarding injury severity. We report a case of an injury to the index finger MCP RCL diagnosed by ultrasound imaging in conjunction with superb microvascular imaging (SMI) technique where the ligament was found to be entrapped within the MCPJ.

Injuries to the RCL of the MCP joints of the digits are more common than UCL injuries, with the exception of the thumb.[7] Patients often report a mechanism of forced ulnar deviation of the digit with the MCPJ in flexion. In many cases, the diagnosis can be made clinically when there is laxity with ulnar deviation of the MCPJ in both extension and partial flexion compared to the contralateral side. In this patient, ultrasound imaging of her injured digit was obtained because the patient reported continued pain and swelling in her MCPJ six weeks after her initial injury. The ultrasound showed an obvious RCL injury as well as evidence of entrapment of part of the ligament in the MCPJ. This particular injury pattern has not been reported in the literature previously and likely explains the patient's lack of improvement with nonoperative management. In the thumb, injury to the MCP UCL can result in a Stener lesion,[8] in which the adductor pollicis aponeurosis interposes between the UCL at its attachment to the base of the proximal phalanx. This widely recognized injury often requires surgical intervention because the interposed aponeurosis leads

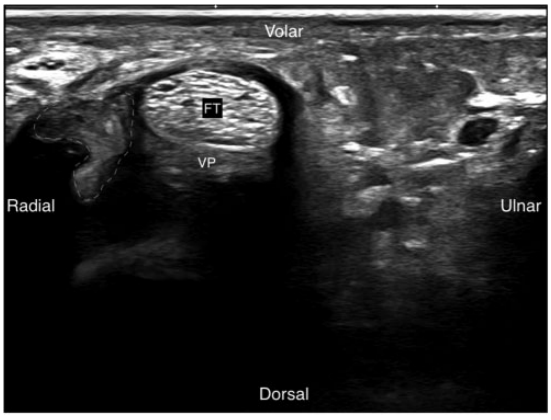

Figure 3. Short-axis sonogram of the MCPJ of the index finger (volar). There is increased hypoechogenicity and a soft tissue flap (dotted white outline) on the radial side of the joint, suggesting a radial-sided injury. The flexor tendon and volar plate are intact.
FT: flexor tendons; VP: volar plate.

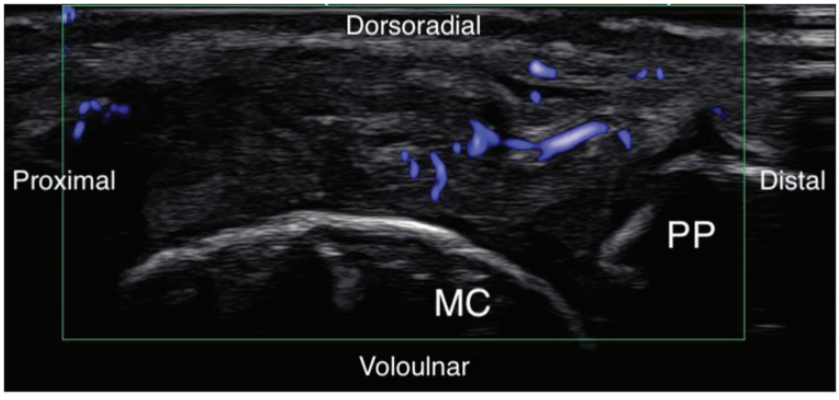

Figure 2. Long-axis sonogram of MCPJ of the index finger (dorsoradial aspect). Superb microvascular imaging demonstrates increased vascular flow of capsular tissue.
MC: metacarpal head; PP: proximal phalanx base.

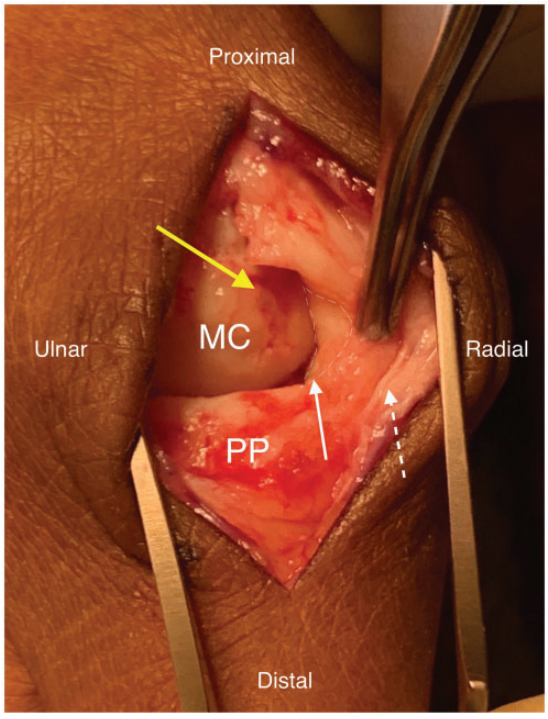

Figure 4. Intraoperative photo of MCPJ of the index finger (dorsal). The entrapped limb of the proximal RCL is seen within the confines of the joint as well as an area of cartilage injury on the radial aspect of the metacarpal head. The image was taken with radial retraction of the capsule/collateral ligament complex in order to expose the joint; without the external force required to expose the joint, the entrapped limb had a more ulnar position within the joint.
MC: metacarpal head; PP: proximal phalanx with the semi-transparent dotted outline outlining the proximal limb of the RCL; solid white arrow: entrapped limb of the RCL; dotted white arrow: dorsal capsule dissected to expose joint; solid yellow arrow: area of cartilage injury on the metacarpal head.

to displacement of the ligament, prevents healing, and causes chronic instability. In our patient, a similar pattern was seen; the RCL was entrapped within the MCPJ leading to severe displacement of the ligament. With continued conservative management, it is unlikely that the ligament would return to a healing position. Therefore, it was reasonable to pursue surgical intervention.

Our sonographic evaluation utilized superb microvascular imaging (SMI) of the patient's RCL injury.[6] This imaging modality was developed by Toshiba, Inc. (Tokyo, Japan) in order to visualize small vessels and low velocity vascular flow without the use of contrast and has been used in the evaluation of pathologies of a wide variety of organ systems including the musculoskeletal system.[9,10] However, the literature surrounding SMI and its use in the evaluation of ligamentous injury is sparse. One study by Arslan et al. determined that SMI sonography was superior to traditional color or power Doppler imaging in the detection of lateral epicondylitis.[11] The theory is that microscopic tears secondary to mechanical overloading of the tendon insertion leads to neovascularization in the healing process which can be visualized with SMI. In our patient, there was hyperemia of the MCPJ capsule that suggested possible injury to nearby structures (Figure 2), and the RCL injury was subsequently visualized on another view (Figure 1). DCL injuries, especially low-grade tears, also involve microscopic trauma to the ligament fibers which lead to hypervascularity. SMI may be used to improve the diagnostic accuracy of low-grade digital collateral ligament injuries where there may not be a clear disruption in the ligament substance. Early research on grading of vascularity using SMI in the musculoskeletal system[12,13] has already seen promising results, and with improvements in the technology and conducting similar studies in the hand, it may be possible to stratify and grade injuries to smaller ligaments such as DCL injuries. There are two important limitations to the usage of this technology. SMI is not readily available in all parts of the world and therefore widespread use of this novel technology may take some time to achieve. Second, usage of SMI requires previous sonographic experience and a robust understanding of anatomy which may limit its usage in less experienced ultrasound practitioners.

Conclusion

We have reported a novel diagnosis, using SMI technology, of an index finger RCL injury that was found to have the ligament entrapped within the MCPJ. Similar to the Stener lesion of a thumb UCL injury, this injury pattern should be considered when DCL injuries do not improve symptomatically for the patient. SMI is a promising technology that may be used to diagnose low-grade DCL injuries.

Ethics Approval

No ethics approval was necessary for this publication per our institution policy. Written, informed consent for images used in this publication was obtained from the patient. All identifying features from the images have been removed.

Contributorship

MVH, EAK collaborated on the interesting sonographic finding described in this case report. EXJ and EAK obtained the intraoperative photographs. EXJ and MVH reviewed the ultrasound images and correlated them with the intraoperative photographs. EXJ wrote the first draft of the manuscript and researched the literature. All authors reviewed and edited

the manuscript and approved the final version of the manuscript.

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ORCID iD

Eric X Jiang https://orcid.org/0000-0002-6271-2172

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