Original Article

Sports Injury-Related Fingers and Thumb Deformity Due to Tendon or Ligament Rupture

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Abstract

Background: Hand injuries are very common in sports, such as skiing and ball sports. One of the major reasons causing hand and finger deformity is due to ligament and tendon injury. The aim of this study was to investigate if the high-resolution 3T magnetic resonance imaging (MRI) can demonstrate the complex anatomy of the fingers and thumb, especially the tendons and ligaments, and provide the accurate diagnosis of clinically important fingers and thumbs deformity due to ligamentous and tendinous injuries during sport activities.
Methods: Sixteen fresh un-embalmed cadaveric hands were harvested from eight cadavers. A total of 20 healthy volunteers' hands and 44 patients with fingers or thumb deformity due to sports-related injuries were included in this study. All subjects had MR examination with T1-weighted images and proton density-weighted imaging with fat suppression (PD FS) in axial, coronal, and sagittal plane, respectively. Subsequently, all 16 cadaveric hands were sliced into 2-mm thick slab with a band saw (six in coronal plane, six in sagittal plane, and four in axial plane). The correlation of anatomic sections and the MRI characteristics of tendons of fingers and the ulnar collateral ligament (UCL) at the metacarpal phalangeal joint (MCPJ) of thumb between 20 healthy volunteers and 44 patients (confirmed by surgery) were analyzed.
Results: The normal ligaments and tendons in 16 cadaveric hands and 20 volunteers' hands showed uniform low-signal intensity on all the sequences of the MRI. Among 44 patients with tendinous and ligamentous injuries in the fingers or thumb, 12 cases with UCL injury at MCPJ of the thumb (Stener lesion = 8 and non-Stener lesion = 4), 6 cases with the central slip injury, 12 cases with terminal tendon injury, and 14 cases with flexor digitorum profundus injury. The ligaments and tendons disruption manifested as increased signal intensity and poor definition, discontinuity, and heterogeneous signal intensity of the involved ligaments and tendons.
Conclusions: Sports injury-related fingers and thumb deformity are relatively common. MRI is an accurate method for evaluation of the anatomy and pathologic conditions of the fingers and thumb. It is a useful tool for accurate diagnosis of the sports-related ligaments and tendons injuries in hand.

Key words: Boutonniere Deformity; Fingers; Jersey Finger; Magnetic Resonance Imaging; Mallet Finger; Stener Lesion; Thumb

Introduction

Ligaments and tendons injuries of the hand are very common in sports activities.[1-6] The accurate diagnosis and early treatments of such injuries play an important role in the functional recovery of the involved ligaments and tendons and preventing the occurrence of the injury-related deformities. The common sports-related deformities in hands usually include Gamekeeper's thumb (Skier's thumb), Stener lesion, boutonniere deformity, mallet finger, and jersey finger. For example, skiing is one of the most popular sports in winter, when the skier grips the ski pole; the thumb will sustain the force in abduction and will be vulnerable to the injury of the

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ulnar collateral ligament (UCL). Because this ligament is very small and difficult to see on routine radiography and computed tomography (CT), magnetic resonance imaging (MRI), a noninvasive method, can provide a high-resolution image of the soft tissue in multiple planes and visualize the detailed anatomic structures of the ligaments and tendons of the hands.[7-15] MRI, especially high-resolution 3T MRI is the preferred imaging modality in the diagnosis of the ligamentous and tendinous injuries in fingers and thumb. A comprehensive understanding of the detailed anatomy of the hands and the corresponding MRI features can aid in the diagnosis and treatment of sports-related injuries of ligaments and tendons.

This study was designed to outline the anatomy and MRI appearance of the normal ligaments and tendons in the hands including the UCL at the metacarpal phalangeal joint (MCPJ) of the thumb, the central slip, the terminal tendon, and the flexor digitorum profundus (FDP) using cadaveric specimens and normal volunteers, review the common sports-related fingers and thumb deformity due to ligamentous and tendinous injuries, discuss the mechanisms of injuries, and illustrate the characteristics of MRI using the surgically proven cases of ligamentous and tendinous injuries.

Methods

Ethical approval

The study was adhered to the *Declaration of Helsinki* and approved by the Institutional Review Board of Beijing Jishuitan Hospital. Written informed consent was obtained from all participants in this study.

Cadavers and subjects

The 16 cadaveric hands were harvested from eight cadavers that provided by the Institute of Basic Sciences, Chinese Academy of Medical Sciences. There were five men and three women with age range between 30 and 60 years at death with mean age of 46 years. All specimens included the distal radius and ulna, entire wrist and hand, which were kept at −42°C (Haier BioMedical, DW-40W100, Qing Dao, China) for the following experiments. All specimens were thaw at room temperature for 24 h before MRI was taken.

The normal MRI features of ligaments and tendons in the hands were analyzed on 80 fingers and 20 thumb from 20 healthy volunteers (10 men and 10 women, right hands: 5 men, 5 women; left hands: 5 men, 5 women; age range from 21 to 53 years with mean age of 32 years) in Beijing Jishuitan Hospital from March 2014 to June 2016 without history of ligamentous and tendinous injuries in hands.

Forty-four patients with ligaments or tendons injury who were confirmed by surgery between March 2013 and June 2016 were included and analyzed in this study. In these patients, 12 cases with UCL injury at the MCPJ of thumb, 6 cases with the central slip injury, 12 cases with terminal tendon injury, and 14 cases with FDP injury.

To be included in this study, the healthy volunteers must have no history of hand trauma, free of pain, with normal range of motion in hands. The patients who had UCL injury at the MCPJ must have the history of trauma and localized pain and swell in the ulnar aspect of the MCPJ. In addition to the specific traumatic history, pain and swell, the patients with injuries of extensor mechanisms must have troubles in extending the corresponding joint even the whole finger actively. The patients who had injuries of the FDP were unable to flex the distal interphalangeal joint (DIPJ) with the proximal interphalangeal joint (PIPJ) held in extension.

Magnetic resonance imaging

MR examination was performed with a 3T MRI unit (5680 DA Best, Philips Medical Systems, Netherlands) with a 16-channel hand and wrist receiver only coil (Philips Hand/Wrist 16 3T Tim coil). The healthy volunteers and patients were positioned prone with the examined arms placed above the head, and the hands were placed close to the isocenter of the gantry. The imaging planes for axial, coronal, and sagittal acquisitions must be prescribed with respect to the individual finger rather than the hand. An adjacent finger should be included within the field of view (FOV) to allow internal comparison. The cadaveric specimens were placed in the same way.

The fingers of all cadaveric specimens, volunteers, and patients underwent MRI with the following sequences: proton density-weighted imaging with fat suppression (PD FS) in axial, coronal and sagittal planes (repetition time/echo time [TR/TE]: 2347–3657 ms/40–45 ms), and T1-weighted fast spin-echo in axial, coronal, and sagittal planes (TR/TE: 521–780 ms/20–40 ms); section thickness: 2 mm; interslice space: 0.2 mm; number of excitations: 2–4; FOV: 100–140 mm × 70–100 mm × 26–40 mm; and voxel: 0.15–0.25 mm × 0.15–0.25 mm × 1.50 mm. What was deserved to be mentioned was that the MRI of thumb was taken on axial, oblique coronal, and oblique sagittal planes with the specimen's thumb abduction and other parameters were same to the fingers.

Anatomic specimens preparation

After obtained MRI, all cadaveric specimens were immediately frozen in neutral position at −42°C and were kept at this temperature for at least 24 h. Those specimens were subsequently sliced into 2-mm thick slices (that corresponded to the section thickness of the MRI) with a stainless steel band saw (American Meat Equipment Corp, Montebello, USA). Fingers and thumbs in six specimens were sectioned along the coronal plane, six along the sagittal plane, and four along the axial plane. Each slice was digitally photographed (EOS 6D, Canon, Japan), and colored photographs were obtained for the anatomic correlation analysis with the corresponding MRI.

Magnetic resonance imaging: Anatomic comparison and analysis

All MRI were interpreted independently by two musculoskeletal radiologists who had 5–10 years of experience. Both radiologists were blinded to the clinical data, including the findings in the surgery reports.

Any discrepancy would be resolved by consensus with introducing an additional radiologist with more than 10 years of experience. Every UCL at the MCPJ of thumb, central slip, terminal tendon, and FDP of fingers was analyzed in the 16 cadaveric hands and 20 volunteers' hands. The appearance and signal intensity of normal ligaments and tendons on MRI in 16 cadaveric specimens were compared with the appearance derived from the inspection of the corresponding colored photographs obtained from anatomic slices. The MRI characteristics of normal ligaments and tendons in 20 healthy volunteers' hands were analyzed and confirmed. In the 44 patients, the corresponding injured structures would be referred to the normal anatomy and analyzed. In addition, the MRI characteristics and results were compared with the surgical results in a double-blind manner.

Results

Gross anatomy and magnetic resonance imaging characteristics of the related ligaments and tendons

The normal ligaments and tendons of fingers and thumb in 16 cadaveric hands and 20 volunteers' hands showed hyposignal intensity on all the MR sequences [Figures 1–6].

Ulnar collateral ligament at the metacarpal phalangeal joint of thumb

The UCL at the MCPJ originated from the ulnar aspect of the dorsal tubercle of the first metacarpal and inserted into the base of the proximal phalanx. The UCL was mainly stabilized by the adductor aponeurosis (AA), which lay superficial to the UCL and attached at the ulnar aspect of the proximal phalanx [Figures 1 and 2]. With thumb abduction, the AA could be seen in every specimen on oblique coronal images of the thumb. The normal UCL showed as a thicker band than the AA with homogeneously hyposignal intensity. The average thickness is between 2.0 and 2.3 mm. The UCL and the AA could be best visualized in the oblique coronal plane on T1-weighed image (T1WI) and PD FS [Figures 1 and 2].

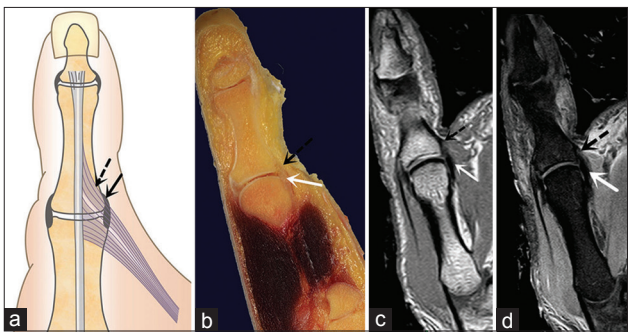

Figure 1: Normal ulnar collateral ligament of the first metacarpal phalangeal joint in the right thumb. (a) Schematic drawing of the UCL in the first MCPJ shows the UCL (arrow) attaches to the ulnar aspect of the dorsal tubercle of the first metacarpal and inserts into the base of the proximal phalanx. The adductor aponeurosis (dotted arrow) lies superficial to the UCL. (b) A coronal image of the right thumb of a 40-year-old cadaver specimen. (c and d) T1 and PD FS coronal images of the right thumb in a 40-year-old cadaver specimen showed normal ulnar collateral ligament and adductor aponeurosis. UCL: Ulnar collateral ligament; MCPJ: Metacarpal phalangeal joint; PD FS: Proton density-weighted imaging with fat suppression.

Central slip

The central slip arose from the extensor digitorum communis and inserted on the base of the dorsum of the middle phalanx of fingers [Figure 3]. The normal central slip demonstrated as a low signal line with a clear border on both T1WI and PD FS. The central slip could be best evaluated in axial and sagittal planes [Figures 4 and 6]. With section thickness 2 mm, the central slip could be identified on at least two consecutive slices on sagittal images.

Terminal tendon

The terminal tendon was formed by the conjoint tendons at the level of the midportion of the middle phalanx and traveled from the distal side of the middle phalange to the dorsum of the base of the distal phalanx [Figure 3]. The terminal tendon was similar to the central slip showing as a low signal line and could be best visualized in axial and sagittal planes on both T1WI and PD FS [Figures 4 and 6].

Flexor digitorum profundus

The flexor tendons of the index, middle, ring, and the little fingers included the flexor digitorum superficialis (FDS) and FDP. At the level of MCPJ, the FDS split into two beams bypassing the FDP, while they remerged into a beam at the PIPJ and inserted on the midportion of the middle phalanx [Figure 3]. The FDP passed superficially at the level of the proximal phalanx and inserted on the volar base of the distal phalanx. On both T1WI and PD FS, the flexor tendons showed as low-signal intensity, and they could be best seen on axial and sagittal planes [Figures 4–6].

Sports-related injuries on magnetic resonance imaging

Gamekeeper's thumb (Skier's thumb)/Stener lesion

The term Gamekeeper's thumb was applied to both acute and chronic injuries of the UCL at the MCPJ of thumb.[16] When the torn UCL retracted and lay superficial to the AA, this lesion was termed Stener lesion [Figure 7].[16] Among

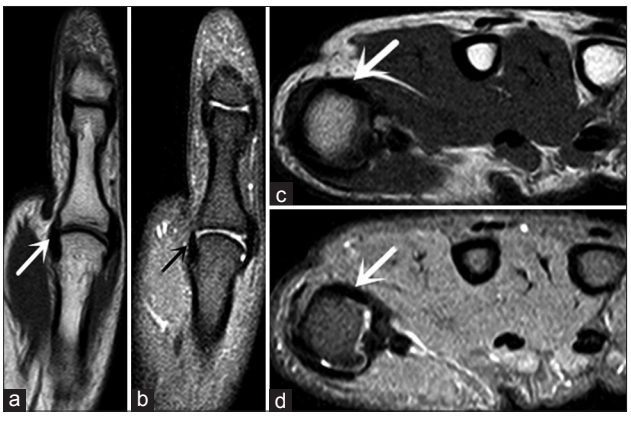

Figure 2: Normal ulnar collateral ligament in the left thumb of a 26-year-old healthy male volunteer. (a) Coronal T1-weighted image, (b) coronal PD FS weighted image, (c) axial T1-weighted image, (d) axial PD FS weighted image showed the homogeneously low-signal intensity of the UCL (arrows). UCL: Ulnar collateral ligament; PD FS: Proton density-weighted imaging with fat suppression.

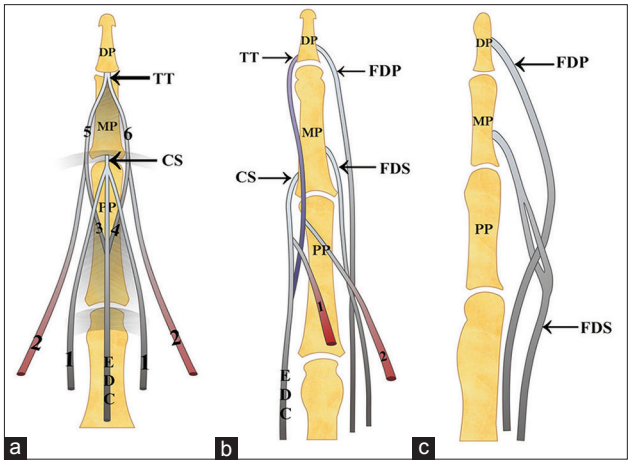

Figure 3: Schematic diagram of the central slip, the terminal tendon and the FDS and FDP. (a) Diagrammatic representation of the dorsal aspect and (b) the lateral aspect of the finger to show the flexor and extensor tendons of the finger including the CS and the TT. (c) Schematic drawing of the finger showed the FDS and the FDP. EDC: Extensor digitorum communis; PP: Proximal phalanx; MP: Middle phalanx; DP: Distal phalanx; 1: Interosseous muscle; 2: Lumbrical muscle; 3: Lateral slip; 4: Medial slip; 5: Lateral conjoined tendon; 6: Medial conjoined tendon; FDS: Flexor digitorum superficialis; FDP: Flexor digitorum profundus; CS: Central slip; TT: Terminal tendon.

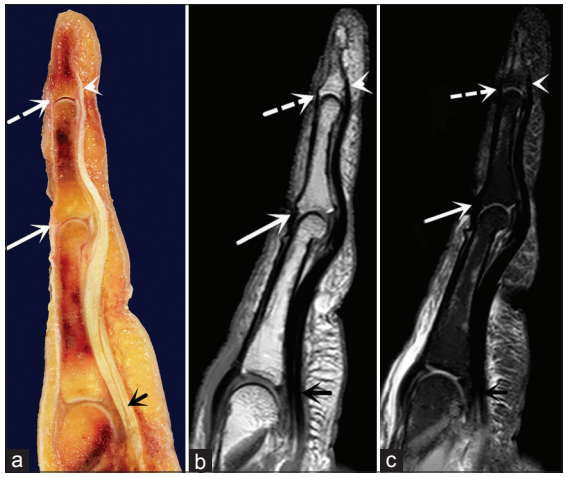

Figure 4: Normal central slip, the terminal tendon, and the flexor digitorum profundus in the middle finger of the left hand in a 60-year-old cadaver specimen. (a) Sagittal anatomic comparison specimen, (b) sagittal T1-weighted image, (c) PD FS weighted image showed the central slip (long arrow), terminal tendon (dotted arrow), the FDP (arrowhead), and the FDS (black short arrow), all demonstrated homogeneous hyposignal intensity on the all he sequences. FDS: Flexor digitorum superficialis; FDP: Flexor digitorum profundus; PD FS: Proton density-weighted imaging with fat suppression.

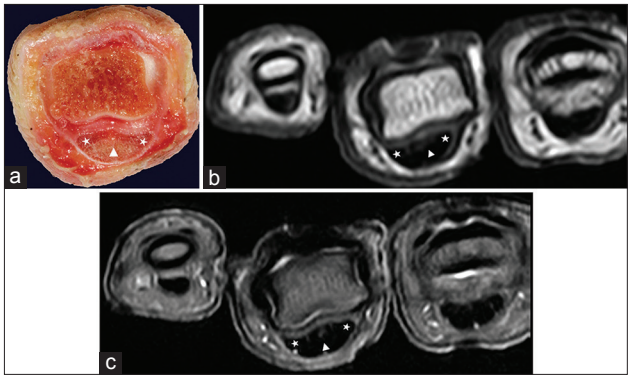

Figure 5: Normal flexor digitorum profundus and flexor digitorum superficialis in the ring finger of the left hand in a 50-year-old cadaver specimen. (a) Transverse anatomic comparison specimen, (b) transverse T1-weighted image, (c) transverse PD FS weighted image of the finger at the level of the proximal interphalangeal joint showed the FDP (triangles) lay superficial to the FDS (stars). FDS: Flexor digitorum superficialis; FDP: Flexor digitorum profundus; PD FS: Proton density-weighted imaging with fat suppression.

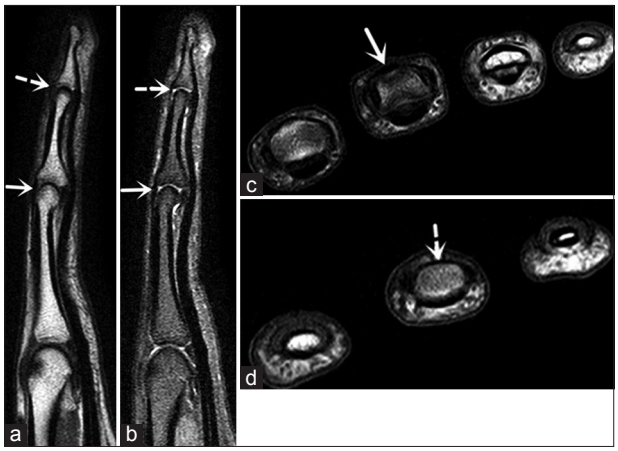

Figure 6: Normal central slip and terminal tendon in the middle finger of the right hand in a 26-year-old man. (a) Sagittal T1-weighted image, (b) sagittal PD FS weighted image, (c) axial T1-weighted image at PIPJ, (d) axial T1-weighted image at DIPJ showed central slip (arrow) as a linear hyposignal intensity line and inserted on the dorsum of the middle phalangeal base, and the hypointense terminal tendon (dotted arrow) inserted on the dorsum of the distal phalangeal base. PD FS: Proton density-weighted imaging with fat suppression; DIPJ: Distal interphalangeal joint; PIPJ: Proximal interphalangeal joint.

the 12 cases with the injury of the UCL, eight cases were Stener lesions and showed the discontinuity and thickening of the UCL with increased signal intensity and displacement superficially to the AA [Figure 7]. Among the Stener lesions, there were five cases with the torn ligament occurred at the insertion into the base of the proximal phalanx, three cases with the torn ligament occurred at the midportion of the ligament. The remaining four cases with non-Stener lesion showed the thickening and partial or total ruptured UCL with hyperintense on PD FS and the continuity of the AA. There were bone marrow edema at the base of the proximal phalanx and the surrounding soft-tissue edema in all 12 cases and among them; there were four cases with avulsion fracture at base of the proximal phalanx. This type lesion was best evaluated on coronal plane.

Boutonniere deformity

The boutonniere deformity referred to disruption of the central slip at the insertion into the base of the middle phalanx and leaded to the flexion of the PIPJ and extension at the DIPJ [Figure 8]. There were six cases with the disruption of the central slip and showed the discontinuity of the normal

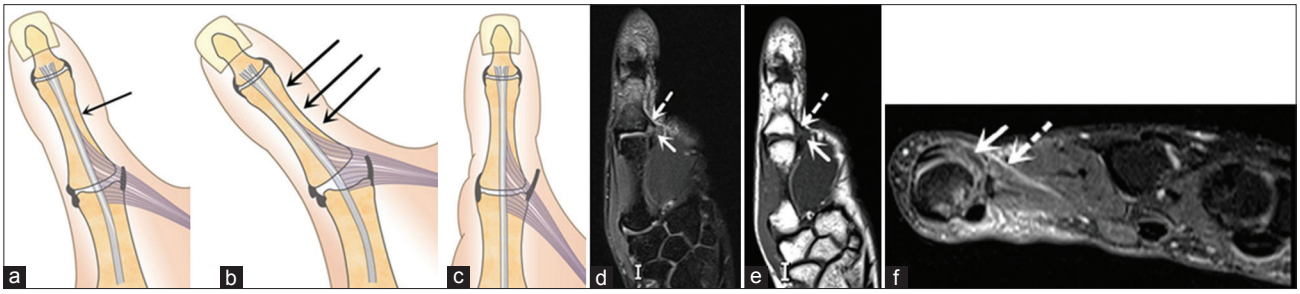

Figure 7: Stener lesion. (a–c) Illustrations of the mechanism of Stener lesion. Normally, the AA lies superficial to the UCL. After a directed abducted injury on the interphalangeal joint of the thumb, causing torn of the UCL. When the thumb returns to neutral position, the torn UCL fragment may locate superficial to the AA, and this is so called the Stener lesion. (d–f) A 42-year-old man with Stener lesion in the right thumb. (d) Coronal PD FS weighted image, (e) coronal T1-weighted image, (f) axial PD FS weighted image showed the torn UCL (*arrow*) was retracted and located superficial to the AA (dotted arrow). It is better evaluated on the coronal plane. UCL: Ulnar collateral ligament; AA: Adductor aponeurosis; PD FS: Proton density-weighted imaging with fat suppression.

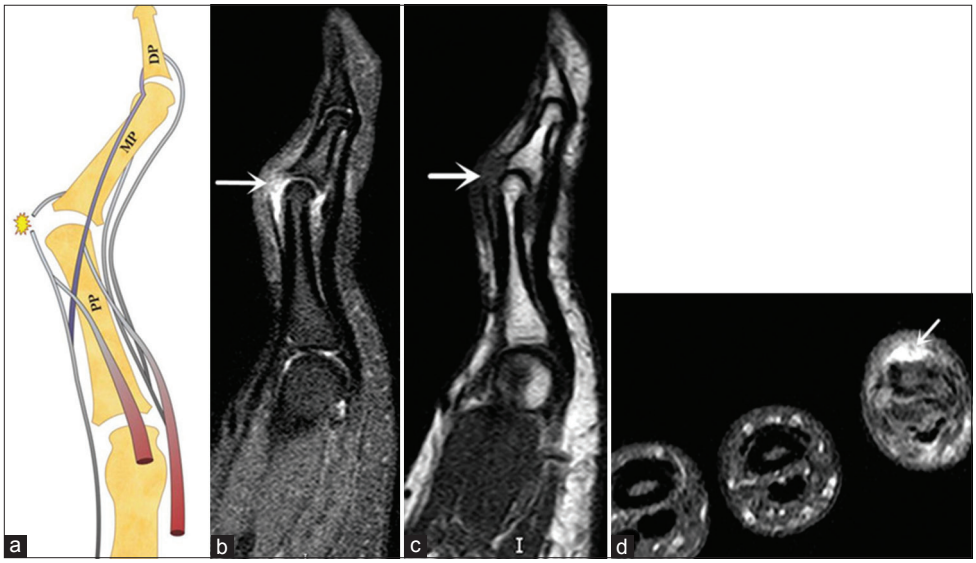

Figure 8: Boutonniere deformity. (a) Schematic drawing of the boutonniere deformity shows disruption of the central slip at the base of the MP resulting in the flexion of the proximal interphalangeal joint and extension at the distal interphalangeal joint. (b–d) A 26-year-old male with classical boutonniere deformity in the little finger. (b) Sagittal PD FS-weighted image, (c) sagittal T1-weighted image, (d) axial PD FS weighted image showed the discontinuity and abnormal signal of the central slip (arrows), and the deformity of the interphalangeal joint. MP: Middle phalanx; DP: Distal phalanx; PP: Proximal phalanx; PD FS: Proton density-weighted imaging with fat suppression.

hypointense linear tendon with retraction. In the acute case, there was adjacent soft-tissue edema. The sagittal was the best plane to demonstrate this deformity [Figure 8]. In these six patients, four people had injuries in the little finger, and two in the index finger.

Mallet finger

The mallet finger was caused by the rupture of the terminal tendon at its distal insertion on the dorsal aspect of the distal phalangeal base and resulted in the flexion of the DIPJ. This type injury was often accompanied by the avulsion fracture of the dorsal aspect of the distal phalanx base [Figure 9]. Twelve cases with the rupture of the terminal tendon showed the discontinuity of the hypointense of the tendon, which could be evaluated on the sagittal PD FS [Figure 9]. Among these 12 patients, five people had injuries in the ring finger, five in the little finger, and two in the middle finger. Among the 12 patients, one patient had the avulsion fracture of the dorsal aspect of the distal phalanx base in the little finger.

Jersey finger

The jersey finger referred to the injury of the distal FDP tendon at the base of the distal phalanx [Figure 10]. It usually occurred when the finger was forcibly extended and it was commonly happened with an avulsion fracture of the volar aspect of the distal phalanx base. The best image to demonstrate this type of injury is on the sagittal PD FS images, when there is complete tear of the tendon, the discontinuity of the hypointense tendon along the volar, the extent of retraction, and the increased signal intensity could be best visualized [Figure 10]. There were five patients with ring finger injury, five with little finger injury, three with the middle finger, and one with the index.

Discussion

Ligaments and tendons injury of the hand are relatively common in sports,[17] and some of the most common injuries

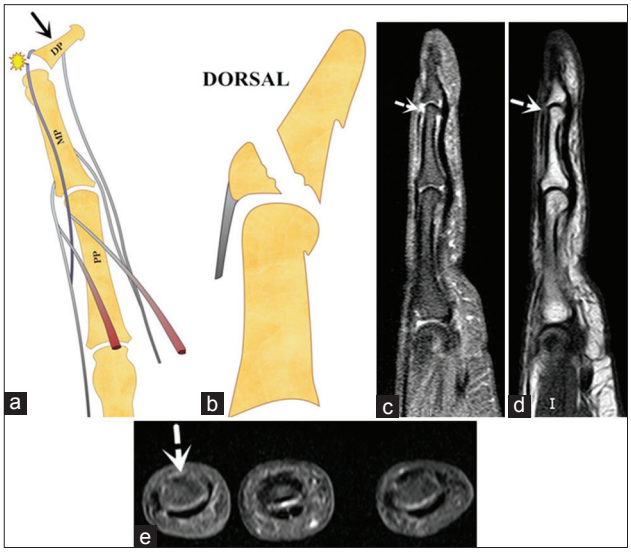

Figure 9: Mallet finger. (a and b) Illustrations of the mallet finger demonstrate that the forced flexion of the extended distal interphalangeal joint resulting in the disruption of the terminal tendon at the base of the DP and it often accompanies with the avulsion fracture of the bone. (c-e) A 40-year-old male with classical mallet deformity in the ring finger. (c) Sagittal PD FS weighted image, (d) sagittal T1-weighted image, (e) axial PD FS weighted image showed the disrupted terminal tendon (dotted arrow). MP: Middle phalanx; PP: Proximal phalanx; PD FS: Proton density-weighted imaging with fat suppression.

resulting in the disability of the hands. Therefore, the accurate and early diagnosis is of vital significance. MRI, with its excellent soft-tissue resolution and multiplanar imaging capabilities, has become a preferred modality in evaluation of ligamentous and tendinous injuries in the hands and fingers.[18-24]

The Gamekeeper's thumb/Skier's thumb including Stener lesion results from a directed force on an abducted thumb, most often related to the skiing injuries.[25,26] In the skiing sport, the skier grips his/her ski pole when sustains a fall with the thumb in abduction position may result in a valgus/radial stress on the thumb.[16] The radial side stress applied to the ulnar side of the distal thumb, across MCPJ, and caused the UCL injury. This type of lesion is also seen in football, basketball, and other contact-collision sports.[17] Spaeth *et al*.[10] described the Stener lesion as "yo-yo on a string" appearance with the string representing the AA, while the yo-yo representing the ruptured and retracted UCL.[27,28] In our study, we found that the disruption and displacement of the UCL were best seen on coronal plane, which confirmed what Cockenpot *et al*. stated.[26] In our study, among these Stener lesions, there were five cases with rupture of UCL at the insertion into the proximal phalanx, which confirmed the statement that in most cases of UCL injuries, most of them occurred at the distal insertion.[17] We assumed that the main reason was the insertion of the UCL which located in the base of the proximal phalanx increased the possibility of injury when the thumb was hyperabducted. In addition, a Stener lesion was an indication for surgical repair.[16]

Boutonniere deformity results from the forced flexion of the PIPJ [Figure 8], a blow to the dorsum of the middle phalanx or volar dislocation of the PIPJ or the middle phalanx.[27-32] Boutonniere deformity is most commonly seen in basketball and volleyball players.[32] Closed extension splinting is the initial treatment option for the boutonniere deformity, because splinting alone typically allows the central slip to heal.[16]

Mallet finger results from the forced flexion of the extended DIPJ [Figure 9].[29,30,33-35] This type of injury is typically observed in softball, basketball, baseball, volleyball, or in receivers in football.[16,17,36] Posner[37] ever stated that the mallet finger was the most common closed tendon injury seen in sports, while there were only 12 cases in the 44 patients with sports-related deformity in our study. This discrepancy might be due to the small sample size in our research. There were five patients had injuries in the ring finger, five in little finger, and two in the middle finger. Those findings basically confirmed what Cockenpot *et al*. said that the mallet finger occurred most in the middle, ring, and little fingers.[26] It is important to notice that the approximate percentage of articular surface involvement in cases with bony avulsion of the base of the distal phalanx, the gap between the fracture fragments, and palmar subluxation and dislocation of the distal phalanx in the radiographs of osseous injuries. If the imaging findings consist with a fracture of the base of the distal phalanx with a dorsal fragment that involves >30% of the articular surface, fragment diastasis >3 mm, or palmar subluxation of the distal phalanx with respect to the middle phalanx, surgical management is recommended.[16,33]

Jersey finger is the result of the forced hypertension of the DIPJ while the DIPJ is actively flexed [Figure 10].[38,39] It is commonly seen in football, flag football, or rugby.[26] Some scholars have stated that this type deformity is most commonly seen in ring finger.[17,26,31] Hong found that the ring finger is involved in up to 75% of this type injury.[40] However, the involved ring finger accounts for 5/14 in our study. This discrepancy might be due to the small sample size in our research.

In conclusion, sports-related fingers and thumb deformity due to ligament and tendon injury is common, and the early treatment plays profound effect on the functional recovery and preventing permanent deformity. MRI has high resolution of soft tissue and can be used to visualize the ligaments and tendons in hand. It plays a significant role in detecting the injuries and assessing the extent and instructing the most appropriate treatment protocols.

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Conflicts of interest

There are no conflicts of interest.

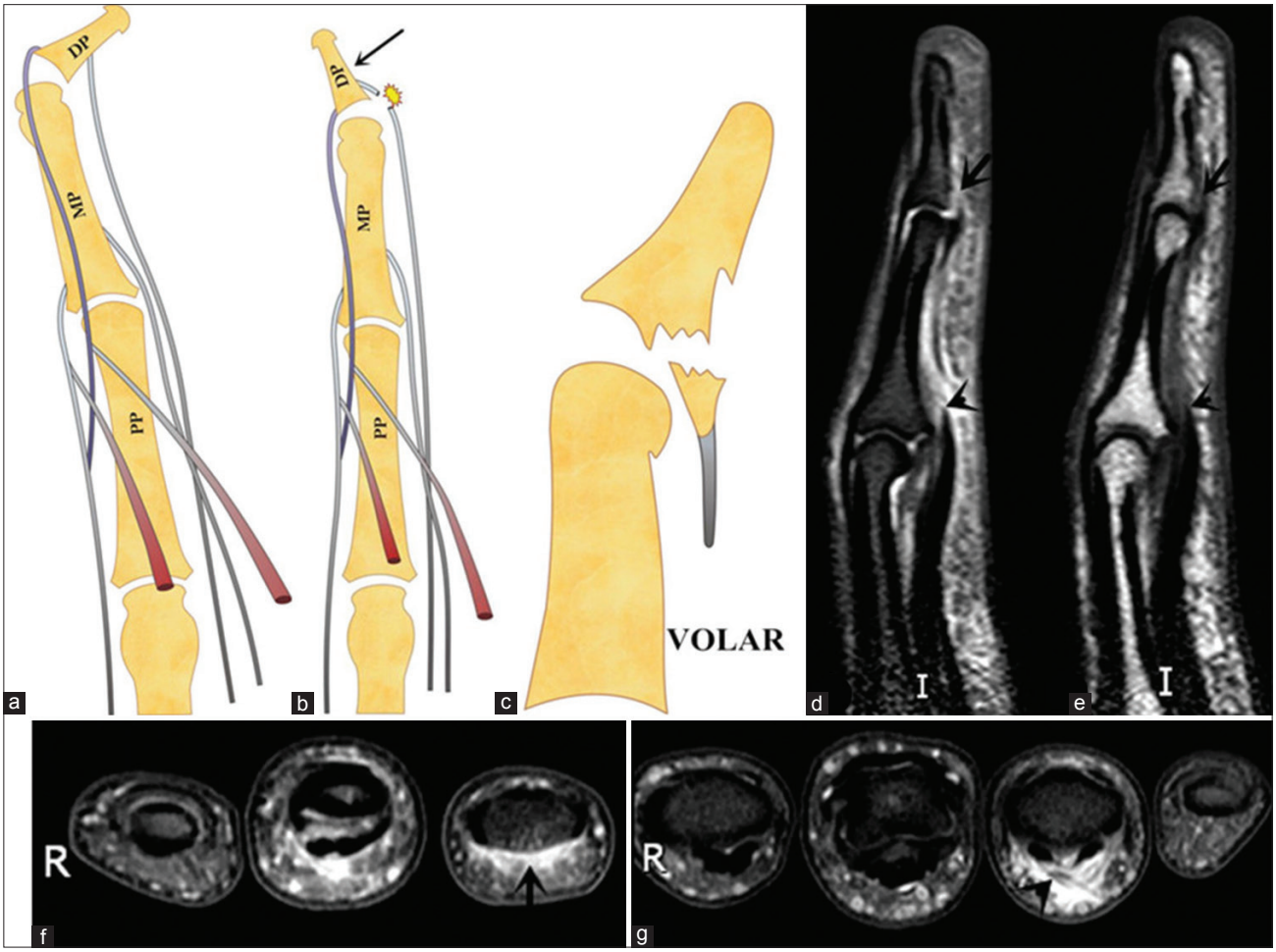

Figure 10: Jersey finger. (a–c) Schematic drawing of the mechanism of jersey finger. When DIPJ is flexed actively, the forced hypertension of the DIPJ would lead to the injury of the FDP tendon and it may be associated with the avulsion of the volar aspect of the DP base. (d–g) A 36-year-old female with injury of the FDP in the ring finger of the right hand. (d) Sagittal PD FS weighted image, (e) sagittal T1-weighted image, (f) axial PD FS weighted image at the level of the insertion of FDP, (g) axial PD FS weighted image at the level of the distal retracted site of FDP, showed the tear of the FDP at the insertion of the base of the distal phalanx (arrow) and retraction to the level of the middle phalangeal base (arrowhead). The distance of retraction was measured as 23.62mm. There was edema between the FDP and the volar soft tissue of the phalanx. DIPJ: Distal interphalangeal joint; DP: Distal phalanx; MP: Middle phalanx; PP: Proximal phalanx; FDP: Flexor digitorum profundus; PD FS: Proton density-weighted imaging with fat suppression.

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肌腱或韧带断裂引起的运动损伤手指拇指畸形

摘要

背景：手指肌腱韧带损伤在临床上很常见，该研究利用3.0 T高分辨MRI研究手指肌腱韧带的正常解剖及运动损伤的影像学特点，为手指肌腱韧带运动损伤导致的手指畸形，提供精准的MR诊断依据。

方法：选择8具尸体中的16只新鲜尸体手标本，进行磁共振检查和相应层面的断层解剖切片，研究尸体标本的正常解剖结构和MR表现，选择20位健康志愿者，研究健康志愿者的正常MR表现特点。选择44例手指肌腱韧带运动损伤导致手指畸形的患者，进行病变部位的MR检查。所有标本和受试者均接受MRI扫描，扫描序列包括T1WI和PD-FS（质子抑脂）序列，扫描体位包括横轴位、冠状位及矢状位。将MR检查后的手指标本采用断层解剖带锯切割，16只尸体手标本（6只手标本以冠状面切割，6只以矢状面，4只以轴位切割）层厚为2mm，分析断层解剖标本与相应层面MRI影像特点的相关性。20例健康志愿者与44例经手术证实具有运动损伤畸形的患者均行MR检查，研究手指肌腱韧带和拇指掌指关节的尺侧副韧带损伤畸形的MRI影像特点。

结果：16只尸体手标本及20位健康志愿者手指的正常韧带和肌腱在MRI各个序列上均表现为均匀低信号。44例有手指肌腱或韧带损伤的患者中，拇指掌指关节尺侧副韧带损伤12例（Stener损伤8例，非Stener损伤4例），中央束损伤6例，末端腱损伤12例，指深屈肌腱损伤14例。韧带和肌腱损伤断裂表现为病变部位信号增高，被液体充填，肌纤维结构显示不清，相应韧带肌腱纤维不连续，信号不均匀。

结论：手指运动损伤导致的畸形临床上比较常见。高分辨MRI能够准确评价手指的正常解剖结构，以及损伤部位的MR特点，为损伤的早期诊断治疗及术后随访康复提供科学准确的影像学依据。