Boxer's knuckle of non-boxer patients

非拳師病者的「拳師指節」

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Boxer's knuckle is the eponym describing injuries to the sagittal band at the metacarpophalangeal joint, resulting in subluxation or dislocation of the extensor tendon, classically in boxers. This condition is often devastating because it can cause severe morbidity not only in professional athletes but also in manual workers. The unique anatomical position of the extensor apparatus system predisposes fingers to this type of injury. With better understanding of the anatomy and pathology of this injury, good functional outcome can be anticipated with appropriate treatment. Two cases of extensor tendon subluxation in non-athletic patients are presented here. The anatomy, diagnosis and current management of this particular injury are discussed. (*Hong Kong j.emerg.med.* 2006;13:161-167)

「拳師指節」是一代名詞，以形容由於掌指關節的矢狀帶損傷而引致伸肌腱半脫位或全脫位，經典上發生於拳師們。這病況往往破壞性很大，因其可引致職業運動員及體力勞動工人嚴重的病態。伸肌機械結構系統的獨特解剖位置導致有這類創傷的傾向。對這創傷的解剖學及病理學有較佳的了解及給予適當的治療後，可以期待有好的功能結果。現描述兩個非運動員病者的伸肌腱半脫位個案，並討論這特別創傷的解剖學、診斷及時下的治理。

Keywords: Boxing, finger injuries, hand injuries, metacarpophalangeal joint, para-articular tendons

關鍵詞：拳擊、手指創傷、手部創傷、掌指關節、關節週腱

Case 1

An 81-year-old lady presented in January 2005 to our emergency department for sudden onset of pain at the left hand. She experienced pain after swinging her left hand. She denied any direct impact or punching injury at the left hand. There was no previous injury noted. Examination of the left hand revealed mild swelling at the left 3rd metacarpophalangeal joint (MCPJ). The finger was held at about 15 degrees of flexion at the MCPJ and active movement was limited. The extensor tendon was found drifted ulnarly even when the fingers were extended (Figure 1). No neurovascular compromise was found on the left middle finger. X-ray of the left hand showed a small crack at the base of the proximal phalanx (Figure 2).

The medical officer on duty referred the patient to the occupational therapy department for a metacarpal brace. At the follow-up visit one week later, it was found that her finger was splinted in a traditional functional position and the extensor tendon was actually subluxed ulnarly even in the splint! Radial extensor hood injury with dislocation of the extensor tendon was diagnosed. She was admitted to the orthopaedic ward for operative repair. However, she refused operation and preferred conservative treatment. Nine months after the injury, her hand function was generally satisfactory except minor degree of painless ulnar drifting of the extensor tendon on flexion of the MCPJ.

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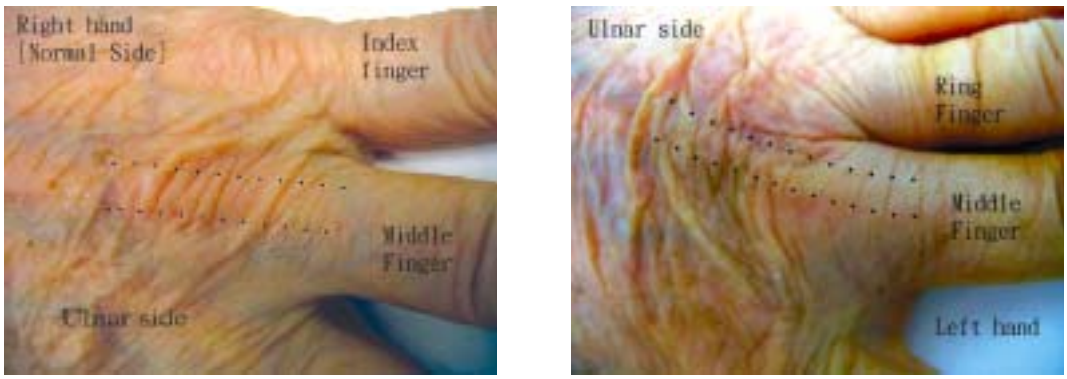

Figure 1. Subluxation of the extensor digitorum tendon of the left middle finger shown as dotted lines compared with the normal position of the tendon of the right middle finger in case 1.

Figure 2. A crack fracture at the radial base of the proximal phalanx of the left middle finger shown on the anteroposterior (left) and oblique (right) X-ray projections (arrows).

Case 2

A printing factory worker, aged 55, 'sprained' his hand during work three days before presentation in May 2005. He complained of pain and swelling at the left middle finger. He denied any direct impact on the left hand. Flexion of the left middle finger was impaired with intense pain. X-ray of the left hand showed no bony fracture. The first attending doctor discharged the patient with oral analgesics and a diagnosis of 'sprained' left hand only. However, he attended our department again one month later for persisting symptoms. Ulnar subluxation of the extensor tendon at the MCPJ was then found at the left middle finger (Figure 3). Circulation and sensation were normal. The working diagnosis was radial extensor hood injury and he was then referred to the orthopaedic clinic for further management. His finger was splinted in full extension for three weeks, followed by rehabilitation exercise. At seven months after the injury, he managed to return to work although there was still mild ulnar subluxation of the extensor tendon and pain. The range

Figure 3. The clinical photo of case 2 showing both hands. The extensor digitorum tendon is subluxed on the left hand as shown by the broken lines. The normal right hand is also shown for comparison.

of movement was nearly full at the last follow-up ten months after the injury.

Discussion

Extensor tendon subluxation or dislocation can be very disabling not only in professional boxers but also in lay people, as it will cause impairment of hand function and persistent pain. The first reported case of traumatic ulnar dislocation of an extensor tendon was credited to Legoust in 1868.[1] It has been considered unusual in patients who are not suffering from rheumatoid arthritis.[2,3] Boxer's knuckle is the eponym used to describe the injuries to the extensor hood at the MCPJ in boxers, resulting in extensor tendon instability.[4] Boxer's knuckle is less well known than Boxer's fracture (closed fracture of the neck of the 5th metacarpal bone with volar angulation) among emergency physicians in Hong Kong. The two attending doctors in the above case reports failed to recognise the subluxation of the tendon and the underlying pathology. They just treated the patients as minor fracture and sprain injury. This would cause long-term morbidity and jeopardise the chance of full recovery as adhesion or contracture may form.

The extensor hood at the MCPJ is a fibrous complex overlying the MCPJ (Figure 4). It consists of a centrally located longitudinal extensor tendon and two transverse peripheral fibres connecting peripherally from the central tendon.[5-7] These two fibrous bands were called sagittal bands. These bands along with the palmar plate at the neck of the respective metacarpal bone form a closed cylindrical tube surrounding the metacarpal head.[8] The sagittal band envelops the extensor digitorum tendon by a thin superficial layer and a thick deep layer, forming a groove for the central tendon (Figure 5).[8,9] The extensor tendon stability during finger flexion relies very much on the sagittal band. Longitudinal or oblique tear of one of the two sagittal bands may lead to subluxation and dislocation of the extensor tendon because of unopposed force exerted on the central tendon by the uninjured sagittal band.

The two cases presented above had the same injury to the radial sagittal band of the middle finger. This is not surprising, as the middle finger has been found to be the most frequently involved digit in this type of injury. Shinohara et al reviewed 16 available case series (141 digits) of extensor tendon dislocation from 1954-

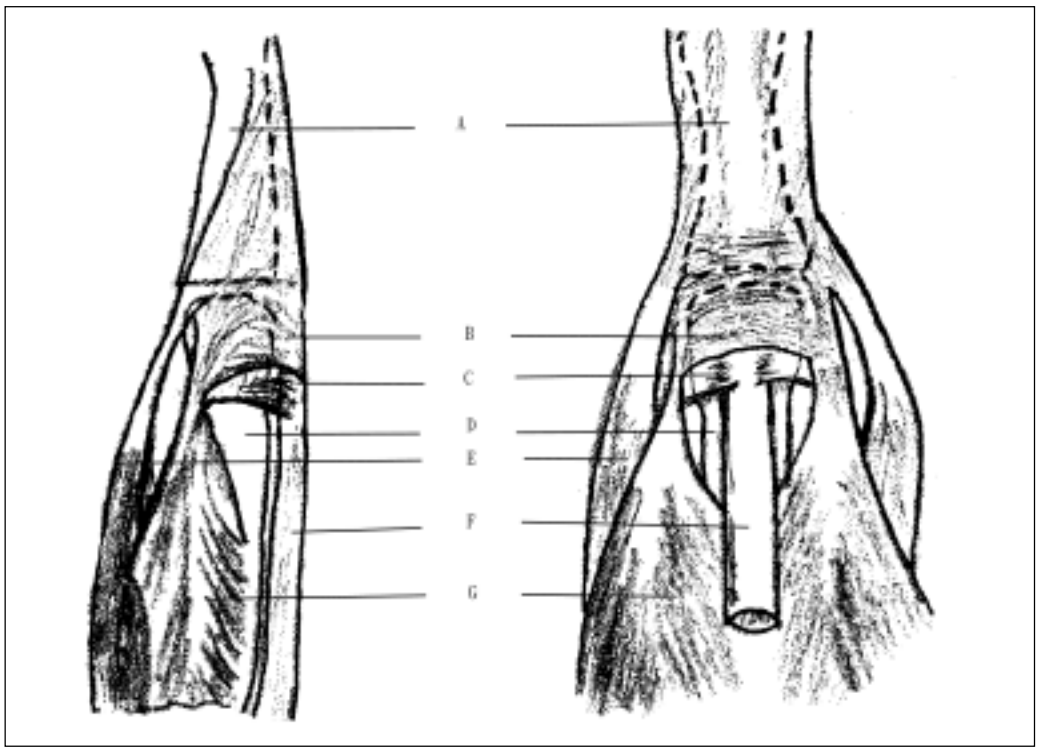

Figure 4. Schema of the extensor apparatus of the long finger shown in lateral and on-top views. A=proximal phalanx; B=extensor hood; C=sagittal band; D=metacarpal bone; E=tendon of the lumbrical; F=extensor tendon; G=interosseous muscle.

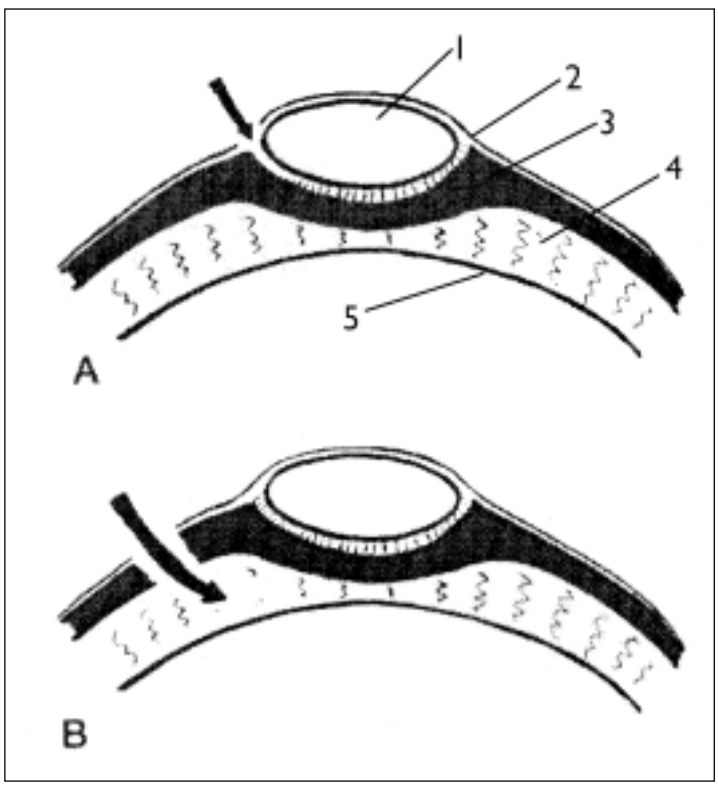

Figure 5. Cross-sectional schema of the extensor apparatus at the level of the metacarpophalangeal joint (reproduced with permission from Ishizuki).[9] 1=extensor tendon; 2=superficial layer of the sagittal band; 3=deep layer of the sagittal band; 4=loose connective tissue between the sagittal band and the dorsal capsule; 5=dorsal capsule of the metacarpophalangeal joint. A. Spontaneous (non-traumatic) dislocation. The thin superficial layer of the sagittal band is ruptured just radial to the extensor tendon. B. Traumatic dislocation. Both layers of the sagittal band are ruptured radial to the extensor tendon.

2001.[10] They found that the most frequently involved digit was the middle finger. The other digits involved in decreasing order of frequency were the ring finger, little finger and index finger. The greater prominence of the middle finger metacarpal head compared to other digits and the relatively loose fibrous attachment of the sagittal bands at a more distal level have been proposed as the predisposing factors for the middle finger to this type of injury by some authors.[8,11]

Ulnar dislocation of extensor tendon, in other words, radial sagittal band injury, was found in our cases. This is also in line with the common finding of ulnar dislocation in the literature.[3,5,11] The propensity for ulnar dislocation is related to the anatomical difference between the radial and ulnar sagittal bands. Rayan found that the radial sagittal band was often thinner and longer than the ulnar component, therefore more vulnerable to injury.[8] In an anatomical study in cadavers, it was found that partial section of the proximal radial sagittal band produced tendon subluxation while even complete section of the ulnar sagittal band produced only a mild degree of radial instability.[7] This finding suggests that other structures e.g. the tendon juncture, may contribute to the stability of the extensor tendon in the ulnar aspect.

Although ulnar sagittal band injury was thought to be rare and anatomatically more stable, radial dislocations have been reported.[12,13] The patient of the first reported case of ulnar sagittal band injury, resulting in radial dislocation of the extensor tendon, was actually an orthopaedic surgery resident.[12] He was successfully treated with splintage alone. In a study of professional boxers, in which surgical exploration revealed seven ulnar sagittal band ruptures, six of them were associated with radial subluxation.[5] Therefore ulnar sagittal band injuries are not that rare as once thought. With high-energy impact and/or capsular tear, ulnar sagittal band tears can develop and radial subluxation result. It is interesting to note that the little finger does not have the typical subluxation or dislocation when the radial sagittal band is injured. Instead the finger will develop abduction deformity.[2] When the radial sagittal band is torn, the axis of the extension force on the little finger may change. The little finger will appear abducted.

The common presentations of extensor hood injury include sudden onset of pain and swelling at the MCPJ level, visible snapping of the extensor tendon, limitation in flexion, and abduction deformity in the little finger.[2] These symptoms develop right after a direct blow to the hand, typically in a closed-fist position. Similar to the two cases presented above, non-traumatic (spontaneous) cases have also been reported. The patients with the non-traumatic type of injury described the pain starting just after 'flicking of fingers', crossing of the fingers, or while doing normal household work.[2,3,9] Examination of the affected digits typically reveals swelling and bruises over the MCPJ. The active range of flexion may be limited by pain in acute injury. The diagnosis is obvious if subluxation or dislocation of the extensor tendon can be revealed by passive flexion of the MCPJ. However, it can be difficult to achieve a definite diagnosis especially when the patient has intense pain and swelling right after the injury, and the patient refuses to make a fist. This may be the reason for the delay in making the correct diagnosis in our second patient.

Magnetic resonance imaging (MRI) has been employed to detect the extensor hood injury in difficult situations. In a case series done in France, it was concluded that the MRI findings in patients with acute traumatic extensor hood injury correlated well with the operative findings.[14] Ultrasonography is another promising diagnostic tool, especially nowadays when more and more emergency physicians utilise ultrasound in their daily practice. The ultrasound findings are soft tissue swelling but normal echogenicity in the extensor tendon, displacement of the extensor tendon sheath, and visualisation of the subluxation or dislocation of the extensor tendon upon flexion of the MCPJ in dynamic study.[15] One of the advantages of ultrasonography over MRI is the ability to perform dynamic assessment. The real time image of the movement of the extensor tendon can be seen and the diagnosis can readily be confirmed. Also, it is easily available and repeatable so that the treatment outcome can be assessed objectively.

The treatment options are surgical repair or conservative treatment by means of splintage. However,

there is no randomised controlled trial on direct comparison of these two treatment modalities. Many authors in the literatures advocated surgical repair [2,3,5,9,13] but some suggested conservative treatment in the form of splintage.[12,16] The choice of treatment methods and the outcome of treatment may be governed by different factors. Ishizuki treated 16 patients surgically, in which 11 of them belonged to the spontaneous type. He found that the spontaneous type was associated with rupture of the superficial layer of the sagittal band only, while the traumatic type was associated with more severe tearing of both the superficial and deep layers of the sagittal band (Figure 5).[9] This observation may account for the failure of conservative treatment in the traumatic type of sagittal band injuries. Operative treatment may be indicated for this deep injury if good outcome is imperative.

Trauma may also cause capsular tear apart from sagittal band injury. In a series published by Hame et al, surgical exploration revealed capsular tear in 19 out of 27 digits in professional boxers.[5] This finding is logical as high impact force would be passed onto the extensor mechanism during boxing, resulting in more damages. Arai also reported failure of conservative treatment in all eight cases, in which six joint capsules were found ruptured.[13] It was postulated by the same author that ruptured capsule would not heal properly and fistula between the MCPJ and subcutaneous space would develop, especially when the MCPJ was splinted in extension in conservative treatment. However, Hame had contradictory findings. No functional deficit was found in Hame's study even though all the capsular tears were deliberately not repaired but just debrided.[5] The associated capsular tear may just represent a more severe form of injury to the extensor mechanism at the MCPJ. The role of capsular tear and the necessity for capsular repair in the context of sagittal band tear are yet to be found out.

The degree of instability may also affect the outcome of treatment. Rayan classified the traumatic extensor injury into three types.[2] Type I is a simple contusion to the extensor mechanism without tear. Type II is associated with extensor subluxation defined as lateral displacement of the extensor tendon beyond midline, but still remaining in contact with the condyle of the metacarpal head during full MCPJ flexion. Type III is the dislocation of the extensor tendon identifiable as displacement of the tendon in the groove between the two metacarpal heads. Half of the patients (3/6) with type III injury failed in conservative treatment in his study.[2] Thus dislocation may indicate more severe damage to the sagittal band and other stabilising structures which may not heal well with conservative treatment alone. This may be the reason for the persistent ulnar drifting of the tendon after conservative treatment in our patients, although they had satisfactory functional recovery without disabling symptoms.

Different methods of surgical repair have been advocated by different authors. The main aim is to prevent re-dislocation of the tendon. They included direct repair of the sagittal band defect with sutures and relocation of the central tendon,[5,9,11] release of the unaffected sagittal band and utilisation of a portion of the central tendon to anchor to other neighbouring structures.[3,17] Detailed discussion of different surgical techniques is beyond the scope of this article.

Conservative treatment has been suggested as a trial in patients who presented within three weeks after injury and in patients who do not demand high physical performance as in professional sportsmen.[2,5] Ritts reported two cases of sagittal band injury (one of them was actually the first reported case of radial subluxation) successfully treated with conservative treatment.[12] The two cases were non-traumatic. They received splintage at full extension for 4 weeks and 3 weeks respectively. No recurrence was found at the follow up about two years after the injury. In a retrospective study published in 2006, 8 out of 11 acute sagittal band injuries were treated successfully with splintage.[16] The authors classified the injuries as traumatic while other researchers may have considered them as non-traumatic. The specially designed splint employed in the study allowed active MCPJ movement coupled with other digits. However, the time for splintage was 8 weeks, which was longer than previously reported protocols.[2,13] In a retrospective study done by Arai et al, despite failure in conservative

treatment, surgical salvaging treatment could produce satisfactory results.[13] Our patients were managed by conservative treatment with satisfactory recovery. Although treatment was started late in our second patient, only a mild degree of ulnar drift of the extensor remained at the last follow up. He regained nearly a full range of movement at the MCPJ and he could still manage to resume his former duty after the conservative treatment. Thus it is reasonable to offer non-operative treatment in non-traumatic patients at the first instance. Of course, the earlier the treatment begins; the better would be the outcome. However, if the symptoms are persistent, or there is persistent disabling subluxation or dislocation after conservative treatment, surgical repair is indicated. For those who require professional physical performance or meticulous craftsmanship, or present late after injury, surgical repair should be a more appropriate option.

Conclusion

Dislocation of the extensor digitorum tendon can present in non-rheumatoid patients. The special anatomy of the extensor mechanism makes the middle finger most susceptible to this type of injury. Failure to recognise this specific injury may result in long-term morbidity. Diagnosis is usually clinical and ultrasonography provides further evidence of tendon instability in difficult cases. Conservative treatment in the form of splintage in extension is the treatment of choice for the non-traumatic type of injury. Surgery is indicated in highly demanding patients, severe traumatic type of injury, late presentation or failure of conservative treatment.

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