CASE REPORT

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Failed Extensor Indicis Proprius Tendon Transfer for Extensor Pollicis Longus Tendon Rupture after Distal Radial Fracture

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Open reduction and internal fixation using volar plating for the treatment of distal radial fractures (DRFs) is becoming an increasingly popular method. Tenosynovitis of extensor tendons causes delayed extensor pollicis longus (EPL) tendon rupture which known as complication following screw penetration of the dorsal cortex after volar plating for DRFs. As the reconstructive procedure for a closed ruptured EPL tendon in minimal displaced DRF, extensor indicis proprius (EIP) transfer is widely used. However, tendon injuries of the fourth compartment, which includes the extensor digitorum communis or EIP, can be caused by screw irritation after volar plating for DRFs. We encountered a rare case of failed EIP tendon transfer for delayed EPL tendon rupture after volar plating for a DRF. Because the EIP tendon can also be damaged by screw penetration, care must be taken to use EIP tendon for treatment of delayed EPL rupture after volar plating for DRFs.

Keywords: Extensor indicis proprius, Distal radius fracture, Tendon transfer, Volar plate fixation

INTRODUCTION

The known complications of distal radial fractures (DRFs) include tendon rupture, tendon lag, trigger finger, and tenosynovitis[1]. Open reduction and locking plate fixation via the volar approach for treatment of an unstable DRF is becoming an increasingly popular method and has been reported to cause tenosynovitis of the extensor tendons, which leads to delayed extensor tendon rupture[2]. The extensor pollicis longus (EPL) tendon is most commonly ruptured. Screw penetration of the dorsal radius cortex to the third compartment after internal fixation of a volar plate for

a DRF is thought to be the cause of EPL tendon rupture[3-5]. The extensor digitorum communis (EDC) tendon and extensor indicis proprius (EIP) tendon can also be ruptured[6,7]. In addition, de Boer et el.[8] reported rupture of both the EPL and EIP tendons after conservative treatment for a DRF. We encountered a rare case of failed EIP tendon transfer for delayed EPL tendon rupture after volar plate fixation for a DRF. Because the extensor tendons of the third and fourth compartments could also be damaged, the careful use of tendons for treatment of delayed EPL tendon rupture after volar plating for a DRF is necessary.

CASE REPORT

A 51-year-old, right hand dominant man sustained an extra-articular displaced right DRF 5 months prior to evaluation. He had undergone open reduction and internal fixation with a volar distal radius locking plate at another institution. After fracture healing, he regained pain-free function of his right hand and wrist. Three months after fracture fixation, he had no antecedent symptoms, but could not extend his thumb. Physical examination of the right wrist revealed normal range of motion. Other fingers also revealed normal range of motion except the thumb. He could flex his thumb but could not actively extend it. Radiographic evaluation of the right wrist revealed a healed fracture of the distal radius and screws that were excessively long penetrating the dorsal cortex (Fig. 1). We planned to perform EIP tendon transfer. Under general anesthesia, a skin incision was made vertically on the Lister's tubercle. With deeper dissection, the third compartment of the extension tendon group was exposed (Fig. 2). Surgical exploration revealed that the tips of screws had penetrated the lateral side of Lister's tubercle and the EPL tendon had ruptured over the distal edge. The extensor carpi radialis longus tendon of the second compartment had partially ruptured. Plate and screws were removed.

We performed complete debridement of the granulated and frayed tissue in the ruptured margin, removed the plate, and transferred the EIP tendon. We did not assess the fourth compartment for screw penetration injury. Postoperatively, the patient underwent dynamic motion protocol wearing a forearm splint with limited but progressively increased active flexion and extension of the interphalangeal (IP) joint. Ten days after the operation, he experienced sudden loss of extension of the affected thumb. The patient underwent surgical exploration, which revealed intact coupling of the EIP and EPL tendon. A ruptured stump was noted 2 cm proximal to the EIP tendon muscle junction (Fig. 3). The change of excursion or increased ten-

Fig. 1. (A, B) Radiograph showing a healed distal radius fracture and screws with extra length.

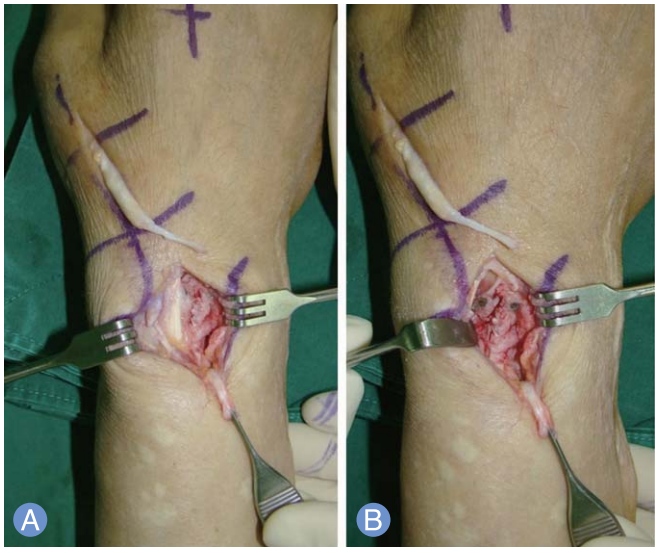

Fig. 2. (A, B) Surgical exploration revealing the penetrated tips of screws and a frayed extensor pollicis longus tendon rupture over the distal edge.

Fig. 3. **(A)** Intact coupling of the EIP and EPL tendon. **(B)** A rupture can be seen proximal to the EIP tendon. **(C)** PL tendon transfer to the EPL. EIP, extensor indicis proprius; EPL, extensor pollicis longus.

sion of the transferred EIP tendon injured by screw penetration was thought to be the cause of progression to a complete rupture. After debridement of the ruptured previously transferred EIP tendon, we attached the palmaris longus (PL) tendon graft to the ruptured site of EIP. Intact coupling of EIP and EPL tendon was preserved (Fig. 3). The same dynamic motion protocol was planned for rehabilitation. Three months after the second operation, full range of motion without a splint was allowed. At the 1-year follow-up examination, the patient could independently independent extend the thumb affected by the tendon without pain.

DISCUSSION

The incidence of reported complications from DRF is 6%-80%. Known complications are nonunion, malunion, incongruent articulation, nerve, and tendon injury[1,2]. Although palmar plating was reported to reduce the risk of tendon irritation, which is a major problem after dorsal plate fixation, the incidence of extensor tendon injury, most commonly the EPL tendon, was reported to be 2%–17%[1,2,9]. Injuries to the flexor and extensor tendons include adhesion, simple irritation, and frank rupture[5,10]. Tendon ruptures can occur as an early or late complication. Sharp fracture fragments cause early tendon rupture and irritation with the fixed plate, penetrated screws, and changed tendon excursion due to peritendinous adhesion cause late complications[1,3,10]. Only few studies have reported other extensor tendon injuries. Al-Rashid et al.[4] reported 1 case of ruptured EDC tendon and EIP tendon and suggested that a dorsally penetrated screw was the cause. Singh et al.[6] reported EIP tendon and EDC tendon rupture after locking plate fixation of a DRF 7 months postoperatively, and found that the bony spur at the healed fracture site was the cause. Hattori et al.[7] reported delayed rupture of the EDC tendon after volar plating of a DRF. Penetration of the screw to the fourth extensor compartment was thought be the cause of the rupture. It is possible that the tendon of the third and fourth compartment can be injured at the same time. de Boer et al.[8] reported delayed EPL tendon rupture with a conservatively treated DRF. They found concomitant EDC II tendon injury during dissection for the EIP tendon transfer. The EIP tendon transfer can only be used if the EDC II tendon is intact. Sadr[11] reported sequential rupture of the EDC II tendon within 4 months after EPL tendon rupture. The treatment methods for EPL tendon rupture are EIP tendon

transfer, EPL reconstruction with intercalary tendon graft, and thumb IP arthrodesis[10]. From May 2007 to April 2014, we encountered 12 cases of EPL tendon rupture combined with DRF. Direct repair of the EPL tendon was possible in only 1 case. Six of the 11 remaining patients underwent EIP tendon transfer and 5 of the 11 cases received a PL tendon graft. In this case, EPL function loss occurs 10 days after EIP transfer. Although penetration of the distal ulnar side screw was suspected on initial radiograph, we did not confirm the integrity of the extensor tendon of the fourth compartment. The coupling of EIP and EPL was intact. The location of ruptured EIP stump was more proximal which could be irritated by the penetrated screw. The injured EIP tendon couldn't bear the change of excursion or increased tension.

When EIP transfer is planned for treatment of EPL tendon rupture after volar plating for a DRF, the integrity of the fourth extensor compartment should be considered.

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원위부 요골 골절의 내고정술 후 발생한 무지 신전건 파열에 대한 시지신건 이전술 후 실패

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배측 전위된 원위부 요골 골절의 치료에 있어 수장측 접근법을 통한 관혈적 정복술 및 금속내고정술은 점점 일반적인 방법화 되어가고 있다. 신전건의 건초염은 원위 요골 골절의 수장측 금속판 고정술 후 나사의 배측 피질골 관통에 따른 합병증으로 알려진 장무지 신전건 파열을 초래한다. 최소 전위된 원위 요골 골절에서 장무지 신전건 파열 재건술식의 표준으로서, 시지신건의 건 이전술이 널리 이용되고 있다. 하지만, 원위 요골 골절의 수장측 금속판 고정술 이후 지속된 나사의 자극으로 인해 발생한 제4신전건 구획의 건 손상 또한 보고되었다. 저자들은 원위 요골 골절의 수장측 금속판 고정술 이후 발생한 지연된 장무지 신전근 파열에 대해 시지신건 이전술 시행 후 실패한 증례를 경험하였다. 시지신건 또한 손상될 수 있기 때문에 원위 요골 골절의 수장측 금속판 고정술 후 발생한 지연된 장무지 신전건 파열의 치료로 시지신건 이전술 사용 시 주의를 요한다.

색인단어: 원위부 요골 골절, 건 이전술, 시지신건, 수장측 금속판 고정

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