Chiang Mai Med J 2011;50(1):23-29.

Cases report

Closed Flexor Tendon Ruptures of the Ulnar-Sided Fingers within the Hand: Treatment with Looped Palmaris Longus Tendon Graft: Report of 5 Cases

Jirachart Kraisarin, M.D., Kanit Sananpanich, M.D., and Preecha Chalidapong, M.D.

Department of Orthopedics, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Abstract

Spontaneous ruptures of the flexor tendons are considered to be uncommon conditions that generally occur after the tendon loses its tensile strength due to preexisting pathologies. The presenting symptoms; pain and weakness of grip strength, are not specific to this condition. The site of tendon rupture also is difficult to identify clinically. We recently treated five patients who had closed rupture of the flexor tendon of the ulnar-sided fingers within the hand and they presented inability to flex the little finger fully. They also experienced pain and discomfort during daily activities. These reported cases involved spontaneous tendon rupture involving the flexor digitorum profundus of the ulnar digits. Three patients had identifiable pathologies: nonunion of the hamate hook, bony spur at the hamate hook and gouty tendinopathy; and the other 2 patients had no identifiable abnormality.

All patients were treated with tendon repair using looped palmaris longus tendon graft. All but one showed improved digital motion, and satisfactory hand function was restored. Closed flexor tendon rupture of the hand occurs more often than previously recognized. Surgical reconstruction using tendon graft produced satisfactory results. **Chiang Mai Medical Journal 2011;50(1):23-29.**

Keywords: flexor digitorum trofundus, spontaneous tendon rupture, tendon graft

Closed spontaneous ruptures of the flexor tendons are uncommon conditions and not completely understood. Spontaneous tendon ruptures usually occur in patients with preexisting pathologies of the bones and joints, which serve for tendon passage, i.e. rheumatoid arthritis, gouty arthritis, and degenerative arthritis.[1-3] The pathologies of tendons and tendon sheaths, such as tenomalacia and proliferative tenosynovitis, also lead to susceptibility to rupture. Spontaneous ruptures of the flexor tendon of the ulnar digits within the carpal tunnel have been reported, comprising one or two cases in each piece of literature.[3-8] The underlying pathologies were identified as abnormality of the hamate,[4,7,9] pisotriquetral joint arthritis,[3] triangular fibrocartilage calcification,[6] anatomical variation of the flexor tendon,[10,11] and intratendinous deterioration.[12] When

excluding cases with such clear causes, it is found that most closed flexor tendon ruptures are caused by avulsion of the FDP from its insertion.[13] The purpose of this study was to report five cases of spontaneous flexor tendons rupture in the hand in terms of patient characteristics and the results of treatment.

MATERIALS AND METHODS

A retrospective review was conducted of five patients who sustained a spontaneous rupture of the flexor digitorum profundus (FDP) tendon of the little finger over the period, November 2005 to January 2009. They were treated at Maharaj Nakorn Chiang Mai Hospital. There were four male patients and one female patient, ranging in age from 53-67 years (59.4±5.9 years). The rupture occurred in the dominant hand in four cases. The small finger was involved in all cases, with one patient having rupture of the FDP tendon of both the ring and small fingers (Table 1). In all cases, the site of tendon rupture was within the palm. All patients experienced sudden dysfunction of the involved digit (Fig. 1), but delayed seeking treatment for two to three months. One of the patients was treated surgically by the first physician (surgical exploration at the level of the A1 pulley) in an unsuccessful attempt to identify the site of rupture.

Surgical Technique

Tendon reconstruction was performed in all patients using free palmaris longus (PL) tendon graft. The mid portion of the PL tendon was weaved to the distal stump of the ruptured tendon at a site proximal to the A1 pulley. Both ends of the PL tendon were passed through the carpal tunnel and connected to the proximal tendon stump just distal to the musculotendinous junction using a weaving technique (Fig. 2). For the patient with rupture of the flexor tendon of both the ring and little finger, the PL graft was weaved to the distal end of the profundus of both fingers. The proximal juncture was attached to the proximal stump of the FDP of the ring finger. Postoperatively, controlled active rehabilitation was used with all patients. Open carpal tunnel release was performed routinely to assess associated pathology of the carpal bones. This also allowed us to check the adjacent tendon, which

Table 1. Patient characteristics and the results of treatment

Patient no.	Age(yrs) /gender	Involved Hand	Identified pathology	Occupation	Involved finger/tendon	Delayed time of diagnosis (days)	TAM (degree)	Grip stregthaffected/opposite hand (percentage)
1	53/male	Right	Bony spur hook of hamate	Farmer	Ring,little/ FDP	87	110	N/A
2	67/male	Left	Tophaceous gout infiltration in tendon	Driver	Little/ FDP	60	200	16/18 (88%)
3	54/male	Right	None	Driver	Little/ FDP	67	235	16/24 (66%)
4	63/female	Right	Nonunion hook of hamate	Home maker	Little/ FDP	75	255	16/14 (114%)
5	60/male	Right	None	Farmer	Little/ FDP	9	210	N/A

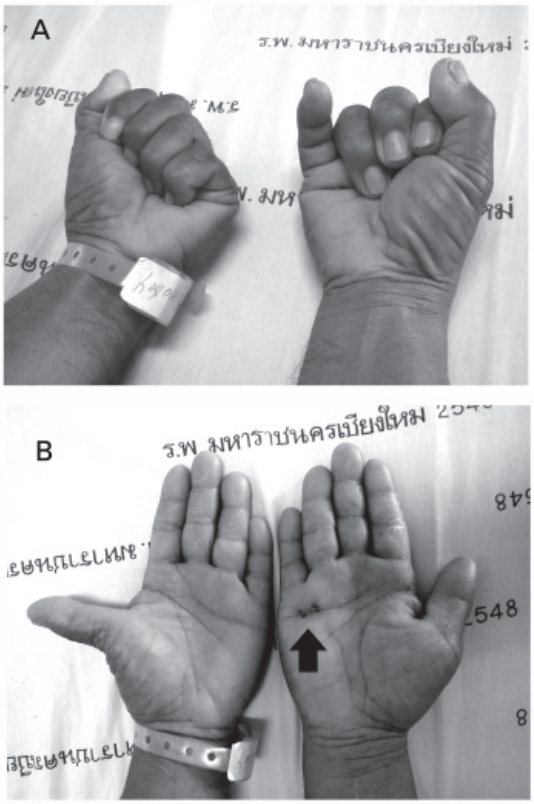

Figure 1. Clinical presentation of the patient with spontaneous flexor digitorum profundus rupture of the little finger. **Figure 1A**: The patient was unable to actively flex the little finger. **Figure 1B** shows the surgical wound (block arrow), which had been explored by the primary physician. The ruptured site could not be identified with this incision

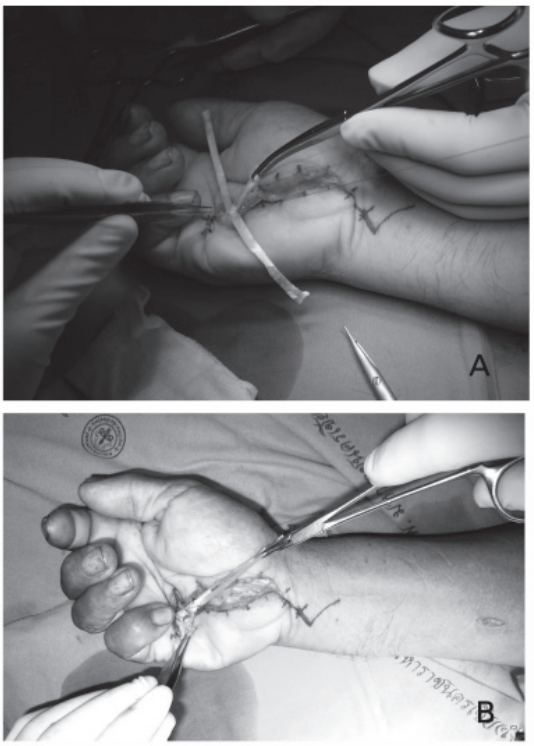

Figure 2. Tendon reconstruction was performed using palmaris longus (PL) tendon graft. **Figure 2A**: The midpoint of the total length of the PL graft was weaved to the distal stump of the FDP tendon. **Figure 2B**: Both ends of the PL graft were pulled to evaluate the motion of DIP and PIP joints. Then both ends were weaved to the proximal stump of the FDP tendon at a level proximal to the carpal tunnel.

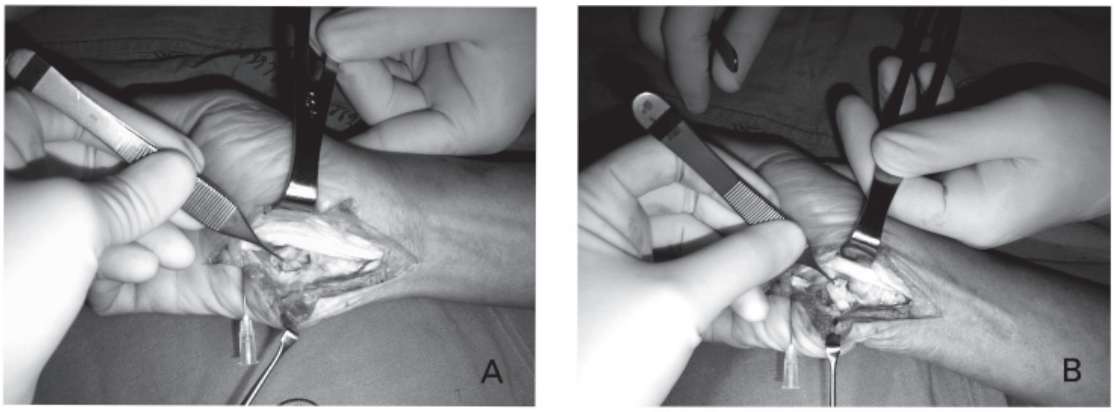

Figure 3A. This patient had nonunion of the hook of the hamate. The nonunion fragment was removed. **Figure 3B**: The proximal ulnar portion of the transverse carpal ligament was used as fascial flap to cover the raw area after resection.

is sometimes frayed. Associated procedures involving smoothening of the inner surface of the hamate, nonunion excision of the hamate hook, and covering the raw surface of the hamate using part of the transverse carpal ligament (Fig. 3) were also performed. The follow up period was 25.6 weeks (20-40 weeks). Outcome measurement showed total active motion (TAM) and grip strength (Hydraulic Hand Dynamometer, Jamar Dynamometer Model 1, Asimow Engineering, Los Angeles, CA).

RESULTS

Pathologic conditions, which had been identified during surgical exploration, were found in three patients, including nonunion and the presence of a rough surface of the hamate hook, and gout tophi within the flexor tendon. The remaining two patients ad no abnormality of the tendons or carpal bones. Plain x-ray of the wrist, including carpal tunnel view, was obtained from four patients. Neither the nonunion nor the rough surface of the hamate hook was shown on the plain x-ray.

The diagnosis of closed flexor ruptures had been delayed for months after onset (Table 1). Two patients had been referred from primary doctors who diagnosed trigger finger and cubital tunnel syndrome. Two patients had delayed seeking treatment. The remaining patient was diagnosed with spontaneous flexor tendon ruptures. In that case, surgical exploration was made through incision at the A1 pulley level. However, the site of tendon rupture was not identified by this incision (Fig. 1A).

The result of treatment, for all five patients, was reported as total active motion (TAM) of affected finger. The average TAM was 202±55.74º (range 110-255º) (Fig. 4). The patient with both ring and little finger involvement achieved only 110° of TAM; the others achieved greater than 200º. Grip strength, which was determined in three patients, was 89% of the normal side (range 66-114%) (Table 1).

DISCUSSION

Closed flexor tendon rupture usually results from FDP avulsion from the base of the distal phalanx. Spontaneous flexor ten-

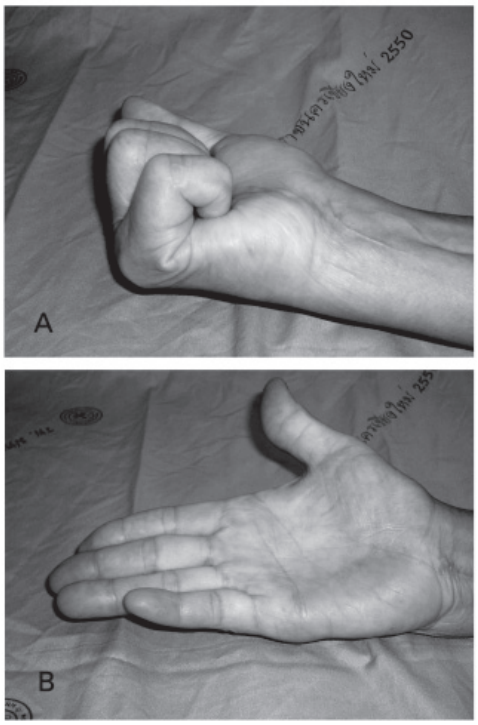

Figure 4. Four months after surgery, this patient had gained full flexion of the little finger (Figure 4A). Ten degrees of metacarpophalangeal joint flexion contracture was noted (Figure 4B).

don ruptures in the palm are relatively rare and usually involve FDP of the little finger, sometimes including the ring finger. Patients may notice a popping sound and the sudden onset of pain in the palm. At presentation, patients are unable to flex the DIP joint of the affected finger(s) and experience a loss of grip strength. By reviewing records/ referral notes of the patient, the wrong diagnosis may be given such as trigger finger, cubital tunnel syndrome, or avulsion injury of the FDP tendon. Physical examination that shows mild tenderness on the ulnar side of the carpal tunnel, can help to determine the rupture site. Clinical symptoms and signs are important in differentiating spontaneous rupture from avulsion injury. Bois et al reviewed 38 cases from the literature of spontaneous tendon rupture. They reported that 68.4% experienced pop or snap, and 26.3% had sudden sharp pain at the palm.[12] In contrast, FDP avulsion injury caused discomfort within the area of the flexor tendon sheath of the finger.

Plain x-ray is not helpful in identifying preexisting carpal bone pathology. Preexisting lesions, which may cause tendon ruptures, have been reported including abnormal projection of the hamulus,[4,14,15] nonunion of the hamulus,[7,14,15] intraosseous ganglion of the hamate,[9] calcification of the triangular fibrocartilage,[6] and pisotriquetral joint arthritis.[3,14] Two of our patients had abnormalities of the hamate, which is the distal ulnar border of the carpal tunnel. The radial surface of the hamate also acts as a pulley for the FDP tendons of the ring and little finger during power grip. The tendon path of the ring and little finger around the hamulus places the tendons at risk of attritional injury. Another patient was found to have gout tophi deposition within the tendon substance, which makes the tendon weak and susceptible to rupture. In a situation where there is o identifiable pathology of the bones and tendons, as with two of the patients in our study, other hypotheses have been offered. One such hypothesis is anatomic variation of the FDP tendon. This has been described as an abnormal connection of the FDP between the ring and little fingers.[10-12] Another possible cause is derangement of the tendon itself. Tendon hypovascularity from chronic wearing out of tendon fiber, has also been proposed.[12,16]

The options for restoring tendon function include direct tendon repair,[10,16] tenodesis to the adjacent tendon,[15] tendon transfer from the superficialis tendon,[6,16] and free tendon graft.[6,9,11,14,16] All of our patients were treated with PL tendon graft, because there was a significant gap between the two stumps of the ruptured tendons. The diameter of the FDP stump is larger than that of the PL tendon graft. However, the PL tendon graft is long enough to use in double-strand fashion. The advantage of this technique is obtaining not only increased tendon graft diameter, but also improved strength of the graft. Nevertheless, we are concerned that the looped tendon graft may cause a bulky anastomotic site. Therefore, the distal juncture was located just proximal to the A1 pulley, in full finger-extension, to ensure that the suture site did not enter the tenosynovial sheath during tendon gliding. The proximal juncture was placed close to the musculotendonous junction to allow smooth gliding within the carpal tunnel.

The results of treatment were considered as good, with excellent functioning being restored, except in one patient who had two

fingers involved. In this case, the PL graft was weaved to the distal FDP stump of both the ring and little finger. This resulted in a Y-shaped interconnection, which inhibited smooth gliding within the palm. With this condition, we believe that using single strip tendon graft to each finger separately would allow individual gliding, which could improve the digital motion. Alternatively, grafting the PL tendon to the proximal FDP stump first will leave 2 ends of the PL tendon, which can be weaved individually to the distal stump of the ring and little finger. Tendon grafting is our treatment of choice.

Spontaneous flexor tendon ruptures may occur more often than previously recognized. The clinical presentation of this condition is different from avulsion injury. Spontaneous ruptures not only occur within a predictable location, but also usually in the ulnar sided fingers.

REFERENCES

1. Mannerfelt L, Norman O. Attrition ruptures of flexor tendons in rheumatoid arthritis caused by bony spurs in the carpal tunnel. A clinical and radiological study. J Bone Joint Surg Br 1969; 51:270-7.
2. Minami A, Ogino T, Tohyama H. Multiple ruptures of flexor tendons due to hypertrophic change at the distal radio-ulnar joint. A case report. J Bone Joint Surg Am 1989;71:300-2.
3. Takami H, Takahashi S, Ando M, Kabata K. Rupture of the flexor tendon secondary to osteoarthritis of the pisotriquetral joint: case report. The Journal of trauma 1991;31:1703-6.
4. Okuhara T, Matsui T, Sugimoto Y. Spontaneous rupture of flexor tendons of a little finger due to projection of the hook of the hamate. A case report. The Hand. 1982;14:71-4.
5. Wray RC, Jr., Parlin LS. Spontaneous flexor tendon rupture in the palm. Annals of plastic surgery. 1989;23:352-3.
6. Fukui A, Kido A, Inada Y, Mii Y, Tamai S. Closed rupture of the flexor digitorum profundus tendon of the little finger caused by calcification of the triangular-fibrocartilage. Journal of hand surgery (Edinburgh, Scotland). 1996;21:375-7.
7. Hartford JM, Murphy JM. Flexor digitorum profundus rupture of the small finger secondary to nonunion of the hook of hamate: a case report. The Journal of hand surgery 1996;21:621-3.
8. De Smet L, Baeten Y. Closed rupture of both flexor tendons of the fifth finger due to a calcium hydroxyapatite deposit in the carpal tunnel. Acta orthopaedica Belgica 1998;64:336-8.
9. Masada K, Kanazawa M, Fuji T. Flexor tendon ruptures caused by an intraosseous ganglion of the hook of the hamate. Journal of hand surgery (Edinburgh, Scotland) 1997;22:383-5.
10. Davis C, Armstrong J. Spontaneous flexor tendon rupture in the palm: the role of a variation of tendon anatomy. The Journal of hand surgery. 2003;28:149-52.
11. Masaki F, Isao T, Aya Y, Ryuuji I, Yohjiroh M. Spontaneous flexor tendon rupture of the flexor digitorum profundus secondary to an anatomic variant. The Journal of hand surgery. 2007;32:1195-9.
12. Bois AJ, Johnston G, Classen D. Spontaneous flexor tendon ruptures of the hand: case series and review of the literature. The Journal of hand surgery. 2007;32:1061-71.
13. Imbriglia JE, Goldstein SA. Intratendinous ruptures of the flexor digitorum profundus tendon of the small finger. The Journal of hand surgery. 1987;12:985-91.
14. Yamazaki H, Kato H, Hata Y, Nakatsuchi Y, Tsuchikane A. Closed rupture of the flexor tendons caused by carpal bone and joint disorders. The Journal of hand surgery, European volume. 2007;32:649-53.
15. Jebson PJ, Ferlic RJ, Engber WF. Spontaneous rupture of ulnar-sided digital flexor tendons: don't forget the hamate. The Iowa orthopaedic journal. 1995;15:225-7.
16. Naam NH. Intratendinous rupture of the flexor digitorum profundus tendon in zones II and III. The Journal of hand surgery. 1995;20:478-83.

เอ็นงอนิ้วก้อยและนิ้วนางขาดโดยไม่มีบาดแผล: การผ่าตัดรักษาโดยใช้การปลูกเอ็น: รายงานผู้ป่วย 5 ราย

จิรชาติ ไกรศรินท์, พ.บ., คณิตศ์ สนั่นพานิช, พ.บ. และปรีชา ชลิดาพงศ์, พ.บ.

ภาควิชาออร์โธปิดิกส์ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

บทคัดย่อ

ภาวะเส้นเอ็นงอนิ้วขาดโดยไม่มีบาดแผล เป็นภาวะที่พบได้ไม่บ่อย ส่วนมากเกิดกับเส้นเอ็น ที่เกิดพยาธิสภาพ ทำให้เส้นเอ็นสูญเสียความแข็งแรง อาการที่นำผู้ป่วยมาโรงพยาบาล ได้แก่ ปวดบริเวณฝ่ามือ และแรงกำมือลดลง ซึ่งไม่จำเพาะต่อภาวะนี้ การตรวจทางคลินิกไม่สามารถ บอกตำแหน่งที่เส้นเอ็นขาดได้แน่ชัด การศึกษาครั้งนี้รายงานผู้ป่วยที่มีปัญหาเส้นเอ็นงอนิ้วนาง นิ้วก้อยขาดโดยไม่มีบาดแผล จำนวน 5 ราย โดยผู้ป่วย 3 รายสามารถพบพยาธิสภาพที่เป็นสาเหตุ ให้เส้นเอ็นขาด ได้แก่ กระดูก hamate ไม่ติด, กระดูกงอกที่ hook ของกระดูก hamate, และเส้นเอ็นมีผลึกเก๊าท์เกาะ ในขณะที่ ผู้ป่วยอีก 2 รายไม่สามารถตรวจพบความผิดปกติ ผู้ป่วยทุกรายได้รับการรักษาโดย การเย็บซ่อมเอ็นที่ขาดโดยใช้ palmaris longus tendon graft ผู้ป่วยจำนวน 4 ใน 5 ราย ได้ผลการรักษาที่พอใจ สามารถกำและเหยียดนิ้วได้

ภาวะเส้นเอ็นงอนิ้วขาดโดยไม่มีบาดแผล ควรนึกถึงการขาดที่ตำแหน่งในฝ่ามือ การรักษาโดยการซ่อมด้วย tendon graft ได้ผลที่น่าพอใจ **เชียงใหม่เวชสาร 2554;50(1):23-29.**

คำสำคัญ: เอ็นงอนิ้วส่วยปลาย เอ็นขาดโดยไม่มีบาดแผล การปลูกย้ายเอ็น