Ulnar-sided wrist pain due to radial bifurcation of the extensor digiti minimi tendon: A case report and literature review

Ryo Sasaki, Koichi Yano, Yasunori Kaneshiro, Seungho Hyun and Hideki Sakanaka

Abstract
Stenosing tenosynovitis of the extensor digiti minimi (EDM) without trauma is very rare. We report a 21-year-old woman who presented with dorsoulnar wrist pain during palmar wrist flexion and soft tissue mass at the site of pain. Ultrasonography and magnetic resonance imaging showed a round mass radial to the EDM tendon. Conservative treatment for 3 months failed to improve the patient’s pain levels. Intraoperative findings revealed smaller radial slip of the EDM tendon, and bifurcation of these was under the distal portion of the extensor retinaculum (ER). Surgical release of the ER, resection of the smaller slip of the EDM tendon, and tenosynovectomy were performed. Histological examination showed tenosynovitis. At the final follow-up 1 year postoperatively, she was asymptomatic. A literature review suggested that stenosing tenosynovitis of the EDM tendon might be caused by frequent use of the hand with a background history of bifurcation of the EDM tendon.

Keywords
bifurcation, extensor digiti minimi, pain, tenosynovitis, wrist

Introduction
In tenosynovitis of the hand and wrist, trigger finger of a thumb and fingers and de Quervain disease are commonly exhibited in clinical settings. However, stenosing tenosynovitis of the extensor digiti minimi (EDM) without trauma is very rare and has been described in only 10 cases in the literature written in English. The purpose of this case report was to report on a patient with non-traumatic stenosing tenosynovitis of the EDM treated by surgery. We also present a review of the literature on its etiology, cause, treatment, and clinical outcomes.

Case report
Informed consent for publication was obtained from the patient, and this case report was approved by the institutional review board. A 21-year-old left-handed woman was referred to us for further treatment due to 3-month history of pain and soft tissue mass of the left hand. She was employed as an illustrator with 1-year career history. On busy days, she worked 20 h/day. She had no remarkable medical history.

Initially, she felt pain at the dorsoulnar aspect of the left wrist during palmar flexion of the wrist while working and noticed a soft tissue mass at the site of pain. Therefore, she...
visited a clinic and underwent physiotherapy using low-frequency therapy device for 3 months, which failed to improve her symptoms. She reported that the size of the mass did not change during this 3-month period.

Initial examination revealed a firm mass that was 2–3 mm in diameter on the dorsoulnar aspect of the left wrist (Figure 1(a)). The skin was not reddish, and the mass was not adherent to the overlying skin as it moved during small finger motion. The mass was accompanied by tenderness. There was no triggering and limited range of motion of the left little finger. Plain radiography showed no remarkable findings. Ultrasonography revealed that the low echoic solitary mass was located radial to the extensor of the small finger. Magnetic resonance image confirmed a round mass radial to the EDM tendon. On T1-weighted images, the mass had a low signal intensity; T2-weighted images displayed the low signal intensity of the mass and the high signal intensity of its surroundings (Figure 1(b) and (c)). Fibrous tumor was suspected as a preoperative diagnosis; we planned incisional biopsy for definite diagnosis. She scored 5.8 in disability/symptom and 25 in work section on the Disability of the Arm, Shoulder, and Hand (DASH) questionnaire.

Operative treatment was performed under supraclavicular regional anesthesia using a pneumatic tourniquet. A transverse incision was made over the mass. After releasing the distal side of the extensor retinaculum (ER), we observed that the EDM tendon had a small bifurcation radial to it, and the bifurcated site of these two tendons was under the distal portion of the ER (Figure 2(a), (b) and (c)). Additionally, there was extensive tenosynovitis around the site of the bifurcation. There was no space-occupied lesion. Intraoperative findings led us to a diagnosis of stenosing tenosynovitis of the EDM tendon due to bifurcation of the EDM tendon at the distal aspect of the ER. Resection of the smaller radial slip of the EDM tendon and tenosynovectomy were performed (Figure 2(d) and (e)). Histological examination for tenosynovitis showed proliferation of the synovium and capillary vessels and infiltration of lymphocytes, which was compatible with a definitive diagnosis of stenosing tenosynovitis of the EDM tendon (Figure 3).

The postoperative course was uneventful. At 4 weeks postoperatively, she reported relief of her pain. At the final follow-up 1 year postoperatively, she was asymptomatic and did not have any disability during daily life and while working. Her DASH score was 1.7 in disability/symptom and 0 in the work section.

Discussion

Stenosing tenosynovitis or trigger finger of the flexor tendon is exhibited by a locking or clicking of a thumb or a finger and caused by a mismatch of size between the flexor tendon and A1-pulley. The prevalence of trigger finger is 2.6% in the nondiabetic population. Moreover, stenosing tenosynovitis of the EDM is rarer than trigger finger and de Quervain disease. On reviewing the literature on stenosing tenosynovitis of the EDM without trauma, we discovered 10 cases (11 wrists) with available surgical findings and outcomes. Table 1 lists the demographic data of patients. The mean age of the patients was 29 years, and it was younger than that of trigger fingers. Patient occupations and hobbies involved the frequent use of hands.
There were frequent anatomical variations in the extensor tendons of the ulnar side than the radial side, including multiple tendon slips of the EDM, variable attachments of the extensor digitorum communis (EDC), and deficiency of the EDC in the little finger.\textsuperscript{12,13}

On review, there were four causes of stenosing tenosynovitis of the EDM: based on the original reports, which occurred at the site of EDM separation, tendon sheath-like structure, synovial septum, and hypertrophy of ER (Table 2). First, the duplication of the EDM was well described in a previous cadaver study; our review showed duplication of the EDM in 7 of the 12 wrists. Schenck reported that 48 of the 57 cadaver hands had duplication of the EDM and the site of the division was proximal to the ER in 15\%, at the level of the ER in 81\%, and distal to the ER in 4\%.\textsuperscript{13} As shown in the present case, three wrists showed bifurcation of the EDM distal to the ER, and symptoms were recovered by release or excision of the ER.\textsuperscript{6} Thus, the important anatomical cause is not duplication of the EDM, but the site of duplication (distal to the ER), which is a finding that can be supported by the decreased frequency of cadaver wrists exhibiting division of the EDM distal to the ER. Second, anatomical findings of the tendon sheath-like structure or synovial septum using cadavers are reported.\textsuperscript{4,12,14} Third, Khazzam et al. reported hypertrophy of the ER in a diabetic patient.\textsuperscript{5} Frequent use of hands might precipitate stenosing tenosynovitis of the EDM ten- don with a background history of the bifurcation of the EDM.

For conservative treatment, steroid injection for three wrists and medication for two wrists were not effective. While a prospective study showed that a single steroid injection was effective in 64\% of patients with trigger fin- ger, there might be publication bias to these outcomes because all cases with stenosing tenosynovitis of the EDM were treated by surgery.\textsuperscript{11} Surgery showed excellent results, and all wrists became asymptomatic postopera- tively. In the present case, release of the ER and resection

| Table 1. Demographic data of patients with stenosing tenosynovitis of the extensor digiti minimi on literature review. |
|---|---|---|---|---|---|---|---|---|
| Case no. [Ref #] | Age | Sex | Occupation/hobby | D | I | Symptom |
| Case 1\textsuperscript{2} | 23 | NA | Tool maker | R | L | + | + |
| Case 2\textsuperscript{3} | 37 | F | Cash register | NA | R | + | + | + | + |
| Case 3\textsuperscript{3} | 19 | F | Piano | NA | R | + | + | + | + |
| Case 4\textsuperscript{3} | 43 | F | Typist | NA | R | + | + | + | + |
| Case 5\textsuperscript{4} | 32 | M | NA | NA | NA | + | + |
| Case 6\textsuperscript{4} | 28 | F | NA | NA | R | + | + |
| Case 7\textsuperscript{4} | 35 | M | Carpenter | NA | R | + | + |
| Case 8\textsuperscript{5} | 17 | F | NA | R | L | + | + |
| Case 9\textsuperscript{6} | 50 | NA | Book keeper | R | R | + | + |
| Case 10\textsuperscript{7} | 23 | F | Typist | R | R | + | + |
| Our case | 21 | F | Illustrator | L | L | + | + | + |

D: dominant side of hand; I: injured side of hand; LRM: limited range of motion of small finger; NA: not applicable; M: male; F: female; R: right; L: left.

| Table 2. Pathogenesis and treatment for patients with stenosing tenosynovitis of the extensor digiti minimi on literature review. |
|---|---|---|---|---|---|---|
| Case no. [Ref #] | Cause | Duplication | Conservative treatment | Surgical treatment |
| Case 1\textsuperscript{2} | TS | + | NA | Incision of TS |
| Case 2\textsuperscript{3} | TSLS | – | Steroid inj., splint | Res. of the TSLS and ER |
| Case 3\textsuperscript{3} | TS | – | NA | Res. of the TS, S |
| Case 4\textsuperscript{3} | Tenosynovium | – | NA | Res. of the ER |
| Case 5\textsuperscript{4} | SS | + | NA | Rel. of the SS |
| Case 6\textsuperscript{4} | SS | + | Medication, PT | Rel. of the SS |
| Case 7\textsuperscript{4} | SS | + | Medication, PT | Rel. of the SS |
| Case 8\textsuperscript{5} | Hyper. | – | NA | Rel. of the ER |
| Case 9\textsuperscript{6} | Hyper., Bifur. | + | NA | Rel. of the ER |
| Case 10\textsuperscript{7} | Bifur. | + | Steroid inj. | Excision of the ER |
| Our case | Bifur. | + | PT | Rel. of the ER, res. of the EDM slip |

TS: tendon sheath; TSLS: tendon sheath-like structure; SS: synovial septum; Hyper.: hypertrophy of extensor retinaculum; ER: extensor retinaculum; Bifur.: bifurcation of EDM; inj.: injection; PT: physical therapy; EDM: extensor digiti minimi; Res., resection; S: synovectomy; Rel., release; NA: not applicable.
of the EDM minor slip were performed, but the latter might not be necessary. The limitation of this case report was no assessment for the distal attachment of the EDM minor slip.

Conclusion

Stenosing tenosynovitis of the EDM is rare and has several causes due to variations in anatomical structure. Clinical results by surgical treatment were excellent, and quality of life in patients with stenosing tenosynovitis could be improved after surgery.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Ryo Sasaki  https://orcid.org/0000-0003-2782-6331
Koichi Yano  https://orcid.org/0000-0002-5231-7312

Figure 2. Intraoperative photograph. (a) The EDM tendon has smaller radial slip. (b) Enlarged view of the bifurcation of EDM tendon. (c) Schema of the lesion before operation. (d) After resection of the smaller radial slip. (e) Schema of the lesion after operation. EDM: extensor digiti minimi; ER: extensor retinaculum; Bi: bifurcation of EDM tendon.

Figure 3. Histological examination of the tenosynovium. Proliferation of the synovium and capillary vessels, and infiltration of lymphocytes are noted.
References

1. Lapidus PW and Fenton R. Stenosing tenovaginitis at the wrist and fingers; report of 423 cases in 369 patients with 354 operations. *AMA Arch Surg* 1952; 64(4): 475–487.

2. O’Rourke PJ, O’Sullivan T, and Stephens M. Extensor tendon sheath stenosis resulting in triggering of the little finger. *J Hand Surg Br* 1994; 19(5): 662–663.

3. Yamaguchi T, Watari S, and Tsuge K. Cases of snapping finger originating in tendovaginitis of extensor digiti quinti proprius tendon. *Hiroshima J Med Sci* 1984; 33(4): 755–758.

4. Yoo MJ, Chung KT, Kim JP, et al. Tendon impingement of the extensor digiti minimi: clinical cases series and cadaveric study. *Clin Anat* 2012; 25(6): 755–761.

5. Khazzam M, Patillo D, and Gainor BJ. Extensor tendon triggering by impingement on the extensor retinaculum: a report of 5 cases. *J Hand Surg Am* 2008; 33(8): 1397–1400.

6. Hooper G and McMaster MJ. Stenosing tenovaginitis affecting the tendon of extensor digiti minimi at the wrist. *Hand* 1979; 11(3): 299–301.

7. Park SE, Kim YY, Ji JH, et al. Double triggering of extensor digiti minimi: a case report. *Arch Orthop Trauma Surg* 2013; 133(3): 429–432.

8. Ryzewicz M and Wolf JM. Trigger digits: principles, management, and complications. *J Hand Surg Am* 2006; 31(1): 135–146.

9. Strom L. Trigger finger in diabetes. *J Med Soc N J* 1977; 74(11): 951–954.

10. Shakeel H and Ahmad TS. Steroid injection versus NSAID injection for trigger finger: a comparative study of early outcomes. *J Hand Surg Am* 2012; 37(7): 1319–1323.

11. Murphy D, Failla JM, and Koniuch MP. Steroid versus placebo injection for trigger finger. *J Hand Surg Am* 1995; 20(4): 628–631.

12. Tanaka T, Moran SL, Zhao C, et al. Anatomic variation of the 5th extensor tendon compartment and extensor digiti minimi tendon. *Clin Anat* 2007; 20(6): 677–682.

13. Schenck RR. Variations of the extensor tendons of the fingers. Surgical significance. *J Bone Joint Surg Am* 1964; 46: 103–110.

14. Seradge H, Tian W, and Baer C. Anatomic variation of the extensor tendons to the ring and little fingers: a cadaver dissection study. *Am J Orthop (Belle Mead NJ)* 1999; 28(7): 399–401.