Clinical Case Report

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Closed rupture of extensor tendon resulting from untreated Kienböck disease

A case report and a review of the literature

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Abstract

Rationale: Spontaneous closed extensor tendon rupture is a rare complication of Kienböck disease with only 23 cases reported in the English literature.

Patient concerns: We present a case of painless attritional rupture of the extensor tendons of the right fourth finger in a 69-year-old woman with Kienböck disease and review reported cases of Kienböck disease with subcutaneous closed tendon rupture.

Diagnoses: Physical examination had shown mild painless swelling of the dorsum of the right hand. Plain radiographs showed a dorsally displaced fragment of collapsed lunate bone fracture (Lichtman grade IIIb). Although surgery was recommended, the patient did not desire surgery because she had no pain and no interference with the activities of daily living. Six months later, however, the patient returned to our hospital with complaints of loss of spontaneous extension of the fourth finger. CT and MRI showed aseptic necrosis and large dorsally displaced fragments of the lunate under the extensor tendons of the fingers, suggesting a subcutaneous fourth extensor tendon rupture.

Interventions: Surgery was performed to achieve functional recovery of the ring extensor and to prevent further subcutaneous tendon rupture. The extensor digitorum communis (EDC) of the ring finger was found to be ruptured and the EDCs to the third and fifth fingers were frayed due to attrition from the protrusion of the dorsal fragmented lunate bone. Inspection of the floor of the compartment revealed that the dorsally displaced fragment of the lunate bone had perforated the wrist capsule and protruded into the fourth compartment. The dorsal and volar fragments of the lunate bone were excised completely and scaphocapitate arthrodesis followed by the reconstruction of the fourth extensor tendon was performed.

Outcomes: A year after the surgery, radiography showed complete union of the scaphocapitate arthrodesis. The joint motion reached 45% of normal without any pain and there was full active extension of the fourth finger.

Lessons: Because dorsally displacement of collapsed lunate bone fragments is a risk factor for attritional closed rupture of tendons, radiography, and MRI are essential to diagnose and to treat any closed tendon rupture.

Abbreviations: CT = computed tomography, EDC = extensor digitorum communis, EDM = extensor digiti minimi, EIP = extensor indicis proprius, ECRB = extensor carpi radialis brevis, MRI = magnetic resonance imaging, ROM = range of motion.

Keywords: advanced Kienböck disease, attritional tendon rupture, case report, closed tendon rupture, extensor tendon

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Informed consent was obtained from the patient for surgery and for publication of this case.

The authors declare that they have no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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1. Introduction

Attritional closed tendon rupture of finger is a well-known complication in rheumatoid arthritis, osteoarthritis, calcium pyrophosphate dihydrate crystal deposition disease, and distal radius fractures.[1–7] On the other hand, although closed tendon ruptures of fingers are a well-known complication due to in advanced Kienböck disease, only 23 cases (extensor 18, flexor 5 cases) have been reported in the English literature.[8–20] In previous reports, all the closed tendon ruptures were caused by the protrusion of fragments of the lunate bone or a mass of ectopic bone, suggesting the closed tendon ruptures are attritional ruptures in advanced Kienböck disease. We present a rare occurrence of attritional extensor tendon rupture of the right fourth finger in a 69-year-old woman with Kienböck disease and review reports of similar cases.

2. Case presentation

A 69-year-old female presented to our hospital with a 3-week history of swelling of the dorsal right wrist. She was a waitress in a Japanese traditional restaurant; she did not engage in sports.

Figure 1. Presenting anteroposterior (C) and lateral (D) radiographs at the third visit of our hospital, showing a collapse of the lunate bone and a protruded dorsal fragment of lunate bone (arrowhead) from previously asymptomatic Kienböck disease.

She had a past history of minor trauma, having fallen and bruised the right wrist 3 years previously, and had been first referred to our hospital at that time. Plain radiographs had shown a fragmented lunate bone, suggesting advanced Kienböck disease, but the condition was not diagnosed.

Physical examination at her second visit 3 years later had shown mild swelling of the dorsum of the right hand; there was no pain in the wrist. The wrist showed 60° of extension, 50° of flexion, and full range of forearm rotation. The patient had 67% wrist range of motion (ROM) compared with the contralateral wrist. The grasp strength was 22 kg, 100% compared with the contralateral wrist. Plain radiographs acquired at this presentation also showed a dorsally displaced fragment from a lunate bone fracture (Fig. 1A, B). Magnetic resonance imaging (MRI) revealed the fragmented lunate bone and synovitis of the extensor tendons. Surgery was recommended. However, the patient did not desire surgery because she had no pain and no interference with the activities of daily living. Thus, the patient was observed.

Six months later, however, the patient referred to our hospital a third time with complaints of loss of spontaneous extension of the fourth finger (Fig. 2A, B). Although the ROM and grasp strength were the same as previous evaluation on clinic, she had complained mild pain with activities of daily living when her forearm was rotated. Modified Mayo Wrist Score[21] was 55 points (Pain 10; Satisfaction 10; ROM 10; Grip strength 25). Computed tomography (CT) (Fig. 3A, B) and MRI (Fig. 4A–D) showed aseptic necrosis, Lichtman grade IIIb,[22] and large dorsally displaced fragments of the lunate under the extensor tendons of the fingers, suggesting a subcutaneous fourth extensor tendon rupture. Informed consent was obtained from the patient for surgery. She also gave written permission for her anonymized images to be used in publication of this case.

Surgery was performed to achieve functional recovery of the fourth digit extensor and to prevent further subcutaneous tendon ruptures. A straight incision on the dorsal wrist made through the fourth dorsal compartment revealed the inflamed synovium around the extensor digitorum communis (EDC) of the fourth finger. The extensor was ruptured and its proximal end was adherent to the EDC of the third digit in the extensor retinaculum (Fig. 5 A). In addition, the EDCs to the third and fifth fingers were frayed due to attrition from the dorsal protrusion of the lunate

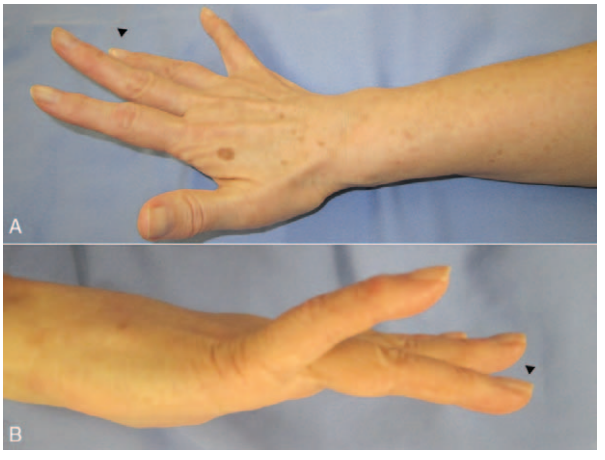

Figure 2. Closed rupture of the extensor digitorum communis of the right fourth digit as a result of Kienböck disease in a 69-year-old woman. Initial oblique (A) and lateral (B) clinical photographs 3 years prior to presentation at our hospital, showing apparent active extension lag of the fourth finger (arrowhead).

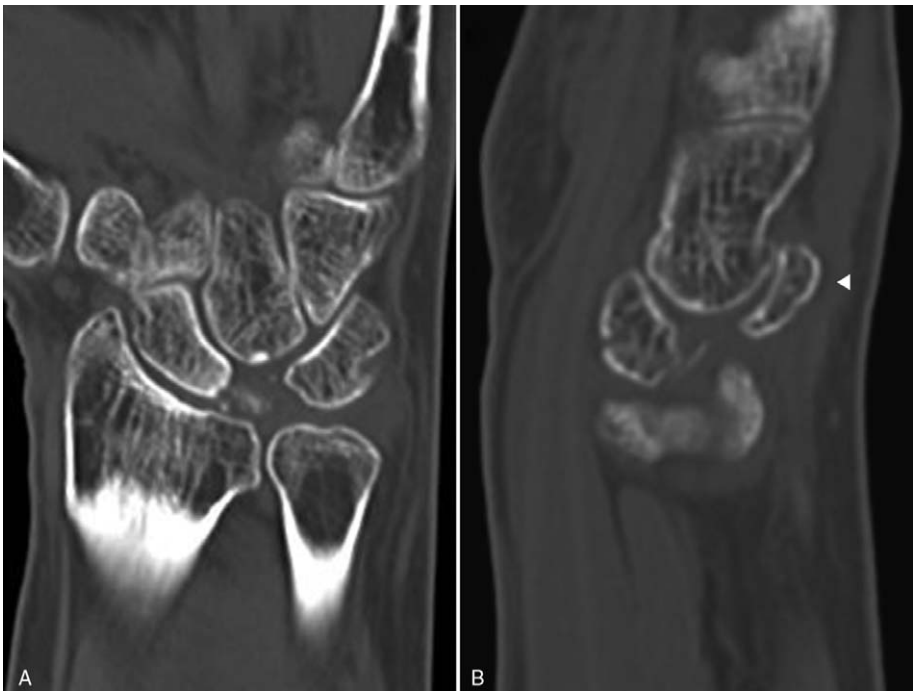

Figure 3. Coronal (A) and sagittal (B) computed tomography (CT) of view of the right wrist, showing a collapsed and separated lunate. Two large fragments of the lunate bone are displaced dorsally and volarly with more marked protrusion of the dorsal fragment (arrowhead).

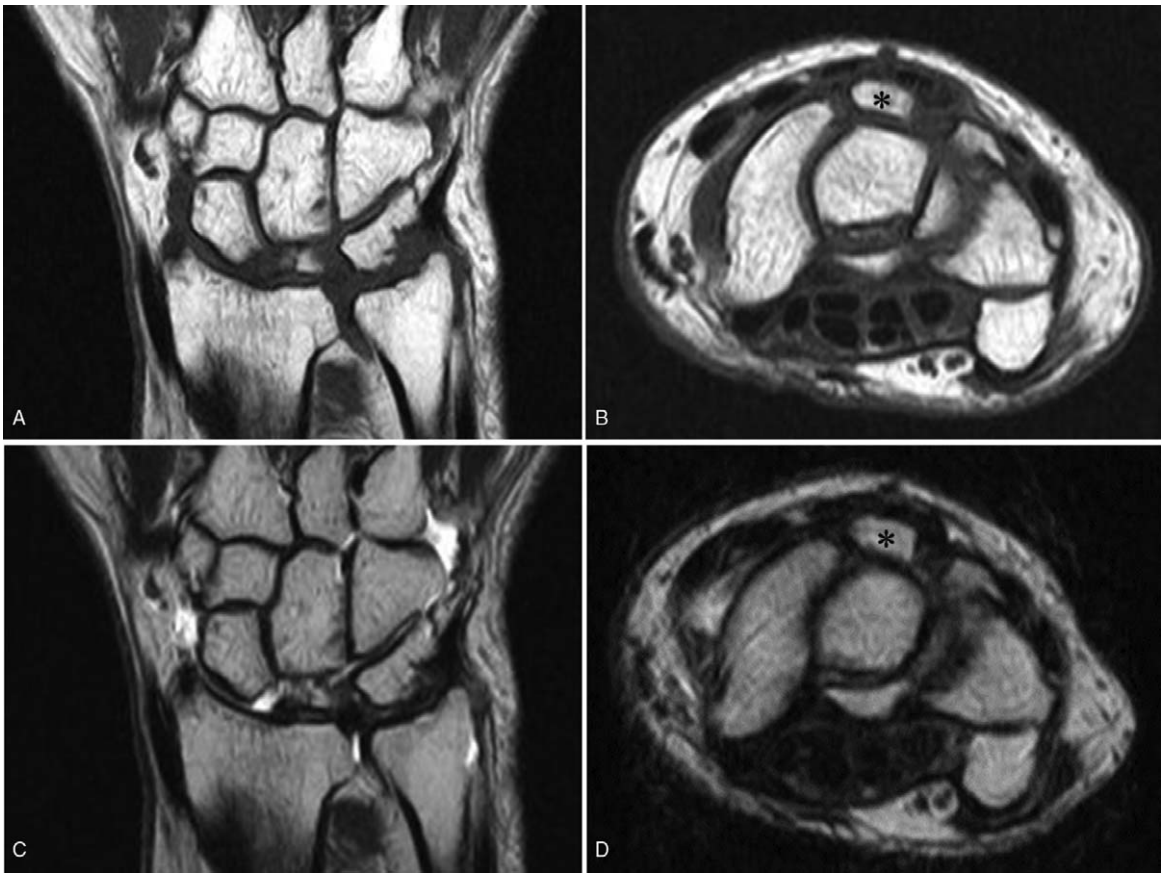

Figure 4. Magnetic resonance imaging (MRI) of the right wrist, showing the collapsed and fragmented lunate bone, which has a low signal intensity on a T1 (A) and T2-weighted images (C). Axial MRI of the right wrist, showing a dorsal fragment (asterisk) which had a signal intensity isointense to other carpals. The fragment is surrounded by a diffuse low-intensity area, which indicates the extensor tendons, on a T1 (B) and T2-weighted image (D).

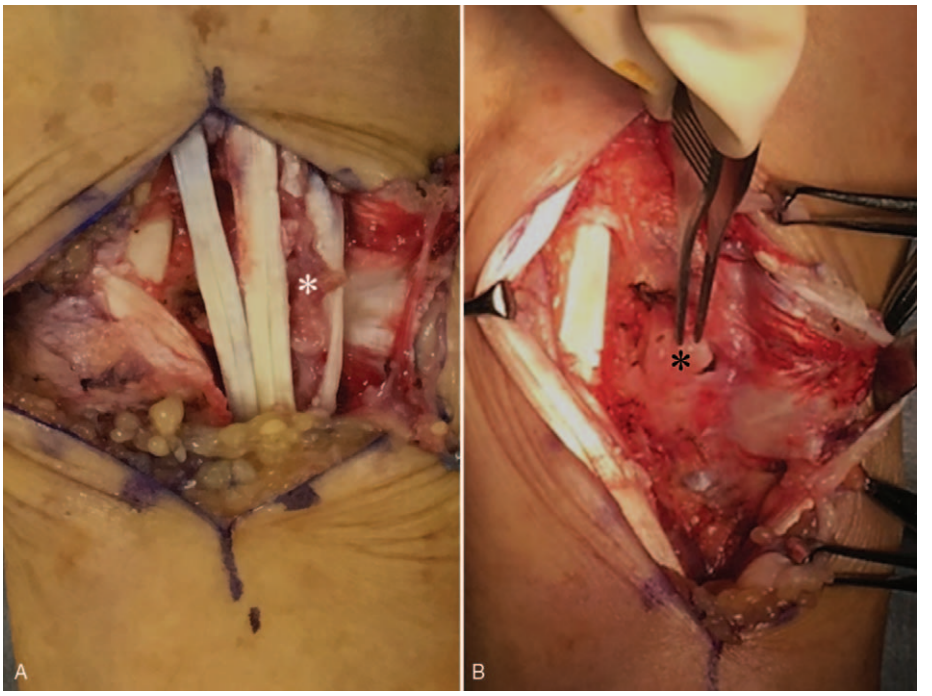

Figure 5. Perioperative photograph. Exposure of the fourth dorsal compartment revealed the inflamed synovium around the ruptured extensor digitorum communis (EDC) of the ring finger (asterisk) (A). Inspection of the floor of the compartment reveals that the dorsally displaced lunate bone fragment (asterisk) had perforated the wrist capsule and protruded into the fourth compartment (B).

bone fragments. The EDCs to the second digit, the extensor indicis proprius (EIP) and the extensor digiti minimi (EDM) in the fifth extensor compartment, were intact. Inspection of the floor of the compartment revealed that dorsal displacement of lunate fragments had perforated the wrist capsule and entered the fourth compartment (Fig. 5B) (Supplement video, http://links.lww.com/MD/D184). The distal end of the tear of the EDC was located 4 cm proximal to the corresponding MCP joints. The dorsal and volar fragments of the lunate bone were excised completely and scaphocapitate arthrodesis was performed with 4 screws

Figure 6. (A) anteroposterior and (B) lateral radiographs of the right wrist at a year postoperatively, showing the established scaphocapitate arthrodesis.

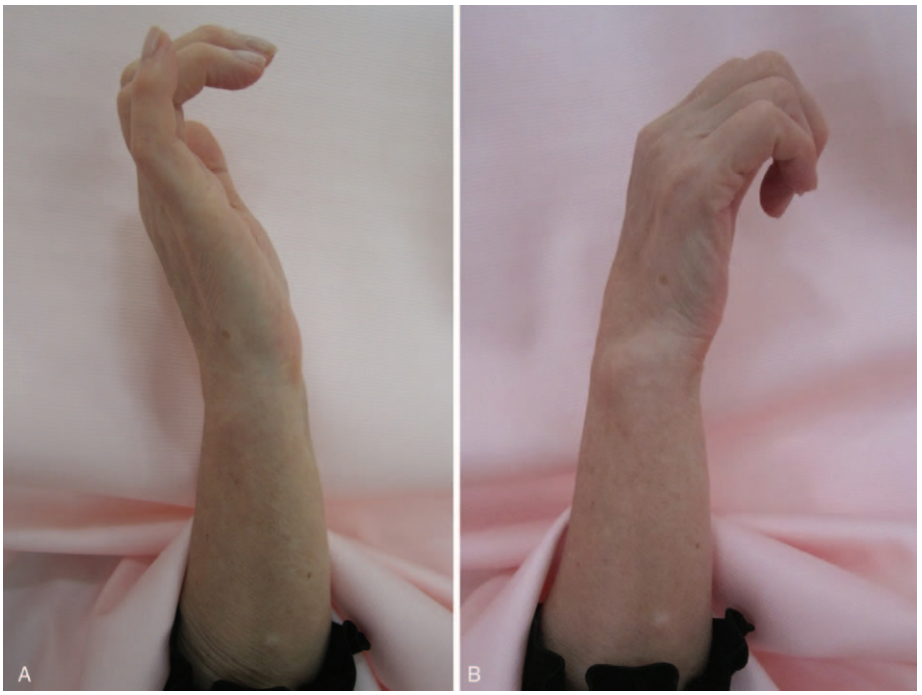

Figure 7. Lateral clinical photographs at a year postoperatively, showing 45° of extension (A), 30° of flexion (B).

(**DTJ, MEIRA**, Corp., Nagoya, Japan). To reconstruct the extensor of the fourth digit, the palmaris longus was used as a bridge graft to the distal end of the tear of the fourth digit extensor tendon with interlacing sutures. Subsequently, the proximal end of the grafted palmaris longus was connected to the EDC of the third digit with interlacing sutures. Histopathology of the resected lunate revealed fatty necrosis and disappearance of osteoid surrounded by reactive new bone and granulation tissue. A short-arm cast was applied for 6 weeks, including a flexion block for the first 3 weeks. Active extension exercises were permitted beginning the day after surgery. After the removal of the cast, the patient was encouraged to begin active ROM exercises without restriction. A year after the surgery, plain radiography showed complete union of the scaphocapitate arthrodesis (Fig. 6A, B). The wrist showed 45° of extension, 30° of flexion (Fig. 7A, B) and full range of forearm rotation. The grasp strength was 18 kg, 86% compared with the normal wrist. The wrist ROM reached 45% of normal without any pain, and there was full active extension of the fourth digit (Fig. 8A, B). Modified Mayo Wrist Score was 65 points (Pain 25; Satisfaction 20; ROM 5; Grip strength 15).

3. Discussion

Spontaneous closed tendon rupture has been described as the one of the well-known complications in Kienböck disease.[8–20] To our knowledge, however, only 23 cases (extensor 18, flexor 5 cases) have been reported in the English literature (Table 1). Although painless swelling was the prodromal symptom of closed extensor rupture in our case, prodromal symptoms of spontaneous closed tendon ruptures have been reported in only a few cases. Before the occurrence of closed tendon ruptures, only 7 patients had complained of mild wrist pain and 8 patients had prodromal symptoms, such as swelling or pain in the dorsum of the wrist in 22 patients,[8,9,12,13,18–20] suggesting nonspecific symptomatology. Thus, although wrist pain would be occasionally occurred as the prodromal symptom of closed tendon rupture, asymptomatic tendon rupture could occur in advanced Kienböck disease with collapsed lunate bone.

In cases presenting with abnormal ROM, radiography, CT, and MRI are essential to diagnose and subsequently treat any closed tendon rupture when a patient presents with wrist edema or abrupt loss of digital extension or flexion. In previous reports, all the closed tendon ruptures were caused by the protrusion of fragments of the lunate bone or a mass of ectopic bone, suggesting the closed tendon ruptures are attritional ruptures in advanced Kienböck disease.[8] Among the closed tendon ruptures in Kienböck disease, flexor tendon ruptures were extremely rare and were caused by volarly displaced lunate bone frag-

Figure 8. oblique (A) and lateral (B) clinical photographs at a year postoperatively, showing full active extension of the fourth digit.

Table 1

Reviews of all known published reports of closed tendon ruptures in Kienböck disease.

Authors	Year	No. of wrists	Age (y)/ Sex	Side	Occupation	History of previous wrist pain (duration)	Symptom at the time of the tendon rupture	Lichtman class	Cause of tendon ruptures	Ruptured tendon	Damaged tendon
James	1949	1	50/M	Lt	Motor driver	Wrist pain (9y)	Swelling without pain	IIIb	Fragmented lunate	FPL, FDP (2)	None
Hallet and Motta	1982	1	56/M	Lt	*	Intermittent pain (30y)	Wrist pain	III	Palmar displacement of lunate fragment	FPL	FDP (2)
Miki et al	1986	3	84/M	Lt	Professional painter	None	Swelling, ecchymosis, wrist pain	III or IV	A mass of ectopic bone	EIP, EDC (2)	ECU
			72/F	Lt	*	None	None	III or IV	Dorsal displacement of lunate fragment	EDC (3,4)	EIP
			64/F	Lt	*	None	None	III or IV	Dorsal spur of fragmented lunate	EDC (3,4)	EDC (2)
Masada et al	1987	1	62/M	Rt	Woodsman	None	None	IIIb	Palmar displacement of lunate fragment	FDS (2), FDP (2)	FDP (3)
Ribbans	1988	1	27/F	Rt	Bookbinder	None	None	III	*	FPL	None
Inoue	1994	2	59/M	Rt	Woodworker	mild pain (30y)	None	IV	Dorsal displacement of lunate fragment	EDC (3,4)	None
			58/M	Lt	Carpenter	mild intermittent pain (30y)	wrist pain	IIIb-IV	dorsal displacement of lunate fragment	EDC (4)	None
Murase et al	1997	1	62/M	Rt	Housewife	None	swelling	III	Dorsal displacement of lunate fragment	EIP, EDC (2)	None
Ramkumar et al	2000	1	64/M	Rt	Plasterer	None	None	III	Dorsal spur of fragmented lunate	EDC (4,5)	EDC (3), EIP
Park et al	2007	1	64/M	Rt	*	None	None	IIIb		EDC (2–4)	None
Pacha-Vicente et al	2007	1	*/F	*	*	*	*	III or IV	Dorsal displacement of lunate fragment	EIP, EDC (2)	None
		1	*/F	*	*	*	*	III or IV	Dorsal displacement of lunate fragment	EDC (3)	EDC (2,4,5), EDM
Niwa et al	2010	6	76/M	Rt	Farmer	None	None	IIIb	palmar fragment of lunate	FDP (4,5)	*
			72/F	Rt	Farmer	Wrist pain (20y)	Mild wrist pain	IV	Dorsal displacement of lunate fragment	EDC (4,5)	*
			73/M	Lt	Farmer	None	None	IV	Dorsal displacement of lunate fragment	EIP, EDC (2)	*
			69/F	Rt	Farmer	Wrist pain (8y)	None	IV	Dorsal displacement of lunate fragment	EDC (4)	*
			85/F	Rt	None	None	None	IV	Dorsal displacement of lunate fragment	EDC (4)	*
			68/F	Lt	Cleaning Woman	Wrist pain (41y)	Mild wrist pain	IV	Dorsal spur of fragmented lunate	EDC (4,5)	*
Hernandez-Cortes et al	2012	3	67/M	Lt	*	None	None	IIIb	Dorsal spur of lunate	EIP, EDC (2)	None
			73/M	Rt	*	None	None	IIIb	Dorsal osteophyte of lunate	EIP, EDC (2)	None
			68/F	Rt	*	None	None	IIIb	Dorsal osteophyte of lunate	EIP, EDC (2–5)	None
Present case	2019	1	69/F	Rt	Restaurant worker	None	Swelling	IV	Dorsal displacement of lunate fragment	EDC (4)	EDC (3,5)

* No data.

M = Male, F = female; y = year, Lichtman class = Lichtman classification, EIP = extensor indicis proprius, EDC = extensor digitorum communis, EDM = extensor digiti minimi, FPL = flexor pollicis longus, FPS = flexor digitorum sublimis, FDP = flexor digitorum profundus.

ments.[8,14,15,18,19] On the other hand, causes of closed extensor tendon ruptures in Kienböck disease have been reported to be associated with dorsal protrusion of lunate bone fragments or a mass of ectopic bone.[8–13,16,17,20] In our case, the dorsally displaced lunate fragments had pierced the capsule of the wrist, resulting in chronic attrition of the extensor tendons.

Although closed flexor tendon ruptures secondary to Kienböck disease mainly affect the flexor of the thumb or index finger, closed extensor tendon ruptures occurred in the extensor of the second, third, and fourth digits in the fourth dorsal compartment of the wrist (Table 1). Thus, closed tendon ruptures secondary to Kienböck disease mainly involve the extensor tendon in the fourth dorsal compartment or the flexor tendon of the first or second digit.[8,9,14]

The association of Kienböck disease with tendon damage is more common because of the associated attritional closed tendon damage, which may involve multiple tendons (Table 1). Any tendon damage should be considered as an impending rupture due to the attrition from the protrusion of fragments of the lunate bone.[8,10] All but 1 reported cases have been in patients of advanced age with lesser functional demand and, usually, with fewer symptoms in the wrist (Table 1). Thus, patients might not feel the necessity for surgical intervention. However, because delayed surgical intervention might eventually result in worsening of the function of the wrist, ruptured, or damaged tendons must be treated as early as possible.[8,9] On the other hand, whether or not wrist arthroplasty should be performed is still controversial.[23] In our case, the patient had slight restriction of the wrist joint without pain, but postoperatively, partial arthrodesis resulted in >50% restriction of the wrist joint compared with contralateral wrist. According to Table 1, all but 1 reported case have been in patients of advanced age with lesser functional demand and with few symptoms in the wrist. In many cases, only excision of the fragmented lunate bone had been performed, which did not provide relief of the wrist pain or difficulties with the activities of daily living.[9,10,12,13,16–20] There might not therefore be a need for simultaneous arthroplasty or partial arthrodesis of bones. Whether arthroplasty or arthrodesis of the affected wrist is essential or not is still unknown and further study is necessary.

4. Conclusion

We reported a case of spontaneous closed extensor tendon rupture caused by a dorsally displaced fragment of lunate bone in advanced Kienböck disease. Because dorsal displacement of lunate bone fragments is a risk factor for attritional closed rupture of tendons, radiography, and MRI are essential to

diagnose and to treat any closed tendon rupture. Bone fragments must be excised, and ruptured, or damaged tendons should be treated to prevent further attritional extensor tendon ruptures as early as possible.

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Author contributions

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Writing – original draft: Yuji Tomori.
Writing – review & editing: Yuji Tomori, Mitsuhiko Nanno.

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