

Lunate excision combined with palmaris longus tendon ball arthroplasty for stage III Kienböck's disease: a retrospective case series

Wei Zhao

First Affiliated Hospital of Hebei Medical University

Rong-Rong Ren

Binzhou People's Hospital

Yan-Bin Wu

Chinese PLA General Hospital

Si-Ce Wang

Chinese PLA General Hospital

Xiao-Yang Fu

Chinese PLA General Hospital

Xi-Wei Peng

Chinese PLA General Hospital

Qian-Ru Yao

Hebei Medical University

Gui-Lan Zhang

Binzhou Medical College Hospital

Yong-Tao Liu

Binzhou Medical College Hospital

Kun-Xiu Song

Binzhou Medical College Hospital

Jiang Peng

peng.jiang301@126.com

First Affiliated Hospital of Hebei Medical University

Case Report

Keywords: Kienböck's disease, Lunate excision, Palmaris longus tendon ball, Stage III, Tendon interposition arthroplasty

Posted Date: October 11th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11021976/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.
[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Kienböck's disease (KD) is a rare avascular necrosis of the lunate. For stage III disease, lunate excision combined with tendon interposition arthroplasty is one of the operative options, but clinical evidence remains limited. This study aimed to evaluate the clinical outcomes of lunate excision combined with palmaris longus tendon ball arthroplasty for stage III KD and to describe the surgical technique.

Methods

Six patients with stage III KD treated by lunate excision combined with palmaris longus tendon ball arthroplasty in our department were retrospectively reviewed. The necrotic lunate was completely excised, and the defect was reconstructed with a tendon ball fashioned intraoperatively by harvesting and braiding both palmaris longus tendons. Clinical outcomes-including pain relief, return to daily and occupational activities, wound healing, and complications-were evaluated at a mean follow-up of 12 months. This report was prepared in accordance with the CARE guidelines.

Results

All six patients completed the follow-up. Surgical incisions healed within 2 weeks without infection, skin necrosis, or other complications, and all patients returned to their previous occupations within 4 weeks. At the final follow-up (mean 12 months), all patients reported pain relief and maintained functional wrist use for daily and occupational activities.

Conclusions

Lunate excision combined with palmaris longus tendon ball arthroplasty provided satisfactory short-term outcomes in this small series and may be considered a viable operative option for stage III KD. Larger comparative studies with longer follow-up are needed to confirm these findings.

Introduction

Avascular osteonecrosis of the lunate, or Kienböck's disease (KD), is a rare condition with unclear etiology [1]. It is characterized by lunate osteonecrosis, often leading to fractures, carpal disorganization, and eventually arthritis [2]. Disease progression is driven by multiple factors, including vascular, anatomical, traumatic, mechanical, and systemic influences [3–5]. In advanced stages (III and IV), the condition becomes irreversible, often necessitating surgical intervention. Based on clinical presentation and imaging findings, various surgical approaches are available for managing KD. These include procedures such as ulnar lengthening, radial shortening, intercarpal fusion, vascularized bone grafts,

tendon interposition arthroplasty, radial metaphyseal decompression, proximal row carpectomy, and wrist fusion [6–11]. Minimally invasive techniques, including arthroscopic procedures and lunate excision combined with tendon ball interposition (using the palmaris longus, pronator quadratus, or extensor carpi radialis longus), have gained attention due to their favorable outcomes [3, 9, 12]. This study reports our clinical experience with lunate excision combined with palmaris longus tendon ball arthroplasty for stage III KD, focusing on the surgical technique and short-term functional outcomes.

Patients and methods

This retrospective case series included six patients; the majority were engaged in physically demanding occupations, such as construction, farming, or manual labor. Three individuals reported prior wrist trauma of varying severity. Most participants had undergone conservative management, including local anesthetic injections, acupuncture, oral medications, and physical therapy. This study received ethical approval from the Ethics Committee of the authors' institution. All participants provided informed consent for data usage with guaranteed confidentiality. The cohort consisted of patients with stage III KD (Table 1) [4, 13], who underwent lunate excision combined with palmaris longus tendon ball arthroplasty at our institution. This retrospective case series was reported in accordance with the CARE (Case Report) guidelines. Postoperative clinical outcomes-including pain relief, return to daily and occupational activities, wound healing, and complications-were evaluated at each follow-up visit.

Table 1 **The Kienböck’s disease classification**

Stage	Features
0	Normal x-rays with transient pain, but intermittent ischaemia
I	Continuous pain with normal x-rays and marrow changes
II	Osteonecrosis with visible lunate sclerosis and no lunate collapse
III	
III A	Osteonecrosis with collapse and no wrist collapse
III B	Carpal collapse and proximal capitate migration
III C	lunate fracture
IV	Radiocarpal or midcarpal degenerative arthritis

Operative technique

Patients were placed in the supine position with the affected arm abducted. After administration of brachial plexus block anesthesia, a pneumatic tourniquet was applied to the proximal upper arm to establish a bloodless surgical field. A 3 cm curvilinear (S-shaped) incision was created along the dorsal midline. After careful dissection through subcutaneous tissues, the extensor digitorum tendon was identified and gently retracted in an ulnar direction. A longitudinal incision was made to expose the lunate joint capsule, and the dorsal ligaments surrounding the lunate were divided. Upon confirming

lunate osteonecrosis, the necrotic bone was completely excised, preserving the surrounding ligaments and capsule. Following complete resection of the necrotic lunate and surrounding ligamentous attachments, the surgical field was thoroughly irrigated. Subsequently, two 1 cm volar wrist incisions were made to harvest the palmaris longus tendons, which were carefully mobilized through a distal incision and fashioned into a spherical graft using 5 – 0 Prolene® polypropylene sutures. This tendon construct was then precisely sized and securely anchored within the lunate fossa, providing both volume replacement and structural support through fixation to the residual periarticular ligaments. The procedure was completed with anatomic repair of the dorsal radiocarpal and intercarpal ligaments, followed by meticulous closure of the joint capsule and extensor retinaculum. After tourniquet release and complete hemostasis, a layered wound closure was performed.

Postoperative management

Postoperatively, patients were maintained in a supine position with the operated limb elevated to enhance venous return and minimize edema. The wrist was immobilized in a neutral-position plaster cast to prevent periarticular adhesions while promoting functional recovery. Sutures were routinely removed at 2 weeks postoperatively, followed by cast removal and initiation of active wrist flexion-extension exercises. NSAIDs were prescribed as needed for pain control during the rehabilitation period.

Clinical outcomes evaluation

Clinical outcomes were evaluated at each follow-up visit on the basis of pain relief, return to daily and occupational activities, wound healing, and the occurrence of complications. Formal validated instruments such as the Modified Mayo Wrist Score (MMWS) were not administered systematically, and quantitative measures-including wrist range of motion, grip strength, and radiographic parameters such as the carpal height ratio-were not routinely recorded; functional assessment therefore relied on clinical observation rather than quantitative scoring.

Results

All six patients completed the postoperative evaluation. No perioperative complications, such as infection, skin necrosis, tendon-ball dislocation, or nerve injury, were observed. All incisions healed within 2 weeks, and cast removal was followed by progressive active wrist flexion–extension exercises. Each patient had an uncomplicated postoperative course and achieved full return to occupational activities within 4 weeks. At a mean follow-up of 12 months, all patients reported pain relief and maintained functional wrist use for daily and occupational activities; formal MMWS scores and quantitative measurements were not systematically documented.

Case presentations

Case 1

A 61-year-old female presented with a one-year history of left wrist pain and restricted motion. She reported a prior left wrist sprain, after which she developed persistent pain and limited flexion/extension. Local corticosteroid injections provided no significant relief. Imaging confirmed lunate osteonecrosis (Fig. 1a-b). Under brachial plexus block anesthesia, she underwent lunate excision, palmaris longus tendon ball arthroplasty, and below-elbow cast immobilization (Fig. 1c-d).

Case 2

A 57-year-old female presented with left wrist pain and swelling after a fall. Radiography and CT revealed a distal radius fracture with concomitant lunate osteonecrosis (Fig. 2a). Detailed history-taking indicated that the patient had experienced left wrist pain before the fracture. Initial management at a local hospital consisted of manual reduction and plaster immobilization, together with cold compresses and analgesia to relieve swelling and pain. Definitive surgery consisted of open reduction and internal fixation of the distal radius fracture using a volar locking plate, with fixation of the ulnar styloid using K-wires. Concurrently, lunate excision, palmaris longus tendon ball interposition arthroplasty, and below-elbow cast immobilization were performed (Fig. 2b-c). At the 1-year follow-up, the patient underwent uneventful removal of the internal fixation plate with restoration of normal wrist function (Fig. 2d).

Case 3

A 44-year-old female presented with pain and discomfort in the right wrist after a fall injury 2 months earlier. Conservative treatment partially relieved the pain. MRI at a local hospital revealed lunate osteonecrosis, and the diagnosis was confirmed on radiographs and CT (Fig. 3a). The patient was admitted for lunate excision, palmaris longus tendon ball arthroplasty, and below-elbow cast immobilization (Fig. 3b-c).

Discussion

Stage III Kienböck's disease (KD) is characterized by lunate fragmentation, joint-space narrowing, and progressive wrist dysfunction [14]. Clinically, patients typically exhibit chronic pain, joint stiffness, and marked limitation of motion, with therapeutic goals focused on functional restoration and symptomatic relief [15]. While treatment protocols for stage III KD remain controversial [6], lunate resection combined with tendon interposition arthroplasty has emerged as a viable surgical option in selected cases.

The lunate plays a pivotal biomechanical role in maintaining wrist stability and kinematics [16]. Its complete excision inevitably compromises the dorsal radiocarpal and intercarpal ligaments, leading to a characteristic triad of carpal derangement: proximal row dysfunction, capitate migration, and abnormal scaphoid loading—all potentially accelerating carpal collapse [12]. This understanding has established

tendon reconstruction as an essential component of lunate excision procedures. Among available techniques, tendon interposition arthroplasty using autografts (particularly palmaris longus, pronator quadratus, or extensor carpi radialis longus (ECRL) tendons) has gained substantial clinical validation [3, 4, 9, 12, 17], and our institution prefers the palmaris longus tendon because of its favorable biomechanical profile and ease of harvest. Our clinical observations of consistent pain relief and early return to functional activities are in line with previous reports of palmaris longus tendon ball arthroplasty.

The palmaris longus tendon ball graft offers biomechanical advantages, particularly in stage III Kienböck's disease [6]. After graft placement, the tendon ball fills the collapsed lunate space, providing stability and improving the mechanical environment of the wrist joint [18]. This helps alleviate pain and may reduce bone wear and the progression of osteoarthritis caused by lunate collapse [19].

In our experience, harvesting bilateral palmaris longus tendons and suturing them into a single tendon ball is essential to adequately fill the lunate defect cavity. This construct yields a fuller, more robust, and load-resistant graft. This study has several limitations. First, due to the rarity of KD, only six patients were enrolled; such a limited sample precludes statistical comparison and may underdetect rare complications. Second, this was a retrospective case series without a control group, and quantitative outcome data (wrist range of motion, grip strength, MMWS scores, and radiographic parameters such as the carpal height ratio) were not systematically recorded, so the functional assessment relied mainly on subjective clinical parameters, including pain relief and return to occupational activities. Third, the mean follow-up of 12 months is relatively short, and longer observation is required to determine whether the tendon ball can prevent progressive carpal collapse. Fourth, one patient (Case 2) sustained a concomitant distal radius fracture, which may confound the functional outcome attributable to the lunate procedure.

Conclusion

In conclusion, lunate excision combined with palmaris longus tendon ball arthroplasty achieved satisfactory short-term outcomes in this small series of patients with stage III Kienböck's disease and may be considered a viable operative option. Further studies with larger samples, longer follow-up, and comparative designs are warranted.

Abbreviations

KD Kienböck's disease

MMWS Modified Mayo Wrist Score

Declarations

Acknowledgements

None.

Authors' contributions

Kun-Xiu Song, Jiang Peng, Gui-Lan Zhang, Yong-Tao Liu and Wei Zhao conceived the study design, collected clinical data, and performed statistical analyses. Wei Zhao prepared the initial manuscript draft, with Rong-Rong Ren providing radiographic documentation. Yan-Bin Wu, Si-Ce Wang, Xiao-Yang Fu, Xi-Wei Peng and Qian-Ru Yao supervised the research implementation. All authors participated in data interpretation and provided critical revisions of the manuscript for scientific accuracy. The final version was reviewed and approved by all contributing authors.

Funding

This study was funded by the National Key Research and Development Program of China (2024YFA1108600) and the clinical specialty construction foundation of Shandong Province (2020, SLCZDZK-0303).

Data availability

Not applicable.

Ethics approval and consent to participate

This study received ethical approval from the institutional review board of Shandong Medical and Pharmaceutical University Hospital (2025-KYLL-070) and conducted in accordance with the Declaration of Helsinki (as revised in 2013). All participants provided written informed consent prior to enrollment.

Consent for publication

Written informed consent was obtained from all participants for publication of their clinical data and any accompanying medical images.

Competing interests

The authors affirm no competing financial interests or commercial relationships that could influence the research findings or interpretation of results.

Clinical trial number

Not applicable.

References

1. Gerwin M. The history of Kienböck's disease. *Hand Clin.* 1993;9(3):385–90.

2. Golay SK, Rust P, Ring D. The Radiological Prevalence of Incidental Kienböck's Disease. *Arch Bone Jt Surg.* 2016;4(3):220–3.
3. Wang F, Wang L, Lv L, et al. Results after open lunate excision alone or in combination with palmaris longus tendon ball arthroplasty for the treatment of Kienböck's disease. *J Orthop Surg Res.* 2023;18(1):476.
4. Salva-Coll G, Esplugas M, Carreño A, Lluch-Bergada A. Kienböck's disease: preventing disease progression in early-stage disease. *J Hand Surg Eur Vol.* 2023;48(3):246–56.
5. O'Laughlin SJ. Kienbock's disease. *J Orthop Sports Phys Ther.* 2010;40(6):376.
6. Innes L, Strauch RJ. Systematic review of the treatment of Kienböck's disease in its early and late stages. *J Hand Surg Am.* 2010;35(5):713–e7177174.
7. Lichtman DM, Lesley NE, Simmons SP. The classification and treatment of Kienbock's disease: the state of the art and a look at the future. *J Hand Surg Eur Vol.* 2010;35(7):549–54.
8. Lichtman DM, Pientka WF 2nd, MacLean S, Bain G. Precision Medicine for Kienböck Disease in the 21st Century. *J Hand Surg Am.* 2022;47(7):677–84.
9. Zhang W, Hou P, Wu T, Ho PC, Sun L, Wang C. Tendon ball arthroplasty and proximal carpal stabilization with tendon graft for advanced Kienböck's disease. *J Hand Surg Eur Vol.* 2024;49(11):1356–61.
10. Stahl S, Hentschel PJ, Santos Stahl A, Meisner C, Schaller HE, Manoli T. Comparison of clinical and radiologic treatment outcomes of Kienböck's disease. *J Orthop Surg Res.* 2015;10:133.
11. Fouly EH, Sadek AF, Amin MF. Distal capitate shortening with capitometacarpal fusion for management of the early stages of Kienböck's disease with neutral ulnar variance: case series. *J Orthop Surg Res.* 2014;9:86.
12. Aslantürk O, Ertem K, Ergen E, Köroğlu M. Extensor carpi radialis longus tendon ball interposition arthroplasty for treatment of late-stage Kienböck's disease: Short-term results of a novel technique. *J Orthop Surg (Hong Kong).* 2018;26(3):2309499018802514.
13. Lichtman DM, Pientka WF 2nd, Bain GI. Kienböck disease: a new algorithm for the 21st century. *J Wrist Surg.* 2017;6(1):49–57.
14. Elshahhat A, Nour K, Abed Y. Scaphocapitate fusion in stage III Kienböck's disease: effects of lunarectomy on postoperative pain and function. *Arch Orthop Trauma Surg.* 2025;145(1):174.
15. Camus EJ, Van Overstraeten L. Kienböck's disease in 2021. *Orthop Traumatol Surg Res.* 2022;108(1S):103161.
16. Park JH, Jang WY, Kwak DH, Park JW. Lunate morphology as a risk factor of idiopathic ulnar impaction syndrome. *Bone Joint J.* 2017;99–B(11):1508–14.
17. Beredjiklian PK. Kienböck's disease. *J Hand Surg Am.* 2009;34(1):167–75.
18. Küçük L, Ozdemir O, Coşkunol E, Süğün TS, Ozaksar K. The effect of excisional arthroplasty with palmaris longus tendon on carpal height ratio in Stage 3 Kienböck's disease. *Acta Orthop Traumatol Turc.* 2011;45(6):393–8.

19. Ueba Y, Nosaka K, Seto Y, Ikeda N, Nakamura T. An operative procedure for advanced Kienböck's disease. Excision of the lunate and subsequent replacement with a tendon-ball implant. J Orthop Sci. 1999;4(3):207–15.

Figures

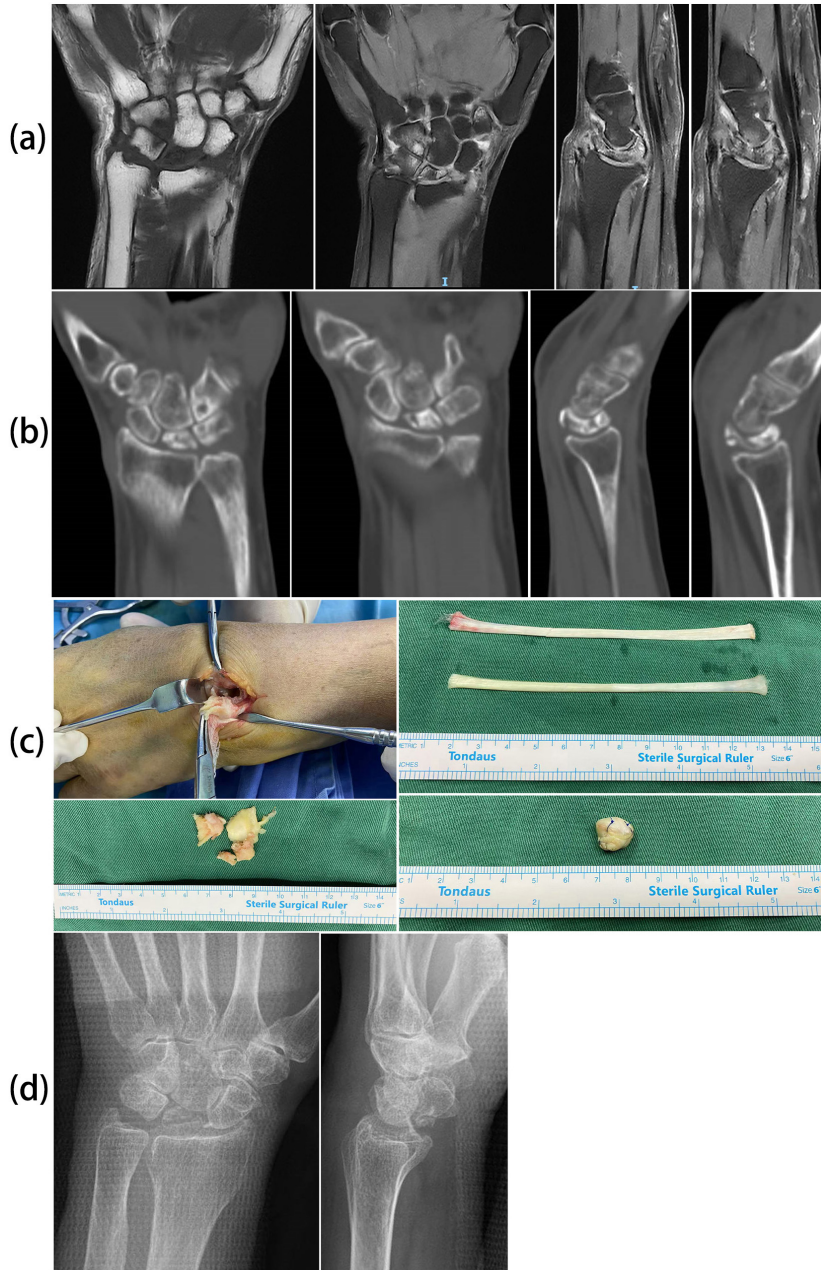


Fig 1 (a) T1WI demonstrated complete homogeneous decreased signal intensity throughout the lunate; T2WI demonstrated focal or patchy high signal intensity and bone collapse. (b) CT demonstrated bony sclerosis, fragmentation, collapse of the lunate. (c) The necrotic lunate was removed, harvest bilateral palmaris longus tendons, weave and suture the palmaris longus tendon into a ball. (d) X-ray confirmed that the necrotic lunate was completely removed.

Figure 1

See image above for figure legend.

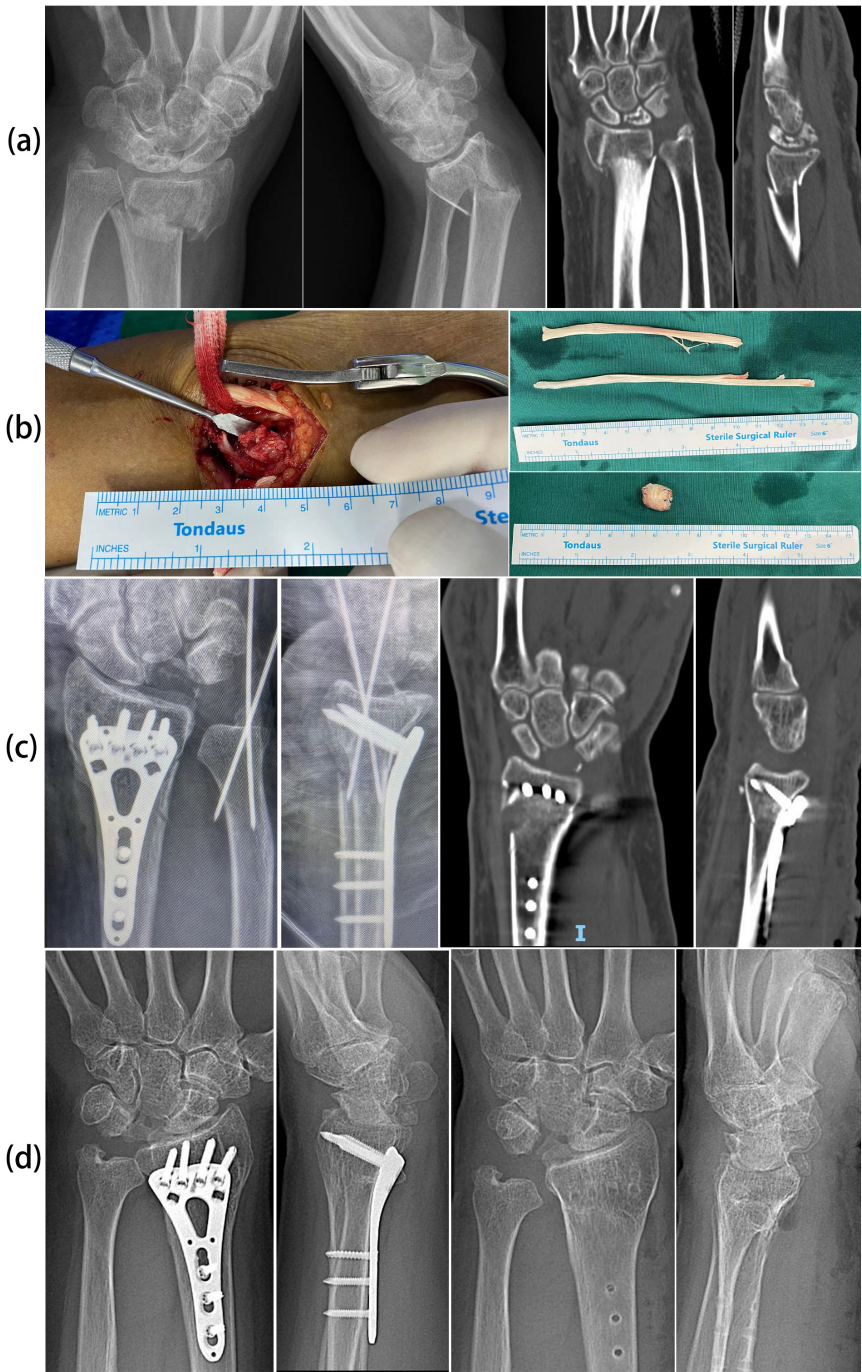


Fig 2 (a) X-ray and CT demonstrated distal radius fracture and lunate collapse, trabecular disruption and lunate fragmentation. (b) The necrotic lunate was removed and palmaris longus tendon ball graft. (c) X-ray and CT confirmed that the necrotic lunate was completely removed after surgery. (d) Removed the internal fixation plate at the 1-year follow-up.

Figure 2

See image above for figure legend.



Fig 3 (a) Preoperative wrist X-ray and CT.
(b) The necrotic lunate was removed and palmaris longus tendon ball graft.
(c) The necrotic lunate was completely removed.

Figure 3

See image above for figure legend.