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Case Report

Radiocarpal Arthrodesis with a Variable-Angle Locked Plate System Preserving Midcarpal Motion After Failed Primary Surgery in an Elderly Adult: A Case Report

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Abstract

Introduction: Complex fracture-dislocations of the wrist in elderly patients represent a surgical challenge due to severe articular compromise, osteopenia, and high failure rates with initial fixation. When primary surgical management proves insufficient, partial radiocarpal arthrodesis using locked fixation systems constitutes an effective salvage option that stabilizes the radiocarpal joint while preserving midcarpal mobility.

Case Presentation: A 74-year-old male presented with a complex radiocarpal fracture-dislocation of the right wrist resulting from a low-energy fall from his own standing height. The patient had undergone previous surgical intervention that resulted in insufficient reduction and construct failure. Upon evaluation, due to irreparable radiocarpal articular destruction, a revision salvage partial radiocarpal arthrodesis was performed via a dorsal approach using a variable-angle locking plate system, preserving the midcarpal joint space. Bone autograft was used at the fusion site. Radiographic consolidation was confirmed at 12 weeks, with complete fusion, pain resolution, and functional range of motion maintained at the 12-month follow-up.

Conclusion: Partial radiocarpal arthrodesis with a variable-angle locking plate system is a reliable salvage procedure following failed initial surgery in elderly patients, providing stable fixation and preserving functional midcarpal motion.

Keywords: *Arthrodesis; Wrist Joint; Salvage Therapy; Treatment Failure; Fracture Fixation, Internal; Aged.*

Introduction

Radiocarpal and intercarpal joint fracture-dislocations represent severe osteoarticular injuries that generate significant biomechanical instability, high risk of joint collapse, and post-traumatic osteoarthritis (1,2). In elderly patients, these complex injuries frequently result from low-energy mechanisms, such as a fall from standing height, where reconstructive management is challenged by compromised bone quality, concomitant osteopenia, and severe articular comminution (3).

Although conservative treatment or open reduction with conventional internal fixation are common alternatives in simple injury patterns, primary fixation in osteopenic bone carries a notable risk of mechanical failure or insufficient stability (3,4).

When primary surgical management proves inadequate or yields persistent articular incongruity, revision or salvage procedures become mandatory (4-6). While total wrist fusion eliminates pain, it sacrifices overall carpal motion; therefore, in cases where radiocarpal damage is non-reconstructable but the midcarpal joint remains viable, partial radiocarpal arthrodesis serves as an effective motion-preserving alternative (6,7).

The application of rigid internal fixation systems with variable-angle locking technology allows for optimal structural stability, minimizing fixation failure in osteopenic bone and facilitating early digit mobilization (8,9). By fusing only the compromised radiocarpal unit while preserving the integrity of the midcarpal joint, functional range of motion in flexion and extension can be maintained (7,9).

The objective of this manuscript is to report the clinical and radiological outcomes of a salvage motion-preserving partial radiocarpal arthrodesis using a variable-angle locking system in a 74-year-old male patient with a complex fracture-dislocation of the right wrist secondary to a fall from standing height, following an insufficient initial surgical treatment.

Case Presentation

Initial Evaluation and Diagnosis

A 74-year-old right-hand-dominant male presented to our specialized unit evaluating a failed primary intervention on his right wrist. The index injury occurred secondary to a low energy fall from his own standing height. Prior to evaluation at our center, the patient had undergone emergency open reduction and internal fixation elsewhere; however, post-procedure progress was unfavorable, characterized by persistent pain, mechanical instability, and loss of reduction.

Physical examination showed wrist deformity, surgical scars from the prior procedure, marked local tenderness, and severe functional restriction. Neurovascular examination confirmed intact radial and ulnar pulses and preserved distal sensory and motor function.

Radiographic and computed tomography imaging revealed an insufficiently reduced radiocarpal fracture-dislocation, articular incongruity, and severe destruction of the radiocarpal articular surface. Importantly, the midcarpal joint space (capitate-lunate/scaphoid interface) remained preserved and viable (Figure 1).



Figure 1. Preoperative radiographs. (A) Anteroposterior (AP) and (B) Lateral radiographs showing a complex radiocarpal fracture-dislocation with persistent articular incongruity, carpal displacement, and mechanical failure of the initial osteosynthesis construct in osteopenic bone.

Surgical Approach and Intervention

Under regional anesthesia and pneumatic tourniquet control, a revision procedure was performed through a dorsal approach extending along the prior scar line over Lister's tubercle. Previous insufficient osteosynthesis material was removed. Direct inspection confirmed complete destruction of the radiocarpal articular cartilage, whereas the midcarpal cartilage demonstrated adequate integrity.

The radiocarpal joint space was thoroughly debrided of fibrous tissue and remaining cartilage down to subchondral bone, which was fenestrated and packed with autologous cancellous bone graft. The midcarpal joint was carefully preserved without instrumentation. Rigid stabilization was achieved using a low-profile variable-angle locking plate system (APTUS® Wrist system, Medartis, Basel, Switzerland). Screws were placed at convergent and divergent trajectories to maximize fixation purchase in osteopenic and previously instrumented bone fragments. Alignment and midcarpal joint preservation were verified under intraoperative fluoroscopy.

Postoperative Course and Outcomes

A short-term volar splint was used for 2 weeks, after which active finger motion and controlled midcarpal range-of-motion rehabilitation were initiated.

At 12-month follow-up, radiographic evaluation showed complete radiocarpal fusion without hardware migration or failure (Figure 2). Visual Analog Scale (VAS) pain score reduced from 8/10 to 1/10. Preserved midcarpal range of motion was functionally adequate (wrist extension: 25°, flexion: 20°, pronation: 75°, supination: 70°). QuickDASH score was 14.2, PRWE score was 17.5, and grip strength reached 76% relative to the contralateral uninjured limb, restoring complete independence for daily activities (Figure 3).



Figure 2. Postoperative radiographs. (A) Anteroposterior (AP) and (B) Lateral radiographs following revision surgery, demonstrating a partial radiocarpal arthrodesis utilizing a variable-angle locking plate system. The images show restoration of overall radiocarpal alignment and solid osseous fusion across the radiocarpal interface, with total preservation of the midcarpal joint space.

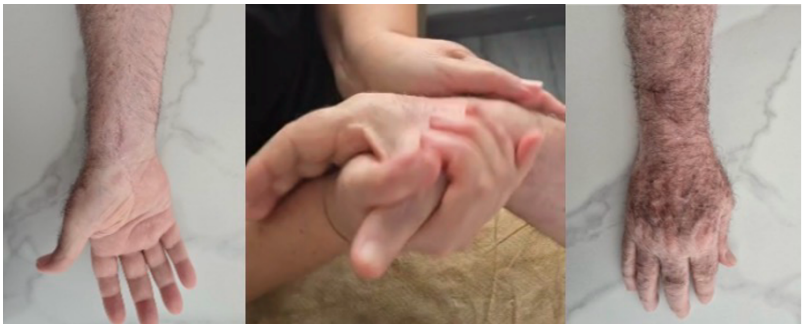


Figure 3. Postoperative clinical photographs. Clinical appearance at final follow-up demonstrating a completely healed dorsal surgical incision without soft-tissue complications, showcasing a satisfactory functional range of motion.

Discussion and Conclusion

Radiocarpal and intercarpal joint fracture-dislocations in elderly patients present a considerable surgical challenge due to the combination of joint comminution, multidirectional instability, and compromised bone quality secondary to osteopenia or osteoporosis (1-3). In this population, these severe injuries frequently occur as a consequence of low-energy mechanisms, such as a fall from standing height (3). In this context, the therapeutic dilemma lies in deciding between open reduction and internal fixation to preserve movement or performing a reconstructive or salvage procedure (4-6).

When primary surgical management proves insufficient or yields construct failure and persistent articular incongruity, the clinical decision becomes even more complex (4,6). Current clinical evidence supports the use of partial radiocarpal arthrodesis as a reliable salvage strategy when anatomical restoration of the radiocarpal articular facets is unfeasible, or when the risk of carpal collapse, chronic pain, and post-traumatic functional disability outweighs the hypothetical benefits of preserving an incongruent and painful joint (4,6,7).

While total wrist fusion reliably eliminates pain, it results in complete loss of wrist motion. In cases where the destructive process is limited to the radiocarpal unit and the midcarpal joint remains cartilage-spared, a partial radiocarpal arthrodesis offers a superior functional alternative (7). By fusing only the damaged radiocarpal interface and leaving the midcarpal joint space untouched, this technique achieves rigid stabilization while preserving a useful functional arc of flexion, extension, and deviation through the midcarpal articulation (7,9).

The evolution of osteosynthesis materials has substantially modified the outcomes of wrist arthrodesis (5,8). Historically, traditional techniques required prolonged periods of immobilization in plaster casts and increased the rate of pseudoarthrosis or loosening due to failure of fixation in trabecular bone. The development of variable-angle locking plate systems offers critical biomechanical advantages, particularly in revision surgery and osteopenic bone beds:

Variable-angle fixation: Allows for the placement of screws oriented in multiple convergent and divergent trajectories, optimizing bone purchase in small, low-density, or previously instrumented metaphyseal and carpal fragments without compromising locking rigidity (8,9).

Low profile and anatomical design: Minimizes impingement or mechanical irritation of the extensor tendon mass on the dorsum of the wrist during preserved midcarpal motion, significantly reducing the need for secondary implant removal (5,9).

Immediate structural stability: The rigidity of the screw-plate interface acts as an internal fixator that evenly distributes mechanical loads, promoting a biological environment conducive to bone fusion while enabling early mobilization of the metacarpophalangeal, interphalangeal, and preserved midcarpal joints (8-10).

In the case presented, selecting a partial radiocarpal arthrodesis with a variable-angle locking system successfully solved the technical challenges of revising a failed primary procedure in a 74-year-old patient with fragile bone stock (4,6). The construct provided stable mechanical support that prevented carpal collapse, relieved chronic pain, and facilitated early functional rehabilitation (10). Early mobilization of the hand and fingers is a fundamental pillar in the geriatric population, as it prevents complications associated with prolonged immobilization, such as digital stiffness, complex regional pain syndrome (CRPS), and severe loss of grip strength (10).

The limitations of this study lie in those inherent to the case report design, the lack of very long-term follow-up, and the absence of comparison with cohorts treated with total wrist fusion or alternative salvage methods. However, the main strength of this report lies in documenting the biomechanical and clinical success of a motion-preserving radiocarpal arthrodesis using variable-angle rigid internal fixation as an effective salvage procedure following failed initial surgery in an elderly patient.

Funding and Conflicts of Interest

This work was carried out using independent resources without grants. The authors declare no conflicts of interest.

Ethical Considerations

This case report was conducted in strict compliance with the ethical principles of the Declaration of Helsinki.

Informed Consent

Anonymity and absolute confidentiality were guaranteed by omitting any identifying information, initials, or medical record numbers.

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