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CASE REPORT

Management of a Five-Decades-Old Nonunion of the Ulna: A Rare Case Report

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Abstract

Introduction: Chronic nonunion of fractures, especially of long-duration standing, is challenging to manage. The nonunion of forearm bones is now often effectively treated with open reduction and internal fixation using a plate. **Case report**: A 71-year-old male was presented with a nonunion of the ulna following the fractures of radius and ulna, 51 years ago, which was treated with open reduction and internal fixation, using square nails. Later, an attempt to remove the broken ulnar nail was successful partially. Now, the patient presented with stiffness and decreased range of motion of the elbow and wrist joints, along with features of ulnar nerve palsy. We managed this case by open reduction and internal fixation of the ulna fractures, removal of broken square nail and bone grafting. Additionally, anterior ulnar nerve transposition was done. This treatment resulted in fracture union and neurological improvement. **Conclusion**: This rare case is the longest nonunion ever reported. It demonstrates the complexity of managing long-standing nonunions, through a combined approach of providing mechanical stability and biological augmentation.

Keywords: Fracture fixation; Non union; Ulna fractures; Elbow; Treatment outcomes

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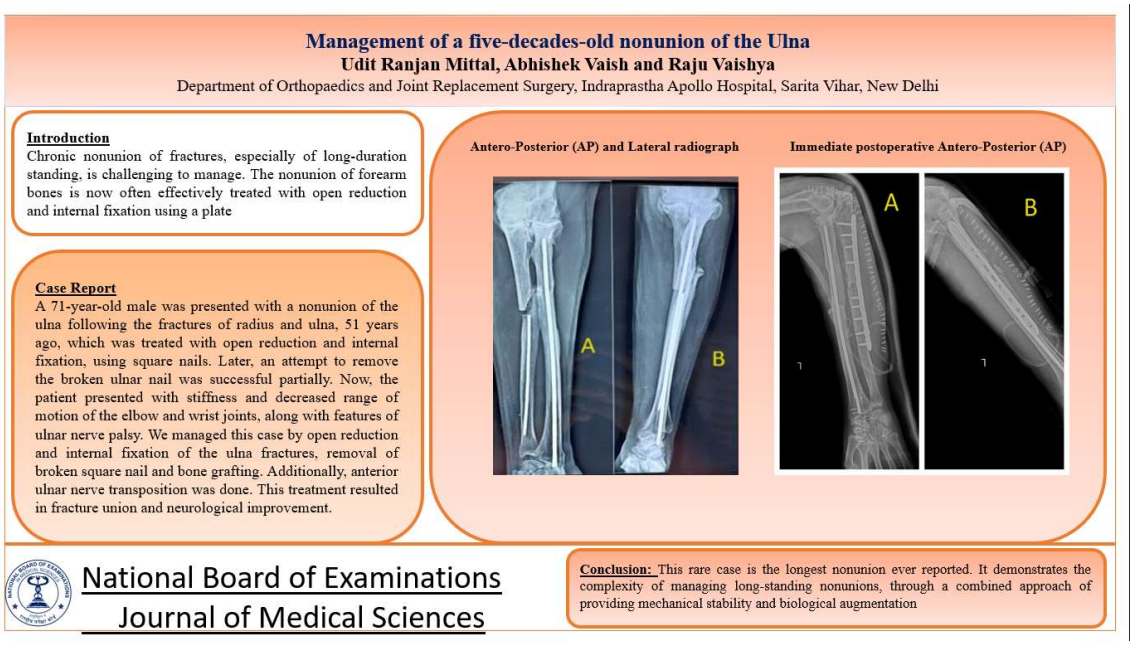
Graphical Abstract



Introduction

Chronic nonunion of long bones, especially of the ulna, presents significant clinical challenges. Nonunion is defined as the failure of a fracture to heal within the expected timeframe, generally between six to nine months [1]. Nonunions lead to a substantial burden to the patients with pain, loss of function and psychological distress with very high medical expenses leading to significant financial loss [2], and these can be of hypertrophic or atrophic types [3].

Around 2-10% of all forearm fractures may complicate and lead to nonunion. Forearm nonunions are problematic due to poor bone mass, previous implants, and joint stiffness due to prolonged immobilization [4]. The fractures occurring in the middle third of the ulna shaft are most prone to nonunion as this region has the poorest blood supply [5]. Forearm nonunion is mostly atrophic and results in a bony defect after removing all the sclerotic bone at the site of un-united bone [6]. In most cases, forearm nonunions can be successfully treated by plate fixation, irrespective of whether it involves the radius, ulna or both bones. Additional bone grafting can be done in cases of atrophic nonunion to enhance the local blood supply [7]. Forearm nonunion is challenging to treat as it requires restoration of length, axis and rotation of the ulna and radius to preserve the stabilizing effect of the soft tissue. With dynamic or locking compression plates, the nonunion rates have been reduced to less than 5% [8]. Intermedullary nails (IM nails) were traditionally used to treat forearm fractures. However, they are generally inappropriate as they cannot provide sufficient rotational stability to this region, leading to higher nonunion rates and the need for additional long-term fixation [9].

We present a rare and significant case report of a 51-year-old long nonunion of the ulna, making it the longest reported and managed nonunion date. This case adds to our understanding of nonunion management and underscores the potential for successful treatment, even in the most challenging cases.

Case report

A 71-year-old male patient presented to us with complaints of inability to lift heavy objects from his left upper limb. He also had stiffness in the left elbow and wrist joints. His complaints started after suffering from an injury to his left forearm, causing fractures of the radius and ulna of the left side around 51 years back, which were surgically managed by open reduction and internal fixation. Initially, his symptoms were not that severe, and he was able to do his day-to-day work, but they started progressing gradually in the last ten years. He also started having progressive weakness in his left hand, which decreased sensations over his little finger and ring finger. His complaints progressed with time and became so severe that he faced difficulties in his day-to-day activities. A healed surgical scar mark was present over the forearm and wrist. There was no tenderness. The range of motion at the elbow joint, especially pronation, supination and elbow flexion, was severely restricted (pronation and supination of 40°, elbow flexion of 50°). His wrist range of motion was also severely restricted.

A wasting of hypothenar muscles and web space was present, along with decreased sensations in the little finger and ring fingers. Mild clawing of the fingers was present. Froment's and ‘card’ signs were present. These findings were suggestive of high ulnar nerve palsy (due to the early elbow injury).

Plain radiographs revealed a nonunion ulnar shaft fracture with a partially removed broken nail in the distal Ulna. The radial fracture was united with an existing nail in situ. The left elbow and wrist joints had evidence of osteoarthritis (OA), with the radial nail impinging the carpal bones (Figure 1). The nerve conduction studies confirmed the diagnosis of chronic sensory-motor axonal neuropathy of the ulnar nerve in the elbow region.

Figure 1. Antero-Posterior (AP) and Lateral radiograph of the forearm showing nonunion of the ulna shaft with a broken nail in the distal fragment and a nail in the radius, with associated arthritic changes seen in the elbow and wrist joint.

Chronic nonunion of ulnar fracture was managed by removing the broken remanent nail and fixing the fracture after freshening the fracture ends and reaming the intramedullary canal of the ulna with one 11-hole low-contact dynamic compression plate (LCDCP) (Figure 2). Autogenous cortico-cancellous bone grafts (harvested from the iliac crest) were also placed around the nonunion site. Left ulnar nerve decompression and anterior transposition were also done.

The postoperative period was uneventful, and the wounds healed by primary intention. Hand, wrist and elbow physiotherapy was started to gain the range of motion (ROM) and muscle strength. Left ulnar nerve palsy started showing an early recovery in the hand sensation. The neurological recovery was significant at three months, and the ulnar fracture showed signs of union (Figure 3).

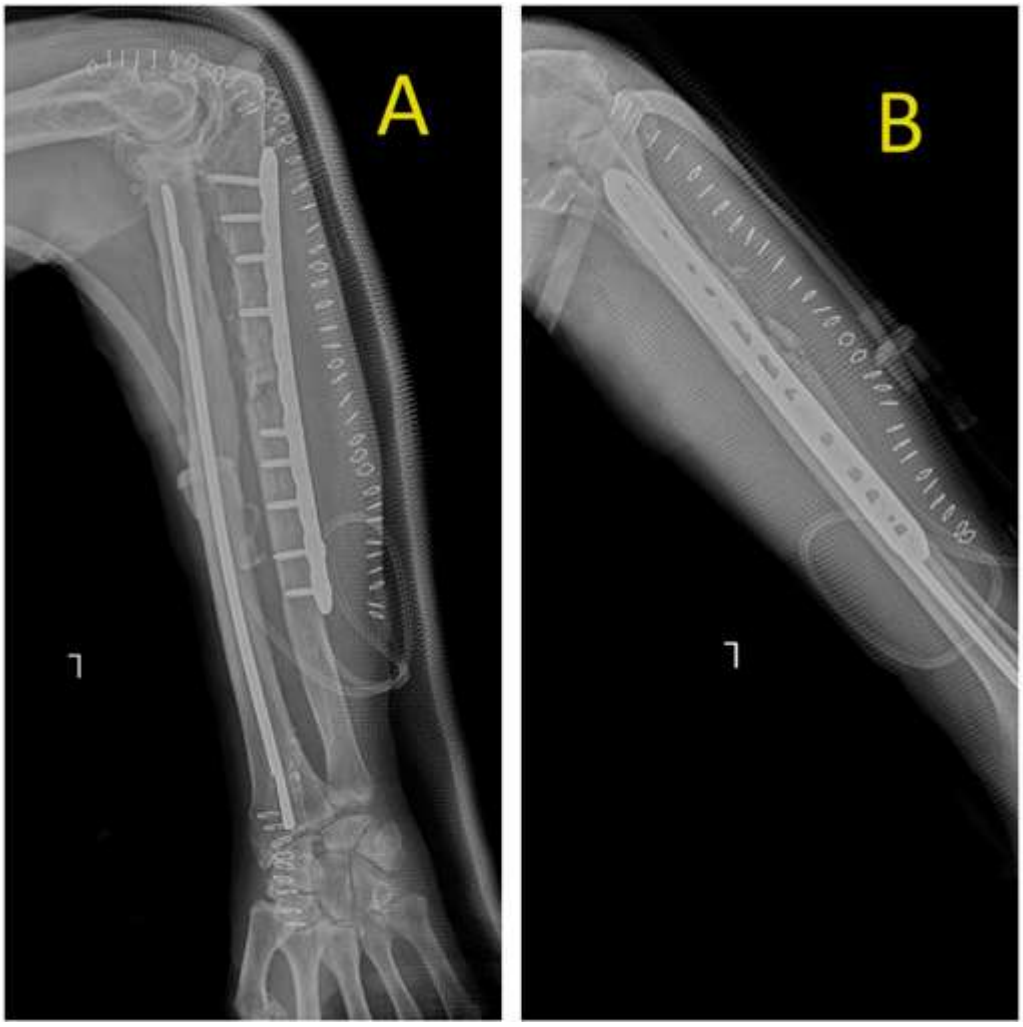


Figure 2. Immediate postoperative Anteroposterior (AP) and lateral forearm radiographs showing fixation of ulnar nonunion with a plate.

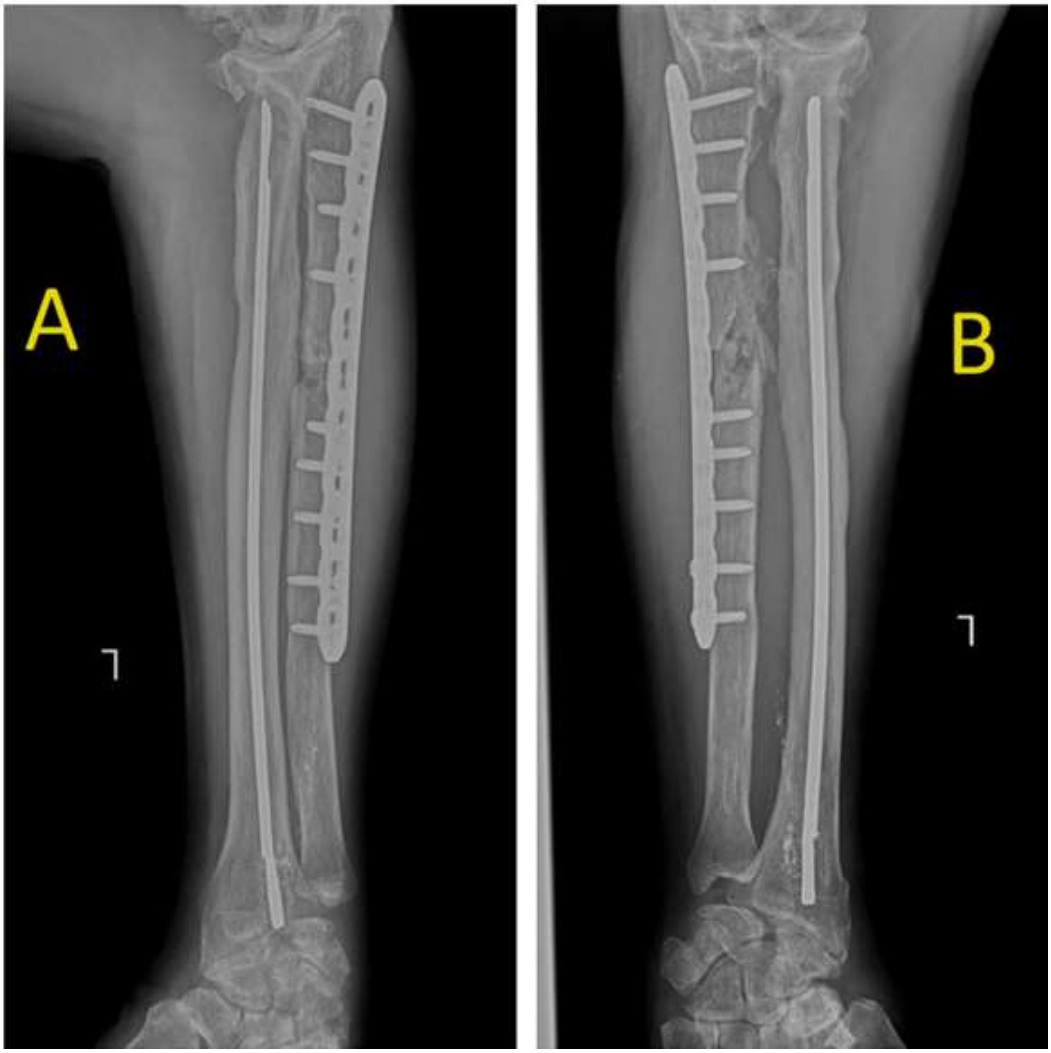


Figure 3. The anteroposterior (A) and lateral (B) X-rays of the forearm at three months follow up showing good progress and signs of union.

Discussion

This case exemplifies the difficulties encountered in managing chronic nonunion of the ulna, given that the forearm represents a distinct anatomical region where all associated bones and structures function as an intricate unit. The primary objective of surgical intervention for forearm nonunion is to restore appropriate bone length, anatomical integrity, and functional capability while alleviating pain. To achieve a favourable outcome in the treatment of forearm nonunion, it is essential to optimize the fracture's biology and the nonunion site's stability [10]. Contributing factors to nonunion may include insufficient initial treatment, biological variables, and the presence of comorbidities in the patient. Surgical approaches incorporating stable fixation and bone grafting have demonstrated efficacy in facilitating union.

In this case, the primary fixation was done with square intramedullary (IM) nails (Stainless steel- Talwalkar's nail). The IM nailing may have certain advantages,

such as lower risks of infection, lesser duration of surgery and small scars, but older implants, like square nails, did not provide adequate rotational stability and had nonunion rates of more than 10% [11], which are comparable to non-operative management [12,13].

The reported long-duration nonunion of long bones is relatively rare and often anecdotal. Cases of nonunion persisting for decades have been documented, but specific durations can vary widely**.** For instance, some reports have documented nonunions persisting for over 30 years. The 51-year duration of nonunion described in our case report is among the most protracted documented cases. Initial displacement in cases of ulna fracture is directly related to the chances of nonunion. There is a 20% chance of nonunion if the displacement is more than half of the diameter of the shaft [5].

Kloen et al. [14] conducted a comprehensive review of a substantial cohort of forearm nonunions, with durations ranging from 2 to 312 months. Their treatment approach involved meticulous debridement, the removal of unsuccessful hardware, and the restoration of proper alignment, length, and rotation. They emphasized the importance of stable fixation, preferably through compression, and optimising a conducive environment for bone formation, including bone grafting when necessary. This multifaceted strategy facilitated the healing of all nonunions within 18 months following the initial procedure.

A debate exists between the use of a plate or a nail. Plating requires extensive soft tissue dissection that compromises the blood supply. Also, osteoporosis at the fracture site may result in inadequate screw purchase leading to inadequate fixation making it less suitable for fixation in older patients. Hong et al. [15] treated 26 diaphyseal fracture nonunions of forearm bones, with IM nailing (‘Foresight’ interlocking intermedullary nail system (Smith and Nephew, Memphis)) resulted in 96% of radiological union with a mean healing time of 14-15 weeks for radius and Ulna. Interlocking IM nailing adds to anti-rotational control, preventing the nail from backing out**.** It is a stress-sharing device that increases peri osteal vascular reaction, leading to better healing than standard interference-fit-forearm nails. However, this technique was inferior to the plate and screw fixation as it required prolonged immobilization, which led to loss of function and stiffness.

Nonunion epidemiology is variable and could be related to patient-dependent and independent risk factors (Table 1).

Table 1. Factors related to Nonunion of Fractures

NonunionFactors	Risk factors
Patient Dependent	• Advancing age • Steroid use • Smoking • Metabolic diseases • Nutritional deficiency

Patient Independent	• Fracture pattern and location • Severity of soft tissue injury • Bone loss • Infection • Quality of surgical fixation

Successful management of chronic nonunion requires a comprehensive strategy incorporating surgical procedures, biological enhancement, and careful postoperative management. The "diamond concept" also emphasizes the significance of mechanical stability and the biological milieu, equally. The healing of a fracture is dependent on the favourable biological environment at the fracture site like the availability of molecular mediators, progenitor cells, extracellular matrix, and immunoregulatory cells etc. An optimal mechanical environment is also equally crucial by providing adequate fracture stability, thereby promoting a physiological process that allows fracture healing [1].

Conclusion

We present a rare case of a 51-year-old chronic ulna nonunion, It was successfully managed by employing a combination of biological and mechanical strategies. The prolonged duration of this nonunion highlights the effectiveness of surgical principles in addressing even the most resistant and chronic cases.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

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