

Non-operative Management of Adult Both Bone Forearm Fractures – A Case Report and Literature Review

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Learning Point of the Article:

Although non-displaced adult both bone forearm fractures are rare, they can be successfully treated non-operatively with careful patient selection, proper immobilization, and use of adjunct therapy such as bone stimulators.

Abstract

Introduction: Adult both bone forearm fractures (BBFF) are common injuries that are typically treated with operative fixation given their instability. Non-displaced fractures can be theoretically treated non-operatively, but there is no literature demonstrating treatment outcomes of such fractures.

Case Report: We present a case of non-displaced BBFF in a 23-year-old Caucasian male adult who was treated with cast immobilization and concomitant ultrasound stimulator use; this patient went on to have solid fracture healing without complication.

Conclusion: Based on this case, we demonstrate that non-operative management of non-displaced BBFF in adult patients is an option if close follow-up is available. This is significant for the fields of both orthopedic and plastic surgery, as there is little concrete evidence of outcomes of such non-displaced fractures in hand surgery literature.

Keywords: Both bone forearm fractures, adult fracture, radius and ulna fracture, non-operative management, bone stimulator.

Introduction

Concurrent diaphyseal radius and ulna fractures, also known as both bone forearm fractures (BBFF), are common upper extremity injuries in the adult population. These can arise from either direct or indirect forces on the radius and ulna. Direct forces usually cause fractures at the same level in both bones while indirect forces, such as axial loads during falls onto an outstretched hand, can cause fractures at different levels. Given the large force necessary to fracture both bones, these fractures are often displaced and difficult to maintain in adults without operative fixation.

True non-displaced BBFF are rare in adults, and there is a current dearth of information about the outcomes of the management of these fractures [1]. In theory, these could be managed non-operatively in a cast; however, review of the current literature surprisingly offers no outcomes of non-

operative treatment of adult, non-displaced BBFF. Here, we present a case of non-displaced BBFF in an adult, treated non-operatively, as well as a literature review of the topic.

Case Report

A 23-year-old, Caucasian, right hand dominant male, otherwise healthy, was seen in the emergency department after a skateboard accident. He reported falling onto his dorsal left proximal forearm and experienced immediate pain in the area without other injuries. Physical examination was notable for tenderness over the proximal radius and ulna and limited pronosupination secondary to pain. Plain radiographs demonstrated non-displaced but slightly comminuted, short oblique fractures of the proximal third of the radius and ulna (Fig. 1a, b). After discussion with the patient and his family, the decision was made to place the patient in a long arm cast (Fig.

Author's Photo Gallery



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Access this article online

Website:
www.jocr.co.in

DOI:
10.13107/jocr.2020.v10.i07.1916

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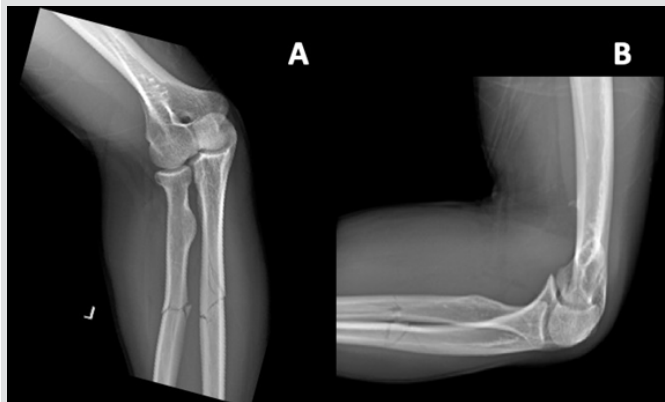


Figure 1: AP (a) and lateral (b) X-rays demonstrate non-displaced fractures in the proximal third of the radius and ulna with minimal comminution.

2a, b) and follow-up in the clinic in 1 week.

On follow-up, the patient had satisfactory pain control, and the cast was appropriately in position. A hole was cut into the cast so that an ultrasound bone stimulator could be used to promote healing. The stimulator was positioned equidistant between the two fractures. The patient reported some mild increase in fracture site pain in the 1st week with the bone stimulator, but this abated after a few days. The next follow-up visit was 3 weeks later (4 weeks post-injury), and the patient reported significantly improved pain. The cast was removed, and his examination was significant for restoration of pronation and supination to 70 degrees each. Imaging demonstrated appropriate healing of the fracture with callus without displacement or malalignment (Fig. 3a, b). Another long arm cast was placed for an additional month, at which time the fractures were completely clinically healed, so a removable splint was placed. With the cast off, the ultrasound stimulator could be placed directly over the fracture sites, one at a time.

On his final follow-up visit, the patient was 3 months out from his injury. He had been continuing to use the bone stimulator and reported no pain. On examination, he had 90 degrees of pronation and supination; wrist extension was 60 degrees and wrist flexion was 80 degrees, all of which were similar to the

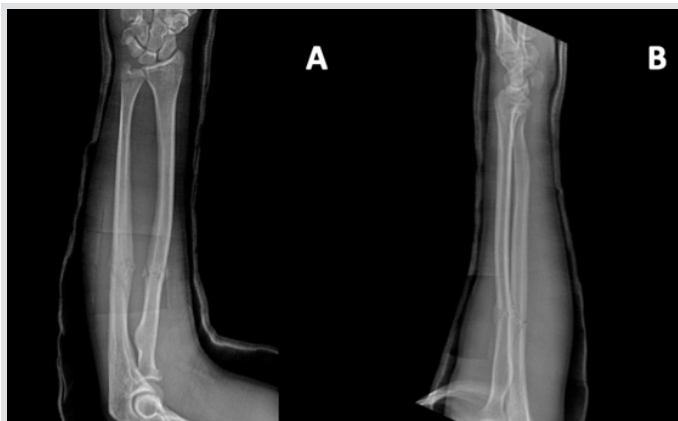


Figure 3: AP (a) and lateral (b) X-rays demonstrate the same fractures with interval callus formation without significant change in fracture angulation or displacement 1 month after injury. Note the window cut out of the cast at the level of the fracture to allow for ultrasound stimulator use.

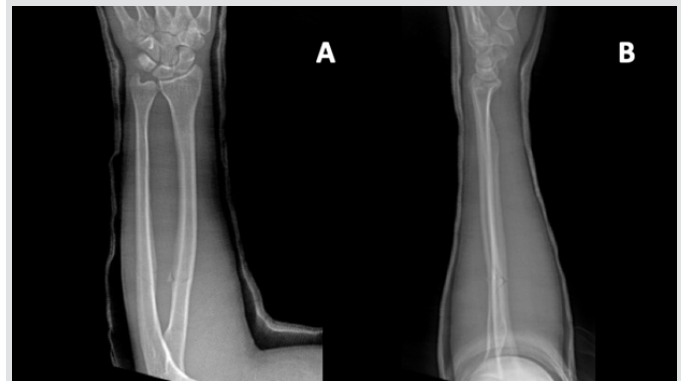


Figure 2: AP (a) and lateral (b) X-rays demonstrate the both bone forearm fractures with interval cast placement without any new fracture displacement or angulation.

opposite side. Imaging demonstrated healed radius and ulna fractures with no malalignment (Fig. 4a, b). Given these findings, the patient was told to return to baseline activity with the exception of a custom forearm shell splint for skiing and to return to the clinic as needed.

Discussion

BBFF in adults are virtually always treated with open reduction and internal fixation given the historical risk of nonunion and malunion with non-operative management. In fact, we were unable to identify a single case report or review of non-operative treatment of adult BBFF in the literature. Soon after the founding of the organization now known as Arbeitsgemeinschaft für Osteosynthesefragen, the first case reports of open reduction internal fixation (ORIF) of the forearm were published in the 1950s [2]. Since then, a number of techniques have been described for the treatment of these combined radial and ulnar shaft fractures such as intramedullary nailing, external fixation, plate fixation, and hybrid combinations [3]. At present, compression plating remains the most popular operative strategy for fracture fixation [4].

Open reduction and internal fixation of BBFF is not without complication. Zhao et al. performed a meta-analysis of 13

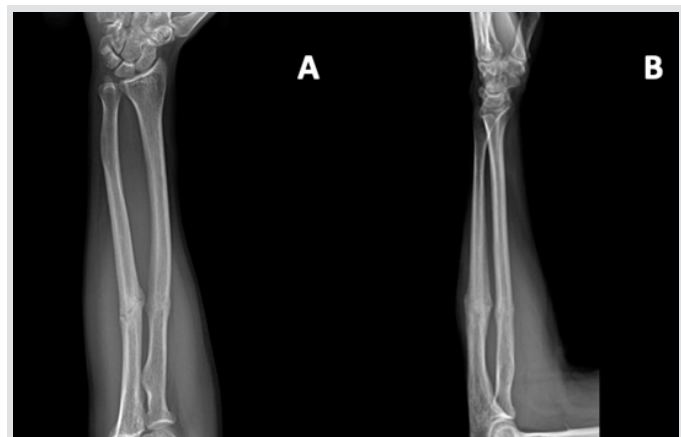


Figure 4: AP (a) and lateral (b) X-rays demonstrate the same fractures with complete bony callus formation 3 months after injury.

studies comparing intramedullary nailing with plate fixation of BBFF in both children and adults. They noted in both groups reported complications of delayed union and nonunion, loss of rotation, wound infections and superficial radial nerve palsies, and hypertrophic scars [5]. This is in conjunction with the obvious financial and emotional costs associated with having a procedure. Thus, while these risks are typically outweighed by the benefits of surgery in the typical presentation of BBFF, they must be heavily considered in an adult patient with truly non-displaced BBFF.

Goals of non-operative management should include immobilizing the fracture with a well-placed mold and appropriate cast index in regard to the relationship between cast material and soft protective material underneath. The effect of acute swelling after injury must be considered as well, as the cast may become loose as the swelling abates, leading to potential fracture angulation/displacement [6]. We explained to the patient that, should any angulation have developed during his follow-up period, ORIF would have been recommended. Follow-up appointments should ideally be made within 2 weeks after the injury to reexamine the patient and reimagine the arm to monitor for interval fracture displacement. Consideration of the patient compliance must be made as well. In a retrospective study of 293 patients with distal radius fractures, 18% were lost to follow-up and a risk factor was non-operative management. Other risk factors for failure to return to the clinic included lack of secondary education, lower socioeconomic status, as well as poorer overall health [7]. Our patient's family member is a physician at our hospital and compliance was never an issue.

In our patient, an ultrasound bone stimulator was used as an adjuvant for fracture healing. The ultrasound signal is thought to simulate mechanical stress and accelerate fracture healing by modulating gene expression, increasing blood flow to the affected area through capillary dilation, and enhancing angiogenesis [8]. Originally studied in animals beginning in the 1950s, the method is now used for the treatment of acute fractures, delayed unions, and non-unions. A systematic review

and meta-analysis of 13 trials found that low-intensity ultrasound bone stimulation significantly shortened the time to radiological union for acute fractures of the upper limb undergoing non-operative treatment [9]. Although no studies have specifically looked at this method in BBFF, Kristiansen et al. performed a randomized placebo-controlled clinical trial that found accelerated healing and decreased loss of reduction in distal radial fractures with low-intensity ultrasonic bone stimulation [10]. While there is no way to determine whether the bone stimulator used in this case truly accelerated healing, there was quite a rapid formation of callus seen on X-ray. Anecdotally, the senior author has had experience with delayed healing of non-operative treatment of non-displaced ulnar shaft fractures and has seen positive results using ultrasonic bone stimulation.

Conclusion

Adult BBFF are common upper extremity injuries that are prone to non-union and problematic malrotation given the inherent instability of the forearm without fixation. These are typically treated operatively with open reduction and internal fixation, but non-operative management is theoretically possible for non-displaced fractures without angulation, rotation, or displacement. Here, we present a case of non-displaced adult BBFF that went on to heal without complication with casting and ultrasound bone stimulator use. Selection of non-operative management must be judicious in these cases, and the patient demographics and characteristics must be taken into account.

Clinical Message

Non-displaced concurrent radius and ulna fractures can be treated non-operatively in adults provided stable immobilization, close follow-up, and considered use of adjuvant therapy such as bone stimulation.

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Conflict of Interest: Nil

Source of Support: Nil

Consent: The authors confirm that Informed consent of the patient is taken for publication of this case report

How to Cite this Article

Hong DY, Berube ER, Strauch RJ. Non-operative Management of an Adult Both Bone Forearm Fractures – A Case Report and Literature Review. *Journal of Orthopaedic Case Reports* 2020 October;10(7): 53-56.