Scientific Research Publishing

Open Journal of Orthopedics, 2024, 14, 1-11
https://www.scirp.org/journal/ojo
ISSN Online: 2164-3016
ISSN Print: 2164-3008

Rare Bilateral Radius and Ulna Fractures: A Case Report

Kwabena Nana Achiaw Dankwa[1], Ekins Kuuzie[2], Samuel Kwame Ofori[1]

[1]Department of Surgery, Ghana Police Hospital, Accra, Ghana
[2]Department of Surgery, St. Dominic Hospital, Akwatia, Ghana
Email: kwabenadankwa2295@gmail.com, kuuzieekins@gmail.com, Ofsam@hotmail.com

How to cite this paper: Dankwa, K.N.A., Kuuzie, E. and Ofori, S.K. (2024) Rare Bilateral Radius and Ulna Fractures: A Case Report. *Open Journal of Orthopedics*, **14**, 1-11.
https://doi.org/10.4236/ojo.2024.141001

Received: December 8, 2023
Accepted: January 13, 2024
Published: January 16, 2024

Abstract

Introduction: Forearm fractures involving both the radius and ulna, present distinctive challenges in orthopedic trauma management. This case report explores the complexities of a rare case of bilateral fractures, emphasizing the importance of a comprehensive approach for optimal outcomes. **Case Presentation**: This report presents the case of a 40-year-old motorcyclist who was involved in a road accident and arrived at the emergency department shortly after the incident. Clinical examination revealed closed fractures in both forearms with mild swelling and severe tenderness. Fortunately, no neurovascular issues or compartment syndrome were detected. The patient was administered intravenous fluids and effective pain relief. Forearm splints were applied and the arms were elevated using pillows. Radiographs showed fractures in the right distal radius and ulna, as well as the left mid-shaft radius and ulna. Under general anesthesia, open reduction and internal fixation were performed using plates and screws for all four fractures. Postoperatively, the patient's arms were immobilized and elevated, with gradual recovery during follow-up appointments over six months, eventually achieving full function without complaints. **Conclusion**: This article highlights the possibility, although infrequent, of bilateral shaft fractures of the ulna and radius. With thorough clinical assessment and radiological investigation, such fractures can be well-defined. The required definitive treatment, which usually involves open reduction and internal fixation, can be performed.

Keywords

Forearm, Fracture, Ulnar, Radius, Bilateral

1. Introduction

The forearm comprises the radius and ulna; two parallel bones that connect the

elbow and wrist joints [1]. The shaft of the ulna is relatively straight compared to the bowed radius [2]. The radius and ulna are proximally fused by the capsule of the elbow and the angular ligaments [2]. Distally, they are bound by the wrist joint capsule, radio-ulnar ligaments, and fibro-cartilaginous articular discs [2]. They form a joint at their distal end, where the bowed radius rotates around the ulna to allow supination and pronation of the forearm. The inter-osseous membrane, a thickened fibrous sheet, connects the mid-shafts of the radius and ulna, originating proximally at the radius and inserted distally on the ulna. The inter-osseous membrane has a thickened central band that significantly contributes to forearm stability [2].

Forearm fractures represent one-third of upper limb fractures presenting to the primary care physician or emergency department [3] [4]. Bilateral forearm fractures, characterized by the simultaneous occurrence of fractures in both the radius and ulna bones of the forearm, represent a distinctive subset of injuries with unique challenges across various domains of healthcare [3]. Epidemiological studies have provided little insight into the incidence and demographic patterns of bilateral forearm fractures. While these fractures are relatively uncommon compared to unilateral fractures, their occurrence has been linked to high-energy trauma [3]. Motor vehicle accidents, falls from height, and sports-related injuries are significant contributors to the incidence of bilateral forearm fractures [3]. The exact values for the prevalence may vary in different populations, but research consistently indicates that these fractures account for a small percentage of all forearm fractures [3] [5] [6].

The clinical presentation of bilateral forearm fractures typically involves a combination of pain, swelling, and deformity in both forearms [1]. Patients often present with an acute onset of symptoms, and a thorough physical examination is crucial for assessing the extent of injury [7]. Diagnostic imaging, including X-rays and, in some cases, CT scans, is employed to confirm the diagnosis and assess the fracture pattern [3]. Radiological evaluation is instrumental in determining the appropriate course of treatment and guiding surgical interventions when necessary.

Management strategies for bilateral forearm fractures require a multidisciplinary approach [8] [9]. Orthopedic surgeons, emergency physicians, and rehabilitation specialists collaborate to ensure comprehensive patient care [7]. Stabilization and reduction of fractures are the primary goals of the initial management phase, with surgical interventions such as open reduction and internal fixation (ORIF) or external fixation being common approaches. The choice of surgical technique depends on factors such as the severity and pattern of fractures, associated injuries, and the patient's overall health [10] [11]. Postoperative care involves pain management, immobilization, and early initiation of rehabilitation to optimize functional outcomes.

Complications associated with bilateral forearm fractures encompass a range of issues, including mal-union, non-union, compartment syndrome, and neurovascular injuries [11] [12]. Timely identification and intervention are critical to

mitigating these complications and preventing long-term disability [13]. Close monitoring of patients, particularly in the postoperative period, is essential to identify and address any complications promptly.

Rehabilitation plays a pivotal role in the overall management of bilateral forearm fractures [9]. Physical therapy aims to restore range of motion, strength, and functionality in both forearms. Patient education regarding home exercises and precautions to avoid further injury is integral to long-term success [8] [9]. The rehabilitation process is tailored to individual patient needs, considering factors such as age, overall health, and the severity of the fractures [8].

A comprehensive understanding of the clinical presentation, and management strategies associated with bilateral forearm fractures is essential for healthcare professionals [10]. Collaborative efforts across various specialties, coupled with ongoing research into surgical techniques and rehabilitation protocols, will contribute to further advancements in the care of individuals with this challenging injury [10]. As we continue to refine our approach to bilateral forearm fractures, the ultimate goal remains optimizing patient outcomes and quality of life.

This case report serves as a valuable contribution to the existing body of literature by shedding light on the rare occurrence of bilateral radial and ulnar fractures. It not only highlights the uniqueness of such cases but also underscores the effectiveness of surgical interventions in their successful management. In doing so, this study enriches our understanding of orthopedic practices and their outcomes in addressing complex fractures.

2. Case Presentation

A helmeted 40 year old left-handed male motorcyclist, with no co-morbidities, was involved in a road traffic accident with an oncoming vehicle and was rushed to the emergency department minutes after the incident. Upon examination, the patient had closed fractures of both forearms, with mild swelling and severe tenderness. No associated neurovascular deficits or signs of compartment syndrome were observed. Intravenous fluids and parenteral analgesia were administered. The forearms were then splinted and elevated while resting on a pillow.

2.1. X-Rays of Both Forearms

Radiographs of both forearms revealed the following fractures, with neither distal nor proximal radio-ulnar joint involvement:

- An oblique mid-shaft fracture of the left radius (AO/OTA Classification: 2R2A2) (**Figure 1**).
- A transverse mid-shaft fracture of left ulna (AO/OTA Classification: 2U2A3) (**Figure 1**).
- An oblique fracture of the distal right radius with wedge fragment (AO/OTA Classification: 2R2B2) (**Figure 2**).
- A transverse fracture of distal right ulna (AO/OTA Classification: 2U2A3) (**Figure 2**).

Figure 1. Radiograph—oblique mid-shaft fracture of the left radius and transverse mid-shaft fracture of the left ulna.

Figure 2. Radiograph—oblique fracture of the distal right radius with wedge fragment and transverse fracture of the distal right ulna.

2.2. Definitive Management

Three days after the injury, under general anesthesia, open reduction and internal fixation with plates and screws were performed for all four fractures. Right forearm fractures were assessed using Henry's approach, and 7-hole and 6-hole plates were used to fix the right radius and right ulna, respectively. The left ulnar fracture was accessed via the posterior approach and fixed with an 8-hole plate. Henry's approach was used to access the left radial fracture, which was fixed with a 7-hole plate. Medtronic Titanium Dynamic Compression Plates (DCP) and screws of length ranging from 18 mm to 22 mm were used. Radiographs of the fixed forearm fractures were obtained (Figure 3 and Figure 4). Postoperatively, the patient's forearms were elevated on pillows while in bed and kept upright in broad arm slings. He was monitored for 6 days, during which he started physiotherapy and was discharged with oral analgesia.

Figure 3. Radiograph—left forearm showing fixation with plates and screws.

Figure 4. Radiograph—right forearm showing fixation with plates and screws.

2.3. Follow-Up

He was reviewed at the clinic after 3 weeks, during which time he complained of numbness in the right thumb and index finger. Sensation was intact in both upper limbs, with satisfactory motor function of 3/5 power. Wrist and elbow movement had moderately reduced range of motion. He subsequently underwent serial follow-up clinic sessions for 6 months, at which time he had full recovery of function and normal range of motion at wrists and elbows with no complaints. Unfortunately, a midterm X-ray, crucial for further analysis, could not be retrieved from the patient. Moreover, due to the patient's lack of follow-up after such robust recovery, obtaining a recent radiograph for an updated assessment was regrettably not possible.

3. Discussion

Literature on the incidence of forearm fractures in adults is limited. A study in the United States demonstrated that ulna and radial fractures, whether isolated or combined, accounted for 44% of all fractures involving the forearm and hand [5]. A study involving 2812 fractures of the forearm had only 5% involving the diaphysis whereas the vast majority, 74%, involved the distal radius [6].

The causes of forearm fractures include, but are not limited to, a direct blow to the forearm, falls from a height, road traffic accidents, and athletic injuries. The most common is a direct blow to the forearm, which usually causes a single fracture of the radius or ulna, or both. The fall on the outstretched hand with pronation is next in line [3]. Diaphyseal fractures are usually secondary to falls during sports or height [3]. Gunshot injuries may cause a fracture of both the ulna and radius and usually cause nerve injury and significant soft tissue and bone loss. Industrial and farm machines usually cause severe disabling injuries that may pose a challenge to the clinician or surgeon in limb salvage decision-making [4].

Various systems are employed in the classification of forearm fractures, with limited practical utility for prognostic assessments and treatment planning [2]. None of these classifications provides a comprehensive coverage of all forearm fracture types [2]. Consequently, anatomical descriptions, encompassing fracture location, pattern, angulation, displacement, and concurrent soft tissue injuries, serve as common alternatives [2]. The management of these fractures is usually determined by these factors. The widely utilized AO/OTA classification, featuring an alpha-numerical system, is prominent in categorizing forearm fractures [2]. Additionally, specific classifications such as Gustilo and Anderson, OTA open fracture, Monteggia, and Galeazzi offer nuanced perspectives on distinct aspects of forearm fractures [2] [3].

Clinical assessment of fractures involving both the radial and ulnar shafts is usually straightforward, as non-displaced shaft fractures of both bones are highly unlikely. Patients with forearm fractures would typically have an overtly deformed forearm supported by their unaffected hand [3]. Complaints of pain, loss

of function of the affected forearm, and obvious deformities are common. Clinical signs to pay keen attention to include neurologic deficits, especially of the radial, median, and ulnar nerves, which are not uncommon in open fractures, should be ruled out, and a high index of suspicion should be held for compartment syndrome when a tense compartment with insurmountable pain is present. A suspicion of compartment syndrome would require the measurement and monitoring of compartment pressure, especially in unconscious patients [3]. It is of great importance to rule out ipsilateral fractures as well as other skeletal injuries using a preliminary secondary survey [3].

Diagnostic investigations of forearm fractures, mainly imaging, aim to identify the specific location, type of fracture, and presence of joint dislocations. As such, each image performed should span the full length of the forearm and include the elbow and wrist joints. X-Ray imaging is usually enough to adequately assess most forearm fractures. Antero-posterior and lateral views are the standards for going by. Computed tomography (CT) is rarely used and may be helpful in assessing distal radial fractures with radio-ulnar joint injuries [3]. Magnetic resonance imaging (MRI) is not usually indicated. On the other hand, angiography and vascular Doppler ultrasonography may be used to assess the degree of vascular injury when vascular injury is suspected [3].

Conservative management of forearm fractures is more common in pediatric fractures than in adult fractures [7]. The ongoing bone growth and remodeling in children allow for satisfactory alignment of fracture fragments after conservative therapy. Closed reduction under analgesia or sedation with subsequent cast immobilization is usually the treatment for pediatric fractures of the forearm [7]. The cast is applied to traverse the wrist, forearm and elbow with the elbow in flexion at 90˚. The position of the forearm in the cast is important for ensuring stable reduction. For distal third fractures, the forearm is kept in a prone position in the cast. The middle third fractures are kept in the neutral position, and the proximal third fractures are kept stable by supination [3]. A weekly follow-up radiograph of the immobilized forearm is necessary for the early detection of displacement [3]. The recommended age limit for routine closed reduction and casting is 10 - 12 years in girls and 12 - 14 years in boys. Closed reduction and casting in children beyond this age range has been shown to have a higher risk of failure when both the radius and ulna are involved [8].

Fractures of the ulna and radius require open reduction and internal fixation [3]. This is usually performed using plates and screws, and the ideal plate should be long enough to permit fixation with six screws [11]. The radial plate should be contoured to maintain the natural curvature of the radius that permits pronation and supination [11].

In patients with segmental fractures, diaphyseal osteopenic bone fractures, failed compression plates, and nonunion, intramedullary (IM) nailing may be required. IM nailing for both ulnar and radial fractures requires stable fixation of the radial fracture to avoid radial elongation, subsequent distraction of the ulnar fracture, and malunion [3]. The pre-bent triangular IM nail designed by

Sage in 1959 has been shown to be useful in maintaining the radial contour and rotational stability. Kim *et al.* demonstrated that a combination of IM nailing and plate fixation may be helpful in patients in whom exclusive plating may not be feasible [10].

Urgent surgical treatment is needed for open fractures, which are usually associated with nerve and major blood vessel injuries, and the recommendation is to initially manage open forearm fractures using irrigation and debridement [13]. More recent management trends favor immediate open reduction, and internal fixation with thorough debridement is achieved. Duncan *et al.* demonstrated a 90% treatment success in Gustilo type I, II, and IIIA open diaphyseal forearm fractures managed by the latter trend, with unsatisfactory outcomes in Gustilo type IIIB and IIIC [13].

Postoperative complications in the management of both bone forearm fractures include compartment syndrome, infection, mal-union, nonunion, and synostosis. Compartment syndrome postoperatively is usually due to failed hemostasis or closure of the deep fascia [3]. This can be avoided by releasing the tourniquet prior to wound closure to observe any bleeding, as well as by suturing only the subcutaneous tissue and skin [3]. Adequate wound irrigation, debridement, and prophylactic antibiotics are crucial to prevent infections in open wounds. Nonunion and mal-union of radial and ulnar shaft fractures are relatively uncommon and would usually occur in the setting of infection or poor surgical techniques [14]. Synostosis may occur where there is extensive soft-tissue dissection, radio-ulnar hematoma and inter-osseous membrane injury [3]. These are commonly associated with internal fixation of proximal third fractures of both the radius and the ulna [15].

The presented case involves a 40-year-old left-handed male motorcyclist who sustained closed fractures in both forearms following a road traffic accident. The initial assessment in the emergency department revealed mild swelling and severe tenderness in both forearms, without neurovascular deficits or signs of compartment syndrome. This case poses a unique challenge given the bilateral nature of the fractures, emphasizing the importance of a comprehensive and timely management approach.

The prompt evaluation of the patient's condition upon arrival at the emergency department played a crucial role in determining the severity of the injuries. The absence of neurovascular deficits and compartment syndrome was a positive indication, allowing for initial stabilization through intravenous fluids and parenteral analgesia. The decision to splint and elevate the forearms on a pillow reflects standard practice in minimizing further trauma and facilitating comfort.

The X-ray findings provided a detailed insight into the nature and extent of the fractures. The presence of an oblique fracture of the distal right radius with a wedge fragment, a transverse fracture of the distal right ulna, an oblique mid-shaft fracture of the left radius, and a transverse mid-shaft fracture of the left ulna indicated a complex pattern of injuries. Such comprehensive imaging is

vital for formulating an appropriate treatment plan.

The decision to opt for open reduction and internal fixation under general anesthesia was well-founded, considering the complexity of the fractures. The use of Henry's approach for assessing the right forearm fractures and posterior approach for the left ulnar fracture, along with the application of plates and screws, reflects a meticulous surgical strategy. The chosen fixation methods, including 7-hole and 6-hole plates, demonstrate the consideration for the specific anatomical features and fracture patterns.

Postoperatively, the patient's forearms were appropriately managed with elevation, broad arm slings, and physiotherapy initiation after 6 days. Monitoring the patient for six days post-surgery allowed for the early detection of any complications. The subsequent 3-week follow-up revealed a complaint of numbness in the right thumb and index finger, highlighting the importance of continued vigilance during the recovery phase.

The serial follow-up sessions over six months demonstrated the patient's satisfactory recovery with no residual complaints. The restoration of full function in both upper limbs signifies the success of the chosen surgical interventions and postoperative care.

This case highlights the effective management of bilateral forearm fractures in a motorcyclist involved in a road traffic accident. The multidisciplinary approach, involving emergency department care, detailed radiographic evaluation, meticulous surgical intervention, and postoperative rehabilitation, contributed to the positive outcome. The case underscores the significance of tailored treatment strategies in complex orthopedic injuries, emphasizing the need for ongoing monitoring and follow-up to ensure optimal recovery and functional restoration.

Despite the thorough assessment and management outlined in this case report, it is imperative to acknowledge certain limitations. Unfortunately, the unavailability of a midterm X-ray, which is pivotal for a comprehensive analysis, represents a regrettable constraint in our capacity to offer a thorough assessment. Furthermore, owing to the patient's limited engagement in follow-up care post-recovery, the acquisition of a recent radiograph for an updated evaluation, a valuable component for a more nuanced understanding of the healing trajectory, was regrettably not feasible. This circumstance, while challenging, underscores the importance of consistent patient collaboration for an optimal and comprehensive healthcare continuum.

4. Conclusion

Although uncommon, bilateral fractures of both the radius and ulna may occur in high-energy trauma, such as road traffic accidents. Systematic clinical assessment is crucial for ruling out neurovascular injuries. Radiological examinations must thoroughly define the involved fractures. In adult patients, the treatment of choice is usually open reduction and internal fixation, which often involves the use of plates and screws. Healthcare professionals must be aware of the potential

occurrence of this uncommon combination of fractures to accurately identify and provide necessary treatment.

Consent

Verbal consent was obtained from the patient for publication of this case report as well as the accompanying images.

Data Availability Statement

Data sharing is not applicable to this article, as no datasets were generated or analyzed for this case report.

Author Contribution

Conceptualization: Kwabena Nana Achiaw Dankwa.
Data curation: Kwabena Nana Achiaw Dankwa, Samuel Kwame Ofori.
Formal analysis: Kwabena Nana Achiaw Dankwa, Samuel Kwame Ofori.
Investigation: Kwabena Nana Achiaw Dankwa.
Methodology: Kwabena Nana Achiaw Dankwa, Samuel Kwame Ofori.
Resources: Kwabena Nana Achiaw Dankwa.
Software: Kwabena Nana Achiaw Dankwa.
Supervision: Samuel Kwame Ofori.
Validation: Samuel Kwame Ofori.
Writing—original draft: Kwabena Nana Achiaw Dankwa.
Writing—review & editing: Kwabena Nana Achiaw Dankwa, Dr. Ekins Kuuzie, Dr. Samuel Kwame Ofori.

Conflicts of Interest

The authors declare that they have no conflicts of interest or financial support.

References

[1] Scott, B.W. and Becker, J.A. (2009) Common Forearm Fractures in Adults. *American Family Physician*, **80**, 1096-1102.

[2] Rafi, B.M. and Tiwari, V. (2023) Forearm Fractures. StatPearls Publishing, St. Petersburg.

[3] Chung, K.C. and Spilson, S.V. (2001) The Frequency and Epidemiology of Hand and Forearm Fractures in the United States. *The Journal of Hand Surgery*, **26**, 908-915. https://doi.org/10.1053/jhsu.2001.26322

[4] Hotchkiss, R.N., An, K.N., Sowa, D.T., Basta, S. and Weiland, A.J. (1989) An Anatomic and Mechanical Study of the Interosseous Membrane of the Forearm: Pathomechanics of Proximal Migration of the Radius. *The Journal of Hand Surgery*, **14**, 256-261. https://doi.org/10.1016/0363-5023(89)90017-8

[5] Chung, K.C. and Spilson, S.V. (2001) The Frequency and Epidemiology of Hand and Forearm Fractures in the United States. *The Journal of Hand Surgery*, **26**, 908-915. https://doi.org/10.1053/jhsu.2001.26322

[6] McQueen, M.M. (1997) Epidemiology of Forearm Fractures. In: McQueen, M.M., Jupiter, J.B., Eds., *Radius and Ulna*, Butterworth-Heinemann, Oxford, 1-11.

[7] Liu, Y., Zhang, F.Y., Zhen, Y.F., Zhu, L.Q., Guo, Z.X. and Wang, X.D. (2021) Treatment Choice of Complete Distal Forearm Fractures in 8 to 14 Years Old Children. *Journal of Pediatric Orthopedics*, **41**, e763. https://doi.org/10.1097/BPO.0000000000001934

[8] Bowman, E.N., Mehlman, C.T., Lindsell, C.J. and Tamai, J. (2011) Non-Operative Treatment of Both-Bone Forearm Shaft Fractures in Children: Predictors of Early Radiographic Failure. *Journal of Pediatric Orthopedics*, **31**, 23-32. https://doi.org/10.1097/BPO.0b013e318203205b

[9] Sage, F.P. (1959) Medullary Fixation of Fractures of the Forearm: A Study of the Medullary Canal of the Radius and a Report of Fifty Fractures of the Radius Treated with a Prebent Triangular Nail. *The Journal of Bone & Joint Surgery*, **41**, 1489-1525. https://doi.org/10.2106/00004623-195941080-00010

[10] Kim, S.B., Heo, Y.M., Yi, J.W., Lee, J.B. and Lim, B.G. (2015) Shaft Fractures of Both Forearm Bones: The Outcomes of Surgical Treatment with Plating Only and Combined Plating and Intramedullary Nailing. *Clinics in Orthopedic Surgery*, **7**, 282-290. https://doi.org/10.4055/cios.2015.7.3.282

[11] Droll, K.P., Perna, P., Potter, J., Harniman, E., Schemitsch, E.H. and McKee, M.D. (2007) Outcomes Following Plate Fixation of Fractures of Both Bones of the Forearm in Adults. *The Journal of Bone & Joint Surgery*, **89**, 2619-2624. https://doi.org/10.2106/JBJS.F.01065

[12] Mseddi, M.B., Manicom, O., Filippini, P., Demoura, A., Pidet, O. and Hernigou, P. (2008) Intramedullary Pinning of Diaphyseal Fractures of Both Forearm Bones in Adults: 46 Cases. *Revue de Chirurgie Orthopedique et Reparatrice de L'appareil Moteur*, **94**, 160-167. https://doi.org/10.1016/j.rco.2007.11.006

[13] Duncan, R., Geissler, W., Freeland, A.E. and Savoie, F.H. (1992) Immediate Internal Fixation of Open Fractures of the Diaphysis of the Forearm. *Journal of Orthopaedic Trauma*, **6**, 25-31.

[14] McQueen, M.M. and Wakefield, A. (2008) Distal Radial Osteotomy for Malunion Using Non-Bridging External Fixation. *Acta Orthopaedica*, **79**, 390-395. https://doi.org/10.1080/17453670710015300

[15] Bauer, G., Arand, M. and Mutschler, W. (1991) Post-Traumatic Radioulnar Synostosis after Forearm Fracture Osteosynthesis. *Archives of Orthopaedic and Trauma Surgery*, **110**, 142-145. https://doi.org/10.1007/BF00395796

Abbreviations

CT = Computed Tomography
IM = Intramedullary
MRI = Magnetic Resonance Imaging
AO = Arbeitsgemeinschaft für Osteosynthesefragen
ORIF = Open Reduction and Internal Fixation
OTA = Orthopaedic Trauma Association