



## Case Report

# Quadruple bilateral fracture-dislocation of the elbow and the wrist: A rare and complex case report

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## ABSTRACT

We report an exceptionally rare and complex case of quadruple bilateral fracture dislocation of the elbow and the wrist in a 39-year-old construction worker, who sustained the injury after falling from a scaffold of 9 m secondary to a 6.9 magnitude earthquake. The patient was treated with a combination of closed and open reduction, internal fixation, and radial head arthroplasty, and had a good functional outcome at 12 months follow-up, with no complications or instability. This case illustrates the challenges and the possibilities of managing such complex injuries, and adds to the scarce literature on this topic.

## Introduction

Fracture dislocations of the elbow and the wrist are uncommon injuries that require prompt diagnosis and treatment to avoid complications and disability [1,2]. The elbow and the wrist are complex joints that allow a wide range of motion and function of the upper limb [1–4]. They are composed of multiple bones, ligaments, tendons, muscles, nerves, and blood vessels, which can be damaged by trauma. Fracture dislocations of the elbow and the wrist involve a combination of bone fracture and joint dislocation, which can compromise the stability, alignment, and congruency of the joint surfaces.

The combination of both injuries in the same upper limb is even more rare [5–9], and usually results from high-energy trauma, such as falls, motor vehicle accidents, or sports injuries. The mechanism of injury is complex and variable, depending on the direction and magnitude of the applied force, the position of the limb, and the integrity of the soft tissues [6,8,10–12]. The most common types of fracture dislocations of the elbow are Monteggia and elbow fracture dislocation [3,10], and the most common types of fracture dislocations of the wrist are Galeazzi and radiocarpal fracture dislocation [12,13]. The Monteggia fracture dislocation consists of a fracture of the ulna shaft with dislocation of the radial head [10], and it is classified according to the Bado [10] and Jupiter systems [11]. The elbow fracture dislocation consists of a dislocation of the ulna and the humerus associated with a fracture of the radius, the ulna or the humerus [14]. The Galeazzi fracture dislocation consists of a fracture of the radius shaft with dislocation of the distal radioulnar joint (DRUJ) [12], and it is classified according to the Fernandez system. The radiocarpal fracture dislocation consists of a fracture of the distal radius with dorsal or volar dislocation of the carpus, and it is classified according to the Moneim and Dumontier systems.

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The management of these complex injuries is challenging and requires a multidisciplinary approach, involving orthopedic surgeons, radiologists, anesthesiologists, and physiotherapists [1,2]. The goals of treatment are to achieve anatomical reduction, stable fixation, early mobilization, and prevention of complications such as infection, stiffness, nonunion, malunion, nerve injury, and joint instability. The treatment options include closed or open reduction, internal or external fixation, arthroplasty, or arthrodesis, depending on the type and severity of each fracture and dislocation, and the associated injuries. The outcome of these injuries depends on several factors, such as the age and occupation of the patient, the time and quality of the treatment, the extent of the soft tissue damage, and the development of complications [1,2,15].

In this article, we present an exceptionally rare and complex case of quadruple bilateral fracture dislocation of the elbow and the wrist, and describe the clinical, radiological, and surgical findings, as well as the post-operative rehabilitation and outcome. To the best of our knowledge, this is the first case report of such an injury in the literature. This report has been written in line with the SCARE criteria [16].

## Case presentation

### *Patient information*

#### *Demographic details*

The patient was a 39-year-old male construction worker with right side dominance and no comorbidities. He was a nonsmoker and a moderate alcohol consumer. He had no allergies or medications.

#### *Past medical and surgical history*

He had no history of previous trauma, surgery, or chronic disease.

### *Presentation*

#### *Timeline*

The patient sustained the injury on September 15, 2023, at 10:15 am, after falling from a scaffold of 9 m secondary to a 6.9 magnitude earthquake, which occurred at 10:12 am. He was brought to the emergency department by ambulance, at 10:45 am, with severe pain and deformity of both his elbows and wrists. He had no head or other injuries, and his vital signs were stable. He was admitted for further evaluation and treatment, and taken to the operating room at 12:00 pm. The surgery was completed at 6:30 pm, and he was transferred to the ward at 7:00 pm. The splints and casts were removed at 6 weeks, and the Kirschner wires were removed at 8 weeks. He was followed up regularly for 12 months, and he showed a good functional outcome, with no complications or instability.

#### *Mechanism*

The mechanism of injury was a fall from a height, with both arms extended and abducted, resulting in a high-energy impact on the elbows and wrists. The fall was caused by an earthquake, which shook the scaffold and made the patient lose his balance. The earthquake was of 6.9 magnitude, with the epicenter located 20 km away from the patient's location.



**Fig. 1.** X-ray of the right elbow, shows Monteggia lesion.

### Clinical findings

On physical examination, he had bilateral swelling, ecchymosis, and tenderness of the elbows and wrists, with limited and painful range of motion. There was no evidence of neurovascular compromise or open wounds. The initial diagnosis was bilateral fracture dislocation of the elbow and the wrist, and he was admitted for further evaluation and treatment.

### Imaging diagnosis

The radiological examination confirmed the diagnosis and revealed the following findings:

- **Right elbow:** Monteggia fracture dislocation [10], consisting of a fracture of the proximal third of the ulna shaft with posterior dislocation of the radial head (Bado type II [10], Jupiter type IIC [11]) (Fig. 1).
- **Right wrist:** Radiocarpal fracture dislocation, without associated intercarpal dissociation, with a large radial styloid fracture fragment (Moneim Type I [17], Dumontier Type II [13]) (Fig. 2).
- **Left elbow:** Elbow fracture posterolateral dislocation with a radial head fracture (Mason type IV [18]) (Fig. 3).
- **Left wrist:** Galeazzi fracture dislocation, consisting of a fracture of the distal third of the radius shaft with posterior dislocation of the distal radioulnar joint (DRUJ) [12] (Fig. 4).

### Diagnosis challenges

The diagnosis of these injuries was challenging, as they are rare and complex, and require a high index of suspicion and a thorough clinical and radiological examination. The diagnosis was also complicated by the fact that the patient had bilateral injuries, which made the comparison with the contralateral side impossible. Moreover, the patient had multiple fractures and dislocations, which could mask or mimic each other, and require careful classification and evaluation.

### Diagnostic reasoning

The diagnostic reasoning was based on the following steps:



Fig. 2. X-ray of the right wrist, shows radiocarpal fracture dislocation.



**Fig. 3.** X-ray of the left elbow, shows posterior elbow fracture dislocation.

- **History:** The patient provided a clear history of the mechanism of injury, which suggested a high-energy trauma to the elbows and wrists, and raised the possibility of fracture dislocations.
- **Physical examination:** The patient had signs of fracture dislocations, such as swelling, ecchymosis, tenderness, deformity, and limited and painful range of motion. The patient also had no signs of neurovascular compromise or open wounds, which ruled out the need for immediate intervention.
- **Radiological examination:** The patient underwent plain radiographs of both upper limbs, which confirmed the diagnosis of fracture dislocations, and revealed the type and severity of each fracture and dislocation, as well as the associated injuries.

### Management

#### Timeline

The patient was taken to the operating room on the same day, under general anesthesia. The surgical technique was as follows:

- **Right elbow:** A dorsal approach was used to expose the fracture site [19]. The ulna fracture was reduced and fixed with a dynamic compression plate (DCP) with 6 holes. The elbow was checked for stability and range of motion, and no instability was detected. The wound was closed in layers and a posterior splint was applied (Fig. 5).
- **Right wrist:** The fracture dislocation was reduced by axial traction, then hyper-extension and radial inclination, in contrast with the Agee method [20]. The reduction was confirmed by fluoroscopy and maintained with two Kirschner wires. Then a short arm cast was applied (Fig. 6).
- **Left elbow:** The fracture dislocation was reduced by gentle traction and external rotation, and the reduction was confirmed by fluoroscopy. However, the radial head fracture was comminuted and irreparable, and the elbow was unstable in valgus stress. Therefore, the decision was made to perform a radial head arthroplasty. A Kocher lateral approach was used to expose the elbow joint and the radial head [21]. The radial head was excised and replaced with a metallic prosthesis of appropriate size. The elbow



**Fig. 4.** X-ray of the left wrist, shows Galeazzi lesion.



**Fig. 5.** Post-operative X-ray of the Monteggia ORIF.



Fig. 6. Post-operative X-ray of the radiocarpal fracture dislocation reduction and pinning.

was checked for stability and range of motion, and no instability was detected. The wound was closed in layers and a posterior splint was applied (Fig. 7).

- **Left wrist:** A Henry volar approach was used to expose the radius fracture [22]. The fracture dislocation was reduced by axial traction and supination, and the reduction was confirmed by fluoroscopy. The radius fracture was fixed with a T-shaped plate with 7 holes. The DRUJ was stable in supination. Therefore, a short arm cast was applied in supination position (Fig. 8).

**Left wrist:** A Henry volar approach was used to expose the radius fracture [22]. The fracture dislocation was reduced by axial traction and supination, and the reduction was confirmed by fluoroscopy. The radius fracture was fixed with a T-shaped plate with 7 holes. The DRUJ was stable in supination. Therefore, a short arm cast was applied in supination position (Fig. 8).



Fig. 7. Post-operative X-ray of the Galeazzi ORIF.





Fig. 8. Post-operative of the radial head arthroplasty.

#### *Medical treatment*

The patient received prophylactic antibiotics and analgesics, and was transferred to the ward. He also received tetanus prophylaxis and anti-inflammatory drugs. He was monitored for signs of infection, bleeding, or neurovascular compromise.

#### *Surgical treatment*

The surgical treatment was performed by two orthopedic surgeons, one for each upper limb, with the assistance of two residents and two nurses. The patient was positioned in a supine position, with both arms abducted and supported by arm boards. The surgical site was prepared and draped in a sterile manner. The anesthesia was induced and maintained by an anesthesiologist, who also monitored the vital signs and the blood loss. The fluoroscopy was used to confirm the reduction and the fixation of the fractures and dislocations. The surgical instruments and implants were provided by the scrub nurse. The procedure was recorded and documented by the circulating nurse.

#### *Subsequent surgeries*

The patient did not require any subsequent surgeries, as the initial intervention achieved satisfactory reduction and fixation of all the fractures and dislocations, and no complications or instability occurred during the follow-up period.

#### *Outcome*

#### *Post-operative instructions*

The patient was instructed to keep the splints and casts dry and clean, and to elevate and move the fingers and shoulders regularly. He was also advised to avoid weight-bearing and strenuous activities, and to report any signs of infection, bleeding, or neurovascular compromise.

#### *Short-term follow-up*

The patient was followed up weekly for the first month, and monthly for the next five months. He underwent plain radiographs of both upper limbs at each visit, to monitor the healing and alignment of the fractures and dislocations. He also underwent clinical examination, to assess the pain, swelling, and range of motion of the elbows and wrists.

#### *Long-term follow-up*

The patient was followed up every three months for the next six months, and every six months thereafter. He underwent plain radiographs and CT scans of both upper limbs at each visit, to evaluate the union and stability of the fractures and dislocations, and the function and integrity of the implants. He also underwent clinical examination, to measure the range of motion, the pain, the grip strength, and the disability scores, such as the Mayo Elbow Performance Score (MEPS) [23] and the Disabilities of the Arm, Shoulder and Hand (DASH) score [24].

#### *Intervention adherence and compliance*

The patient was compliant with the post-operative instructions and the follow-up visits. He also adhered to the rehabilitation

protocol, which was supervised by a physiotherapist and an occupational therapist. He participated in the passive and active assisted exercises of the shoulders and fingers, the active and resisted exercises of the elbows and wrists, and the stretching and strengthening exercises of the forearm muscles. He also performed the daily activities and the work-related tasks, as instructed by the occupational therapist.

### Outcomes

The patient started passive and active assisted exercises of the shoulders and fingers on the first post-operative day, under the supervision of a physiotherapist. The splints and casts were removed at 6 weeks, and the Kirschner wires were removed at 8 weeks. The patient continued with active and resisted exercises of the elbows and wrists, as well as stretching and strengthening exercises of the forearm muscles. He also received occupational therapy to improve his daily activities and return to work.

The patient was followed up regularly for 12 months, and he showed a good functional outcome, with no complications or instability. The final range of motion of the elbows was 10–130° of flexion-extension and 70–70° of pronation-supination, and the final range of motion of the wrists was 60–60° of flexion-extension and 30–30° of radial-ulnar deviation. The patient had no pain or stiffness, and he was able to resume his work as a construction worker. The final radiographs showed no signs of nonunion, malunion, infection, or implant failure. The final MEPS was 90 for the right elbow and 85 for the left elbow, indicating excellent and good results, respectively. The final DASH score was 10, indicating minimal disability.

### Discussion

This case report describes an exceptionally rare and complex case of quadruple bilateral fracture dislocation of the elbow and the wrist, which was successfully treated with a combination of closed and open reduction, internal fixation, and radial head arthroplasty. To the best of our knowledge, this is the first case report of such an injury in the literature.

Fracture dislocations of the elbow and the wrist are uncommon injuries that account for <5 % of all fractures [25]. They are usually caused by high-energy trauma, such as falls, motor vehicle accidents, or sports injuries. The mechanism of injury is complex and variable, depending on the direction and magnitude of the applied force, the position of the limb, and the integrity of the soft tissues [26].

The combination of both injuries in the same upper limb is rare [4–9,27], and usually involves the same side of the forearm, such as Monteggia and Galeazzi, or elbow fracture dislocation and radiocarpal fracture dislocation. However, the occurrence of quadruple bilateral fracture dislocation of the elbow and the wrist was never described in the literature before.

The diagnosis of these injuries is based on the clinical and radiological examination, and it is important to identify and classify the type and severity of each fracture and dislocation, as well as the associated injuries, such as nerve, vascular, or soft tissue damage [2]. The treatment of these injuries is challenging and requires a multidisciplinary approach, involving orthopedic surgeons, radiologists, anesthesiologists, and physiotherapists. The goals of treatment are to achieve anatomical reduction, stable fixation, early mobilization, and prevention of complications such as infection, stiffness, nonunion, malunion, nerve injury, and joint instability [1,2,14,26].

The surgical technique for each fracture and dislocation depends on the type and severity of the injury, and the preference and experience of the surgeon. The Monteggia fracture dislocation is usually treated with ORIF of the ulna fracture and reduction and stabilization of the radial head, using a dorsal or a volar approach [10,19]. The radial head fracture is usually treated with ORIF, excision, or arthroplasty, depending on the degree of comminution and instability [28]. The Galeazzi fracture dislocation is usually treated with ORIF of the radius fracture and reduction and stabilization of the DRUJ, using a volar or a dorsal approach [12,22]. The radiocarpal fracture dislocation is usually treated with closed or open reduction and percutaneous or internal fixation, using a dorsal or a volar approach [13,17].

The post-operative rehabilitation is essential for the recovery of the function and the prevention of complications. The rehabilitation protocol varies according to the type and severity of the injury, the stability of the fixation, and the healing of the soft tissues. The general principles include early passive and active assisted exercises of the shoulders and fingers, followed by active and resisted exercises of the elbows and wrists, as well as stretching and strengthening exercises of the forearm muscles [29,30]. The splints and casts are usually removed at 6 weeks, and the Kirschner wires are usually removed at 8 weeks. The patient also receives occupational therapy to improve his daily activities and return to work.

The outcome of these injuries depends on several factors, such as the age and occupation of the patient, the time and quality of the treatment, the extent of the soft tissue damage, and the development of complications. The most common complications are infection, stiffness, nonunion, malunion, nerve injury, and joint instability [1,2]. The functional outcome is usually measured by the range of motion, the pain, the grip strength, and the disability scores, such as the Mayo Elbow Performance Score (MEPS) [23] and the Disabilities of the Arm, Shoulder and Hand (DASH) score [24].

In our case, the patient had a good functional outcome at 12 months follow-up, with no complications or instability. The final range of motion of the elbows was 10–130° of flexion-extension and 70–70° of pronation-supination, and the final range of motion of the wrists was 60–60° of flexion-extension and 30–30° of radial-ulnar deviation. The patient had no pain or stiffness, and he was able to resume his work as a construction worker. The final radiographs showed no signs of nonunion, malunion, infection, or implant failure. The final MEPS was 90 for the right elbow and 85 for the left elbow, indicating excellent and good results, respectively. The final DASH score was 10, indicating minimal disability.

Our case is unique in several aspects. First, it is the first case report of quadruple bilateral fracture dislocation of the elbow and the wrist in the literature. Second, it is the first case report of a Monteggia fracture dislocation and a radiocarpal fracture dislocation on the same side of the forearm. Third, it is the first case report of a radial head arthroplasty for a Mason type IV fracture with Galeazzi



fracture dislocation. Fourth, it is the first case report of such an injury caused by a fall from a scaffold secondary to an earthquake.

## Conclusion

We report an exceptionally rare and complex case of quadruple bilateral fracture dislocation of the elbow and the wrist in a 39-year-old construction worker, who sustained the injury after falling from a scaffold of 9 m secondary to a 6.9 magnitude earthquake. The patient was treated with a combination of closed and open reduction, internal fixation, and radial head arthroplasty, and had a good functional outcome at 12 months follow-up, with no complications or instability. This case illustrates the challenges and the possibilities of managing such complex injuries, and adds to the scarce literature on this topic.

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## CRedit authorship contribution statement

**Zakaria Chabihi:** Conceptualization, Data curation, Methodology, Resources, Writing – original draft, Writing – review & editing. **Brahim Demnati:** Formal analysis, Writing – review & editing. **Abdelwahed Soleh:** Validation, Writing – review & editing. **Yassine Fath El Khir:** Supervision. **El Mehdi Boumediane:** Supervision. **Mohamed Amine Benhima:** Supervision, Writing – review & editing. **Imad Abkari:** Supervision, Validation, Writing – review & editing.

## Statement of informed consent

Written informed consent was obtained from the patient for their anonymized information to be published in this article.

## Statement of human and animal rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from the patient for being included in the study.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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