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Humeral Capitellum Fracture Bryan-Morrey Type IV Performed Open Reduction Internal Fixation Treatment: A Rare Case Report

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ABSTRACT

Introduction: *Capitellum fracture is a very rare fracture with an incidence of 1% of fracture cases in the elbow area and 6% of all fracture cases in the distal humerus area.*
Case Report: *A 41-year-old man presented to the emergency room with left elbow pain after a fall and unable to move his arm. An X-ray revealed a lateral condyle fracture (Milch type 2) with joint dislocation and soft tissue swelling. However, a CT scan showed a different fracture extending from the capitellum to the trochlear (Bryan Morrey type IV or McKee fracture). She underwent successful ORIF with K-wires, experiencing sharp pain post-procedure but recovering well overall.*
Discussion: *The rarity of capitellum fractures is due to its protected position behind the radial head, humeral trochlea, and humeral collateral ligaments. Specific radiographic signs, like the double arc sign on lateral X-rays, are crucial for diagnosis. This sign should not be overlooked and should be confirmed by a pre-operative 3D CT scan to prevent misdiagnosis. Treatment typically involves ORIF, ideally with a Herbert screw, although K-wires can be used as an alternative in certain circumstances.*
Conclusion: *Capitellum fracture is a very rare injury. Before surgery, a CT scan and 3D reconstruction should be conducted to evaluate the anatomy and accurately classify the fracture. The Herbert screw is considered the optimal treatment, but in emergencies or when cost is a concern, K-wires can be a suitable alternative.*

Keywords: Capitellum; CT-Scan; 3D reconstruction; K-wire

INTRODUCTION

Capitellum fracture is a very rare fracture with an incidence of 1% of fracture cases in the elbow area and 6% of all fracture cases in the distal humerus area (Wiktor et al., 2022). Although uncommon and rare, capitellum fractures are more common in women than men and their prevalence increases as age increases and osteoporosis risk factors increase (Kapil et al., 2020). Correct classification, optimal imaging and rapid diagnosis will assist in pre-operative planning and implementation of surgical stabilization (Wiktor et al., 2022; Necorino et al., 2018). Capitellum fractures are divided into 4 subtypes and among the various subtypes, this case falls into the specific Bryan-Morrey classification type IV, modified by McKee (Tanrıverdi et al., 2020).

Type IV Capitellum fracture according to the Bryan-Morrey classification (McKee modification) emphasizes the coronal shear fracture type which involves the capitellum which extends to the trochlea area (Presentation, 2020). Based on its anatomical structure, the capitellum is a bone with a bulge that is located on the distal aspect of the lateral condyle and articulates with the tip of the radial head, which allows flexion, extension and rotation movements to occur. In the case of a capitellum fracture, these movements are difficult due to weakness in the capitellum which acts as one part of the radial- humerus articulation. This fracture has a significant impact on elbow function and patient mobility so that it can interfere with daily activities and reduce the patient's quality of life. This poses

additional challenges in selecting a treatment strategy, requiring precision surgical intervention to restore normal elbow anatomy (Ul at el., 2017).

Although the medical literature continues to expand in the context of capitellum fractures, case reports of type IV capitellum fractures according to the Bryan-Morrey classification (McKee modification) remain a rare occurrence. Therefore, this case study report was written to contribute to further understanding and treatment of the condition of capitellum fractures, which are still rare.

CASE REPORT

A 41-year-old man was presented to the emergency room at Universitas Sebelas Maret hospital with the main complaint of left elbow pain after falling down the stairs. The patient fell on his elbow 2 days before entering the hospital. The patient complained that his left hand was painful and could not be moved. Figure 1. shows an anterior-posterior (AP) elbow X-ray examination was carried out with interpretation of reported radiological findings with findings of a fracture of the lateral condyle of the left humerus (Milch type 2) with dislocation of the humeroradial joint and soft tissue swelling. Radiological interpretation also included the finding of a central sclerotic dot in the proximal ⅓ of the diaphysis of the left humerus with suspicion of a pathological fracture *et causa* osteoid osteoma. A complete blood laboratory examination was also carried out with all results within normal limits, except those monocytes increased insignificantly to a value of 8.3% (reference value: 0-7.0%).

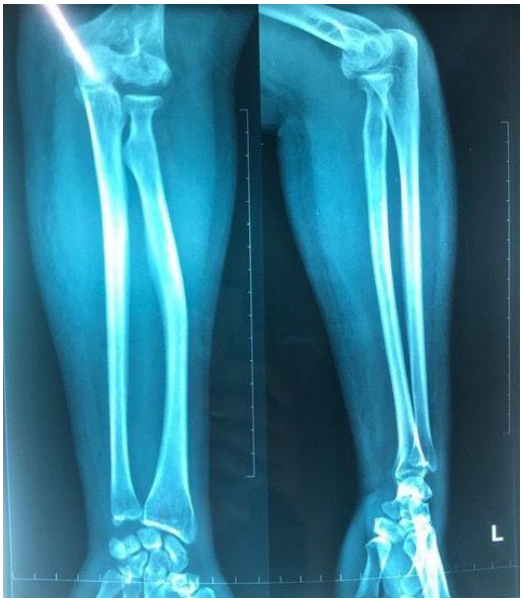

Figure 1. X-ray left elb

On physical examination, the basic pulmonary sounds were found to be normal, there were no wheezing or rales. Heart sounds were regular, no murmurs were found at all auscultation points. Physical examination of the abdomen showed no tenderness and normal bowel sounds were found, but from chest x-ray, cardiomegaly was found with a cardio-thoracic ratio (CTR) of 66% and a grounded apex. In the lung fields, inhomogeneous opacity was found in the right paracardium. The costophrenic sinus was sharp, there were no signs of pleural effusion or signs of pulmonary edema. The radiologist interpreted the patient with suspect of contusion pulmonum and pneumonia. The patient was also consulted by a cardiologist for further treatment, but these findings were not related to the fracture case found.

Due to doubtful radiological clinical suspicion, another radiological examination was carried out using CT-Scan and 3D reconstruction to confirm the location of the fracture. From the results of the

CT-Scan and 3D reconstruction (Figure 2.), it turned out that a fracture of the capitellum down to the trochlear of the left humerus was found. From the Bryan- Morrey classification, the type of fracture obtained is type IV or McKee fracture. From the reconstruction results, there were no signs of subluxation or dislocation of the humeroradial joint and no central sclerotic dot was found. The results of the CT scan and reconstruction examination were then used as a working diagnosis because the results of the CT scan and reconstruction were different from the initial X-ray results.

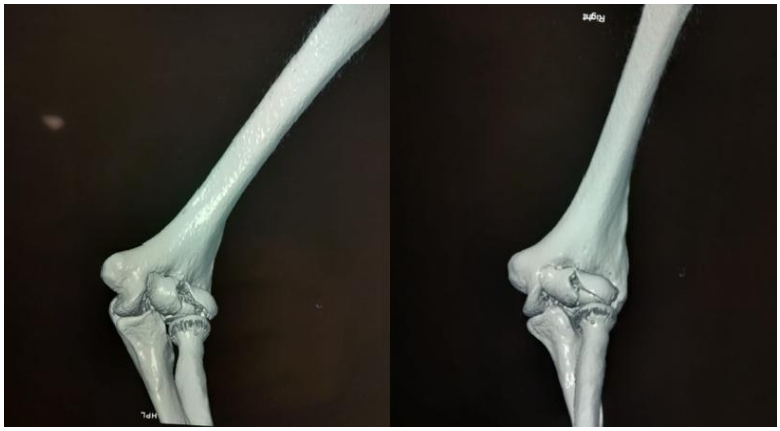

Figure 2. CT Scan and 3D reconstruction

After CT-Scan and 3D reconstruction were done, open reduction internal fixation (ORIF) was performed on the capitellum of the left humerus with Kirschner wire (K-wire). On the same day, an X-ray to evaluate ORIF was performed. The K-wire appeared to be installed distal to the left humerus, there were no signs of lytic lesions, sclerosis or bone destruction. No subluxation or dislocation is visible. There is no visible soft tissue lucidity. Postoperative soft tissue swelling was present without evidence of bleeding at the ORIF site (Figure 3). Following ORIF, the patient complained of continuous stabbing pain with a pain scale of 5 with the patient's general condition being good, blood pressure 141/92 mmhg, SpO2 97%, temperature 36.6ºC, and respiratory rate 20x /minute. Figure 4. shows the patient's elbow two months after ORIF, the patient demonstrated a full range of elbow motion, with normal flexion and extension and no pain during movement.

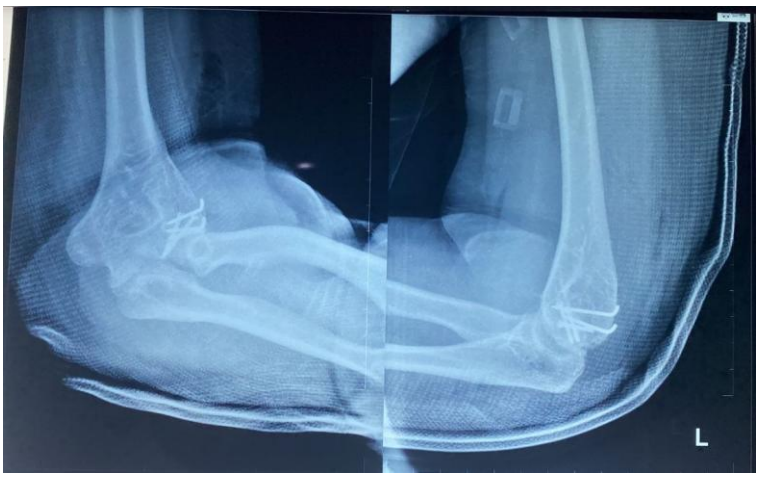

Figure 3. X-ray of left elbow after ORIF

Figure 4. Patient's elbow after two months of ORIF

DISCUSSION

Capitellum fracture is a rare case with an incidence of 1% of elbow area fractures and 4% of all distal humerus fractures (Borbas et al., 2022; Tajika et al., 2024). Capitellum fractures are four times higher in women than men. This is related to the strength and compactness of men's stronger bone material. In addition, the transport angle in women's bones is greater after menopause, which also influences their resistance strength (Sultan et al., 2017). Cases of capitellum fracture are very rare due to the anatomical position of the capitellum which is protected by the radial head, trochlea of the humerus and equipped with humeral collateral ligaments (Chin et al., 2021). In addition, the elbow joint at the capitellum has a very stable inherence compared to other joint articulations in the body (Panero et al., 2019; Heifner et al., 2023). This inherence is reinforced by small joints such as the proximal ulna joint (Stylianou, 2021). Other factors such as the even distribution of forces in the two joints in the brachium region also support the rarity of fracture cases involving the capitellum (Kerkhof et al., 2028).

Although capitellum fractures are rare, in general elbow fractures are a fairly common condition. The elbow is a complex structure consisting of 3 articulations: ulnohumeral, radiohumeral, and proximal radioulnar. The elbow is also equipped with 2 important ligaments, namely the ulnar collateral ligament (UCL) and lateral collateral ligament (LCL). The capitellum itself is a structure that functions as the elbow shaft. The capitellum is the "ball" part of the ball and socket joint that rotates on the radial head. Isolated fractures of the capitellum are very rare, considering that this structure is located deep and protected by muscles and ligaments (Baydar et al., 2022; Liman et al., 2024). Fractures of the capitellum can occur by several mechanisms. Fall on out streched hand (FOOSH) is the most common mechanism causing capitellum fractures. This is due to the large mechanical forces distributed along the lower and upper arms. In addition, direct impact to the lateral elbow is also a common mechanism causing capitellum fractures in traffic accidents. This mechanism causes the radial head to exert a vertical force on the capitellum which results in fracture of the capitellum (Eschweiler et al., 2022; Sehgal et al., 2020).

Patients with capitellum fractures usually present with pain in the elbow accompanied by swelling that occurs after trauma. Adequate visualization of the capitellum fragment is sometimes difficult with standard elbow views. The diagnostic approach using lateral x-rays plays an important role because fractures are often missed if the projection is oblique. The double arc sign on the elbow should not be missed on an x-ray examination. Apart from that, comparative imaging with CT-scan and 3D reconstruction will be very helpful in confirming the diagnosis (Sultan et al., 2017; Lamas et al., 2021; Luchetti et al., 2020). As happened in the case, the X- ray showed a Milch type 2 lateral condyle fracture, but after CT-scan and 3D reconstruction it was found that there was a missed diagnosis with the working diagnosis being a Type IV Bryan Morrey capitellum fracture.

Capitellum fractures require an appropriate therapeutic approach to prevent complications such as avascular necrosis, osteoarthritis, and heterotopic ossification. The ORIF approach is the method

currently most frequently used in capitellum fractures (Baydar et al., 2022). The choice of fixation hardware plays an important role in the prognosis of capitellum fractures. Fixation is usually done with K-wire, cancelous screws or Herbert screws. In cases of capitellum fractures, Herbert screws are reported to be more effective in providing fixation than k-wire and cancelous screws (Sultan et al., 2017; Bayam et al., 2020; Gao et al., 2023). In addition, Mehmet et al. also reported that the use of headless canulated compression screws is considered safe and offers stable fixation with a minimally invasive approach involving small incisions and anteroposterior and posteroanterior screw placement as an easy to apply and safe alternative to current surgical methods and fixation techniques (Baydar et al., 2022). In the case presented above, K-wire were chosen as fixation hardware due to limited funds available and the only hardware available at that time was K-wire, considering that K-wires are a fixation hardware modality that is less expensive and easy to find (Brewer at al., 2021; Muhammad et al.,2021; Png et al., 2022). According to the case presented, we propose that although the Herbert screw is the best modality for capitellum fractures, the use of K-wires as fixation hardware for capitellum fractures can also be used, especially in developing countries with emergency situations and when there is no adequate cost or modality.

CONCLUSION

Capitellum fractures are rare and challenging injuries to treat. Preoperative CT- scan and 3D reconstruction are essential to accurately assess anatomy and classify the fracture, guiding the choice of surgical approach and fixation method. While the Herbert screw is preferred for its effectiveness, K-wire fixation can be a viable alternative in emergencies or when cost is a concern. Early postoperative mobilization is crucial for improving functional outcomes after treatment.

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