



Advances in Management of Pediatric Capitellum Fractures: A Retrospective study

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Abstract

Background: Capitellum fractures are rare in the pediatric population, with most documented cases occurring in individuals over 12 years old. These fractures present unique challenges in diagnosis and treatment due to the rarity and complexity of pediatric bone healing. The limited literature on this subject often emphasizes adult treatment protocols, leaving gaps in understanding pediatric cases. This study investigates the outcomes of six children, aged 12 to 16, with displaced capitellum fractures treated with open reduction and internal fixation (ORIF). **Methods:** Between 2000 and 2020, six pediatric patients with displaced capitellum fractures were treated at AL-Hussain Teaching Hospital. All fractures were classified as type 1 Hahn-Steinthal fractures and were managed using ORIF with screw fixation. Postoperatively, patients were immobilized for three weeks and followed up clinically and radiologically for 20 months to 4 years to assess pain, range of motion, and any complications. **Results:** All patients achieved solid fracture union with no cases of avascular necrosis, heterotopic ossification, or infection. Following cast removal, patients initially experienced stiffness but ultimately regained full elbow function, with only two patients experiencing minor flexion loss. There were no

radiological signs of degenerative changes or deformities. **Conclusion:** ORIF using screw fixation is effective in managing displaced capitellum fractures in pediatric patients, resulting in solid union and good functional outcomes. Early intervention and careful postoperative management are crucial in minimizing complications. However, the rarity of these injuries underscores the need for further research to establish standardized treatment protocols.

Keywords: Pediatric fractures, capitellum, open reduction, internal fixation, elbow injuries, bone healing, orthopedic surgery

Introduction

Elbow fractures are a common injury in pediatric populations, typically presenting as supracondylar fractures or fractures involving the lateral condyle. However, fractures of the capitellum, a small, rounded eminence on the distal humerus, are rare in children and more commonly observed in adults (Fowles & Kassab, 1974; Johansson & Rosman, 1980). Most documented cases of capitellum fractures occur in individuals over the age of 12, with a significant number of studies focusing on adult populations. This has led to a limited understanding of the presentation, treatment, and outcomes of capitellar fractures in pediatric patients (Letts, Boughner, & deHaan, 1997; Mehdiyan & McKee, 2000).

Capitellum fractures in children can be challenging to diagnose and treat due to their rarity and the complexities of pediatric bone healing. These fractures typically involve a disruption of the articular surface, which can lead to long-term complications such as stiffness, deformity, or loss of function if not managed appropriately (Wood & Tullos, 1997). The standard treatment

Significance | This study showed the effectiveness of ORIF in treating rare pediatric capitellum fractures, emphasizing early intervention for optimal outcomes.

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approach for displaced fractures in adults often includes open reduction and internal fixation (ORIF). However, the application of these techniques in children requires careful consideration of the developing skeleton and the potential for growth disturbances (Simpson & Richards, 1986).

Few studies have examined the treatment outcomes of capitellum fractures in children, making it difficult to establish standardized treatment protocols. The existing literature suggests that displaced fractures of the capitellum in children should be managed similarly to those in adults, with an emphasis on achieving stable fixation to allow for early mobilization and to prevent complications such as avascular necrosis or heterotopic ossification (Poynton, Cummings, & Lee, 1998; Scapinelli, 1990).

This study aimed to contribute to the limited body of knowledge on pediatric capitellum fractures by reporting on the outcomes of six children aged 12 to 16 years who sustained displaced fractures of the capitellum. All patients were treated with open reduction and internal fixation using screws. The study examines the clinical and radiological outcomes of these patients, focusing on fracture union, elbow function, and the presence of any complications such as avascular necrosis, heterotopic ossification, or loss of motion. The findings from this study provide valuable insights into the effectiveness of ORIF in managing capitellum fractures in pediatric patients and highlight the importance of early intervention and appropriate surgical techniques to ensure optimal outcomes.

Given the limited number of cases and the challenges associated with treating pediatric fractures, this study also underscores the need for further research to establish evidence-based guidelines for managing capitellum fractures in children. Understanding the long-term outcomes of these injuries is crucial for improving treatment strategies and ensuring that children who sustain these rare fractures can achieve the best possible functional outcomes. Through this study, we aim to provide a comprehensive overview of the treatment and outcomes of pediatric capitellum fractures, contributing to the development of more effective and standardized approaches to managing these injuries in the future (Acharya, Bhat, & Patel, 1996; Drvaric & Rooks, 1990; Grantham, Johnson, & Miller, 1981; Hirvensalo, Pauku, & Järvinen, 1993; Salter & Harris, 1963).

2. Methods and Material

From 2000 to 2020, six children aged 12 to 16 years with displaced fractures of the capitellum were treated at AL-Hussain Teaching Hospital. All fractures were classified as type 1 or Hahn-Steinthal fractures, characterized by displacement in an upward and forward direction. The cohort consisted of three males and three females, with four right-sided and two left-sided fractures. The mechanism of injury was a fall onto an outstretched hand in all cases. Diagnosis

was confirmed using standard anteroposterior and lateral radiographs of the affected elbow.

Each patient underwent open reduction and internal fixation under general anesthesia with a tourniquet applied. A posterolateral incision was used to expose the fracture site, and the displaced fragment was repositioned and secured using a small screw. Care was taken to ensure that the screw was inserted posteroanteriorly through the posterior aspect of the lateral condyle, avoiding penetration of the articular surface. Postoperatively, the elbow was immobilized in a back slab with the elbow flexed at a right angle for three weeks.

Clinical and radiological follow-ups were conducted over a period of 20 months to 4 years. Patients were assessed for pain, elbow range of motion, and overall function. Pronation and supination were compared with the contralateral side, and the carrying angle was measured using a goniometer. Radiographs were reviewed for signs of fracture healing and any complications, including avascular necrosis or degenerative changes.

Ethics

This study was conducted in compliance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The research protocol was reviewed and approved by the Ethics Committee of AL-Hussain Teaching Hospital prior to the commencement of the study. Informed consent was obtained from the parents or legal guardians of all pediatric patients included in the study, with assent from the patients themselves where appropriate, considering their age and understanding.

All data collected were anonymized to protect the identities of the participants. The patients received no financial compensation, and their participation was entirely voluntary, with the assurance that they could withdraw from the study at any time without affecting their ongoing medical care. The surgical interventions and postoperative care followed the best clinical practices, with a focus on minimizing harm and ensuring the well-being of the participants.

The study adhered to the principles of beneficence, non-maleficence, autonomy, and justice, ensuring that the research was conducted with the highest ethical considerations and respect for the rights and dignity of the participants.

3. Results

All six patients achieved solid union of their fractures, with no reported cases of avascular necrosis or heterotopic ossification. Following cast removal, patients initially experienced stiffness but were able to regain full elbow motion and return to normal daily activities without pain. Only one patient required physiotherapy for six weeks. Clinically, two patients had a slight loss of flexion, measuring 5 and 10 degrees, respectively. There were no reports of



Figure 1. All fractures classified as type 1 or Hahn-Steinthal fractures[4] which normally displaced upwards then forwards



Figure 2. Diagnosis was complete on standard anteroposterior and lateral views of the broken

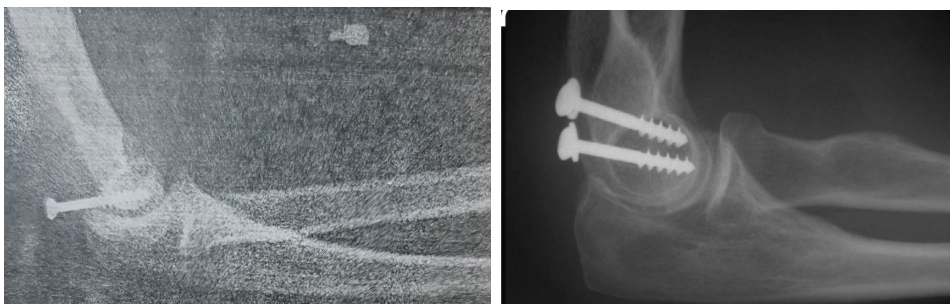


Figure 3. To prevent the screw's tip from penetrating the articular surface, it was inserted posteroanteriorly via the posterior side of the lateral condyle.

infection, elbow deformities, or radiological signs of degenerative changes (Figure 1, Figure 2, Figure 3).

4. Discussion

Capitellum fractures in pediatric patients are rare, and their management presents unique challenges due to the need to preserve the growth potential and joint function. True capitellum fractures, which involve only the articular surface of the capitellar epiphysis, are uncommon in children and should not be confused with type IV Salter-Harris fractures of the lateral condyle of the humerus. Differentiating between these types of fractures is crucial for determining the appropriate treatment approach (Salter & Harris, 1963).

The typical presentation of a capitellum fracture includes tenderness, swelling, and pain on the lateral aspect of the elbow joint. The diagnosis is usually confirmed with a lateral elbow radiograph, which reveals a semilunar fragment separated from the humeral condyle and displaced anteriorly. In our study, arthrography was deemed unnecessary for accurate diagnosis, consistent with findings from other studies (Drvaric & Rooks, 1990).

The mechanism of injury for capitellum fractures is typically a fall onto an outstretched hand, with cubitus valgus or cubitus recurvatum deformities potentially increasing the risk of this injury (Letts et al., 1997). While these deformities were not observed in our study, their potential role in the etiology of capitellum fractures warrants further investigation.

Management of capitellum fractures in adults often includes a variety of treatment options, such as closed reduction, fragment excision, or open reduction with internal fixation (ORIF) (Mehdian & McKee, 2000). However, excision of the capitellar fragment is not recommended in children due to the potential for compromised elbow stability. In our study, ORIF using a small cancellous screw was employed, providing stable fixation and allowing for early mobilization.

Our results suggest that open reduction and internal fixation are effective in treating displaced capitellum fractures in pediatric patients. All patients achieved solid union with no significant complications, and most regained full elbow function. The slight loss of flexion observed in two patients did not impact their overall functional outcomes, and no long-term complications were noted. The findings of this study are consistent with previous reports that emphasize the importance of achieving stable fixation in pediatric capitellum fractures to ensure optimal outcomes (Simpson & Richards, 1986). However, the small sample size and the retrospective nature of the study limit the generalizability of the results. Further research with larger cohorts is necessary to establish more definitive treatment guidelines for this rare injury in children.

5. Conclusion

In conclusion, ORIF is a recommended approach for managing displaced capitellum fractures in pediatric patients. Early surgical intervention and careful postoperative management are essential for achieving good functional outcomes and minimizing the risk of complications.

Author contributions

J.H.I. conceptualized the study, conducted the research, and prepared the manuscript. J.H.I. also reviewed and approved the final version of the manuscript.

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Competing financial interests

The authors have no conflict of interest.

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