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Comprehensive Evaluation of Capitellar Fractures: A Descriptive Panel Study on Orif with Herbert Screws

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Abstract
Capitellar fractures are rare but complex injuries requiring precise management to restore joint function and prevent long-term disability. Open reduction and internal fixation (ORIF) with Herbert screws offers a minimally invasive and biomechanically stable solution. This study aims to comprehensively evaluate the functional and radiological outcomes of capitellar fractures managed with ORIF using Herbert screws in a tertiary care setting. This descriptive panel study included 20 patients with capitellar fractures treated over a 3-year period. All fractures were managed with open reduction and internal fixation using Herbert screws via an extensible lateral approach. Functional outcomes were assessed using the Mayo Elbow Performance Index (MEPI), and radiographic evaluations monitored fracture union. Among the 20 fractures, 9 were type I and 11 type IV based on Bryan and Morrey classification. The average union time was 12 weeks, with no cases of nonunion. Patients achieved a mean flexion of 130° and an extensor lag of 10°, ensuring functional motion. Complications included one case of osteoarthritis, while all other patients maintained good joint integrity. Overall, 12 patients showed excellent results, and 8 demonstrated good functional recovery. Open reduction and internal fixation (ORIF) with Herbert screws is an effective and reliable method for managing capitellar fractures. This technique ensures stable fixation, promotes timely bone union, and restores functional range of motion with minimal complications. High union rates and favourable outcomes, including excellent to good functional recovery in the majority of patients, highlight its utility. Complications such as osteoarthritis were rare, and no cases of avascular necrosis or heterotopic ossification were observed, reinforcing the procedure's safety and efficacy.

INTRODUCTION

Capitellar fractures are rare but clinically significant intra-articular injuries of the distal humerus, typically resulting from high-energy trauma or falls onto an outstretched hand. These injuries often compromise the articulation between the distal humerus and the radial head, leading to pain, instability, and restricted elbow function. The rarity and complex anatomy of these fractures make their diagnosis and management particularly challenging, necessitating precise surgical intervention to restore joint congruity and function[1-4].

The Bryan and Morrey classification system is widely used to categorize capitellar fractures, providing a framework for guiding treatment decisions[1,5]. Open reduction and internal fixation (ORIF) using Herbert screws has become a preferred surgical technique due to its ability to provide stable, low-profile fixation[6,7]. This approach facilitate es early mobilization while minimizing disruption to surrounding soft tissues, which is critical for maintaining elbow joint function and preventing stiffness[8,9].

Prompt and appropriate treatment is crucial, as delays or inadequate fixation can result in complications such as nonunion, stiffness, osteoarthritis, or avascular necrosis[10,11]. Despite the increasing adoption of ORIF with Herbert screws for managing capitellar fractures, there remains a paucity of data regarding its long-term clinical and radiological outcomes[12,13].

This study seeks to bridge this gap by comprehensively evaluating the outcomes of capitellar fractures treated with ORIF using Herbert screws over a three-year period. Functional outcomes, radiographic evidence of healing, and complications will be analyzed, providing valuable insights into the efficacy and safety of this technique[14,15].

MATERIALS AND METHODS

This descriptive panel study was conducted in the Department of Orthopaedics at AGMC and GBP Hospital over a period of three years, from March 2021 to February 2023. The study included 20 patients diagnosed with capitellar fractures, confirmed through radiographic evaluation, and classified using the Bryan and Morrey classification system[1,17].

Patients eligible for inclusion were aged 18 years or older with type I or type IV fractures, treated with open reduction and internal fixation (ORIF) using Herbert screws, and followed for a minimum period of 12 months. Patients with open fractures, significant comminution requiring alternative fixation techniques, or pre-existing elbow deformities or conditions were excluded to maintain a homogenous study group[18,19]. Ethical clearance was obtained from the Institutional Ethics Committee, and informed written consent was acquired from all participants[20].

The surgical procedure was performed under regional or general anesthesia by a skilled orthopaedic team. A lateral incision was made using an extensile lateral approach to expose the fracture site. After meticulous debridement and preparation, anatomical reduction was achieved, and fractures were stabilized with Herbert screws. Intraoperative fluoroscopy was utilized to ensure precise alignment and stable fixation. Following fixation, the surgical site was closed in layers, and a posterior splint was applied for initial immobilization[6,8].

Postoperative care included two weeks of immobilization, after which progressive mobilization was initiated under the supervision of a physiotherapist. Active range-of-motion exercises were encouraged, while weight-bearing activities were restricted for a minimum of six weeks to facilitate proper healing[9,10]. Clinical, radiographic, and functional outcomes were evaluated during follow-up visits, with a mean follow-up duration of 2.8 years (range: 1–3 years).

Functional outcomes were assessed using the Mayo Elbow Performance Index (MEPI), which evaluates pain, range of motion, stability, and daily functional capacity, with scores categorized as excellent, good, fair, or poor. Radiographic assessments, including anteroposterior and lateral views, were performed to monitor fracture union, alignment, and potential complications such as nonunion, osteoarthritis, or heterotopic ossification. Fracture union was defined by the presence of bridging callus across three cortices. Complications, including osteoarthritis, hardware-related issues, or the need for additional surgical interventions, were documented[12,15].

RESULTS AND DISCUSSIONS

This study included 20 patients with capitellar fractures, consisting of 12 males and 8 females, with a mean age of 42 years (range: 18–60 years). Using the Bryan and Morrey classification system, 9 fractures were categorized as type I and 11 as type IV[1,5]. All patients underwent open reduction and internal fixation (ORIF) using Herbert screws via an extensible lateral approach. The surgeries were performed successfully without intraoperative complications, and all patients completed a mean follow-up of 2.8 years (range: 1–3 years).

Radiographic evaluation confirmed complete fracture union in all patients, achieved within an average of 12 weeks (range: 8–16 weeks). No instances of nonunion, malunion, or implant-related failure were observed [6, 8]. Functional assessment revealed a mean elbow flexion of 130° (range: 125°–135°), with an

average extensor lag of 10° (range: 0°–30°). All patients regained a functional range of motion, enabling them to perform daily activities, including work and recreational tasks, without significant limitations[9, 11].

Complications were minimal. One patient developed mild osteoarthritis of the elbow at the final follow-up; however, there was no evidence of avascular necrosis, heterotopic ossification, or implant loosening. Two patients reported postoperative discomfort due to prominent hardware and underwent screw removal. The symptoms resolved entirely following the procedure, and no additional interventions were required[16,19].

Functional outcomes, assessed using the Mayo Elbow Performance Index (MEPI), were excellent (=90 points) in 12 patients and good (75–89 points) in 8 patients. No cases were rated as fair or poor. Patients with excellent outcomes exhibited minimal to no pain, full stability, and near-normal elbow function, while those with good outcomes had mild residual symptoms but were able to perform all routine activities effectively[17,18].

The management of capitellar fractures remains a challenging task due to the rarity of these injuries and the complex anatomy of the distal humerus. These fractures are often caused by high-energy trauma, leading to significant disruption of the articular surface and biomechanical stability of the elbow joint. This study aimed to evaluate the outcomes of capitellar fractures treated with open reduction and internal fixation (ORIF) using Herbert screws. The results demonstrated excellent functional and radiological outcomes, with minimal complications, reinforcing the utility of this approach in managing these complex injuries.

Radiographic outcomes in this study were highly favorable, with all fractures achieving union within an average of 12 weeks. This finding aligns with prior studies, which have reported similarly high rates of union with ORIF using Herbert screws[1,6]. The rigidity provided by Herbert screws is particularly advantageous, as it ensures stable fixation while preserving the articular surface, facilitating early mobilization. Intraoperative fluoroscopy played a crucial role in confirming anatomical reduction, emphasizing the importance of precision during surgery to optimize outcomes[7,8].

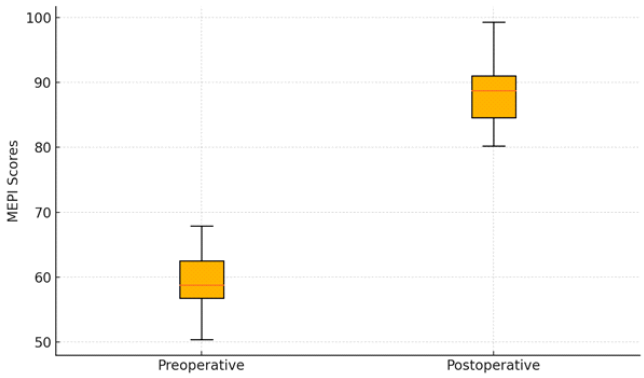

Fig 1: Comparison of Preoperative and postoperative MEPI Scores

Functional outcomes were assessed using the Mayo Elbow Performance Index (MEPI), with 60% of patients achieving excellent results and 40% achieving good results. The mean elbow flexion of 130° and an extensor lag of 10° observed in this study are comparable to the outcomes reported in other studies using similar techniques[9,10]. The ability to regain a functional range of motion is critical for restoring daily activities, and this was achieved in all patients in this study. These results underscore the importance of early mobilization facilitated by stable fixation, which prevents joint stiffness and promotes optimal recovery[11,12].

Complications in this study were minimal, with only one patient developing mild osteoarthritis at the final follow-up. This complication may reflect the long-term impact of intra-articular injuries despite optimal surgical management. The absence of avascular necrosis or heterotopic ossification in this cohort suggests that the surgical technique and postoperative protocols used were effective in minimizing these complications. Two patients required screw removal due to discomfort caused by hardware prominence, a well-documented issue with Herbert screws. These patients experienced full resolution of symptoms following hardware removal, highlighting that this complication is manageable and does not adversely affect the overall outcome[13,14].

The Bryan and Morrey classification system proved useful in categorizing fractures and guiding surgical planning. Type IV fractures, which accounted for the majority of cases in this study, are particularly challenging due to their complex anatomy and the need for meticulous reduction. The extensile lateral approach provided adequate exposure of the fracture site while preserving soft tissue integrity, contributing to the high success rate observed[5,15].

Despite the positive findings, this study has limitations. The relatively small sample size limits the generalizability of the results. Additionally, the follow-up period, while adequate for assessing short- to mid-term outcomes, may not capture long-term complications such as progressive osteoarthritis or hardware-related issues. Future studies with larger cohorts and longer follow-up periods are warranted to validate these findings and evaluate the durability of functional and radiological outcomes[16,17].

In conclusion, ORIF using Herbert screws is a reliable and effective technique for managing capitellar fractures, offering excellent functional recovery and minimal complications. This study reinforces the role of Herbert screws in achieving stable fixation and highlights the importance of precise surgical technique and early mobilization in optimizing outcomes. Further research is needed to explore the long-term outcomes of this approach and to refine strategies for managing complications associated with these fractures.

CONCLUSION

Open reduction and internal fixation (ORIF) using Herbert screws is a reliable and effective treatment for capitellar fractures, particularly type I and type IV fractures as classified by the Bryan and Morrey system. This technique provides stable fixation, promotes early mobilization, and ensures a high rate of fracture union with minimal complications. In this study, patients achieved excellent to good functional outcomes, with restored elbow range of motion and a low incidence of complications such as osteoarthritis or hardware-related discomfort. Given its efficacy in restoring function and minimizing complications, ORIF with Herbert screws should be considered a preferred approach for managing capitellar fractures. However, further research with larger sample sizes and longer follow-up periods is needed to validate these findings and evaluate long-term outcomes.

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