**ORIGINAL ARTICLE**

# Management of Isolated Coronal Shear Humeral Capitellum Fracturefixation with Herbert Screws

MARATIB ALI[1], ADEEL AHMED SIDDIQUI[2], IRFAN MUHAMMAD RAJPUT[3], *JAVED HUSSAIN KHASKHELI[4], MUHAMMAD YOUNIS PATHAN[5], SYED AMIR JALIL[6]*

*[1]Professor of Orthopaedic Surgery, Dow University of Health Sciences Karachi*
*[2]Assistant Professor, Department of Orthopaedics Dow University of Health Sciences Karachi*
*[3]Assistant Professor, Department of Orthopaedics Dow University of Health Sciences Karachi*
*[4]Senior Medical Officer, Orthopaedic Department Dr Ruth KM Pfau Civil Hospital Karachi*
*[5]Senior Medical Officer, Orthopaedic Department Dr Ruth KM Pfau Civil Hospital Karachi*
*[6]Prof, Orthopaedic Department Abbasi Shaheed Hospital Karachi*
*Correspondence to: Dr Adeel Ahmed Siddiqui, Email: zone4444@hotmail.com, Mobile # 03343706234*

## ABSTRACT

**Introduction:** Humeral fractures are very rare accounting for less than 1% of fractures. The usual cause of capitellum and the trochleafractures of humeral is the result of axial loading. In 1996, Mckee proposed a category of humeral fractures mentioned as coronal shear fractures of the humerus. This category of fracture extends beyond the capitellum up to the trochlear ridge. Although surgeons have tried various options such as K-wires, mini fragment screws, headless compression screws and bio-absorbable implants. Herbert screw fixation has proved to be a promising option due to excellent compression at fracture site, stability and good intra-articular fixation.

**Method:** This cross-sectional study was performed at the Department of Orthopedics, Dr Ruth KM Pfau Civil Hospital Karachi.Patients with isolated coronal shear fractures were included in the study between ages 15-75 years.Open reduction and internal fixation was used and lateral approach was used as it offers better visualization.The mayo elbow performance index (MEPI) score was used to evaluate the post-operative functional outcome.

**Results:** A total of 12 cases presented during the study duration. The mean operating time was 85 ± 2 minutes. All patients had complete healing of the fracture. One patient developed post-traumatic osteoarthritis of the affected joint. During follow up, one patient develop moderate ache while routine activities. The pain was resolved at subsequent follow ups. The average loss of range of motion among affected patients was 5 degrees of flexion-extension and 8 degrees of supination-pronation. The average MEPS score was 93.4 +5.3.

**Conclusion:** Herbert screw fixation offers promising results with isolated coronal shear humeral fractures. All patients in our study has good functional outcome. One elderly patient developed post-traumatic osteo-arthritis of the affected joint.

**Keywords:** coronal shear fractures, Herbert screw fixation, capitellum fractures

## INTRODUCTION

Humeral fractures are very rare accounting for less than 1% of fractures[1]. The usual cause of humeral fractures is the result of axial loading of the capitellum and the trochlea[2]. The management for these fractures includesopen reduction and internal fixation[3]. in 1996, Mckee proposed a category of humeral fractures mentioned as coronal shear fractures of the humerus. This category of fracture extends beyond the capitellumupto the trochlear ridge. It gives a double arc sign. If the diagnosis is not made on X-ray, CT scan and MRI can also be used. The most commonly used approach is from the antero-lateral aspect of the elbow which offers better visualization of the joint and associated ligaments and hence screw fixation and bone grafting is relatively easier[4].

The most common mode of injury for capitellum fractures is fall on outstretched hand[5,6]. In this mode of injury the radius applies pressure on the capitellum. If the elbow is flexed at zero to 30 degrees, maximum force is transmitted to the capitellum[7]. Although surgeons have tried various options such as K-wires, mini fragment screws, headless compression screws and bio-absorbable implants. Herbert screw fixation has proved to be a promising option due to excellent compression at fracture site, stability and good intra-articular fixation.The anterolateral approach offers excellent visualization of the capitellum, trochlea and associated articular structures. If helps in better open reduction and bone grafting[8].

The most effective technique for early fixation of capitellum fractures is open reduction and internal fixation. It helps in preventing many complications such as join stiffness, degenerative changes, arthritis. It also helps maintain the anatomical congruity of the joint[9,10]. The minimal amount of soft tissue present at this site puts it at an increased risk for displaced fractures[11].

## METHOD

This is a cross-sectional study performed at the Department of Orthopedics, Civil Hospital Karachi. The study duration is from 1st November 2018 to 30th October 2019. Informed consent was taken from all patients participating in the study. Demographic variables such as age, gender, race, mechanism of injury, other injuries at first presentation were recorded. A total of 12 cases were included in the study. Patients with isolated coronal shear fractures were included in the study between ages 15-75 years. Exclusion criteria includes patients with multiple fractures and fractures of other bones.

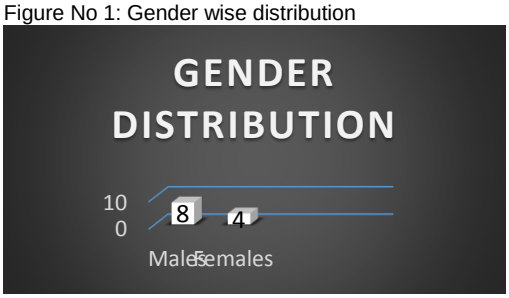
Plain radiographs were ordered along with CT scan to confirm the findings. A brachial plexus anesthesia was

given. Open reduction and internal fixation was used and lateral approach was used as it offers better visualization. This approach provides better visualization for all articular fragments and hence aids in screw placement and bone grafting. Post-operatively a long arm posterior plaster splint was applied and kept for a duration of two weeks. After removal of splint, active range of motion was commenced. Patients were asked to follow up at 4 weeks interval. The mayo elbow performance index (MEPI) score was used to evaluate the post-operative functional outcome.This scale measures pain, ulno-humeral motion, stability and the ability to perform five functional tasks. The total score is 100. There are four categories for score range: poor (less than 60 points), fair (60-74), good (75-89), excellent (90-100).

## RESULTS

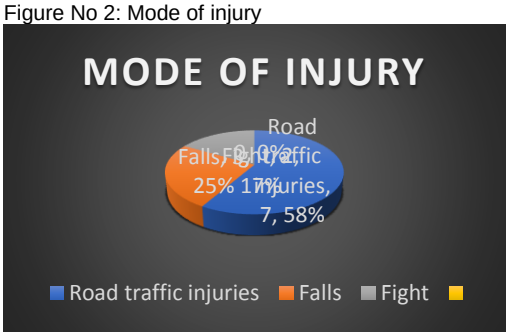
A total of 12 cases presented during the study duration. Eight patients were males while four were females (Figure 1). The mean age of patients was 42 ± 10.5 years..

Figure No 1: Gender wise distribution




The most common mode on injury was road traffic accidents (n=7), followed by falls (n=3) and fight (n=2) (Figure 2)

Figure No 2: Mode of injury




The mean operating time was 85 ± 2 minutes. All patients had complete healing of the fracture. One patient developed post-traumatic osteoarthritis of the affected joint. This patient had 60 years of age and the mode of injury was fall from height. This patient had multiple co-morbid conditions such as diabetes mellius, hypertension and vitamin D deficiency. During follow up, one patient developed moderate ache while routine activities. The pain was resolved at subsequent follow ups. The average loss of range of motion among affected patients were 5 degrees of flexion-extension and 8 degrees of supination-pronation. The average MEPS score was 93.4 +5.3 (Table 1).

Table No 1: MEPI score of study subjects

| PATIENTS | MEPI SCORE |
|---|---|
| Patient 1 | 91 |
| Patient 2 | 92 |
| Patient 3 | 80 |
| Patient 4 | 91 |
| Patient 5 | 92 |
| Patient 6 | 93 |
| Patient 7 | 97 |
| Patient 8 | 100 |
| Patient 9 | 92 |
| Patient 10 | 98 |
| Patient 11 | 99 |
| Patient 12 | 96 |
| MEAN MEPI SCORE | 93.4 +5.3 |

Preoperative radiographs

Postoperative Finding at 4th month

## DISCUSSION

Our study shows good functional outcome in all patients except one which developed post-traumatic osteoarthritis. This patient had risk factors for the development of post-traumatic osteo-arthritis such as advanced age, diabetes mellitus, hypertension and vitamin D deficiency. Our study reports are similar to Tengbo et al's study whomanaged fifteen patients with isolated coronal shear fractures of capitellum head. These patients were managed using Herbert screw fixation using anterolateral approach. All patients recovered completely and had excellent functional outcome. There was one incomplete posterior interosseus nerve injury which was healed in a short period without any compromise. The operating time was also similar among our study and Tengbo et al's study. His study reports no significant differences in range of motion between affected and unaffected arm. This is similar to our study. the average loss of motiomamong affected patients were 5 degrees of flexion extension and 8 degrees of supination and pronation. The similarity in study results in due to the use of anterolateral approach for Herbert screw fixation in both studies[12]. Singh et al in his study reports outcome of 14 patients with capitellum fractures managed with open reduction and internal fixation using Herbert screws. All patients had good functional outcome. No patients had

degenerative changes and avascular necrosis[13]. Mighell et al in his study underwent open reduction and internal fixation using headless compression screws in 18 patients with large coronal shear fractures of capitellum. Seventeen patients had good functional outcome. Three patients developed avascular necrosis while five patients developed arthrosis post-operatively[14]. Imatani et al managed six patients with coronal shear fractures of distal humerus with open reduction and internal fixation using Herbert screws. He concluded that patients had good post-operative functional outcome[15]. Mahirogullali et al in his study concludes the post-operative outcome of 11 patients with type1 capitellum fractures treated by open reduction and internal fixation using Herbert screw. His study patients show excellent functional outcome in eight patients and good outcome in three patients. However, he used posterior approach and recommends it as superior to anterolateral approach. He further concludes that early mobility helps in improving functional outcome of these patients[16]. Stamatis et al reports a study in which he managed six patients with type IV coronal fractures using open reduction and internal fixation with Herbert screws. The average healing time for his study patients was between six to nine weeks. Two patients developed post-operative complications. One patient developed mild degenerative joint disease while one patient developed osteonecrosis of coronal shear fragment. All patients had good functional outcome with Mayo elbow performance scale scores between 98-100[17].

Our study results report excellent functional outcome with mean MEPI score of 93.4. Hence we can conclude that anterolateral approach offers promising results. Goodman et al in his study reports patients with coronal shear fractures among nine patients who underwent open reduction and internal fixation using lateral approach. All patients had excellent functional outcome[18]. Silva et al reports the case of an 11-year-old child with capitellum fractures which was managed with open reduction and internal fixation using headless compression screws. Capitellum fractures are extremely rare in pediatric patients. however, the management of this patient using ORIF offers excellent results with no evidence of avascular necrosis. The patient had completely restored the range of motion. Radiographs showed completely healed fracture with restoration of articular line[19]. Kurtulmus et al in his study reports eight adolescent patients with capitellum shear fractures. These patients were managed with open reduction and internal fixation using headless compression screws. Fractures were completely healed with excellent functional outcome[20].

## CONCLUSION

Herbert screw fixation offers promising results with isolated coronal shear fractures. Our study patients show excellent functional outcome and complete healing was evident in radiographs of all patients. we hereby conclude that Herbert screw fixation is better than any other technique used for coronal shear fractures such as K-wires, mini fragment screws and bio-degradable implants. For Herbert screw fixation, antero-lateral approach is the most convenient approach and hence should be implemented by orthopedic surgeons.

## REFERENCES


1. Morrey BF. The elbow and its disorders. Elsevier Health Sciences; 2009.
2. Dubberley JH, Faber KJ, MacDermid JC, Patterson SD, King GJ. Outcome after open reduction and internal fixation of capitellar and trochlear fractures. JBJS. 2006 Jan 1;88(1):46-54.
3. Mighell M, Virani NA, Shannon R, Echols Jr EL, Badman BL, Keating CJ. Large coronal shear fractures of the capitellum and trochlea treated with headless compression screws. Journal of shoulder and elbow surgery. 2010 Jan 1;19(1):38-45.
4. Ruchelsman DE, Tejwani NC, Kwon YW, Egol KA. Open reduction and internal fixation of capitellar fractures with headless screws. JBJS. 2008 Jun 1;90(6):1321-9.
5. Poynton AR, Kelly IP, O'Rourke SK. Fractures of the capitellum—a comparison of two fixation methods. Injury. 1998 Jun 1;29(5):341-3.
6. Pradhan BB, Bhasin D, Krom W. Capitellar fracture in a child: The value of an oblique radiograph: A case report. JBJS. 2005 Mar 1;87(3):635-8.
7. Morrey BF, An KN, Stormont TJ. Force transmission through the radial head. The Journal of bone and joint surgery. American volume. 1988 Feb;70(2):250-6.
8. Trinh TQ, Harris JD, Kolovich GP, Griesser MJ, Schickendantz MS, Jones GL. Operative management of capitellar fractures: a systematic review. Journal of shoulder and elbow surgery. 2012 Nov 1;21(11):1613-22.
9. Ring D, Jupiter JB, Gulotta L. Articular fractures of the distal part of the humerus. JBJS. 2003 Feb 1;85(2):232-8.
10. McKEE MD, Jupiter JB, Bamberger HB. Coronal shear fractures of the distal end of the humerus. JBJS. 1996 Jan 1;78(1):49-54.
11. Goodman HJ, Choueka J. Complex coronal shear fractures of the distal humerus. Bulletin-Hospital for Joint Diseases. 2004;62(3-4):85-9.
12. Yu T, Tao H, Xu F, Hu Y, Zhang C, Zhou G. Management of isolated coronal shear fractures of the humeral capitellum with Herbert screw fixation through anterolateral approach. BMC musculoskeletal disorders. 2018 Dec;19(1):108.
13. Singh AP, Singh AP, Vaishya R, Jain A, Gulati D. Fractures of capitellum: a review of 14 cases treated by open reduction and internal fixation with Herbert screws. International orthopaedics. 2010 Aug 1;34(6):897-901.
14. Mighell M, Virani NA, Shannon R, Echols Jr EL, Badman BL, Keating CJ. Large coronal shear fractures of the capitellum and trochlea treated with headless compression screws. Journal of shoulder and elbow surgery. 2010 Jan 1;19(1):38-45.
15. Imatani J, Morito Y, Hashizume H, Inoue H. Internal fixation for coronal shear fracture of the distal end of the humerus by the anterolateral approach. Journal of shoulder and elbow surgery. 2001 Nov 1;10(6):554-6.
16. Mahirogullari M, Kiral A, Solakoglu C, Pehlivan O, Akmaz I, Rodop O. Treatment of fractures of the humeral capitellum using Herbert screws. Journal of Hand Surgery. 2006 Jun;31(3):320-5.
17. Stamatis E, Paxinos O. The treatment and functional outcome of type IV coronal shear fractures of the distal humerus: a retrospective review of five cases. Journal of orthopaedic trauma. 2003 Apr 1;17(4):279-84.
18. Goodman HJ, Choueka J. Complex coronal shear fractures of the distal humerus. Bulletin-Hospital for Joint Diseases. 2004;62(3-4):85-9.
19. Silva M, Moazzaz P. Coronal shear fracture of the distal humerus in an 11-year-old patient. Journal of Pediatric Orthopaedics B. 2011 Jan 1;20(1):50-5.
20. Kurtulmus T, Saglam N, Saka G, Avci CC, Kucukdurmaz F, Akpinar F. Posterior fixation of type IV humeral capitellum fractures with fully threaded screws in adolescents. European Journal of Trauma and Emergency Surgery. 2014 Jun 1;40(3):379-85.