ORIGINAL ARTICLE

Humeral Capitellar Fractures Fixation with Herbert Screws

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ABSTRACT

Background: Capitellar fractures are quite rare injury and often missed primarily. Different treatment options are available but optimal elbow functions can only be achieved by rigid anatomical fixation. Headless screw system is current trend of fixation.
Aim: To asses functional outcome of Herbert screw fixation in capitellar fractures.
Methods: Fifteen patients with displaced capitellar fractures were studied between October 2014 & May 2018 at Orthopedics II, Jinnah Hospital Lahore. All were operated through lateral approach. Herbert screw fixation was done after anatomical reduction. All patients were followed up for an average of 22.53 months. Clinical and functional assessment were measured by Mayo Elbow Performance Index (MEPI) & radiologically.
Results: All patients were evaluated according to MEPI scoring over 100 points. 66.66% (10) patients got excellent outcome with mean MEPI score of 89.The average arc of ulnohumeral joint was 125 degree with supination/pronation 170 degree. Radiologically, average capitellar fracture healing time was 9 weeks with none of case having AVN. 4 cases (26.66%) developed heterotrophic ossification. Osteoarthritis was noted in two cases (13.33%).
Conclusion: Herbert screws fixation of capitellar fractures has good functional results because of adequate compression, rigid fixation and early rehabilitation.
Keywords: Capitellar, Herbert screws, fracture

INTRODUCTION

Although fracture around distal humerus in all age groups is quite common but capitellum fracture occurs in only 1% cases.[1,2] This rare, coronal plane partial articular shear fracture usually happened in working age groups[3,4,5]. It results with low energy fall of outstretched hand[2,4.] Direct axial load of radial head to the capitellum and occasionally to trochlea and/or spontaneous reduction of posterolateral elbow subluxation, are the responsible forces for this injury[3,5,6].

Capitellar fracture may be accompanied by one or both medial and lateral collateral ligaments injury of the elbow and/or ipsilateral radial head fracture [2,7,8,9].
Untreated displaced fracture usually migrates superiorly, where on mal-union it causes anterior bone block and restriction of elbow flexion[1,4,8,9,10].

These fractures are usually missed on standard AP view of elbow because of overlap of fractured capitellum on distal humerus. True lateral view is necessary to pick the fracture radiologically.[5,6] CT elbow with sagittal and coronal plane reconstructions is quite helpful for detailed assessment of fracture's geometry and planning for operative intervention[4,8,11].

Several classifications of capitellar fractures are described in literature. We used McKee modifications of Bryan & Morrey classification[2,4.]
According to it,
Type I-Coronal capitellar fracture with or without little trochlear involvement.
Type II-Capitellar fracture with minimal subchondral bone attachment.
Type III-Comminuted capitellar fracture.
Type IV-Non comminuted coronal capitellar fracture extending medially to trochlea, as a single fragment.

Various treatment options are available, like close reduction and casting, excision of the fragment or open reduction and internal fixation. ORIF can be done with K wires, mini-fragment plates, cannulated screws or headless screws[6-8, 10-21]

The purpose of the study is to assess functional and radiological outcome following open reduction and internal fixation of capitellar fracture with Herbert screws.

Materials and Methods

Fifteen patients with capitellar fractures were operated in Orthopedic Department Unit II, Jinnah Hospital Lahore, between October 2014 and May 2018, with average age of 27.46 years.
Time of presentation was 5 to 90 days with mean of 22.45 days. Eight (53.33%) out of fifteen patients had history of fall on outstretched hand. There was no other associated injury. All were operated on elective list after detailed clinical and radiological evaluation. X-ray elbow both AP and lateral views were advised as per routine. CT was done only in cases with fracture comminution.

All patients were operated under GA with pneumatic tourniquet through the lateral Kocher approach.[13]Extensor mechanism, if needed, was partially divided for exposure of fracture. Which was repaired later on. Fracture fragments identified, care was taken not to detach soft tissue totally to save vascularity. Fracture reduced anatomically in both type-I and type-IV and fixed with two Herbert screws from posterior to anterior direction over the K -wires, holding the fractured fragments without any intra-articular step.[14,17-21] Special attention for screw size was given to remain buried on articular side. In type-II & III small comminuted fragments were excised and elbow stability was assessed [8,14,15].
Postoperatively, above elbow back slab was given for 2 weeks in type-I & IV and for 3 weeks in type-II & III cases[10,11,13,15]

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All patients were discharged on 2nd post operative day with average 5 days of gram +ve oral antibiotics coverage. At 2nd week, in type-I & IV, and 3rd week in type-II & III back slab was replaced with poly sling and active range of motion (ROM) exercises started for 3 weeks[11,14.] Later on, passive ROM was encouraged, till patient got maximum ROM both flexion/extension at elbow and supination / pronation at forearm. Patients were called up for serial follow up with X-Rays. They were assessed for fracture healing and/or any complication like AVN, heterotrophic ossification, non-union, delayed union or mal-union. All patients were evaluated for pain, ROM, elbow functions and stability according to Mayo elbow performance index (MEPI).[2]

Table : Mayo Elbow Performance Index(MEPI)

Variable	Definition	n
Range of motion	Arc >100	20
	Arc 50-100	15
	Arc<50 degrees	05
Function	Able to comb hair	05
	Able to feed oneself	05
	Able to perform personal hygiene tasks	05
	Able to on shirt	05
	Able to put on shoes	05
Stability	Stable	10
	Moderately	05
	Unstable	
	Grossly unstable	0
Pain	None	45
	Mild	30
	Moderate	15
	Severe	0

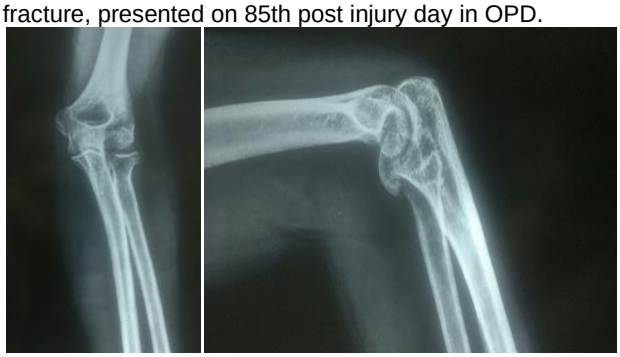
Statistically, for all types of capitellar fractures, functional outcome/MEPI scores was evaluated by using student t- test and P value was considered significant if P <0.05.

Total MEPI scores range 5-100 points with higher the score better the functions.

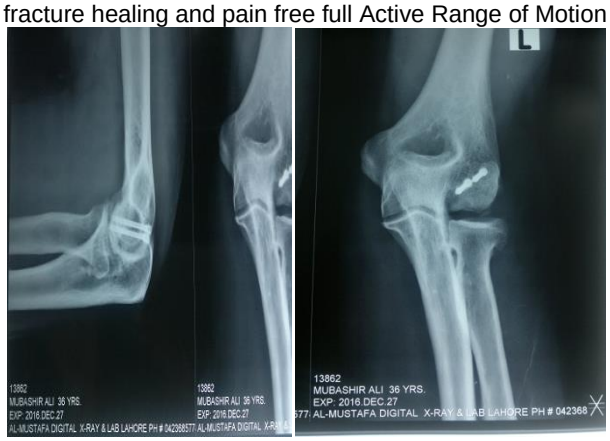
Excellent 90-100
Good 75-89
Fair 60-74
Poor <60

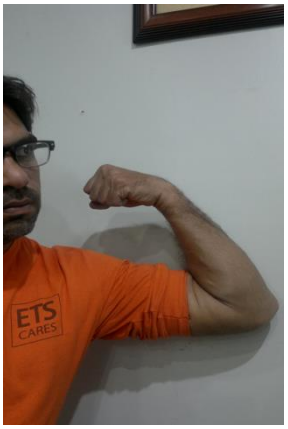
Patients discharged from follow up when were pain free with near normal or maximum ROM or no further improvement noted over minimum of 12 weeks.

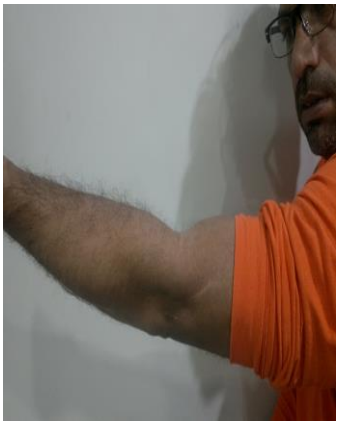
Case 1: 35 years old Painter with Type I Capitellar fracture, presented on 85th post injury day in OPD.



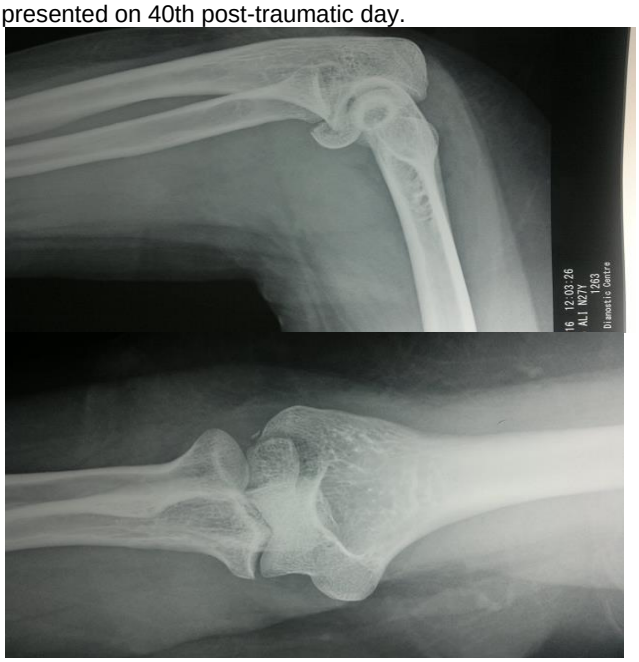
12th weeks of uneventful follow-up, with complete fracture healing and pain free full Active Range of Motion



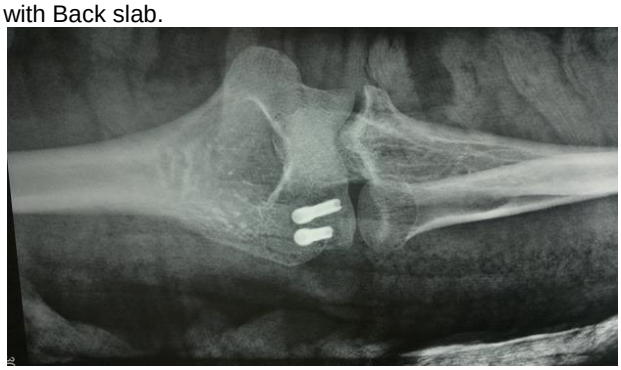


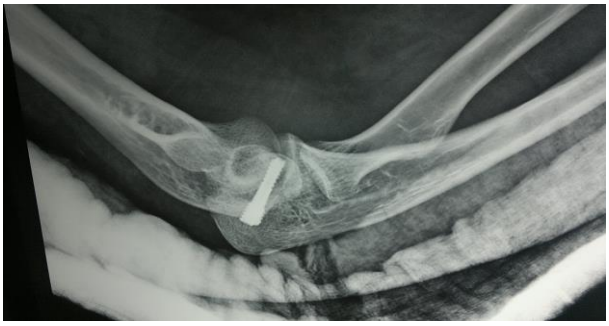


Case 2: 30 years old with type I Capitellar fracture, presented on 40th post-traumatic day.



1st week Follow-up with two Herbert Screws fixation, still with Back slab.





RESULTS

All of 15 patients 10(66.6%) were male with mean age of 27.46 years. Right arm was involved in most of the cases(73.33%). 8 patients (53.33%) had low energy trauma. Of the capitellar fractures, type-I fracture was most common, i-e, 11 cases (73.33%), type-IV, two cases (13.33%) and 1 case (6.66%) for each of type-II & III.
All were closed fracture with average time of presentation 22.45 days (5-90 days). In majority of cases (80.66%) fracture was missed by primary treating physician.

None of the patients had concomitant upper limb musculoskeletal trauma like radial head fracture. 13 out of 15 patients, were fixed with two Herbert screws with average bone union time 8.93 weeks. Arc of motion at ulnohumeral joint was 90 to 145 degree with average of 125 degree. ROM was restricted in two cases (13,33%), each of type-II and III, both at ulnohumeral joint, flexion/extension, 110/20 & 115/15 and at radiocapitellar joint, supination/pronation, 70/75 & 70/70 respectively. Otherwise, average flexion ulnohumeral joint was 135 degree (110 to 145 degree) and extension lag 7.66 degree with range of 5 to 20 degree.

The mean MEPI scores for type-I capitellar fractures was 94.09, type-IV 82.5, type-II 75,type-III was 60 corresponding with overall 66.66% excellent, 26.66% good, 6.66% fair and zero% poor outcome.
At the last follow up of type-I and type-III, statistical analysis revealed significant difference with respect to arc of motion at ulnohumeral joint p=0.04, total flexion p=0.03 and extension lag p=0.05.

Average duration of follow up was 22.53 months, with range of 6-to-43 months. None our patient developed AVN, non-union, mal-union, elbow instability, tardy ulnar nerve palsy and/or Infection.

Four 26.66% out of 15 patients developed heterotrophic ossification. Two of them 13.33% were of type-II,III each and had also developed degenerative changes at 3 & 4 months of follow up respectively.
All of our patients were satisfied with treatment and were able to perform pain free normal daily activities except two 13.33% (one each of type-II & III) who had to take pain medications off and on especially after strenuous work.

DISCUSSION

Rare injury of capitellar fracture mostly caused by fall on out stretched hand with extended elbow[1,2,4,8]. It is common in females because of hyper laxity [4,9,10,18]. However, in our study male gender was mostly involved.

Capitellar fracture diagnosis is mostly missed because of improper clinical examination & inadequate x-ray[5,6,9,11]. True lateral view of elbow is important to identify the capitellar fracture especially in case of "double-arc sign" of type IV fracture pattern .[4,7,10] For comminuted fractures like type III, CT scan is important.[6,8,12] MRI is recommended for associated ligamentous injuries,[8,14,15] which we did not encounter in any of our case.

Un-displaced capitellar fractures can be managed in plaster and/or percutaneous pinning with 6-8 weeks of elbow immobilization, but usually end up with elbow stiffness.[2,4,7,8]

Open reduction & internal fixation is currently recommended to regain quick functional recovery with early rehabilitation protocol[13-15,17].

Different fixation options are supported in literature like, ORIF with K- wires, cancellous screws, fibrin glue, maxillofacial plates, Acutrak screws & Herbert screws[6,7,12,15,16-21].

We preferred Herbert screws because of its primary compression at fracture, rigid fixation, buried beneath the articular surface & no need of future hardware removal[18,19].

Both extensile & lateral Kocher approaches were published but we were comfortable with Kocher approach, as heterotrophic ossification is commonly reported with extensile approach.[13,14] If needed, common extensor origin was partially cut which was repaired.[16,17]
Various complications are reported in different studies including elbow stiffness, degenerative osteoarthritis, infection, non-union, mal-union, implant failure/cut out, valgus instability of elbow, tardy ulnar nerve palsy, heterotrophic ossification(HO) & avascular necrosis(AVN).[7,9,11,13,15,20,22,23]

None of our patient developed any of mentioned complication except four (26.66 %)HO & two (13.33%) degenerative osteoarthritis.

The reason of HO was late presentation more than 80 days for two patients(13.33%). All four cases (26.66%) having HO & two out of them with degenerative changes were because of fracture pattern i-e. type II & III.

Our results were superior to Akalin et al.[24] who reported 45% cases of HO & degenerative OA in study of 11 patients & Dubberly et al.[25] whose 12 out of 28, 42% patients developed osteoarthritis. That might be because

48% and 36% of their patients respectively, had type III fracture which were only 6.66% in our study.

The overall functional outcome of our cases was comparable with literature published in favor of ORIF of capitellar fractures.[4,5,7,9,11,13-17,19-25,27,28] The average range of motion at elbow was 125^0 & the MEPI score was 89 points, showing excellent results in 10 patients (66.6%), good in 4 patients (26.66%), fair in one 6.66% with non (0%) of poor results.

The mean flexion-extension arc of elbow reported by Ring et al.[26] was 96 & MEPI score of 91 points. That happened probably because of 5 out of 21 patients had fracture extension through medial epicondyle & also they did olecranon osteotomy for surgical exposure , which we did not.

Moreover, the functional results of type IV fracture in our series were consistent with some other published series of capitellar fracture, two(13.33%) of our patient with type IV had mean ulnohumeral arc of motion of 130^0 & average MEPI score of 84.5 points, which were better than reported series of McKee et al,[4,7] (i.e. arc was 126 & MEPI score of 81.5 points & comparable with Goodman & Choueka[27] who reported 127^0 arc of motion at elbow & 84 points MEPI score .

This restriction of arc of motion and decreased functional outcome of both the researchers were because of concomitant radial head fracture leading to greater flexion contracture which was not there in our patients.

CONCLUSION

Open anatomical reduction & rigid internal fixation with headless screws is recommended for capitellar fracture even if its late presentation, especially in type I & IV fractures as the outcome is promising. Regarding complications like degenerative changes & heterotrophic ossification, especially in type II & III capitellar fracture, may be prevented by encouraging early active range of motion exercises & post operative usage of pharmacological prophylaxis[8,9,15] and/or single course of low dose radiation therapy[16,22,28].

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