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Original Research Article

Treatment of Type I and Type IV Capitellar Fractures by Open Reduction & Internal Fixation – A Series of 16 Cases

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Abstract

Objectives: The purpose of the present study was to evaluate clinical, radiographic, and patient-based functional outcomes following the open reduction and internal fixation of capitellar fractures. **Material and Methods**: An observational study of 9 years duration was conducted on 16 patients admitted in the Department of Orthopaedics of Patna Medical College & Hospital in the age group of 20 to 58 years. The patients were treated by open reduction and internal fixation of type 1 & type 4 capitellar fractures. An extensile lateral approach was used, and fractures were fixed by K-wires (5), cannulated cancellous screws (6), or headless screws (5). Patients were followed up to an average of 36 months. Evaluation of the patients post operatively was done according to the Mayo elbow performance index (MEPI). **Results:** Union occurred in all the cases. There were no case of instability or AVN. The mean MEPI was 87 points with 6 excellent outcomes, 7 good outcomes, 2 fair outcomes and one poor rating. The mean range of movements at elbow in flexion\extension was 125^0 (115^0- 135^0) while range of movements in pronation\supination was 170^0 (120^0- 180^0). **Conclusion:** Open reduction and internal fixation is preferred mode of treatment for type 1 and type 4 capitellar fractures. Radiological and functional outcomes are good to excellent in most of the cases using the extensile lateral approach for surgery.

Keywords: capitellum, extensile lateral approach, cannulated cancellous screw, headless screw.

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Introduction

Fracture of the capitellum is rare injury accounting for 1% of all elbow fractures and 6% of distal humeral fractures[1-3]. It occurs mostly due to fall on outstretched arm[4,5] and is the result of a direct force transmitted through the radial head that provides a shearing and/or compressive load to the capitellum and occasionally to the lateral portion of trochlea. Fracture fragments tend to displace and can migrate superiorly and unite with anterior humerus and cause mechanical block to elbow flexion by obstructing the radial and/or coronoid fossa. These fractures if left

untreated always lead to poor outcome. Furthermore, capitellar fractures may be associated with concomitant ligamentous injury (medial collateral ligament or lateral ligamentous complex tears) and an ipsilateral radial head fracture[4,6,7].

Several classifications for the fracture of capitellum have been described in the literature. Bryan and Morrey classification includes Type 1 injuries consisting of coronal shear fractures of the capitellum that had little to no involvement of the trochlea; Type 2 injuries were shear fracture of the capitellum with minimally attached subchondral bone; and Type 3 injuries were essentially comminuted fractures of the capitellum. McKee et al. subsequently added a 4th type that involved a large coronal shear fracture of the distal humerus, where the capitellum and trochlea consisted as 1 single fragment[5,8].

As the complex nature of capitellar fractures has become better appreciated[4,6,9] treatment options have evolved from closed reduction and immobilization[10,11] and fragment excision[7,12,13] to a preference for open reduction and internal fixation in order to achieve a stable anatomic reduction, to restore articular congruity, and to initiate early elbow range of motion. The purpose of the present study was to evaluate clinical, radiographic, and patient-based functional outcomes following the open reduction and internal fixation of capitellar fractures.[14,15]

Material & Methods:

This was an observational study conducted between January 2010 and December 2020 in which 16 cases of capitellar fractures were treated in Patna Medical College & Hospital by open reduction & internal fixation. Our study population consisted of 11 males and 5 females. The mean age of the patients at the time of surgery was 38 years (range 20–58). The Right elbow was more commonly affected (13:3). The mean time from presentation to internal fixation was 7 days (range, 3-16 days). Fractures were classified according to the Bryan and Morray classification system and only type I and type IV were included in the study. Fractures were initially classified based upon routine radiographs and the fracture type was confirmed intraoperative.

Surgical Technique: All cases were operated under Brachial block and/or general anesthesia. Sterile tourniquet was applied in all cases and assessment for ligament instability was done. Lateral Kaplan approach was used in all the patients. Incision was given approximately 5 cm proximal to the lateral epicondyle of the humerus; it was carried distally approximately 5 cm distal to the epicondyle along the lateral surface of the forearm. Subcutaneous tissues were dissected and retracted. Interval between the triceps posteriorly and origins of the extensor carpi radialislongus and brachioradialis anteriorly was developed.

The forearm was kept in full pronation in order to avoid injury to the radial nerve in the proximal aspect of the incision where it enters the interval between brachialis and brachioradialis muscles. The brachioradialis and extensor carpi radialis muscles along with the anterior capsule were subperiosteally elevated to create an anterior full thickness flap which was connected distally to the Kocher interval. This exposed the capitellum and the lateral aspect of the humerus. A full thickness flap was raised posteriorly which was also required for the placement of cannulated cancellous screws. Fracture site was cleared of haematoma and soft tissue debris for better identification of the fracture fragments which were reduced and fixed temporarily with Kirschner wires (K wires). In 5 cases the method of definitive fixation remained K-wires, while 6 cases were treated with cancellous screws and 5 cases were treated with headless screws.

Post-operative protocol: A long arm posterior plaster splint was applied with elbow at approximately 90^0 of flexion. After 5-7 days, active mobilization was

started in patients treated with cancellous and headless screws. In patients treated with K-wires mobilization was delayed and started after 3 weeks in hinged functional elbow brace. Strengthening exercises were started after clinical and radiological evidence of fracture union.

Evaluation of the patients post operatively was done according to the Mayo elbow performance index (MEPI). It is one of the most commonly used physician based elbow rating systems. The total score ranges from 5-100 points, with larger scores indicating better function. If the total score is included between 90 and 100 points, it can be considered excellent; between 75 and 89, good; between 60 and 74 points, fair; less than 60 points, poor[14].

Results:

Total no. of cases was 16, out of which 11 were males and 5 females. Involvement of Right elbow was found in 13 cases and left elbow in 3 cases. Fractures were classified according to the Bryan and Morray classification system. There were 12 type I and 4 type II fractures. All fractures were closed. There were no associated neurovascular injuries.

Radiological union occurred in 1 case within 6 weeks, in 3 cases between 7-10 weeks, in 11 cases between 11-16 weeks and in 1 case in more than 17 weeks. Bone grafts were not used in any of the patients. There were no instances of instability or non-union.

The mean MEPI was 87 points with 6 excellent outcomes, 7 good outcomes, 2 fair outcomes and one poor rating. The mean range of movements at elbow in flexion\extension was 125^0 (115^0- 135^0) while range of movements in pronation\supination was 170^0 (120^0-180^0). Radiologically no evidence of avascular necrosis was noted in any of the patients at 1 year of follow up. All the patients returned to their previous levels of activity.

Discussion:

In coronal shear fractures of the distal humerus after a fall on an outstretched hand, the radial head impacts the distal articular surface and shear off a variable amount of the osteo Chondral surface of the distal humerus resulting in an isolated fracture of the capitellum. Regarding the classification of capitellar fractures, type 1 (Hahn-Steinthal) involves the entire anterior capitellum, type 2 (Kocher-Lorenz) involves the entire anterior cartilaginous surface, and type 3 refers to a comminuted fracture[15]. In addition, type 4 indicates an extension into the lateral trochlea[5].

We have included only type 1 and type 4 in the study. Type 2 and type 3 fractures are treated conservatively or by excision of fracture fragments. We used the extensile lateral approach for fracture fixation. This exposure was adequate to deal with trochlear extension in type 4. A separate medial approach or olecranon osteotomy was not necessary in any of the cases. Olecranon osteotomy and medial approach are associated with higher flexion contracture rates and hardware problems associated with olecranon osteotomy necessitating revision surgery for hardware removal. The absence of such complications in our study supports lateral approach as safe exposure for capitellum fractures.

The results of our study are comparable with the previous literature as we have good no. of cases for comparison. (Table 1)

Table 1: Previous studies on capitellar fractures, number of cases studied (n), material used for fixation, assessment method, and outcome of the study with complications reported.

Study	No. of cases	Duration of follow up	Material used	Assessment method	Outcome	Complications
Ring[6]	21		Herbert screws	MEPI	12–good 5–fare 4–excellent	
Dubberlay[4]	28	56 months	Canulatedcancellous screws in type I and bone grafting in type II & III	MEPI	Overall mean score in MEPI – 91	9 osteoarthritis 3 osteonecrosis
Ruchelsman[3]	16	24 months	Herbert screws	MEPI	9–excellent 6–good 1 – fair	
Mighell[2]	18	16 months	Headless Compression Screws	BrobergMorrey	12– excellent 5– good 1 – poor	
Present study	16	36 months	K-wires, cannulatedcancellous screws & headless screws	MEPI	6–excellent 7 – good 2–fair 1 – poor	

Ruchelsman et al. and Mighell et al. have used cannulated headless compression screws for stabilization and the range of motion in flexion extension averaging around 125° with contracture less than 10° with almost full rotation[2,3]. The results with our study are nearly equal to the above with no contracture noted in any patient. The MEPI scores too are comparable. The results with Herberts screws used by Ring et al. are low with 123° flexion with an average of 27° contracture with poorer MEPI scores[6]. CC screws were also used by Dubberley et al. in Type I fractures with 144° flexion in type Ia and 124.5° of flexion in type Ib noted[4].

In our study, we have evaluated 16 patients with capitellum fractures all being unilateral. 11 out of 16 patients were male showing male predominance of the fracture. Majority of the fractures united within 12 weeks. There was no case of

AVN even though the exposure involved more soft tissue dissection and periosteal stripping. This is due to the posterior dependent blood supply of lateral portion of distal humerus. In cases treated with cancellous and headless screws active physiotherapy can be started after 1 week while in cases treated by K-wires, physiotherapy is started after 3 weeks. However it took longer time to regain full range of motion in patients with K-wire group but there was no difference in outcome in both groups at 6 months of follow up. In our experience it is not the implant but timely intervention, accurate reduction, meticulous dissection and dedicated physiotherapy decides the result.

Conclusion:

Open reduction and internal fixation is preferred mode of treatment for type 1 and type 4 capitellar fractures. Post-operative physiotherapy regimen varies with the type of implants and stability of fixation. Radiological and functional outcomes are excellent using the extensile lateral approach for surgery.

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