



Case series : Capitellum fracture treated with open reduction and Internal Fixation with Herbert Screw

Orthopaedics

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ABSTRACT

Introduction: The outcome of operatively treated capitellar fractures has not been reported frequently. The purpose of the present study was to evaluate the clinical, radiographic, and functional outcomes following open reduction and internal fixation of capitellar fractures that were treated with a uniform surgical approach.

Materials and Methods: Between December 2014 and April 2016 three patients with right sided type IV capetular fracture were treated by ORIF and internal fixation with Herbert screw . All three were male age 28 , 35 , 48 . A double arc sign in the lateral views of the X-rays of the elbow was seen in all the cases. Under tourniquet, using extended lateral approach, open reduction and internal fixation was done using Herbert screw , under vision from posterior to anterior direction from the posterior aspect of lateral condyle of humerus avoiding articular penetration.

Results: All the fractures united uneventfully. At the end of one year follow-up, two cases had excellent elbow function, there were no signs of AVN or arthritis. The third case had good elbow ROM at 11 months without AVN.

Conclusion: If capitellum fracture are treated with good operative technique and implant the results are good.

KEYWORDS:

Capitellum , Fracture , ORIF

Introduction :

Coronal shear fractures involving the capitellum represent substantial partial articular injuries that may occur in isolation, extend medially to involve the trochlea, or occur in association with complex ipsilateral periarticular elbow trauma that includes osseous or ligamentous injuries extending beyond the lateral column. There are several fracture classifications¹⁻⁴ (Fig. 1), and surgical exposure and hardware selection are based on the fracture pattern and the extent of articular involvement. As the complex nature of capitellar fractures has become better appreciated, treatment options have evolved from closed reduction and/or immobilization⁵⁻⁷ and fragment excision⁸ to a preference for open reduction and internal fixation to achieve a stable anatomic reduction in order to allow the initiation of early motion. Extensile surgical exposures and Herbert cannulated variable-pitch screws are used to address more complex fracture patterns, which may be more common than previously thought. These injuries are characterized by metaphyseal comminution and ipsilateral radial head fracture, and they often require supplemental fixation¹. Studies on the outcomes of open reduction and internal fixation of capitellar fractures¹⁻⁴ and associated injuries to the trochlea, radial head, and the lateral collateral ligamentous complex are limited , but they have demonstrated satisfactory functional results in the majority of patients when the injury is limited to the radiocapitellar compartment. We have utilized a uniform surgical approach for capitellartrochlear fractures consisting of an extensile lateral exposure, articular fixation with buried cannulated variable-pitch Herbert compression screws, and simultaneous repair of associated osseous injuries.

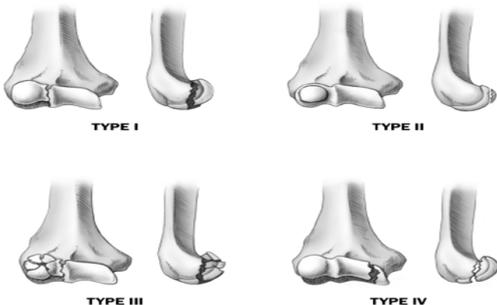


FIG. 1

The Bryan and Morrey¹ classification system. Type-I fractures are complete capitellar fractures with little or no extension into the lateral aspect of the trochlea; Type-II fractures are anterior osteochondral shear fractures with only a minimal amount of subchondral bone; Type-III fractures are comminuted or compression fractures of the capitellum; and Type-IV fractures¹ extend medially to include most of the trochlea. (Reprinted, with permission, from: Ruchelsman DE, Tejwani NC, Kwon YW, Egol KA. Coronal plane partial articular fractures of the distal humerus: current concepts in management. JAAOS. 2008;16:716-28.)

Material and Method :

This series included 3 patients from December 2014 to April 2016 after taking written consent from patients at Mahatma Gandhi Medical

College and Hospital, Sitapura, Jaipur, Rajasthan after obtaining approval from ethical committee. Patient was evaluated at pre-treatment time, then at 1 month follows up , at 3 month follows up , at 6 month follows up and finally 12th month follow up .

True AP and lateral view are taken at the time of admission. CT scan was not done due to poor economic condition of patient. All patients are given with above elbow slab pre-operatively.

Surgical technique :

All cases were operated upon under regional anaesthesia. The injured elbow was assessed clinically for ligamentous stability. A sterile tourniquet was used in all cases. The elbow was handled through an extensile lateral approach. A skin incision was centred over the lateral epicondyle extending from the anterior aspect of the lateral column of the distal end of the humerus to approximately 2 cm distal to the radial head. Following dissection through the subcutaneous tissue layers, the lateral column was palpated. The forearm was pronated to move the radial nerve away from the surgical field. A flap was raised by elevating the common extensor origin along with the anterior capsule and connected to the Kocher interval distally. This resulted in a continuous full-thickness anterior soft tissue flap. The fracture site was debrided of haematoma and soft-tissue debris to allow visualisation of the fracture fragments. Saline irrigation was used to achieve greater clarity.

In patients with a lateral epicondylar fracture fragment, the epicondylar fragment with the lateral collateral ligamentous complex origin was reflected distally to enhance exposure. Fracture fragments were reduced and provisionally fixed with K-wires. The terminally threaded Herbert screws, directed posterior to anterior were used to fix the fracture. The distal thread was buried beneath the articular surface. With an exception of very small fragments, we used two screws to fix the fracture. In cases of non-union, augmentation with bone graft from the ipsilateral olecranon was done. Supplemental fixation with mini-fragment screws or Kirschner wires was used to reconstruct more complex fracture patterns with lateral metaphyseal comminution and/or trochlear extension. The radial wrist extensors were repaired to the soft-tissue cuff on the lateral supracondylar ridge, and the Kocher interval was closed in continuity with the proximal exposure of the lateral column. The remainder of the wound was closed in layers.

Postoperatively, the elbow was immobilised in a splint for four to six days following which range of motion exercises were initiated under supervision. Patients were followed up at regular intervals and clinico-radiological evaluation was done. The condition of bone union, evidence of avascular necrosis on radiographs, wound healing problems or other complications, if any, were recorded. Stability, pain, and range of motion of the elbow joint were evaluated according to the

Mayo elbow performance score.

Case I:

28 year male sustained injury to his Right elbow when he fell on the flexed elbow while getting out of a vehicle . Subsequently, he presented in the orthopaedic clinic, after 48 hours, with pain and swelling of the right elbow, and limitation of flexion. There was tenderness of the lateral aspect of the elbow. A true lateral and AP view showed the "double-arc" sign (**Fig 2 a**) and diagnosed with type IV capitellum fracture

The patient underwent open reduction through an extended lateral Kocher's approach, and the fracture was fixed with two Herbert screws (**Fig 2 b**), from anterior to posterior . He regained a full range of movements in final follow up .



Fig. 2 a : Lateral and AP View of right elbow Showing type IV capitellum Fracture



Fig 2 b : Post op. x-ray right elbow showing capitellum fracture fixed with two Herbert Screws

Case II

35 year male sustained injury to his Right elbow after a fall from a motor cycle and presented in Emergency department with pain and swelling of the right elbow, and limitation of flexion. There was tenderness of the lateral aspect to the elbow. A true lateral and AP view showed the "double-arc" sign (**Fig 3 a**) and diagnosed with type IV capitellum fracture.

The patient underwent open reduction through an extended lateral Kocher's approach, and the fracture was fixed with two Herbert screws (**Fig3 b**), from anterior to posterior . He regained a full range of movements in final follow up .



Fig.3 a :Lateral and APview of rith elbow showing type IV capitellum fracture



Fig. 3 b: Showing capitellum fracture fixed with 2 herbert screws in PA direction

Case III

48 year male sustained injury to his Right elbow after fall from height, after he fell on the out-stretched hand and presented in Emergency department with pain and swelling of the right elbow, and limitation of flexion. There was tenderness of the lateral aspect to the elbow. A true lateral and AP view showed the "double-arc" sign and radial head fracture (**Fig 4 a**) and diagnosed with type IV capitellum fracture.

The patient underwent open reduction through an extended lateral Kocher's approach, and the fracture was fixed with two Herbert screws (**Fig4 b**), from anterior to posterior and radial head fracture was too small to fix so excised and elbow was stable post operatively . He regained a full range of movements in final follow up .



Fig 4 a : Lateral and AP view of right elbow showing type IV fracture of capitellum and Fracture of radial head



Fig. 4 b : Showing capitellum fracture fixed with two herbert screws in AP direction

Results :

All three patients were males. The right side was involved in three cases . The dominant limb was involved in all cases. All cases are

classified as Bryan and Morrey Type IV .. The mean operative time was 12 hours (range 8–20 hours). Peroperatively, in one case, capitellum fragments were found free and devoid of soft tissue attachments. These were replaced, fixed and showed good union in due course. No intraoperative or postoperative complication was encountered. The mean extension of the elbow was 7.5° (range 0°–20°) and the mean flexion was 132° (range 128°–135°). All patients had full pronation and supination. All patients had good stability, and none had residual pain. Overall, results were found to be excellent.

Follow-up at 1 month follows up , at 3 month follows up , at 6 month follows up and finally 12th month follow up .All patients were satisfied with the operative outcome and returned to their previous levels of activity.All fractures healed well. No evidence of avascular necrosis of the fragments was noted and no incidence of osteoarthritis has been noticed so far.

Discussion :

Proper visualization of the capitellar fragment is sometimes not possible in the routine views of the elbow and a radial head- capitellum view may help in better delineation of the fracture personality. [9] Properly positioned lateral view is essential for diagnosis, with the fracture easily missed if the projection is slightly oblique as per Fowles and Kassab.[10] A comparative view of the opposite elbow or CT scan will help in diagnosis. A properly taken lateral view usually shows anterior and superior migration of the capitellar fragment. Characteristic finding in the lateral X-ray is the "double arc sign" because of the sub-chondral bone of the capitellum and lateral part of trochlea. The sub-chondral bone of the trochlea creates the double arc and when this sign is present it signifies that a part of the trochlea is also involved.

Radiological diagnosis is difficult in a child because the capitellum is not fully ossified and fused before the age of 9-10 years. [11] Other authors have suggested an oblique radiograph to detect this injury. [11]In case of difficulty, in interpreting the radiographs, an arthrogram may be done. [11] Fractures are often missed in the emergency room setting as the outline of the distal end of the humerus is intact. One case was missed in this series in the emergency room. A CT scan delineates the fracture extent more clearly and helps the surgeon plan the approach, since, if the fragment is displaced on the medial side, another medial approach may be needed for reduction.

Treatment of type 2 and 3 capitellum fractures can be either conservative or excision of the fragments. [13] Ochner reported, in 1996, successful outcome of closed reduction of coronal fractures of the capitellum in nine cases with long term follow-up. [12] In none of our cases closed reduction was attempted even before open reduction. Closed reduction of the fracture can lead to early arthritis, loss of motion of the elbow or instability of the elbow as it is usually a non anatomical reduction. [14]

Excision of the fragment can lead to instability of the elbow. Excision to prevent avascular necrosis is suggested by few authors. [15] Fragment excision due to fear of avascular necrosis or redisplacement can lead to radio-humeral osteoarthritis and instability of the elbow. Alvarez advocated excision of the fragment in 10 out of 14 cases

Approaches described include lateral approach (Modified Kocher approach), [15] posterior approach with olecranon osteotomy. [15] Sano [15] advocates olecranon osteotomy approach for proper visualization of the trochlea, but in the present series by retracting the medial structures with a bone lever the entire medial aspect of the trochlea could be visualized. The authors [15] found the olecranon osteotomy approach useful if the trochlea also need to be fixed. Screws inserted from posterior to the anterior (PA) direction have more bio-mechanical stability than antero-posterior screws and this prevents damage to the articular cartilage. Moreover, purchase of screw threads in the sub-chondral bone is more in PA directed screws, and splintering of the sub-chondral bone due to countersinking is less. Lateral collateral ligament has to be preserved during the procedure.

Various internal fixation methods have been described, including K wires, [13],[15] 4 mm cancellous screws, Herbert screws [11],[14] and absorbable polyglycide pins. [22] There are also reports of plate fixation of the fracture. Kirschner wires do not provide enough stability for mobilization before fracture healing and also damage the articular cartilage. [13] The better functional outcome of operative fixation has

been documented. We used Herbert screw and get excellent results .

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