



A Study of Outcome of Distal Humerus Fracture Fixation by Various Methods.

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ABSTRACT

Background : Distal humeral fractures in adults often pose a challenge to the orthopaedic surgeon. The chevron modification of the olecranon osteotomy affords excellent surgical exposure of the joint surface for fractures with an intra-articular component. When two plates are used to fix the lateral and medial distal humeral columns, it is best to orient them so that, when looked at in cross section, they are at right angles to each other. The achievement and maintenance of an anatomic reduction secure enough to permit early functional, pain-free motion of the elbow can be best ensured by open reduction and internal fixation with careful attention to detail.

Aim : To evaluate anatomical and functional outcome and impact of fixation related complications after fixation with two approaches of distal humerus fracture & to know which technique is better for stable fixation and early mobilisation.

Material & methods : A prospective study of 30 cases of comminuted supracondylar / intercondylar fracture of distal humerus of Riseborough & Radin type III & IV treated with two standard approaches and hardware.

Results : we studied patients between 18 years to 70 years of age with mean age 52 years. Among them 15 were male patients and 15 were females. We observed paratricipital approach good for extra-articular and partial articular & olecranon osteotomy approach for intra-articular distal humerus fractures. Mayo elbow performance score good to excellent for both approaches with rigid fixation with dual plating with early mobilisation and minimum post operative complications.

KEYWORDS :: Distal humerus fracture, mayo elbow score

Distal humerus fractures are uncommon injuries that account for fewer than 2% of all adult fractures. The complex shape of the elbow joint, the adjacent neurovascular structures and the sparse soft tissue envelope combine to make these fractures difficult to treat. Treatment, both surgical and non surgical has been associated with a high rate of complications and poor outcomes, when compared with other injuries.

The principle of anatomic restoration of articular surface, stable fixation and early motion are the optimal treatment goals. Recent treatment supports these goals and early postoperative active mobilization. The fabrication of new implants, however, has increased the reliability of operative stabilization, while placing additional demands upon the surgeon's expertise.

In this study, we have reviewed the functional results obtained in a series of supracondylar intraarticular fracture of the distal end of humerus treated by open reduction and internal fixation with various approaches.

MATERIALS AND METHODS

Prospective study of 30 cases of comminuted supracondylar / intercondylar fracture of lower end of humerus was studied. Patients between 18-70 years of age, who have completed minimum of 6 months post operative follow ups, were included in study. Patients with vascular and brachial plexus injury were excluded from study.

Preoperative planning included high quality AP and lateral x-rays of elbow of affected as well as normal side. Supracondylar intercondylar fractures of distal humerus was classified according to Radin & Riseborough¹ classification. A detailed neurovascular examination as well as the status of patient's compartments of arm & forearm is documented. In a fracture with extensive comminution, bone graft was planned. We have operated intercondylar fracture as early as possible, when general condition is fit for anesthesia. Muller² classification of distal humeral fracture is part of the AO scheme but due to complexity not implemented.

OPERATIVE TECHNIQUE:

We performed two approaches which depend upon type and severity of fractures.

- (1) O'Driscoll³ combined medial (triceps-reflecting) paratricipital and lateral (modified Kocher) paratricipital approach (Alonso-Llames)⁴

We used the TRAP approach for exposure of the elbow as described by O' Driscoll *et al* . A straight posterior incision was made just lateral to the olecranon tip, approximately 10 cm proximal and 8 cm distal. Medial and lateral skin flaps were raised to expose the supracondylar ridges on either side of the distal humerus. The ulnar nerve was first localized proximally where it emerged beneath the triceps tendon. The distal aspect of the intermuscular septum was released to increase the mobility of the ulnar nerve. Its branches to the flexor carpi ulnaris were carefully preserved. Laterally, the flap was elevated to expose the interval between the anconeus and the extensor carpi ulnaris. The anconeus-triceps flap was detached from its distal attachment (5-7 cm from the tip of olecranon) and dissected off the lateral side of the elbow and proximal ulna, preserving the integrity of the lateral collateral ligament complex, including annular ligament. The posterior capsule was incised and the dissection was carried out proximally between the triceps and posterior humerus. The fibers of the deep head of the triceps were dissected off the posterior humerus by sharp and blunt dissection.

- (2) Trans olecranon approach (Chevron v shaped osteotomy)

A 3.2-mm drill is used to make a pilot hole for seating a 6.5-mm cancellous lag screw for fixation of an olecranon osteotomy. The hole is tapped until good torsional resistance is encountered, at which point the depth of insertion of the tap is measured to guide later selection of screw length. The lateral and medial aspects of the waist of the olecranon are defined down to the margin of the articular surface. A Freer elevator is used to protect the articular cartilage surface while making a chevron-shaped osteotomy with a thin oscillating saw. The osteotomy is completed with a thin, sharp, fine-tipped osteotome (the apex of the chevron cut points distally). Once the remaining capsular attachments at the margin of the proximal olecranon have been cut, the tip of the olecranon and the attached triceps-tendon insertion are retracted proximally, lifting the triceps off the posterior aspect of the humerus and thereby affording a clear view of the fracture, including its articular portion. The ulnar and radial nerves are protected and simultaneously further isolated and delineated as

necessary. The olecranon is exposed and anconeus muscle is partially lifted from the radial side of the ulna to expose the lateral edge of the trochlear fossa. If an osteotomy has been utilized, repair is performed with a 6.5-mm diameter cancellous screw over a washer. A figure-of-eight wire loop can be used to supplement the fixation.

Nonarticular Fractures

Fixation of nonarticular type of fractures is dictated by the fracture pattern. As mentioned previously, when two plates are used (one on each of the distal humeral columns), their orientation should be at 90 degrees to each other in cross section. The use of lag-screw fixation when the fracture pattern permits is advisable, but due to the thinness of the bone at the olecranon fossa, this is sometimes not feasible (e.g., if the screw protrudes into the olecranon or the coronoid fossa, the olecranon or coronoid will impinge on it and block elbow motion). With low medial-column fractures, the plate (e.g., the flattened end of a one-third tubular plate) may be contoured around the medial epicondyle so as to permit the placement of an interfragmentary lag screw that addresses the medial-column fracture line (Fig.8). If the fixation device impinges on the cubital tunnel in this fashion, it is necessary to do an ulnar-nerve transposition to keep the nerve from being irritated or compressed.

Intra-articular Fractures

The intra-articular components are usually addressed first. Reduction is accomplished under direct vision and can be provisionally held with one or more Kirschner wires. Definitive fixation is achieved with use of a lag screw, placed either independently or through a hole in a contoured plate, depending on the fracture pattern. A cannulated screw can be used to advantage when low medial- or lateral-column fractures prompt lag-screw placement through the end hole of a contoured plate. The guide pin is then placed, and a hole is drilled at the end of the aluminum template. The template is pressed against the bone surface with the guide wire through the drilled hole. The template is then used to guide the contouring of the plate. The use of soft tissue protection sleeves and/or an oscillating drill attachment will help ensure avoidance of injury to the neurovascular structures during the course of the procedure. Provisionally fixed low articular fractures may need to be reduced to the shaft fragments and held temporarily, depending on whether the preoperative plan calls for screws to be situated at the end of the plate in the articular fragment. For most T- or Y-variety type C fractures, one plate is situated medially along the medial column. A second plate is situated on the posterior aspect of the lateral column; this plate can extend as far distally as the posterior aspect of the capitellum. The intra-articular fracture line is compressed with either a separate lag screw or a lag screw from an end hole in one of the plates. When there is a segmental articular fragment (Fig. 9), the reduced fragment can sometimes be advantageously secured with a differential-pitch bipolar threaded screw (e.g., a Herbert screw) or an interfragmentary screw with the head situated (by countersinking) just below the articular surface level. Care must be taken to avoid interfering with the position of the main interfragmentary lag screw. Screw cannulation and sighting down the guide pin with a C-arm fluoroscope to verify proper positioning may be advantageous. (Figure 1)

OBSERVATION

Ours was a prospective study including 30 patients with minimum age of 18 years and maximum age was 70 years. 9 (31%) patients were above 60 years. Occurrence of fracture was same in males and females. Housewives were affected commonly (11 patients, 36.6%) followed by laborers' (7 patients, 23.8%). 16 (53.4%) patients suffered injury by fall on elbow while 14 (46.6) patients met with vehicular accidents. 17 patients suffered left elbow injury while 13 suffered right. 25 patients presented within 3 days after injury while 5 presented within a week. Most of the patients presented early due to pain and disability. 26 patients were having closed type of fracture while 4 patients were having compound type 2 fracture. Type III fractures (T shaped fracture with separation of fragments and significant rotatory deformity) were 23. Type IV fracture (T shaped fracture with severe comminution of articular surface and wide separation of humeral condyle) were 13 in present series. Patients have no other injuries while 4 patients had lower end radius fracture, one patient had ulnar fracture, 1 patient had calcaneus fracture, and 1 patient had abdominal injury. All patients were operated within a week after trauma, while 21 (70%) patients were operated within 72 hours.

87% of fractures were fixed with plates and screws, 3% of fractures were fixed with screws and K wires and 10% of fractures were fixed only with K wires. In 28 (93 %) patients ORIF was done through O'Driscoll paratricipital triceps on approach, while in 2 (7%) patients it was done through posterior trans olecranon approach. Postoperative mobilization of the elbow was started within 1-3 weeks in 12 (40%) cases, within 3-6 week in 17(56.7%) cases, and after 6 weeks in 1 (3.3%) cases in our series. 56.9% of patients had complications following surgery, among them 7 patients developed infection of wound for which they required daily dressing and antibiotics. 2 patients had ulnar nerve palsy, 2 patient had nonunion and 2 patient had malunion leading to cubitus varus deformity and 4 patients had implant failure. Range of motion gained after operation were excellent in 7 patients (23.8%), good in 15 patients (50.2%), fair in 4 patients (13%) and poor in 4 patients. 19 (63%) of patients could go back to their pre injury work within 6 months, 4 (13%) could go to work after 6 month and 7(23.8%) were not able to do work. Almost all fracture 24 patients (80%) were united as seen in last follow-up x-ray, 2 patients had nonunion, 2 patients had malunion, 1 patient had irregularity of joint surface and 1 patient had arthritic changes.

Table 1 show that 66.6% of patients were satisfied, 13.4% of patient had accepted the fair results of operation and 20% of patients were not satisfied because of restricted elbow movement. In present series excellent results in 9 cases, good results in 11 cases, fair results in 4 cases and poor results in 6 cases. Excellent results found in 9 cases where all fractures are closed type and these patients were operated within 72 hours, all fractures were fixed with bipolar plates and screws. In fair results most patients were closed type III or IV fracture, fixed with plates and screws, but active mobilization and exercise were started late around more than three weeks. So final outcome of range of motion of elbow joint is fair.

DISCUSSION :

The management of intercondylar fractures of humerus has progressed from conservative approach in form of cuff and collar sling, olecranon pin traction, closed reduction and pinning, closed reduction and plaster immobilization to the modern era of operative management in form of open reduction and rigid fixation, and further advancement in form of total elbow arthroplasty.

Triceps-splitting, triceps-reflecting and olecranon osteotomy are the most common posterior surgical approaches to the adult elbow. In the TRAP approach the dissection is in the internervous planes and hence muscle injury with resultant fibrosis and injury to intramuscular nerve branches are avoided with this approach.

Even with modern available operative facilities the management of supracondylar intercondylar fracture has been an enigma for an orthopaedic surgeon because the achievements of perfect articular congruity is difficult. This leads to an inevitable restriction of elbow movement at varying degrees.

It is generally thought that a posterior surgical approach provides optimal exposure of the intraarticular aspect of the distal part of the humerus and the olecranon osteotomy is the gold standard against to which other approaches are compared mostly.

Average age in our study was 60 years while it was 57 years in Jupiter series and 32 years in Bradford series. This suggest that intercondylar fractures are more common in middle and old aged patients. This is because of osteoporosis of bone, weakened metaphyseal bone and poor bone stock. So intercondylar fracture are easily caused by minor trauma like fall on elbow in middle and old age.

Table 1: Patient's satisfaction (According to Mayo's Elbow Score)⁵

Patient's satisfaction	Cases	Percentage
Well satisfied	10	33.3%
Satisfied	10	33.3%
Accepted	4	13.4%
No satisfied	6	20.0%
Total	30	100%

Figure 1 : pre and post op x-ray.



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