

Study of Bicolunar Supracondylar and Intercondylar Fractures of Distal Humerus Managed by Orthogonal Plating

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Abstract

Background: Supracondylar and Intercondylar in fractures of distal humerus are one of the common and complex fractures encountered in trauma care with a challenging management in terms of surgical approach as well as attainment of acceptable congruity of joint for proper elbow joint function. The aim of the study was to access the outcome of bicolumnar supracondylar and intercondylar fractures of distal humerus managed by orthogonal plating. **Materials and method:** This study was carried out under the Department of Orthopaedics, S.R.G. Hospital and Jhalawar Medical College, Jhalawar (Rajasthan). The study comprised of 15 patients 11 males and 4 females (fracture type, c1 - 9 cases, c2 - 4 cases, c3 - 2 cases) of supra and intercondylar fracture of distal humerus treated by orthogonal plating of both medial and lateral column of supracondylar humerus with olecranon osteotomy. all cases intra operative range of the motion was 100%, with appreciable stable fixation. **Results:** Results were analysed by mayo elbow performance index (MPEI) and Out of 15 patients 9 had excellent outcome, 5 patients had good outcome, 1 case fair results were obtained due to poor bone stock and compliance. **Conclusion:** The posterior trans-olecranon approach gives excellent exposure of the distal articular surface of the humerus. Use of bicolumnar orthogonal plating is found to be successful method in obtaining the desired results if performed with expertise.

Keywords: Supra Condylar Intercondylar; Trans Olecranon; Bicolunar; Orthogonal Plating.

Introduction

Supracondylar and Intercondylar fractures of distal humerus are usually as a result of high energy trauma and therefore have a complex presentation. They comprise of approximately 30% of all elbow fractures [1].

In elderly cases a low energy trauma may also present with these kinds of fractures owing to the osteoporotic bones.

These fractures are often complex, traditionally used methods of k-wire fixation and conservative methods needing prolonged cast immobilization are now out dated due to associated complications

like joint stiffness, muscles atrophy, mal union etc.

These days ORIF with bicolumnar plating is considered to be ideal treatment option when aided with multiple techniques to expose the joint in order to achieve acceptable joint congruity, with restoration of functional bone axis and a stable fixation in order to set early mobilization [2-4].

Although nonconstructable fractures especially in elderly may be treated by total elbow replacement as its treatment of choice [5,6]. Adequate exposure of the articular surface of the distal humerus and elbow joint is required for operative stabilization of supracondylar humerus fracture, these are multiple technique described like, transolecranon approach,

triceps splitting approach, triceps reflecting approach, triceps reflecting anconeus pedicle graft (TRAP) technique. However, transolecranon approach which provides complete posterior visualization and access to the distal humerus is most commonly used surgical approach [7].

The technique of orthogonal bicolumnar plating may be the best therapeutic option for management of complex supra and intercondylar fracture of distal humerus particularly in selected patients with fragility requiring multiple points of fixation in various planes [8-10].

Aims and objective: The objective of this study was to ascertain the clinical results of Supracondylar and Intercondylar fractures of distal humerus treated by orthogonal bicolumnar plating.

Materials and methods

This study was carried out Under Department of Orthopaedics, S.R.G. Hospital and Jhalawar Medical College, Jhalawar (Rajasthan) from January 2016 to January 2018.

The study comprises of 15 patients (11 males and 4 females) between age group 20-60 years, with Supracondylar and Intercondylar fracture of distal humerus treated with ORIF with bicolumnar plating by transolecranon approach.

The inclusion criteria for the study was:-

- 1) AO Type |c₁|c₂|c₃
- 2) Closed fracture's and Gustilo-Anderson type 1 and 2.
- 3) Fresh cases presenting within a week of trauma.
- 4) Those without any associated neurovascular injuries.
- 5) Those without any other associated comorbidities.

Preoperative planning: all the patients were subjected to thorough assessment including recording of history, physical examination pre anaesthetic workup and patient compliance.

AP, lateral and oblique radiographs were obtained and in selected cases CT scan was also done.

Surgical technique: After obtaining the consent the patient was then taken under general anaesthesia or intra scalene block and was placed in lateral decubitus position with side to be operated over the

supporting arm rest with forearm hanging. A skin incision over posterior aspects of arm starting approximately 8 cm proximal to tip of olecranon running longitudinally and medially on posterior surface of elbow to about 5cm distal to apex of olecranon was given.

At the medial edge of the triceps, the ulnar nerve was isolated, it was released from cubital tunnel and protected by a loop to set it aside.

Olecranon osteotomy as described by chevron [11] was performed to expose the joint posteriorly.

The intercondylar fragments were analysed and subsequently held in reduction with reduction clamps to form a single distal fracture fragment with was initially fixed with k-wire followed by fixation with 4mm c-c screw.

Then the single distal fragment formed was fixed to the supracondylar proximal part. bicolumnarly, fixing the medial column on medial surface and lateral column on posterior surface using either recon plates or 1/3rd tubular plates with appropriate contouring.

Bones grafting was not required in any of the case performed.

The olecranon osteotomy performed was fixed by tension band wiring.

Finally the ulnar nerve was repositioned and on table range of motion was examined.

The incision was closed in layers with especial attention to avoid any ulnar nerve entrapment.

A well-padded above elbow slab with elbow in 90° flexion was given, check dress was done and ROM exercises started after removing the slab at 5th day and stiches removed by 15th day, follow-up done at 6th 10th and 14th weeks

Follow up and assessment: Patients were followed up at 14th week for final assessment of outcome which was graded as per the mayo elbow performance score or index (MEPS/MEPI) 12

The Mayo Elbow Performance score (MEPS) or MEPI (Mayo Elbow Performance Index) is an instrument used to test the limitations to use the elbow during ADL caused by the pathology. This specific test uses 4 subscales, namely

1. pain,
2. arc of motion of the art.
3. humeroulnaris stability
4. disorders in ADL.

Technique:

MEPS is a 4 part test where clinical information is rated based on a 100 points scale.

Part 1: Pain

- no pain - 45 points,
- mild pain - 30 points,
- moderate pain - 15 points and,
- severe pain - 0 points

Part 2: Arc of motion

- >100° flexion - 20 points,
- 100°- 50° flexion - 15 points and
- < 50° flexion - 5 points

Part 3: Stability

- elbow stable - 10 points
- mildly unstable elbow - 5 points.
- Unstable elbow - 0 points

Part 4: ADL (Activities of daily life)

Based on 5 ADL's who are each given 5 points if patient is able to do them and scored 0 points if they are not comfortable

The activities are:

- a. combing your hair,
- b. performing personal hygiene,
- c. self eating
- d. putting on shirt
- e. putting on shoes.

The results are calculated out of a maximum of 100 points after adding the score obtained from each of the 4 parts and can be put into 4 groups as follows:

- 91- 100: excellent
- 90 - 81: good
- 80 - 71: fair
- - 70: poor

The 1st and 3rd part is scored as per the patients answering while part 2nd and 4th are analysed by the therapist and scored accordingly.

Evidence

Turchin et al. [13] described the MEPS as: "The Mayo elbow-performance index had a clear format. The associated costs were low because only a goniometer was necessary. Little training was needed, and the system was suitable for

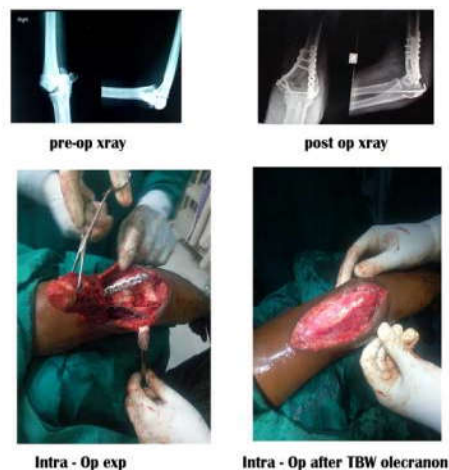
use in a clinic. Neither strength nor deformity was included in the content of the scale, and motion was assessed only in terms of flexion and extension. The scaling was ordinal and seemed appropriate. Function and motion were weighted less heavily than pain."

Results

15 patients (11 males and 4 females) enrolled in this study were with fracture type, c₁- 9 cases, c₂- 4 cases, c₃- 2 cases, in all cases intra operative range of the motion was 100%, with appreciable stable fixation.

The results were analysed by mayo elbow performance index as described previously

Out of 15 patients all 9 c₁ cases had excellent outcome with nearly complete range of motion at 14 week follow up almost no to mild pain and a stable joint, 5 patients [4 c₂ and 1c₃] had good outcome with average arc of motion 100° (range 45°-135°) mild to moderate pain and a stable joint, in 1 case fair result was obtained with only 70° of flexion, moderate



Case illustration: 45 year old male with right sided involvement

pain and relatively unstable joint due to poor bone stock and compliance.

Discussion

Distal humerus represented by 3 column model triangular system of lateral, medial and intercondylar (transverse) column as the parts [14], and thus the stability depends upon this system.

The ORIF remains the standard of care in the treatment of intra-articular distal humerus fractures in the physiologically active patient [15,16,17]. The treatment of distal humeral fractures is labor-intensive, complex and, expectedly, there is a high incidence of complications [18]. Severe comminution, bone loss, and osteopenia predispose distal humeral fractures to unsatisfactory results due to inadequate fixation [19,20].

Orthogonal plating techniques evolved after a publication by Jupiter and colleagues in 1985, reporting on patients having successful outcomes with ORIF of distal humerus fractures [21]. They noted that the key to surgical success was obtaining enough bony stability to permit early range of motion. This usually required the utilization of two plates, one on the medial column and the other on the lateral column [21].

It became accepted that Kirschner wire fixation alone did not provide adequate stability to treat bicolunar distal humeral fractures [22,23]. In addition, Waddell and colleagues have shown that elbow immobilization of three to four weeks post-operatively leads to unacceptable stiffness [24].

In contrary to the study by Kumar et al. [25] he used 4.5 mm single LCP with 4 cortices purchase screw for fixation we used a combination of either 2 reconstruction plates (3.5mm) or combining recon plates with conventional 1/3rd tubular plates positioned in 90° although studies by Shin et. al in 2010 and Lan et al. in 2013 reports no difference in parallel and 90° position of these plates [26,27]

In contrary to Joshua M. Abzug et al. [28] who concludes that Parallel plating may be the preferred technique utilized for very distal fracture patterns since more stability can be obtained by providing additional screws in the distal fragment. And Orthogonal plating may be preferred in cases of an anterior shear fracture where the fixation from posterior to anterior will provide additional stability to the intra-articular fractures. We prefer 90° plating as a better resort for the attaining fixation owing to triangular framework.

Use of third additional posterolateral plate to increase the rigidity of fixation as described by Jupiter JB et al. was not done in any of the case as adequate purchase of the cortex with stable fixation was attained in all cases by orthogonal plating itself [29].

In 1969 the trans-olecranon approach was popularized by Cassebaum [30] though MacAusland had described the technique as early as in 1915. There are several modifications to this technique, such as the chevron-shaped osteotomy, commonly advocated by the AO group [31]. The chevron osteotomy increases rotational and translational stability at the time of surgery and increases the contact area for achieving the bony union

None of the case with transolecranon approach reports with non union observed by Ring et al. [32]. Gofton et al. recommended utilizing a contoured 3.5 mm reconstruction plate to fix the olecranon osteotomy provide the most reproducible results as Their series had no nonunions and no isolated procedures for hardware removal [33].

In our study The olecranon osteotomy is preferably fixed by two parallel K-wires passed obliquely into the proximal ulnar anterior cortex below the coronoid and fixed by tension band wiring, with two tightening loops and bend wires that are pushed until they are buried under the triceps tendon and it reported no non-union cases and therefore plate to fix olecranon was not used.

Conclusion

The management of supra condylar intercondylar fracture of distal humerus are often challenging owing to complex nature of fracture, with adequate congruity of fragments as a must to ensure acceptable range of motion. The key to successful treatment of these fractures is obtaining anatomic reduction with stable fixation to allow early range of motion. Performing anatomic reductions while minimizing soft tissue trauma will lead to improved patient outcomes while minimizing the complication rates. The posterior trans-olecranon approach gives excellent exposure of the distal articular surface of the humerus. Use of bicolunar orthogonal plating is found to be successful method in obtaining the desired results if performed with expertise. The olecranon osteotomy is preferably fixed by two parallel K-wires passed obliquely into the proximal ulnar anterior cortex below the coronoid and fixed by tension band wiring in figure of eight shape and bend wires that are pushed until they are buried under the triceps tendon.

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