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Original Research Article

Study of surgical management of closed diaphyseal fractures of humerus in adults by open reduction and internal fixation with dynamic compression plate and screws

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Abstract

Background: In this modern age, fractures of humerus are on an increase & the management of these fractures also form an important part of orthopaedic management. Fractures of Humerus are accounts for nearly 3% of all fractures. The present study is an attempt to study the advantages & disadvantages of open reduction internal fixation using dynamic compression plate with screws for fracture shaft of Humerus, analyze the results & compare with the standard studies.

Materials and Methods: This study is a hospital based prospective study centered in Department of Orthopaedics at Indira Gandhi Government General hospital and Post Graduate Institute, Puducherry, from September 2010 to September 2012 in which 30 patients with diaphyseal humerus fractures are treated with dynamic compression plate and screws.

Results: Patients were regularly followed-up post-operatively. Thirty cases were available for follow up. Excellent results were seen in 17 patients, good results in 8 patients, fair results in 2 patients and poor results in 3 patients.

Conclusion: Open reduction and internal fixation with dynamic compression plate and screws gives better functional and anatomical results in diaphyseal humerus fractures. The successful use of dynamic compression plate for diaphyseal humerus fractures requires careful assessment of fracture pattern, appropriate patient selection, meticulous surgical techniques appropriate choice of fixation, judicious augmentation with internal fixation, careful post-operative monitoring and aggressive early institution of rehabilitation. The final functional result of treatment of diaphyseal humerus fractures not only depends of on anatomical reduction but also depends on surrounding soft tissue injuries and mobilization.

Keywords: Diaphyseal humerus fractures, dynamic compression plate, screws

1.Introduction

In this modern age, fractures of Humerus are on an increase & the management of these fractures also form an important part of orthopaedic management. Fractures of Humerus accounts for nearly 3% of all fractures[1].

Unlike fractures of other bones, there is no overriding, on the contrary there is adanger of delayed union or non-union, as the weight of the limb will act as a distracting force. Although most of

humeral shaft fractures can be managed conservatively with Good to excellent results, the matter of consideration is of maintaining their alignment, length, rotations & early mobilization of the neighbouring joints.

Open reduction & internal fixation with dynamic compression plate gives following Advantages:-

a. The reduction is done under direct vision

- b. This is a method of achieving a stable fixation with almost perfect reduction.
- c. Good reduction is achieved & maintained as the plate is placed on the tensile side. The muscle tone provides compression at the fracture site.
- d. Rotatory instability is prevented.
- e. Cost effectiveness.
- f. Clean & sterile operation theatres with good antibiotics have decreased the chances of infection.
- g. As there is no need for C- arm the medical staff has no radiation hazards.
- h. The limb can be mobilized early & joint stiffness as well as muscle contractures can be minimized.

The present study is an attempt to study the advantages & disadvantages of open reduction internal fixation using dynamic compression plate with screws for fracture shaft of Humerus, analyze the results & compare with the standard studies.

2. Materials and Methods

This present study includes 30 patients of diaphyseal fractures of humerus in adults treated with open reduction internal fixation with dynamic compression plate and screws admitted to Indira Gandhi Government General hospital and Post Graduate Institute, Puducherry, from September 2010 to September 2012. We excluded patients with age >65 years, pathological fractures, malunited, compound and infected fractures and medically unfit patients from our study.

Assessment of diaphyseal humerus fractures was done with reference to skin condition (closed / open fracture), peripheral circulation, neurologic examination especially radial nerve, compartment syndrome and associated injuries.

Diagnosis is confirmed through anterior-posterior and lateral radiographs of injured humerus. Diaphyseal fracture of Humerus were classified according to Klenerman classification[2]. Basic investigations like Haemoglobin%, blood grouping and typing, random blood sugar, urine analysis, were performed. In the preoperative period splintage with above elbow POP slab and was carried out which facilitate fracture reduction and precision of dynamic compression plate and screws.

2.1 Surgical Technique

Under the effect of general anesthesia the patient was placed supine on the operation table. No tourniquet was used. An intravenous antibiotic in the form of 1gm of ceftriaxone was given before the start of the procedure. The arm, Forearm, hand was scrubbed with Betadine scrub and was painted with betadine and spirit and then draped. The limb was placed on side board. Open reduction and internal fixation of the fracture was done by using antero-

lateral[6] and posterior approach[7]. Taking care not to injure vessels and nerves the dynamic compression plate is fixed with screws. Reduction and fixation is verified under fluoroscopy. At the end of procedure above elbow slab was given to all patients. Intra venous antibiotics are administered for five days and then it is converted to oral antibiotics for next five days.

2.2 Post Operative Care and rehabilitation

Check X -rays were taken in both antero-posterior and lateral views on postoperative day one. The reduction of the fracture was confirmed and any displacement of fracture was studied. Active exercises of wrist, fingers and thumb were commenced from the day of operation. Second postoperative day the dressing were removed. The patient was educated regarding pop care.

The patients were called for inspection and dressing change at the interval of one week for the next 4 weeks. The patient was assessed subjectively for pain at the fracture site, clinically for tenderness at fracture site. Suture removal was done after 10 days. U-slab was removed after four weeks and shoulder and elbow, forearm and wrist range of movements exercises are advised. Elbow and shoulder range of movements are recorded and documented on every visit after four weeks. All cases are followed after 4th week, 8th week, 12th week and 6 months.

3. Results

The age of the patients in the study ranged from eighteen years to sixty three years, average being 36.6year. 24 patients are male (80%) and 6 patients are female (20%). Out of 30 patients 28 patients direct injury and 2 patients sustained indirect injury. Sixteen were right and fourteen were left sided fractures. Among the 30 patients classified according to L.KLEIRMAN'S one had fracture in the Upper third [Type I], Two had fracture at the junction of Upper & Middle third [Type II], Seventeen had fracture of the Middle third [Type III], Ten had fracture at the junction of the Middle & Lower third [Type IV] & none of the fracture were present in the Lower third Type [V]. Among patients, two patients had fracture ipsilateral both bone of forearm, one patient had ipsilateral femoral shaft & Contralateral tibia shaft fracture, in one patient there was ipsilateral femoral shaft fracture with brachial plexus injury, Four patients had radial nerve palsy. All the patients are followed till six months.

In the study, the Total time taken for fracture union ranged between 10 weeks to 21 weeks averaging 12.4 weeks. In seventeen patients fracture united between 10 to 12 Weeks, in eleven patients

fracture united between 13 to 15 weeks, in one patient fracture united between 16 to 18 weeks & In one patient there was non-union which required revision plating with bone grafting after six months.

The functional outcome was divided into Grade I, Grade II, and Grade III & Grade IV as per American Shoulder & Elbow Surgeons Score. Of the thirty patients, eighteen were of Grade I, Eight were of Grade II, Two were of Grade III & two were of Grade IV at the end of six months.

Only one patient had complication that had Non-union of Diaphyseal fracture of Humerus, for

which subsequently revision with plate fixation & bone grafting was done.

None of the patients had infection or iatrogenic radial nerve palsy.

In the present study of thirty cases of Diaphyseal fractures of Humerus managed by Dynamic compression plate & screws were assessed & evaluated as per the criteria Formulated. There were seventeen cases (56.6%) had excellent results, eight cases (26.7%) had good results, two cases (6.7%) had fair results & three cases (10.0%) had poor results.

Figure 1: X-rays

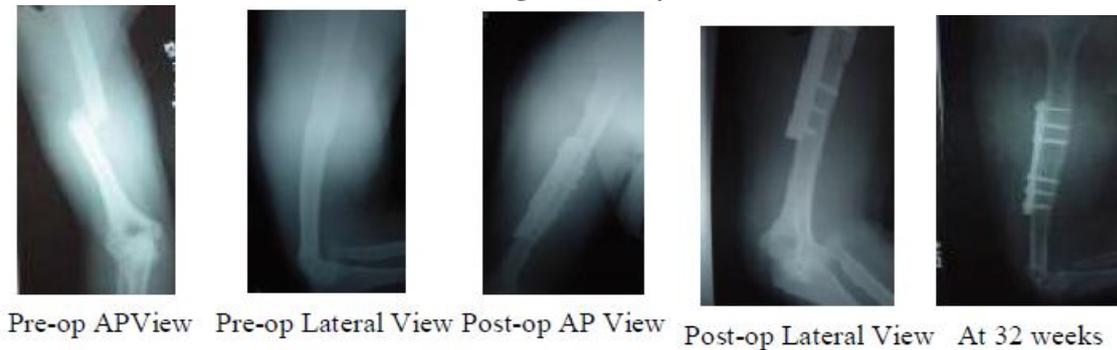


Figure 2: Clinical Photographs



a) Shoulder abduction with elbow flexion



c) Shoulder adduction and forearm rotation



b) Abduction with elbow extension



d) Wrist Dorsi flexion

4. Discussion

It must be emphasized that this study is only short term follow up of six months and the discussion that follows is essentially a preliminary assessment.

The aim of this study is to evaluate the anatomical and functional results of diaphyseal humerus fractures treated with dynamic compression plate and screws from September 2010 to September 2012.

The age of the patients in the study ranged from eighteen years to sixty three years, average being 36.6years. Higher incidence in this age is mostly due to active life style and prone for accidents resulting in high velocity injuries.

The incidence of fractures in our study was more common in males (80%) which can be attributed to the risk of injury due to occupational and ambulant life led by them.

Among modes of injury road traffic accidents are the most common (76.7%). This is comparable to the study made by Robert Vander Griendin 1986[4] & Tzu-Liang Hsu *et al* in 2005[8]. The least common would be assault. In the study done by Hunter in 1982[3] fall was the commonest mode of injury. This gives us the idea of the force of trauma, which further helps in the management of the fracture.

In the study of thirty patients, two patients had fracture Ipsilateral both bone of forearm, one patient had Ipsilateral femoral shaft & Contralateral tibia shaft fracture, in one patient there was Ipsilateral femoral shaft fracture with brachial plexus injury, Four patients had radial nerve palsy.

Among the 30 patients classified according to L. Kleirman's one had fracture in the Upper third [Type I], Two had fracture at the junction of Upper & Middle third [Type II], Seventeen had fracture of the Middle third [Type III], Ten had fracture at the junction of the Middle & Lower third [Type IV] & none of the fracture were present in the Lower third Type [V].

The minimum period of immobilisation is four weeks and it increases to six weeks in comminuted fractures. Minimum follow up of six months has been done.

Majority of the patients (93.4%) showed fracture union between ten –fifteen weeks. In one patient's fracture united by eighteen weeks. Except for one (3.3%) non-union there were no complications like infection or radial nerve injury. For non-union after six months revision plating was done with bone grafting which united later.

In the study by McCormack *et al*[5] in 2000 where they have compared the fixation of the fracture

shaft of Humerus with Dynamic compression plate & Intramedullary Interlocking nailing, they have noticed that the incidence of non-union is more with Intramedullary Interlocking nailing. They also noticed that the incidence of other complications like Iatrogenic radial nerve palsy, late fracture, intra operative comminution, Infection, shoulder impingement & adhesive capsulitis of shoulder was more with Intramedullary Interlocking nailing. Open reduction & Internal fixation with Dynamic compression plating, we encountered minimal complications.

In the study of Iodine JD, *et al* plating of acute humeral diaphyseal Fractures through an anterior approach in multiple trauma patients is effective[9].

Functional outcome as per A.S.E.S. score graded as Grade I, Grade II, Grade III & Grade IV & Complications. Of the thirty patients there were seventeen patients (56.6%) with excellent results, eight patients (26.7%) had good results, fair results were seen in two patients (6.7%) & three patients (10.0%) had poor results.

5. Conclusion

In our study dynamic compression plate and screws was used in 30 patients with diaphyseal humerus fractures. We had 17 excellent, 8 good, 2 fair and 3 poor results.

This series concludes that in younger age group (<50%) diaphyseal fractures fixed with dynamic compression plate and screws consistently results in a favorable outcome in the management.

The rate of serious complications is low. With careful dissection and placement of plate and screws accurately the radial nerve injury can be avoided. Most complications are minor and easily treated and do not affect outcome.

The dynamic compression plate and screws is simple and inexpensive. It stabilizes the fracture and allows early shoulder and elbow range of motion thus preventing stiffness and wasting. Though some cases have residual stiffness, pain and arthritis can be prevented.

By the analysis of the data collected in the present study, Dynamic compression plate & screw remains the implant of choice in the management of Diaphyseal fractures of Humerus.

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