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A Prospective Study on Clinical Outcome following Surgically Managed Displaced Proximal Humerus Fractures using Proximal Humerus Internal Locking System

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Abstract: ***Proximal humerus fractures encompass a broad spectrum of injuries. They are often the result of a fall in an osteoporotic patient, but also occur in high-energy trauma. These account for 4 -5 % of all fractures and incidence increase rapidly with age. Functional results associated with non-operative treatment of displaced fracture of proximal humerus are poor. Over the last decades, several techniques have been applied for treatment of proximal humerus fractures. Widely accepted is the initiation of a conservative treatment regimen for undisplaced fractures; however, the ideal treatment of displaced fractures, especially 3 and 4 part fractures is still the center of scientific debate. In our hospital 30 patients with 30 proximal humerus fractures were treated with locking compression plate from January 2014 to January 2016 .Among these; 16 were males and 14 were females. Youngest patient was 24 years and oldest was 65 years. Fractures were classified according to Neer's classification & type 2, 3, & 4 were included in the study. Post operatively rehabilitation started depending upon stability of fixation and tolerability of patient. According to Neer's scoring system approximately 60% of patients had satisfactory to excellent results, 30 % had fair results and 10% had unsatisfactory to poor results. Materials & Methods: Design: A prospective study. Duration: January 2014 - January 2016. Sample: 30 patients with displaced proximalhumerus fractures were treated surgically by PHILOS. Inclusion criteria: Age: Patients with skeletal maturity and Displaced proximal humerus fractures (Neers type2,3,4). Exclusion criteria: Neers type 1 undisplaced fracture and Fractures associated with scapular neck fractures and clavicular fracture. They were followed up for a minimum period of 1 year by the senior author and evaluated for clinical outcome using X-RAYS, subjective evaluation, range of movements; complication according to Neer's scoring system. Results: Out of 30 cases 27 cases had excellent results without complications. 1 patient had partial necrosis of head with minimal functional limitation.1patient had implant back out but the patient is protected till the fracture united. 1 patient had collapse at fracture site with secondary penetration of screw into the joint. Conclusion: In our study of 30cases of displaced proximal humerus fractures, were effectively treated surgically with PHILOS gave good to excellent results & to be considered a good surgical modality for displaced proximal humerus management fracture management .***

Keywords: Proximal humerus fractures, PHILOS, Neer's classification and osteoporotic fractures.

1. Introduction

Proximal humerus fractures are estimated to account for 4 to 5 % of all upper extremity fractures[1,2].Incidence rapidly increases with age, older individuals and are more likely to sustain these injuries.71% of proximal humeral fractures occur in patients over the age of sixty years[3,4].

It occurs twice as commonly in females than in males. In the elderly, most of these fractures are related to osteoporosis[5] .Most common mode of injury was fall from a standing height where as in younger patients it was high impact trauma. Non displaced fractures and fractures with minimal displacement and adequate stability usually are successfully treated non operatively[6-8].Unless contraindicated, the recommended general strategy for the management of displaced proximal humerus fractures is operative, with use of some forms of internal fixation.

A variety of treatment techniques has been proposed, including open reduction and internal fixation with proximal humerus plates, hemiarthroplasty and percutaneous or minimally invasive techniques such as pinning, screw osteosynthesis, and the use of intramedullary nails[9-17].the basic principle in many of these methods is to provide stability to the fracture, which prevents loss of reduction; however there are several complications that have been reported in association with these techniques, including implant failure, non union or mal union of the fracture, impingement syndrome, osteonecrosis of the humeral head[10,18-20].

Recent advances in fracture fixation technology have shown developing interest in these fractures using Locking compression plates and screws as they provide angular stability and its low profile implant with better purchase in especially osteoporotic fractures.

2. Materials & Methods

This prospective observational case series was conducted at S.S.I.M.S & R.C Hospital, Davanagere between Jan 2014 – Jan 2016 under Dept of Orthopaedics. There were 30 patients with proximal humerus fracture who were treated with proximal humerus LCP. There are various locking compression plate designs available for fixation of the proximal humerus fractures, most commonly used is PHILOS plate. In our study we have used proximal humerus AO 3.5 mm LCP as it provides angular fixation, it's a low profile internal fixator, excellent in osteoporotic bone and

suits better to the proximal humerus anatomy. Our aim was to achieve union, normal to near normal functional outcome with no or minimal complications. After thorough pre operative evaluation, patients with included if they were skeletally mature, who met the indications for operative treatment as per Neer's criteria[21](i.e., angulation of the articular surface of more than 45 degrees or displacement of more than 1 cm between the major fracture segments) and who provided written informed consent prior to enrolment.

Undisplaced stable fractures and fractures with minimal displacement and adequate stability as well as fractures involving only the greater or lesser tuberosities were not considered for treatment with the Locking Compression Plate[22].

There were 16 males (53.3%) and 14 females (46.67%) between age group of age group 24-65 years. Average age group 44.5 years.

Commonest mode of injury was fall from a standing height in elderly and high velocity injury in young patients.

All fractures were classified using Neer's classification.13 patients had two part fracture, 10 had three part fracture and 7 had four parts fracture.

Pre op evaluation consisted of careful inspection of the shoulder. Tenderness was elicited over the shoulder and the movements of the shoulder were painful and restricted.

There was no axillary nerve injury or tendon injuries recorded in our series of 30 patients.

Routine X rays of antero posterior and axillary lateral views of shoulder were taken and fracture fragments were analysed and the involvement of the head of the humerus, greater and lesser tuberosities and their displacement angulations with the shaft of the humerus and others were assessed and fractures classified according to Neer's classification.

In all elderly patients 2D ECHO, routine blood investigations were done.

All patients were immobilised in arm pouch until the time of surgery.

All 30 cases were done under general anaesthesia and fixed with 3.5 mm LCP.

3. Surgical Technique

Patient placed in supine position on operating table under general anaesthesia. The entire upper limb including shoulder up to the neck was scrubbed with savlon, and beta scrub and was painted with betadine and spirit and draped.

Under strict aseptic precautions, with standard deltopectoral approach incision was made, deltoid was retracted fracture fragments exposed and identified and reduced, if required temporarily fixed with K-wires, reduction checked by both anteroposterior views and lateral views. Once acceptable reduction was achieved it was stabilised with locking compression plate and locking screws and again the fracture reduction and fixation was confirmed by image intensifier. It was made sure the LCP was placed distal to the greater tuberosity and lateral to the biccipital groove and biceps tendon was protected completely.

At the end of surgical procedure sterile dressing was done and no cast or slab was applied, but limb was placed in elevation in arm pouch.

Antibiotics (Injection Ceftriaxone 1gm IV BD for 3 days, then orally cefixime 200 mg BD for 5 days) were given along with analgesics.

Average duration from the date of injury to the date of surgery was 1-3 days.

Immediate post operative check xrays were taken in both anteroposterior and lateral views.

Phase 1-Passive assisted stretching for 6 weeks.
Phase 2-Active ROM with terminal stretch until full active range for 4-6 weeks.
Phase 3-At 10 weeks resisted strengthening with maximum recovery by 1 year.

Neer's shoulder scoring system to document functional outcome.

Elbow and shoulder exercises were encouraged post operatively immediately from the day of operation to promote circulation, avoid edema and stiffness.

Dressings were removed on 3rd post operative day patient was discharged. Second check X-Ray was taken on follow up at 6th week; the fracture union was assessed clinically by absence of tenderness and radiologically the bridging callus formation.

All cases were followed at an interval of 6 weeks,3 months,6 months and 12 months.

4. Results

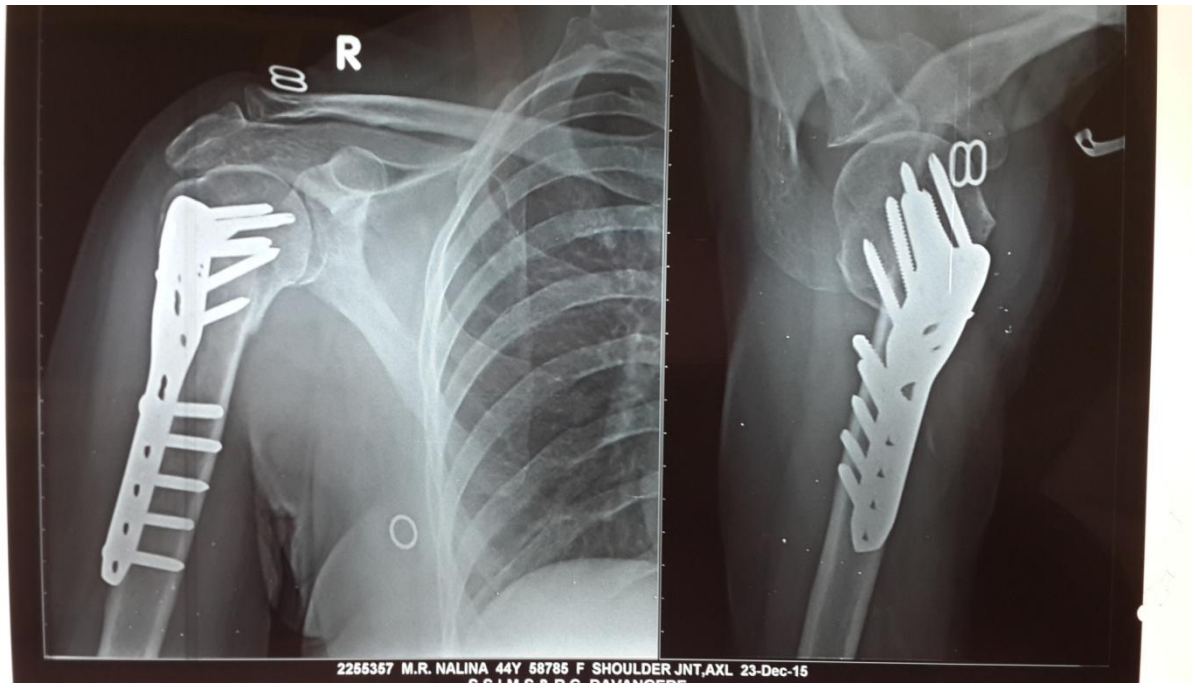
The follow up ranged from 3 months to 12 months with an average follow up of 7.5 months.

- There were no cases of infection as long as they were followed till the 12 months. In our study greatest limitation was abduction in few patients.
- 1 patient had partial necrosis of head with minimal functional limitation.
- 1patient had implant back out but the patient is protected till the fracture united.
- 1 patient had collapse at fracture site with secondary penetration of screw into the joint.

Criteria for results at 6 months include deformity, subjective evaluation, range of movements, complication according to Neers scoring system.

44 year old female with three part fracture of the right proximal humerus

Immediate post op xrays of the same patient



Xrays after 6 months of follow up...

Clinical picture depicting full range of movements.

The overall result according to the rating system based on Neer's shoulder scoring system was:

- 60% excellent results.
- 30% fair results.
- 10% poor results.

Average Neer's Score:
Type 2# - 80.
Type 3# - 70.
Type 4# - 50.

5. Discussion

The management of displaced fractures of proximal humerus are highly challenging and requires careful assessment of patient factors such as age and activity level, and fracture related factors like fracture type, pattern, degree of comminution and bone quality. Since majority of these fractures are seen in patients more than 50 years old and most of the proximal humeral fractures in this population are related to osteoporosis. Stable reduction is essential for healing of the fracture and for achieving early functional recovery of the shoulder. In patients with osteoporotic bone and/or comminuted fractures, operative stabilization is challenging and the treatment of displaced and unstable fractures remains controversial.

A large variety of methods are available and have been used to stabilize fractures including buttress plate, intra medullary nails, tension band wiring techniques, percutaneous K wire fixation and hemiarthroplasty[11,13,15,18].successful outcomes after plate osteosynthesis of proximal humeral fractures have been reported[10,15,22].Open reduction and internal fixation of proximal humeral fractures with non locking plates and screws have been shown to provide the strongest fixation in non osteoporotic bone[15].As the age advances and the bone becomes osteoporotic, there are high chances of screw loosening due to insufficient purchase of screws resulting in high failure rates, especially in three or four part fracture[22].

Kristiansen and Christenson [18] reported satisfactory or excellent results in only 9 of 20 patients who had fixation of proximal humeral fractures with a buttress plate and there was a high fixation failure rates.

Fenichel et al[24], in their retrospective review study of fifty patients who had unstable two or three part fractures treated with percutaneous pin fixation with use of threaded pins reported that seven patients had severe loss of reduction and three patients requiring revision surgery.

Wanner et al[10], used double plate technique fixation using conventional one third tubular plate. They treated sixty shoulder fractures (proximal humerus) with one third tubular plates fixed orthogonally on the anterior and lateral cortices, of which sixty three percent had good and excellent results and twelve percent had complication s such as fracture displacement, osteonecrosis, adhesive capsulitis, subacromial impingement and hardware loosening.

Robbinson et al[25] retrospectively reviewed the results of shoulder hemiarthoplasty for proximal humeral fracture at a single centre and found consistent improvement in the constant score from six weeks to six months post operatively but little change thereafter.

Locking compression plates and screws provide angular stability, as it works as a low profile, internal fixator, and provides good stability even in the osteoporotic bones. Advantages of LCP in proximal humeral fractures include gentle fracture reduction with use of indirect reduction, a high resistance to backout even in patients with poor bone stalk because of the combination of fixed angle screw plate and locking and three dimensional placement of screws in the humeral head, and possibility of early exercise and short period of immobilization because of the high initial stability achieved. There have been only few clinical studies including small number of patients who have reported their results after open reduction and internal fixation of proximal humerus fractures with LCP. Most authors have concluded that plate design provided stable fixation with good clinical outcome and have recommended the use of LCP for the treatment of proximal humeral fractures especially with patients with poor bone quality.

In our series we have treated 30 patients with LCP and screws and achieved 90% excellent to fair results and 10% poor results. We observed those three patients, who resulted in poor outcome where of type 4 fractures,

- 1 patient had partial necrosis of head with minimal functional limitation.
- 1patient had implant back out but the patient is protected till the fracture united.
- 1 patient had collapse at fracture site with secondary penetration of screw into the joint.

In conclusion, open reduction internal fixation of the type 2, 3 and 4 fractures of proximal humerus with LCP and screws having good functional results depends on the fracture type and personality, meticulous surgical technique and early rehabilitation programme. In our study with clover leaf LCP we had satisfactory results particularly in osteoporotic proximal humerus fractures. However there is scope to improve results particularly in osteoporotic proximal humerus fractures and type four fractures. The key to success for good functional results in the proximal humerus fractures using LCP and screws is to achieve good anatomical reduction, adequate screw purchase into the humeral head, minimizing intraoperative errors and early mobilization and rehabilitation.

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