PRECON TOURED PLATE OSTEOSYNTHESIS IN PROXIMAL HUMERUS FRACTURES IN ADULTS

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ABSTRACT

AIM

To evaluate the reliability and safety, functional outcome & complication associated with proximal humerus locking plate in treatment of proximal humerus fracture in adult and old age patient.

MATERIAL AND METHODS

The present study evaluates the functional outcome of 40 patients with displaced proximal humerus fracture managed with proximal humerus locking plate via deltopectoral approach in a prospective manner. All male or female patients between 18-60 years of age, with proximal humerus fractures and duration of injury less than 2 weeks, between May 2011 to May 2015 were evaluated. Patients were called for regular follow up for evaluation on the basis of constant shoulder Score (CSS) with the parameters of pain, range of motion and strength of limb.

RESULTS

The age of all patients ranged from 25-69 yrs. with mean (±SD) 49.70±12.16 yrs. Most of the patients were above 45 yrs. of age (65.0%) and mostly males (60.0%). There were 18 patients with Neer classification part 2, 18 with part 3 and 4 were with part 4. The union time for all patients ranged from 8-12 wks. with mean (±SD) 10.40±1.23 wks. Similarly, the duration of surgery of all patients ranged from 70-140 min with mean (± SD) 100.00 ± 20.84 min. No wound infections, vascular injuries, avascular necrosis, or loss of fixation ensued. Two patients with axillary nerve palsy recovered spontaneously within 3 months. 28 patients did not have treatment related complications (70.0%). However, 12 patients have treatment related complication (30.0%) with 5.0% screw perforation and 15.0% shoulder stiffness and 10 % varus mal-reduction. However, based on constant shoulder Score (CSS), at final evaluation, the functional outcome (i.e. efficacy of the treatment) of most of the patients were found to be excellent (70.0%), good (15.0%), poor (10.0%) and fair the least (5.0%).

CONCLUSION

Proximal humerus locking plate is a good modality for treatment of Neer type 2 and 3 displaced proximal humerus fractures but its application in Neers type 4 is associated with high complication rates.

KEYWORDS

Locking plate, Neer's, Osteoporotic fractures, Proximal Humerus fractures.

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INTRODUCTION: Proximal humeral fractures are common in elderly patients[1] The increased incidence in the older population is thought to be related to osteoporosis.[2,3] Proximal humeral fractures are usually undisplaced fractures or fractures with minimal displacement and with adequate stability that can be successfully managed non operatively.[4,5] However, the optimal treatment of displaced or unstable fractures remains controversial.[6] Various techniques, including open reduction and internal fixation with proximal humeral plates, intramedullary nailing, percutaneous or minimally invasive techniques with pins or screws, and arthroplasty, have been described.[7-10] Complications of these techniques include cutout or back-out of the screws and plates, avascular necrosis, non-union, malunion, nail migration, rotator cuff impairment, and impingement syndromes.[11-13] Insufficient anchorage from conventional implants may lead to early loosening and failure, especially in osteoporotic bones.[14] Over the past decade, the trend of fixation of these fractures has been toward angular stable plate fixation. Several biomechanical studies has shown better stability for angular stable implants when compared with conventional plates and numerous clinical studies reported good clinical results for proximal humeral fractures.[15-17] The principal advantage of this system is that it provides improved fixation using multiple screws at divergent angles which are locked to the plate via a thread in the screw head and a matching thread in the screw hole

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in the plate. Whilst the fixed angle locking screw design of the plate has been designed to improve the quality of fixation in osteoporotic bone, there have been reports in the literature of failure of fixation using the proximal humerus locking plate also. Complications associated with the Philos plate fixation include screw perforations into the Gleno-humeral joint or Humoral head, screw loosening and backing out, secondary implant dislocations from the humeral head, avascular necrosis of the humeral head, pseudo-arthrosis with a broken plate, subacromial impingement requiring plate removal, non-union, mal-union due to loss of purchase in the humeral head, broken distal screws with separation of the plate from the bone, and transient axillary nerve palsies.[18] The aim of present study is to evaluate the functional outcome, reliability and safety of proximal humerus locking plate in treatment of proximal humerus fracture in adult and old age patient and also to record the complications with this fixation device.

MATERIAL AND METHODS: This study was done on patients with proximal humerus fracture admitted in Department of Orthopaedics, in a tertiary care centre during years May 2011-May 2015. Detailed history and clinical examination was done to record age, sex, menopausal status, mechanism of injury, type of fracture and general condition of the patients. Radiograph were taken in two plane (AP and AP in 90 degree internal rotation), and CT scan (optional) was done to assess the nature, type of fracture in complex fracture pattern. Written informed consent was taken from every patient before the study. Laboratory investigation was done to evaluate for surgical fitness as per requirement. Stable two part fracture, pathological fractures, fractures in patients less than 18 year age group, shaft humerus fractures with proximal extension, multiple fractures in same upper limb, open fracture and fracture dislocation were excluded from the study. All fractures were classified using Neer's classification. All the fractures were operated by delto-pectoral approach under general anaesthesia. K wires were used to provisionally stabilize the fracture followed by definitive fixation with proximal humerus locking plate. Plate was applied over lateral aspect of proximal humerus, 8 mm distal to upper end of greater tuberosity. The rotator cuff tendons were secured by Ethibond sutures and used as an aid to reduce tuberosity fragment. Medialization of shaft was managed by a diaphyseal 3.5 cortical screw to neutralize pull of pectoralis major muscle. At least three diaphyseal screws were used.

Post operatively patients were managed as per protocol and patient discharged on 5th day and sutures were removed on 12th day. Follow up was done at one and half month 3, 6, 9 months and at 1 year interval postoperatively. Plain AP view and AP view in 90 degree internal rotation were taken at each visit for assessing reduction status, fracture union and complications if any. Post-operative shoulder rehabilitation protocols were divided into three phases. In phase one (approximately first 3 weeks), immobilization or support was given and intermittent pendulum exercises and gently assisted motion were allowed. In Phase 2 (approximately weeks 3-9), active-assisted forward flexion and abduction were allowed provided there are signs of union on X-ray and clinically patient is asymptomatic. External rotation and Abduction against resistance was avoided for first 6 weeks. In Phase 3 (approximately after week 9) isotonic, concentric, and eccentric strengthening exercises were added. If there was evidence of bone healing but joint stiffness, then passive stretching by physiotherapist were done. Any complications during intra-operative period and during follow up were recorded. Functional outcomes were assessed according to the Constant scoring system.

The Constant score was graded as Poor (0-55), Fair (56-70), Good (71-85) and Excellent (86-100). Strength was measured as per European Society for Shoulder and Elbow Surgery with the arm in 90 degrees of elevation in the plane of the scapula (30 degrees in front of the coronal plane) and elbow straight with Palm of the hand facing the floor (Pronation).The patient was asked to maintain this resisted elevation for 5 seconds. If patient is unable to achieve 90 degrees of elevation in the scapula plane the patient gets 0 points.

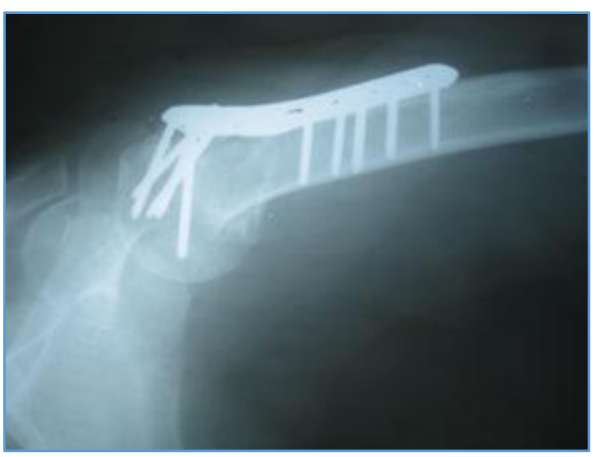
Continuous data were summarized as Mean ± SD while discrete (categorical) in number and percentage. Categorical groups were compared by chi-square (χ^2) test. A two-tailed ($\alpha=2$) $p<0.05$ was considered statistically significant. All analyses were performed on STATISTICA (version 6.0) software.

RESULTS: The age of all patients ranged from 25-69 yrs. with mean (± SD) 49.70±12.16 yrs. Most of the patients were above 45 yrs. of age (65.0%) and mostly males (60.0%). There were 18 patients with Neer's classification part 2 (45.0%), 18 patients with part 3 (45.0%) and 4 patients were with part 4 (10.0%). The mode of injury of most of the patients was minor fall (MF), followed by RTA, External Rotation of Arm in Abduction (ERAA) and direct blow (DB) the least. The duration from injury to surgery of all patients ranged from 1-5 days with mean (± SD) 3.10±1.37 days. The duration from injury to surgery of most of the patients was more than 2 days (55.0%). Similarly, the duration of surgery of all patients ranged from 70-140 min with mean (±SD) 100.00±20.84 min. The duration of surgery of most of the patients was more than 90 min (55.0%). The mean union time ranged from 8-12 wks with mean (±SD) 10.40±1.23 wks. Most of fractures united in less than 10 weeks (70.0%). At final evaluation, the functional outcome (of most of the patients was found to be excellent (70.0%) followed by good (15.0%), poor (10.0%) and fair in 5% cases. Out of 40 patients, 28 patients did not have any treatment related complications (70.0%). However, 12 patients (30.0%) had treatment related complication with 10.0% screw perforation and 20 % varus mal-reduction.

DISCUSSION: Proximal humerus fractures are one of the most common fractures in elderly population.[1] The increased incidence in the older population is thought to be related to

osteoporosis and these fractures are at greater risk of fixation failure, screw loosening, and fracture displacement.[2,3] Undisplaced fractures can be treated conservatively but displaced fractures need open reduction and internal fixation. Various Implants and approaches has been used to achieve union with early and good functional results in these cases but there is insufficient evidence to support any one type of procedure or fixation modality in these fractures in terms of good results.[4] The fixation with AO T-plate and screws has been associated with a high rate of complications such as avascular necrosis, subacromial impingement, or screw loosening in osteoporotic bone.[1-13] The bulky Plant-Tan plate requires wide surgical exposure and has high rates of infection and fixation failure in patients with osteoporosis.[19] The technique requires extensive soft tissues stripping, compromising the vascular supply to the humeral head. Percutaneous pinning requires advanced skills, good bone quality, minimal fracture comminution, and a cooperative patient. In an in vitro model of a reconstructed 3-part proximal humeral fracture, the locking plate provided better torsional fatigue resistance and stiffness than did the blade plate.[20,21] 80% of patients treated with Polarus nails reported satisfactory results. Most of them had 2-part fractures. However, a failure rate of 45% was also reported. With antegrade nailing, shoulder function can be impaired because of subacromial impingement or rotator cuff injury at the nail entry point.[22,23] But there are recent literature from cadaveric studies supporting use of proximal humeral locking nails in 3-4 part fractures.[24,25] In our study, the Philos plate fixation was suitable for 3- and 4-part proximal humeral fractures. We got excellent (70.0%) followed by good (15.0%), poor (10.0%) and fair results in 5% cases in our study with average union time of about 10 weeks. Similar results were also found in various other studies when we reviewed the literature.[24,25-29] In our study we have 30 % of complications in our patients in terms of varus-mal reduction (20%) and screw perforation (10%).The varus-mal reduction may have taken place because of severe osteoporosis and because of hardware problem. In our study, the complication rate was low, probably because our patients were relatively young, and both the bone quality and the surgical technique were good. In a study by Egol KA. et al on early complications with plate fixation, eight shoulders in eight patients (16%) had screws that penetrated the humeral head. Two patients developed osteonecrosis at latest follow-up. One acute fracture and one non-union failed to unite after index surgery. Significant heterotopic bone developed in 1 patient. Early implant failure occurred in 2 patients; one was revised to a longer plate, and one underwent resection arthroplasty. There was one acute postoperative infection.[10] Based on the survey by Tepass A. et al regarding current modalities of treatment for proximal humeral fracture fixation, a preference for surgical treatment of proximal humeral fractures was found, with stabilization predominantly being attempted by the use of angle-stable implant.[5] A Study by M Königshausen et al also conclude that the combination of angular stability with the possibility of variable polyaxial screw direction is a good concept for reduction and fixation of displaced proximal humeral fractures, but anatomical reduction and medial support remain important preconditions for a good outcome.[7] During dissection and head penetration with proximal interlocking screws, care should be taken to avoid damage of the anterior humeral circumflex artery and the axillary nerve. The screw position must be checked intra-operatively with image intensification. In elderly patients with poor bone stock, the humeral head and shaft should be packed with bone grafts or substitutes to prevent fixation failure of the screws.

CONCLUSION: We have found locking proximal humeral plate an advantageous implant in comminuted 2-part fractures, 3-part fractures with osteoporosis in elderly patients. Fixed angular stability and meticulous rotator cuff repair leads to early mobilization and satisfactory functional outcome.



Axillary views showing fracture consolidation

AP View showing fracture consolidation

Pre-operative axillary views

Pre-operative AP views

Functional results

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