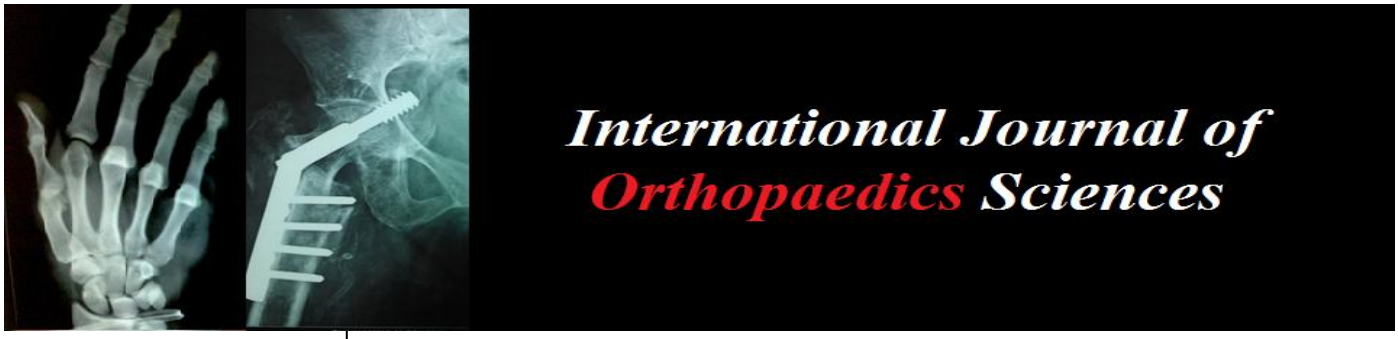


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# Functional outcome of displaced proximal humerus fractures treated conservatively versus open reduction internal fixation with locking compression plate

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**Abstract**
**Introduction:** The field of orthopedic surgery has been in the vanguard in creating new information, establishing new principles of treatment and solving both new and old problems of musculoskeletal system. Fractures of proximal humerus are still unsolved fractures in many ways. The indication for surgical management continues to be modified. Fixation techniques are myriad and none is ideal for all cases.
**Materials and Methods**: Total of 34 cases of two parts, three parts and four parts fractures of proximal humerus were admitted included in the study after fulfilling inclusion and exclusion criteria. Detailed clinical history, local and neurological examination was done.
**Results:** Out of 34 patients who were included in this study 16 were treated conservatively and 18 surgically by open reduction internal fixation with locking compression plate. The two treatment groups were comparable with regard to age, gender and type of fracture. In surgical group two 2 part fractures had moderate constant score and two good, six 3 part fracture had good constant score and three poor constant score while two 4 part fracture had poor constant score and three good. In the conservative group two 2 part fracture had moderate constant score and one good, in 3 parts one had poor, four moderate and four good constant scores, in 4 parts all had poor constant scores.
**Conclusion:** This study explains that a locking plate for the treatment of proximal humerus fractures uniformly leads to a satisfactory functional outcome over long term follow up in most of the patients. Although the results are poorer in old aged individuals with osteoporosis, they are nevertheless better than those achieved with non locking plates.

**Keywords:** Humerus, Fracture, Internal Fixation, Deltopectoral Approach, Transosseous, Implants, Constant Score, Neer's Classification

## Introduction
Fractures of proximal humerus are quite common especially in older age group. They have been reported to account 4% - 5% of all fractures [1, 2]. About 85% of these fractures are minimally displaced or non-displaced and are effectively treated symptomatically with immobilization followed by early motion. The remaining 15% of fractures are displaced unstable and may have disruption of the blood supply. The treatment of these kinds of fractures gives a therapeutic challenge to the orthopedician. Displaced and unstable extra-articular fractures are most commonly treated by operative reduction and fixation using various techniques [3]. The treatment is more controversial for articular fractures which carry a high risk of the humeral head necrosis. In Neer's classification, these are two part anatomical neck, three –part and four – part fracture and those with dislocation of head of humerus. A review of published result suggests that there is no universally accepted form of treatment. Conservative management may be associated with non-union, malunion and avascular necrosis resulting in painful dysfunction [4, 5]. Primary hemiarthroplasty is favoured by many authors but is associated with a large number of complications, and objective functional results which are disappointing [6]. Studies which report poor result of internal fixation have been carried out on elderly patients with poor bone quality and have not assessed the quality of reduction obtained with operative intervention [7, 8]. Conversely series with a favorable outcome have frequently consisted of younger patients with good bone quality, who had sustained impacted

fractures, for which invasive approach with minimal internal fixation is used. Interestingly favorable results have been reported despite subsequent avascular necrosis. Proximal humeral fracture, whether caused by trauma (or) related to osteoporosis, requires carefully planned, individual treatment. Current therapeutic options for proximal humerus fractures are IM nails, plates, tension band wiring, and percutaneous (or) minimally invasive technique such as pinning, intramedullary flexible nails, screw osteosynthesis and hemiarthoplasties [3, 4]. The Choice of technique and devices depends on quality of bone, soft tissue, age and reliability of patients. However the goal of Proximal Humerus fracture fixation should be stable reduction allowing early motion of fracture. This study is conducted to analyze the results of displaced proximal humerus fractures treated conservatively versus open reduction internal fixation with plate osteosynthesis.

**Aim of the study**

To compare the functional outcome of displaced proximal humerus fractures treated conservatively versus open reduction internal fixation with locking compression plate.

**Materials and methods**

This is a non-randomized prospective study comparing functional outcome of displaced proximal humerus fracture in elderly patients treated conservatively by one consultant and by open reduction internal fixation by other consultants. Total of 34 cases of two parts, three parts and four parts fractures of proximal humerus were admitted between June 2011 to June 2013 conducted in Ernakulam Medical Centre, Palarivattom, and N.H Bypass Kochi. Patient's consent and Institutional ethics committee permission was taken.

**Inclusion criteria**

- Displaced proximal humeral fractures in patients above 60 years.
- Two, three and four part proximal humeral fractures with dislocation.
- Two part fractures with fracture of articular segment and shaft were included in the study

**Exclusion criteria**

- Refusal to participate in the study
- Under 60 years of age
- Not independent
- Dementia/alzheimers
- Pathologic fracture or a previous fracture of the same proximal humerus
- Alcoholism or drug addiction
- Other injury to the same upper limb requiring surgery
- Major nerve injury (e.g., complete radial- or axillary nerve palsy)
- Rotator cuff tear arthropathy
- Open fracture
- Multi-trauma or -fractured patient
- Non-displaced fracture
- Isolated fracture of the major or minor tubercle
- Any medical condition that excludes surgical treatment

On admission of the patient a careful history was elicited from the patients and/or attendants of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. The general condition of the patient and the vital signs were recorded. Methodical examination was done to rule out fractures at other sides. The local examination of injured shoulder was done for swelling, deformity loss of function and altered attitude. Any nerve injury was also looked for and noted. Local neurologic deficit of axillary nerve was also assessed by looking for anesthetic patch over lateral aspect of shoulder. Radiograph of proximal humerus i.e., antero-posterior view and axillary view were taken and fractures were classified according to Neer's classification. Next the limb was immobilized in U-slab and arm-pouch.

The patient was taken for surgery after routine investigation and after obtaining physician fitness towards surgery. Routine investigations such as Hb%, urine for sugar, FBS, TC, DC, ESR, CRP, blood electrolytes, blood urea, and serum creatinine, HIV, HbsAg and ECG were done.

**Conservative Treatment**

The patients included in the conservative group are treated by immobilizing with cuff and collar sling and passive pendulum exercises started as pain tolerated after three weeks. Patients were followed at 1week, 6 weeks, 3 months, 6 months and 12 months.

**Surgical Approach**

**Deltopectoral Approach:** This approach was used for displaced two part, three part, and four part fractures with dislocation. Incision starts at anterior aspect of acromio-clavicular joint. The incision extended medially along the margin of lateral 1/3rd of clavicle. Then further down along anterior border of deltoid upto midpoint of its origin and insertion. The deltopectoral groove, is identified where cephalic veins and deltoid branches of thoraco-acromial vessels lie. Cephalic vein is either retracted medially or ligated and cut. Then clavicular origin of deltoid muscle is detached by dividing it near its origin and then retracted laterally. Pectoralis major is retracted medially. This exposes the fracture site [9].

**Open reduction and internal fixation of two part, three part and four part fracture using locking plate [10, 11, 12, and 13]:**

**Procedure**

An extended deltopectoral approach was used for open reduction and internal fixation of three and four part fractures. The long head of the biceps is important landmark for identification of fractures fragments. In most four part fracture the greater tuberosity is displaced from the shaft and from the head and lesser tuberosity as a separate fragment. The greater tuberosity fracture line is posterior to bicipital groove.

The greater tuberosity was first reduced and stabilized to the head and lesser tuberosity with K-wire. Now the four part fracture was converted into two part fracture. The shaft was manually reduced and held using bone clamps. The reduced head, greater tuberosity and lesser tuberosity are attached to the shaft with the locking plate on the lateral side, the plate was initially held with k wires. Reduction was assessed under image intensifier. Definitive fixation with proximal humerus locking plate was done with plate positioned at least 5 mm distal to the upper end of the greater tuberosity and at least 2 mm posterior to the bicipital groove thus sparing the tendon of long head of biceps [10]. Transosseous sutures with 2-0 ethibond were taken which aid in holding the reduction. Position of plate and reduction checked under image intensifier. Plate was fixed with multiple 3.5mm locking screws in the head and distally with three or four

cortical/locking screws. Position of plate and reduction re-checked under image intensifier. Wound washed and closed in layers with drain in situ. Post operatively limb is immobilized in arm pouch.

**Postoperative management**

- All patients are immobilized in arm pouch with cuff and collar sling.
- Appropriate antibiotics and analgesics were used.
- Immediate post-operative radiographs were taken to determine the bone alignment and maintenance of reduction.
- Sutures removed by 14$^{th}$ day
- Passive range of motion and pendulum exercises is begun after suture removal depending on pain.

**Follow up**

All patients were followed at 1week, 6 week, 3months, 6months and 1 year

- The active assisted exercises followed by active range of motion were started at 2-4 weeks, postoperatively, depending on stability of osteosynthesis and bone quality.
- The sling is discontinued by 8-12 weeks depending upon fracture stability [1, 4, 14, and 15].
- Further follow ups were done at 8 weeks and 12 weeks and 24 weeks.
- The patients were examined clinically and radiologically, assessed for range of motion and bony union and complication.
- The patient with shoulder stiffness given physiotherapy for 1 week to 15 days on Outpatient basis. Functional assessment of outcome using constant shoulder score was done.

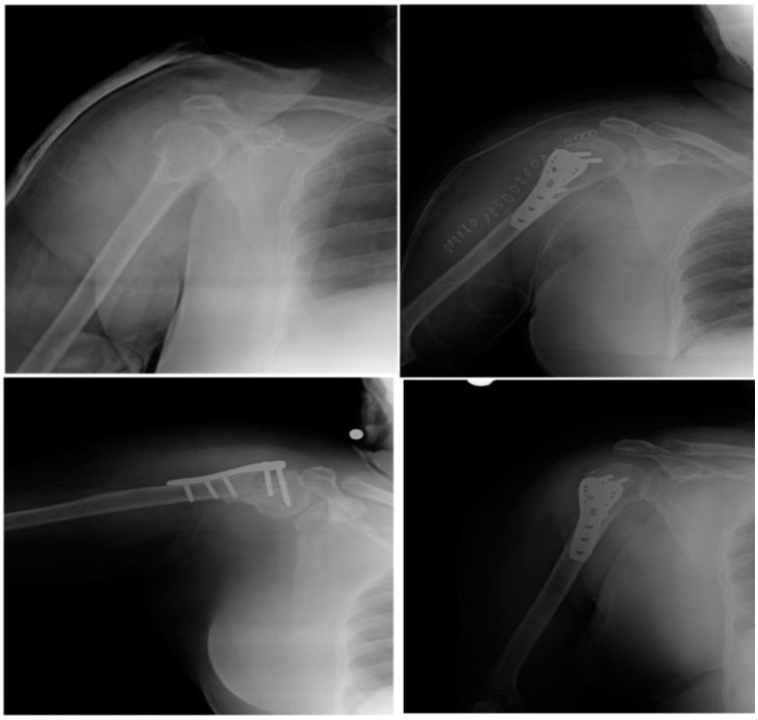

**Fig 1:** Preoperative and Postoperative Radiographs

**Results**

Out of 34 patients who were included in this study 16 were treated conservatively and 18 surgically by open reduction internal fixation with locking compression plate. The two treatment groups were comparable with regard to age, gender and type of fracture. There were 6 males and 12 females in surgical group and 8 males and 8 females in conservative group. The overall incidence of proximal humerus fractures was more in females 58.8% as compared to males. In our study 70.60 % of patients were above 70 years suggesting an age related osteoporotic fracture. There were total 7(20.59%) two part, 18(52.94%) three part and 9(26.47%) four part fractures. In surgical group two 2 part fractures had moderate constant score and two good, six 3 part fracture had good constant score and three poor constant score while two 4 part fracture had poor constant score and three good. In the conservative group two 2 part fracture had moderate constant score and one good, in 3 parts one had poor, four moderate and four good constant scores, in 4 parts all had poor constant scores. The mean constant score for two part fractures was 69.57$\pm$ 6.99, for three part fracture was 66.28$\pm$ 15.16 and four part fracture was 53.11$\pm$ 17.04.The constant scores were higher for the patients who were younger in their respective groups. Almost all the fractures united by an average of 20 weeks (18-24weeks). In the conservative group 31.3% of the patients had poor constant scores 37.50% had moderate constant scores and 31.30% had good constant scores. While in surgical group 27.80% had poor constant score 11.10% had moderate constant scores and 61.10% had good constant scores suggesting that surgical group has better functional outcome but in long term follow up there is not much difference other than the initial pain in the conservative group. This difference could not be proven statistically as the p value was 0.126 which is statistically insignificant and the independent values for pain, activities of daily living and range of motion were not showing significant difference suggesting that in patients above 60 yrs of age with displaced fracture of the proximal humerus there was no difference in functional outcome in long term follow up other than the initial pain relieve in the surgically treated patients than conservative group.

**Table 1:** Age Distribution of the Cases

| | | Age Group | | | | Total |
|---|---|---|---|---|---|---|
| | | Up to 70 yrs | 71-80 yrs | 81-90 yrs | Above 90 yrs | |
| Category | Surgical | 7 | 7 | 2 | 2 | 18 |
| | | 38.90% | 38.90% | 11.10% | 11.10% | 100.00% |
| | Conservative | 3 | 7 | 6 | | 16 |
| | | 18.80% | 43.80% | 37.50% | | 100.00% |
| Total | | 10 | 14 | 8 | 2 | 34 |
| | | 29.40% | 41.20% | 23.50% | 5.90% | 100.00% |

**Table 2:** Types of Fractures

| | | Diagnosis | | | Total |
|---|---|---|---|---|---|
| | | 2 part | 3 part | 4 part | |
| Category | Surgical | 4 | 9 | 5 | 18 |
| | | 22.20% | 50.00% | 27.80% | 100.00% |
| | Conservative | 3 | 9 | 4 | 16 |
| | | 18.80% | 56.30% | 25.00% | 100.00% |
| Total | | 7 | 18 | 9 | 34 |
| | | 20.60% | 52.90% | 26.50% | 100.00% |

**Table 3:** Types of fractures – frequency and Percentage

| Diagnosis | Frequency | Percent |
|---|---|---|
| 2 part | 7 | 20.59 |
| 3 part | 18 | 52.94 |
| 4 part | 9 | 26.47 |
| Total | 34 | 100 |

**Table 4:** Constant Score

| | | | Constant score | | | Total |
|---|---|---|---|---|---|---|
| Category | | | Poor | Moderate | Good | |
| Surgical | Diagnosis | 2 part | | 2 | 2 | 4 |
| | | | | 50.00% | 50.00% | 100.00% |
| | | 3 part | 3 | | 6 | 9 |
| | | | 33.30% | | 66.70% | 100.00% |
| | | 4 part | 2 | | 3 | 5 |
| | | | 40.00% | | 60.00% | 100.00% |
| | Total | | 5 | 2 | 11 | 18 |
| | | | 27.80% | 11.10% | 61.10% | 100.00% |
| Conservative | Diagnosis | 2 part | | 2 | 1 | 3 |
| | | | | 66.70% | 33.30% | 100.00% |
| | | 3 part | 1 | 4 | 4 | 9 |
| | | | 11.10% | 44.40% | 44.40% | 100.00% |
| | | 4 part | 4 | | | 4 |
| | | | 100.00% | | | 100.00% |
| | Total | | 5 | 6 | 5 | 16 |
| | | | 31.30% | 37.50% | 31.30% | 100.00% |

**Table 5:** Distribution of Constant Score

| | | Constant score | | | Total |
|---|---|---|---|---|---|
| | | Poor | Moderate | Good | |
| Category | Surgical | 5 | 2 | 11 | 18 |
| | | 27.80% | 11.10% | 61.10% | 100.00% |
| | Conservative | 5 | 6 | 5 | 16 |
| | | 31.30% | 37.50% | 31.30% | 100.00% |
| Total | | 10 | 8 | 16 | 34 |
| | | 29.40% | 23.50% | 47.10% | 100.00% |

**Table 6:** T-Test

| Group Statistics | | | | |
|---|---|---|---|---|
| | Category | Mean | Std. Deviation | p |
| Pain | Surgical | 12.22 | 2.557 | 0.109 |
| | Conservative | 10.63 | 3.096 | |
| Activities of Daily Living | Surgical | 14.61 | 2.913 | 0.278 |
| | Conservative | 13.69 | 1.74 | |
| Range of Motion | Surgical | 20.89 | 3.771 | 0.203 |
| | Conservative | 19.38 | 2.895 | |
| Strength of Power | Surgical | 18.06 | 11.522 | 0.831 |
| | Conservative | 17.19 | 11.968 | |
| Total Score | Surgical | 65.78 | 15.299 | 0.364 |
| | Conservative | 60.88 | 15.731 | |

The p value less than .05 is significant. In our study no category comes to a significant level.

The Constant score was graded as poor (0-55 points), moderate (56-70), good (71-85) or excellent (86-100).

## Discussion

For many decades attempts have been made to overcome the difficulties which orthopaedic surgeons encounter in the treatment of displaced proximal humerus fractures. The choice of treatment of displaced proximal humerus fracture is not clear. Osteoporosis predisposes to low energy fractures having a complex pattern and difficult fixation owing to poor screw purchase [16, 17]. Rate of failure of fixation is also high. Various techniques [11, 12, 13, 18 and19] have been utilized for the treatment of these fractures and include intramedullary nails, plate osteosynthesis, tension band wiring, percutaneous K-wire fixation and hemi-arthroplasty. Varying outcomes have been reported with plate osteo-synthesis for proximal humerus fractures [12, 20]. Whereas such fractures in young have uniformly good results with plate and screw fixation, results in osteo-porotic fractures of elderly patients are often poor. Esser reported excellent results in 22 out of his 26 patients of three part and four part fractures of proximal humerus treated with a modified clover leaf plate [21]. Wijgman *et al*. reported fair to excellent results in 87% of their 60 patients with three or four part proximal humeral fractures operated with a T-buttress plate and cerclage wires [12]. Paavolainen *et al*. reported satisfactory results in 74.2% of their 41 patients with severe proximal humerus fractures treated with plate and screw devices [22]. However all these authors found poor results in 4 part fractures and recommended a prosthetic replacement in such patients.

The recent evolution of locking plate technology for proximal humerus fractures seems to have revolutionized the management of these fractures. However there have been very limited prospective studies investigating the results of locking plates for open reduction and internal fixation of proximal humeral fractures. Most of these studies have reported good functional outcomes and recommended the use of locking plates for proximal humerus fractures especially in elderly patients with poor bone quality. The results of our prospective study showed moderate to good outcomes in around 72.2% of our patients in surgical group and 68.8% patients in conservative group which are comparable to studies done by aggarwal *et al*., chandan kumar and Olerud P, *et al*. [10, 23, 24]. Application of locking plate technology for proximal humerus fractures has a steep learning curve and appropriate surgical technique is very important for achieving good functional outcome. While the conservative treatment is safe and simple with cuff and collar sling and regular follow up.

In our study, results with Neer type 2 and 3 were good while in between neer type 3 and 4 fractures, which is expected as these fractures are more complex and open reduction and internal fixation is tougher, results of three part came out better than four part [23]. The results were also inferior in patients with age older than 70 years. Nevertheless our results in older age patients are better than those of traditional plates used in such osteoporotic fractures [12, 21, and 22]. We, thus believe, that a locking plate device for proximal humerus fractures gives a satisfactory outcome in most of the patients including those with old the age and poor bone density. A potential limitation of our study was not taking into account the complications of surgical treatment as we focused on the functional outcome of both the treatments. Thus we cannot actually determine which method of treatment has better overall outcome. Nevertheless our results are better than those of the previous studies in which plate osteosynthesis other than locking plate has been used [25, 26, and 27]. Also the prospective design of our study, and a decent average follow up period (12 months) adds strength to our study but on the other side a small sample size weakens it.

## Conclusion

To conclude, we believe that a locking plate for the treatment of proximal humerus fractures uniformly leads to a satisfactory functional outcome over long term follow up in most of the patients. Although the results are poorer in old aged individuals with osteoporosis, they are nevertheless better than those achieved with non-locking plates. The Neer type 3 and 4 fractures have poorer outcome as compared to type 2 fracture. Results in type 3 fracture are good enough to recommend open reduction and internal fixation with locking plates in these patients. The surgery carries a steep learning curve. However, proper use of locking plate principles and a meticulous soft tissue repair with aggressive post-operative rehabilitation go a long way in ensuring a satisfactory functional outcome

## References


1. Gerald Williams R, Kirk Wong L. Two-part and three part fractures-Management of proximal and distal humerus fracture. Orthop Clin North Am 2000; 31(1):1-21.
2. Lind T, Kronerk Jensen J. The epidemiology of fractures of proximal humerus. Arch Orthop Trauma Surg 1989; 108:285.
3. Lous U, Bigiliani. Chapter 9 The shoulder, Vol-1 ed, Charles Rockwood, Frederick A. Fractures of proximal humerus. In Rockwood CA, Matsen. Philadelphia: W.B. Saunders, 1990, 278-334.
4. Scott Powell E, Robert W. Chandler: Fractures of the proximal humerus. Chapter-11, In: Text book of Operative techniques in upper extremity sports injuries. Ed.Frank W. Jobe, Mosby 1995, 313-340.
5. Zyto K. Non-operative treatment of communited fracture of proximal humerus in elderly patients. Injury 1998; 29:349-52.
6. Zyto K, Wallace WA, Frostick SP, Preston BJ. Outcome after hemiarthroplasty for three and four part fracture of the proximal humerus. J Shoulder Elbow Surg. 1998; 7:85-9.
7. Schai P, Imhoff A, Preiss S. Communited humeral head fracture: A multicenter analysis. J Shoulder Elbow Surg. 1995; 4:73-80.
8. Zyto K, Ahrengart L, Sperbar A *et al.* Treatment of displaced proximal humeral fracture in elderly patients. J Bone Joint Surg (Br). 1997; 79-13:412-8.
9. Andrew H, Crenshaw Jr. Surgical techniques and approaches. Chapter-1, In: Campbell's operative orthopaedics, loth Edn., Vol.l, edt. S. Terry Canale, Kay Daugherty, Linda Jones, London: Mosby Year Book Publication, 2003, 3-122.
10. Sameer Aggarwal, Kamal Bali, Mandeep Dhillon S, Vishal Kumar, Aditya K Mootha. Displaced proximal humeral fractures: an Indian experience with locking plates. Aggarwal *et al*. Journal of Orthopaedic Surgery and Research 2010; 5:60.
11. Koukakis A, Apostolou CD, Taneja T *et al*. Fixation of proximal humerus fractures using the PHILOS plate: early experience. Clin Orthop Relat Res. 2006, 442:115-

20.
12. Wijgman AJ, Roolker W, Patt TW *et al*. Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus. J Bone Joint Surg A. 2002; 84:1919-25.
13. Karataglis D *et al.* New trends in fixation of proxima humeral fractures: A review Injury, 2010. doi:10.1016/j.injury.2010.10.016.
14. Neer CS. Displaced proximal humeral fracture: Part 1: Classification and evaluation. J Bone Joint Surg (Am). 1970; 52-A:1077-89.
15. Evan Flatow L. Fracture of the proximal humerus. Chapter-25, In: Text book of Rockwood and Green's fractures in adults. Vol.l, New York: Lippincott Willimas & Wilkins, 2001, 997-1035.
16. Szyszkowitz R, Seggl W, Schleifer P *et al.* Proximal humeral fractures. Management techniques and expected results. Clin Orthop 1993; 292:13-25.
17. Cofield RH. Comminuted fractures of the proximal humerus. Clin Orthop 1988; 230:49 57.
18. Resch H, Povacz P, Frohlich R. *et al*. Percutaneous fixation of three- and four-part fractures of the proximal humerus. J Bone Joint Surg Br. 1997; 79:295-300.
19. Schmal H, Klemt C, S¨udkamp NP. [Evaluation of shoulder arthroplasty in treatment of four-fragment fractures of the proximal humerus]. Unfallchirurg German 2004; 107:575-82.
20. Gerber C, Worner CM, Vienne P. Internal fixation of complex fractures of the proximal humerus. J Bone Joint Surg (Br). 2004; 86(60:848-55.
21. Esser RD *et al.* Open reduction and internal fixation of three and four part fractures of proximal humerus. Clin Orthop 1994; 299:244-251.
22. Paavolainen P, Bjorkenheim JM, Slatis P, Paukku P. "Operative treatment of severe proximal humeral fractures". Acta Orthop Scand 1983; 54:374-379.
23. Chandan Kumar, Anil Kumar Gupta, Rohit Nath, Javed Ahamed. Open reduction and locking plate fixation of displaced proximal humerus fracture. Indian journal of Orthopedics, March 2013|Vol. 47| Issue 2
24. Olerud P, Ahrengart L, Ponzer S, Saving J, Tidermark J. Internal Fixation Versus Nonoperative Treatment of Displaced 3-Part Proximal Humeral Fractures in Elderly Patients: A Randomized Controlled Trial. J Shoulder Elbow Surg. 2011; 20(5):747-55.
25. Cuomo F, Flatow EL, Maday MG, Miller SR, Macllveen SJ, Bigiliani LU. "Open reduction and internal fixation of two and three part displaced surgical neck fractures of proximal humerus". J Bone Joint Surg. 1992; 1:287-293.
26. Douglas J, Rowles, Tames E. "percutaneous pinning of proximal part of the humerus". J Bone Joint Surg. 2001; 83-A(11):1695-1699.
27. Qidwai, Shakeel, Ahmed. Treatment of proximal humeral fractures by intramedullary Kirschnerwires. J of Trauma - Injury Infection & Critical Care. 2001; 50(60:1090-1095.