Original Research Paper

Volume - 13 | Issue - 03 | March - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Orthopaedics

SURGICAL MANAGEMENT OF PROXIMAL HUMERUS FRACTURES USING PROXIMAL HUMERUS INTERNAL LOCKING OPERATIVE SYSTEM PLATING – A PROSPECTIVE STUDY

Dr Rajaneesh B

Dr Srikanth etikala neruganti

Dr Vachan S* *Corresponding Author

Dr Sujith Patil B

Dr Vishruta A V

ABSTRACT **INTRODUCTION** Proximal humerus fractures accounts for about 4 to 5% of all fractures. They are the third most common fractures in elderly population after hip and distal radius fractures. Regarding treatment of proximal humerus fractures, controversies still exists whether to do conservative or operative management. Various operative procedures are carried out, recent trend in internal fixation has moved on to locking plates. The present study is undertaken to evaluate the functional outcome and complication of proximal humerus fractures treated by philos locking plate. **Purpose** The goal of the study is to test the efficacy and functional outcome of proximal humerus internal locking system (PHILOS) Locking plate in proximal humerus fractures. To evaluate the incidence of complication that may occur with PHILOS locking plate in proximal humerus fractures. **Methods** Prospective study involving Adults(>18yrs) with proximal humerus fractures admitted to VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES from november 2014 To october2016. In this study period 20 cases of fractures of proximal humerus were treated by open reduction and internal fixation philos Locking Plate were evaluated. **Results** In our series, majority of the patients were males, elderly aged, with road fall being the commonest mode of injury, involving 2 part,3part and 4part fractures of proximal humerus . The fractures united in all 20 patients. Excellent and satisfactory results were found in 80% of patients with unsatisfactory results in 20 % according to Neer's criteria. **Conclusions** In conclusion Philos locking plate is an advantageous implant in proximal humeral fractures due to angular stability, particularly in comminuted fractures and in osteoporotic bones in elderly patients, thus allowing early mobilization.

KEYWORDS :

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 is still unsolved fractures in many ways.

Disagreement exists regarding reliability of classification system. The indication for surgical management continue to be modified. Fixation technique Are myriad and none is ideal for all cases[1]

Fracture of proximal humerus are not uncommon 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 fractures is therapeutic challenge. Displaced and unstable extra-articular fractures are most commonly treated by operative reduction and fixation using various tecnique[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 pain dysfuction.[4,5]

Proximal humeral fracture, whether caused by trauma (or) related to osteoporosis, requires carefully planned, individual treatment.A wide variety of treatment options have been described beginning with percutaneous fixation , non-absorbable rotator cuff-incorporating sutures and the use of tension band devices , intramedullary nails .

The use of methods of open reduction and internal fixation with the more contemporary use of locking plates advocated recently ,The role of hemiarthroplasty in the treatment of these fractures has also been advocated in both the acute setting and as a delayed procedure[6].

Current therapeutic options for proximal humerus fractures are humerus 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 conducted to analyze fractures of the proximal humerus that were treated with the proximal humeral internal locking system (PHILOS) locking plate and documents their clinical and functional outcome .

2. MATERIALS &METHODS

Source of the data:

Adults(>18yrs) with proximal humerus fractures admitted to VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES from november 2014 To october 2016

Method of collection of data:

The study purpose to include patients with proximal humerus fractures admitted and examined according to protocol, associated injuries noted. Clinical and Radiological evaluation done. Fractures classified using Neers classification.

Routine investigation carried out to get fitness for surgery Patients will undergo Open reduction internal fixation with philos locking plating for the sustained fracture under general anaesthesia Post operative physiotherapy followed according to protocol, to evaluate the functional outcome. Patients will be followed up at 6 weekly interval until fracture union and at once at 1yr after the surgery

A minimum of 30 cases will be studied without any sampling procedure.

Inclusion criteria:

- Two part, three part and four part fracture of proximal humerus.

- Adult(>18yrs) is included
- Patients fit for surgery

Exclusion criteria:
- Children and adolescent patients <18yrs
- Acute infections
- polytrauma
- Compound fractures
- Pathological fractures
- Patients medically unfit for surgery

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 anaesthetic patch over lateral aspect of shoulder.

Radiograph of proximal humerus i.e., antero-posterior view and axillary view were taken and fractures were classified accoridng 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.

The investigations are as follows :Hb%, urine for sugar, FBS, blood urea, serum creatinine, HIV, HbsAg and ECG.

The consent for surgery was also taken from the patient and attendants after explaining the procedure and possible complications. Limb was shaved from shoulder to hand including axilla 1 day before the surgery. Injection tetvac and antibiotics were given 1 hour preoperatively.

OPERATIVE TECHNIQUES :
General anesthesia was used in all patients.

PATIENT POSITION AND DRAPING:
Patients placed in supine position on operating table with wedge a sandbag under the spine and medial border of scapula to push the affected side forward while allowing the arm to fall backward. Drape the arm free, because it will have to be moved during the approach.

SURGICAL APPROACHES[7]:
surgical approaches were used is Deltopectoral approach.

Deltopectoral approach :
Incision starts just above the corocoid process, which is palpated in deepest point in the clavicular concavity distally towards aromioclavicular joint. An 8 to 1ocm incision started from just above corociod process advanced following the line of deltapectoral groove. The intravenous plane is between the deltoid muscle which is supplied by axillary nerve and the pectoralis major muscle, which is supplied by the medial and lateral pectoral nerves. Retract pectoralis major medially and deltoid laterally, splitting the two muscle apart. The vein is retracted either medially or laterally. The short head of biceps and the corocobracialis must be displaced medially before access can be gained to anterior aspect of shoulder joint.

Beneath the tendons lie the transversely running fibers of subscapularis muscle. Apply external rotation to the arm to stretch the subscapulari ,bringing the muscle belly into wound and making its superior and inferior borders easier to define . Pass a blunt instrument between the capsule and the subscapularis, then divide the suscalpularis in from insertion onto to the lesser trochanter of humerus . Incise the capsule longitudinally to enter the joint wherever the selected repair must be performed.

Lateral approach :
A 5 cm longitudinal incision is made from the tip of the acromion down The lateral aspect of the arm.
Deltoid is split in line of its fibres from the acromion downward for 5 cm. Insert a suture at the inferior apex of the split to help prevent it from extending accidentally, with consequent axillary nerve damage, as the exposure is worked on.

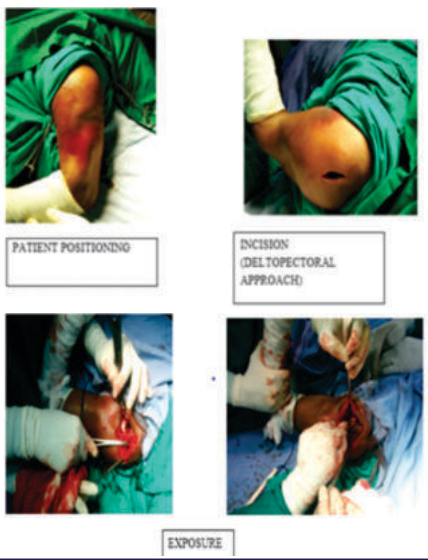
The lateral aspect of the upper humerus and its attached rotator cuff lie directly under the deltoid muscle and the subacromial bursa. In fractures of the neck of the humerus ,the bare ends of bone usually appear at this point without further dissection.

Procedure :
All patients received a prophylactic dose of 1gm cefoperazone + sulbactum intravenously preoperatively. The operation was done in supine position with small sand bag under shoulder, under general anesthesia. Through delto-pectoral approach, the fracture was exposed and reduced with minimal soft tissue dissection. Briefly, the anatomical relationship between humeral head and greater tuberosity was reduced and fixed temporarily with K wires. In case of obvious rotation or displacement of the humeral head, a joystick technique was used .Then the shaft fragment was reduced by abduction, traction and rotation of the arm. Reduction was checked under image intensifier. Definitive fixation with locking plate was done with plate positionedlateral to bicipital groove sparing tendon of long head of biceps and 1cm distal to greater trochanter. The screws were chosen according to preoperative planning, and all the four head screws were supposed to be inserted to the head fragment. The inferior screws supporting the humeral head were considered critical.

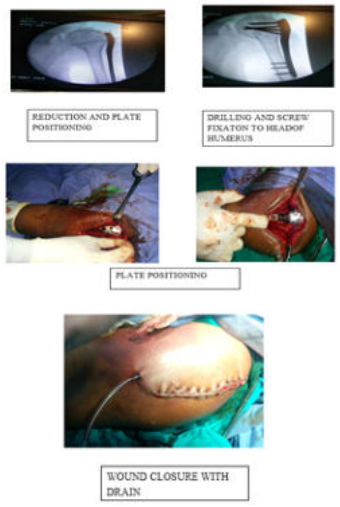
Proximal locking screws were inserted to hold the humeral head, which are multi Directional screws with the tips of the screws staying 5–0 mm away from the articular surface.All proximal locking screws were placed in a unicortical fashion through an external guide and confirmed to be within the humeral head with intraoperative fluoroscopy.

AP (internal and external rotation) views and axillary views 90 degrees to each other were used to visualize screw placement. The distal shaft screws were placed bicortically A minimum of three bicortical screws were used. Fluoroscopic images were taken to confirm satisfactory fracture reduction, plate positioning and proper length of screws in the humeral head. In case of severe comminution or instability, the rotator cuff, the greater tuberosity, and the lesser tuberosity were fastened to the plate using non-absorbable sutures . Range of motion of shoulder was checked on the table for impingement. Wound was closed under negative suction, which was removed after 48 hours.

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 maintainance of reduction.
- Sutures removed by 10th day
- Passive range of motion and pendulum exercises are begun immediately depending on pain.



PROXIMAL HUMERUS -PHILOS PLATING OPERATIVE PICS



RESULTS :

Twenty patients with closed displaced proximal humerus fracture were treated by Open Reduction with Locking compression plate. The following observations were made from the data collected during the study.

Age in years	No of patients	percentage
18 - 30	3	10
31-40	3	10
41-50	9	30
51-60	12	40
>60	3	10
total	30	100

Majority of the patients i.e. 12 (40%) were from age group of 51-60 years followed by 9 patients (30%) in 41-50 age group. The average age of patient was 50.9 yeaars. Majority of the patient in our group are elderly in our study.

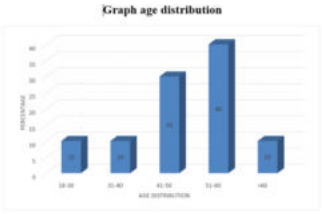


TABLE –2 SEX DISTRIBUTTION

Sex	No.of patients	percentage
Male	18	60
Female	12	40

Majority of the patients were males i.e. 60% and 40% were females. Male : Female sex ratio is 1.5: 1.

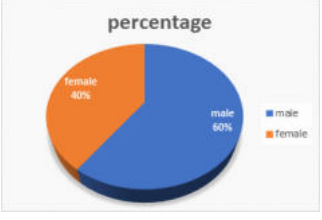


TABLE –3 MODE OF INJURY

Nature of trauma	No.of patients	Percentage
Road traffic accident	9	30
fall	21	70

In our study 70% of injury was due to fall and 30% of the patients presented with road traffic accidents.

TABLE –4 SIDE AFFECTED

Side	No.of patients	Percentage
left	12	40
right	18	60

In this study the fracture occurred on right side in 18 patients (60%) and on left side in 12 patients (40%)

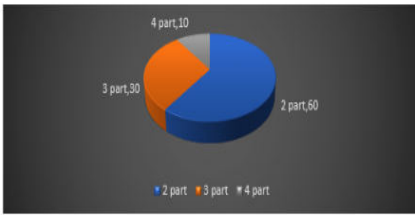
GRAPH 4-SIDE

TABLE –5 FRACTURE PATTERN

Fracture pattern(NEER CLASSIFICATION)	No.of patients	Percentage
2 part fracture	18	60
3 part fracture	9	30
4 Part fracture	3	10

In our study, 60% of the patients presented with two part fracture, 30% of the patients Presented with three part fracture, 10% presented with four part fracture of proximal Humerus according to Neer,s classification.

GRAPH-5 FRACTURE PATTERN



Method of treatment :

All patient underwent open reduction and internal fixation with philos locking plate.

ASSOCIATED FRACTURE :

One case presented with type I compound fracture calcaneum for which steinmann pin was applied which was removed after wound healing and later below knee cast was continued till healing.

TIME OF SURGERY:

The average interval between fracture and surgery was 4.33 days.

STAY IN HOSPITAL:

The average hospital stay in our study was 10.55 days.

TABLE –6 COMPLICATIONS

Complication	No.off patients	Percenntage
Impingement	3	10
Varus Malunion	6	20
stiffness	3	10

Impingement, of the implant with restriction of movements was present in 3(10%) of cases. There were 6 (20%) cases with varus malunion ,stiffness was present 3(10%) of the cases.

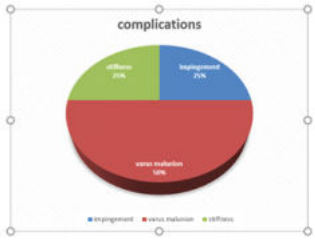
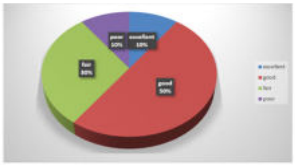
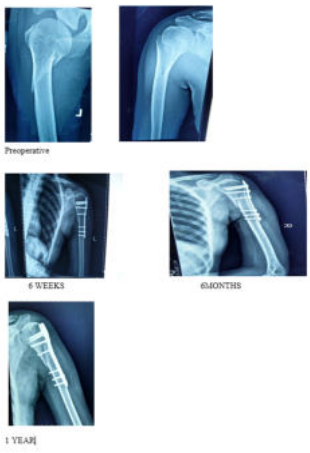


Table 7. Final outcome based on Constant Shoulder score

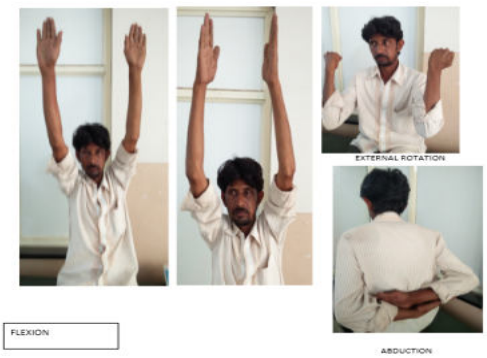
outcome	score	number	percentage
excellent	86-100	3	10
good	71-85	15	50
fair	56-70	9	30
poor	0-55	3	10
total		30	100



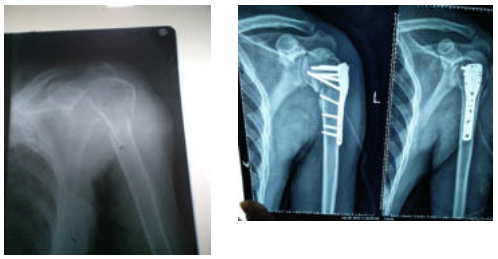
CLINICAL AND RADIOLOGICAL PHOTOGRAPHS



CLINICAL IMAGES PHOTOGRAPHS



INTERNAL ROTATION
CASE NO 2

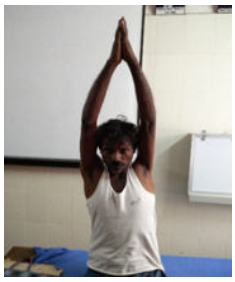


PRE OPERATIVE IMMEDIATE POST OPERATIVE

X RAY AT 6 MONTHS

MOVEMENTS

FLEXION

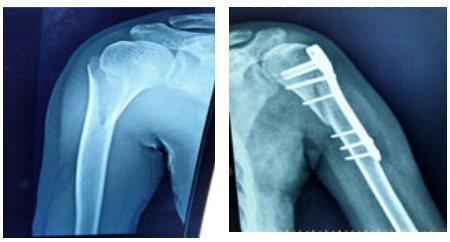


ABDUCTION

EXTERNAL ROTATION

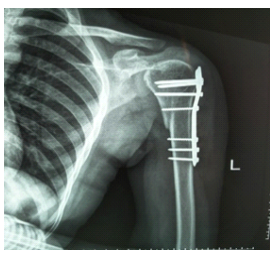
INTERNAL ROTATION

CASE NO 3



PRE OPERATIVE IMMEDIATE POST OPERATIVE

X RAY AT 6 MONTHS



MOVEMENTS

FLEXION

EXTERNAL ROTATION

ABDUCTION

INTERNAL ROTATION

DISCUSSION

Proximal humerus fractures may present with many different configurations in patients with varying comorbidities and expectations. The operative treatment of proximal humeral fractures provides orthopaedician with a therapeutic challenge. As a result, the treating physician must understand the fracture pattern, the quality of the bone, other patient-related factors, and the expanding range of reconstructive options to achieve the best functional outcome and to minimize complications.

Most of the proximal humerus undisplaced fracture can be treated conservatively. Current treatment options range from non-operative treatment with physical therapy to fracture fixation using percutaneous or open techniques to arthroplasty reconstructions. However, the best management in these injuries is still uncertain .Even if the injury is thoroughly analyzed and the literatureis understood, treatment of displaced fracture or fracture dislocation is difficult .

Open reduction and internal fixation (ORIF) provides the features of anatomical fracture reduction, rigid fixation, and the possibility of bone grafting. With the aim of getting anatomically accurate reductions, rapid healing and early restoration of Function, open reduction and internal fixation, is the preferred modality of treatment.

In proximal humerus fractures, PHILOS plate offers good functional outcome with context to the early joint mobilisation and rigid fixation of the fracture. The present study was undertaken to assess the efficacy and the functional outcome following internal fixation with PHILOS (proximal humeral internal locking system) plate for displaced proximal humerus fractures.

Numerous investigators have described the various surgical treatment different techniques have been described for fixation of and displaced proximal humeral fractures. All these techniques have been associated with a varying rate of complications. Functional outcome not only depends on the quality of bone stock, but also on the stability provided by the implant. . The PHILOS plate was designed to improve screw fixation and minimize soft tissue dissection. It attempts to achieve these aims through a combination of multidirectional locking screws for the head, precontouring of the plate, and locking screws in the shaft .In an internal locking system like the PHILOS plate, all forces are transmitted from the bone via the locking head screws to the blade, and vice versa. Hence, the principle of fixed angle plates enables a gain in torsional stiffness and stability, and may therefore promote superior outcome.

In some studies, the objective functional results of conservative treatment have been unsatisfactory.The fractures are defined by variety of classification systems. The difficulty in accurately classifying the fracture creates problems in reporting outcome and also none of the system gives clear prognosis and direction of treatment.

Overall, open reduction and internal fixation, although not in all institution, have yielded satisfactory results. The best results are obtained if the fracture is well reduced and planned rehabilitation program followed. It must be the goal to select fractures for open reduction and internal fixation which can be anatomically reduced. This is dependent on various factors such as type of fracture, the quality of the bone and the technique of reduction and fixation. The present study was conducted to assess the results of two part, three part and four proximal humeral fracture treated by open reduction internal fixation by philos locking plate.

RESULTS

The final results are graded according to constant and murley score.We had Excellent results in 10% of the cases, good results in 50% of the cases, fair in 30% of the cases and poor results in 10% of the cases.

TABLE –11: RANGE OF MOVEMENTS

Movements	Excellent		Good		Fair		Poor	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Flexion	170-180	173.3	120-160	140	100-120	114.4	80-90	86.6
Abduction	160-170	163.3	110-140	126	80-110	100	70-80	76.6
External rotation	80-90	86.6	60-80	70.6	50-70	57.1	40-50	43.3
Internal rotation	80-90	83.3	60-90	70	60-70	62.2	40-50	43.3

We had poor results in 3 (10%) patients. The poor result was due to varus malunion in 2 cases with restriction of abduction and flexion movements. One patient developed stifness with persistent pain which was a poor outcome. The outcome was independent to sex, mode of injury and type of fracture Majority of the patients had clinical (85%) and radiological union (75%) during second follow up at three months. The range of motion at first, second and third follow ups showed gradual increase in mean flexion, abduction, external rotation and internal rotation during subsequent follow ups. These findings suggest that internal fixation with PHILOS (proximal humeral internal locking system) plate for displaced proximal humerus fractures results in overall good results that is nearly 60% of the patients had excellent and good results. All fracture united by 3 months on an average of 10 weeks (8 to 12weeks).

CONCLUSION

The present study was done to evaluate functional out come and complication following surgical management of proximal humerus fracture by proximal humerus internal locking plate.

Proximal humerus fracture is common in elderly aged patients in our study. The commonest mode of injury is fall. Road traffic accident is next common mode of injury.The results are comparable with other studies.

Proximal Humeral Internal Locking system (PHILOS). It combines the principles of fixation with a conventional plate with those of locking screws. The plate is pre-shaped and contoured for the proximal humerus .

In the locking of the threaded heads of the screws in the plate itself provides for a construct with angular and axial stability, eliminating the possibility of screw toggling (windscreen wiper effect), or sliding of the screws in the plate holes. ocking of the threaded heads of the screws in the plate itself provides for a construct with angular and axial stability, eliminating the possibility of screw toggling (windscreen wiper effect), or sliding of the screws in the plate holes.

PHILOS plate showed significantly less plastic deformation subsequent to torsional and axial forces. all forces are transmitted from the bone via the locking head screws to the blade, and vice versa. Hence, the principle of fixed angle plates enables a gain in torsional stiffness and stability, and may therefore promote a superior outcome,coupled with a divergent or convergent screw orientation, this makes for much improved resistance to pull out and failure of fixation,PHILOSplate also allows for a ore biological fixation as the underlying periosteum and blood supply to the fractured regions are much less compressed.

The most common complication in open reduction and plate fixation is plate impingement, leading to limitation of abduction and varus malunion.

The surgical management of proximal humerus fracture is demanding.

The PHILOS plate is effective in maintaining fracture reduction in proximal humerus fractures. Due to stable restoration, early functional aftercare is possible and allows the patient to regain good shoulder function and return to work earlier. Fixation should be followed by early physiotherapy. The rehabilitation programe plays important role in functional outcome of surgical management of proximal humerus fracture. A varus malalignment was found to be a strong predictor of poor functional outcome and should be avoided wherever possible by anatomical reduction and fixation.

In conclusion Philos locking plate is an ideal internal fixation material for the osteosynthesis of proximal humerus fractures in patients of all

ages, particularly in osteoporotic bones in elderly patients and in comminuted fractures and thus allows early mobilization of the shoulder without compromising fracture union.

REFERENCES

1. Gerald R. Williams and Kirk L. Wong, 2000: "Two-part and three part fractures-Management of proximal and distal humerus fracture". Orthop Clin North Am, January 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: p278-334.
4. Scott E. Powell, 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: p.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. Wijgman A.J, Roolker W,Patt T W et al , open reduction and internal fixation of three and four part fractures of proximal humerus. Scientific Article November 01, 2002
8. Stanley Hoppenfield Operative exposure 4th edition page 4-15,
9. Gerber C, Worner CM, Vienne P. "Interal fixation of complex fractures of the proximal humerus". J Bone Joint Surg (Br), 2004 Aug; 86(60):P 848-
55. 10. Neer CS. Dispalced proximal humeral fracture : Part 1: Classification and evaluation. J Bone Joint Surg (Am) 1970; 52-A: 1077-89.
11. Neer CS. "Displaced proximal humeral fractures. Part II. Treatment of three part and four part displacement". J Bone Joint Surg, 1970; 52A: 1090-1103.
12. Paavolainen P, Bjorkenheim JM, Slatis P, and Paukku P."Operative treatment of severe proximal humeral fractures". Acta Orthop Scand, 1983; 54: 374-379.
13. Siebler G, Kuner EH , "Late results following the surgical treatment of proximal humerus fractures in adults". Unfall chirurgie 1985; 11(3): 119-
127. 14. Kristiansen B and Christensen SW : Plate fixation of proximal humeral fractures, Acta Orthop Scand, 1986; 57: 320-323,
15. Hawkins RT, Bell RH, et al, "The three-part of proximal part of humerus". J Bone Joint Surg 1986; 68A: 1410-1414.