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The Surgical And Functional Outcome In Two Part And Three Part Fracture Of The Proximal Humerus Using Proximal Humerus Locking Plate (Philos Plate).

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Abstract: *Proximal humerus fracture remains a major challenge for treating surgeons. While non-displaced fractures can be managed conservatively, displaced ones are often treated surgically. The incidence of proximal humerus fractures has increased in last few years due to changes in life style and increase in road traffic accidents. Hence, the challenge of the modern day treatment was to get accurate reductions anatomically, fast healing and early restoration of function. Objectives: To assess the efficacy, functional and anatomical outcome of locking plate in management of two part and three part fracture of proximal humerus according to Neer's classification. Methods: This is a prospective study in which 30 patients of the proximal humerus fracture, between 25 years to 55 years age group who provided the written inform consent to participate in the study were included and treated using proximal humerus locking plate technique from August 2016 to August 2018. Outcome measure using radiological and clinical parameters, functional outcome was access by DASH SCORE. Result: All patients were subject to ORIF with locking proximal humerus plate. Proximal humerus fracture is common in age group of 36 to 45 years (46%). 22 out 30 (73%) patients were male. The commonest mode of injury was Road traffic accident (53%).In the present study 16(53.33%) cases had 2 part fracture and 14 (46.67%) had 3 part fracture. In our study the mean duration of operation was 45.5minutes. Out of 12 patients, 6(17%) had complication.1 patient (8.5%) had superficial infection and 2 patient (8.5%) had stiffness of the shoulder.The collected data was analyzed using SPSS software version 23.0. A p value <0.05 was considered significant. Conclusion: The proximal humerus locking plate method for proximal humerus fracture emerges to be safe, effective, reliable fixation with minimal complications.*

Keywords: *Proximal humerus fracture, Neers classification and locking plate*.

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I. Introduction

Proximal humerus fractures are the 2nd most common fracture of upper limb after distal radius fracture and accounts for 26% of all humerus fracture[1]. Humerus fracture most commonly occur in the elderly due the weakened osteoporotic bone. In younger patients, high-energy trauma is the cause and displacement is often more severe[2]. The morphology of fractures depends on the mechanism of injury, numbers of muscular forces on fracture fragments and connection of fragments to periosteum. It has been divided into avulsion and impaction fractures. For impaction fractures the mechanism are fall on the abducted arm with the glenoid consequently depressing the humeral head into the shaft thereby blowing out the minor tubercle ventrally and the greater tuberosity laterally resulting in a valgus-impacted four-part fracture. On the contrary, the avulsion fracture causes disruption of periosteum and subsequently more pronounced dislocation of affected tuberosities as well as rotational and usually varus malpositioning of the humeral head leads to two-and three-parts fractures. The term avulsion may be misleading because it generally refers to isolated avulsion fractures of the greater and lesser tuberosity. It has been observed that two- and three-part fractures often show a comminuted fracture area at the medial calcar induced by compressive forces, while tension forces are seen on the lateral side. So, in adducted arm (or neutral position), an axial forces of the humerus directed cranially to the acromion rather than to the glenoid cavity. The rotary muscles then pull the humeral head mediocaudally and the acromion additionally depresses the central and medial aspect of the humeral head caudally into varus. In contrast, a fall on the abducted arm transfers axial forces to the glenoid depressing the head into valgus. Therefore like femoral neck fractures it is reasonable to distinguish between abduction (valgus) and adduction (varus) fractures of proximal humerus and term avulsion fracture for isolated fractures of the tuberosities[2]. Women are affected more than men in the ratio of 3:1[3]. Proximal humerus fractures occur in a bimodal frequency, either in younger

people following high- velocity/energy trauma or in those older than 50 years with lower- energy injuries[3, 4, 5]. Undisplaced or minimally displaced fracture can be treated conservatively,[9] Treatment options for these displaced fractures include closed reduction and percutaneous screws fixation, closed reduction and percutaneous Kirschner (K)-wires fixation and open reduction and internal fixation. Decision of the fracture treatment should take into account of patient's individual needs and characteristics, such as his/her biological age, accompanying illness, bone quality and morphology of the fracture[11]. Excellent outcome have been obtained with advent of locking compression plates technology[12, 13]. It preserves the biological integrity of the humeral head and secures an anatomical reduction with multiple screws and angular stability[14].Conservative treatment of displaced proximal humeral fractures may result in unacceptable deformity and stiffness of the shoulder. Recently, Proximal Humeral locking plate, providing greater angular stability, has been proposed for operative fracture treatment.

The purpose of the present study was to evaluate the functional and radiological outcome of proximal humerus fracture managed with proximal humerus locking plate clinically by evaluating pain, range of motion and muscle power and radiological union of fracture, patient compliance and complications.

II. Materials and Methods:

With due approval from the institutional research ethics board and after obtaining written informed consent, of the individual patients, all patients with proximal humerus fractures who came to the department of orthopaedics from emergency services and out-patient department(OPD), were admitted between august 2016 to august 2018. The study was a hospital based prospective cohort study without control. All the patients of either sex between 25-55 years with closed fractures and with proximal humerus fractures of types II and III as per Neer's classification were included in the study. Patients with age >55 years or <25 years, children, pregnant women, patients with neurological deficit, compound injuries and patients unfit for anaesthesia and/or surgery were excluded from the study. 30 patients were included in the study after meeting inclusion criteria. They were assessed by antero-posterior, lateral view X-rays and CT-scan with 3D reconstruction of the affected limb. Routine Investigations were done for all the included patients. The collected data was analyzed using SPSS software version 23.0. A 'p' value less than 0.05 was considered significant.

Surgical techniques: All the patients in this study were operated upon under regional or general anaesthesia. Patients were positioned in either the beach chair or supine semilateral position on an operation table. After preparing and draping the limb, the fracture site was approached through either by the anterolateral deltoid-splitting approach or the deltopectoral approach. The incision is centered between the anterior and middle heads of the deltoid, with the proximal extent of the incision approximately one finger breadth proximal to the anterolateral border of the acromion. This incision is extended as far distal as necessary to adequately expose the fracture and facilitate plate placement, while aiming toward the lateral epicondyle of the humerus. Proximally, the interval between the anterior and middle heads of the deltoid is entered using sharp dissection. The axillary nerve is identified during this portion of the dissection, which should be approximately 6cm distal to the acromion. The subacromial bursa is incised proximal to the nerve to expose the rotator cuff, while blunt dissection is utilized just distal to the axillary nerve to identify the proximal portion of the humeral diaphysis. Only the axillary nerve needs to be identified and protected. At this point, fracture reduction can commence, which can be facilitated by the placement of tagging sutures within the rotator cuff tendons to help gain control of tuberosity fragments. These tagging sutures through the rotator cuff can be secured to the plate at the conclusion of the procedure to assist in fixation of the tuberosity fragments. The incision wound is closed in three layers with a negative suction drain and pressure bandage is applied. Fixation may be confirmed by C-Arm in AP and Lateral views. The operated limb was kept elevated with both the shoulder and elbow extended. During this time, passive and active movements of the fingers was encouraged.

Follow up: Patients was followed up every 3 weekly for the first 12 weeks after surgery, then once a month for the next 3 months and then every 3monthly for a period of one year. Thorough clinical examination followed by local examination of the operated site and the whole limb were done and compared with the other site in terms of range of motion, power, tone, muscle wasting etc. All relevant findings were recorded. In each visit, radiological assessment of union and fracture callus quality was recorded in addition to functional limb assessment.

III. Result

All patients were subject to ORIF with locking proximal humerus plate. Proximal humerus fracture is common in age group of 36 to 45 years (46%). 22 out 30 (73%) patients were male. The commonest mode of injury was Road traffic accident (53%).In the present study 16(53.33%) cases had 2 part fracture and 14 (46.67%) had 3 part fracture. In our study the mean duration of operation was 45.5minutes. Out of 12 patients, 6(17%) had complication.1 patient (8.5%) had superficial infection and 2 patient (8.5%) had stiffness of the shoulder.

AGE AND SEX:

Sl no	sex	25-35 year age	36-45 years	46-55 years	Percentage
1	Male	6	11	5	73.33
2	Female	2	3	3	26.67
	Total	8	14	8	100

TYPES OF FRACTURES:

Sl no	Sex	2 parts fracture	3 parts fracture
1	Male	10	12
2	Female	6	2

SIDE OF INJURY:

Side	No of patients	Percentage
Right	22	73.33
Left	8	26.67

MECHANISM OF INJURY:

Mechanism of injury	No of patient	Percentage
Direct blow	6	20
Accidental fall	8	26.67
RTA	16	53.34

RADIOLOGICAL AND CLINICAL UNION:

Type of union	Duration of union(weeks)	Mean duration to union (weeks)
Radiological	8-32	18
Clinical	9-20	13.5

COMPLICATIONS OF PROXIMAL HUMERUS LOCKING PLATE:

Complications	No of patients	Percentage
Subacromial impingement	1	
Stiffness	2	
Superficial infection	1	

DASH SCORE:

Completed weeks	DASH score	Mean DASH score
4 weeks	50-60	49.50±3.26
12 weeks	20-30	25.03±3.20
36 weeks	5-10	6.83±1.53

IV. Discussion

Locking proximal humeral plate fixation achieved acceptable functional results in the elderly and in osteoporotic bones. In this study, the PHILOS plate fixation provided stable fixation with early range-of motion to achieve functionally acceptable results. In this study, the Philos plate fixation was a suitable choice for two- and three-part proximal humeral fractures. Its complication rates were low, probably because these patients were relatively young, and both the bone quality and the surgical technique were good. During dissection and head penetration with the proximal interlocking screws, care had to be taken to avoid damage of the anterior humeral circumflex artery and the axillary nerve. The screw position had to be checked intraoperatively with image intensification. The incidence of fractures was more common in the people with the mean age group of 42.3 years which was comparable with the studies of Jakob et al, Roolker et al and Sohal et al. In our study males were affected more compared to females and this higher in ratio can be explained by a higher involvement of male in day to day activities than females and this gender related issue in this study was similar with the studies of Kumar et.[16] .Vehicular accidents are the most common cause of skeletal injury globally. In our study this act remains as most common cause of proximal humerus fracture with high energy trauma (53%) followed by domestic fall (26%). The major mechanism concerned with fracture was fall on outstretch hand (26%), high energy trauma (53%), and direct blow (20%). This observation of the present study was in accordance with the observations of Sohal et al in which 20% of fractures were due to fall on outstretch hand and 68% of fractures were related to high energy trauma[15]. In this study 22 (73%) patients were affected with proximal humerus fracture on right handed side and remaining 8 (27%) on left handed side. None of them had fracture on both the sides. This feature was similar with the observations of Geiger et al[7]. According to Neer's classification, two-part fractures in 16 (53%) patients and three-part fractures in 14 (47%) cases. Similar reports were observed in a study conducted by Bansal et al in which 11 patients had 2-part fractures, 11 patients had 3-part fractures, and 3 patients had 4-part fractures[15]. In this study the mean time of union was 18 and 13.5 weeks. Complications occurred in 1 case superficial infection and 1 case of subacromial impingment and 2 cases of stiffness. In a

study conducted by Kumar et al and Vander et al, the mean time of union observed was 12 and 16 weeks respectively[16,17]. In contrast to our findings, Kumar et al in his study reported complications in 4 cases with varus malunion, 1 case of subacromial impingement, 1 case of deep infection, 1 case of intraarticular screw penetration and 1 case of failure of fixation[16]. In study of Atalar et al, 10 patients treated with minimally invasive bone grafting and suturing had an average of DASH score 23[18].This was comparable to DASH score of our study in 30 patients after 3 months of follow up. Thyagarajan et al recommend the use of the proximal humerus locking plate as a surgical option in the management of displaced proximal humeral fractures[19]. According to Shahid et al management of proximal humeral fractures with the proximal humerus locking plate were equally good in all the patients but the functional outcome was better in younger patients[20]. Patil et al confirms proximal humerus locking plate produces promising functional outcomes by giving proper anatomical reduction[21]. Nonetheless, the choice of treatment should be based on patient age, functional requirements, bone quality, fracture pattern, and the surgeon's preference. Prospective randomized trials are needed to compare the different methods of fixation.

V. Conclusion

The most important factor for the favorable outcome in two-part and three-part fracture in the humerus is a good anatomical reduction, which is achieved by locking plate osteosynthesis with multiplanar screws and it is a safe and effective method, with minimal tissue damage, higher primary stability, and load transfer through the implant, which are important to avoid complications. The PHILOS Plate produces promising functional outcomes. The suggested surgical approach reduces the risk of soft-tissue damage and provides early functional recovery.

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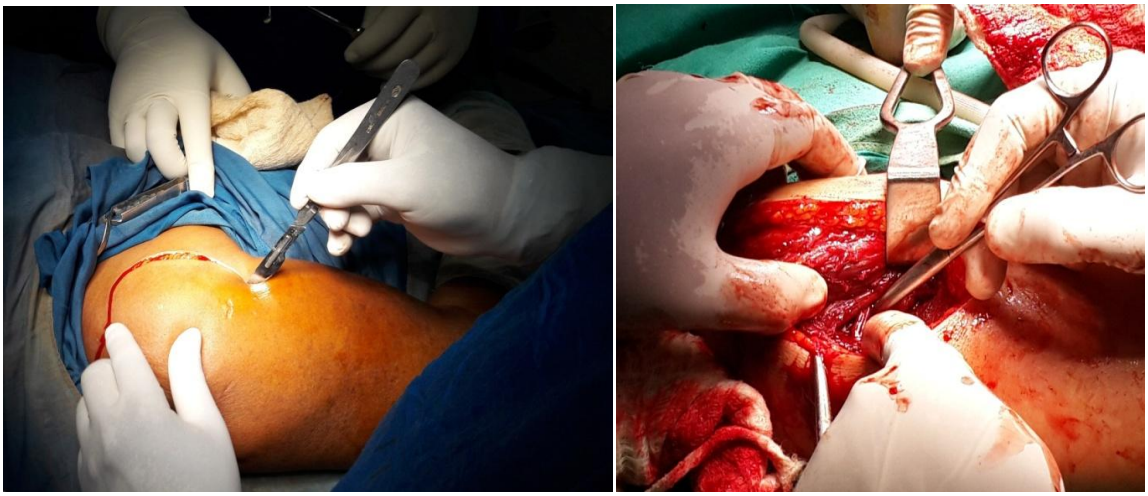

Fig: incision and exploration

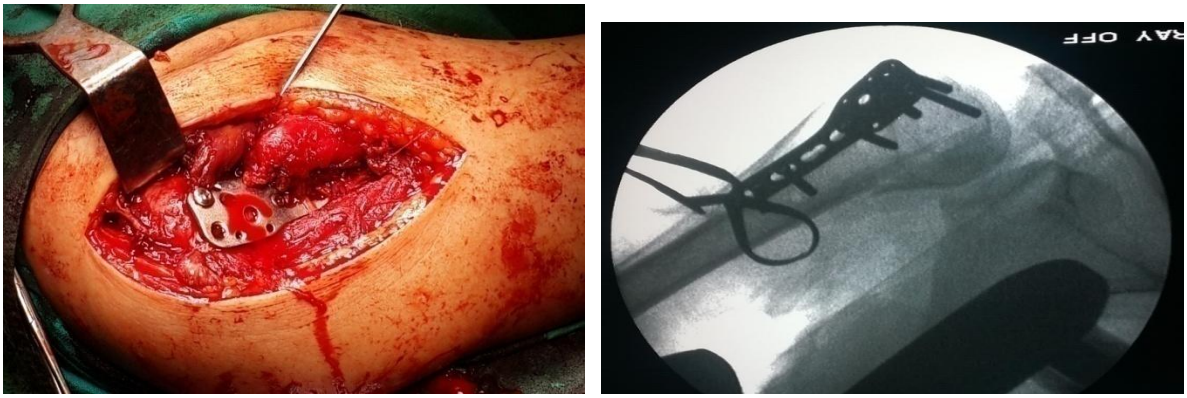

Fig: fixation and intraoperative x ray

Fig: preoperative and postoperative x ray

Fig: postoperative range of motion at shoulder joint

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