ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 12 | December - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY OF RESULTS TO FIND OUT THE PROGNOSTIC PARAMETERS FOR OPERATIVE INTERVENTION IN PROXIMAL HUMERUS FRACTURES WITH PHILOS PLATE FIXATION.

Orthopaedics

Dr. Biplab Chatterjee	M.S. Orthopaedics, AO Fellow, Associate Professor at Burdwan Medical College.
Dr Divyanshu Kumar	Senior resident, M.S. Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Sanjoy Mondal	Senior resident, M.S. Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Atanu Kayal	Senior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Bikram Chakraborty	Senior resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Aviroop Chakraborty	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Avishek Mallick	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Abdul Jabbar Shaikh	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Jishan Azad	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Tonmoy Mahato	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.
Dr. Tanmoy Saha	Junior Resident, Department of Orthopaedics, Burdwan Medical College, Burdwan.

ABSTRACT

Background:- Proximal humerus fractures are common in the elderly population. Many of these fractures are associated with osteopenia and may be caused due to fragility fracture. Various operative methods are available for proximal humerus fractures. Open reduction and internal fixation with PHILOS plate, conventional AO plate, proximal humerus nail, blade plate, Tension band wiring , and replacement surgeries are some of the options. In this study we aim to find out the prognostic factors for operative intervention in proximal humerus fracture treated with PHILOS plate. **Methods:-** This is a prospective study in which the follow up of 15 cases with proximal humerus fracture treated with open reduction and internal fixation with PHILOS plate was done. Clinical and radiological evaluation was done at 2 weeks, 4weeks, 6 weeks, 6 month and 1 year. Functional outcomes for pain, motion and muscle power, and function are assessed using the Constant and a Murley scoring system. Pain was scored on basis of VAS(Visual analogue scale). Various prognostic factors were studied which had an impact on the functional outcome after operation. **Results:-** Out of 15 patients 2 patients were lost to follow up after 3 months and 6 months. Age distribution of the patients show maximum number of the patient fell in the age group of 41-50 years(40%). Young age has a positive correlation to good outcome (p=0.0047). 9 patients had intact calcar and 6 patients had disrupted calcar. Fracture with intact calcar had good outcomes whereas with disrupted calcar had poor outcome (p=0.015). Varus fixation is not associated with outcome (p=1). **Conclusion:-** Young age and intact medial calcar support were related to good prognostic features whereas disrupted medial calcar was associated with bad prognostic feature for functional outcomes. Immediate varus fixation was not associated with any change in functional outcome.

KEYWORDS

Proximal humerus fracture, Constant and Murley score, PHILOS plate

INTRODUCTION:-

Proximal humerus fractures are fractures occurring at or proximal to the surgical neck of the humerus. These fractures are the second most frequent injury of the shoulder girdle in adults(1), and comprise 4% of all fractures and approximately one-half of all humerus fractures.(2,3,4) In patients above the age of 65 years, proximal humerus fractures are the second most frequent upper extremity fracture, and the third most common nonvertebral osteoporotic fracture after proximal femur and distal radius fractures, accounting for 10% of fractures in this patient population.(5,6,7)

In the adult population, proximal humerus fractures have a unimodal distribution, peaking at 84 years of age for both males and females.(8,9). Females are therefore more frequently affected, with only 15% to 30% of fractures occurring in males.(10)

Many of these fractures are often treated conservatively however, Charles Court-Brown and his co-authors stated, "Proximal humerus fractures often occur in the fit elderly independent patient who is still a net contributor to society but who might well be converted to a degree of social dependency by the fracture."(11)

The introduction of periarticular plates with locking screws was perceived as a game changer in proximal humerus fracture fixation.(12) However, the reported complication rates using this fixation strategy were unexpectedly high.(13) These failures have prompted a renewed interest in alternative fixation techniques, in particular intramedullary (IM) nailing.(13) On the replacement side, hemiarthroplasty, introduced decades ago,(15) has been limited by tuberosity failures, especially in elderly patients. Reverse shoulder arthroplasty has become more and more popular for the management of displaced fractures in the elderly.(16) Its role continues to expand even though improved outcomes have not always been easy to establish.(17)

Clinical Features:

The most common presenting complaints of patients with proximal humeral fractures include pain in the shoulder and difficulties with active motion of the affected upper extremity. Upon inspection, soft tissue swelling, fluctuation and ecchymosis of the shoulder should raise the suspicion of a proximal humeral fracture. Neurovascular injuries must be ruled out through a detailed exam. Hypoesthesia over the lateral aspect of the proximal arm suggests an axillary nerve injury.

A thorough exam of the brachial plexus and its branches is performed to identify additional neurologic deficit. Distal radial pulse and capillary refill of the fingers should also be assessed.

Investigation:
Radiographic evaluation is essential for accurate fracture classification and treatment decision. Following views of X-ray will be more useful.
1) True Anteroposterior (AP) view of shoulder
2) Axillary view (or) Velpeau axillary view.
3) Lateral Y view of the scapula

Computed Tomography:
3-Dimentional reconstructive computed tomography are helpful in evaluation of intraarticular fractures to assess the degree and nature of damage to articular surface.

METHODOLOGY :-
It was a prospective study in which 15 cases of proximal humerus fracture were treated by open reduction and internal fixation with PHILOS plate at Burdwan Medical College from 2019- 2020. Patients were followed up at 2 weeks, 4 weeks, 6 weeks, 6months and 1 year. These patients were initially kept in arm sling pouch. In all cases Delto-Pectoral approach was used. Fracture was anatomically reduced and fixed with locking compression plate. Fixation rigidity was checked on table, post-operative check radiographs taken. Patients were mobilized in the arm pouch. All patients were encouraged pendulum exercises as early as possible. Sutures were removed on the 14th post-operative day.

OPERATIVE PROCEDURE(18):
Positioning:
Proximal humeral plating is best performed in the beach chair position. The trunk is also positioned laterally on the table, so that part of the shoulder region and the whole arm are accessible for reduction maneuvers and to obtain adequate fluoroscopic visualization. The C-arm is positioned at the head of the patient entering along the side of the table.

Surgical Approach:
We have performed the proximal humerus plating through Delto-Perctoral Approach. The distance between the tip of the coracoid and the posterolateral corner of the acromion is divided in thirds, and the skin incision is placed proximally at the junction between the medial third and the lateral two-thirds of this distance. Cephalic vein and delto-pectoral interval is identified. Then cephalic vein is mobilised medially which allows for improved exposure by avoiding proximal tethering of the cephalic vein. The anterior distal deltoid insertion is gently elevated off the lateral side of the humerus in continuity with the lateral arm soft tissue sleeve with the aid of a periosteal elevator, just enough to allow the correct lateral plate placement. Place a pointed retractor over the coracoid and a second pointed retractor around the humeral shaft for better exposure.

The arm is then placed in abduction to relax the deltoid, and the subdeltoid space is released. Next, the clavipectoral fascia is opened and the space between the conjoined tendon and the subscapularis and lesser tuberosity is developed as well. Careful soft tissue management is required to avoid devascularization of the fractured fragments.

Key Surgical Steps in proximal humeral plating are:
Tuberosity identification and control with traction sutures
Head to shaft reduction and provisional wire fixation ± bone grafting
Tuberosity reduction and suture fixation
Provisional plate positioning
Plate fixation into the diaphysis
Plate fixation into the humeral head
Suture fixation of the tuberosities to the plate
Selective cement augmentation(if required)
Wound was closed with 2-0 ethylon with drain in situ. Dressing was done with betadine soaked gauze and dynaplast.\

Post-operative Protocol:
After operation, arm was placed in shoulder immobiliser. Active range of motion exercise of hand ,wrist and elbow was adviced immediately after OT .Wound was inspected after 48 hours and in same sitting drain was removed and dressing with Mupirocin Ointment was done. From the next day Codman Pendulum exercise was adviced to patient. Patient is discharged the third day.

First follow-up at 2 weeks where stitch removal was performed and patient was adviced passive assisted Range of Motion exercise at home.

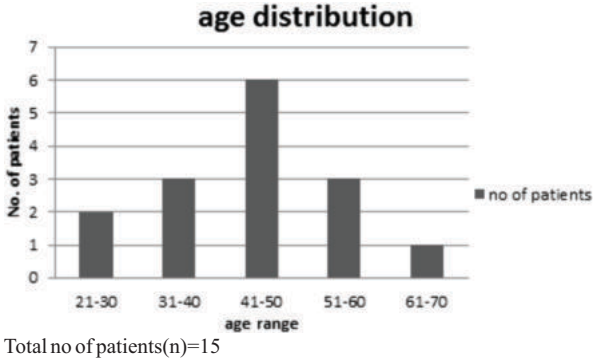
Next follow-up was done at 4 weeks, 6weeks, 3 months,6 months and 1 year. At each followup Xray of shoulder joint was done for radiological assessment and functional assessment was done side-by-side.

At 6 weeks active range of motion exercises were given .At 3 months stretching exercise and strengthening exercises were given.

RESULTS:-
Out of 15 patients 2 patients lost followup after 3 months and 6 months.

Distribution Of Study Population(n=15) According To Age
Table : Age Distribution

Age	No. of patients	Percentage
21-30 years	2	13.3
31-40 years	3	20
41-50 years	6	40
51-60 years	3	20
61-70 years	1	6.6



Total no of patients(n)=15
minimum age of patient=25
maximum age of patient=68
maximum number of patient lies in age group of 41-50 years which is 6(40%)
mean age = (45.06±11.94)years
range = (25-68) years

Keeping the upper limit of adult 55 years ,we divided the population in 2 groups

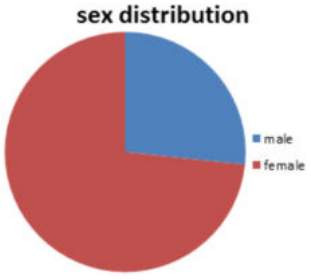
Below and equal to 55 years
Above 55 years
Correlating it with the outcomes(at 1 year)
Here n=13 as 2 patients lost followup at one year

Age	Moderate to excellent outcome	Poor outcome
Less than equals 55	10	0
More than 55	0	3

Running Pearson's Chi-squared test
X-squared = 7.9769, df = 1, p-value = **0.004738**

Distribution Of Population According To Sex
Table: Sex Distribution

Sex	No. of patients
Male	4
Female	11
Total	15

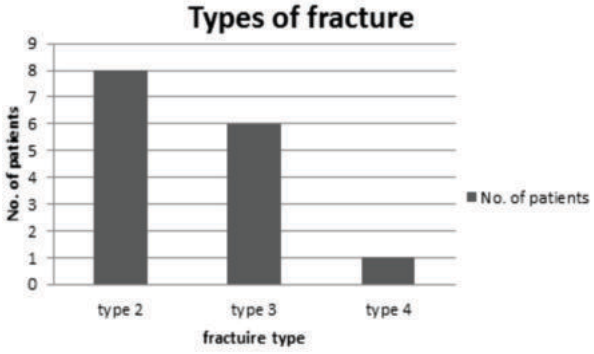


Majority of patients were female 11(73.3%)
Female :male ratio=2.75:1

Types Of Fracture:
All the proximal humerus fracture patterns were classified according to NEER in this study.

Table: Types Of Fracture

Fracture type	No. of patients	Percentage
Type 2	8	53
Type 3	6	40
Type 4	1	6.6

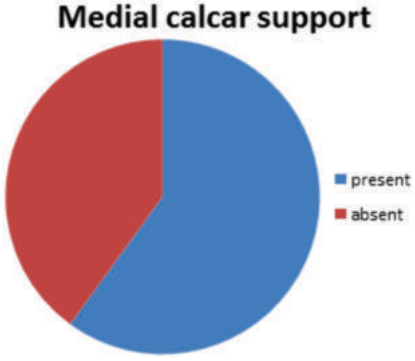


Of all fracture patterns type 2 was the most common accounting for 53%.Next was type 3 accounting 40% and to the least was type 4 which made up 6.6%.

Medial Calcar Support
Of different fracture pattern we looked into the absence or presence of medial calcar support.

Table : Medial Calcar Support

Medial calcar support	No. of patients
Present	9
Absent	6



Out of 15 fracture patterns there were 9 fracture patterns with intact medial calcar and 6 patterns were there with no medial calcar support.

Establishing a relationship between outcome and medial calcar support(n=13)

Medial calcar support	Moderate to excellent outcome	Poor outcome
Present	8	0
Absent	1	4

Running Pearson's Chi-squared test
X-squared = 5.8703, df = 1, p-value = 0.0154

Establishing relationship between medial calcar support and osteonecrosis

Here also we will take n=13 as 2 patients didn't complete the followup

Table : Medial Calcar Support And Osteonecrosis

Medial calcar support	Osteonecrosis present(+)	Osteonecrosis absent(-)
Present(+)	0	8
Absent(-)	4	1

Running Pearson's Chi-squared test
X-squared = 5.8703, df = 1, p-value = 0.0154

Varus Fixation And Outcome
Here we try to establish relationship between immediate varus fixation and outcome.

Here also we take n=13 as two patients didn't complete the followup of 1 year.

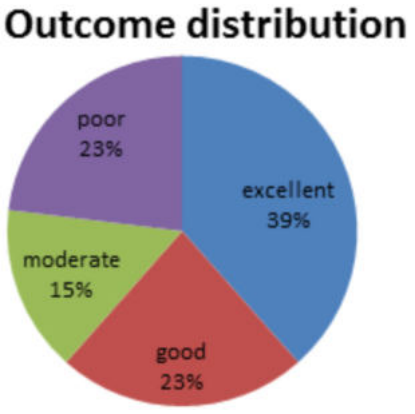
Table: Varus Fixation And Outcome

Varus fixation	Moderate to excellent outcome	Poor outcome
Present	3	2
Absent	6	2

Running Pearson's Chi-squared test
X-squared = 4.3175e-32, df = 1, p-value = 1

Distribution On Basis Of Outcome At End Of 1 Year(n=13).

	Excellent	Good	Moderate	Poor
No. of patients and percentage	5(38.46%)	3(23.07%)	2(15.38%)	3(23.07%)



Here keeping n=13 as two patients lost followup at the end of 1 year,maximum number of patients had excellent outcome after surgery.Pooling the outcome to excellent to good and poor then 76.91% of patient had excellent to moderate result while 23.07% of patient had poor result.

DISCUSSION:-
The main principle of fixation is reconstruction of articular surface including
restoration of anatomy, stable fixation with minimal injury to soft tissues preserving the vascular supply.
Poor results in these complex fractures are due to following causes:
1) Inadequate fracture reduction especially medial cortex
2) Unstable fixation
3) Incorrect positioning of the fixation devices.

There is consensus in the literature that, regardless of the procedure and the implant chosen, a good functional final result depends mainly on anatomical reduction of the fracture combined with a stable fixation, and early initiation of functional rehabilitation of the shoulder. But in this study, age of the patient, minimal part of fractures directly increase the functional outcome.

Pre contoured locking compression plates work on the principle of angular stability, less disruption of vascularity and less change of plate failure. Improved fixation by locking plates is attributed to angular stability of the screws locking in plate and their three dimensional distribution in the humeral head.

15 patients were treated with proximal humeral lock plate(PHILOS).

Out of 15 patients 2 patients lost followup after 3 months and 6 months.

Age distribution of the cases showed that mean age of the cases was (45.06±11.94)years with range being 25 to 68 years.

Maximum number of the patient fell in the age group of 41-50

years(40%).

Total population were divided into 2 groups
- less than equal to 55 years
- more than 55 years

Correlating age distribution with the outcome by Pearson's Chi Square test P value=**0.0047(significant)**

So there is a positive correlation between young age and excellent to good outcome .So it can be said that patient below age of 55 undergoing plate fixation has excellent to moderate outcome at the end of 1 year and hence young age is a good prognostic marker.

Sex distribution showed female preponderance with female to male ratio being 2.75:1.

Coming on to **types of fracture distribution**,Neer type 2 was 53% which accounts for the maximum and minimum was 4 part fracture which was 6.6%.

In studies done by **MA Fazal et al.** of 27 cases 13 (48%) were 2 part fractures, 12 (44.5%) were 3 part fractures and 2 (7.5%) were 4 part fractures.(19) Another study by **Siwach R, Singh R et al**. of 25 cases 12(48%) were 2 part fractures, 13 (52%) were 3 part fractures, no 4 part fractures indicating that the incidence of type of fracture is nearly consistent with the studies in literature.(20)

Distribution of population according to **medial calcar support.**

Medial calcar support: In any fracture pattern distal metaphyseal extension of head fragment of 8mm or less,it is said to be disrupted calcar support and metaphyseal extension of more than 8 mm means intact calcar support.

On this basis,9 patient has intact calcar and 6 patient had disrupted calcar.

Correlating calcar support and outcome,by Pearson's Chi Square test p value=**0.015**,(significant).This means fracture with intact calcar has excellent to moderate result while those with disrupted calcar has poor result.

Correlating medial calcar support and osteonecrosis, by Pearson's Chi Square test p value=**0.0154**,(significant). So it can be said that disruption of calcar support has a positive relationship with osteonecrosis.

Distal metaphyseal extension of the head fragment of 8 mm or less, disruption of the medial "hinge" between the humeral head and the shaft at the level of the calcar, and fractures through the anatomic neck were independent predictors for humeral head ischemia.(21)

There were some fracture which was fixed in varus (not varus collapse) While correlating varus fixation with outcome,by Pearson's Chi Square test P value=**1** which is non-significant.Hence,it can be said that varus fixation is not associated with outcome.

Overall surgical outcome at the end of 1 year (total 13 patients) in our study are 38.46% Excellent (5 patients), 23.07% Good (3 patients), 15% Moderate (2 patients) and 23.07% Poor (3 patient) based on Constant and Murley score.

CONCLUSION:-

So in the end it can be concluded that:
Dispalced proximal humerus fracture being treated with locking compression plate(PHILOS):

Good prognostic factors are: Young age
Intact medial calcar support
Bad prognostic factor is: Disrupted medial calcar

Immediate varus fixation is **not a prognostic factor.**

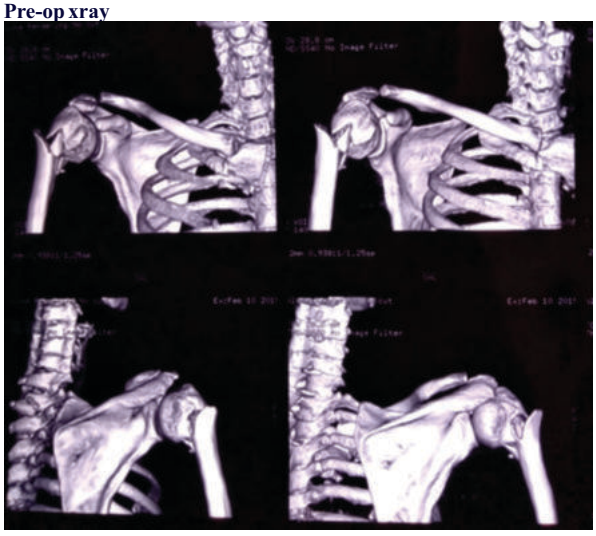
young age is a good prognostic factor as young patients are compliant,have more pain threshold which allow them for early physiotherapy and has good bone quality and vascular integrity. medial calcar support is an important prognostic factor as it is closely associated with vascular supply of the head of the humerus and its disruption leads to avascular necrosis.

GALLERY:-

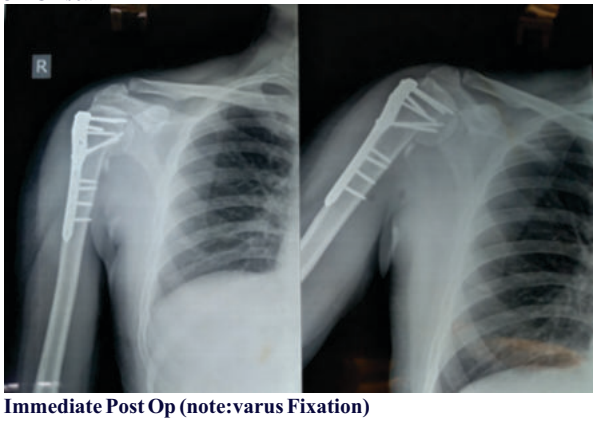
Case 1:
47 years old male
Neer type 2 fracture of right side.
At end of 1 year:
Flexion:160^0
Abduction:180^0
External rotation:70^0
Internal rotation:90^0
Constant score:86
Comment: excellent outcome

Radiological Images:

Pre-op xray



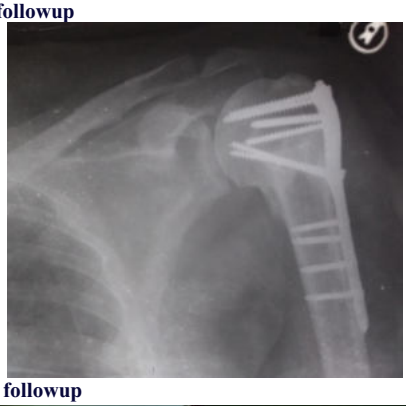
3D CT scan



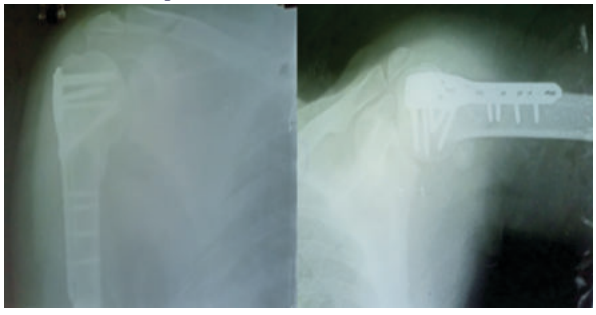
Immediate Post Op (note:varus Fixation)

4 weeks followup

3 months followup



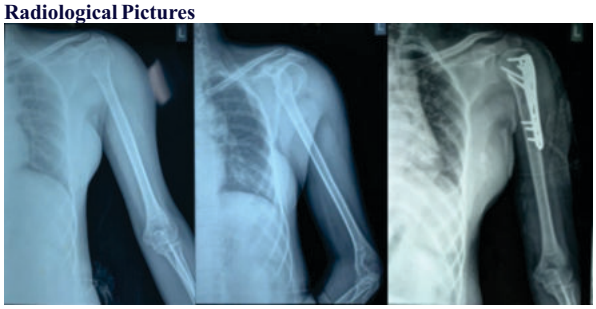
6 Months followup



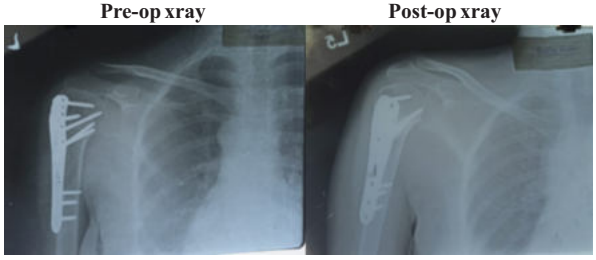
1 year follow-up

Case 2:-
34 year old female
Neer type 3 fracture
At end of 1 year:
Flexion:170^0
Abduction:120^0
External rotation:80^0
Internal rotation:70^0
Constant score:94
Comment:Excellent outcome

Radiological Pictures



Pre-op xray **Post-op xray**

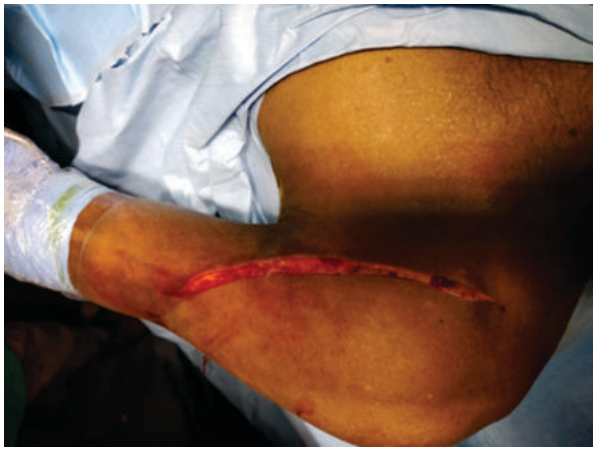


6 months followup **1 year followup**

OPERATIVE PHOTOGRAPHS

A. Position of C-Arm-head end
Pt is in breach chair position

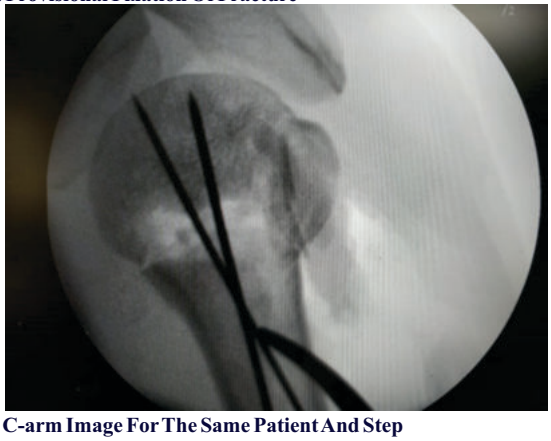
B. Position Of Arm: Outside The Edge Of Table



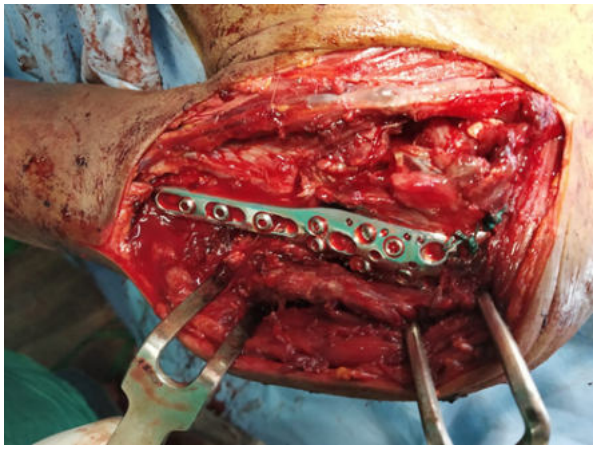
C. Incision For Delto-pectoral Approach

D. Identification Of Cephalic Vein

E. Provisional Fixation Of Fracture



F. C-arm Image For The Same Patient And Step



G. Final Plate Position And Fixation With No5 Ethibond Suture(non-absorbable)

H. Final plate position checked under fluoroscopy

REFERENCES:

1. Nordqvist A, Petersson CJ. Incidence and causes of shoulder girdle injuries in an urban population. *J Shoulder Elbow Surg*. 1995;4(2):107–112.
2. Horak J, Nilsson BE. Epidemiology of fracture of the upper end of the humerus. *Clin Orthop Relat Res*. 1975(112):250–253.
3. Kim SH, Szabo RM, Marder RA. Epidemiology of humerus fractures in the United States: nationwide emergency department sample, 2008. *Arthritis Care Res (Hoboken)*. 2012;64(3):407–414.
4. Rose SH, Melton LJ 3rd, Morrey BF, et al. Epidemiologic features of humeral fractures. *Clin Orthop Relat Res*. 1982(168):24–30.
5. Baron JA, Barrett JA, Karagas MR. The epidemiology of peripheral fractures. *Bone*. 1996;18(3 Suppl):209S–213S.
6. Baron JA, Karagas M, Barrett J, et al. Basic epidemiology of fractures of the upper and lower limb among Americans over 65 years of age. *Epidemiology*. 1996;7(6):612–618.
7. Calvo E, Morcillo D, Foruria AM, et al. Nondisplaced proximal humeral fractures: high incidence among outpatient-treated osteoporotic fractures and severe impact on upper extremity function and patient subjective health perception. *J Shoulder Elbow Surg*. 2011;20(5):795–801.
8. Court-Brown CM, Garg A, McQueen MM. The translated two-part fracture of the proximal humerus. Epidemiology and outcome in the older patient. *J Bone Joint Surg Br*. 2001;83(6):799–804.
9. Kim SH, Szabo RM, Marder RA. Epidemiology of humerus fractures in the United States: nationwide emergency department sample, 2008. *Arthritis Care Res (Hoboken)*. 2012;64(3):407–414.
10. Bell JE, Leung BC, Spratt KF, et al. Trends and variation in incidence, surgical treatment, and repeat surgery of proximal humeral fractures in the elderly. *J Bone Joint Surg Am*. 2011;93(2):121–131.
11. Court-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humeral

fractures. *Acta Orthop Scand*. 2001;72(4):365–371.
12. Robinson CM, Amin AK, Godley KC, et al. Modern perspectives of open reduction and plate fixation of proximal humerus fractures. *J Orthop Trauma*. 2011;25(10):618–629.
13. Jost B, Spross C, Grehn H, et al. Locking plate fixation of fractures of the proximal humerus: analysis of complications, revision strategies and outcome. *J Shoulder Elbow Surg*. 2013;22(4):542–549.
14. Gadea F, Favard L, Boileau P, et al. Fixation of 4-part fractures of the proximal humerus: Can we identify radiological criteria that support locking plates or IM nailing? Comparative, retrospective study of 107 cases. *Orthop Traumatol Surg Res*. 2016;102(8):963–970.
15. Neer CS 2nd. Displaced proximal humeral fractures. II. Treatment of three-part and four-part displacement. *J Bone Joint Surg Am*. 1970;52(6):1090–1103.
16. Wall B, Walch G. Reverse shoulder arthroplasty for the treatment of proximal humeral fractures. *Hand Clin*. 2007;23(4):425–430.
17. Roberson TA, Granade CM, Hunt Q, et al. Nonoperative management versus reverse shoulder arthroplasty for treatment of 3- and 4-part proximal humeral fractures in older adults. *J Shoulder Elbow Surg*. 2017;26(6):1017–1022.
18. Antonio M. Foruria, Joaquin Sanchez-Sotelo. Proximal Humeral Fractures. In: Paul Tornetta III,Willium M.Ricci, Robert F.Ostrum, Margaret M.McQueen, Michael D.McKee, Charles M.Court-Brown(Eds.). Rockwwod and Green's Fracture in Adults. 9th ed. Philadelphia: Wolters Kluwer; 2020. p1865-2027.
19. MA Fazal,FS Haddad "PHILOS plate fixation for displaced proximal humeral fractures" journal of orthopaedic surgery2009;2009 17(1)15-8.
20. Siwach R Singh R et al Rajesh Kumar Rohilla et al Internal fixation of proximal humerus fracture by locking proximal humerus plate in elderly osteoporotic J Orthopaed Traumatol (2008) 9:149–153.
21. Hertel R, Hempfing A, Stiehler M, et al. Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus. *J Shoulder Elbow Surg*. 2004;13(4):427–433.