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Outcome evaluation of proximal humerus fractures management by proximal humeral internal locking plates- A clinico- radiological study

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***Abstract*---**Introduction: Proximal humerus fractures are amongst the most common upper extremity fractures that are found in elderly as well as young age groups. Although majority of them are treated conservatively, due to the demand for early return to the daily activities and problems of late collapse/ displacement with conservative measures there arise a need for plate ostesynthesis. Amongst the various methods of fixation, Proximal humerus intrlocking plates designs promise an opportunity to minimize the common complicsations. However, a gap still exists between in vitro results and clinical outcomes. Addressing to the limitations and need to evaluate the efficacy of the currently available proximal humerual interlocking plates, the purpose of this study will be to evaluate the short and medium term functional resultys with fixation of proximal humerus fracture and review the common complications associated. Materials and methods: In this prospective observational study, conducted at a tertiary care centre, patients from 18-85 age group were selected according to the inclusion and exclusion criteria. Giving inform ed and written consent, patients were enrolled to complete the sample size in the s t ipulated duration i. e., convenience s ampling technique. Patients were followed up for 12 months of duration. Results: Total 25 study subjects were followed up at intervals of 3 weeks, 6 weeks, 6 months and 12 months., There were 9 males and 16 females thus it was more common in females. 6

were less than age of 40 and 19 were more than age 40. All the patients who suffered low velocity trauma were above 40 yr of age. Majority of fractures were right sided (4:1). Majority (52%) were 3-part fractures and none of them were 1 part fracture. Every patient was operated by the same surgeon team. There were no immediate post operative complications. All of them had an uneventful recovery and were discharged as per standered schedule and were requestewd to follow up at 3 weeks, 6 weeks, 6 months and 12 months and scoring was done according to Constant Murley score. Majority of the patients had (11:1) good to excellent score at 6 weeks. Except 2 patients, every patient had a satisfactory score > 70 at 12 months followup. Patients below 40 years were associated with better score compared to elders. Every patient who was below 40 years had > 70 score at 1 year follow up. Conclusion: Majority of the patients were of age group more than 40. Females were more common than males. (3:1). most of these suffered a high velocity trauma leading to this fracture. But amongst those who suffered low velocity trauma, all were above 40 yr of age. Majority of the fractrures were of right side. Patients having two-part fractures had a satisfactory score >70 at the 12 months of followup. However, majority of the fractures were 3 parts. People above 40 yrs were more associated with 3 parts whereas people below 40 were more associated with 2-part fracture. Every 4-part fracture was due to a high velocity trauma. Patients below 40 years were associated with better scores compared to the elders. Every patient who was below 40 years had score > 70 at 12 months follow up. every male patient had a score >70 at 12 months of follow up. None of the patients suffering low velocity trauma had an excellent score >85. Every patient having fair to poor score (<70) suffered a high velocity trauma at 1 year. Once and two-part fractures had significant higher constant score compared to 3 and 4 part fracturesat 12 months of followup.

***Keywords*---**evaluation, proximal humeral,radiological.

Introduction

Proximal humeral fractures are the second most common fractures of the upper extremity in adults, ac counting for 24 - 38 % of all upper limb fractures and with increase in incidence and complexity of the fracture with age[1] . Although a Majority of undisplaced proxima lhumeral fractures can be treated conservatively, th ereisan over whel ming need for osteosyn the sisin these fractures due to the change in the demographic pattern and more complex fractur epresentations with road traffic/ motor vehicl eaccidents on therise, demand fo rearly return to activities and problems of late collapse/ displacement with conservative measures[2] .

Various methods for Osteosynthesi sinproximal humerus include Kirschner wires, transosse ous wires, proximal humerusnails, and plates[3]. Among these, plateosteosy nthesis is the widely accepted standard of fixation and supported by many biomechanical studies. Owing to its short learning curve, versatility across

all fracture patterns and stable construct in geriatric/ osteoporoticsituations, the locked platesare the most commonly performed instrumentati on However, the complications (10- 44 %) reported in literature have varied and the notable are screw cut outs, subacromialimpingements, varuscollapse, avascularnecrosis of head, implant failures, infections and subsequently varied reoperation rates[4]. Although, biomechanical studies on the cuurently available platedesigns promise anopportunity to minimize the aforementione dcomplications, agapstill exists between invitroresults and the clinicaloutcomes. Further more, current literature has poor consens us on the efficacy of these plates a cross varied fracture geometry. Addressing to the limitations and a need to evaluate the efficacy of the currently available proximal humeral internal lock ingplates, the purpose of this study will be to evaluate the short and medium term functional results with fixation of proximal humerus fracture and review the common complic ati ons associated.

Results:

In this hospital based, observational prospective study conducted in a tertiary care centre, patients from 18-85 age group were selected. Every consecutive patient fullfillinf diagnostic criteria and inclusion and exclusion criteria, giving inf or med and written consent w ere enrolled to comp letet the sample size inthesti pulated duration i.e convenience sampling. Patients were followed up for 12 months of duration. Patients satisfying inclusion criteria were taken up for study after obtaining their written informed consent.

History by verbal communication after Clinical examination and base line investigations and Routine radiological examination were done. A Written and well informed consent was taken for surgical procedure. The sample size for this study was calculated and which was 96 (The sample size for observational propective studies is given as N = Zp (1 - p)/ d 2, Where N= sample size Z= 1.96; p= maximum expected preva lence= 0.5; d= acceptable error = 10 %). For simplification of the calculations, we took 100 But, availability of cases, their readiness for foIlow up at a private hospital, and tim ebou nd nature of study, being an issue, the sample size was restricted to 25 patients.

Result

Total 25 study subjects were followed up at intervals of 3 weeks, 6 weeks , 6 months and 12 months. Out of these 6 were less than age of 40 and 19 were more than age 40. Thus majority of patients (3:1) were above age 40.

Also, amongst total 25 patients, there were 9 males and 16 females thus it was more common in females. According to the mode of trauma, high velocity were 22 and low velocity were 3. Thus majority of patients were of high velocity trauma. Out of those high velocity traumas, 6 were less than age 40 and 16 were more than age 40 and remaining 3 were due low velocity trauma. Thus, all the patients who suffered low velocity trauma were above 40 yr of age. Gendre wise, there were 8 males and 14 females who suffered high velocity trauma that of 1 male and 2 females who suffered low velocity traumas.

No significance. 5 of them were left sided and 20 were right sided humerus fractures. Thus majority of fractures were right sided (4:1)

Classification wise, 9 were of Neer's 2 part, 13 were of 3 part, 3 were of 4 part proximal humerus fractures. Thus, a majority (52%) were 3 part fractures and none of them were 1 part fracture. Amongst the Patients those are less than 40 yrs age, 4 had 2 part neers , 2 had 3 part neers that of those more than 40 yrs age , 5 had 2 part neers and 11 had 3 part neers.

Although the difference was not significant , people above 40 years were more asso with 3 part fractures while people below 40 years were more associated with two aprt fractures. Amongst males , 2 part were 2 , 3 part were 4 , 4 part were 3 that of amongst females , 7 were 2 part , 9 were 3 part. Every patient who had 4 part fracture was male.

Out of the high velocity traumas , 8 were 2 part , and 11 were 3 part, 3 were 4 part. That of low velocity traumas, 1 was 2 part and 2 were 3 part. Every male who had a 4-part fracture, had a high velocity trauma. Amongst the 2 part fractures, 2 were males and 7 were females

That of the 3 part , 4 were males and 9 were females

And of 4 part, all were males i.e., 3

Thus every patient who had a 4 party fracture was a male.

Patients operated less than 1 day of trauma were 14 than that of the more than 1 days were 11

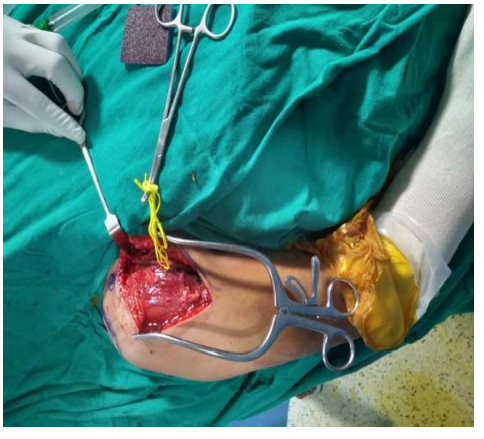
Every patient was operated by the same surgeon team. There were no immediate post operative complications. All of them had an uneventful recovery and were discharged as per standered schedule and were requestewd to follow up at 3 weeks , 6 weeks , 6 months and 12 months and scoring was done according to

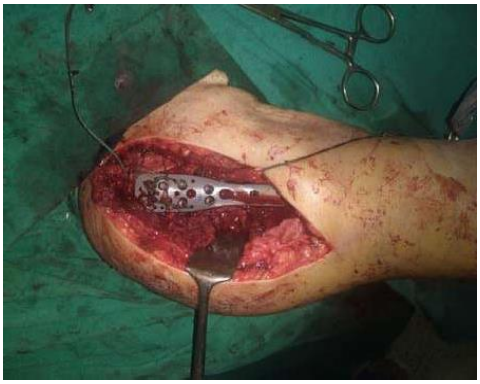
Constant Murley score.

Majority of the patients had (11:1) good to excellent score at 6 weeks.

Except 2 patients, every patient had a satisfactory score > 70 at 12 months followup.

Preop and Intraop images:





Discussion

The study was per formed at Medical Trust Hospital, Kochi, Kerala, with 25 patients suffering humerus fracture, under going operative reduction and regular foIlowup at 3 weeks, 6 weeks, 6 months and 1 year. This hospitalis tertiary referral centre for orthopedic case s with round the clock emergency and surgical services, including the advance methods.

Majority of the patients (3:1) were above 40 years age. Humerus is a very strong bone with very strong attachments. A very strong force is needed to break it. Osteoporosis leading to bone weakening has been mentioned as a risk factor for this fracture. In Neer's original series of 300 fractures the average age of the Patients was 55. 6 years[13]. Lind found that three fourth of his patients with Proximal humerus fractures were over 60 years[14]. Our findings correlates with observation of these prior published studies that this fracture is mainly present in older age due to weakening of the bone with age related problems.

Majority of the patients (2:1) were females. There was no significant association between gender of patients and age distribution, how ever majority of the females were over 40 years age. The problem of osteoporosis is more common in females, postmenopausal. This finding leading to more fractures in females reflected in our study. Mayoclinic identified a predominance of proximal humerus fracture in women at ratio of 1.5:1[15]. Our study correlating with this finding indicates the

propensity of this fracture occurring in females more due to weakening bone postmenopausal

The majority of patients (7:1) had high velocity trauma. This was aIso correlated in the study of Hinter mann B et al [24]. Every patient suffering a low velocity trauma was over 40 years age, this was correlated by Bjorkenheim JM et al [26].

This correlates with the fact that high velocity needed to injure a strong bone with strong attachments, and weak force helps only if the bone is weakened prior due to age.

Majority of the fractures (4:1) were on the right side. This has not been discussed in prior published studies, however the lateralization dominance may be due to the fact that the right arm is dominant in majority people probably leading to chances of injury more on the right side.

Majority of the fractures (52%) were three part fractures. None of the fractures were one part fractures. This was correlated by Hintermann B et al(81%) [24] and Ashwood n et al(100%) [30] The breaking into multiple parts may be explained due to the high momentum required to produce this fracture.

Although the difference was not significant, people above 40years were more associated with three part fractures while people below 40 years were more associated with two part fractures. This was reciprocated by Sameer Agarwal et al[35]. Brittle bone breaks into more parts and this may be the reason for the same.

Every patient who had a four part fracture had a high velocity trauma. This is to be expected with high velocity trauma leading to more severe breakage.

At follow up, at 3weeks, 6weeks, 6 months and 1year, the Constant scoring was done for functional outcome.

23 out of 25 patients developed satisfactory scores over 70 at 1year follow up. Only one patient had screw breakage, and one patient had Varusdisplacement. On comparing this with published literature it is seen that:

Table

Patients below 40years had better scoring. This was correlated by Sameer Agarwal et al[35].

One and two part fractures had significant better Constant score compared to three and four part fractures. This correlates with Fazal MA et al[34].

Every patient below 40years had good to excellent range of flexion. Every male had good to excellent flexion. Every patient with low velocity trauma had good to excellent flexion. The only patient with poor flexion had a three to four part NEER's fracture.

The only person to have poor abduction was above 40years age, and female, having fracture NEER three to four parts.

Correlating with prior published studies, it is seen that Ashwood N et al[30], Felix Brunner et al [33], MA Fazal et al[34], Sameer Aggarwal et al[35] correlated excellent range of movement including flexion and abduction with early and proper operative fixation.

From comparing the result of this study with prior published studies, it is seen that this implant gives excellent results even in bad cases, leading to excellent to good recovery at the end of one year including acceptable range of movement of the affected limb thus having wonderful rehabilitation of the injured patient. The results of this study are in agreement with prior similar studies leading to encouragement in early operative fixation of this fracture with said implant for better outcomes and quality of life

Conclusion:

The salient findings in this study are as follows:

1. Majority of the patients (3:1) were above 40 years age.

2. Majority of the patients (2:1) were females. There was no significant association between gender of patients and age distribution, however majority of the females were over 40 years age.

3. The majority of patients (7:1) had high velocity trauma

4. Every patient suffering a low velocity trauma was over 40 years age

5. Majority of the fractures (4:1) were on the right side

6. Majority of the fractures (52%) were three part fractures. None of the fractures were one part fractures.

7. Although the difference was not significant, people above 40years were more associated with three part fractures while people below 40 years were more associated with two part fractures.

8. Every patient who had a four part fracture had a high velocity trauma

9. Except two patients, every patient had a satisfactory score >70 at 1year.

10. Patients below 40 years were associated with better score compared to elders. Every patient who was below 40 years age had >70 score at 1 year.

11. Every male patient had scoring>70 at 1year follow-up

12. None of the patients suffering low velocity trauma had an excellent score>85. Every patient having fair to poor score (<70) suffered a high velocity trauma at 1 year.

13. One and two part fractures had significant higher constant score compared to three and four part fractures at 1 year.

14. Every patient having one and two part fractures had a satisfactory score >70 at 1 year.

Recommendation

1. Elderly patients (who are osteoporosis prone) should be alert for fractures of proximal humerus

2. Operative fixation should be recommended due to the excellent results based upon surgical technique and experience

3. Even bad and severe fractures can be satisfactorily fixed by locking compression plate based upon experience of the surgeon, with good outcome

4. Proper post operative physiotherapy can build the limb back to prior normal strength and functions

5. Proper postop care can prevent complications related to the implant and help in excellent outcome

Limitation

1. This study was a single centre study

2. Small sample size

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S.NO.	NAME	HOSPITAL NO.	AGE	GIENDER	LEFT / RIGHT	MODE OF TRAUMA (HIGH/LOW VELOCITY)	FRACTURE CLASSIFICATION	DURATION (DAYS)	Score 3 weeks	SCORE (6WEEKS)	Score 6 months	Score 1 year	Flexion	Abduction	internal rotation points	external rotation points	FINAL OUTCOME COMMENT	COMPLICATIONS
1	SURESH	1300129	53	M	RIGHT	HIGH	3	2	73	88	57	72	160	100	6	6	GOOD	
2	ANISH	1439562	27	M	RIGHT	HIGH	2	2	86	72	80	86	110	100	8	8	EXCELLENT	
3	RARACITH	1442319	45	F	RIGHT	HIGH	2	2	57	54	77	89	90	90	8	8	EXCELLENT	
4	PARMESHWARAN	1444292	50	M	RIGHT	HIGH	4	3	57	79	86	72	110	100	6	6	GOOD	
5	ANJANA	1450264	19	F	RIGHT	HIGH	2	1	58	87	88	90	110	120	10	10	EXCELLENT	
6	ASWATHY	1427748	83	F	RIGHT	HIGH	2	1	72	86	71	86	160	90	6	6	EXCELLENT	
7	NIMMY SABU	14552268	43	F	LEFT	HIGH	3	1	59	60	66	60	100	90	6	6	MODERATE	VARUS COLLAPSE
8	KOMAL VALLY AMMA	1461080	80	F	RIGHT	HIGH	3	1	60	73	99	76	110	70	8	8	GOOD	
9	PUSHPAVALLI	1462081	68	F	LEFT	HIGH	3	1	69	82	87	72	130	120	8	8	GOOD	
10	THAURKEEMA	1464993	72	F	RIGHT	HIGH	3	2	57	77	73	55	90	90	4	6	POOR	SCREW BREAKAGE
11	RAJAN	1467926	54	M	RIGHT	LOW	2	2	56	74	74	74	120	80	4	4	GOOD	
12	ARJUN RAJ	1376828	39	M	RIGHT	HIGH	3	2	51	84	72	72	100	80	8	8	GOOD	
13	GEETHA BABY	1485785	59	F	LEFT	HIGH	2	1	57	76	88	87	80	70	10	10	EXCELLENT	
14	AK SHAJI	1367604	61	M	RIGHT	HIGH	3	1	66	79	54	87	130	120	10	10	EXCELLENT	
15	VASANTA KUMARI	1254313	62	F	RIGHT	LOW	3	1	45	90	88	73	160	80	4	4	GOOD	
16	VN BHASKARA	1347624	85	M	RIGHT	HIGH	4	2	67	77	80	72	130	120	6	4	GOOD	
17	MOHINI	1375852	44	F	RIGHT	HIGH	3	2	58	79	81	76	50	40	8	8	GOOD	
18	MARY JASMINE	1490493	49	F	RIGHT	HIGH	3	1	64	76	86	86	80	160	8	6	EXCELLENT	
19	SHAJAN	1451505	54	M	RIGHT	HIGH	4	1	56	88	72	86	170	170	8	8	EXCELLENT	
20	MANJU	1379493	31	F	RIGHT	HIGH	2	1	54	80	89	88	170	170	8	6	EXCELLENT	
21	INDIRA	1355090	39	F	LEFT	HIGH	2	1	68	82	75	87	100	90	6	6	EXCELLENT	
22	CLARAMMA	1358245	77	F	RIGHT	LOW	3	2	59	86	90	72	90	90	10	8	GOOD	
23	LATHIKA	1359359	30	F	RIGHT	HIGH	3	1	61	90	88	86	90	90	8	8	EXCELLENT	
24	MOLLY MATHEW	1368105	75	F	RIGHT	HIGH	2	2	64	84	87	90	80	90	8	8	EXCELLENT	
25	ARUN RAJ	1376828	30	M	LEFT	HIGH	3	1	54	73	76	86	90	90	10	10	EXCELLENT	