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Prospective Comparative Study of Proximal Humerus Fractures Treated Conservatively Versus Open Reduction Internal Fixation With Locking Plate

Sunil Kumar*[1], Mukesh Parmar[2], Alok Gupta[3], Prateek Rastogi[4], Vasudeva B[5,] Rakesh Vishwakarma[6], Laxminath Mishra[7]
[1]associate Professor, [2] Senior Resident ,[3,4,5,6,7]resident,
Department Of Orthopaedics, Up Rural Institute Of Medical Sciences & Research, Saifai, Etawah, Uttar Pradesh, India.

Abstract
Background*: Even in 21st century, restoration of functional movement of shoulder joint after fractures of proximal humerus is still a major problem with the best of conservative and operative interventions. These fractures account 4-5% of all fracture and are not uncommon especially in older age groups. About 85% of fractures of proximal humerus are minimally displaced and are effectively treated by immobilization followed by early motion. The remaining 15% are displaced unstable fractures. The treatment of displaced proximal humerus fractures is still a therapeutic challenge. Displaced proximal humerus fractures can be treated both conservatively and by open reduction internal fixation by locking compression plate for better functional outcome.*
Materials And Methods*: Over a period of 18 months, 34 elderly patients of proximal humerus fractures were admitted and randomly divided into 2 groups. 18 patients were treated surgically and 16 patients treated conservatively. Patients treated conservatively by Shoulder Immobilizer/ U slab/Cast. Patients who are treated surgically were taken up for open reduction and internal fixation by locking compression plate using delto-pectoral approach. Patients were followed at 3wk, 6wk, 3month, 6month, 9month and 12 month and were assessed for pain, range of motion, strength using constant shoulder score .*
Result*: In the conservative group (31.3%) patients had poor, (37.50%) moderate and (31.30%) good constant scores. While in surgical group (27.80%) had poor, (11.10%) moderate and (61.10%) 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.*
Conclusion*: In elderly patients with osteoporotic bone, locking plates do well but there is no significant difference in functional outcome on long term follow up of patients treated conservatively or surgically.*
Keywords*: Proximal Humerus Fractures, Neer's Classification, locking compression plate, PHLP, PHILOS, Constant Murley Shoulder score.*

Corresponding author;
Dr Sunil kumar
Associate professor Deptt.of orthopaedics, UP RIMS & R, SAIFAI,ETAWAH,U.P.,INDIA.
Email: sksrimsnr@gmail.com

I. Introduction

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[1].
Fractures 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 treated conservatively and mobilized early to regain joint mobility. The remaining 15% of fractures are displaced unstable and may have disruption of the blood supply. The treatment of these fractures is a therapeutic challenge. Displaced and unstable extra- articular fractures are most commonly treated by operative reduction and fixation using various technique[3].

According to *Neer's classification*[4], proximal humerus fractures are two part, 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, avascular necrosis and arthrosis of joint resulting in painful dysfunction.[5,6]. Primary hemiarthroplasty

is favoured by many authors but is associated with a large number of complications, and objective functional results which are disappointing[7].

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[8,9].

The Choice of technique and devices depends on quality of bone, soft tissue, age and reliability of patients. Various techniques[10-15] have been utilized for the treatment of these fractures and include intramedullary nails plate osteosynthesis, tension band wiring, percutaneous K-wire fixation and hemiarthroplasty. Varying outcomes have been reported with plate osteo-synthesis for proximal humerus fractures[,14]. Results of plate osteosynthesis in osteo-porotic elderly patients are often poor as compared to younger patients. Esser[16] 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. Wijgman *et al*[14] et al reported good 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. Paavolainen *et al*[17] reported satisfactory results in 74.2% of their 41 patients with severe proximal humerus fractures treated with plate and screw devices. 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 (PHLP, PHILOS) 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.

However the goal of Proximal Humerus fracture management is stable reduction allowing early movement to prevent arthritis and joint stiffness and achieve pain free mobile shoulder.

This study was conducted to analyze and compare the functional outcome of displaced proximal humerus fractures treated conservatively and by open reduction internal fixation with plate osteosynthesis.

II. Materials And Methods

34 cases of fractures of proximal humerus, after history taking, clinical examination, neurovascular assessment and full radiological evaluation, were admitted to tertiary level hospital with level I trauma centre in Northern india with inclusion and exclusion criteria.

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.

Exclusion Criteria:

- Open fractures
- Pathologic fracture or a previous fracture of the same proximal humerus
- Other injury to the same upper limb requiring surgery
- Major nerve injury (e.g., complete radial- or axillary nerve palsy)
- Rotator cuff tear arthropathy
- Poly-trauma or Multi-fractured patients
- Any medical condition that excludes surgical treatment.

Patients who fulfilled the study criteria were randomly allocated in conservative and surgical groups. Patients in the conservative group were given shoulder immobilizer/ u slab / cast for 3-6 weeks. Passive & active assisted exercises were begin as pain tolerated by patient.

Patients in the surgical group after complete pre anaesthetic evaluation were operated through deltopectoral approach. After open reduction fragments were fixed with k wires and locking compression plate was fixed with cancellous and cortical screws. Isometric deltoid, bicep, and triceps strengthening were begun after 3 days or as soon as pain tolerated by patient .

Patients in both the group were assessed radiologically and functionally at 3 weeks, 6 weeks, 3 months, 6 months and evaluated outcome by Constant and Murley score.

III. Result

Out of 34 patients 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 pattern. There were 6 males and 12 females in surgical group and 8 males and 8 females in

conservative group (Table-1). There were total 7(20.59%) two part, 18(52.94%) three part and 9(26.47%) four part fractures. The overall incidence of proximal humerus fractures was high in females (58.8%) as compared to males(41.2%). In our study 70.60 % of patients were above 70 years suggesting an age related osteoporotic fracture. Within surgical group out of 4- two part fractures, 2 had moderate and 2 had good constant score, out of 9- three part fractures 6 had good constant score and poor score in 3. Out of 5- four part fracture 3 had good and 2 poor constant scores.

In conservative group out of 3-two part fractures 2 had moderate and 1 had good constant score. Out of 9- three part 4 had good, 4 moderate and 1 had poor constant score. All the 4 patient with 4 part fractures treated conservatively had poor constant score.(Table-2).

The constant scores were higher for the patients who were younger in their respective groups. Almost all the fractures in both the groups radiological union was seen by an average of 20 weeks (18-24weeks). In the conservative group out of 16, 5 (31.3%) had poor, 6 (37.50%) moderate and 5 (31.30%) good constant scores. While out of 18 patient in surgical group 5 (27.80%) had poor, 2 (11.10%) moderate and 11 (61.10%) good constant scores. Results suggested that patient in surgical group had better functional outcome as compared to patient in conservative group but in long term follow up there was not much difference in either group. (Figure:1-6).

Table 1: Age And Sex Distribution

Category	Age Group					Sex		Total
	Up to 70 yrs	71-80 yrs	81-90 yrs	Above 90 yrs		Male	Female	
Surgical	7	7	2	2		6	12	18
	38.90%	38.90%	11.10%	11.10%		33.30%	66.70%	100%
Conservative	3	7	6	---		8	8	16
	18.80%	43.80%	37.50%	---		50%	50%	100
Total (34)	10	14	8	2		14	20	34
	29.40%	41.20%	23.50%	5.90%		41.20%	58.80%	100%

Table 2: Fracture Pattern And Constant Scores

Category	Fracture pattern	Constant score			Total
		Poor	Moderate	Good	
Surgical	**2 part**	---	2	2	4
		---	50%	50%	100%
	3 part	3	---	6	9
		33.30%	----	66.70%	100%
	4 part	2	----	3	5
		40%	----	60%	100%
	Total	5	2	11	18
		27.80%	11.10%	61.10%	100%
Conservative	**2 part**	----	2	1	3
		----	66.70%	33.30%	100%
	3 part	1	4	4	9
		11.10%	44.40%	44.40%	100%
	4 part	4	----	-----	4
		100%	-----	-----	100%
	Total	5	6	5	16
		31.30%	37.50%	31.30%	100%

Figure 1: X-ray

Figure 2: X-ray at 6 months follow-up with

Figure 3: Clinical pics of patient showing range of movement after conservative treatment at 6 months

Figure 4(a): Pre-op X-ray

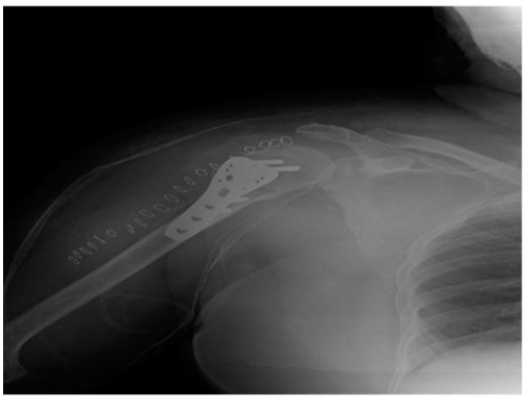

Figure 4(b): Immediate post-op X-ray

Figure 5: X-ray at 6 months follow-up

Figure 6: Clinical pics of patient showing range of movement after surgical treatment at 6 months

IV. Discussion

For many decades attempts have been made to overcome the difficulties encounter in the treatment of displaced proximal humerus fractures. The choice of treatment of displaced proximal humerus fracture is not clear. Fixation techniques continued to evolve with advent of stable locking plate constructs. Osteoporosis predisposes to low energy fractures having a complex fracture pattern and difficult fixation owing to poor screw purchase[18,19] ,increased fixation failure and poor functional outcomes.

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*[20] , Chandan kumar[21] and Olerud P *et al*[22]. 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 clinical manipulation and maintenance of reduction with U cast/ Shoulder immobilizer.

In our study, results with Neer type 2 and 3 were good. Neer type 3 and 4 fractures are more complex and open reduction and internal fixation is tougher, thus results of type 3 came out better than type 4 [21] . 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[16,14]. LCP gives satisfactory outcome in most of the patients with poor bone density and elderly age group as this construct has ability to maintain adequate reduction and provides a bio-mechanical construct that permits immediate post operative rehabilitative program of active and passive range of motion.

In the conservative group the functional outcome in two part fractures was fairly good except pain during initial 2-3 weeks after removal of plaster. In 3 part fractures cast was applied to two patients for two weeks more which lead to increased stiffness and poor functional outcome. In 4 part fracture, one patient had poor compliance with collapse, increased duration of pain and decreased functional outcome.

In the surgical group 2 part patients did fairly well with good fixation, decreased pain and timed rehabilitation. In 3 part fractures patients aged (>70yrs), shoulder immobilizer was given for two weeks to protect fixation due poor bone density which lead to stiffness and decreased functional outcome. In one 4 part fracture patient due to poor bone density and in compliance screw pull was seen which was protected by cast for 3 weeks leading to decreased functional outcome.

Since our study was focused on the functional outcome of both treatment modalities, the results of which were comparable with previous studies[23,24,25]. 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.

The individual quantitative parameters of the constant score viz. pain, activities of daily living, range of motion and strength of power when compared in conservative and surgical groups gave a statically insignificant p value(>.05)(table3).

TABLE 3 DATA ANALYSIS OF BOTH GROUP AS PER CONSTANT AND MURLEY SCORE

Constant scale parameters	Category	Mean	Std. Deviation	p Value
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	

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[26]. 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.

In patients above 60 yrs of age with displaced fracture of the proximal humerus there was statistically non significant trend in functional outcome favoring operating treatment with locking plate than conservative treatment. In conservatively treated patients excessive pain in the initial few days of treatment about 3 weeks was most distressing for the patients as compared to the operative group in which the patient was more

comfortable after the surgery. Once the initial few days of pain were tolerated conservatively treated patients had good functional outcome with good range of movement.

V. Conclusion

In elderly patients with osteoporotic bone, locking plates do well for maintaining a stable reduction but the outcomes in 3 part and 4 part fractures are not good. All this can be avoided by selecting the patient, fracture pattern and looking for the quality of bone, thereby, categorizing the patient to be optimal for surgery or conservative treatment.

So the treatment for every patient need to be individualized considering the patient's age, activity level, bone quality, fracture pattern, stability and other associated complications. There is no significant difference in long term follow up in the outcome of patients treated conservatively or surgically.

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