



PATTERNS AND PROBLEMS IN THE MANAGEMENT OF HUMERAL SHAFT FRACTURES IN OUR GOVERNMENT GENERAL HOSPITAL.

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ABSTRACT

Fractures of the shaft of Humerus continue to be a problem to the orthopaedic surgeon. In spite of extensive work done on the methods of management and variety of complications that follow, no Universally accepted standard treatment has emerged as yet.

There is a general belief that fractures of the shaft of humerus like any other fracture are best treated by non—operative techniques.

That would of course mean that the patient is much better off if he were not to be subjected to the problems of surgery per se. However, non-operative management can be recommended only when successful results are guaranteed at the end of treatment. Such guarantees cannot be ensured at the present time.

The introduction of compression plating has eliminated the problems of stiffness of joints and promoted excellent healing and functional end results. Are we to state that compression fixation has overcome the deficiencies of ordinary fixation techniques? Has this method of fixation compensated for the complications of open reduction, however small they be?

This study is a comparison of results of primary non-operative treatment, primary operative treatment and fixation of fractures that have failed to heal with non-operative treatment.

KEYWORDS : Internal fixation, Non –Union, Fixation, Pseudarthrosis, Humeral shaft.

MATERIALS AND METHODS:

Transverse fractures at the junction of middle third and lower third of shaft of humerus are more prone for non-union if treated conservatively. So, this type of fractures should be considered for primary internal fixation.

For the purpose of this study, we followed the definition of shaft of Humerus given by KEY. Key's land marks were fractures contained between the superior boarder of the insertion of the pectoralis major muscle to an area immediately above the supra condylar ridges. A total number of 119 patients were seen between January, 1984 and December 1989 with fractures of the humeral shaft and were taken up for study of the problems of conservative treatment and operative treatment.

All the cases came within one week after injury and all were above the age of 20 years.

All of them were treated and followed up in Kasturba Medical College Hospital, Manipal. The study is a prospective and retrospective analysis of treatment modalities, functional results and failures.

Out of 119 patients, only 69 patients came for final follow up. A three month interval was arbitrarily selected as minimum follow up.

A fracture which took more than 8 weeks to unite was classified as showing delayed union. As suggested by Chacha (1974)(1), a fracture which was still mobile after 3 months and which on radiography showed sclerosis of the fracture ends with pseudarthrosis and abortive callus was called ununited.

Functional results of shoulder, elbow, were classified follows: Excellent: more than 90 degrees motion of shoulder, elbow, wrist and fingers.

Good : 70 - 90 degrees motion of shoulder, elbow, wrist & fingers.
Fair : 50 - 70 degrees motion of shoulder, elbow, wrist and fingers.

Poor : Less than 50 degrees motion of shoulder, elbow, wrist and finger5.

Grip strength is assessed with the help of spring balance using 2", 1", 1/2" rods. If grip strength is more than 15.5 Kg average, it is considered fair and if it is less poor. If the grip strength is 19.5 Kg average in a man who is doing light work it is considered fair otherwise poor. If the grip strength in a man who is doing heavy work has 22.5 Kg, it is considered

fair otherwise poor.

Radiological parameters:

Biplane radiographs are taken in all cases at presentation, after reduction in conservative treatment and after fixation in operative treatment and each follow up in both types of treatment.

Anatomical level of fracture and shape of fracture were assessed in initial X-rays. At each follow up in either type of treatment the complications of fracture was assessed in the form of non-union and delayed union.

Treatment methods:

Conservative treatment	-33
Operative treatment	-36
Mode of treatment in conservative treatment	
Long arm cast	-7
Hanging arm cast	-2
U -Splint	-23
Shoulder spica	-1

Operative treatment

Union	-34
Non – Union	-2
Polytrauma	-3
Radial nerve palsy	-2

Type of implants used in 36 cases of open reduction and internal fixation

Dynamic compression plate	-23
Muller plate	-10
Sherman plate	-2
Two Rush Rods	-1

ANALYSIS AND RESULTS:

Total number of patients seen with fresh fractures of the shaft of humerus, from January, 1984 to December, 1989, were 119

Inadequate follow up - 41
No follow up - 9

Remaining 69 cases came for final follow up and were analysed.

Age: All patients were grouped in decades. The youngest patient was 20 years old and the oldest, 82 years old. In the 69 patients, half of them were in between 20 - 30 years. In the remaining age group, the next

highest were 17 patients in between 31 - 40 years. Only 6 patients were above 50 years of age. The mean age group was 34.49 years. The mode was 30 years.

Sex: There were 60 (86.95%) males and 9 (13.04%) females. The overall male, female ratio was 6:0.9. In patients below 50 years male, female ratio was 8:1, and over 50 years male, female ratio was 1:1. Among males highest incidence was seen in the 3rd decade. Among females upto 70 years uniform distribution, but there were no patients above 70 years of age.

Mechanism of Injury: 66.66 of fractures resulted from Road traffic accident. 11.59 resulted from fall from a tree. Remaining cases were due to significant trauma.

Closed/Open fractures: Among 69 patients 82.60 (57) were closed fractures and 17.39% (12) open fractures. Majority of open fractures were caused by Road traffic accident.

Anatomical level of fractures: Anatomical level was determined as seen in the plain radiographs and as suggested by L. Klenerman et. Al(2).

Total Number of cases	-69
upper most third of shaft	-4 (5.75%)
At the junction of upper third and the middle third of shaft	-5 (7.25%)
Middle third of shaft	-32 (46.37%)
At the junction of Middle third and lower third of shaft	-23 (33.33%)
Lowest third of shaft	-5 (7.25%)

The peak incidence was in the middle third of shaft. The next highest incidence fell into the Junction of middle third and lower third of shaft.

Pattern of fracture:

Total number of patients	-69
Transverse fractures	-15 (21.73%)
Oblique fractures	-32 (46.37%)
spiral fractures	-2 (2.89%)
Comminuted fractures + butterfly fragment	-20 (28.98%)

Radial Nerve Palsy:

Out of 69 humeral shaft fractures, 15 were associated with radial nerve palsy at the time of presentation, an overall rate of 21.73. Closed fractures were associated with radial nerve palsy at a rate of 20.28 and open fractures at the rate of 1.44. The middle third of the humerus was the most common location for fractures producing radial nerve palsy. (66.66) 93.33% (14 cases) recovered spontaneously within an observation period of one day to three months. Secondary suturing of the nerve was done in one case. Post operatively two patients developed radial nerve palsy (5.55%). One patient recovered spontaneously within three weeks period. One was advised secondary suturing of the nerve, but refused.

Level of fracture in Radial nerve palsy:

Upper third of shaft	-0 (0%)
At the junction of upper third and middle third of the shaft	-1 (5.88%)
Middle third of shaft	-10 (66.66%)
At the junction of middle third and the lower third of shaft	-4 (23.52%)
Lowest third of shaft	-0 (0%)

Type of Radial nerve palsy:

Neuropraxia	13
Axonotmesis	2

Post operative Radial nerve palsy:

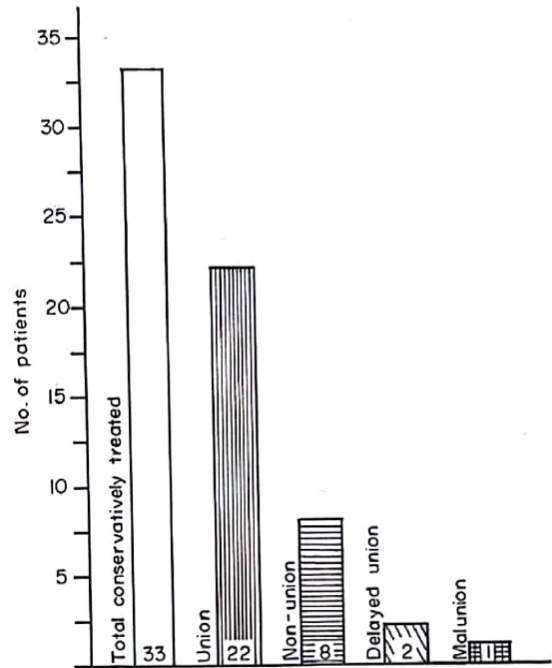
Neuropraxia	1
Partially recovered	1

Analysis of the results of conservative treatment

Total Number of patients treated conservatively	-33
Upper third of shaft	-1(3.03%).
At the junction of upper third and middle third of shaft	-3 (9.09%)
Middle third of shaft	-16 (48.48%)
At the junction of middle third and lower third of shaft	-11(33.33%)
Lower third of shaft	-2 (6.06%)

Pattern of fracture:

Middle third was the commonest site of fracture presentation with oblique fracture pattern.



RESULTS OF CONSERVATIVE TREATMENT

Graph -1 : Results of conservative treatment.

Long arm cast

In one patient who was treated with long arm cast malunion resulted (Varus angulation of 35 degrees and 10 degrees Anterior bowing at the fracture site). In this patient functionally shoulder and elbow movements were good but cosmetically he did not accept the deformity. So in this patient corrective osteotomy, plating and bone grafting was done. All the fracture in the remaining six patients were united with 5 - 10 degrees of varus angulation without any functional disability.

Hanging arm cast:

One case of hanging arm cast went into non-union after 16 weeks. Radiologically it was defect non-union. This fracture was at the junction of middle third and lower third with spiral pattern. This patient was treated with plating and autogenous bone grafting.

U - Splint:

Out of the 6 cases of non-union, 3 cases were Hypertrophic type, (Two- elephant foot type and one oligotrophic) one was torsion wedge type of non-union and other two atrophic type. The causes of non-union were two cases soft tissue interposition between the fragments, and another four cases, poor opposition of fragments. All the cases were treated with plating and bone grafting. The causes of delayed union in both the cases were soft tissue interposition. These two cases were treated with plating and bone grafting. One patient who was treated with this method after 12 weeks of sustaining an injury, refractured at the same fracture site. The case resulted in non-union (Horsehoff type) after further immobilisation. Subsequently, plating and bone grafting was done.

Shoulder spica:

Initially, he was treated outside with shoulder spica for 2 weeks. Since, the alignment of fragments were acceptable, he was advised to continue the same treatment. The fracture united in 8 - weeks. Out of the 22 united fractures three united in 6 - weeks, 5 united in 8 - weeks time and 14 fractures branded as delayed union, united with continuation of conservative treatment for a longer period.

CORRELATION OF CLINICAL & RADIOLOGICAL DEFORMITY & FUNCTIONAL RESULT IN CONSERVATIVELY TREATED PATIENTS

Case No.	Clinical Deformity	Fracture Level	Radiological deformity in degrees at the fracture site				Functiona Result
			Varus angula-	Valgus	Anterior bowing	Posterior	
1	-	J U/3 & M/3	5	-	-	-	Excellent
2	-	M/3	6	-	-	-	Excellent
3	-	J M/3 & L/3	9	-	-	-	Excellent
4	-	J U/3 & M/3	5	-	-	-	Excellent
5	Palpable lump	J M/3 & L/3	22	-	10	-	Poor
6	-	M/3	5	-	-	-	Excellent
7	-	M/3	6	-	-	-	Excellent
8	-	M/3	5	-	-	-	Excellent
9	-	J U/3 & M/3	10	-	-	-	Excellent
10	-	U/3	5	-	-	-	Excellent
11	-	J M/3 & L/3	5	-	-	-	Excellent
12	-	M/3	5	-	-	-	Excellent
13	-	M/3	8	-	-	-	Excellent
14	Obvious lump	J M/3 & L/3	35	-	10	-	Excellent
15	-	L/3	5	-	-	-	Excellent
16	-	M/3 & L/3	8	-	-	-	Excellent
17	Palpable lump	M/3	22	-	10	-	Excellent
19	-	M/3	8	-	-	-	Poor
20	-	M/3	6	-	-	-	Excellent
21	-	L/3	8	-	-	-	Excellent
22	-	M/3	8	-	-	-	Excellent

Table-1: Correlation of clinical & Radiological deformity and functional results in conservatively treated patients.

Analysis of failures due to conservative treatment

All the transverse fractures at the junction of middle third and lower third of the shaft resulted in non union. All these cases were treated with U - splints. 50% of comminuted fractures at the middle third of shaft resulted in non-union. One was treated with an U - splint and the other treated with long arm cast.

Analysis of the results of operative treatment:

Operative groups:

Dynamic compression plating:

This method gave excellent results in 86.95 (20 cases). united clinically and radiologically.

Bone grafting: One case bone grafting was done in primary operative treatment.

Complications of operative treatment:

Both the cases of non-union were in the lower third and were comminuted fractures. In one case the cause of non-union was infection and in the other case it was implant failure and subsequently, distraction of fracture fragments. In both the cases defect non-union was the result. Out of two patients who developed radial nerve palsy, one patient recovered within 3 - weeks period and the other patient at 3 - months follow up had partial recovery of nerve palsy.

Associated injuries:

Out of 20 - patients, 8 - patients had fracture humerus associated with ipsilateral fracture both bones forearm. Among 8 patients 4 - patients were treated conservatively and 4 operatively. All the results of conservative treatment were poor (3 cases resulted in non-union and one case resulted in Malunion).

All the results of primary operative treatment were excellent. Out of 20 patients 65% associated with Polytrauma.

COMPARISON OF RESULTS OF FUNCTIONAL EVALUATION			
Results of Manipal (Modified Manipal System)		Results of J.W. Mast (Modified Neer's System)	
Conservative treatment:			
Excellent	- 90.90%	Excellent and Satisfactory	- 92%
Poor	- 9.09%		
Primary operative treatment			
Excellent	- 97.14%	Excellent	- 100%
Secondary operative treatment			
Excellent	- 100%	Excellent	- 56%
OR & IF & Bone grafting in			
Non-operative failures:			
Excellent	- 81.81%		
Poor	- 18.18%		

Table-2 : Comparison of results of functional evaluation(3)

DISCUSSION

The evolution of treatment of humeral shaft fractures parallels the history of orthopaedics itself. The methods adopted by various workers and their failures and successes form controversies that are still continuing. The last word on the management of a particular type of fracture is yet to be said. The high incidence of these fracture problems has attracted many arthopaedic surgeons. The advent of compression plating has solved the problems of stiffness of joints to some extent.

No age group was immune to this fracture. The highest incidence was between 20 - 35 years equals the Mast series. After the age of 40 - years the female ratio was increasing. In these patients trivial trauma caused the fracture. This was due to the bone that had become osteoporotic after the menopausal stage.

The highest percentage of oblique fractures (46.37%) in our study was in contradiction to the Mast series where the highest incidence of fracture presentation was transverse (61%). Middle third of the shaft was the commonest location of fracture presentation (46.37%). These values equals the western literature. (L. Klenerman et. al. Carl L.

Holm, Jeffrey W. Mast et. al.)(2,4,3) The radial nerve palsy rate of 21.73% was slightly higher than that reported by Mast. The level of fracture, namely the midshaft, associated with radial nerve palsy was entirely compatible with the literature. (Jeffrey W. Mast et. al, L. Klenerman et. al, Joseph L. Shaw et. al.)(2,3,5). 50% of fractures in our study were middle third oblique fractures, where as middle third transverse fractures were the commonest presentation. (Klenerman). Median, ulnar nerve palsies and vascular injuries were not reported in our study though Mast series mentioned about it.

In our study, all the cases Of non-union and delayed union were associated with fractures involving the middle third - middle third and lower third junction only. This fact agrees with most of the literature on the subject. (L. Klenerman et al, Robert J. Poster et. al.)(2,6). But disagrees with Mast series where junction of proximal and middle third was the common location for which reasons not mentioned in his paper. The highest of nonu nion or delayed union in middle third, middle third and lower union or delayed union in middle third, middle third and lower third junction was supported by the fact that nutrient vessel to the humerus is located at this level and may be injured by fractures occurring at the mid-distal third of the humerus. In conservative patients majority were treated by U-splints (70%). The remaining cases were treated by shoulder spica (3.03%) and hanging arm cast (6.06%). All the results were equal to Klenerman's series. In conservatively treated patients 30.3% of cases resulted in non-union and delayed union. These values were equal to Klenerman series. All the transverse fractures at the junction of middle third and lower third of shaft resulted in non-union. These results were in contradiction to Klenerman series where transverse fractures resulted in delayed and non-union at middle third of shaft. This was due to less contact of fracture fragments. 50% of comminuted fractures at the middle third of shaft resulted in non-union. These values were same as Klenerman series.

The radiological deformities in conservatively united patients were; varus angulation 5-10 degrees range in 20 patients (90.90%) and remaining two patients 22 - degrees varus angulation but in one patient 22 degrees varus angulation and 10 degrees posterior bowing was present and other patient 22 degrees varus angulation and 10 degrees Anterior bowing was present. Valgus deformity at the fracture site was not present in our study. Valgus deformity was uncommon (Klenerman). In all the patients no functional disability was detected. These values were same as the Klenerman's series.

In primary operative treatment the union and non-union rate in our study and Mast series was the same. Our results of compression fixation were 88.88% equivalent to western literature. (Titze et. al.)(7). The results of operated cases following conservative failures were excellent compared to Mast series where 37.2% of cases resulted in non union.

The total excellent functional results in our study was 92.64% where as in Mast series 88% only. The excellent results of closed treatment in both studies were the same but in operated cases either primarily or after failure of conservative treatment our results were better because Mast had used more than one attempt to get union of bone, which led to

prolonged disability of patient. Grip strength in operatively treated patients were better than conservative methods. The reason could be due to early rehabilitation of patients in operative group.

CONCLUSION:

1. The highest incidence of fractures occur in young males.
2. Middle third of the shaft of humerus is the most vulnerable portion where oblique fractures and radial nerve palsy occur.
3. Transverse fractures at the junction of middle third and lower third of shaft of humerus are more prone for non-union if treated conservatively. So, this type of fractures should be considered for primary internal fixation.
4. The functional end results of operative treatment are better than non-operative methods.
5. Primary internal fixation has given better functional results when compared to internal fixation done for failure of conservative management.

REFERENCE

1. Chacha PB, Compression plating without bone grafts for delayed and non-union of humeral shaft fractures injury 1974;5(4):283-90.
2. Klenerman L. Fractures of the shaft of the humerus Journal of Bone Joint Surg 1966;48(1):105-11.
3. Mast JW et.al, Fractures of the humeral shaft: a retrospective study of 240 adult fractures Clin Orthop Relat Res. 1975;(112):254-62.
4. Holm Carl L. Management of Humeral Shaft Fractures JOEM, 1971;13(3):159.
5. Shaw et. al femoral shaft fractures urnal of Pediatric Orthopaedics: 1997 ;3(5):293-297.
6. Robert J. Foster MD. et al, Internal fixation of fractures and non-union of the Humeral shaft. JBJS 1985;(67):857-864.
7. Titze A, et al. Reconstr Surg Traumatol. 1971. Treatment options in pediatric femoral shaft fractures 1976;59(1):58-64.