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## Functional outcome of operative management of humeral shaft fractures

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### Abstract

Fractures of the humeral shaft are common, accounting for approximately 3% of all Orthopaedic injuries according to a study by World Health Organization [1], and result in a significant burden to society from lost productivity and income. These humeral shaft fractures have traditionally been regarded as benign, with high percentage of primary healing with conservative methods. However loss of reduction in the plaster cast invariably leads to malunion. Surgery is however indicated in some of these patients for optimum outcome. With improved implant design and surgical technique, operative management of humeral shaft fractures has increasingly become accepted [2,3].

**Study Duration:** 1<sup>st</sup> April 2018 to 1<sup>st</sup> April 2019

**Methods and Materials:** Purposive sampling method was used to select 45 patients who sustained humeral shaft fractures requiring surgery. A thorough history and clinical examination was done. Age of the patient, etiology/cause of trauma, time and place of injury, occupation of the patient, associated injuries were recorded in a trauma sheet.

Patients who presented to hospital immediately after injury and required surgery had careful pre-operative planning done. Blood investigations were taken and pre-operative review done by anaesthetist. Surgery was done under general anesthesia and prophylactic antibiotics were administered in all cases. Treatment consisted of a standard posterior triceps-splitting approach to the humerus. The radial nerve was identified and protected for the duration of the procedure. A dorsal 3.5mm or 4.5mm DCP plate was utilized. A minimum of eight cortices of fixation above and below the fracture site were obtained.

Postoperatively, anteroposterior and lateral radiographs were done to assess alignment and reduction of fractures. X-rays were taken immediately post operatively, at 6 weeks and at 6 months. Assessment for pain at the fracture site and evidence of union were checked at 6 weeks, while functional outcome using ASES and Mayo Elbow Performance scores were done at 6 months.

**Results:** 45 patients with humeral shaft fractures were managed operatively by plating. The mean age was 34.6 years. Men accounted for 68.9% (31 out of 45) of the cases. Of these 38 were right hand dominant while the rest were left handed. 26 patients had right humeral shaft fractures while 19 had the left humerus affected. Sixteen patients experienced shoulder pains while 19 were on pain medications. The median shoulder functionality scores in the different age groups ranged from 80 to 85 out of 100. The oldest age group (45 years and above) had lower scores with median score of 80 and range 48.3 to 85. The duration of healing was about 6 months.

**Conclusion and Recommendations:** The results of this study indicate operative management of humeral shaft fractures results in good functional outcomes with little complications. Operative management by plating appears to be method of choice for internal fixation. All patients in this study were fixed by this method.

**Keywords:** Humeral shaft, orthopaedic injuries, CTX, PINP, Vitamin D

### Introduction

Humeral shaft fractures account for approximately 3% of all orthopaedic injuries, and result in a significant burden to society from lost productivity and income. Majority of these fractures are managed conservatively. These humeral shaft fractures have traditionally been regarded as benign, with high percentage of primary healing with conservative methods. However loss of reduction in the plaster cast invariably leads to malunion. Surgery is however indicated in some of these patients for optimum outcome. With improved implant design and surgical technique, operative management of humeral shaft fractures has increasingly become accepted

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[2, 3]. Plate and screw fixation remains the gold standard for surgical treatment [5].

### Justification

Most fractures of the shaft humerus are managed conservatively with good results. However no local data exists on operative management and long term outcome of these fractures. Most of the studies have used fracture union as the major determinant of the outcome and very few studies have examined the functions at the shoulder and elbow.

### Objectives

#### Primary Objective

To study functional outcomes of operative management of humeral shaft fractures

#### Secondary Objective

1. To determine duration of healing
2. To determine method of fixation
3. To assess degree of pain
4. Evaluate function after surgery

### Materials and Methods

#### Study Population

Purposive recruitment of 45 patients will be done at AMC MET Hospital and wards and clinics.

#### Study design

Prospective analytical study

#### Setting

AMC MET Hospital

#### Study duration

1st April 2018 to 1st April 2019

#### Inclusion criteria

1. Acute diaphyseal fractures of humerus (within two weeks of injury)
2. Patients older than 18 years

#### Exclusion criteria

1. Patients with previous osteomyelitis of humerus
2. Patients who do not give consent.
3. Pathological fractures
4. Severe head injury with associated humeral shaft fractures
5. Conservatively managed humeral shaft fractures (older than 2 weeks)
6. Patients less than 18 yrs age
7. Vascular/nerve injury/tendon injury

#### Sample size calculation

Determination of sample size was based on an epidemiological study in the bone and joint journal, where humeral shaft fractures accounted for 3% of all fractures [17].

$$\text{Using Fishers' formula } n = \frac{Z^2 PQ}{D^2}$$

Where

n is the estimated sample size.

Z2 is the score of confidence interval at 95% and is 1.962. P is the prevalence in this case at 3% and Q is 1 - P.

D2 is the degree of error which is 0.052

Therefore

$$n = \frac{1.96^2 \times 0.03 (1 - 0.03)}{0.05^2}$$

n = 45 patients

### Variables to be evaluated

Independent variables: patient demographic data:

1. Age
2. Gender

Dependent variables

1. Cause of traumas
2. Time of injury
3. Occupation of the patient
4. Associated injuries (e.g. neuro-vascular status, tendon injury)
5. Pain
6. Instability
7. Activities of daily living
8. Motion and Function

### Methodology

Approval to perform the study was sought and obtained from the ethics, research and standards committee AMC MET Hospital.

Patients who met the criteria for surgery gave informed consent. Explanation of the study and its aims were done. All the data obtained was kept in the principal investigators possession at all times and subsequently entered into a password protected Microsoft Excel document after data coding. These patients with fracture shaft humerus as seen at casualty or in the ward had all the necessary clinical details recorded in a data collection sheet comprising of:

1. Age of the patient.
2. Mechanism of injury
3. Time of injury.
4. Occupation of the patient.
5. Associated injuries e.g. neuro-vascular status, tendon injury.
6. Medical history of the patient.

Then complete clinical examination comprising of local and systemic examination was recorded on trauma sheet itself.

1. Systemic Examination
2. Local Examination
  - a) Swelling and deformity of the shoulder or elbow
  - b) Check for circulatory status.
  - c) Sensation of the shoulder and arm.
  - d) Condition of the skin.

### All the patients underwent operative management of humeral shaft fractures

Blood investigations were taken and pre-operative review done by anaesthetist. Surgery was done under general anesthesia and prophylactic antibiotics were administered in all cases. Treatment consisted of a standard posterior triceps-splitting approach to the humerus. The radial nerve was identified and protected for the duration of the procedure. A dorsal 3.5mm or 4.5mm DCP plate was utilized. A minimum of eight cortices of fixation above and below the fracture site were obtained.

Patients were placed in an arm sling primarily for comfort for two weeks. Gentle pendulum and active assisted shoulder and elbow range of motion were started at 2 weeks post-surgery

followed by strengthening and passive range of motion exercises.

Post operatively patients were followed up at 2weeks, 6weeks, 3 months and six months. X rays were done at 6weeks, 3 months and 6 months. At six months functional outcome was assessed using the American Shoulder and Elbow Surgeons Scoring System and Mayo Elbow Performance Score.

The American Shoulder and Elbow Surgeons Scoring System form has a patient self- evaluation section and a physician assessment section. The patient self-evaluation section of the form contains visual analog scales for pain and instability and activities of daily living questionnaire.

The patient can complete the self-evaluation portion of the questionnaire in the absence of a physician. The physician assessment section includes an area to collect demographic information and assesses range of motion, specific physical signs, strength, and stability but this has been modified in this study. Level of education was taken into consideration and whether patient has had post-operative physiotherapy or not.

### Patient self-evaluation

The patient self-evaluation form is divided into three sections.

#### Pain

The first section concerns pain.

The patients are asked to identify whether they are having pain in the shoulder and are asked to record the location of their pain on the pain diagram (Fig 1).

Patients are asked whether they have pain at night and whether they take pain medication. The next question identifies the use of a non-narcotic analgesic. Another question identifies the use of narcotic medication. The patient is asked to record the number of pills required each day. The severity of pain is graded on a 10 cm visual analog scale that ranges from 0 (no pain at all) to 10 (pain as bad as it can be).

#### Instability

The patient is asked to identify whether he or she experiences symptoms of instability (Fig 2). The sensation of instability experienced by the patient is assessed quantitatively according to a visual analog scale. A higher score is given, if the shoulder feels very unstable.

#### Activities of daily living

Ten activities of daily living are assessed on a four-point ordinal Scale (Fig 3). The patients are asked to circle 0, if they are unable to do the activity, 1, if they find it very difficult to do the activity, 2, if they find it somewhat difficult to do the activity, and 3, if they find no difficulty in performing the

activity. Each shoulder is assessed separately. Because 10 questions are asked the maximum score is 30. The 10 questions include activities that are heavily dependent on a range of shoulder motion that is free from pain. The patients are also asked to identify their normal work and sporting activities. The cumulative activities of daily living score is derived by totaling the scores awarded for each of the individual activities.

### Shoulder score index

The information obtained from the patient self-evaluation form can be used to derive shoulder score. Equal weight is given to degree of pain experienced by the patient and the cumulative ADL score. The shoulder score is derived by the following formula:

$$(10 - \text{Visual analog scale pain score}) \times 5 = \bullet + (5/3) \times \text{Cumulative ADL score}$$

For example, if the visual analog scale pain score is 6, and the cumulative ADL score is 22, the shoulder function index is:

$$[(10 - 6) \times 5 = 20] + (5/3 \times 22 = 37) = 57 \text{ (out of a possible 100).}$$

Statistical analysis will be done using SPSS version 19.0. Summary descriptive statistics (mean, standard deviation, median, range and proportion) will be determined and presented in the form of tables, line and bar graphs. The final outcome measure will be the shoulder score index.

Functional outcome will be graded as excellent, good, fair or poor. Excellent healing means that complete functional recovery is achieved. The outcome is rated as good if there is a suboptimal recovery without any impact on work and everyday activity. The functional outcome is rated as fair when patients experience functional impairment with daily activities and work. Poor recovery means that daily or work activities have to be abandoned because of functional impairment.

### Results

The study recruited a total of 45 adult patients admitted to AMC Hospital orthopedic department with humeral fractures. The analysis of the patient characteristics and pain severity are presented in this chapter.

#### Sex distribution

As shown in figure 1, 31 (68.9%) male patients presenting with humeral fractures at AMC Hospital were recruited in the study. The Male-to-Female ratio was approximately 2:1.

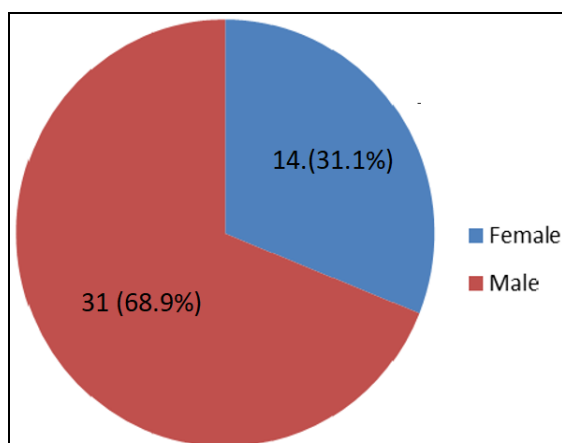
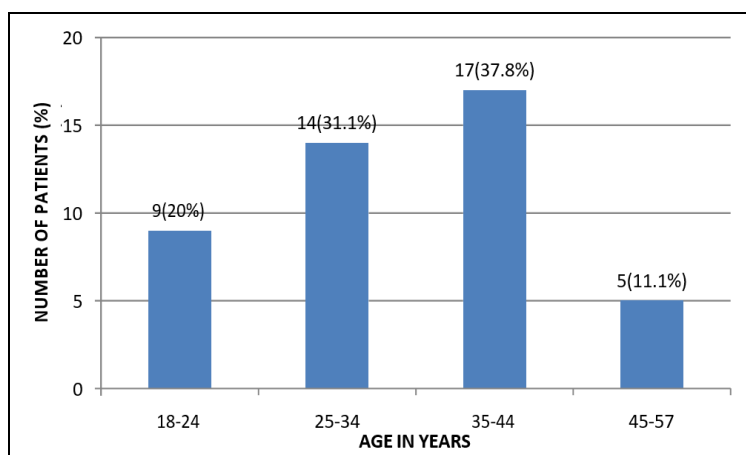


Fig 1: Sex distribution of patients with humeral fractures at AMC MET Hospital

**Patient age**

The mean age of patients presenting with humeral fractures in AMC MET was 34.6 years (SD 10.3) with a range between 18 and 57 years. The modal age group was 35-44 years with

17(37.8%) patients in this age category (figure 2). The second most common patient age group was 25-34 years accounting for 14 (31.1%) patients.



**Fig 2:** Age distribution of patients with humeral fractures at AMC MET Hospital

**Table 1:** Indications for Operative management

Indications	No. of patients	Percentage (%)
Humeral shaft fractures with multiple injuries	25	55
Open fractures (Gustilo 1)	5	11
Fractures with unacceptable reduction	7	16
Humeral shaft with ipsilateral forearm fractures	4	9
Bilateral humeral shaft fractures(one limb operated)	4	9

**Table 2:** Complications

No. of patients	Percentage	
Radial nerve injury	4	8.9%
Infection	0	0

**Humeral fractures**

Out of the 45 patients, 38 (84.4%) had the right dominant hand and the remaining 7 (15.6%) patients had left hand dominant. No patients had the ability to use both left and right hands competently either on physical examination or self-report.

Table 1 shows the distribution of fractures according to affected limb and hand dominance. Overall, 26 (57.8%) fractures affected the right limb and 19 (42.2%) the left limb. Hand dominance did not show an association with the body side affected by fracture, p = 0.38 (table 1).

**Table 3:** Humeral fractures according to hand dominance and body side affected by fracture

Side of fracture				
Dominant hand	Right	Left	Total	Chi; P value
Right	23 (60.5%)	15 (39.5%)	38 (84.8%)	0.76; 0.38
Left	3 (42.9%)	4 (57.1%)	7 (15.6%)	
Total	26 (57.8%)	19 (42.2%)	45 (100%)	

**Pain characteristics and pain management**

Sixteen (35.6%) patients with humeral fractures reported shoulder pains associated with the fracture (table 2). Nineteen (42.2%) patients had pain medications administered and of these patients on pain medications, 6 had stronger pain

medications administered (narcotic pain medications e.g. codeine). Of the patients who received pain medications, 5 received a single pill, 8 two pills and the remaining 6 received between three and six pills (table 2). Two (4.6%) patients reported having had an unstable feeling in the shoulder joint.

**Table 4:** Characteristics of pain and pain management in patients with humeral fracture at AMC MET Hospital

	Frequency (n)	Percent (%)
Shoulder pain	16	35.6
Patients on pain medication	19	42.2
Strong pain medication administered	6	13.3
Number of pills		
None	26	57.8
1	5	11.1
2	8	17.8

3	4	8.9
4	1	2.3
6	1	2.3
Unstable feeling	2	4.6

**Method of fixation**

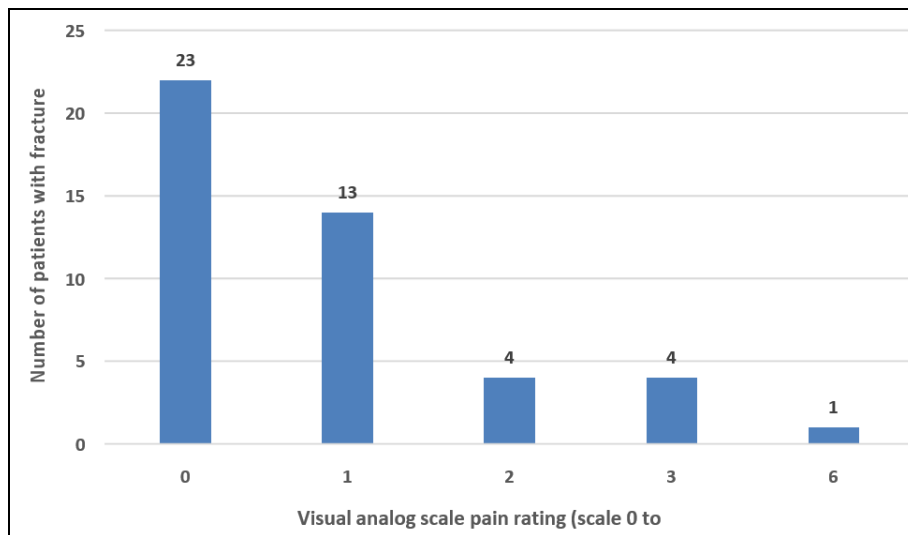
All patients were managed by plating.

**Degree of pain and functioning after surgery**

Patient self-evaluation of pain severity

Based on a visual analogue scale ranging from 1 to 10 for severity of pain, 22 (48.9%) patients rated pain severity associated with humeral fracture at 0 and 14 (31.1%) rated pain at 1 (figure 3).

The maximum pain severity reported was 6 out of 10, rated by one patient.



**Fig 3:** Visual analog scale rating of pain severity in patients with humeral fractures at AMC MET Hospital

**Physician assessment**

The findings of the physical assessment of patients with humeral fractures conducted by a physician are presented in table 3. In common with patient self-reports, physicians established that 23 (51.1%) patients were not in pain. Of the remaining 22 patients, 21 patients had a visual analog pain scale ranging from 1-3. One patient had a visual analog pain

scale of 6. The range of motion in 42 (93.3%) patients was characterized by an arc of motion > 100 degrees and 41 (91.1%) patients had shoulder joint stability. Functional ability was retained for most activities of daily living: combing hair (100%); bathing (93.3%); self-feeding and dressing (86.7%).

**Table 5:** Physician assessment of pain, stability, motion and functional ability in humeral fracture patients at AMC MET Hospital

	Frequency (n)	Percent (%)
<b>Pain intensity</b>		
None	23	51.1
Mild	20	44.4
Moderate	2	4.4
<b>Range of motion</b>		
Arc of motion > 100 degrees	42	93.3
Arc of motion 50-100 degrees	3	6.7
<b>Stability</b>		
Stable	41	91.1
Moderately unstable	4	8.9
<b>Functional ability</b>		
Can comb hair	45	100.0
Can feed themselves	39	86.7
Can bath	42	93.3
Can wear shirt/blouse	39	86.7
Can wear shoes	42	93.3

**Functional Outcome after surgery**

Functional Outcome was assessed using ASES score for shoulder function derived from patient self-reported visual analog score (50%) rating of pain and cumulative activities of daily living scores (50%), yielding a maximum score of 100. On average shoulder functioning following surgery was good with a mean ASES score of 81.1 (SD 10.6) and range 46.7 to

91.7.

The shoulder index score had a negative correlation with patient age (Pearson’s correlation,  $r = -0.236$ ). Figure 4 shows that shoulder functionality declined by 0.26 points for each unit increase in age (in years) but the decline was not statistically significant ( $p = 0.101$ ).



**Fig 4:** ASES shoulder index score and age of patients with humeral fractures at AMC MET Hospital

The median shoulder functionality scores in the different age groups ranged from 80 to 85 out of 100. The oldest age group (45 years and above) had lower scores with median score of 80 and range 48.3 to 85.

**Table 6:** ASES shoulder functionality scores according to patient age groups ASES shoulder index

	Median	Minimum	Maximum
Age group			
18-24 years	83.3	71.7	90.0
25-34 years	85.0	66.7	90.0
35-44 years	83.3	46.7	91.7
45 years +	80.0	48.3	85.0

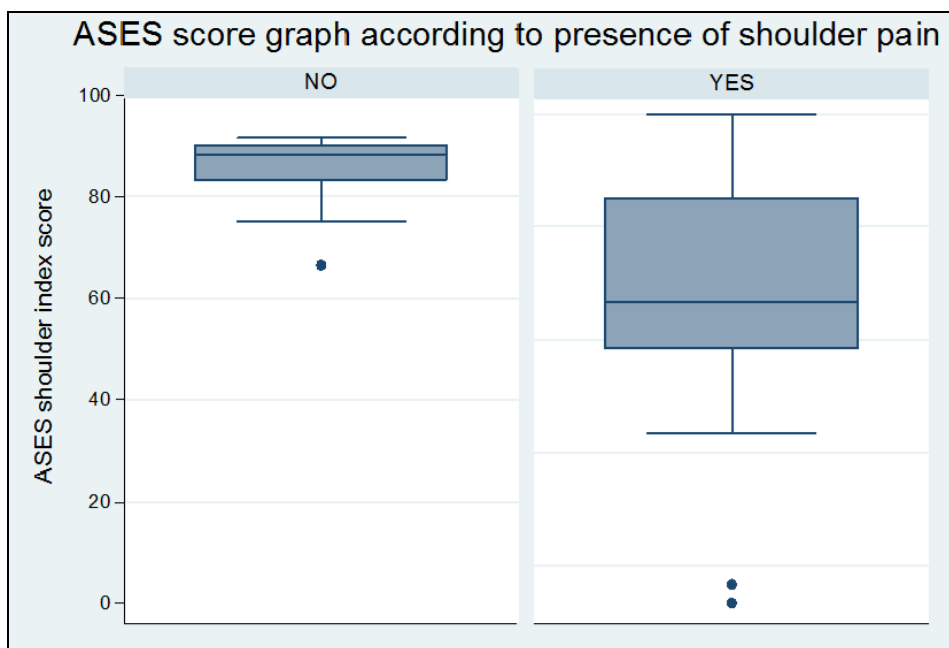
Patient sex was not significantly associated with shoulder functionality. Table 5 shows the scores for male and female patients. Female patients had a lower median score (83.3

versus 85.0) but the differences in shoulder index scores was not statistically significant (Kruskal Wallis  $p = 0.842$ ).

**Table 7:** Patient gender and shoulder functionality following surgery for humeral fractures ASES shoulder index

	Median	Minimum	Maximum
Sex			
Female	83.3	66.7	90.0
Male	85.0	46.7	91.7

The shoulder functionality score was associated with presence of shoulder pain in patients (figure 5). The median ASES index score for patients with no shoulder pain (median = 88.3, IQR 83.3-90) was significantly higher than the index for patients without shoulder pain (median = 73.3, IQR 69.2-82.5), Kruskal Wallis  $p < 0.001$ .



**Fig 5:** ASES shoulder index scores in patients with humeral fractures in AMC MET Hospital according to presence of shoulder pain

Similarly as shown in Table 6, patient report of night pain was associated with the shoulder functionality score. Among te

patients reporting no night pain the median ASES score was 90 (IQR 83.3 - 90) and this score was significantly higher



than the median score in patients with night pain (median = 75, IQR 71.7 - 85.0), Kruskal Wallis  $p < 0.001$ . Shoulder functionality was also lower in patients on pain medication

( $p < 0.001$ ), atients on stronger pain medication ( $p < 0.001$ ) and patients with unstable feeling in the shoulder joint ( $p = 0.02$ ), table 6.

**Table 8:** Pain characteristics and shoulder functionality in humeral fracture patients in AMC MET HOSPITAL

	Characteristic present Median ASES (IQR)	Characteristic absent Median ASES (IQR)	Kruskal Wallis P
Night pain	75(71.7-85)	90(83.3-90)	<0.001
Pain medication	73.3(66.7-81.7)	90(83.3-90)	<0.001
Stronger medication	64.2(48.3-73.3)	85(80-90)	0.0003
Unstable feeling	47.5(range 46.6-48.3)	85(76.7-90)	0.02

**Duration of healing**

On average duration of healing was around 4.5 months based on clinical and radiological evidence.

Study	Mean Healing Time (Plating)
Amit Putti36	16 weeks

**a) Check x-ray immediately post op**



**b) Check x-ray at 6 weeks post op**



**c) Check x-ray at 6months post op**



**Discussion**

In the one year study period, 45 patients with midshaft humerus fractures were admitted both at Amc met medical college. This is under one patient on average per week.

The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described as: fractures in patients with multiple injuries, open fractures, fractures associated with vascular or neural injuries or with lesions of the shoulder, elbow or forearm in the same limb; bilateral upper extremity injuries, fractures for which closed methods of treatment have failed and pathological fractures [25]. In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft. In my study failed closed reduction and associated injuries were the most common indications.

The mean age of patients presenting with humeral fractures in AMC met Hospital was 34.6 years with a range between 18 and 57 years. The modal age group was 35-44 years with 17 patients in this age category. The second most common patient age group was 25-34 years accounting for 14 patients. Studies by Ekholm R and Adami J, found that incidence of these fractures increased from the 5th decade onwards [22]. This is because the studies included elderly population, in whom osteoporosis is common particularly women after the 5th decade [49, 50].

A retrospective study by Gichuhi in 2007 studied and analyzed the pattern of injuries among non-fatal road traffic accident victims16. He found that 69% of patients presented with factures. The 15-44 age groups were the most affected. However, Tytherleigh-Strong and G.Walls found there was a

peak in the third decade for these fractures with a mean age of 40.3 years [49].

Most of these humeral shaft fractures occurred in the male population with a ratio of 2:1 (68%). This is in keeping with previous publications [18, 49].

Of the 45 patients operated on, 38 were right hand dominant while the remaining were left handed of the 38 patients with right hand dominance 23 sustained right humeral shaft fractures while 15 sustained left humerus fractures. Seven patients had left hand dominance and of these 3 had right humerus fractures while 4 had left. In summary, 26 out of 45 patients sustained right humeral shaft fractures accounting for 57.8% while the rest were left. This is in contrast with previous studies which show humeral shaft fractures affecting the left arm [49, 50].

The humeral shaft extends between the upper borders of the insertion of the pectoralis major muscle proximally to the supracondylar ridge distally [21]. The proximal portion of the humeral shaft assumes more of a cylindrical shape, but it develops into a triangular shape as you move distally. A study done in Malawi found 48.8% of the fractures occurred at the lower end of the humerus while 41.1% occurred at the humeral shaft, with only 10.1% of the fractures occurring at the upper end [50].

A different study by Ekholm found that these fractures were through the middle (43.2%) or proximal (40.8%) part of the shaft [22]. This differs somewhat from the findings of Tytherleigh-Strong who used the AO classification and reported an incidence of fractures of the mid-shaft of 64% and of the proximal part in 25% [49]. His study looked at osteoporotic and fragility humeral shaft fractures in the elderly. This may be explained by the different methods of classifying fractures of the proximal shaft and by the fact that pathological fractures were included in the Tytherleigh-Strong study [49].

Sixteen (35.6%) patients with humeral fractures reported that they experienced shoulder pains at 6 months review. Nineteen (42.2%) patients had pain medications administered and of these patients on pain medications, 6 had stronger pain medications administered.

Of the patients who received pain medications, 6 received a single pill, 8 two pills and the remaining 6 received between three and six pills. Two (4.6%) patients reported having had an unstable feeling in the shoulder joint.

All 45 patients were managed operatively by plating. This could be due to surgeon's preference/experience and good previous results with this mode of fixation.

In a study carried out by Amit Putti 36 he reported a mean time of healing of 16 weeks in patients with DCP plating and 18 weeks in patients treated with nailing. In our study we achieved a mean healing time of 17.4 weeks in patients treated with DCP plating. In previous reports the incidence of non-union after plating has ranged from 2% to 4% [52]. In this study no cases of non-union occurred.

The incidence of post-operative radial nerve palsy with fracture shaft humerus varies from 6% to 15% [53]. In our series four patients developed iatrogenic radial nerve injury and they were all sent to the physiotherapist. Dabiezies EJ *et al.* in his study found that in the DCP group incidence of post-operative radial nerve palsy is 2% to 5% [34]. Previous studies have shown excellent results with plating [24, 33, 25], though most compare plating and intramedullary nailing with no significant difference in functional outcomes [32, 33, 34, 35].

Based on a visual analogue scale ranging from 1 to 10 for severity of pain, 22 (48.9%) patients rated pain severity

associated with humeral fracture at 0 meaning they had no pain and 14 (31.1%) mild pain rated at 1. The maximum pain severity reported was 6 out of 10, rated by one patient. This pain was on activity.

The findings of the physical assessment of patients with humeral fractures conducted by a physician were similar to patient self-reports, physicians established that 23 (51.1%) patients were not in pain. Of the remaining 22 patients, 20 had mild pain.

The range of motion in 42 (93.3%) patients was characterized by an arc of motion > 100 degrees and 41 (91.1%) patients had shoulder joint stability. Functional ability was retained for most activities of daily living: combing hair (100%); bathing (93.3%); self-feeding and dressing (86.7%). Kingori and Sitati. F did a similar study though retrospective and found good range of motion post operatively [26].

Functional Outcome was assessed using ASES score for shoulder function derived from patient self-reported visual analog score (50%) rating of pain and cumulative activities of daily living scores (50%), yielding a maximum score of 100. On average shoulder functioning following surgery was good with a mean ASES score of 81.1 (SD 10.6) and range 46.7 to 91.7. This was similar to a previous study by Kingori and Sitati. F whose ASES score on average was [46, 26].

The shoulder index score had a negative correlation with patient age (Pearson's correlation,  $r = -0.236$ ). This implies that as one gets older ASES score becomes poorer.

Female patients had a lower median score (83.3 versus 85.0) but the differences in shoulder index scores was not statistically significant (Kruskal Wallis  $p = 0.842$ ). The shoulder functionality score was associated with presence of shoulder pain in patients. The median ASES index score for patients with no shoulder pain (median = 88.3, IQR 83.3-90) was significantly higher than the index for patients without shoulder pain (median = 73.3, IQR 69.2-82.5), Kruskal Wallis  $p < 0.001$ .

Patients reporting no night pain had a median ASES score of 90 (IQR 83.3 – 90) and this score was significantly higher than the median score in patients with night pain (median = 75, IQR 71.7 - 85.0), Kruskal Wallis  $p < 0.001$ .

Shoulder functionality was also lower in patients on pain medication ( $p < 0.001$ ), patients on stronger pain medication ( $p < 0.001$ ) and patients with unstable feeling in the shoulder joint ( $p = 0.02$ ).

## Conclusion

Fractures of the shaft humerus are one of the common fractures affecting present generation and treatment modality has to be decided carefully. I am of the opinion that the operative treatment of the humerus fractures should be done in patients with poly trauma and in patients with failed conservative treatment.

The results of this study indicate operative management of humeral shaft fractures results in good functional outcomes with few complications.

Operative management by plating was the only method used for internal fixation. All patients in this study were fixed by this method.

Studies should be done in future comparing functional outcomes of different operative modalities.

For patients with indications for operative management of humeral shaft fractures, plating can be done because of good functional outcomes and healing potential. The limitations of the study are that the sample size is small and no patients were managed operatively by nailing.



## Recommendations

From this study, we can deduce that fracture humerus is a common orthopaedic injury. These fractures are managed conservatively with varying degrees of success. My study shows that patients who undergo operation tend to have good functional outcomes.

Another study should be done comparing conservative vs operative management. Other studies should also be done to comparing different modes of operative management. Some studies have compared interlocking nail vs plating with different functional outcomes.

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