

## Results of Hemiarthroplasty in Comminuted Proximal Humerus Fracture in Elderly

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### ABSTRACT

We evaluated the outcome of hemiarthroplasty in the management of comminuted proximal humerus fractures in 21 elderly patient (60 years and above).

Preoperative clinical & radiological assessment was done in all patients. There was female preponderance (61.9% female, 38.1% male). Left side was affected in 13 cases where as right side was affected in 8 cases. The female: male ratio in our series was 1:0.62. Patient's average age at operation was 68.9 years (61-78 years). The average period of follow up was 12.4 months (6-18 months).

Majority of the patients had medical comorbidities (total 10 incidence of hypertension, three cases of diabetes and 3 cases of hypothyroidism) which increase the fracture operation interval. Majority of the patient (61.9%) were operated in the second week. Only three patients were operated in after 2 weeks.

In our series 61.9% patients were discharged within the first week. Only two patients needed hospital stay more than two weeks. We followed up 61.9% patients for 7-12 months and 28.6% for 13-18 months & the average period of follow up was 12.4 months (6-18 months).

Two patients suffered from superficial infection which healed after two weeks. There were no other complications. No patient required revision surgery.

Average forward flexion was 28.8° at 1 month and 74.5° at 6 months, average abduction was 33.3° at 1 month and 80.5° at 6 months. Average Constant-Murley score was improved from 24.1° at 1 month to 47.1° at 6 months. Pre operative VAS score was 8.5 which become 4.7 at 1 month (44.7% reduction) and 2.5 at 6 months (70.6% reduction). This improvement in functional outcome (forward flexion, abduction,

Constant-Murley score) and pain relief from 1 month to 6 months was statistically significant.

In our study, outcome is better at 6 month in patients aged below 70 years. Average forward flexion, abduction, VAS and Constant Murley score at 6 months in the <70 years age group were 82.7°, 88.1°, 1.9, and 50 respectively in comparison to 61.2°, 68.1°, 3.5 and 42.5 in the age group of 70 years and above. Statistical analysis shows the difference to be statistically significant.

After considering all the results & values we divided our outcome in 3 categories- good, fair & poor. We got 47.6 % good result & 42.9 % fair result and 9.5% poor results.

Most of the studies in this field showed that, hemiarthroplasty shoulder in elderly patients provides good pain relief but functional outcome and range of movements was not satisfactory which is corroborative with our findings. Our limitation was small sample size with short follow up period. So, longer study with large number of patients is needed to explore the benefits and pitfalls of hemiarthroplasty of shoulder.

**Keywords:** hemiarthroplasty, comminuted proximal humerus fractures, elderly

### INTRODUCTION

Human shoulder is a vital joint of the body. There are three joints and one articulation of the shoulder girdle; glenohumeral, acromioclavicular and sternoclavicular joints and scapulothoracic articulation. Among these "the shoulder joint" refers to the glenohumeral joint. It is a ball and socket type of joint between the head of humerus and the glenoid cavity of scapula. It is a multiaxial joint and allows a wide range of movements at the cost of stability.

There are multiple treatment options depending upon the patient profile and types of fracture like non operative management, closed reduction and percutaneous pinning, glenohumeral arthrodesis, open reduction and internal fixation (osteosynthesis) and hemiarthroplasty. Most of Undisplaced or mild displaced fracture can be treated by conservative methods. In young patients with good bone stock, displaced fractures is usually treated with osteosynthesis, but treatment of comminuted fractures of the proximal humerus like selected three-or four-part fractures and split fractures of the humeral head is a demanding and unresolved problem, especially in the elderly. Locking plates appear to offer improved fixation. However, screw cut-out rates due to fracture collapse are high. Krappinger et al [1] showed in a recent study that multifragmentary fracture patterns in older patients with low local BMD are prone for fixation failure. In addition, stable open reduction and internal fixation are extremely difficult in presence of significant comminution. Comminuted fractures particularly four-part fractures are susceptible and are associated with a high incidence of avascular necrosis of humeral head, ranging from 34% to 85%, [2-5] secondary to interruption of the ascending branch of anterior humeral circumflex artery as it courses around the proximal humerus and enters the tuberosities around the bicipital groove. [6] Although hemiarthroplasty can be done after failed osteosynthesis or osteonecrosis of humeral head, but result of second operation is never as good as the primary. Revision osteosynthesis or late prosthetic shoulder arthroplasty in these complex fractures is associated with complications, and functional results are usually disappointing. [7,8] Bone loss, malunion, ectopic ossification, avascular necrosis, associated rotator cuff tears, and severe contractions of soft tissues are some of the factors that prevent appropriate prosthesis placement and postoperative rehabilitation, therefore, in presence of comminution and

osteoporosis, primary hemiarthroplasty is possibly a better option than other methods in attempting speedy recovery and functional ability, though some controversies are there. Hemiarthroplasty for comminuted fractures of proximal humerus is the standard of care in most aged patients who are medically stable and are able to take the challenge of the extensive post operative physiotherapy. Hemiarthroplasty in this set of patients is technically demanding and requires a meticulous attention to surgical details including soft tissue handling, proper component positioning and proper tuberosity reconstruction.

### **AIMS AND OBJECTIVES**

#### **Our aims were -**

- To evaluate the results (both structural and functional improvements) of Hemiarthroplasty of shoulder in comminuted proximal humerus fractures in elderly.
- To study various complications of Hemiarthroplasty of shoulder in presence of comminution and osteoporosis.

#### **Our objective were-**

- To attain painless active life for the patients, with good functional range of motion of shoulder.
- To give patient an active and independent life as much as possible.

The true 'Shoulder' (glenohumeral Joint) is a 'ball-and-socket' joint. The ball is formed by the spheroid shaped head of humerus, which form only one third of a sphere. Head is directed medially, upward and backward. The socket is formed by the Pear shaped small and shallow glenoid cavity of scapula. Only one third of humeral head comes in contact with the glenoid in any position. So shoulder joint is relatively unstable. Capsule, ligaments and muscles around the shoulder joint is responsible for the stability.

Proximal humerus consists of humeral head, anatomical neck, lesser tuberosity, intertubercular groove, greater tuberosity,

surgical neck and part of humeral shaft. The neck shaft angle of the proximal humerus averages 145° and is retroverted approximately 30°.

The rotator cuff muscles are important for shoulder stability and movement. Supraspinatus, infraspinatus, and teres minor muscles are attached to greater tuberosity and subscapularis muscle is attached to the lesser tuberosity. They blends with the fibrous capsule and act as musculotendinous rotator cuff, the tonic contraction of which keeps the ball in contact with the socket.

Blood supply to proximal humerus is an important consideration while planning for treatment of proximal humerus fractures. It receives blood supply from anterior and posterior circumflex humeral and suprascapular arteries. The lateral ascending branch of the anterior circumflex humeral artery carries the most important blood supply to the humeral head and damage may lead to avascular necrosis. [9] This artery [10] runs a few millimeters posterior, lateral, and parallel to the biceps brachii tendon and bicipital groove. In comminuted fracture of proximal humerus fractures, blood supply to the humeral head may be jeopardised, leading to avascular necrosis of humeral head.

Trabecular thinning contributes to bone loss with age in both sexes, but trabecular loss occurs to a greater extent in women. In women, the loss of bone nearly triples in the ten years following menopause, after which it returns to the premenopausal state of approximately 0.4% per year. Alterations in the physiologic turnover of bone occur with age and may be influenced by many hormonal, hereditary, medical, and lifestyle factors. So, in old age, chance of proximal humerus fracture is increased due to presence of osteoporosis, especially in women.

## REVIEW OF LITERATURE

Samuel A Antuña, John W Sperling, Robert H Cofield found Significant discrepancy in the functional outcome of

hemiarthroplasty for proximal humerus fractures with short or mid-term follow-up. This study reports the long-term results and rate of complications of shoulder arthroplasty in the treatment of proximal humerus fractures. The review comprised 57 patients (44 women, 13 men) who underwent hemiarthroplasty between 1976 and 1996 as treatment of a proximal humerus fracture and who had a minimum 5-year follow-up (mean, 10.3 years). The mean patient age was 66 years at the time of surgery (range, 23-89 years). According to a modified Neer result rating system, results were satisfactory in 27 patients and unsatisfactory in 30. At the most recent follow-up, 9 patients (16%) had moderate or severe pain and 2 required implant revision or removal. The study data suggest that patients undergoing arthroplasty as treatment of an acute fracture of the proximal humerus may achieve satisfactory long-term pain relief; however, the result for overall shoulder motion is less predictable.

Samuel A Antuña, John W Sperling, Joaquín Sánchez-Sotelo, Robert H Cofield studied, Between 1976 and 1997, 50 shoulders with proximal humeral malunions in 50 patients were treated with hemiarthroplasty or total shoulder arthroplasty and followed up for a mean of 9 years (range, 2-21 years) or until the time of revision surgery. Shoulder arthroplasty resulted in significant pain relief (P <.005). At most recent follow-up, shoulder pain was more intense in patients who had initial operative treatment of their fracture, in those with osteonecrosis, and in those who had arthroplasty less than 2 years after their fracture.

R Szyszkowitz, W Seggl, P Schleifer, P J Cundy treated 143 of 1386 patients with proximal humeral fractures with internal osteosynthesis during a ten-year period (1978-1988). Ninety-seven proximal humeral osteosynthesis cases had adequate documentation, and 77 (80%) were available for clinical review. The 97 fractures were graded by the AO/ASIF classification and included 44 Group A, 32

Group B, and 21 Group C fractures. Exercise-stable osteosynthesis using T-plate, cloverleaf plate, or small condylar plate was performed in 70% of patients. In the remaining patients, a less rigid fixation, with Kirschner wires or screws and Cerclage wires was used.

Displaced four-part fractures or fracture-dislocations should be treated by reconstruction of the proximal humerus, especially in young patients. The use of minimal fixation rather than rigid fixation is considered after careful assessment of the condition of the soft tissue and blood supply of the humeral head fragments. Primary treatment with endoprosthesis is required when internal fixation is impractical in AO/ASIF fracture Types C 2/3 and C3 fractures. Improved clinical results may be achieved, particularly in the more severe fracture types, with increased experience in techniques of internal fixation of proximal humeral fractures.

C A Compito, E B Self, L U Bigliani found Successful treatment of acute fractures of the proximal humerus with prosthetic replacement is a therapeutic challenge to the orthopaedic surgeon, and requires proper elevation of the patient, proper surgical technique, and meticulous rehabilitation. Fractures that require prosthetic replacement as the definitive treatment include 4-part fractures and fracture dislocations, head-split fractures with > 40% articular surface involvement, and selected 3-part fractures

Mehmet Demirhan, OnderKilicoglu, Levent Altinel, LeventEralp, Yilmaz Akalindid a retrospective clinical study. Thirty-two patients [mean age 58 (range 37-83 years)] with a mean follow-up period of 35 months (range 8-80 months). Fifteen cases had Neer type IV, 2 had type III, and 15 patients had fracture-dislocations. Neer's criteria, Constant score, and elevation were used. Radiological parameters were union and position of the tuberosities, bone stock, and position of the prosthesis. Excellent or good results according to Neer's criteria were obtained in 24 of the 32 cases (75%),

and unsatisfactory results in 8 cases (25%). Mean Constant score was 68 (range 19-98) and mean elevation 113 (range 30-180). Thirty-one cases (97%) had no or mild pain.

Cases operated within 14 days following injury had a better general outcome ( $p = 0.005$ ). The humeral offset was directly correlated to the elevation ( $p = 0.011$ ) and Constant score ( $p = 0.002$ ), whereas the head height was inversely correlated to the same parameters ( $p = 0.001$  for both). The cutoff point for the humeral offset-general outcome correlation was calculated as 23 mm using ROC curve analysis. The most common complications were problems concerning the tuberosities (50%), and they adversely affected the clinical outcome ( $p = 0.002$ ). Preoperative delay, problems of tuberosity fixation, and position of the tuberosities were parameters influencing the clinical outcome. Lateralization of the tuberosities results in better scores, whereas their distal transfer can be related to a poorer outcome.

P Dimakopoulos, N Potamitis, E Lambiris treated thirty-eight patients with four-part proximal humerus fractures and fracture dislocations were with humeral head replacement between 1989 and 1995. At follow-up (mean, 37 months; range, 12-48 months) the patients were evaluated for postoperative pain, active range of motion, muscular strength, overall function in everyday activities, and patient satisfaction. Complications developed in five patients and consisted of humeral component malposition (one shoulder), rotator cuff insufficiency (two shoulders), and heterotopic ossification (two shoulders).. The results of the study indicate that humeral head replacement is a dependable method to restore comfort and function to patients with acute or old four-part fractures of the proximal humerus. However, recovery of function and range of motion are much less predictable in patients with an old injury.

Jennifer Nichols, Nicholas Ferran, Radhakant Pandey, Amit Modi, Grahame Taylor and Alison Armstrong report a

retrospective review of outcome after shoulder hemiarthroplasty for proximal humerus fractures. All patients managed with shoulder hemiarthroplasty for proximal humerus fractures between 1997 and 2008 were included. The ASA grade was II in 60% of patients. Mean follow-up was 52 months. Mean OSS was 27 (3-47) of a maximum of 48, with no significant difference between groups. There appears to be no significant difference in functional outcome, complication rate, or implant survival between patients below or above the age of 70 years treated with primary hemiarthroplasty for fracture of the proximal humerus. This procedure however carries a high complication rate in this group of patients.

C. Michael Robinson, Richard S. Page, Richard M.F. Hill, David L. Sanders, Charles M. Court-Brown, Alison E. Wakefield did A thirteen-year observational cohort study of 163 consecutive patients treated with hemiarthroplasty for a proximal humeral fracture was performed. The overall rate of prosthetic survival was 96.9% at one year, 95.3% at five years, and 93.9% at ten years. The overall median modified Constant score was 64 points at one year, with a typically good score for pain relief (median, 15 points) and poorer scores, with a greater scatter of values, for function (median, 12 points), range of motion (median, 24 points), and muscle power (median, 14 points)

Per Wretenberg' and Anders Ekelund evaluated the outcome of acute shoulder hemiarthroplasty in 18 patients following displaced three and four-part fractures of the proximal humerus. The mean age of the patients was 82 (70-92) years and the average follow-up time was 3.5 (2-7) years. No revision due to loosening was performed. All patients were evaluated concerning activities of daily living, of pain WAS-scale, 0-100 mm) and range of motion. The patients had a low functional level, but were able to sleep on the operated side and keep up their hobby. 11 patients were pain free and the worst pain recorded

was 28 mm. Range of motion for all movements, except extension, was statistically significant lower than for the non-operated side. We conclude patients' acute hemiarthroplasty following three- or four-part fractures of the proximal humerus results in good pain relief, but a more limited range of motion than that reported for younger patients.

The total number of Simple Shoulder Test functions that could be performed increased from 4.7 (of a possible 12.0) before surgery to 9.4 at the time of the final follow-up. The patients demonstrated significant improvement in ten of the twelve individual functions of the Simple Shoulder Test ( $p < 0.022$  to  $p < 0.00001$ ). With the numbers studied, gender, diagnosis, age, glenoid wear, and preoperative glenoid erosion did not significantly affect final shoulder function or overall improvement. The range of motion was significantly improved for all individuals ( $p < 0.00001$ ). Radiographically, twenty-two patients had a joint space between the glenoid bone and the humeral prosthesis at the time of final follow-up.

Joseph J. Christoforakis, George M. Kontakis, Pavlos G. Katonis, Konstantinos Stergiopoulos, Alexander G. Hadjipavlou evaluated the results of hemiarthroplasty for shoulder fracture were in 26 patients, 20 women and 6 men with a mean age of  $64.7 \pm 8.2$  years. The follow-up period was 2 to 7 years. Cofield prostheses were used for the first 10 patients and subsequently 9 Globaland 7 Aequalis prostheses were implanted, all cemented. The clinical outcome was assessed using the Constant-Murley scale. The mean score, at the last follow-up, was  $70.4 \pm 16.4$  (39-96). Mean forward elevation of the arm was 150o (30o-175o), mean abduction was 145o (30o-170o), and mean external rotation was 30o (10o-45o). In most of the cases internal rotation corresponded with a position of the dorsum of the hand at the L3 vertebrae. The patients in our series achieved their optimal clinical result within the first 6 months after operation. Shoulder hemiarthroplasty is a

worthwhile procedure, giving predictable results provided the patients have been carefully selected, the individual anatomy of the shoulder is restored and an aggressive rehabilitation program is implemented during the first six months after surgery. Twenty-two patients were followed up at a mean of 33 months after hemiarthroplasty for proximal humeral fractures. Of these, 13 underwent surgery within 30 days of injury and 9 after a mean of 13 months. Outcome was assessed by pain, range of motion, function, stability, and strength. Results were comparable to those from specialist centers. Pain relief was the most predictable outcome. Mean active forward flexion was 93°, active external rotation 24°, and internal rotation to L1. Most patients were satisfied with the outcome. The results were better in younger patients. One patient required a revision after 7 years for aseptic loosening. The severity of the fracture and timing of the operation did not appear to have a bearing on the outcome. Technical problems at surgery, greater tuberosity displacement, late rotator cuff rupture, and poorly motivated patients were the main reasons for failure.

French multicentre study [11] of 406 patients showed that height of implantation, retroversion, positioning of the tuberosity, the use of a fracture jig, rehabilitation and immobilisation are of prognostic value.

## **MATERIALS AND METHODS**

### **Study area:**

Department of Orthopaedics, Institute of Post Graduate Medical Education & Research and S.S.K.M. Hospital, Kolkata-20

**Study period:** December 2011 – October 2013

### **Study Population:**

Elderly patients (more than 60 yrs of age) with comminuted fractures of proximal humerus attending Orthopaedics OPD and Emergency, IPGME&R and SSKM Hospital.

### **Inclusion criteria:**

Patient aged 60 years or above mentally alert patient Comminuted proximal humerus fractures confirmed by Radiological examination. Low demanding patient

### **Exclusion criteria:**

Young patient with high demand  
Open injury  
Neurovascular injury  
Rotator cuff injury  
Infection  
Abuse potential in patient

**Sample size:** 21 cases.

**Sample design:** Random.

**Controls:** not applicable

### **Methods of data collection:**

Patient will be evaluated before and after management by  
Clinical parameters and radiological findings..

### **Initial management:**

1. On admission to the ward, detailed history of the cases were taken regarding age, sex, occupation, socio-economic status, time of injury, mode of injury, any concurrent medical illness, relevant past illness, Previous musculo-skeletal injury or surgery etc.
2. Thorough and detailed clinical examination of nervous system, all other major systems and affected parts were done to confirm the presence of fracture, condition of the skin, presence of any external wound, distal neurovascular status etc.
3. Presence of fracture and the type of fractures is confirmed by radiological examination. X ray of the affected shoulder done in antero- posterior view, lateral view, scapular Y view, axillary view.
4. Appropriate pre-operative investigations were done.
5. Pre-operative anaesthetic assessment and counselling of the patients regarding the procedure, advantages, disadvantages, complications and prognosis etc were done and then put up for operation.

6. Pre-operative antibiotics (Inj. Cefuroxime 1.5gm and inj Amikacin 500mg) were given one hour before operation and continued for 3 days post operatively, and changed to oral Cefuroxime 500mg twice daily post operatively for five days.
7. Preoperative planning was done after properly evaluating the Fracture morphology.

### **Surgical procedures in brief:**

#### **Position:**

The standard beach chair position was used. The patient is under general anaesthesia with a sandbag under the affected shoulder and an arm board attached to the table supporting the arm.

#### **Incision:**

Extended Deltopectoral approach is used.

#### **Dissection and tuberosity identification:**

The deltoid and pectoral muscles are retracted, and the clavipectoral fascia is incised up to the level of the coracoacromial ligament. The biceps tendon is a very useful landmark, because it usually remains intact and is a guide to the interval between subscapularis and supraspinatus, that is, a delineation of the greater and lesser tuberosities. In a 4-part fracture-dislocation, the lesser tuberosity will be found medially and the greater tuberosity, posterosuperiorly.

The lesser tuberosity should be mobilized from its soft tissue attachments using a combination of periosteal elevators or osteotomes.

#### **Humeral Head Retrieval:**

The head is typically found posteroinferiorly.

It is often helpful to forward elevate the extremity and apply slight distal traction. Try and remove the head as one fragment to appropriately size the head. Inspect the glenoid articular surface for damage or wear which may necessitate resurfacing of the glenoid. Save all bony fragments for autograft later.

#### **Tuberosity Mobilization:**

Two traction stitch using #5 nonabsorbable suture or loops of S-S wire should also be placed from outside-in at the bone-tendon junction of the greater and lesser tuberosity. These steps are critical for later tuberosity reconstruction.

#### **Humeral Stem Preparation and Insertion with cementing:**

Proper placement of the humeral component at the correct height and in the proper amount of retroversion is critical to the ultimate stability of the greater tuberosity repair and eventual outcome of the procedure. The appropriate humeral height is determined pre- and intraoperatively and then assessed by trial reduction. Placement in proper retroversion is critical to reduce traction on the greater tuberosity repair.

About 20° of retroversion decreases the tension on the tuberosity repair. This can be achieved by external rotation of the arm to 30° and cementing the component in neutral position. A helpful landmark is that in this of retroversion, the lateral fin of the prosthesis should lie about 1 cm behind the distal bicipital groove. With the trial components removed, drill 2 holes in the humeral shaft, medial and lateral to the bicipital groove, approximately 1.5-2 cm distal to the proximal aspect of the humeral shaft.

Pass a #5 nonabsorbable suture /S-S wires loop of LT from in medial hole, to be used later as a figure-of-eight tension band. Another #5 nonabsorbable suture/SS wire loop of GT through the lateral hole from outside-in.

Retain the needle and grasp the sutures with a straight clamp. With tension applied to the tuberosities, assess anterior and posterior stability, as well as range of motion. Fifty percent translation anteriorly, inferiorly, and posteriorly is desirable.

#### **Tuberosity Reattachment:**

Tuberosity reconstruction is the most important part of this procedure. The goal is to securely reattach the lesser and greater tuberosity to the shaft as well as to each other. Consider placing the greater

tuberosity approximately 5-10 mm below the superolateral rim of the humeral head component. This is achieved by rigid fixation of the greater tuberosity in proper position, below the humeral head and to the shaft with suture or S S wire 1 suture. Next, the lesser tuberosity is fixed to the shaft with suture and S S wire loop and the greater tuberosity with sutures through the fin, and finally reinforced with a figure-of-eight tension band suture.

#### **Wound closure:**

Finally, close the wound over a drain and place the arm in a shoulder immobiliser.

#### **Post operative rehabilitation protocol:**

Post operatively patient's operated limb was put in an arm sling. Arm was immobilized in neutral abduction & rotation for a period of 4 to 6 weeks. Sling should be removed temporarily during exercises. Radiographs in the form of x ray of shoulder in antero posterior and lateral view was obtained and evaluated. On the day one following surgery, Passive Forward Flexion in supine to tolerance, ER in scapular plane to available gentle passive range of motion usually around 30°, Passive internal rotation to chest. Active distal extremity exercise (Elbow, Wrist, Hand) and Pendulum exercise were started. This was continued with gradual increase in passive range of movements for 3 weeks. Sutures were removed after 14 days.

Sling should be used for sleeping and removed gradually over the course of the 4 weeks. While lying supine a small pillow or towel roll should be placed behind the elbow to avoid shoulder hyperextension / anterior capsule / subscapularis stretch. 4 weeks following surgery, after ensuring that the tuberosities have remained in place by radiograph, passive abduction of the arm was permitted starting from a resting position of 30° abduction

Active range of motion exercises was started after 6 weeks emphasising elevation and rotation. Once the tuberosities clearly show radiographic healing, active

mobility is permitted in elevation and internal rotation. Active forward flexion, internal rotation, external rotation, and abduction in supine position was started in pain free ROM. Scapular strengthening exercises & stretching program was started. Patients were discharged with advice to attend follow up clinic at 1 week, 3 weeks, 6 weeks, 3 months, 6 months, 9 months and 12 months.

#### **Follow up:**

The patients were followed up regularly and were put up for clinical & radiological examinations and functional assessment. Radiological assessment was done by AP and lateral view of the affected shoulder. Functional assessment was done by Visual Analogue Scale (VAS), range of motion, Constant Murley score. All these data were recorded in a proforma for each patient.

#### **RESULTS & ANALYSIS**

This study was conducted in the Department of Orthopaedics, Institute of Post Graduate Medical Education & Research and S.S.K.M. Hospital, Kolkata-20, from December 2011 to October 2013.

We operated on the patients of comminuted proximal humerus fractures following trauma in elderly patients with hemiarthroplasty of shoulder

In this prospective randomised study, 21 patients (aged 60 years and above) with proximal humerus fractures were taken into consideration. Among them thirteen (61.9%) were female and eight male (38.1%). All the patients were followed up at least for six months (6 to 18 months).

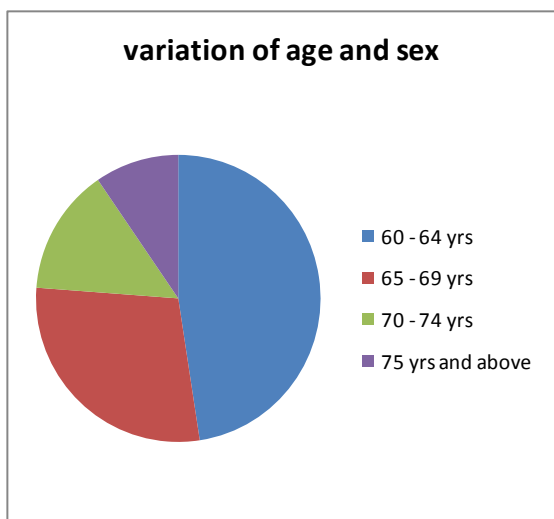
The patient's average age at operation was 68.9 years (61-78 years). Among them, thirteen (61.9%) were below 70 years of age, while eight (38.1%) were above 70 years. The average age of female patients was 70 years and average age of male patients was 67.1 years. The average follow up period was 12.4 months (6-18 months). The average follow up period in female patients was 12.2 months, while in



male patients, the average follow up period was 12.7 months.

**Table 1: Variation of age & sex**

Age	Male	Female	Total	Percentages
60 -64 yrs	2	1	3	14.3
65 – 69 yrs	4	6	10	47.6
70 – 74 yrs	2	4	6	28.6
75 yrs& more	0	2	2	9.5
Total	8	13	21	100



**Figure 1**

The above table shows that majority of the patients were female (61.9%). Among the affected patients (both male and females), mostly were from age group 65-69 years. The average age of affected males was 67.1 years and females were 70 years. The female: male ratio was 1: 0.62.

**Table 2: Incidence of complications**

Complications	Male	Female	Total
Superficial infection	1	1	2
Deep infection	0	0	0
Dislocation	0	0	0
Prosthetic loosening	0	0	0
Periprosthetic fractures	0	0	0
Neurovascular injury	0	0	0

Table 2 shows two patients had superficial infection. No other significant complication was noticed.

**Table 3: Showing the Constant Murley Scores, At presentation, 1 month & 6 months following surgery**

SL.NO	Age	Sex	CONSTANT MURLEY Score (%)		
			At presentation	1 month	6 months
1	67	F	6	28	54
2	72	F	6	22	42
3	71	M	8	24	50
4	66	M	6	26	44
5	65	F	8	28	50
6	69	F	6	24	44
7	66	F	8	20	42
8	61	M	6	26	52
9	72	F	8	22	46
10	68	M	6	24	52
11	69	M	10	24	54
12	76	F	6	26	40
13	78	F	6	20	36
14	65	F	4	24	52
15	69	M	6	24	40
16	73	F	8	22	44
17	71	M	6	24	48
18	64	F	4	26	54
19	62	M	4	28	58
20	74	F	6	20	34
21	69	F	8	24	54
Average			6.5	24.1	47.1

Above table shows improvement of Constant Murley score at 1 month and 6 months from pre operative score. Average Constant Murley score at 1 month post op is 24.1 and at 6 months is 47.1 that means 95.8 % improvement over 5 months.

**Table 4: Comparison of numerical variables within Group – Student's paired t test**

	Mean	Std.Dv.	N	Diff.	Std.Dv. Diff.	t	df	p
FF_1m	28.8	5.22	21	-45.71	14.52	-14.432	20	< 0.001
FF_6m	74.5	18.16						
ABD_1m	33.3	6.19	21	-47.14	12.51	-17.273	20	< 0.001
ABD_6m	80.5	15.88						
CM_1m	24.1	2.49	21	-23.05	5.28	-20.014	20	< 0.001
CM_6m	47.1	6.62						

**Table 5: Gradation of results and outcome**

Criteria	Good	Fair	Poor
CM Score at 6 month	50 or above	40-49	39 or below or no reduction from previous score
VAS Score at 6 month	0-2	3-4	5 or above or No reduction from previous score
Forward flexion at 6 months	90 or above	60 -90	Below 60
Abduction at 6 months	90 or above	60 -90	Below 60
Need of analgesia	Very rarely <once in a week	Sometimes >twice in a week	Almost everyday

**Table 6: Showing the number of patients having good, fair and poor outcome depending on the criteria shown in table 13**

Sex	Good	Fair	Poor	Total
Male	3	5	0	8
Female	7	4	2	13
Total	10	9	2	21
Percentage	47.6	42.9	9.5	

This table shows 10 patients (47.6%) had good result, 9 patients (42.9%) had fair results and 2 patients had poor result.

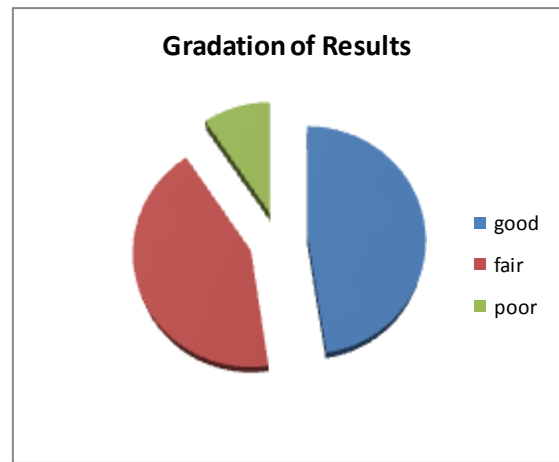


Figure 2

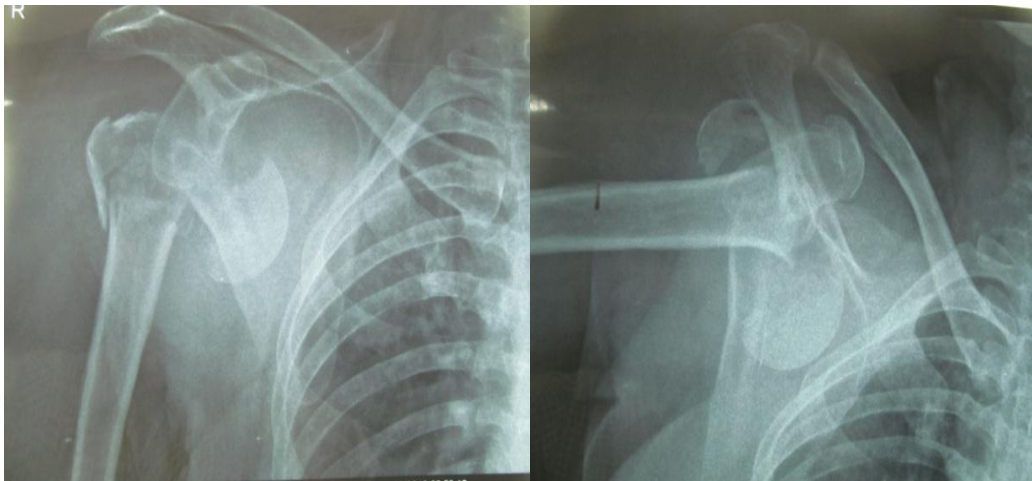


Fig 3: Pre operative X- ray of case no 3

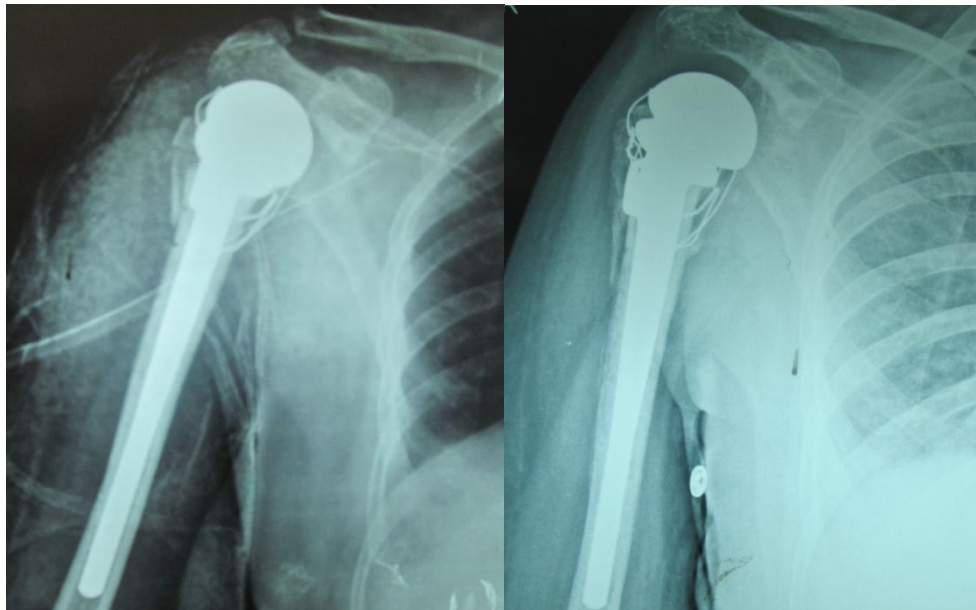


Fig 4: Post operative X-ray of case no 3

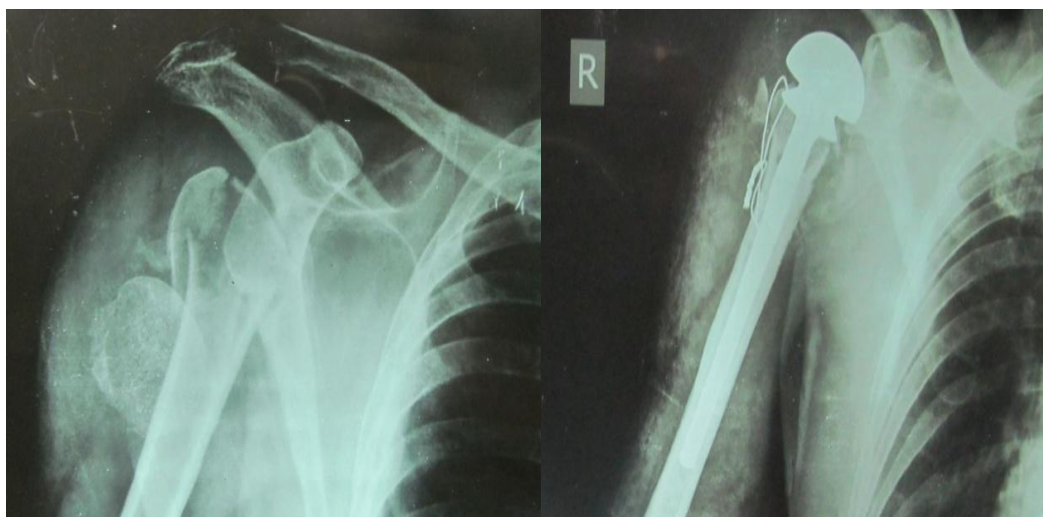


Fig 5: Pre op X -ray of case no 6 post op X- ray of case no 6

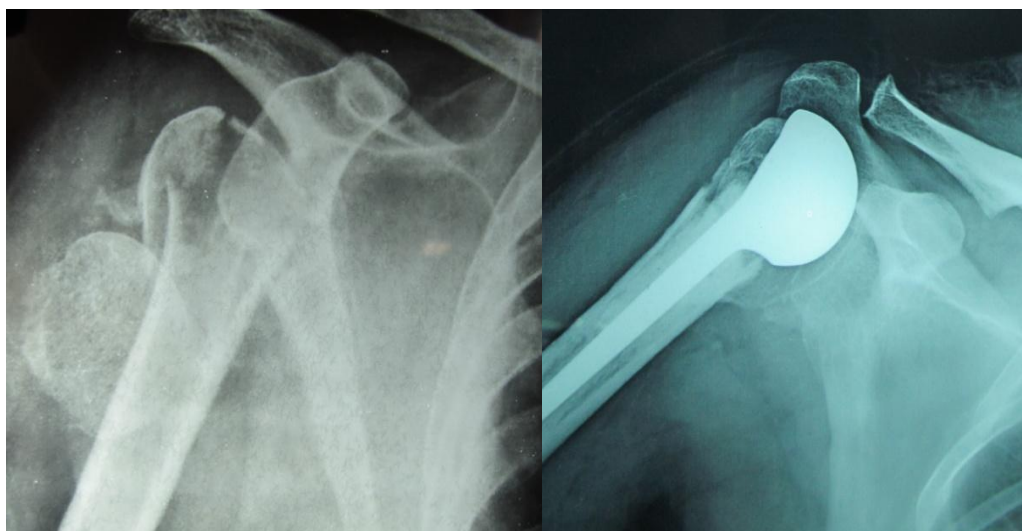


Fig 6: Pre op X- ray of case no 8..... Post op X-ray of case no 8.....

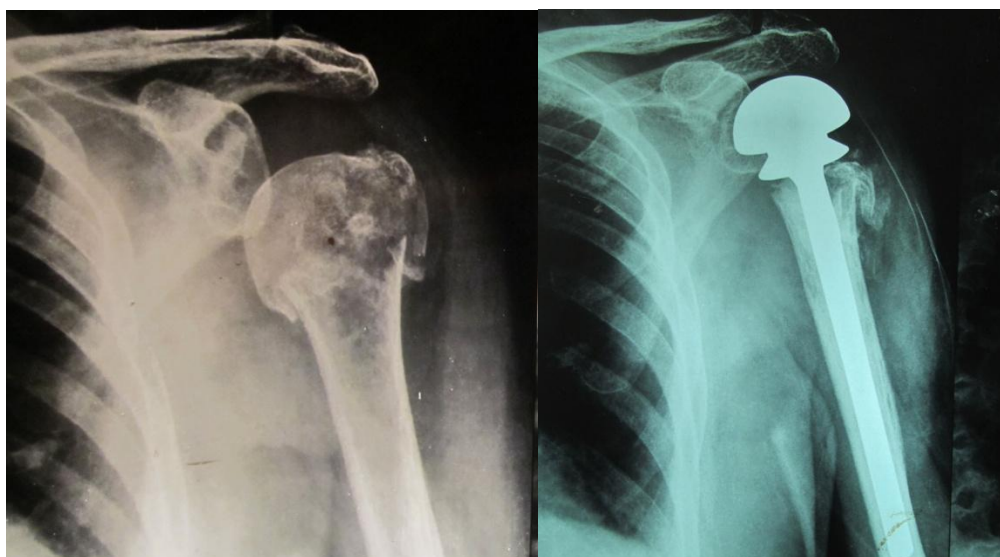


Fig 7: Pre op X- ray of case no 12; Post op X-ray of case no 12

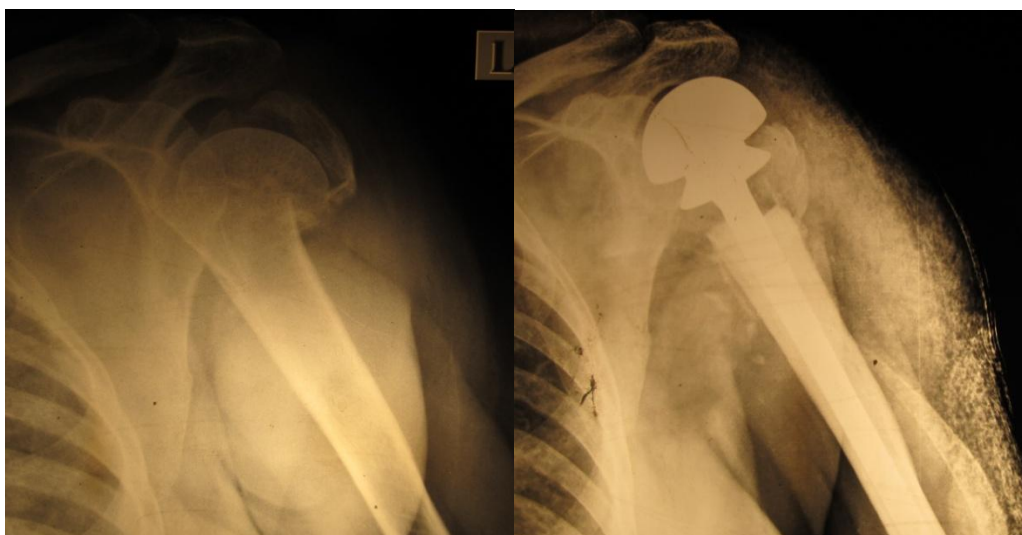


Fig 8: Pre op X- ray of case no 15;

Post op X-ray of case no 15

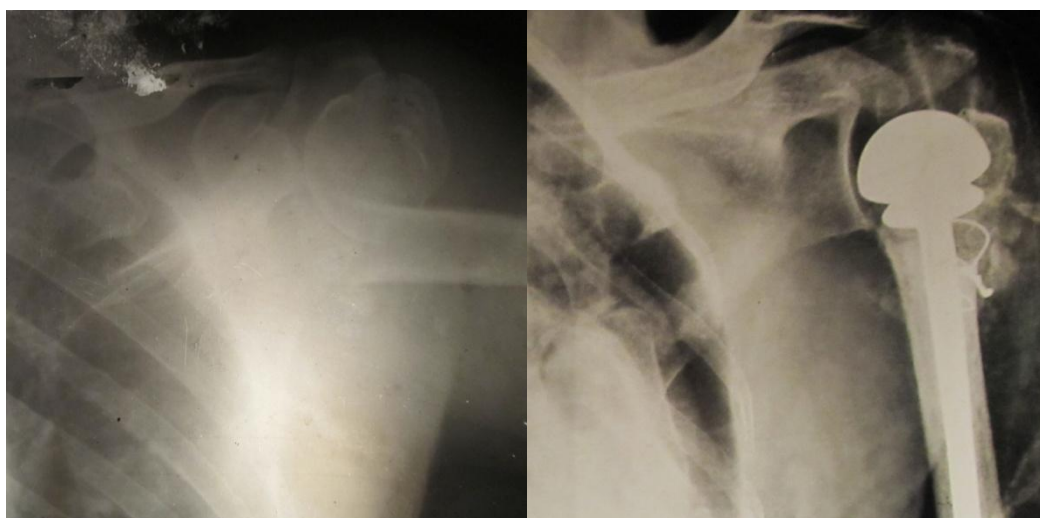


Fig 9: Pre op X-ray of case no 19;

Post op X- ray of case no19

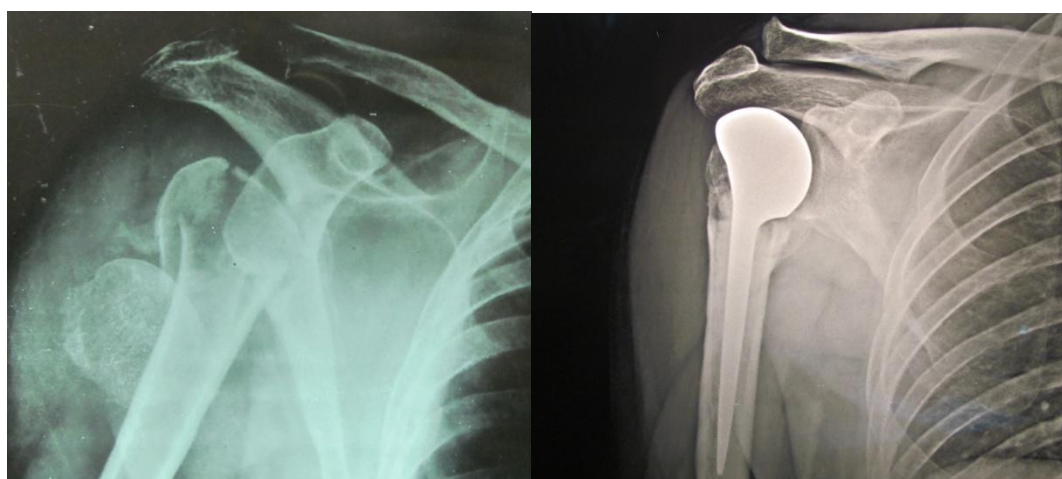


Fig 10: Pre op X-ray of case no 21;

Post op X- ray of case no 21

## DISCUSSION

In our study we selected our patients by pre-operative evaluation including clinical examination, radiographs and

according to inclusion and exclusion criteria. Patients were examined thoroughly and evaluation of Constant Murley & Visual Analogue Score was done pre-operatively.

Hemiarthroplasty of the shoulder done in all patients.

21 patients were operated and followed up & their results are evaluated. Among them, 13 patients (61.9%) had left sided fractures, and 8 patients had fractures in the right side.

Among the 21 patients, there was female preponderance (61.9% female, 38.1% male). 3 were from 60-64 years group, 10 were from 65-69 years group, 6 from 70-74 years group & 2 patients were more than 75 years group. The average age at operation was 68.9 years (61-78 years). The average age of male was 67.1 years and female was 70 years. The female –male ratio in our series was 1:0.62. 10 patients had hypertension, 3 patients had diabetes mellitus and 3 patients had hypothyroidism. Most of the patients (13 out of 21) were operated in the second weeks, where 5 patients were operated in the first week, and three patients were operated after 2 weeks of fractures. Two surgeries were completed within an hour, 5 surgeries were performed more than 2 hours and rest 14 operations took 1-2 hours. In our series, 13 patients (61.9%) were discharged in the first week after operation where 6 patients (28.6%) was discharged in the 2<sup>nd</sup> week and to patients required hospital stay more than two weeks due to superficial infections. In our series, more than half (61.9%) of the patients were followed up for 7-12 months, 28.6% patients were followed up for 13 to 18 months and 2 patient was followed up for 6 months. The average period of follow up was 12.4 months (6-18 months).

Two patients (one male and one female) had superficial infection which was healed within two weeks with regular dressing and antibiotics.

In our study, the patients were evaluated pre-operatively, post-operatively at 1 month & 6 months by Constant Murley score & Visual Analogue Score. The pre-operative average Constant Murley score was 6.5% which increased to 24.1% at 1 month and 47.1 % at 6 months post-operative period. The pre-operative average

VAS score was 8.5, which became 4.7 at 1 month and 2.5 at 6 months, showing 44.7% reduction at 1 month and 70.6% reduction at 6 months.

No patients in our series was able to flex or abduct his/her affected shoulder pre operatively. Forward flexion increased to an average of 28.8° at 1 month and 74.5° at 6 month post operatively. Abduction of the affected shoulder increased to an average of 33.3° at 1 month and 80.5° at 6 months post operatively.

Improvements in flexion abduction, pain (VAS) and Constant Murley score from 1 month to 6 months are statistically significant (p value <.001). We found that functional outcome and pain relief was much better in patients aged below 70 years which was found to be statistically significant.

We graded our results and outcomes in good, fair and poor category depending on various criteria. The different criteria for good were- CM Score at 6 month 50 and above, VAS score at 6 months 0-2, forward flexion and abduction at 6 months above 90°, very rare need of analgesics & good patient satisfaction. 10 patients (47.6%) meet the criteria of good category of them 3 were male, and 7 female.

The criteria to label as fair were, CM score at 6 months 40-49, VAS score at 6 months more than 3-4, forward flexion and abduction at 6 month 60°-90°, need of analgesic more than twice a week and somewhat satisfied patients compared to pre-operative stage. In our study 9 patients (42.9%) were graded as fair, of them 5 were male, 4 were females.

The criteria for poor category was CM score at 6 months more than 39 or below, no reduction from previous VAS score at 1 & 6 months or 5 or more than 5, forward flexion and abduction at 6 month below 60°, need for analgesics almost every day and not satisfied patients.

In our study, 10 patients (47.6%) had good result, 9 patients (42.9%) had fair result and 2 patients (9.5%) patients had poor result according to criteria mentioned above. All patients having poor result are female.

53.8% female (7 out of 13) had good result while 30.8% (4 out of 13) female patients had fair result. 37.5% male (3 out of 8) patients had good results. 62.5% male (5 out of 8) patients had fair results. No patient requires re operation in our series.

The limitation of our study is that we don't have a large number of patients and a long follow up, and the study would have been more analysing if we could have compared it with other modes of management, which is beyond the scope of this study. Long follow-up may reveal more information about the result and other aspects of this operation.

Improvement in pain scores and functional capabilities that were found in our study, were comparable to other workers experience. Most studies done in this topic had used VAS & CM score to assess result, like we did.

## CONCLUSION

In spite of having multiple treatment options for proximal humerus fractures, treatment of comminuted proximal humerus fractures in elderly patients is a great challenge for the surgeon in the background of poor bone quality due to osteoporosis and possibility of AVN of humeral head due to interruption of blood supply to humeral head by the fractures. Hemiarthroplasty has become a standard procedure in most orthopaedic units when the humeral head is nonviable or reconstruction with internal fixation techniques is not possible. [12-14] Satisfactory relief from pain can be expected in most patients, (Neer 1970, Tanner and Cofield 1983, Moeckel et al. 1992). [15-17] Whereas function and the subjective outcome are closely related to the healing of the tuberosity, age of the patients, experience of the surgeon [18-21] and compliance and adherence to post operative rehabilitation protocol. In many cases of these patients, pain can be a greater problem than restriction in range of motion, especially in elderly patients with relatively small demands for physical performance.

Younger individuals have been reported to have better prognosis after hemiarthroplasty for fractures than elderly patients. [19,22-27] In a study by Goldman et al. (1995), [28] patients younger than 70 years had a greater range of motion than older patients. Range of motion is dependent on the ability to restore the function of the rotator cuff at surgery and the quality of the postoperative rehabilitation. In these elderly patients, the tuberosity fragments are more osteoporotic and comminuted than in younger patients. Furthermore, some of the patients in the present study were unable to participate fully in the intense and prolonged rehabilitation program necessary for an optimal functional outcome.

Our results for these elderly patients are well in agreement with these earlier findings. In our study, pain relief is good but range of movement is not very satisfactory. It can be compared with that of more recent studies. [29-31] In our study too, we noticed better outcome in patients aged 70 years and below, both in terms of pain relief and range of movement.

Because of increase incidence of fixation failure and AVN of humeral head after osteosynthesis in three part and four part fractures and the results of a primary arthroplasty are better than the results of hemiarthroplasty performed as a late reconstructive procedure after failed operative fixation, [16,23,32-34] it seems reasonable to consider a hemiarthroplasty in severely displaced and comminuted fractures of the proximal humerus in elderly osteoporotic people.

## CONSTANT-MURLEY SHOULDER OUTCOME SCORE

The Constant-Murley score (CMS) is a 100-points scale composed of a number of individual parameters. These parameters define the level of pain and the ability to carry out the normal daily activities of the patient. [35] The Constant-Murley score was introduced to determine the functionality after the treatment of a shoulder injury. The

test is divided into four subscales: pain (15 points), activities of daily living (20 points), strength (25 points) and range of motion: forward elevation, external rotation, abduction and internal rotation of the shoulder (40 points). The higher the score, the higher the quality of the function. [36]

Subjective findings (severity of pain, activities of daily living and working in different positions) of the participants are responsible for 35 points and objective measurements (AROM without pain, measurements exo -and endorotation via reference points and measuring muscle strength) are responsible for the remaining 65 points. [37] The Constant-Murley score is used in almost every language without official translations. In French a validated translation has been published. Time needed to complete the Constant-Murley test is between 5 to 7 minutes. [38]

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