EVALUATION OF FUNCTIONAL OUTCOME OF COMPLEX PROXIMAL HUMERUS FRACTURES TREATED WITH HEMI ARTHROPLASTY – A PROSPECTIVE STUDY”

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IN
ORTHOPAEDICS
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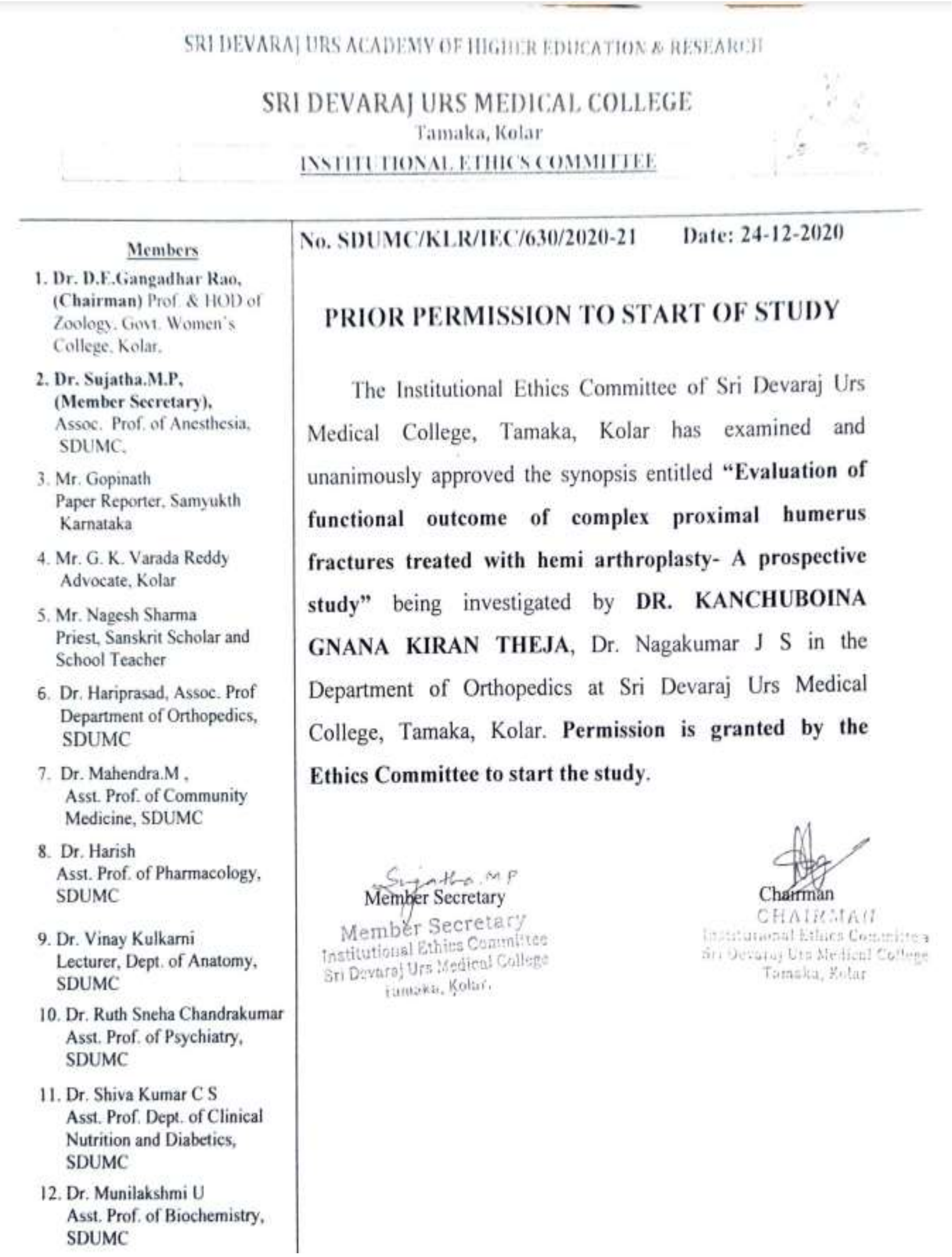

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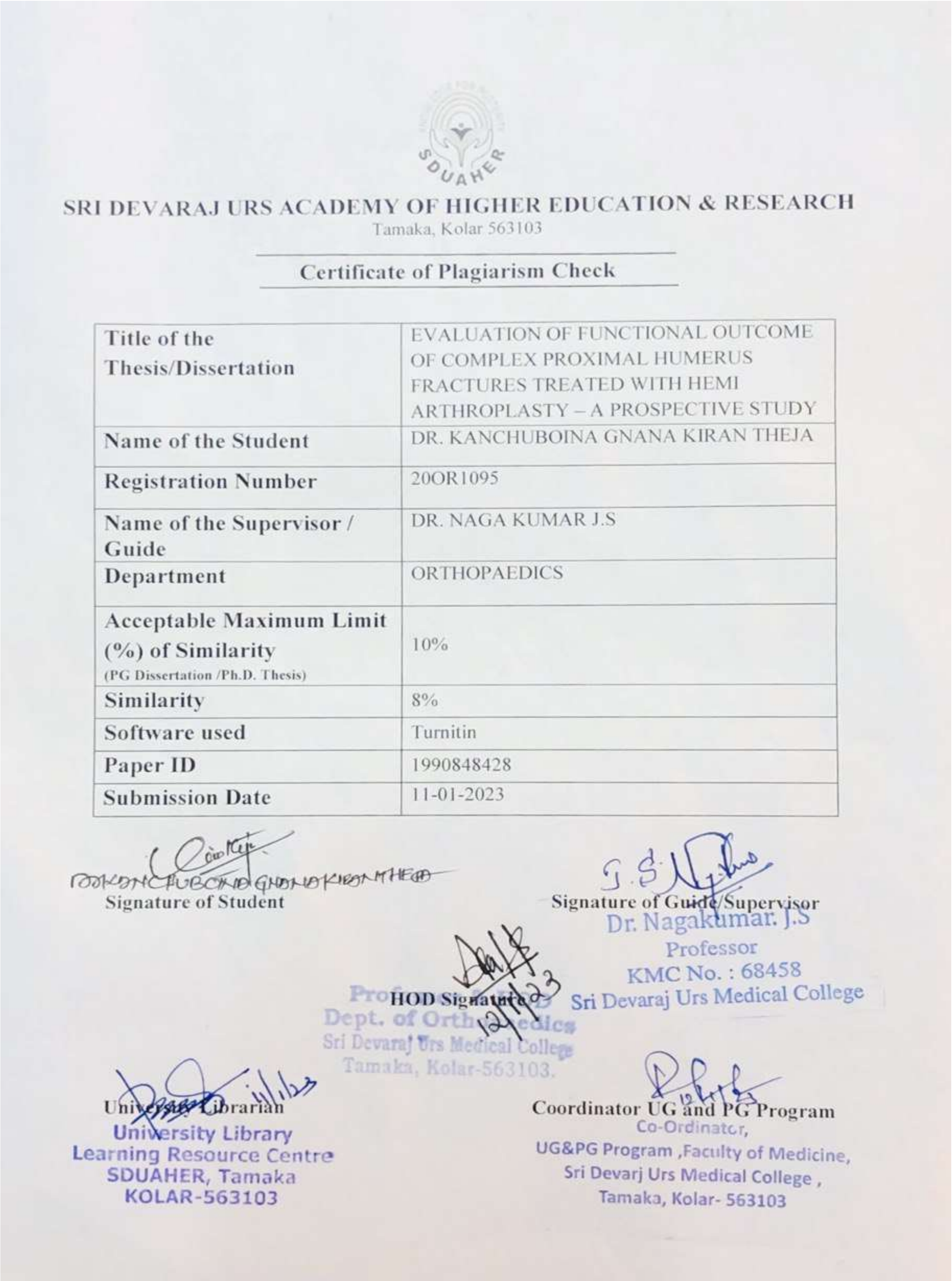

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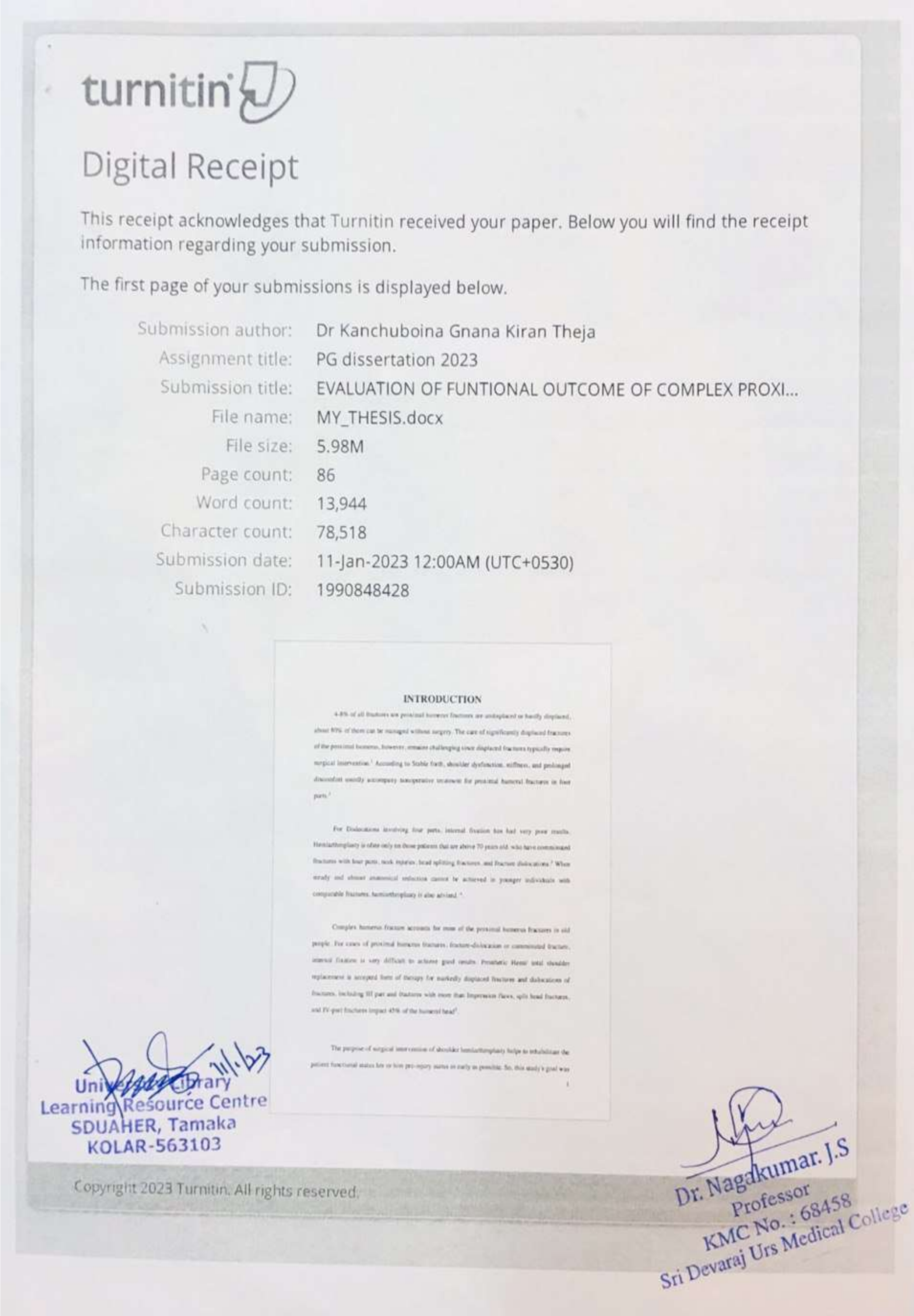

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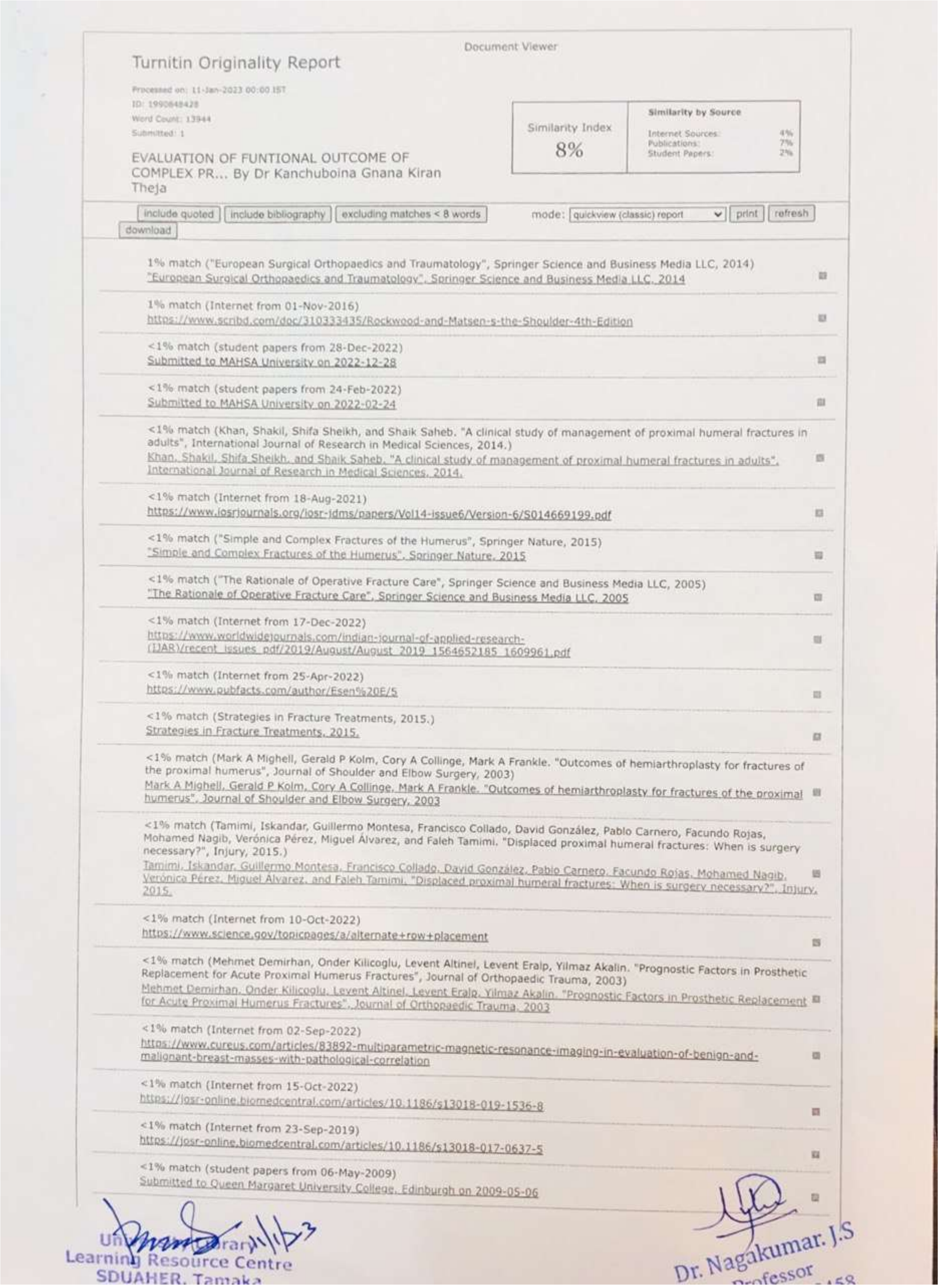

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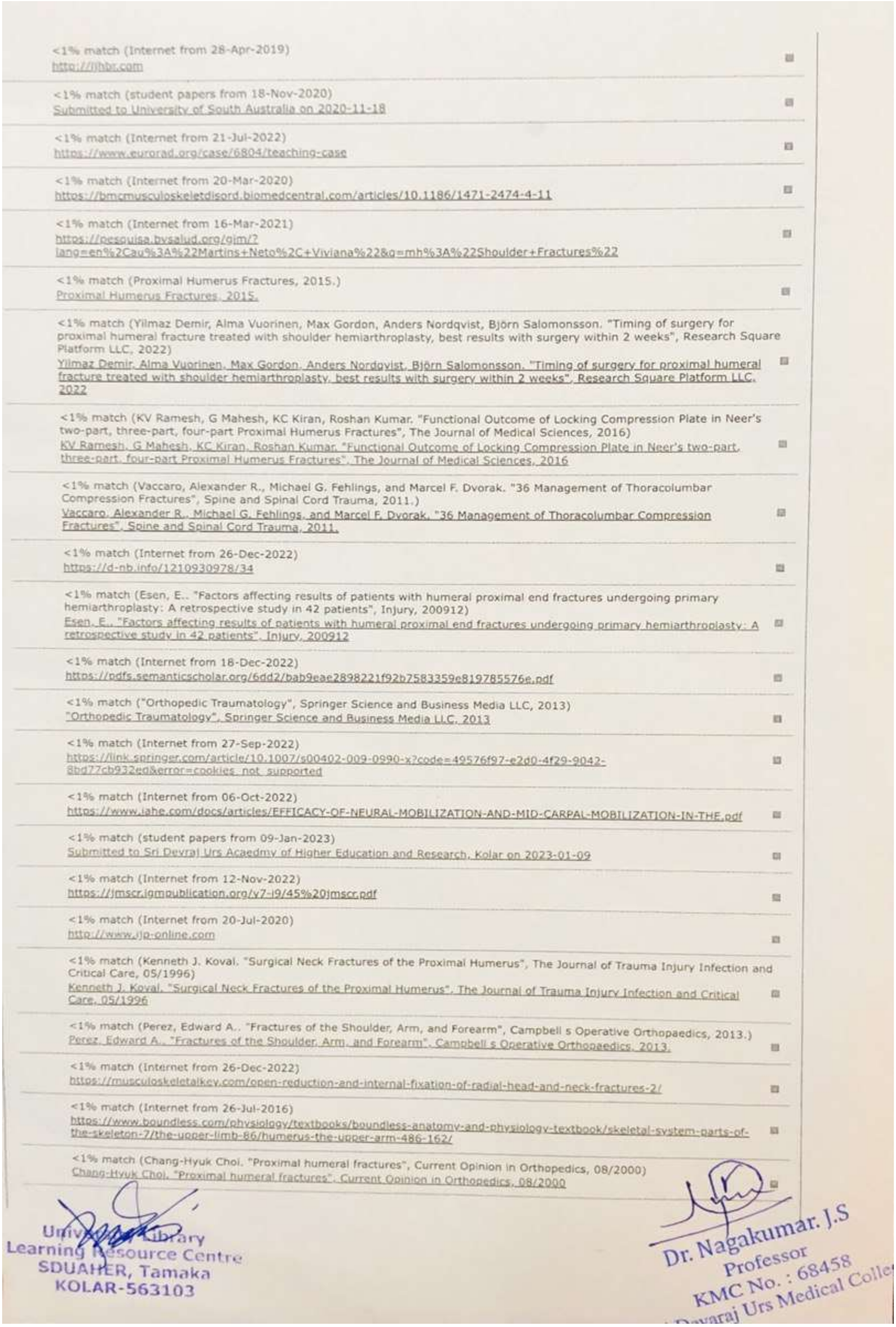

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LIST OF ABBREVIATIONS

#	Fracture
AO	Arbeitsgemeinschaft Furosteosynthesefragen
AP	Anteroposterior
ASES	American Shoulder and Elbow Surgeons
ASIF	Association of Study of Internal Fixation
AVN	Avascular Necrosis
BT	Bleeding Time
CBC	Complete Blood Count
CR	Closed Reduction
CRIF	Closed Reduction and Internal Fixation
CT	Computed Tomography
DASH	Disabilities of the Arm, Shoulder, and Hand Instrument
DCP	Dynamic Compression Plate
ECG.	Electrocardiogram
FAPF	Fixed Angle Plate Fixation
HA	Hypertonia Arterialis
HBsAg	Hepatitis B Surface Antigen
HIV	Human Immunodeficiency Virus
IM	Intramedullary Nail
K	Krischner
MIPPO	Minimally invasive percutaneous plate osteosynthesis
ORIF	Open Reduction and Internal Fixation

PHP	Partial Hospitalization Program
RBS	Random Blood Sugar
RFT	Renal Function Test
RSA	Respiratory Sinus Arrhythmia
RTA	Road Traffic Accident
UCLA	University of California, Los Angeles
VAS	Visual Analog Scale
Y	Years

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ABSTRACT

BACKGROUND:

Complex humerus fracture accounts for most of the proximal humerus fractures in older people. For cases of proximal humerus fractures, fracture-dislocation or comminuted fracture, internal fixation is very difficult to achieve good results. Prosthetic Hemi/Total shoulder arthroplasty is accepted form of treatment for markedly displaced fractures and fracture dislocations, including 3 part and 4-part fractures, head splitting fractures and fractures with impression defects involving more than 45% of the humeral head. The goal of surgical management of shoulder hemiarthroplasty is to restore the patient functional status his or her pre-injury status as early as possible. So, the purpose of this study was to evaluate the outcome of shoulder hemiarthroplasty in patients with complex proximal humerus fracture.

MATERIAL AND METHODS:

A Prospective study was conducted among 24 subjects undergoing primary hemiarthroplasty at Department of orthopedics, R.L. Jalappa hospital and research centre Sri Devaraj Urs Medical college, SDUAHER. The study duration was 1 year 6 months. Institutional Ethical clearance was obtained prior to the start of the study. Informed consent was obtained from all the patients recruited prior to the start of the study. After satisfying the inclusion and exclusion criteria, each patient was reviewed by a thorough history, clinical examination, and radiographs. Patients who undergo shoulder hemiarthroplasty after obtaining consent and surgical fitness under suitable Anaesthesia were included. Following surgery patients were followed up at 1st, 3rd, 6th months. At the time of follow up each patient's range of movement of shoulder will be assessed by using Disability of arm, shoulder and hand score (DASH score) and visual analog scale (VAS score).

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. Paired t test was the test of significance for paired data such as before and after surgery for quantitative data. **Repeated Measures ANOVA (RMANOVA)** was the test of significance to identify the mean difference between more than two measurements. **Post Hoc Bonferroni test** was used to determine the intergroup analysis.

RESULTS:

Mean age of subjects was 58.79 ± 4.587 years. In the present study 66.7% were in the age group <60 years and 33.3% were in the age group >60 years. Mode of Injury in 79.2% was RTA and in 20.8% slip and fall. Most common side of injury was Right side in 58.3%. Most common type of fracture was Neers Type 3 in 62.5%. Median DASH score at 1st month was 56, at 3rd month was 31 and at 6th month was 9. There was significant decrease in DASH score at 3rd month and at 6th month compared to 1st month. Median VAS score at 1st month was 6, at 3rd month was 3 and at 6th month was 1. There was significant decrease in VAS score at 3rd month and at 6th month compared to 1st month. In Complication rate was 4.2%.

CONCLUSION:

From the study findings it is recommended that primary hemiarthroplasty can be utilized to treat complicated proximal humerus fractures. considering the significant improvement in DASH score and VAS Scores. Primary hemiarthroplasty had minimal complication rate. Hence a suitable method in treating complex proximal humerus fractures.

KEY WORDS: Complex proximal humerus fracture, DASH Score, VAS Score and Primary Hemiarthroplasty

INTRODUCTION

Proximal humerus fractures and very common among Adults and older people. Majority of them have little to no displacement and may be managed conservatively with little to no complications and a successful functional recovery. But around 1/5th of patients with displaced fractures may be candidates for surgical treatment.[1]

The fractures can occur at any age, but the incidence rapidly increases withage. The risk factors for proximal humeral fractures are primarily associated with lowbone mineral density and an increased risk of falls. The most common mechanism ofinjury in proximal humeral fractures in elderly patients is a fall from standing heightonto an outstretched upper extremity. In patients aged less than 50 years, the mechanism is often related to high-energy trauma, such as significant falls from height, motor vehicle accidents, or athletic injuries.[1]

The injury is of great importance when it affects the young and middle age groups of the population. It leads to temporary disability and loss of working hours. Restoration of the function of the limb is of paramount importance.[2]

About 80% of proximal humerus fractures, which make about 4-8% of all fractures, may be treated without surgery. The care of significantly displaced fractures of the proximal humerus, however, remains challenging since displaced fractures typically require surgical intervention.[1] According to Stable forth, shoulder dysfunction, stiffness, and prolonged discomfort usually accompany nonoperative treatment for proximal humeral fractures in four parts.[2]

For Dislocations involving four parts, internal fixation has had very poor results. Hemiarthroplasty is often only on those patients that are above 70 years old. who have comminuted fractures with four parts, neck injuries, head splitting fractures, and fracture dislocations.[3] When steady and almost anatomical reduction cannot be achieved in younger individuals with comparable fractures, hemiarthroplasty is also advised.[4]

Complex humerus fracture accounts for most of the proximal humerus fractures in old people. For cases of proximal humerus fractures, fracture-dislocation or comminuted fracture, internal fixation is very difficult to achieve good results. Prosthetic Hemi/ total shoulder replacement is accepted form of therapy for markedly displaced fractures and dislocations of fractures, including III part and fractures with more than Impression flaws, split head fractures, and IV-part fractures impact 45% of the humeral head.[5]

Individuals with displaced complicated fracture patterns or ischemic necrosis of the humeral head after a fracture, hemiarthroplasty is thought to be the standard of therapy. Studies with follow-up of up to 10 years have shown that effective pain treatment is achievable. A considerable minority of patients, although getting sufficient pain management, have only fair functional outcomes, according to other studies, even though many demonstrate Up to 90% of patients have good-to-excellent outcomes. after proximal humeral fracture hemiarthroplasty, the average forward elevation is 110 degrees, with a range of 20 to 180 degrees. Prosthetic revision rates are modest despite a wide range in function, with 97% survival rates after one year, 95% after five years, and 94% after ten years. There is, however, a dearth of research on the dangers, advantages, and functional outcomes of patients who have had hemiarthroplasty in India, particularly in the South Indian population. These questions are the purpose of the investigation.[4,5]

Hence the purpose of surgical intervention of shoulder hemiarthroplasty helps to rehabilitate the patient functional status her or him pre-injury status as early as possible. So, this study's goal was to evaluate how well patients with complicated fractures of the proximal humerus responded to shoulder hemiarthroplasty.[6]

AIM AND OBJECTIVES

To evaluate the functional results of complicated proximal humerus fractures after primary hemiarthroplasty.

OBJECTIVES:

- To assess functional outcome [DASH Score] of complex proximal humerus fractures treated with hemiarthroplasty.
- To assess the Pain by VAS Score among complex proximal humerus fractures treated with hemiarthroplasty.

REVIEW OF LITERATURE

Osteology

The proximal humerus has a complex anatomy. In order to compare anatomic correlations that are stable across individuals, numerous cadaveric studies have been carried out. The articular segment's anatomical linkages to the shaft and the tuberosities are the most important ones in the proximal humerus. These include the head's retroversion, inclination angle, translation, relationship to the larger tuberosity, and relationship to the shaft.

Usually, the articular segment is 30 degrees retroverted with respect to the forearm. The range (0-70°) is rather broad and subject to side-to-side movement. The articular segment's inclination can also change (between 120° and 140°). The range (0-70°) is rather broad and subject to side-to-side movement.[7] Always, the larger tuberosity is above the articular head, but the difference can range from 3-20 mm. The distance between the articular head and larger tuberosity might vary from 3 to 20 mm. The version of a prosthetic articular surface with regard to the fins of the prosthetic body has a consistent relationship to the biceps groove at the articular surface level. The articular segment will be 30° retroverted if anterior aspect is positioned in the bicepital groove. The same amount of retroversion will be recreated if the posterior fin is positioned 8 mm behind to the biceps groove.

Avascular necrosis has been associated with impairment of the proximal humeral artery's blood supply.[8] The major blood supply to the articular segment has been shown by Gerber to come from the anterior circumflex humeral artery's ascending branch (artery of Liang). The vessel will be saved if the fracture spares the medial calcar of the humerus.

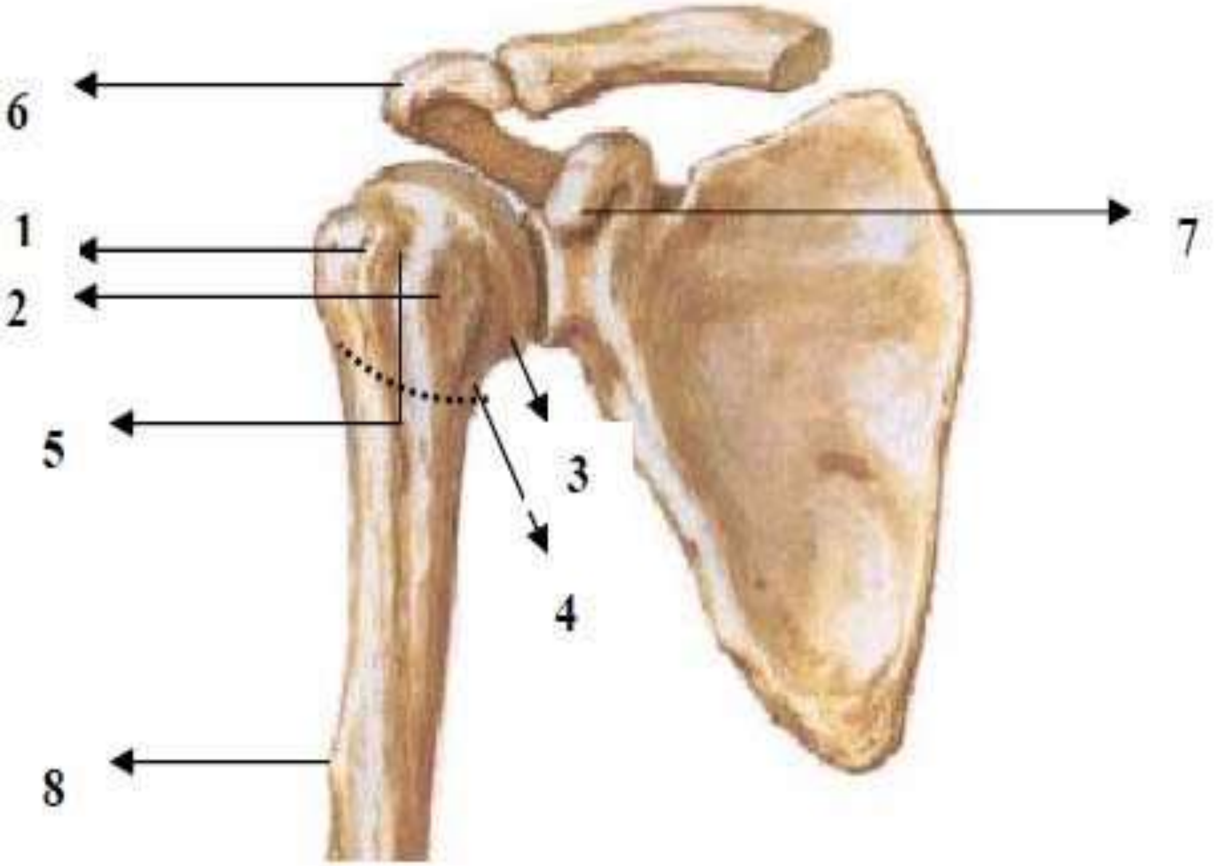


Figure 1: Anatomy of Upper Third Humerus[7,8]

1) Greater tuberosity (GT)
2) Lesser tuberosity (LT)
3) Anatomical neck.
4) Surgical neck.
5) Intertubercular grove
6) Acromion angle
7) Coracoid process.
8) Deltoid tubercle

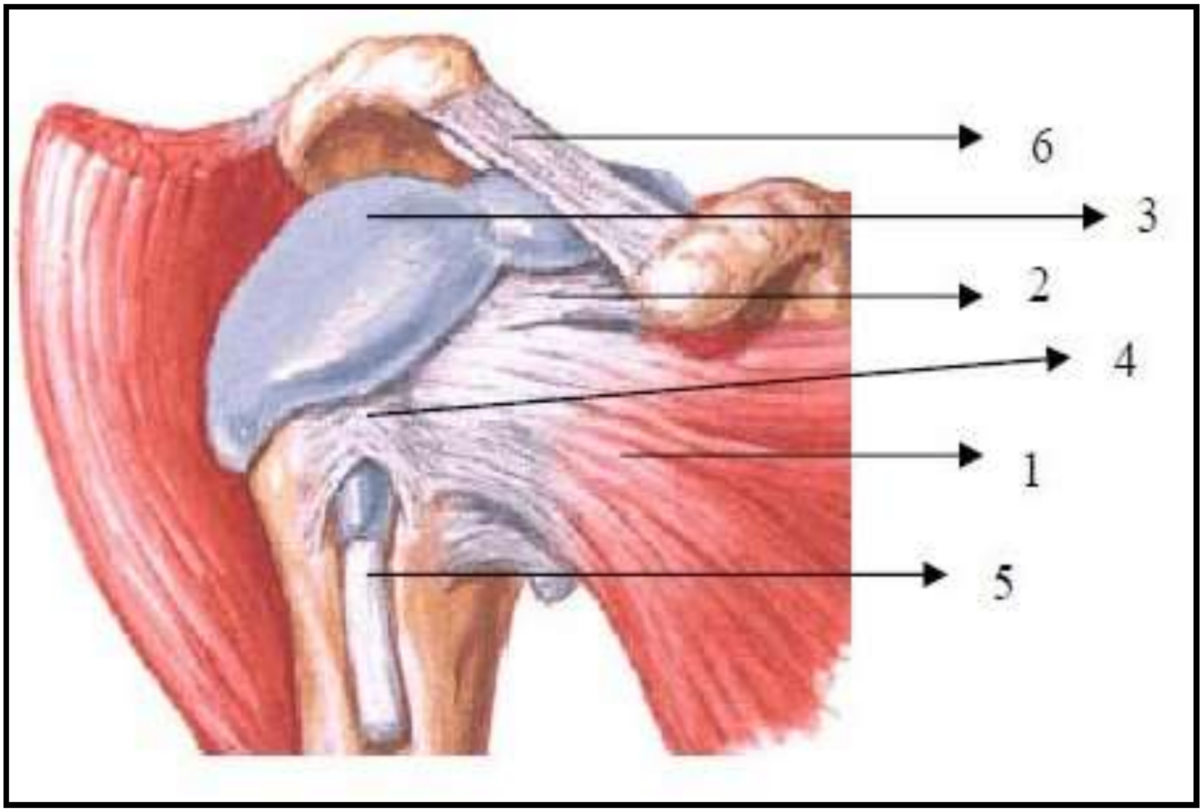


Figure 2: Anterior and Superior Structures of Shoulder Joint[7,8]

1) Subscapularis
2) Supraspinatus
3) Subacromial bUrsae
4) Transverse ligament
5) Long head of bicep tendon
6) Coracoacromial ligament.

Rotator cuff

The crucial structure is the rotator cuff[9]. The facet at superior level and the upper 1/2 of the middle facet are where the supraspinatus joins at larger tuberosity. A brief transverse fracture of the larger tuberosity, which displaces largely superiorly, is caused by avulsion-type forces from this muscle. Straight abduction aids in fragment reduction, while tension band fixation balances off the pressures of initial displacement. The fracture fragment is larger and is shifted superiorly at the infraspinatus, which joins to the entire central aspect of greater tuberosity, is also involved. Horizontal fixation aids in the neutralization of rotational forces from the infraspinatus in addition to a vertical tension band to counteract displacement forces. The smaller tuberosity receives an insert from the subscapularis. The smaller tuberosity is avulsed anteriorly by these fractures. The fractures are best neutralized by horizontal fixation. The supporting components of the articular segment are destroyed along with the tuberosities in 4-part fractures. As a result, this fragment subsides and tilts upward. The medial calcar and its blood supply may be disrupted if the forces axially load the shaft against this head segment.

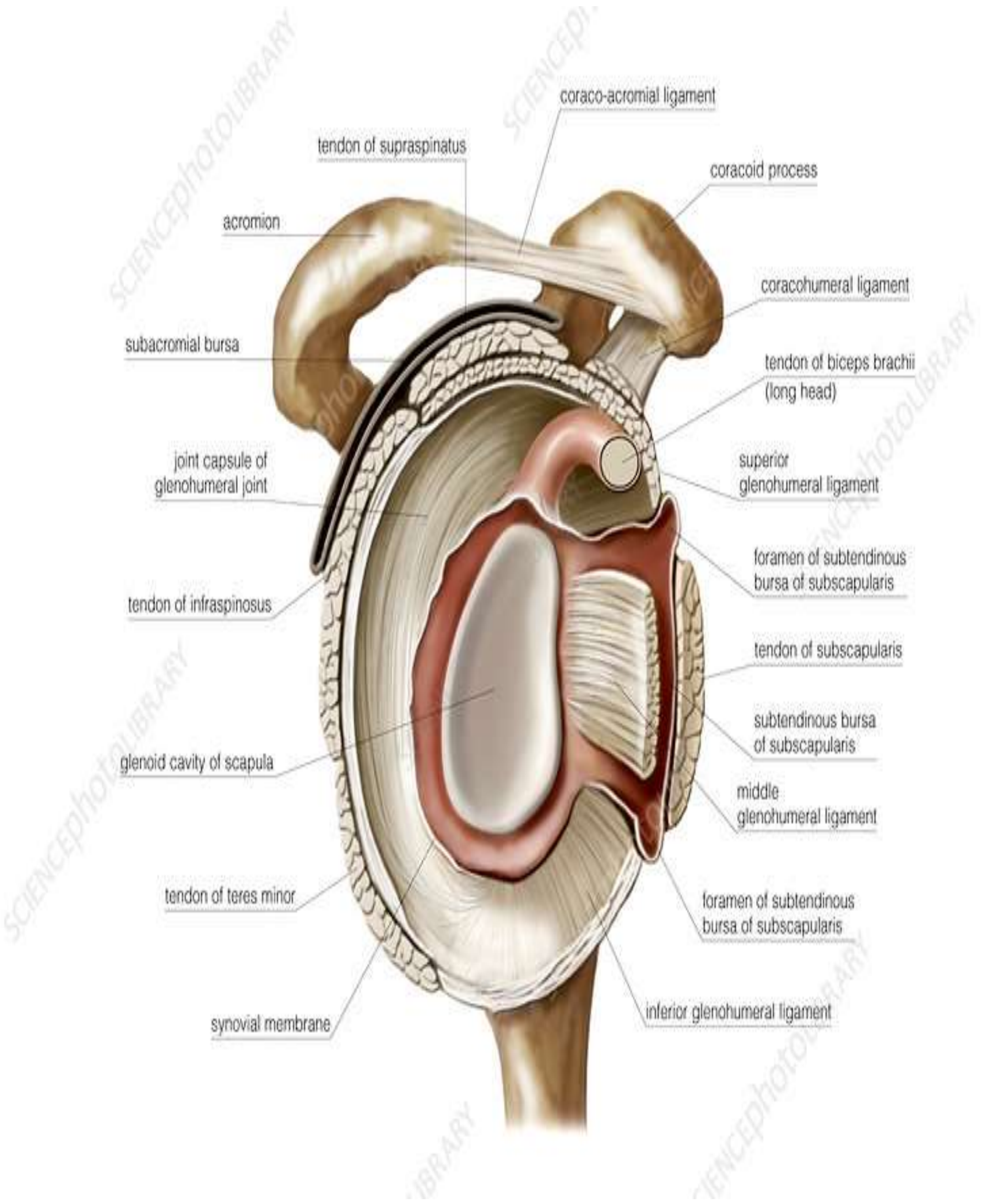


Figure 3: Pattern of arrangement of rotator cuff overhead of humerus.[9]

Neurovascular supply

The humeral head's circulatory supply is mostly comprised of three components. The main vascular contribution to the arcuate artery, the last branch of the anterior humeral circumflex, and the humeral head, supplies the whole epiphysis, is an interosseous blood vessel. This vessel needs to be repaired in order to restore blood flow, which calls for a more distal anastomosis. A tiny section of the posteroinferior aspect of the articular surface is supplied by a branch of the posterior humeral circumflex artery, and the humeral head also receives sporadic vascularity from minor arteries entering through the insertions on the rotator cuff. (Figure 4).

Compared to the arcuate artery, these two provide vascularity. to a significantly lesser extent.[10] Neurovascular injuries are linked to 21% to 36% of proximal humerus fractures. 8% have a permanent motor impairment. The nerve that is affected most frequently is the axillary nerve. a greater tuberosity that is displaced as a result of an anterior fracture is the fracture form most frequently linked to axillary nerve damage. The examiner should be alerted to potential axillary nerve damage if they experience sensation loss over the lateral deltoid. Additionally, the deltoid must be evaluated for isometric contraction.

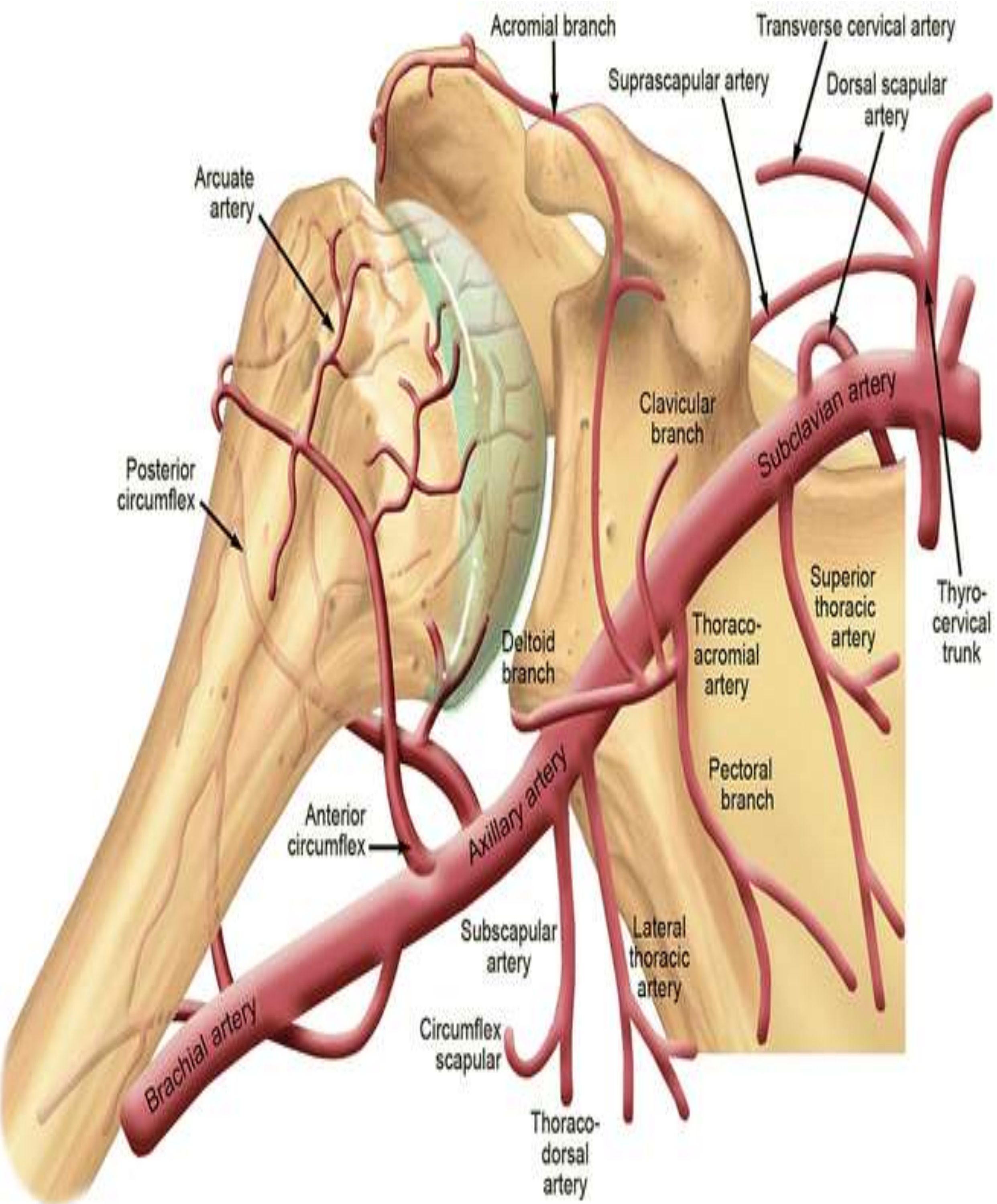


Figure 4: Blood supply of the proximal humerus.[10]

Additionally at risk are the musculocutaneous, radial, and suprascapular nerves. Vascular injuries are uncommon, however in 27% of axillary artery injuries, scapular collateral circulation may allow for the presence of palpable pulses. Consider associated paresthesia and an expanding bulk with suspicion. The majority of vascular injuries (84%) affect patients over the age of 50. Brachial plexus injuries account for 53 percent of cases.

Biomechanics:

The shoulder is generally thought of only scapulohumeral articulation. However, it consists of IV separate articulation's – 'the scapulohumeral, the sterno-clavicular, the Acromio-clavicular and the scapulothoracic joints'.[11] When treating shoulder dysfunction, it is important to take into account how these articulations relate to one another since they work together to give the range of movement in the shoulder joint is the greatest of any other joint. The shoulder's normal operation involves striking a balance between movement and stability. The "big ball-small socket" bone configuration and the capsule of shoulder joint, it does not limit movement until the maximum motion, in addition to the four articulations, allow for mobility. Bony anatomy has been related to the golf ball on a tee since it adds little stability.

The shoulder joint has a complicated anatomy, & its effective functioning depends on the interaction and correct alignment of various anatomical elements. Abduction is the shoulder joint's most crucial function. This movement occurs at glenohumeral joint with considerable movement at scapulo-thoracic joint. According to Recent studies, for initial 30-degree abduction the glenohumeral-scapulothoracic ratio is 4:1 and for further abduction more than 30o the ratio is 2:1. The Abduction more than 90^o is prevented by impingement of greater tuberosity against coracoacromial arch. External rotation of the arm moves tuberosity posteriorly, and also loosens inferior ligaments of glenohumeral joint which allows further abduction.[12]

There are sets of muscles that are intrinsic and extrinsic to the shoulder joint. “The levator scapulae, rhomboids, serratus anterior, and trapezius” are extrinsic muscles that predominantly regulate scapular mobility. “The subscapularis, supraspinatus, infraspinatus, and teres minor of the rotator cuff, as well as the deltoid, pectoralis major, teres major, latissimus dorsi, and biceps brachii’’ are among the intrinsic muscles that regulate the glenohumeral joint. Multiple mechanisms are used by the muscle restraints to produce stability. First, as the shoulder moves, they dynamically arrange the scapula such that the glenoid is appropriately opposing the humeral head. The association was characterized by Rowe to a "ball on a seal's nose." Glenoid and scapula move to maintain a balanced connection while the ball (humerus) moves. Second, whereas ligaments restrict translation and rotation in a static manner, concurrent muscle action increases their stiffness and torsional rigidity. It has been demonstrated that biceps and rotator cuff exercise stiffen the capsule and lessen glenohumeral translation. Third, through cooperating in what Inman, Saunders, and Abbott referred to as "force couples," intrinsic and extrinsic muscle units function as power movers and fine-tuners of motion. In order to maintain stability, the force couplings direct and control the force through the joint.[13]

Since the earliest written medical books, managing proximal humerus fractures has proven difficult for medical professionals.[14] Throughout mediaeval and early modern medicine, the guidelines the medical institutions created by the Greek and Roman administrations persisted relatively constant.[15] The Hippocratic approach via manipulation and forceful reduction by extension (Figure 5), followed by bandaiding and delayed splinting, wasn't disputed until the late eighteenth century.[16] Pathophysiology and anatomy of proximal humeral fractures were better understood during the eighteenth century, and new techniques for reduction and bandaging were created. This time interval is intriguing due to topographic details of the injuries and the rarely postmortem study of the malunited fracture site were used to learn about bone pathology.[17] Nearly a century before radiographs were invented, it is largely astonishing how well medical literature comprehended the issue with complicated proximal humerus fractures.

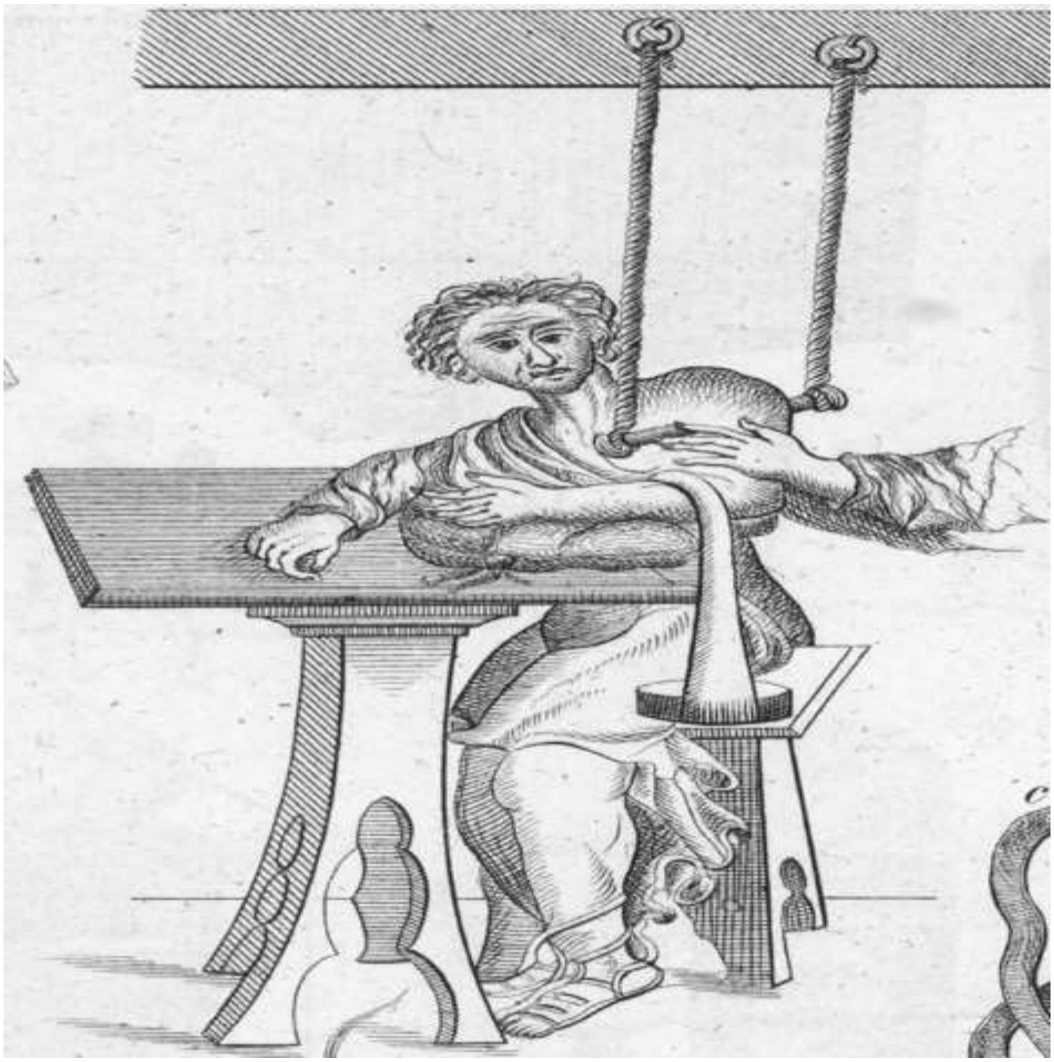


Figure 5: An illustration of the Hippocratic method of humerus fracture reduction [17,18]

As ether anaesthetics were available in 1846.[18] and surgical antiseptic techniques in 1867.[19] The risk associated with invasive humeral head reduction or resection surgeries decreased. However, it wasn't until the early 20th century that internal fixation for proximal humerus fractures was considered.[20] After Roentgen discovered in 1895 fundamentally altered operative orthopaedic and made preoperative planning possible.

In 1934, Codman created a classification based on epiphyseal lines that segmented the proximal humerus into 4 segments. Anatomical, biomechanical, and therapeutic concepts were added to Neer's categorization in 1970, which gave clinicians a helpful foundation for diagnosing and treating patients with these fractures.[21] Casting, traction, closed reduction, and abduction splints made up the initial course of treatment. Operative therapy for displaced fractures became more common in the early 1930s, and this trend persisted in the 1940s and 1950s. The 1950s saw the introduction of humeral head replacement for fractures of the proximal humerus with significant displacement.

Organization for the Study of Internal Fixation, or AO/ASIF promoted plate fixation with screws for fracture fixation during the 1970s, and proximal humeral head prosthesis underwent a redesign. Currently, limited dissection fixation and limited fixation techniques are gaining popularity and Improvements are being made to prosthetic replacement for severe fracture.[22]

In a study of III and IV-part displaced proximal humeral fractures, closed reduction, open reduction, and prosthetic replacement were evaluated. For active patients in either group, closed reduction was determined to be insufficient. When 77 Four- and three-part fracture patients received closed reduction, the results were less than half as good, whereas when the same patients underwent ORIF or prosthetic replacement, the results were more than eighty-six percent excellent and satisfactory.[23]

Another study was conducted between 1994 and 1996 with 73 patients who had closed pinning for their humeral head fractures. There were 7 fracture dislocations, 18 three-part fractures, and 48 two-part fractures. Four to eight weeks were required for all fractures to heal. Avascular necrosis, axillary nerve injury, and infections were nonexistent. In one patient, reduction was lost.They came to the conclusion that A reliable and secure treatment option for humeral head fractures is closed pinning. that can be utilised either alone or in conjunction with other operations. This approach is better to other approaches because of its minimal morbidity.[24]

According to studies, ‘Complex proximal humerus fractures respond better to open reduction and internal fixation’’ when the patient can endure the procedure and has enough internal fixation-capable bone. Conservative therapy frequently causes mal-union and shoulder pain. Internal fixation and restricted soft tissue dissection techniques produce effective fracture fixing and a high percentage of successful outcomes.[25]

In a trial, two modified "K" wires were used to treat 35 patients who had fractures with four components that had moved. At the conclusion of 4-6 weeks, they reported 36% good to exceptional functional results and 41% fracture healing. They came to the conclusion that percutaneous "K" wire pinning is essential in elderly individuals with osteoporotic weak bones who require less soft tissue damage.[26]

Approximately 75% of proximal humerus fractures are supported by the literature as candidates for conservative therapy and functional treatment. An accompanying neurovascular damage, joint instability, or fracture pieces that have been considerably displaced are indications for surgical treatment. Patients' ages, occupations, levels of activity, and specific demands placed on the shoulder joint are other factors that affect surgery. According to research, young patients who have fractures or fracture dislocations that are unstable and severely displaced should have their proximal humerus rebuilt.[27]

In a different study including 21 patients, For the treatment of displaced proximal humerus fractures, crossed screw synthesis was utilized. From the distal piece, the screws were crossed and put anteriorly and posteriorly into the humeral head. Ten patients with two-part fractures, while eleven patients had three-part fractures. In their study, 15 individuals had nice results, 3 had intermediate output , and 3 had bad results. The rate of complications was 29%. They came to the conclusion that crossed screws osteosynthesis is a different surgical approach for treating displaced proximal humerus fractures.[28]

Only a few proximal humeral fractures necessitate osteosynthesis, according to the literature. They are to be used to treat individuals with polytrauma and young patients with good bone density who have considerably displaced unstable fractures. Internal fixation is frequently challenging and poses a surgical therapeutic difficulty.[29]

All 35 patients in this research were operated with locking proximal humerus plates. The results showed that for two-part fractures, For three-part fractures, the consistent score was 77.6 points (75% points) and for four-part fractures, 64.8 points. They ran into issues like screw backing out in two cases and plate breaking in three. They stated that In view of these encouraging results, this plate is suited for displaced humeral head fractures.[30]

Studies have shown that conservative management has significantly damaged valgus fractures of the proximal humerus yields subpar functional results. Internal fixation of these fractures with screws or buttress plates results in favorable radiographic and early functional outcomes.[31]

In a different investigation, the humeral head was replaced with Neer's revised prosthesis in 38 individuals with fracture dislocations and four-part fractures. They came to the conclusion that the best operation to improve patients' comfort and function is humeral head replacement.[32]

Studies show that older patients with two-part surgical neck fractures require exceedingly difficult surgical management; problems include inadequate reduction and implant cutting. With the development of better procedures and the utilisation of bone-strengthening medications, surgical outcomes may be improved.[32]

Another study used closed reduction and intramedullary nail internal fixation to treat 28 patients with displaced proximal humeral fractures. They came to the conclusion that for displaced proximal humeral fractures, intramedullary nailing offers a secure fixation with less soft tissue incision. Early mobilisation and functional recovery are made possible.[33]

Another study used CRIF with J-nails to treat forty-one unstable II-part proximal humeral fractures. One anatomical neck fracture and forty surgical neck fractures each involved two parts. CRIF with 3 J-nails were used to treat all patients. 25 patients had outstanding results, 12 had fair results, 3 had unsatisfactory results, and 1 patient had a failure. They came to the conclusion that J-nail fixation is one of the more dependable and quality treatments for proximal humerus fractures because it has the benefit of being a nearly closed approach without the negative effects of muscle trans-fixation with other methods.[34]

In a comparative study, 51 two-part surgical neck fractures of the proximal humerus were managed with locking intra-medullary nails and locking plates. The researchers came to the conclusion that either implant can produce satisfactory results in the treatment of II-part surgical neck fractures of the proximal humerus. Regarding the ASES score, there was no difference between these two implants. Although fixation with a locking plate had a better 1 year result, the group receiving locking intramedullary nails had a lower complication rate.[35]

According to a study, proximal humerus fractures might result in problems such as malunion, humeral shortening, varus or valgus angulation, and decreased range of motion. According to arterial injection studies, circumflex artery of the anterior humeral and antero-lateral ascending branch provides the humeral head with most vital blood supply. Avascular necrosis may occur if this arterial or one of its major branches sustains damage.[36]

The only successful therapy for ‘four-part fractures, fracture dislocations, head splitting fractures’’ involving more than 40% of the articular surface, as well as some three-part fractures, is prosthetic replacement. Thirty-one of the treated seventy patients had outstanding results, and twenty-two had results that were satisfactory. A delicate soft tissue method, secure prosthesis implantation, tuberosity repair, and intense postoperative rehabilitation are all necessary for a successful outcome.[37,38]

MODE OF INJURY

The most frequent mechanism of proximal humerus fractures is a fall from standing height onto an outstretched hand. High-velocity trauma is a more common cause of injury in younger patients, and the damage it causes is more severe. Athletic injuries, electrical shocks, and severe muscle spasms resulting from seizure activity are other possibilities. Finally, a fracture could result from a direct strike to the proximal humerus.

The nature of the injury and the energy from it determine where the fracture line is located precisely. The fracture lines may be challenging to oppose in fractures of the thinnest cortical bone. These fractures happen in porotic bone, are caused by low-energy forces, and are frequently comminuted. On the other hand, it is simpler to estimate fracture lines on the denser cortical bone that is located closer to the biceps groove and farther down the shaft. High-energy forces cause the fractures in this location, and the pattern of the fractures is dependent on the applied force.

Most shoulder fractures are caused by indirect forces. Predictable fracture patterns can be produced by the dominating force. Torsion, torsion with axial compression, axial compression, and bending are some examples of these damage forces. ‘Transverse, oblique, and spiral fractures’’ are the most seen fracture patterns caused by these forces. A preferred method of fixation has been designed for each fracture type to fend off displacement forces.

Unfortunately, the shoulder has not been adequately defined in terms of these patterns. The muscle-tendon unit that generated the direction of the fracture pattern induced by tension is mostly determined by the displacement force. The patient's motivation, medical history, any concurrent medical conditions, and the fracture type, which is the most important component, are all taken into consideration while making treatment suggestions for these fractures.

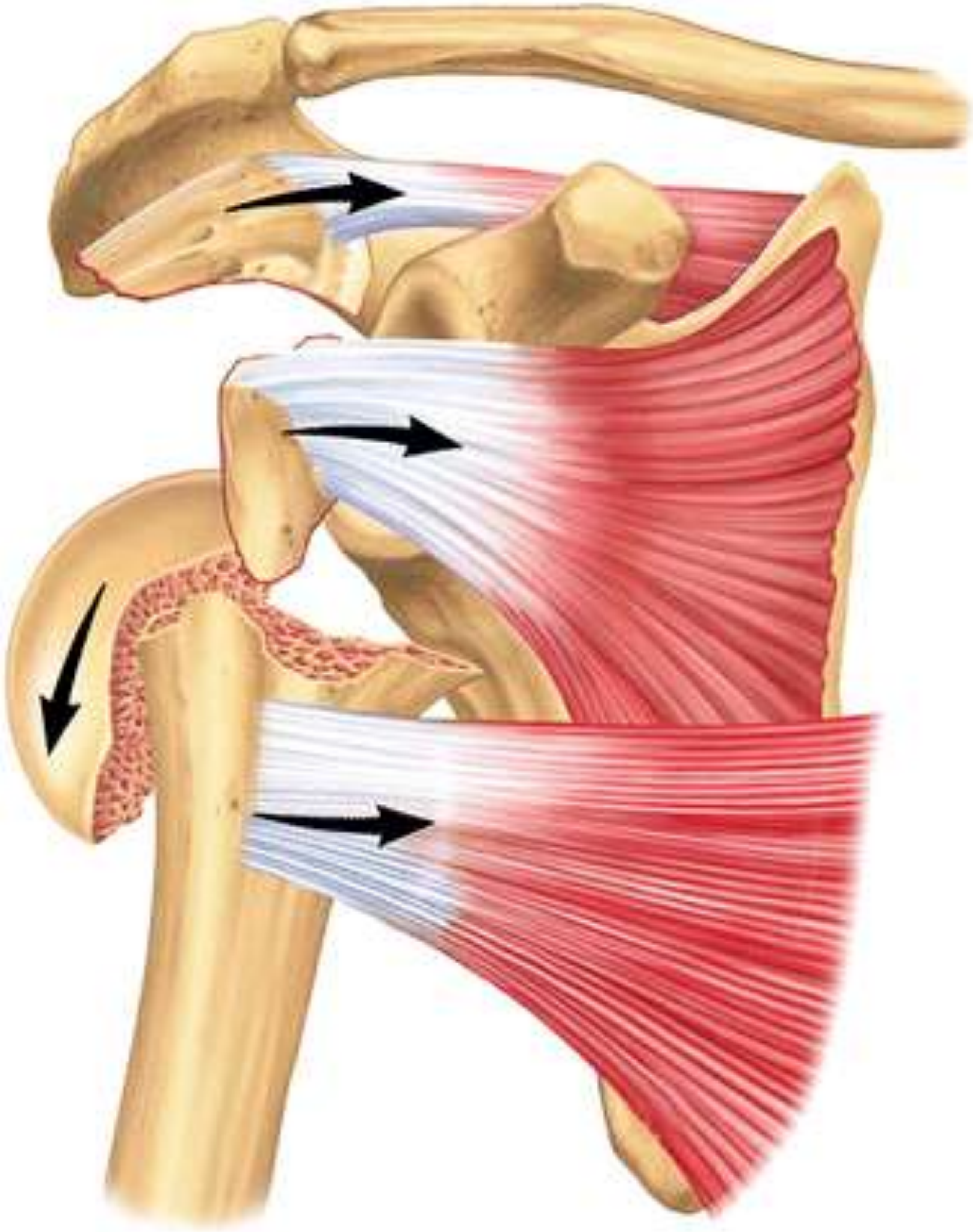


Figure 6: forces that cause the proximal humerus to deform. The orientation of the arrows indicates the deformation that each muscle created.[12]

Recently, the classification of fractures has been reevaluated. Neer's 4-part classification is largely utilised to categorise these fractures into treatment groups, with variants of the 4-part valgus affected type being distinguished from 4-part fractures in which the humeral head has been extruded laterally. Since most fractures are not displaced, nonoperative therapy is usually sufficient. Usually, operational intervention is required for fracture displacement.

Humeral head replacement, open reduction with internal fixation, and closed reduction with percutaneous fixation are surgical therapy options.[39] The fracture patterns best suited for arthroplasty include ‘III-part fractures, In elderly people with osteoporotic weak bone, IV-part fractures, fracture dislocations, head-splitting fractures, impaction fractures, and humeral head fractures’ involving more than 50% of the articular surface are all frequent injuries. However, the fracture patterns of these populations are varied.

CLASSIFICATION OF FRACTURES

This is necessary for proper management, accurate diagnosis of treatment. Various classification techniques have proposed based on:

1. Fracture type according to anatomy.
2. The injury's etiology.
3. The extent of fracture fragment contact.
4. The amount of displacement
5. Articular segment's vascular condition.

Kocher’s classification (1986):

Kocher classified proximal humerus fractures based on different anatomical levels of fracture.[12,40]

- Supratubercular
- Pertubercular
- Infratubercular
- Subtubercular

This categorization has drawbacks in that it does not distinguish between displaced and undisplaced fractures, which require different therapy, nor does it allow for multiple fractures at different levels.

Watson - Jone’s classification:

For surgical neck fractures, it is primarily depending on the mechanism of injury. [12]

- Abduction type
- Adduction type

According to research, this fracture exhibits an anterior angulation deformity. The fracture can be classified as either abduction or adduction depending on whether radiographs are taken with arm in internal or exterior rotation.

Codman’s classification (1934):

According to his theory, fractures can be divided into four different fragments that roughly follow the anatomical lines of epiphyseal union.[12,40] He differed four major segment

- Anatomical humoral head.
- Greater tuberosity (GT)
- Lesser tuberosity (LT)
- Shaft

His conclusion was all fractures were some combination of these different fragments. The Musculo-tendinous cuff attaches more to the proximal fragments and this cuff holds these fragments together.

Dehne Classification (1945):

classified into three major types based on the mechanism of the damage.[12]

a. Lateral mechanism (forced adduction). Lead to three – fragment fracture.(Head, greater tuberosity, shaft).
b. Dorsal mechanism (forced extension) lead to two – fragment fracture withsurgical neck displacement.
c. Central mechanism led to head splitting fracture

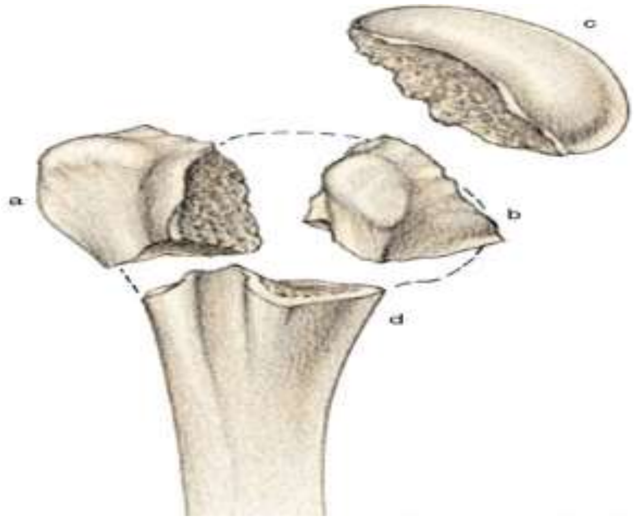


Figure 7: Codmans Classification[12]

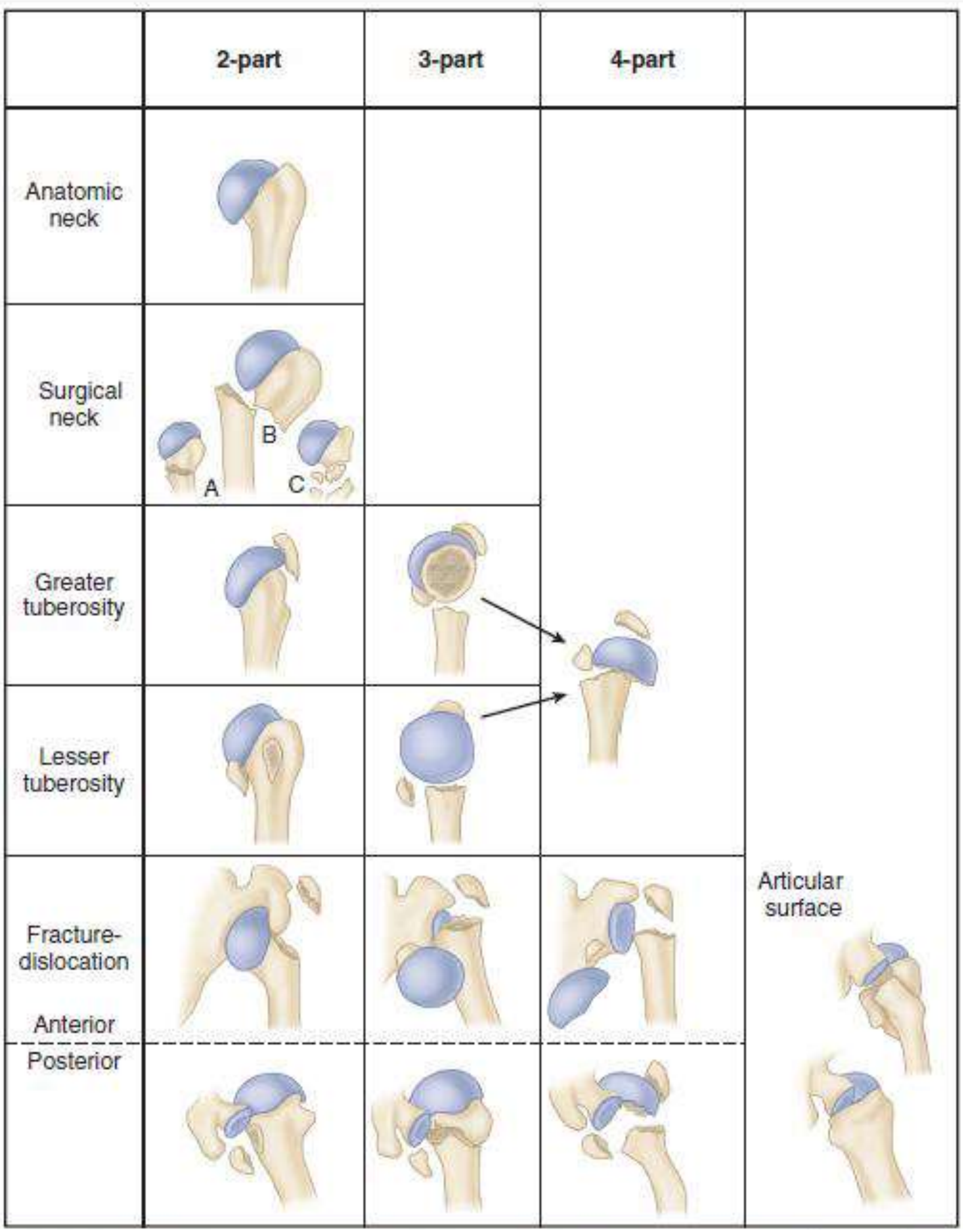


Figure 8: Neers Classification[12,40]

Neer's classification (1970):

He categorized proximal humeral fractures depending on the displacement of the fracture fragments & the venous supply to the head of the humerus. Only correct radiographs with ‘Antero-posterior and Lateral views in the scapular plane, with an axillary view’ can be used to identify pieces. A fracture fragment is deemed displaced, according to his definition, "if there is more than one centimetre of separation or if a fragment is angulated more than 45 degrees from the other fragment." Additionally, articular surface impression fractures can develop and are frequently accompanied by an anterior or posterior dislocation. Tuberosity fractures or surgical neck trauma are linked to head splitting fractures.[12,40,41]

One-part fracture

a. Fracture lines involves 1 to 4 parts
b. None of the parts are displaced (i.e., <1 cm and <45°)

These non-displaced or minimally displaced fractures account for ~70-80% of all proximal humeral fractures and are almost always treated conservatively.

Two-part fracture

a. Fracture lines involves 2 to 4 parts
b. One part is displaced (i.e., >1 cm or >45°)

Four possible types of two-part fractures exist (one for each part):

a. Surgical neck: most common
b. Greater tuberosity
    a. frequently seen in the setting of anterior shoulder dislocation
    b. a lower threshold of displacement (>5 mm) has been proposed
c. Anatomical neck

d. Lesser tuberosity: uncommon

These fractures account for approximately 20% of proximal humeral fractures.

Three-part fracture

a. Fracture lines involves 3 or 4 parts
b. Two parts are displaced (i.e., >1 cm or >45°)

Two three-part fracture patterns are encountered:

a. Greater tuberosity and shaft are displaced with respect to the lesser tuberosity and articular surface which remain together
    a. most common three-part pattern
b. Lesser tuberosity and shaft are displaced with respect to the greater tuberosity and articular surface which remain together

These fractures account for approximately 5% of proximal humeral fractures.

Four-part fracture:

a. Fracture lines involves all 4 parts
b. Three parts are displaced (i.e., >1 cm or >45°) with respect to the 4th

These fractures are uncommon (<1% of proximal humeral fractures).

This pattern has poor non-operative results, and as the articular surface is no longer attached to any parts of the humerus which are attached to soft tissues. This pattern has a high incidence of osteonecrosis.

A O. emphasis on vascular supply to articular fragments in classification.

1. **A = unifocal extra-articular fracture**
2. **A1 Tuberosity and extra-articular unifocal fracture**
    a. Non displaced greater tuberosity
    b. Displaced Greater tuberosity
    c. With a glenohumeral dislocation

3. A2 Impacted metaphyseal fracture with extra-articular unifocal fracture

  a. Without frontal malalignment
  b. With varus malalignment.
  c. With valgus malalignment

4.A3 Extra-articular unifocal fracture, non-impacted metaphyseal.

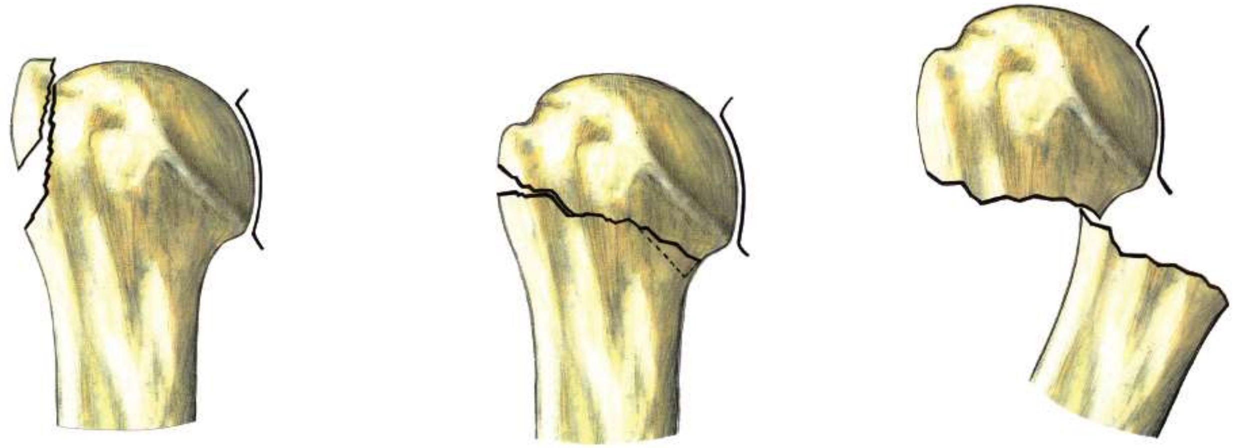
  a. Simple with angulation
  b. Simple with translation.
  c. Multifragmentary

5. B = Extra-articular bifocal fracture

3. B1 Extra-articular bifocal fracture, with metaphyseal impaction

  a. Lateral + greater tuberosity
  b. Medial + lesser tuberosity
  c. Posterior + greater tuberosity

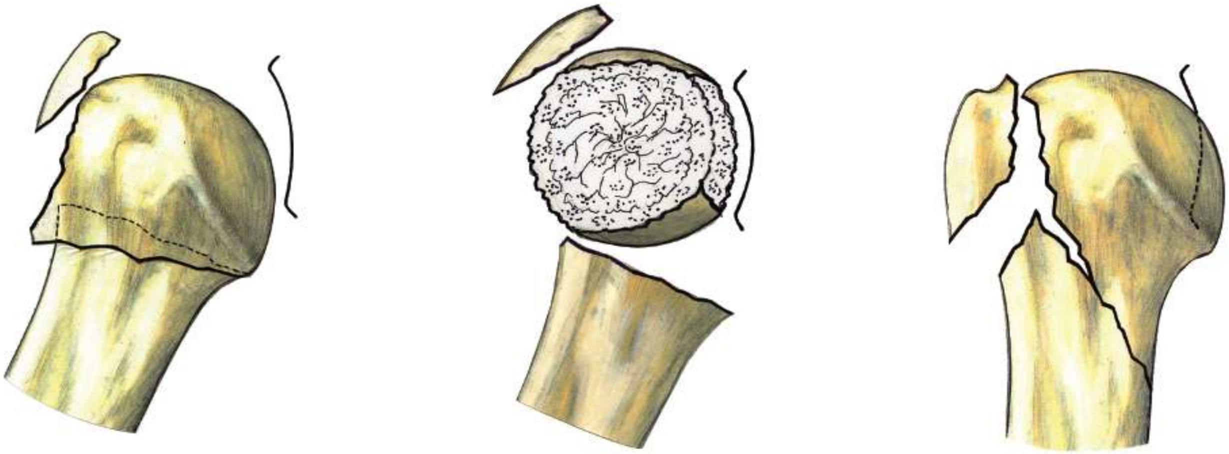
4. **B2 Extra-articular bifocal fracture, without metaphyseal impaction**
    a. Without rotatory displacement of the epiphyseal fragment
    b. With rotatory displacement of the epiphyseal fragment
    c. Multifragmentary metaphyseal + one of the tuberosities
5. **B3 Extra-articular bifocal fracture, with glenohumeral dislocation**
    a. Vertical cervical line + greater tuberosity intact + anterior and medial dislocation.
    b. Vertical cervical line + greater tuberosity fractured + anterior and medial dislocation.
    c. Lesser tuberosity fractured + posterior dislocation
6. **C = Articular fracture**
7. **C1 Articular fracture, with slight displacement.**
    a. Cephalotubercular, with valgus malalignment.
    b. Cephalotubercular, with varus malalignment.
    c. Anatomical neck.
8. **C2 Articular fracture, impacted with marked displacement**
    a. Cephalotubercular, with valgus malalignment.
    b. Cephalotubercular, with varus malalignment.
9. Transcephalic and tubercular, with varus malalignment
10. **C3 Articular fracture, dislocated**
    a. Anatomical neck.
    b. Anatomical neck and tuberosities.
    c. Cephalotubercular fragmentation.



A1
Avulsion of the tuberosity

A2

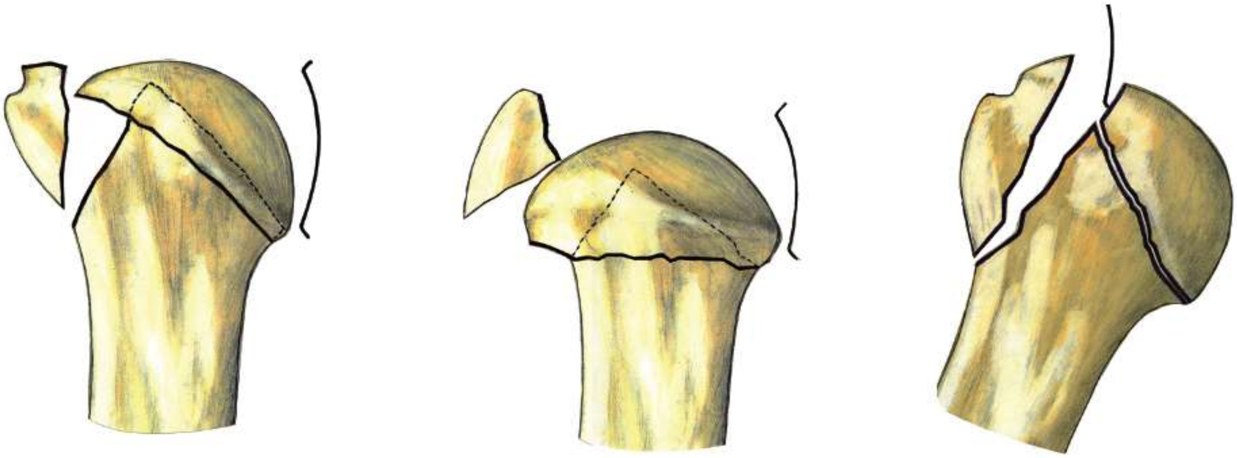
A3



B1

B2
Three-part simple fracture

B3



C1

C2
Three-part complex fracture

C3

Figure 9: AO Classification.[12,40]

EPIDEMIOLOGY AND SYMPTOMATOLOGY

According to a conservative estimate, proximal humerus fractures make around 5% of all fractures. The majority of older patients who sustain these fractures are osteoporotic. Proximal humerus fractures, like hip fractures, are a significant contributor to morbidity in the aged population. The frequency of these fractures will keep rising as the population base ages. High-energy trauma is necessary for this fracture to occur in younger people.[12,40,42]

Signs and Symptoms.

- Pain
- Swelling
- Tenderness
- Crepitus
- Ecchymosis on chest wall or flank
- Loss of shoulder motion.
- Associated with neurovascular deficits like injuries to Brachial plexuses.
- Axillary nerve or axillary vessel.
- Associated with dislocation of shoulder.

IMAGING STUDIES

Radiographs must be taken carefully and accurately in order to plan treatment and predict prognosis.[41,43] Anteroposterior (AP), lateral (Y), and axillary views of the scapula make up the trauma series. The radiographs are taken while the patient is placed in prone, seated, or standing. The fracture can be assessed using these three perpendicular planes. Consequently, fracture displacement may be measured accurately.[43] The afflicted shoulder's posterior aspect is put on an X-ray plate for the scapular A-P view, & the contralateral shoulder is angled forward by around 40 degrees°.[43]

The injured shoulder's anterior portion is put on an X-ray plate for a lateral "Y" image, and the opposing shoulder is tilted 40 degrees forward. An X-ray plate is positioned over the shoulder, an X-ray beam is pointed upward from the bottom, and an axial image is acquired with the diseased arm abducted. When the patient leans back and takes a Velpeau axillary view, the beam is directed into the shoulder while the arm is still in a sling. This is desirable following damage because it keeps the shoulder immobile and prevents fragments from moving around further.[41,43,44]

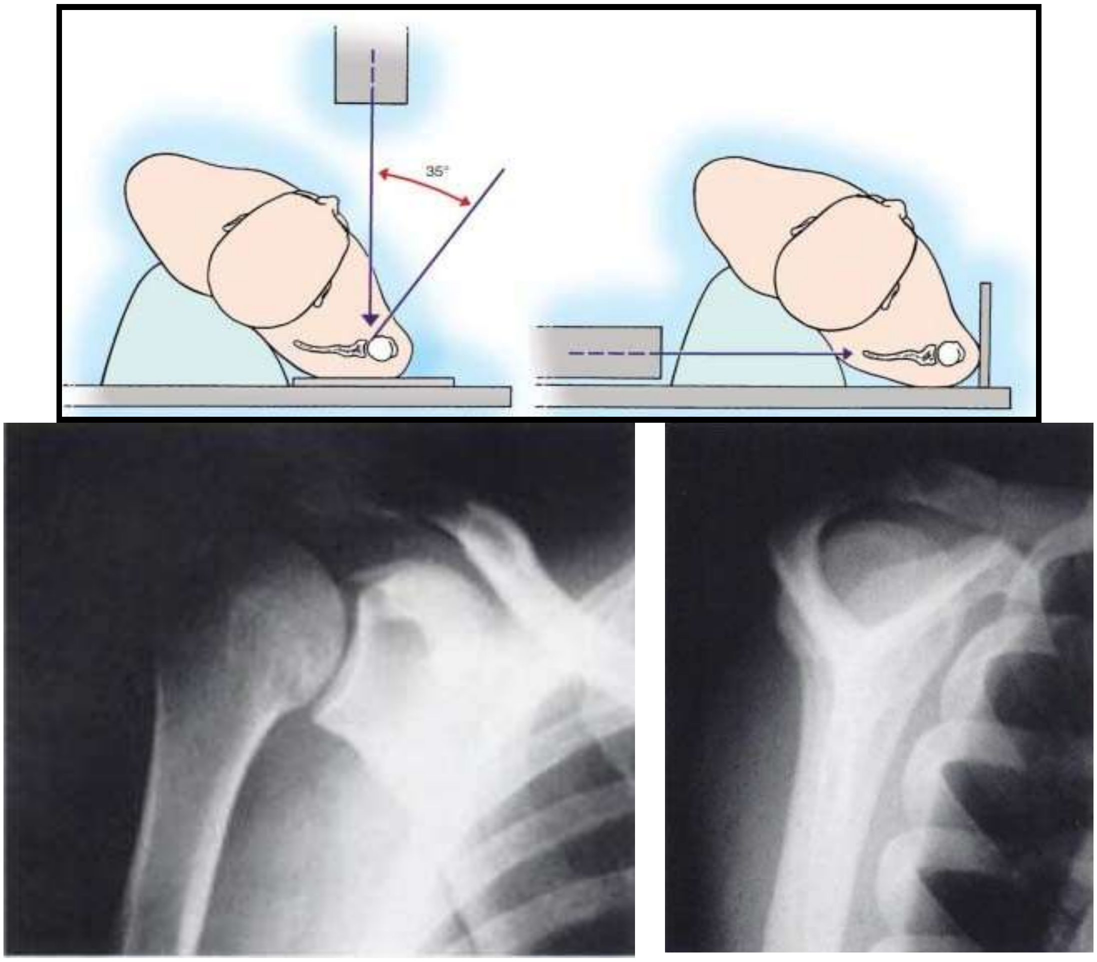


Figure 10: Scapula AP View And Lateral View[43,44]

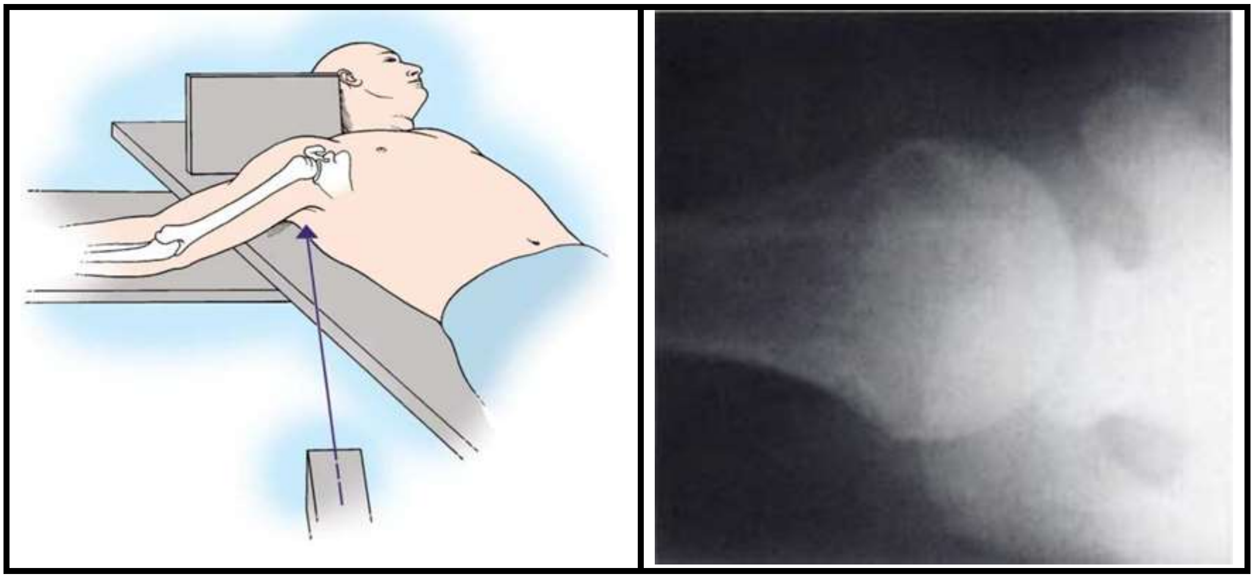


Figure 11: Axillary View.[43,44]

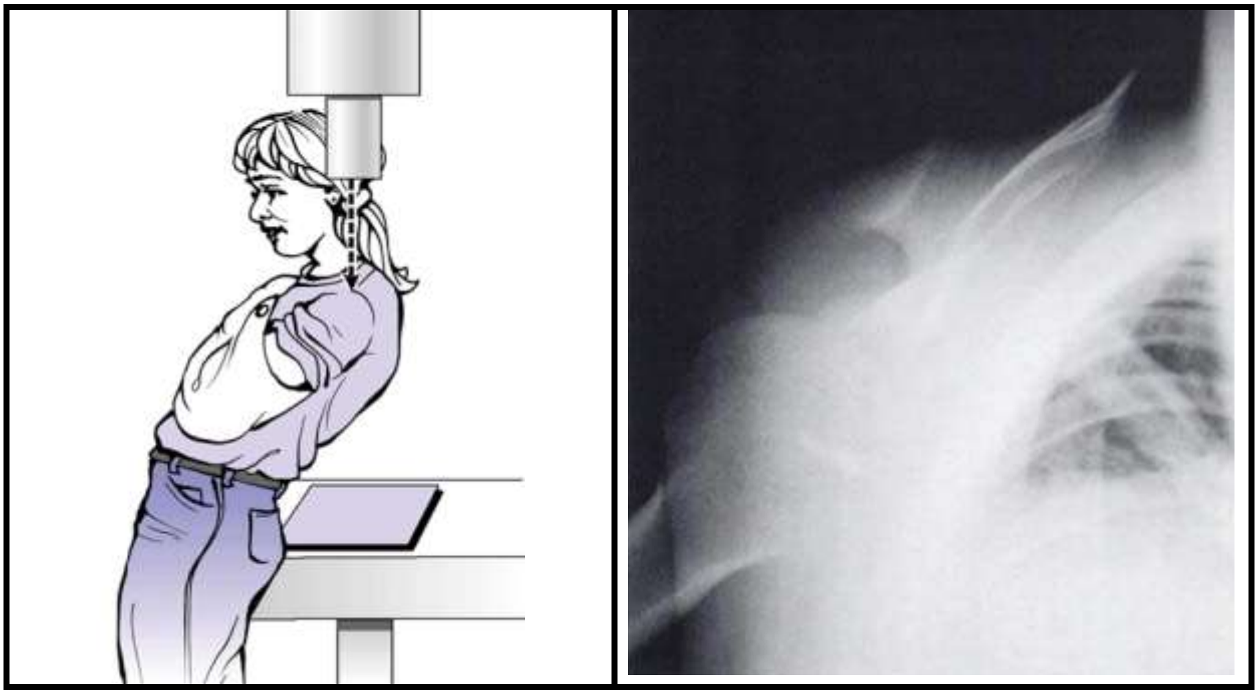


Figure 12: Velpeau View. [43,44]

MANAGEMENT

A. Medical Therapy

Nonoperative treatment options for proximal humerus fractures include early motion after an initial period of immobilization. A arm sling, a shoulder immobilizer can be used to provide initial immobilization.[45]

B. Surgical Therapy

according to the kind of fracture (e.g., Greater tuberosity, surgical neck, anatomic neck, articulating surface, and smaller tuberosity fragments are among the characteristics of the Neer type.), mode of fixation, or both, proximal humerus fractures may be surgically managed (eg, percutaneous fixation or closed reduction with no fixation, ORIF, humeral head restoration associated with greater and lesser tuberosity fixation).[46]

- Reasons for undergoing surgery.[40,43]
- Tuberosity-involved avulsion fractures.
- Failure of the closed reduction.

C. Greater tuberosity fractures, 2-part

Greater tuberosity fracture displacement is typically superior and posterior. With the exception of circumstances where a closed reduction of the fragment may be sufficient, attempts at closed reduction often fail. However, to prevent prolonged posterior displacement that can heal in an ununited posture and result in a mechanical block of motion, close attention to the lateral y-view and the axillary view are required. This form of fracture is rarely accompanied by Hill- Sach's lesion or axillary nerve injury, however it is occasionally linked to rotator cuff tears or anterior shoulder dislocation.[12,47]

For larger tuberosity fractures that have a displacement of at least 5 mm, open treatment is advised to improve shoulder function12. The greater tuberosity fracture type affects the surgical procedure and fixation. Sizes of the fragments might range from little to huge. An avulsion of the supraspinatus muscle results in a tiny piece that is mostly moved superiorly. This fracture is treated anteriorly, similarly to how the rotator cuff is repaired, with an acromioplasty.

Using a deltoid-splitting technique as an alternative to removing the deltoid from the front acromion.[48] Peeling it off the posterior acromion prevents acromioplasty and lessens anterior deltoid weakness. This strategy is especially useful if the fragment is posteriorly displaced. Fixing minor fractures can be done using strong sutures, wire, or, on rare occasions, screws.[47] Associated rotator cuff tears should be closed.

Larger, spiral or oblique fractures can penetrate the metaphyseal bone several centimeters. A delto-pectoral approach provides sufficient view for reduction and correct fixation, which may include drilling holes for sutures or wires from a distal position. If a deltoid-splitting method is utilized for this kind of fracture pattern, the axillary nerve is in danger. For severe fractures, strong suture, wire, and maybe screws for fixation may be explored.

D. Lesser tuberosity fractures, 2-part

Oftentimes, the smaller tuberosity is displaced medially. In the majority of situations, closed reduction with internal rotation can properly realign the tuberosity. Therefore, treating these fractures publicly may not be necessary. However, if a smaller tuberosity fracture is seen alone, posterior dislocation should be suspected.[47] Try closed reduction after a posterior dislocation with the arm in medial rotation or lateral rotation brace for the unstable shoulder (eg, gunslinger type of brace). To prevent nonunion and malunion, the smaller tuberosity must be reduced with care.

The humeral head may infrequently suffer from a Hill-Sachs lesion in reverse. If the skull is only hurt to less than 40% and the shoulder is unstable, the smaller tuberosity can be advanced into the head defect using closed reduction (McLaughlin procedure). Consequently, CT scans may be useful to determine whether the humeral head is involved in lesser tuberosity fractures.

E. Surgical neck fractures, 2-part

Due to drag of the pectoralis major, surgical neck fracture displacement often results in an angulation with an anterior apex and medial displacement of the shaft.[12] Flexing and adducting the arm are reduction motions that can be used to reduce displacement forces. The long head of the biceps might occasionally obstruct reduction. When closed reduction is possible, the following treatments are available: closed reduction alone (if the reduction is stable), percutaneous fixation.

However, it may allow for slow loss of reduction, which could result in malunion and cause mobility loss of at least 1° per degree of deformity. Closed reduction alone under general anesthesia gives minimal morbidity. For instance, a 45° loss of anterior flexion results from a 45° anterior angulation12. As Koval et al. pointed out in osteoporotic bones, 2.5mm pins with terminal threading offer secure fixation and good purchase between pieces.[12,47,30,49]

Technically, this method can be difficult, and it might have hardware issues with osteoporotic bone. For pin removal, repeated operations could be required often. When compared to the above-mentioned closed procedures, ORIF for It is possible for surgical neck fractures that can be closed to result in increased operational morbidity. However, this process might offer a more reliable functional product and a more stable construct.

After a successful reduction, one might choose from a number of fixing methods. These fractures can have different fracture patterns; plate fixation may be preferred in unstable oblique or spiral fractures. The T plate, L plate, cloverleaf plate, LPHP, and 4.5 DCP are examples of frequently used plates. If there is enough area proximal to the fracture for two screws, a DC plate can be fixed laterally. A 90° blade plate that has been customized for the proximal humerus can be used with greater success in osteoporotic bone. There are numerous new IM nail variants being employed that have "high" proximal interlocking screws.[12,13,50-55] Since the nail must be put in adduction, IM nails are favored in fractures that can be reduced in adduction. A tension band suture or wire is used with modified Enders nails in another common method.

F. Anatomic head fractures, 2-part

This uncommon injury may coexist with humeral head dislocation. Due to the head segment's reduced blood flow, the prognosis is generally very gloomy. Avascular necrosis is five times more likely to occur than other proximal humerus fractures.[12,40,56] Due to the restricted amount of bone that may be used to implant fixation devices, open reduction and internal fixation can be challenging. Soft tissue has been handled carefully when using wire or suture tension band procedures. Anatomic head fractures are also treated with primary humeral head replacement.[12,40]

G. Three-part fractures

The majority of three-part proximal humerus fractures are rotational fracture-dislocations, where one tuberosity is dragged back and shifted by the rotator cuff muscles that are connected to it. The second tuberosity and the humeral head are still connected, but they are subluxated or dislocated and rotate in response to the pull of the associated rotator cuff. In most cases, because of poor bone contact they lead to delayed or non-union.[12] The retained soft-tissue attachments may help to maintain the head's blood supply. Avascular necrosis risk, however, is still around 14%. Almost always, these fractures require open surgical treatment.

Typically, elderly individuals with osteoporosis and poor tissue quality need initial hemiarthroplasty. [12,24,40,57] and, Repair of the rotator cuff, if necessary. Try your hardest to keep the humeral head in patients who are younger. Informed consent forms must to mention the option of hemiarthroplasty in the event that fixation is determined to be an ineffective course of treatment during surgery.

H. Four-part fractures

Both tuberosities are detached in four-part fractures, and the humerus head is dislocated from its glenoid. The tension of each rotator cuff muscle causes tuberosities to retreat in that direction. The humeral head is now avascular since it no longer has any functional soft-tissue attachments. Avascular necrosis occurs in about 34% of cases. If a viable shoulder is to be obtained, each of these fractures must be managed through open surgery. Shoulder arthroplasty is the only indicated surgery in four-part fracture with marked communication and in patients with 4-part fracture dislocation.[12,58,59,60,61]

Surgical approaches

The commonly used approaches are

1. Delto pectoral approach.[47,44,62]
2. Trans deltoid split approach.[47,44]

1. Delto-pectoral approach

Deltopectoral approach is the most used approach for the fracture displacement of proximal humerus. Patient is placed in beach- chair or semi sitting position. General anesthesia or scalene block is used.[12] Make an incision of size 12–14 cm long skin between the proximal humeral shaft and the coracoid process. Depending on the operating surgeon, the skin incision may be straight or curved. A more vertical incision may be recommended for an arthroplasty. Use the cephalic vein to expose the deltopectoral groove. Open along the groove after lateral or medial cephalic vein retractions. The anatomical drainage of blood from the deltoid muscle is noted when retracted laterally, but retractors during surgery run the danger of damaging it. In any event, it is best to keep the cephalic vein intact to lessen the surgical edema of the limb.

Find conjoined tendon and the coracoid process. Cut the clavipectoral fascia inferior to the coraco-acromial ligament and lateral to the conjoined tendon. Slide the fore finger below the connected tendons at anterior movement of the subscapularis to locate and feel the axillary nerve. Use a delta (modified Hohmann) retractor to pull the deltoid muscle laterally, and a Lange Beck retractor to retract the conjoint tendon laterally. Up to 2.5 cm distal to the coracoid process, where musculocutaneous nerve enters the coracobrachialis muscle. Vigorous retraction must be avoided since it can result in neuropraxia when put under the conjoined tendon. Identify the anatomical markers and expose the proximal humerus (larger tuberosity, bicipital groove with the bicipital tendon, subscapularis tendon, and lesser tuberosity). Assess the fracture.[44,62]

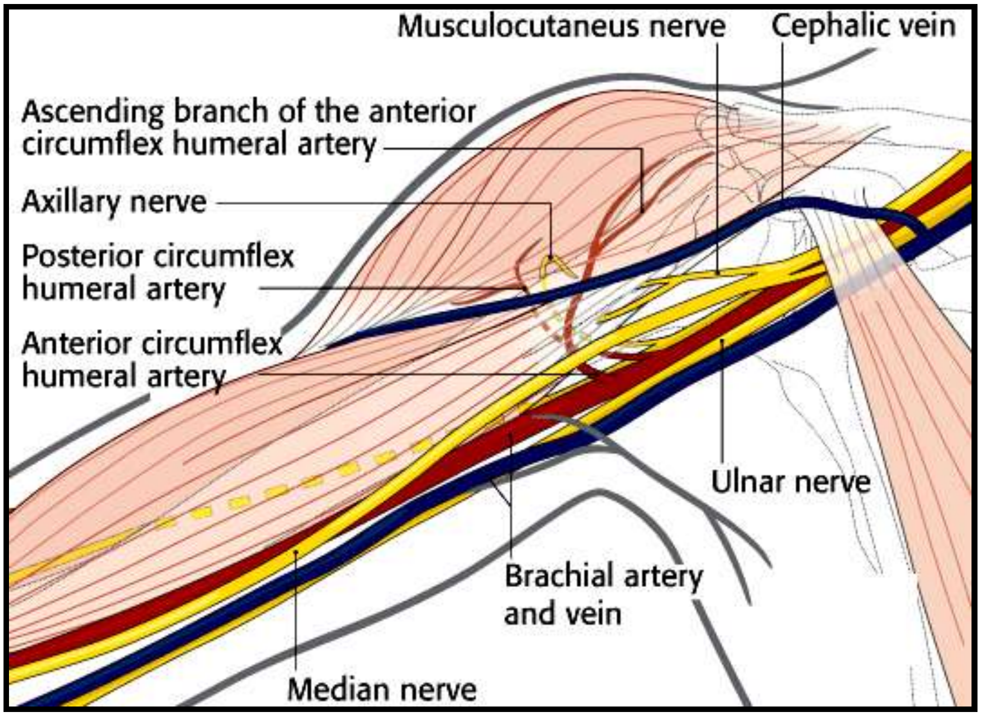


Figure 13: Deltopectoral approach (Neuro-Vascular structure).[62]

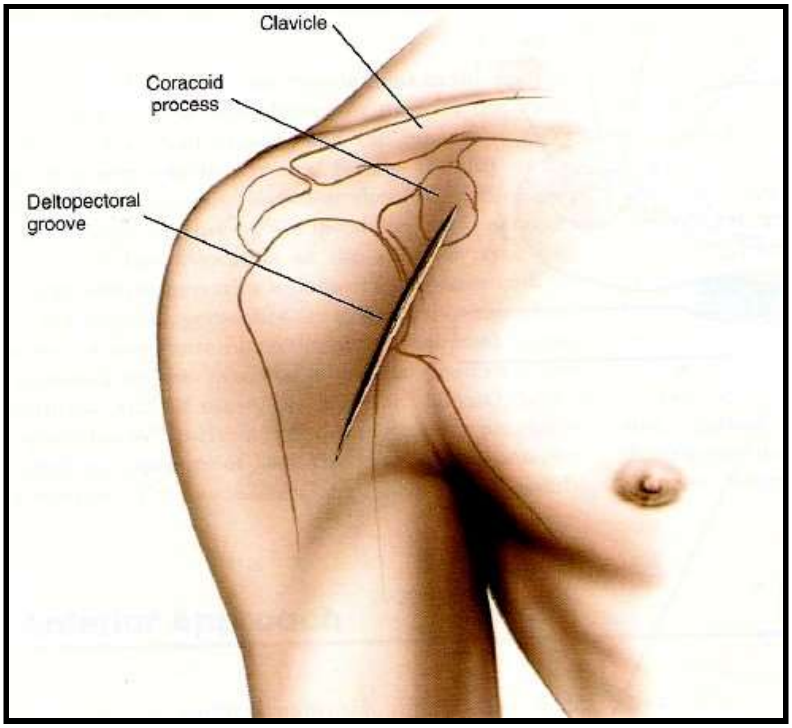


Figure 14: Skin Incision[62]

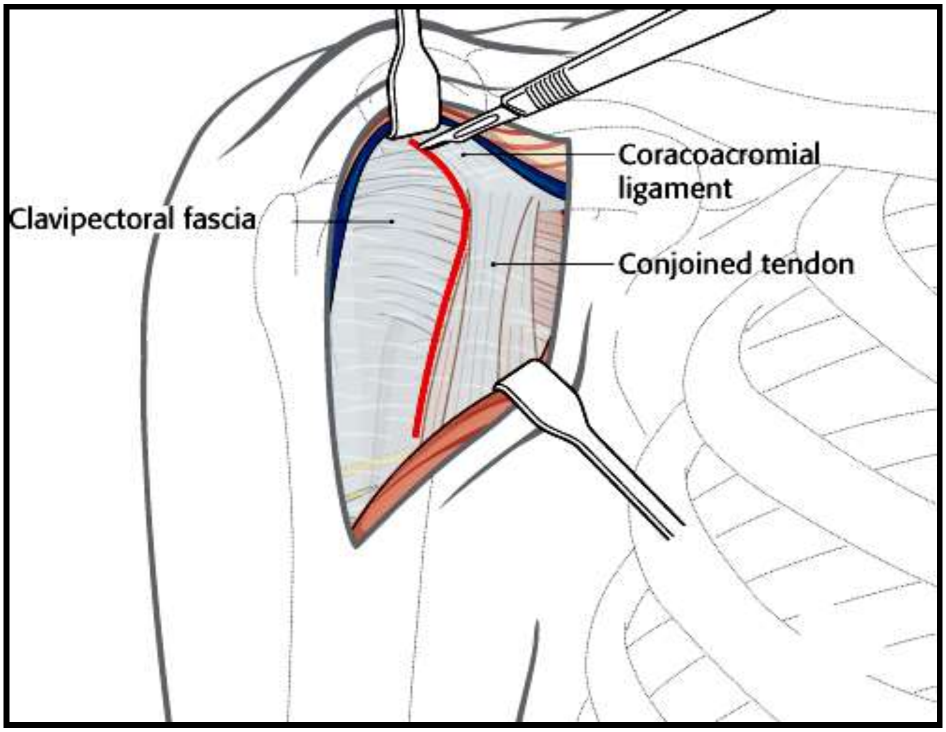


Figure 15: Exposure 1[62]

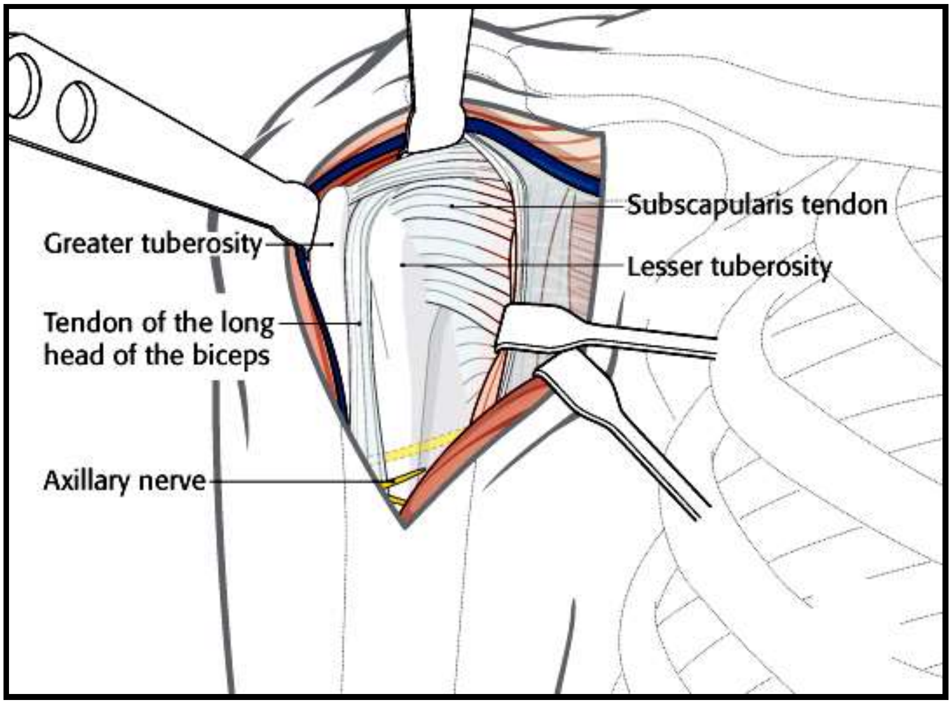


Figure 16: Exposure of Head of Humerus[62]

2. Trans deltoid split approach:

used if an intra medullary device is used or in cases of solitary tuberosity fractures. The skin incision can be made on the patient while they are semi-sitting by making a vertical Sabre cut or by following the junction of the anterior and middle 3rd, the direction of muscle fibers along the upper deltoid. The deltoid is kept 5 cm or less away from the acromion process in order to protect the Axillary nerve. After locating the cuff and reducing the fracture with strong sutures or an isolated screw, the subacromial bursa is removed. The supra spinatous tendon is divided to allow the insertion of nails if intramedullary nailing is selected[44,62].

OPERATIVE PROCEDURES

1. Percutaneous pinning:[12,24,40,57]

Percutaneous pinning with K wires or distally threaded 2.5mm AO pins to fix reduced fracture fragments. Once the fracture has been minimized, the arm should be maintained in medial rotation and adduction. Two pins are put into the head and tuberosity fragments if the reduction is stable, commencing above the deltoid insertion and going into the shaft fragment. Parallel planes must be formed by the two pins. a third pin is inserted proximally into the larger tuberosity from above, moving on to the distal piece. After 4th and 6th weeks, when a fracture is seen on radiographs. stability is shown, pins are removed.

2. Open reduction and internal fixation (ORIF):[12,28,30,40,63]

Stable reduction with internal fixation is necessary to the unstable two-part and three-part fractures. Making a deltopectoral incision to reach the surgical neck and a lateral incision to access the bigger tuberosity is optimal. When the fracture site is revealed, the anterior section of the supraspinatus and the biceps tendon serve as a guidance for the rotator cuff and the superior border of the subscapularis. The unopposed pull of the subscapularis normally causes the head to internally rotate, and bigger tuberosity fractures cause the tuberosity to be moved proximally and posteriorly.

This is compressed with bone-holding forceps and secured to the humerus without the use of screws, non-absorbable sutures, tension band wiring, or wires made of 20 stainless steels. It can be necessary to extend the deltopectoral approach in cases of II- or III-part surgical neck fractures. This can be fixed in bone of excellent quality using an AO T-plate on the lateral surface of the humerus or a blade plate in osteoporotic bones.

3. Intramedullary nailing: [12,40,63,33]

Although less stable than locked plate fixation, intramedullary nailing offers a fixation that is more stable than percutaneous pinning. The rotator cuff is violated when a nail is inserted intramedullary into the proximal humerus, which might cause postoperative shoulder discomfort. The technique's benefits include closed reduction, little soft tissue damage, and less invasive insertion.

4. MIPPO (Minimally Invasive Percutaneous Plate Osteosynthesis):[64-70]

With the introduction of locking plating, there has been an increase in the use of less invasive methods to achieve secure fracture fixing. The motor function for the anterior deltoid muscle is provided by the anterior part of the axillary nerve, sole neural system that is considerably at risk when the proximal humerus is approached from the side. Due to nerve's close proximal aspect to the surgical neck, a single small incision can be used to observe, defend against, and lessen the fracture if necessary. Alternative procedures in comparison to ‘humeral nailing and percutaneous pinning’, which entail blindly placing screws or pins close to the axillary nerve, palpation, direct examination, and/or minor axillary nerve retraction may be more secure.

5. Hemiarthroplasty: [22,40,58,59,61]

Primary prosthetic replacement is the advised course of therapy for fractures with head-split, humeral head fractures, and IV-part displacement fractures. A five-size unrestricted vitalism humeral head prosthesis created by Neer in 1951 underwent a more anatomical redesign by Neer in 1973. Two head sizes (15 and 22 mm) are available for this Neer type II prosthesis, with the bigger head providing higher leverage and a mechanical advantage for forward elevation. There are two stem lengths and three stem sizes (7, 9, 5, and 12 mm) (125 mm and 150 mm).

When it is determined that the humeral head cannot be repaired or when its biological viability is likely to be seriously jeopardized, hemiarthroplasty, commonly known as humeral head replacement, is required. Most often Fractures affecting more than 40% of the articular surface are thought to be more dangerous. and fractures with comminuted head-splitting fragments cannot be repaired. In addition, indicators of head ischemia are taken into account while choosing between surgical fixing and replacement. Hertel and Bastian discovered that there was a higher chance of head ischemia in humerus fractures through the anatomic neck. Further indicators suggesting loss of humerus head perfusion during surgery were loss of the medial hinge, dislocation of the humeral head, and a metaphyseal extension of the humeral head of less than 8 mm. However, when fixation is chosen as the course of therapy, intraoperative ischemia has not been linked to clinically significant AVN of the humeral head, despite the fact that these criteria are routinely used to support replacement surgery. Additionally, several researchers discovered that AVN following proximal humerus fixation is connected to outcomes similar to those of hemiarthroplasty.

6. Indications for Hemiarthroplasty:

The reasons why hemiarthroplasty is currently indicated for proximal humerus fractures are still up for debate, mostly because there is a dearth of reliable data comparing the effectiveness of hemi-arthroplasty to ORIF and RSA. But there is widespread agreement on the type of patient and aspects of the fracture that could be susceptible to hemiarthroplasty.

A patient must be in excellent health and physically able to withstand open surgery, anesthesia, and the ensuing physiological stress in order to be fit for hemiarthroplasty. The patient's age is another aspect to take into account. The best candidates for arthroplasty are elderly individuals with osteoporotic weak bone and comminuted III- and IV-part proximal humerus fractures; ORIF has shown substantial complication and reoperation rates in this population.[71] Historically, hemiarthroplasty was used to treat condition. However, RSA has lately taken the position of hemiarthroplasty in because the reverse implant is less dependent on rotator cuff health and anatomic tuberosity healing, it is more appropriate for the elderly.

Hemiarthroplasty is still a viable surgical option for carefully chosen individuals in a younger population, nevertheless. Most young patients with fracture of proximal humerus who require surgery can benefit from ORIF, which preserves good density bone stock and corrects anatomic alignment. Hemiarthroplasty could be the best choice, nevertheless, if the articular surface has been irreparably damaged, as in the case of a head-splitting fracture or fracture-dislocation. Additionally, if a young patient has a fracture with a fracture pattern that has a significant risk of ischemia and eventual AVN, the surgeon may also contemplate hemiarthroplasty. These include four-part fracture-dislocations, medial calcar extension of less than 8 mm, and rupture of the medial hinge.[72] Because it still has the glenoid and because the rotator cuff function from before the injury is still mostly there at this age, hemiarthroplasty is preferable in this young demographic (as opposed to RSA, as in the older population). Younger individuals often have superior bone quality and a greater chance of curing the tuberosities.

COMPLICATIONS

a. Neurologic and brachial plexus injuries

Neurological and brachial plexus injury accounts till 50% of proximal humerus fractures. Axillary nerve injuries from anterior fracture dislocations are possible. Any deficiencies should be meticulously documented and monitored using electromyography. At three months, explore injuries are still not improving. The risk to the nerve injury is increased in elderly aged patients, surgical neck fractures, dislocations, violent trauma with concomitant bleeding, failure ORIF, and all of these conditions.

b. Vascular injuries

In displaced proximal humerus fractures can lead injury to the axillary artery; this commonly happens after severe blunt trauma or penetrating trauma. Due to the lack of flexibility in the artery walls, this damage can also be seen in older patients with arteriosclerosis who have mildly displaced fractures. The radial pulse should always be assessed, however because of collateral circulation in a vascular damage situation, its existence might be deceiving.

When there are indications of vascular impairment, keep an elevated index of suspicion and move toward an angiography. These include pulsatile external bleeding, bruits, pallor, paresthesia’s, pulselessness, unexplained hypotension, and growing hematoma. When necessary, carry out an emergency artery repair. Amputation, gangrene, and neurologic impairment are all possible outcomes of failing to identify and treat these injuries (due to compression from the hematoma).

c. Stiffness or frozen shoulder

When treating proximal humerus fractures, both nonoperative and surgical methods are used, stiffness or frozen shoulder may develop. The need of a focused physical therapy programme to retain mobility during the post-fracture and post-operative period is highlighted by this. If a patient doesn't improve with stretching exercises, they could need surgery, such as an arthroscopic or open removal of adhesions. As there is a possibility of refracture, manipulation under anesthesia shouldn't be done by one person.

D. Avascular necrosis

Avascular necrosis can be present till 14% of III-part fractures that have undergone closed reduction and up to 34% of IV-part fractures. This problem causes shoulder discomfort and stiffness, and it may eventually necessitate total shoulder arthroplasty.

E. Malunions

Greater tuberosity malunions are brought on by the rotator cuff's pulling. Supraspinatus involvement is required for displacement to be superior. The union at this location may cause impingement syndrome. If the pull is mostly infraspinatus, the displacement is termed to be posterior. External rotation is reduced as a result of posterior impingement against the glenoid caused by union at this location. Pain and a loss of function are indicators that surgery is necessary. Acromioplasty, or tuberosity osteotomy and cuff mobilization, is used to treat superior tuberosity malunion if it is not severe. Treatment for posterior malunions includes capsular release and tuberosity osteotomy, acromioplasty is ineffective. There are very few isolated lesser tuberosity malunions.

Malunions of 3-part fractures and the surgical neck are often multiplanar in nature and include rotation, flexion/extension, and varus/valgus abnormalities. At the surgical neck, significant angulation is acceptable. But there is a corresponding loss of height. In addition, varus malunion results in loss of lateral humeral offset and a larger tuberosity in the subacromial region. Pain is frequently experienced as a result of two elements in a varus malunion of a surgically repaired humeral neck fracture. First there is impingement pain because the varus rotation of humeral head, neck, and tuberosity have positioned the tuberosity at a high level, above the level of humeral head, and in close proximity of lateral acromion. Secondly, the medial rotation and translation of greater tuberosity effectively shortened the supraspinatus and infraspinatus muscle-tendon units, have caused them to function at less than maximal efficiency, and have predisposed them to the muscle fatigue. In three- and four-part fractures, prosthetic replacement is typically necessary due to malunion and avascular necrosis of the humeral head. A glenoid component is also employed, and posttraumatic arthritis is frequently detected on the glenoid surface. It may be challenging to treat a fracture-dislocation that fails to heal. The head is either dislocated posteriorly or anteriorly. Due to the possibility of neurovascular bundle adhesions or associated scar tissue, it needs to be mobilized and removed with extreme caution. Prosthetics regularly need to be replaced

.

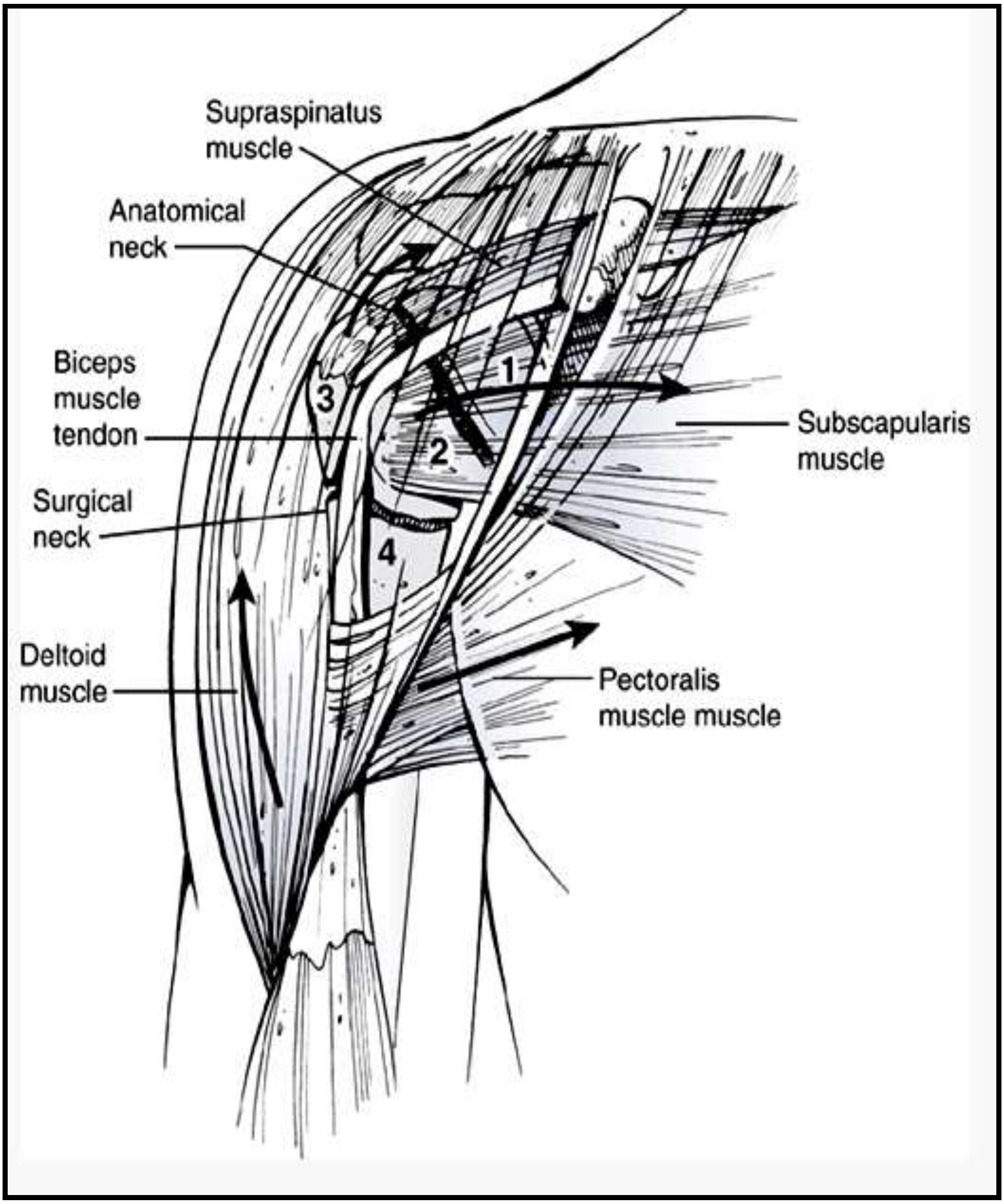


Figure 17: Displacement of the fracture fragments depends on the pull of themuscle of rotator cuff and pectoralis major causing malunion.[62]

REHABILITATION

A solid rehabilitation program that is started as early as the first week after a shoulder injury or proximal humeral fracture is directly responsible for the majority of functional results. The suggested rehabilitation regimen is listed below.[73,44,74,75,76] Under the supervision of physiotherapist.

1. Rehabilitation for fractures of the Greater tuberosity: -

patients can benefit from pendulum exercises in larger tuberosity fractures, external rotation with a stick, and passive elevation in the scapula's plane. Internal rotation must be avoided for three months prior to radiological healing and no vigorous motion is permitted before six weeks have passed. At three months, complete strengthening and stretching are sought.

2. Rehabilitation in isolated lesser tuberosity fractures: -

In these situations, pure forward flexion is used, with complete internal rotation at roughly 90° and passive exterior rotation at neutral. Depending on radiological union, external rotation to 45° and complete elevation are permitted at 6 weeks. Complete stretching and strengthening are started after three months.[73]

3. Rehabilitation in cases of OR & IF with three-part fractures: -

Pendulum exercises can start right away if the fixation is steady and solid. Motion must be postponed if the fixation is not sufficiently secure and the bone is significantly osteoporotic. In the third or fourth week, passive flexion, medial rotation, and lateral rotation begin. Active & resistance motions start in the sixth to eighth week. After three months, full-length strengthening and stretching exercises are initiated.[77]

4. Rehabilitation after proximal humeral prosthetic replacement: -

Start with gentle passive workouts that primarily include forward flexion and external rotation. Pendulum exercises are allowed after 10 days. As the patient's tolerance for discomfort increases, gentle passive and active activities are performed.[73]

Post operative rehabilitation has three well defined phases:

1. Phase I: After the initial pain has subsided, passive range of motion, which includes passive external rotation and forward elevation of the afflicted shoulder, begins on the second or third postoperative day. Internal rotation was later incorporated. These exercises are thoroughly explained to the patient and his attendants and are under the supervision of the surgeon and physiotherapist. after early union has been achieved and radiographically verified,
2. Phase II: It begins at 4-6 weeks and involves an active range stretching activities toward the end of the range-of-movement.
3. Phase III: which starts after the ninth week following surgery and lasts until union is assured and sufficient mobility is attained, comprises of resistive strengthening and terminal stretching exercises.

Realistically, a successful return to function requires 6–12 months of vigorous post-operative therapy.[74]

OUTCOME EVALUATION

Various techniques are being utilised to evaluate shoulder function. All shoulder outcome measures To some extent, assess discomfort, function, range of motion, and strength. The issue is that they all focus on various facets of the shoulder examination. Some focus more on range of motion, while others on discomfort, and yet others prioritise function. Because of these variations, comparing instruments has proven challenging, if not impossible, and no one instrument has gained widespread acceptance.

Originally designed to evaluate shoulder arthroplasty for degenerative shoulder joint degeneration, Neer's shoulder scoring system is now often used to evaluate outcomes after proximal humerus fractures. Neer employed a 100-unit scale, including thirtyfive units for pain, thirty for function, twenty for range of motion, and ten for anatomy. An outcome of 89 or more is considered good; an outcome of 80 to 88 is considered satisfactory; an outcome of 70 to 79 is considered poor; and an outcome of fewer than 70 units is considered a failure. The weight each assessment approach gives to factors like discomfort, Function and range of motion might differ. Elbow and shoulder surgeons in America (ASES)established a standardised method of evaluating shoulder function, regardless of diagnosis, in 1994. This was done to promote communication between researchers, encourage multicenter studies, and enable communication of useful and relevant outcome data to doctors, healthcare organisations, and the general public.

Others include the Disabilities of the Arm, Shoulder, and Hand Instrument (DASH), the Constant Scoring System, the University of California, Los Angeles (UCLA) shoulder rating scale, the Shoulder Severity Index, the Simple Shoulder Test, and PENN score. In the same patient, it is conceivable for one evaluation system to provide an excellent outcome while another system shows a fair or bad result. Additionally, it's possible that the outcome scores now in use distort how patients see the success of their treatments. Patient may be content with pain-free shoulder and restoration of a functional range of motion but not have complete range of motion and strength, which are objective measurements frequently highlighted in outcome instruments.

Studies in Literature:

Robinson et al.,[31] Adults who are medically healthy and compliant who undergo a proximal humeral fracture is treated with a primary shoulder hemiarthroplasty. have acceptable prosthesis survival at 6.3 years on average. Although this procedure frequently leaves the shoulder pain-free, the long-term functional results— After a year, certain aspects, such as flexibility, power, and function, change. Generally speaking, a good functioning outcome is predicted.

R. Castricini et al.,[78] In 91% of our patients, hemiarthroplasty was very good or satisfactory for treating proximal humeral fractures. Achieving positive outcomes appears to depend on careful selection of patient, precise surgical method, and compliance pf the patient with the rehabilitation regimen. A mean Constant score of 59.2 indicated that the majority of patients reported satisfactory joint and ADL function and little to no pain.

Mighell et al.,[4] We looked at 80 shoulders that had had hemiarthroplasty (72 shoulders in 71 individuals). On the American Shoulder and Elbow Surgeons scale, the average internal rotation was to L2, the average exterior rotation was to 43 degrees, and the average score on the Simple Shoulder Test was 7.5. Sixty-six people (93%) who underwent follow-up reported being pain-free and pleased with their outcomes. Radiographic studies showed superior migration in 15, heterotopic ossification in 18, and virtually anatomic tuberosity restoration in 58 shoulders. Patients with superior migration had considerably reduced levels of forward flexion, mean Simple Shoulder Test scores, and scores on the American Shoulder and Elbow Surgeons. Tuberosity-related issues were seen in 16 shoulders. Tuberosity malunion increased was the most common adverse reaction. A lower functional outcome was associated with healing of the larger tuberosity that was more than 2 cm below the humeral head. For proximal humerus fractures, hemiarthroplasty results in reproducible pain relief and shoulder-level function.

Demirhan et al.,[79] 32 patients, with a follow-up period of 35 months on average, and a mean age of 58 (range: 37 to 83 years) (range 8–80 months). Neer types IV and III were present in 15 instances, whereas 15 patients had fracture-dislocations for which hemiarthroplasty shoulder surgery was performed. Neer's criteria were met in 24 of the 32 instances (75%), with excellent or good results, and 8 cases (25%), with poor results. Range 19-98, with a mean Constant of 68 and a mean Elevation degree of 113. (range 30–180).

Esen et al.,[80] Between February 1994 and March 2004 in their clinic, 42 patients with proximal end humerus fractures underwent primary hemiarthroplasty. Of the 42 instances, 14 (33%) were involving men and 28 (67%) included women. On average, it was 68.9, 5.57 years (age range: 59–81 years). In instances with proximal end fractures of the humerus, primary hemiarthroplasty in the early stages with anatomic restoration of the bone and soft tissues of the shoulder joint, as well as a long-term regular rehabilitation programme, are critical factors leading to improved patient satisfaction.

Li JW et al.,[81] old patients with treatment was given for comminated proximal humeral fractures (Neer IV),with a coUrse lasting one to three years. There were four males and twenty seven females, ranging in age between the ages of 55 and 94, with a mean of 71. Thirty-one individuals were monitored for an average of two years and between one and three years. The head of the artificial humerus remained intact in all cases in the HA group; the only exception had a fractured nodule that did not heal. There were no instances of prosthesis loosening, fracture, or subsidence ; and the Neer score was 84.183.55; in the ORIF group, there were 8 cases of proximal humerus bone resorption; one case had a fracture that did not heal; and one case had an internal fixation that had become loose

Gupta et al.,[82] According to the American Shoulder and Elbow Score, Arm, Shoulder, and Hand Disabilities, Constant, ORIF significantly outperformed HA and RSA in terms of clinical results (P 0.05). However, compared to HA and RSA, ORIF had a much greater reoperation rate (P 0.001 for both). There was no difference between HA and RSA in any outcome metric. In the HA group, the percentage of tuberosity non-union was 15.4%. Compared to ORIF, HA, and RSA, there were higher problems after closed reduction and percutaneous pinning (P 0.05). Better clinical outcome ratings are seen with ORIF for proximal humerus fractures, however a greater reoperation rate is also seen. Both HA and RSA work well, although HA still has a problem with tuberosity non-union.

Adam Schumaier et al.,[83] In the elderly, proximal humerus fractures are frequent. With early physical therapy, Most fractures with modest displacement can be treated conservatively. When treating displaced fractures, considerations such as the degree of independence of the patient, the strength of their bones, and surgical risk factors should all be considered. All of these approved treatment options—arthroplasty, locking plates, intramedullary nails, and fixation using percutaneous methods—are available. Medial comminution, varus angulation, and calcar restoration should all get special consideration with internal fixation. The anatomic repair of the tuberosities during arthroplasty as well as the appropriate positioning of the prosthesis should be taken into consideration. Since there isn't a single evidence-based therapy that is preferred, the surgeon should take their degree of comfort with each therapy into account before choosing one.

Dietrich et al.,[84] Age, gender, and fracture type did not differ between the patient groups. For FAPF, the median CS was substantially better (71 vs 41). The two treatment methods in the OSS showed no changes in the evaluation of pain. The FAPF group underwent revision surgery more frequently (25% vs 2%). Functional result with FAPF was better than SHA. However, a greater rate of revision surgery was linked to this. The majority of patients, regardless of the kind of operation, were still able to live comfortably in their previous environment.

After doing a prospective study on 27 patients in Gujarat, in the year 2020, **Tadvi N** recommended that hemiarthroplasty as NEER's categorization indicates that they found acceptable functional results and effective fracture fixations even in osteopenic bones, suggesting that surgery may be an option in the therapy of difficult proximal humeral fractures.[85]. A study was done in vietnam on 30 patients by **Trung D T et al**., in the year 2020 stated that complicated proximal humerus fractures treated with hemiarthroplasty is a valid and reliable technique and after surgery patients have very good shoulder function[86].

In 2019 prospective research conducted at Karad, Patil et al. found that hemiarthroplasty is a feasible option to osteosynthesis in middle-aged patients and to definitive therapy in elderly patients with a substantially comminuted proximal humerus fracture. After shoulder hemiarthroplasty, tuberosity was primarily responsible for a good range of movement and superior functional results.[87]

In 2016, Saurabh A. et al. did retrospective research in New Delhi and arrived to the conclusion that in situations with grossly communicated proximal humerus fracture, hemiarthroplasty is a feasible option to osteosynthesis. They also noted that tuberosity healing was crucial for achieving a good range of motion for a better functional outcome.[88]

A study done in Canada by **Fallatah S et al**., in 2008 according to NEER'S classification on proximal humerus hemiarthroplasty found revealed the state of the soft tissues and the surgical method had a significant impact on late postoperative discomfort and range of motion. Inferior results were observed when hemiarthroplasty was done as secondary procedure post failed internal fixation and also no long-term difference was noted in outcome based on the type of prosthesis.[89]

A similar study done in Canada by **Anjum S N et al.,** on 29 patients in the year 2005, concluded that pain relief following hemiarthroplasty of shoulder is satisfactory according to NEER'S classification. Even though restoration of functional range of movements are poor in elderly patients but the satisfaction rate is on higher side because of their low demand.[90]

MATERIAL AND METHODS

Source of Data: R.L. Jalappa Hospital and Research Center, Department of Orthopedics, Sri Devaraj URS Medical College, SDUAHER.

Study Population: Patients admitted to orthopedics ward from casualty and outpatient department at Sri Devaraj URS Medical College's R.L. Jalappa Hospital and Research Center, affiliated to SDUAHER university.

Inclusion Criteria:

- Three part or four-part complex proximal humerus fractures with or without dislocation (according to Neer's classification)
- Head split fractures and anatomical fractures
- Age group with above 50 years

Exclusion Criteria:

- Associated ipsilateral humeral shaft fractures
- Associated neuro vascular injury.
- Pathological fractures.

Duration of Study: 1st January 2021 to 31th May 2022

Study Design: Prospective Study

Sampling Technique: Convenient sampling

Sample Size: 24 subjects

Assuming alpha error of 5% (95% confidence limit) and an absolute precision (d) of 15%, the minimum required sample size to assess post-surgery functional status among proximal humerus fracture patients was estimated to be 20. The sample size was derived from the following formula:

$$\text{Sample size (n)} = \frac{Z^2(P*Q)}{d^2}$$

Where,

- Z is the critical value for 95% Confidence Interval
- D is the perfect accuracy
- P is the anticipated percentage, and q=1-P.

OpenEpi software version 3.01 (Open Source Epidemiologic Statistics for Public Health) was used to determine the sample size. In our setting, lost-to-follow up was found to be 20% and hence the final sample size was 24 subjects undergoing primary hemiarthroplasty.

Method of Data Collection:

After satisfying the inclusion and exclusion criteria, each patient was reviewed by a thorough history, clinical examination, and radiographs. Patients who undergo shoulder hemiarthroplasty after obtaining consent and surgical fitness under suitable Anaesthesia were included. Following surgery patients were followed up at 1st, 3rd, 6th months. At the time of follow up each patient’s range of movement of shoulder will be assessed by using Disability of arm, shoulder and hand score (DASH score) and visual analog scale (VAS score).

The patients were evaluated by following investigations:

- CBC
- BT, CT, Blood grouping
- RBS
- RFT
- HIV, HBsAg status
- ECG.

Radiological Investigation: Plain X-ray of with shoulder Antero-posterior and axillary view

Shoulder hemiarthroplasty Procedure:

PRE-OPERATIVE EVALUATION

- A clinical evaluation that includes the afflicted limb's neurovascular condition.
- Initial investigations.
- Radiograph: AP, Axial, Scapular view of the shoulder; X-ray of the contralateral shoulder; CT shoulder with in three dimensions reconstruction.
- Informed consent from the patient.
- Anaesthesia - regional anaesthesia/general anaesthesia Fitness from Cardio, Nephro, and Anaesthesia Departments.

POSITION

- Beach Chair position

OPERATIVE PROCEDURE

Approach: Deltopectoral approach

For reconstructive shoulder surgery, the deltopectoral technique is regarded as the standard procedure. The cephalic vein is then identified and reflected laterally following an incision that begins above the coracoids process and progresses down the deltopectoral groove. According to the authors' experience, a clavicle-level incision that is extended 1 to 2 cm laterally from the coracoid process and 2 cm distally from the axillary crease would provide better exposure. Particularly in individuals with muscular atrophy or history of surgery, the deltopectoral gap is not usually obvious. To find the cephalic vein, a full-thickness skin flap is made medially from proximal end of the surgical incision to a point 1 to 2 cm medial to the coracoid process. At this level, there is usually a wide triangle with the clavicle as its foundation. The cephalic vein is clearly seen as it moves out from this triangular space. Most literature suggest dissecting the gap by withdrawing the cephalic vein to lateral side since lateral tributary veins are more frequent than their medial counterparts.

But, when lateral deltoid retraction is necessary, moving the cephalic vein medially prevents its proximal tethering, which improves exposure. Once the deltopectoral breach is made, the subdeltoid space is found and debulked of hypertrophic bursa tissue. ‘Fracture hematoma, fibrous scar tissue, or early callus’ formation are seen at this stage, depending on how long it has been since the accident. To prevent the fracture fragments from being devascularized, careful soft tissue treatment is necessary. It will be much simpler to diagnose the fracture, decrease it, and insert a plate if the long head of the biceps can be located on the anterior region of the proximal shaft. Digital palpation directly medial to the pectoralis major tendon insertion makes it simple to identify the biceps tendon. Due to the proximity to the ascending branch of the ACHA, extensive dissection of this tendon should be avoided. The biceps tendon may have been injured by the fracture, needing a tenodesis to remove a possible source of pain. Additionally, the biceps tendon could make it more difficult to decrease a fracture.

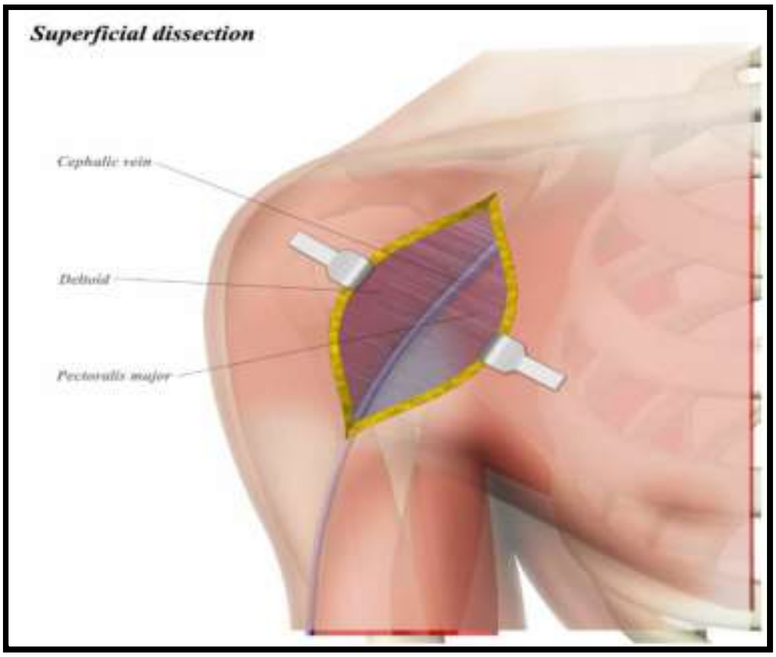


Figure 18: Superficial dissection

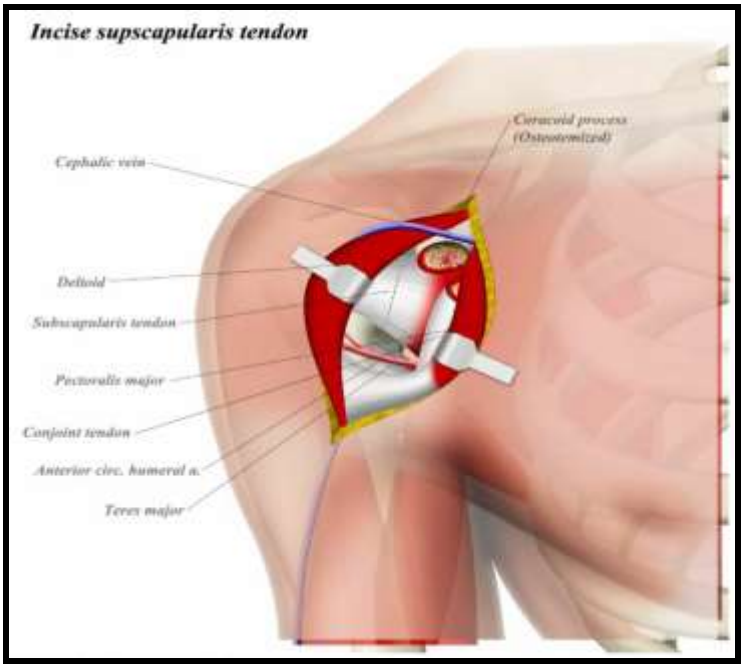


Figure 19: Incise suprascapularis tendon

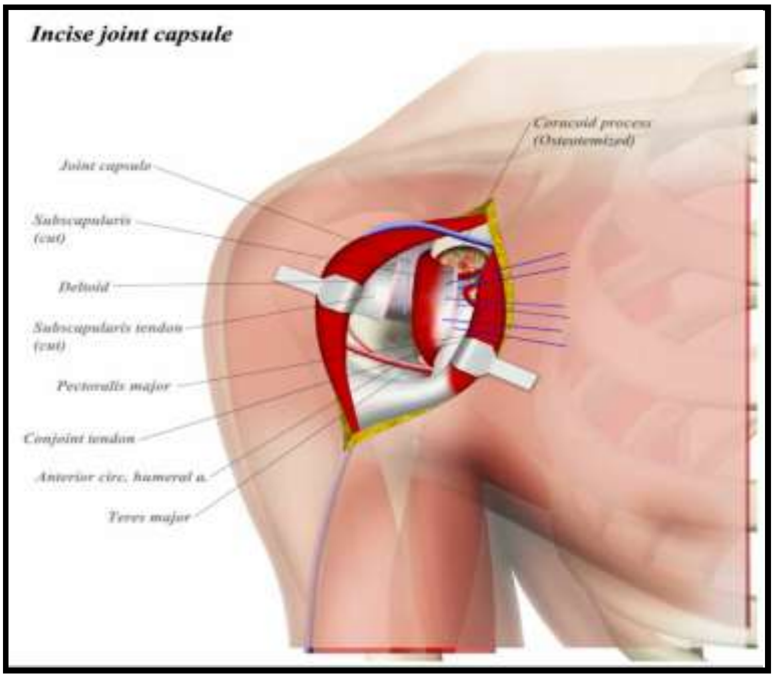


Figure 20: Incise joint capsule

Figure 21: Implant (DR MURKERJI’S PROSTHESIS)

POSTPROCEDURE MANAGEMENT PROTOCOL:

- Shoulder immobilization with shoulder immobilizer
- 1st end of treatment and drain removal - 2nd post op day
- 2nd,3rd end of treatment -- 5th ,7th post op day
- Suture removal-12-15th post op day
- Immobilizer removal – by the beginning of 4th week
- Pendulum exercise - by the beginning of 4th week
- Overhead abduction - by 6th week

FOLLOW UP

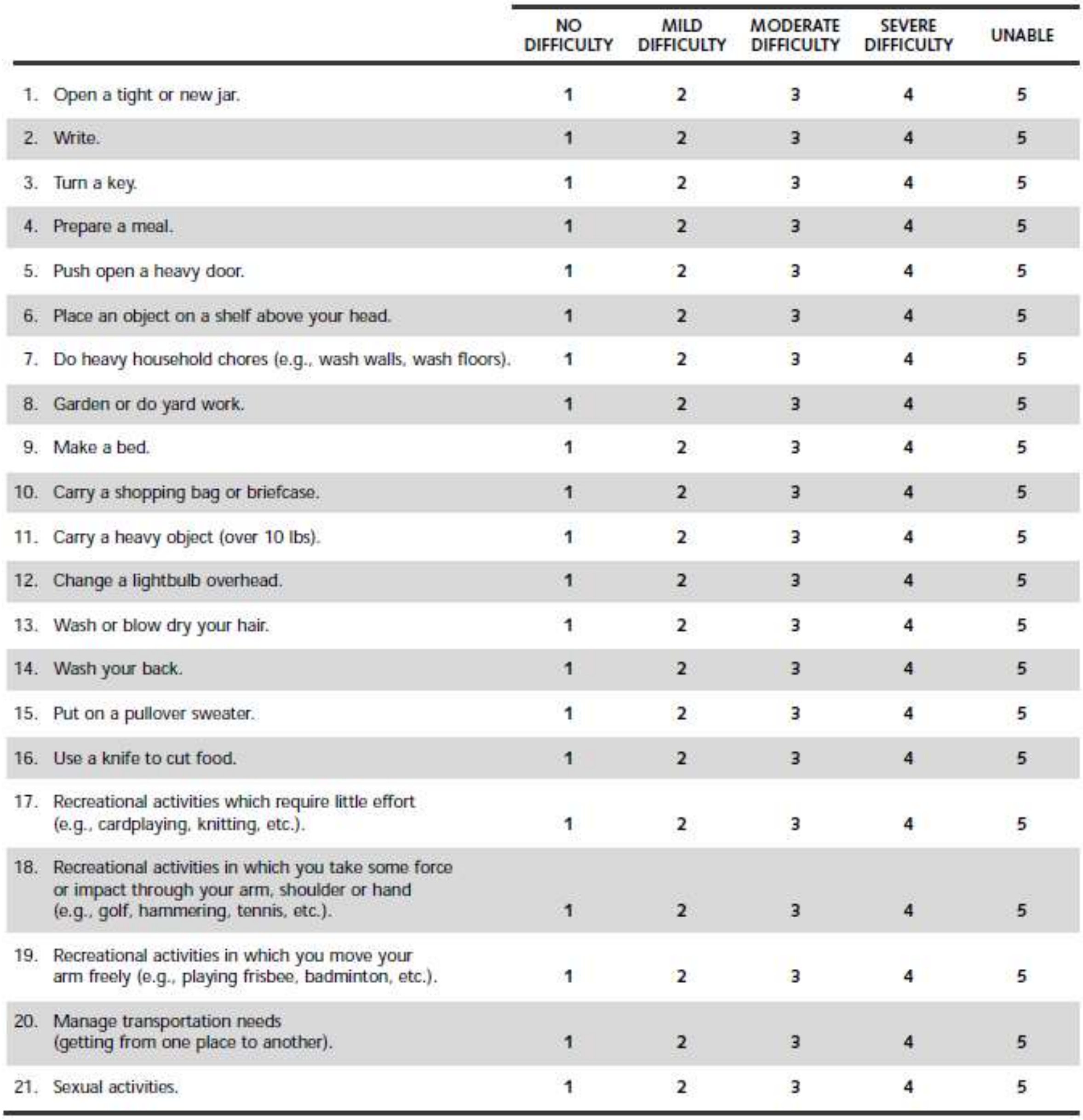
- Daily follow up – up to 15 days
- Weekly follow up – up to 4 weeks
- Twice monthly follow up – up to 3 months
- Monthly follow up– up to 6 month

In each follow up patient is assessed using DASH SCORE, VAS SCORE and x ray shoulder functional Outcome:

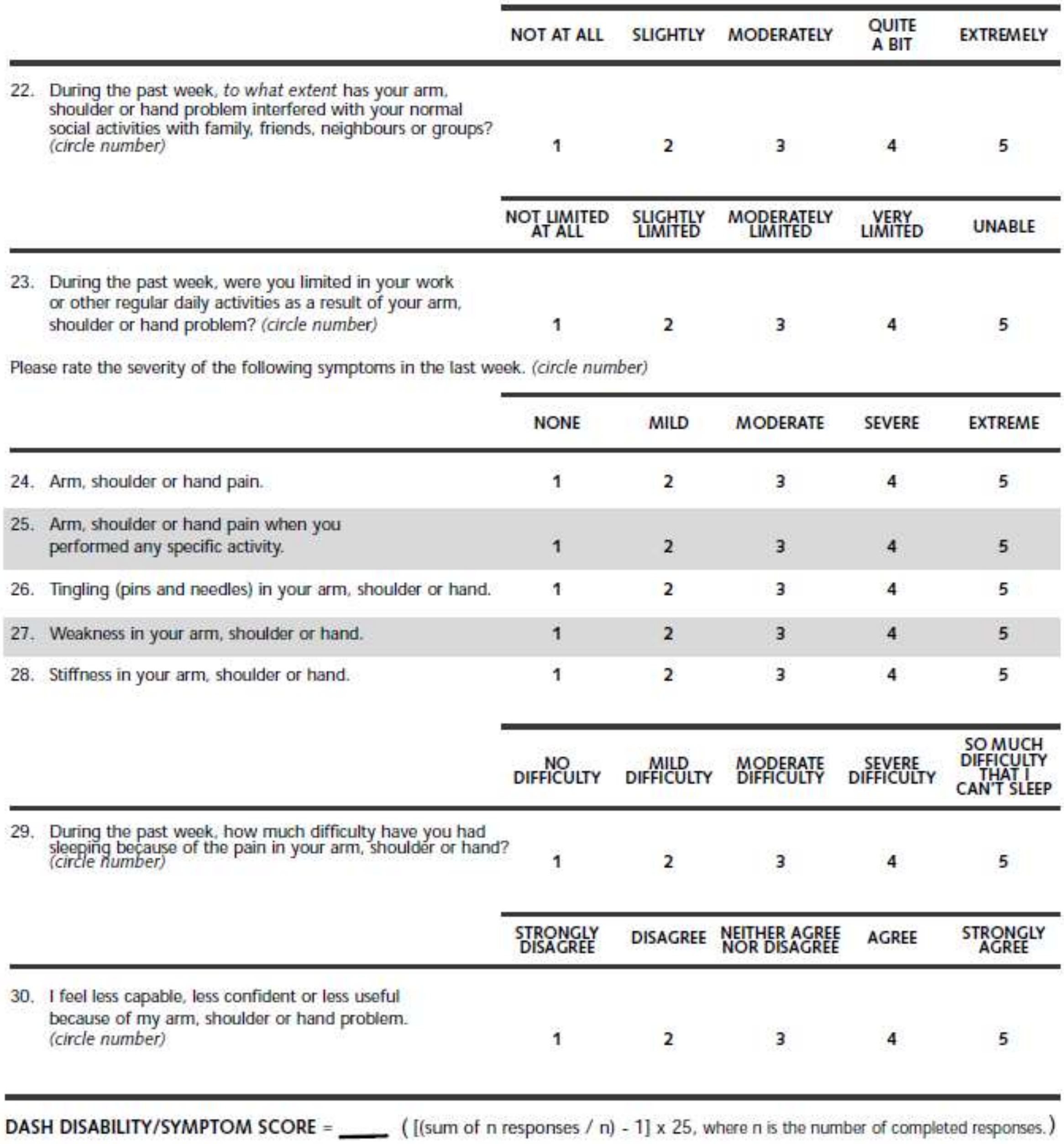
The DASH questionnaire

The DASH is a 30-item measure that evaluates a patient's symptoms and impairment over the past week.[91] Along with the severity of each symptom of ‘pain, activity-related pain, tingling, weakness, and stiffness (5 items)’, the questions ask about how the problem affects social activities, work, sleep, and self-image. They also ask about how tough it is to engage in different physical activities because of the arm, shoulder, or hand problem (21 items) (4 items). There are five alternative responses for each query. The outcomes are then used to generate a scale score, utilizing the findings for all items, that runs from 0 (no disability) to 100. (most severe disability). The outcome of the disability/symptom scale is the DASH score.

DASH SCORE:



	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5



	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

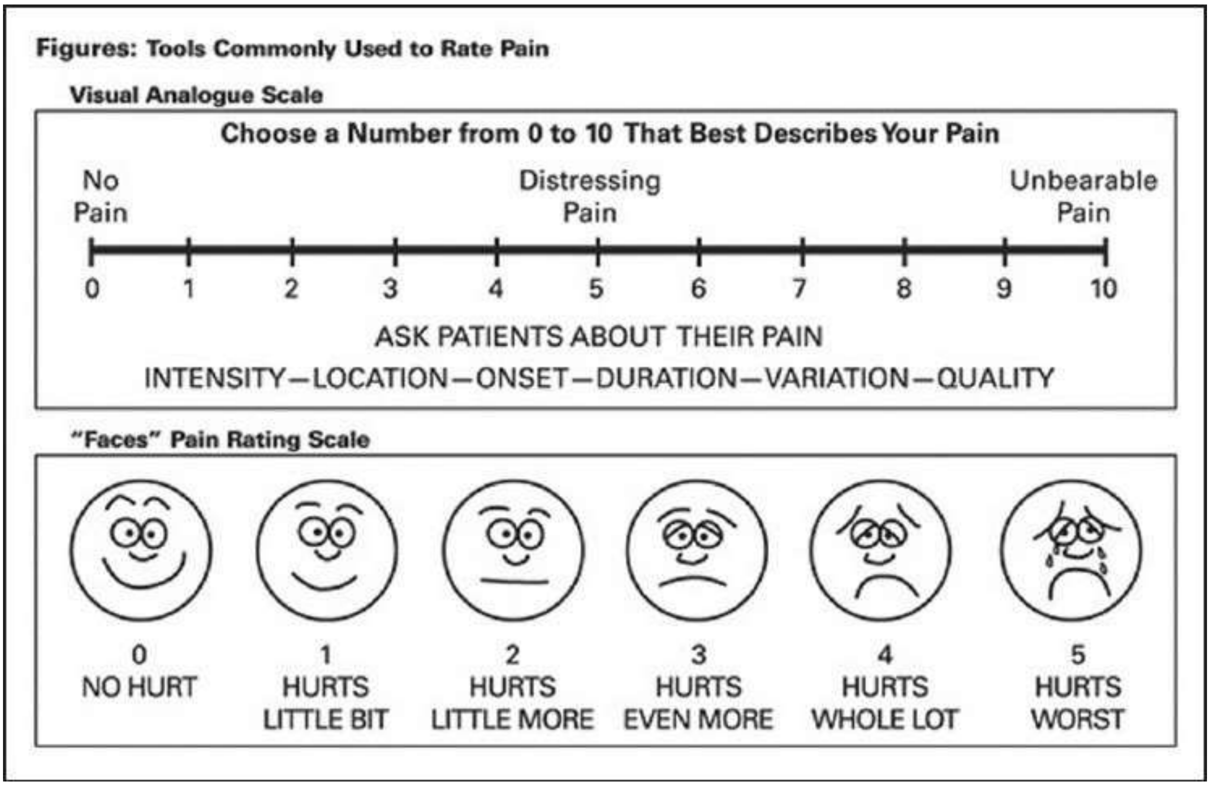
	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = _____ ([(sum of n responses / n) - 1] x 25, where n is the number of completed responses.)

VAS Score:

The visual analogue scale was first established by Hayes and Patterson (VAS) as a method for assessing pain in 1921.[92] scores are mainly on self-reported assessments of symptoms that are recorded with a single handwritten mark at one location along a 10-cm line that represents a continuation between the two ends of the scale—"no pain" on the left end (0 cm) of the scale & "worst pain" on the right end (10 cm).[93] From the left side of the scale, where the scale starts, to the patient marks, centimetre measurements are taken and converted into levels of discomfort. The data is assessed at patient's pain progression or to assess pain in people with similar diseases. The scale has been used to evaluate ‘ambulation, mood, hunger, asthma, dyspepsia, and other conditions in addition to pain’. The VAS is still widely used in clinical and domestic contexts despite contradictory information about its benefit over alternative techniques for recording pain.[94]


Figures: Tools Commonly Used to Rate Pain

Statistical analysis:[95,96,97]

The data, which was documented in Microsoft Excel data sheet, was examined using the SPSS 22 programme. Categorical data was shown as frequencies and proportions. Mean and standard deviation were used to depict continuous data. To evaluate if the continuous data were normal, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were utilised. The statistical analysis of paired data, such as before-and-after surgical measurements in quantitative data, was the paired t test.

Repeated Measures ANOVA (RMANOVA) was the significant difference test used to determine the mean between more than two measurements. **Post Hoc Bonferroni test** was used to determine the intergroup analysis.

Data visualisation: MS Word and Excel were used to create a variety of graphs, including pie and bar diagrams.

A p value (Probability that the result is true) of 0.05 or below was regarded as statistically significant after accounting for all statistical testing rules.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

Ethical consideration:

1. Prior to the start of the investigation, institutional ethical approval was acquired.
2. Before the study began, informed permission was acquired from each patient who was enrolled.
3. Throughout the research and follow-up, all patients received the Standard of Care.

RESULTS

Table 1: Age wise distribution of subjects

		Count	%
Age	<60 years	16	66.7%
	>60 years	8	33.3%
	Total	24	100.0%

33.3% of the study's participants were over 60 years old, while 66.7% of participants were under 60.

Age	
N	24
Mean	58.79
SD	4.587
Minimum	51
Median	59.00
Maximum	68

Mean age of subjects was 58.79 ± 4.587 years.

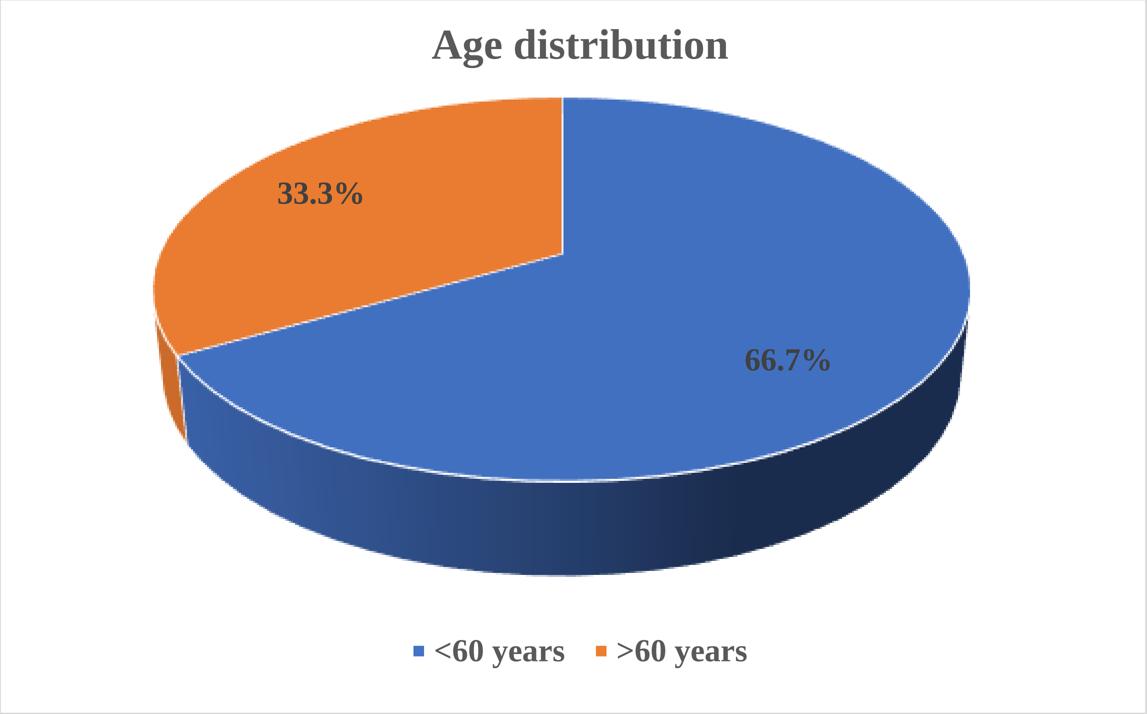


Figure 22: Pie chart displaying the subjects' ages.

Table 2: Gender distribution of subjects

		Count	%
Gender	Female	9	37.5%
	Male	15	62.5%
	Total	24	100.0%

37.5% of the research participants were female, whereas 62.5% were men.

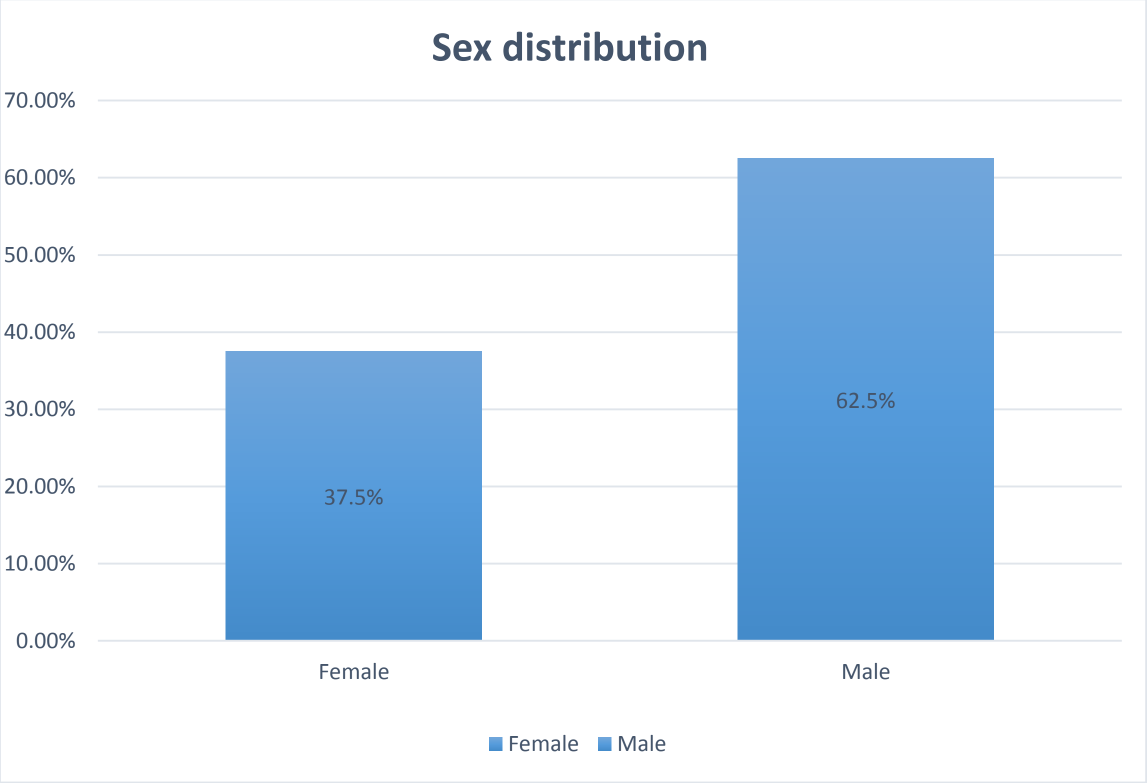


Figure 23: Pie graph showing Sex distribution of subjects

Table 3: Mode of Injury distribution

		Count	%
Mode of Injury	RTA	19	79.2%
	Slip and Fall	5	20.8%
	Total	24	100.0%

In the study 79.2% had RTA and 20.8% had slip and fall.

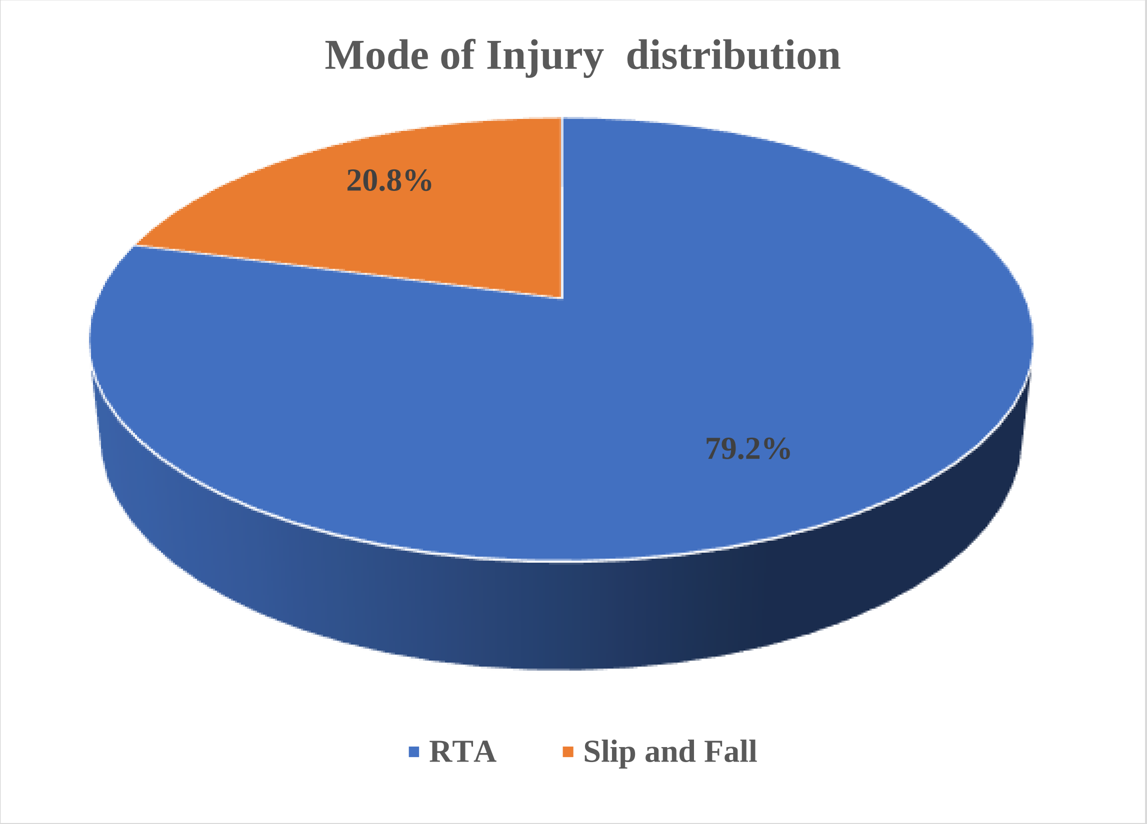


Figure 24: Pie chart displaying the distribution of injury modes

Table 4: injury distribution by side

		Count	%
Side	Left	10	41.7%
	Right	14	58.3%
	Total	24	100.0%

In the research, 41.7% of the left and 58.3% of the right sides were injured.

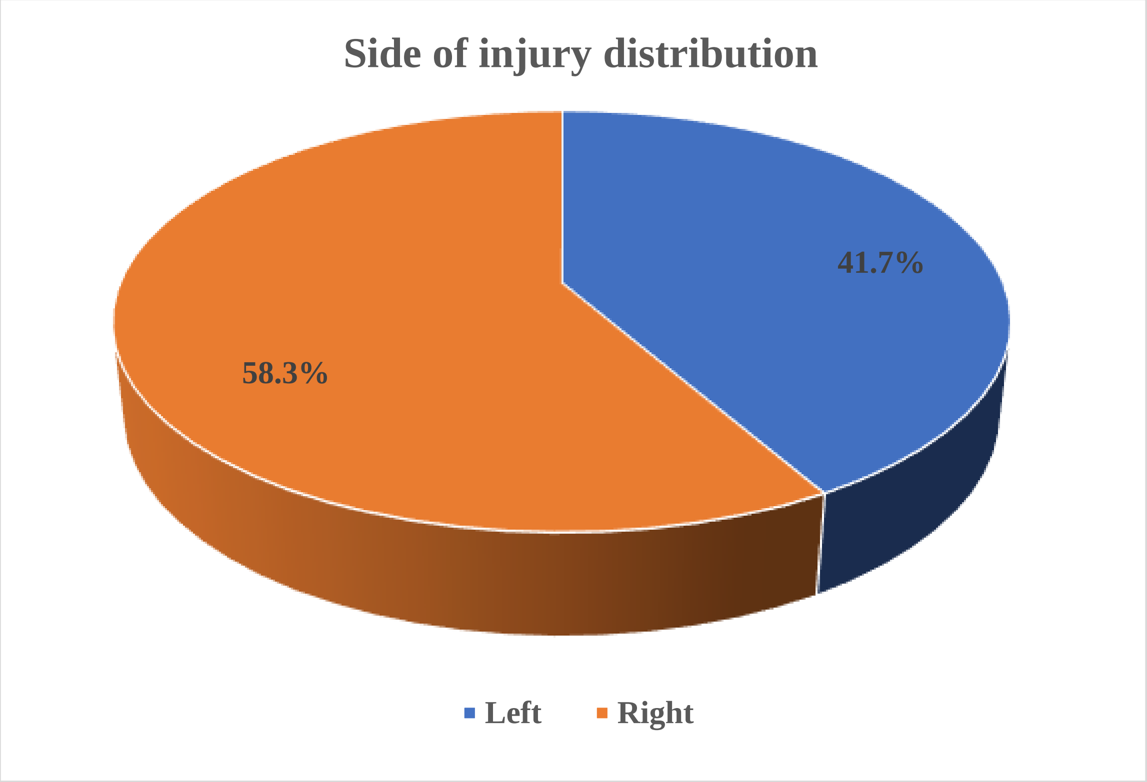


Figure 25: Pie diagram showing Side of injury distribution

Table 5: Diagnosis distribution

Closed Displaced Right Proximal Humerus Fracture		Count	%
Diagnosis	Neer's Type 3	15	62.5%
	Neer's Type 4	9	37.5%
	Total	24	100.0%

Neer's Types 3 and 4 were present in the research in 62.5% and 37.5%, respectively.

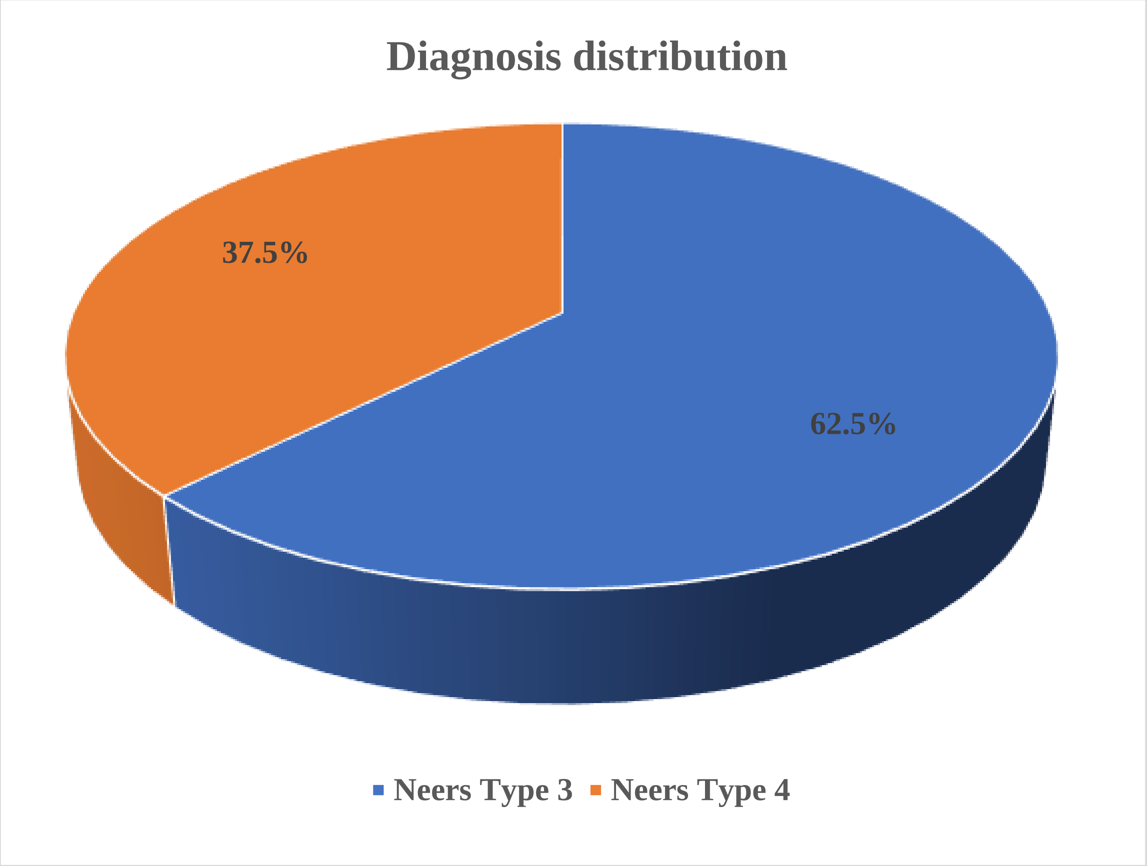


Figure 26: Pie diagram showing Diagnosis distribution

Table 6: Treatment given, Type of anaesthesia and approach

		Count	%
Treatment Given	Shoulder Hemi Arthroplasty	24	100.0%
Type of Anaesthesia	General anaesthesia	24	100.0%
Approach	Delto-Pectoral	24	100.0%

In the study 100% had Shoulder Hemi Arthroplasty, received General anaesthesia and Delto Pectoral approach.

Table 7: Complications distribution

		Count	%
Complications	Nil	23	95.8%
	Respiratory Distress	1	4.2%
	Total	24	100.0%

In the study 4.2% had Respiratory Distress.

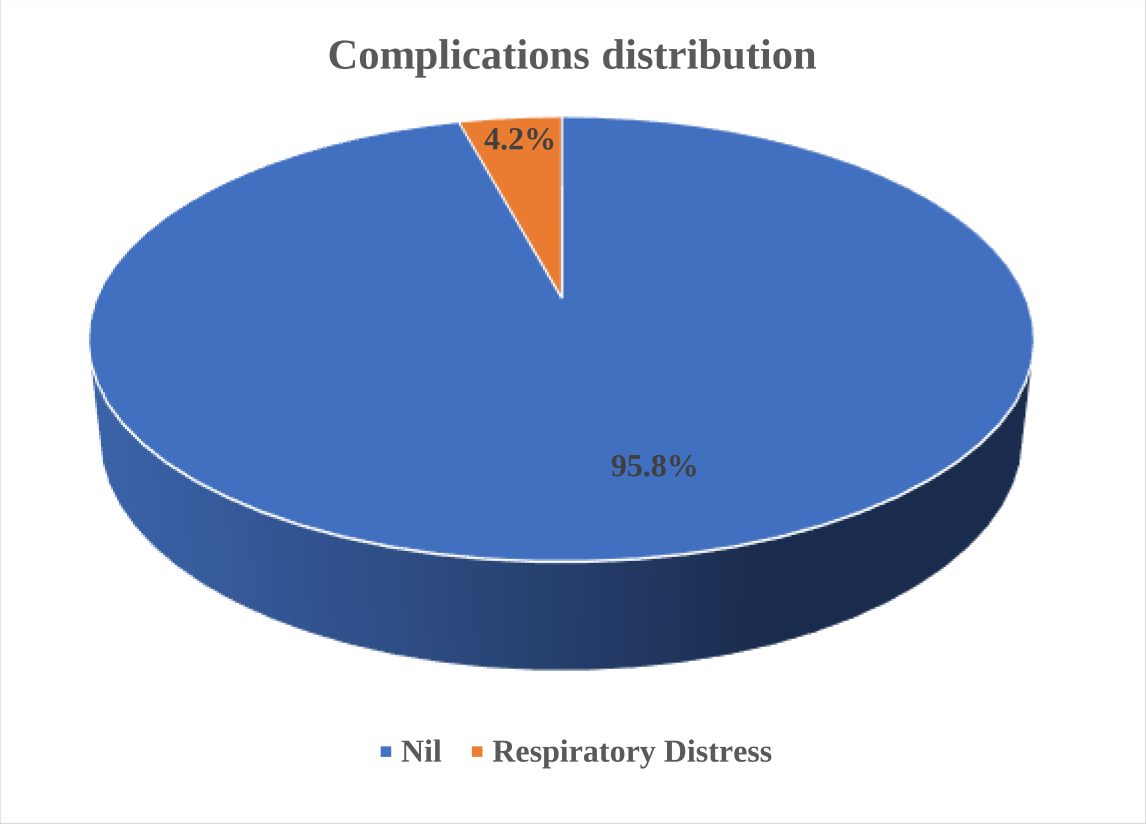


Figure 27: Pie diagram showing Complications distribution

Table 8: Follow Up distribution

		Count	%
Follow Up	6 Months	24	100.0%

All of the research participants were tracked for a total of six months.

Table 9: Dash Score distribution at different periods of follow-up

Dash Score	Mean	SD	Minimum	Median	Maximum	95% Confidence Interval	
						Lower Bound	Upper Bound
1st Month	54.54	10.35	40	56	72	50.169	58.914
3rd Month	30.75	9.00	19	31	44	26.948	34.552
6th Month	9.75	5.24	0	9	20	7.539	11.961

	P value
First versus third months	<0.001*
First versus sixth months	<0.001*
Third versus sixth months	<0.001*

Median DASH score at 1st month was 56, at 3rd month was 31 and at 6th month was 9. When compared to the first month, the DASH score significantly decreased in the third and sixth months.

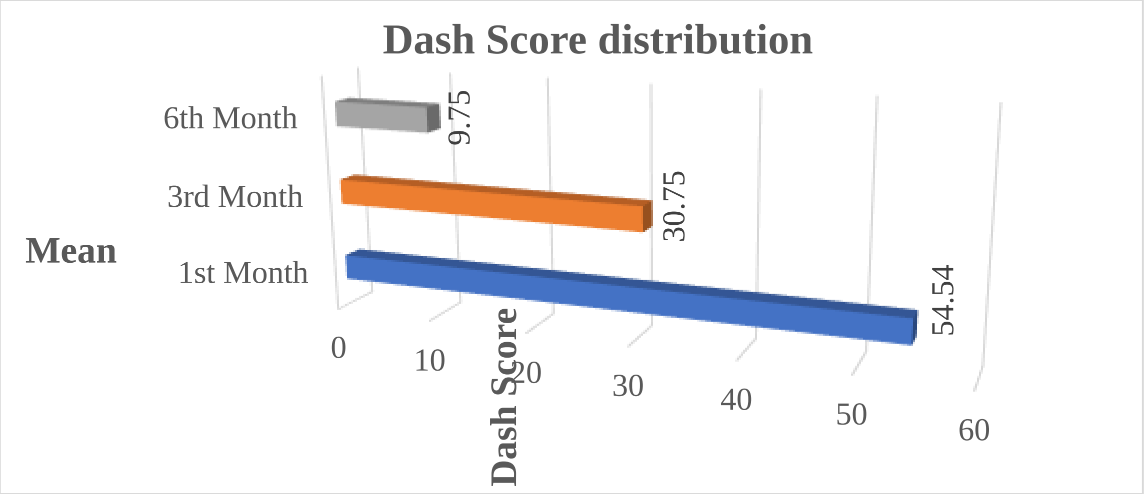


Figure 28: Pie diagram showing Dash Score distribution at different periods of follow-up

Table 10: VAS Score distribution at different periods of follow-up

VAS Score	Mean	SD	Minimum	Median	Maximum	95% Confidence Interval	
						Lower Bound	Upper Bound
1st Month	5.88	0.85	5	6	7	5.516	6.234
3rd Month	3.25	0.53	2	3	4	3.026	3.474
6th Month	0.58	0.50	0	1	1	0.371	0.796

	P value
First versus third months	<0.001*
First versus sixth months	<0.001*
Third versus sixth months	<0.001*

At the first month, the median VAS score was 6, at the third month, 3, and at the sixth month, 1. When compared to the first month, the VAS score significantly decreased in the third and sixth months.

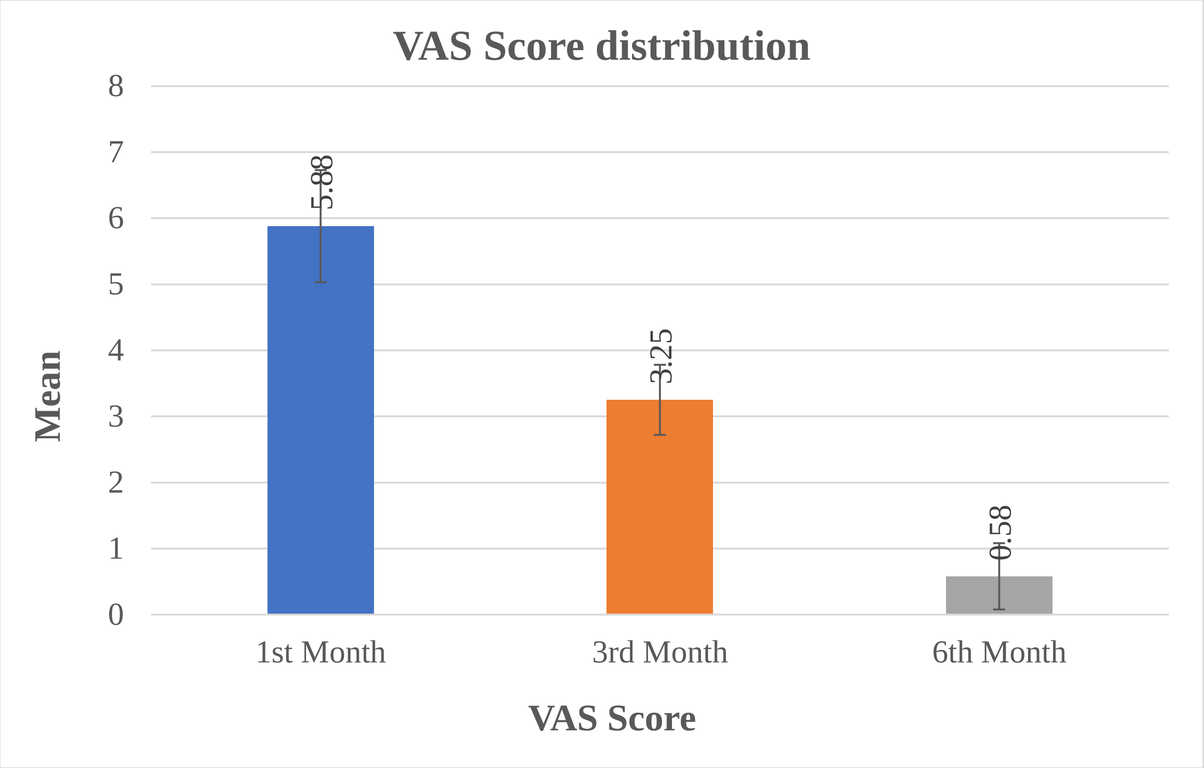


Figure 29: Pie diagram showing VAS Score distribution at different periods of follow-up

DISCUSSION

Adults and older people are more likely to sustain proximal humerus fractures. However, the majority of them have little to no displacement and may be managed conservatively with little to no complications and a successful functional recovery. But around one-fifth of patients with displaced fractures may be candidates for surgical treatment.[98]

For individuals who have displaced complicated fracture patterns or ischemic necrosis of the humeral head after a fracture, hemiarthroplasty is thought to be the standard of therapy. Studies with follow-up of up to 10 years have shown that effective pain treatment is achievable. A considerable minority of patients, although getting sufficient pain management, have only fair functional outcomes, according to other studies, even though many demonstrate Up to 90% of patients have good-to-excellent outcomes. after proximal humeral fracture hemiarthroplasty, the average forward elevation is 110 degrees, with a range of 20 to 180 degrees. Prosthetic revision rates are modest despite a wide range in function, with 97% survival rates after one year, 95% after five years, and 94% after ten years. There is, however, a dearth of research on the dangers, advantages, and functional outcomes of patients who have had hemiarthroplasty in India, particularly in the South Indian population. These questions are the purpose of the investigation.

Hence a Prospective study was conducted among 24 subjects undergoing primary hemiarthroplasty at SDUAHER's R.L. Jalappa Hospital and Research Center Sri Devaraj URS Medical College has an orthopaedics department. The study duration was 1 year 6 months. Before the study began, institutional ethical clearance was acquired. Before the trial began, every patient who was included provided their informed permission. The objectives of the study were to assess functional outcome [DASH Score] of complex proximal humerus fractures treated with hemiarthroplasty.

Age distribution:

The average age of the participants in the current research was 58.79 4.587 years. 33.3% of the population was over 60 years old, while 66.7% of the population was under 60. The results agreed with Neer's research' conclusions about age incidence.[21,23] (55.3 years), compared to 52 years 99 in another research. In their epidemiological research, Court-Brown et al. 100 reported an average age of 66 years, 56 years for males, and 70 years for women.

Table 11: Age distribution comparison

Neer's Study[21,23]	55.3
Dolfi Herscovici[99]	52
Roland P. Jacob[101]	49.5
Court-Brown et al.,[100]	66
Present Study	58.79

Gender distribution:

Regarding gender distribution in literature, predominance of proximal humeral fractures was seen in females[102]. 37.5% of the participants in this research were women, whereas 62.5% were men. The ratio of males to females in the current research was 1.66:1. The male predominance in the study can be due to sampling error or majority of the subjects who presented had RTA.

Table 12: Gender distribution comparison

	Male: female	Male: female ratio
Dolfi Herscvici[99]	22:18	1:0.8
Koji Yamamoto[103]	7:9	1:1.3
Roland P. Jacob [101]	20:10	1:0.5
Court-Brown et al.,[100]	15:35	1:2.3
Present Study	15:9	1.66:1

Dolfi Herscvici et al.,[99] Roland P. Jacob et al.,[101] showed similar findings to the present study with male preponderance. Were as studies by **Koji Yamamoto et al.,[103]** and **Court-Brown et al.,[100]** showed female preponderance. Due to the absence of post-menopausal care and awareness, Women in their fifties see a linear increase in their fracture risk. As the population matures, PHF is more prevalent. There are primarily two categories of risk factors for PHF osteoporotic fractures. Bone fragility is the initial concern, followed by the danger of falling. Bone fragility causes the fracture to become more severe..

Mode of injury:

In the present study 79.2% had RTA and 20.8% had slip and fall. Bone fragility causes the fracture to become more severe. These findings were found to be in line with other research in the literature.[100,104] Consequently, of the forty cases examined, indicated 19 (45%) traffic accidents, 20 (50%) history of falls, and 1 (5%), history of assault. Another research looked at 16 instances, of whom 12 (or 75% of them) had traffic accidents and 4 (25% of them) had prior falls. When we compare the findings of our study to those of previous series, as we can see, the prevalence of high-velocity injuries seen in auto accidents has entirely changed how these fractures are thought of.

Table 13: Mode of Injury Related Study Pattern

	RTA	Fall	Assault	Electric Shock	Total
Dolfi Herscovici[99]	19(47.5%)	20(50%)	01(2.5%)	00	40
Koji Yamamoto[103]	12(75%)	04(25%)	00	00	16
Present Study	19 (79.2%)	5 (20.8%)	00	00	24

Side of Injury:

In the current study, 41.7% of participants had left side injury and 58.3% had right side damage. The dominant side in studies 102, 104, and 105 was the right side in 55.7%, 50%, and 53%, respectively.

Type of Fracture:

In the present study 62.5% had Neer's Type 3 and 37.5% had Neer's Type 4. Neer[99,107] According to the study, 31 (26.5%) of the fractures were in two parts, 43 (36.8) were in three parts, and 43 (36.8%) were in four parts. According to Dolfi Herscovici's study, the incidence of fracture type is virtually compatible with studies in the literature, with 20 (50%) being 2-part fractures, 16 (40%) being 3-part fractures, and 4 (10%) being 4-part fractures.[99]qqqqqqqqq

Our study included only Neer's type 3 and Type 4 in the inclusion criteria. Hence Type of fracture depends on selection criteria as well. Displaced three-part fractures are challenging to reduce and considerably more challenging to hold decreased if the bigger tuberosity was related to the head, since this would have likely caused it to be driven into external rotation with the humeral articular surface facing forward (unstable Fracture).The articular surface was oriented posteriorly if the smaller tuberosity was connected to it. The pectoralis major and fracture fragment were probably wedged together by the large head of the biceps, which pulled the shaft medially and prevented reduction. Additionally, because the fracture frequently occurred in osteoporotic bone, jarring handling and repeated reduction efforts may cause further comminution at the fracture site.

Table 14: Type of Fracture.

	2 part #	3 part #	4 part #	# With dislocation	Total
Neer's Study[21]	31(26.4%)	43(36.8%)	43(36.8%)	00	117
Dolfi Herscovici[99]	20(50%)	16(40%)	04(10%)	00	40
Present Study	00	15 (62.5%)	9 (37.5%)	00	24

In the study by **Tian X et al.,[106]** it was observed that 27.9%were males and 72.1% were females. Mean age was 72.0 years. Most common mode of injury was fall in 90.7% of cases and 9.3% had traffic injury. 76.7% had right side injury and 23.3% had left side injury. According to Neer classification, 48.8%, were Type 3 and 51.2% were four- part fracture.

DASH Score:

The DASH, which assesses shoulder, elbow, wrist, and hand function in one metric on a range of 0 to 100, with 0 being the highest possible score (full functional capacity) and 100 being the worst possible score, has been extensively associated with shoulder-specific measurements (no functional ability).[107] The DASH has been proven to have the strongest correlation with pain levels of any validated measure of upper extremity functional status.[108] Following surgery, all patients received regular physical therapy. At 1, 3, and 6 months, DASH evaluations of the patients were performed.

In the present study Median DASH score at 1st month was 56, at 3rd month was 31 and at 6th month was 9. When compared to the first month, the DASH score significantly dropped in the third and sixth months. In the study by **Narayanan VL et al.,[109]** At the end of a year, the average DASH score for proximal humerus fractures treated with locking compression plates was 8.69, similarly **Ismail et al.,**[110] and **Altmen et al.,**[111] observed similar DASH scores. However, the techniques used in these studies are different from Hemiarthroplasty. This could cause the difference in outcome.

Fisher ND et al.,[112] in their study observed mean DASH score of 22.23±21.8 at 12 months of follow-up. **Bahrs et al.**[113] The average DASH score was found to be 12 points. In 43 patients who received locking compression plates for proximal humeral fractures, Schulte et al[114] discovered a mean DASH score of 11 points (range 0–21.7).**Plath et al.**[115] compared individuals older than 60 treated with a locking plate or a locking blade for a proximal humeral fracture (PHILOS). One year following surgery, patients who received locking plates had a median DASH score of 42 19 points.

Zhao Let al.,[116] observed that mean DASH Score in observational group was 17.95 ± 7.47 at 12 months of follow-up. Our study measured DASH scores at 1,3 and 6 months. Although there were no similar studies comparing the DASH scores at difference intervals. The outcome was similar i.e., significant reduction in DASH score during follow-up was noted in the literature.

VAS Score:

At the first month, the median VAS score was 6, at the third month, 3, and at the sixth month, 1. When compared to the first month, the VAS score significantly decreased in the third and sixth months. **Tian X et al.,**[117] found that the average VAS score was 0.8(0–3) at last follow-up. **Zhao Let al.,**[116] noted that the average VAS score was 1.14 ± 0.96 at 12-month follow-up. **Samborski SA et al.,**[118] discovered that after one year of follow-up, the mean VAS Scores in the surgical group had significantly decreased. At 1, 3, and 6 months, VAS scores were evaluated in our study. Although there were no similar studies comparing the vas scores at difference intervals. The outcome was similar i.e., significant reduction in vas score during follow-up was noted in the literature.

Complications:

In the present study 4.2% had Respiratory Distress and there were no other complications.

Table 15: Complications comparison

	Neer's [21,23]	Richard J Hawkins [119]	Present Study
Stiffness	00	00	00
Post op infection	03	00	00
Implant loosening	00	02	00
Malunion	04	00	00
Non-union	07	00	00
Osteonecrosis	08	02	00
Respiratory distress	00	00	01

In the studies by Neer's et al., [21,23 and] **Richard J Hawkins et al.[119]** exhibited a number of additional problems, none of which were evident in the current investigation, including post-operative infections, implant loosening, malunion, non-union, and osteonecrosis. Our study, which is based on the aforementioned research, demonstrates that hemiarthroplasty is a viable solution for adults and elderly Indian patients with complex fracture patterns and compares favorably to the other global studies in this area. The composite results were assessed in connection to the patient age distribution, sex, time since injury, fracture classification, DASH Score, and VAS Scores, among other variables. The current study was remarkable in its area since DASH Scores and VAS Scores were evaluated during all follow-up periods, and there was no patient attrition (i.e., loss to follow-up).

CONCLUSON

From the study findings it can be concluded that complex proximal humerus fractures undergoing primary hemiarthroplasty had significant functional improvement. DASH score significantly improved from the first month to the third and sixth months. At three and six months, the VAS score both showed a substantial reduction in pain. In this study, a lower rate of problems was seen.

RECOMMENDATIONS

From the study findings it is recommended that primary hemiarthroplasty can be utilized to treat complicated proximal humerus fractures. considering the significant improvement in DASH score and VAS Scores. Primary hemiarthroplasty had minimal complication rate. Hence a suitable method in treating complex proximal humerus fractures.

LIMITATIONS

1. Small sample size
2. Convenient sampling – can lead to selection bias
3. No Comparison group – Ideally a comparison group with standard treatment method or other method of treatment can provide better results than a single group study.
4. DASH Score and VAS score are subjective in nature hence other methods to be used to assess the outcome.

SUMMARY

A Prospective study was conducted among 24 subjects undergoing primary hemiarthroplasty at Orthopaedics division, Sri Devaraj Urs Medical College, R.L. Jalappa Hospital and Research Center, SDUAHER. The study duration was 1 year 6 months. Before the study began, institutional ethical clearance was acquired. Before the trial began, informed permission was sought from each patient who was included.

1. Mean age of subjects was 58.79 ± 4.587 years. In the present study 66.7% were under 60 years old, while 33.3% were over 60 years old.
2. In the present study 79.2% had RTA and 20.8% had slip and fall.
3. In the present study Left side injuries made up 41.7%, while right side injuries made up 58.3%.
4. In the present study 62.5% had Neer’s Type 3 and 37.5% had Neer’s Type 4.
5. In the present study 4.2% had Respiratory Distress.
6. Median DASH score at 1st month was 56, at 3rd month was 31 and at 6th month was 9. When compared to the first month, the DASH score significantly decreased in the third and sixth months.
7. At the first month, the median VAS score was 6, at the third month, 3, and at the sixth month, 1. When compared to the first month, the VAS score significantly decreased in the third and sixth months.

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ANNEXURE I: PATIENT INFORMATION SHEET

STUDY TITLE: “EVALUATION OF FUNCTIONAL OUTCOME OF COMPLEX PROXIMAL HUMERUS FRACTURE TREATED WITH HEMI ARTHROPLASTY - A PROSPECTIVE STUDY”

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details: Patients presenting with proximal humerus fracture in the Emergency department of R.L.J. HOSPITAL AND RESEARCH CENTRE, attached to SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR

Patients in this study will have to undergo routine blood investigations (CBC, RFT, serum electrolytes, blood grouping, HIV & HBsAG), chest x ray, ECG and x-ray of shoulder–AP and axillary view.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study, we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don’t wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will not be made publicly available. Your original records may be reviewed by your doctor or ethics review board. For further information/ clarification please contact

Dr. KANCHUBOINA GNANA KIRAN THEJA,
Department of Orthopaedics,
SDUMC, Kolar
CONTACT NO: 7406618950

ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ

ಅಧ್ಯಯನದ ಶೀರ್ಷಿಕೆ: “ಹೆಮಿ ಆರ್ತ್ರೋಪ್ಲ್ಯಾಸ್ಟಿ ಯೊಂದಿಗೆ ಅಭಿವೃದ್ಧಿಪಡಿಸಿದ ಕಾಂಪ್ಲೆಕ್ಸ್ ಪ್ರಾಕ್ಸಿಮಲ್ ಹ್ಯೂಮರಸ್ ಫ್ರ್ಯಾಕ್ಚರ್‌ನ ಕ್ರಿಯಾತ್ಮಕ ಕಾರ್ಯದ ಮೌಲ್ಯಮಾಪನ - ಒಂದು ನಿರೀಕ್ಷಿತ ಅಧ್ಯಯನ”

ಅಧ್ಯಯನದ ಸ್ಥಳ: ಕೋಲಾರ್‌ನ ತಮಾಕಾದ ಶ್ರೀ ದೇವರಾಜ್ ಉರ್ಸ್ ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಲಗತ್ತಿಸಲಾದ ಆರ್ ಎಲ್ ಜಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ.

ವಿವರಗಳು- ಆರ್.ಎಲ್.ಜೆ.ನ ತುರ್ತು ವಿಭಾಗದಲ್ಲಿ ಪ್ರಾಕ್ಸಿಮಲ್ ಹ್ಯೂಮರಸ್ ಮುರಿತದೊಂದಿಗೆ ರೋಗಿಗಳು. ಹಾಸ್ಪಿಟಲ್ ಮತ್ತು ರಿಸರ್ಚ್ ಸೆಂಟರ್, ಶ್ರೀ ದೇವರಾಜ್ ಯುಆರ್ಎಸ್ ಮೆಡಿಕಲ್ ಕಾಲೇಜ್, ತಮಕಾ, ಕೋಲಾರ್ಗೆ ಲಗತ್ತಿಸಲಾಗಿದೆ

ಈ ಅಧ್ಯಯನದಲ್ಲಿರುವ ರೋಗಿಗಳು ದಿನನಿತ್ಯದ ರಕ್ತ ತನಿಖೆಗೆ ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ (ಸಿಬಿಸಿ, ಆರ್‌ಎಫ್‌ಟಿ, ಸೀರಮ್ ವಿದ್ಯುದ್ವಿಚ್, ◌ೕದ್ಯಗಳು, ರಕ್ತ ಗುಂಪು, ಎಚ್‌ಐವಿ ಮತ್ತು ಎಚ್‌ಬಿಎಸ್‌ಎಜಿ), ಎದೆಯ ಎಕ್ಸರೆ, ಇಸಿಜಿ ಮತ್ತು ಭುಜ-ಎಪಿ ಮತ್ತು ಎಕ್ಸರೆ ಮತ್ತು ಆಕ್ಸಿಲರಿ ವೀಕ್ಷಣೆ

ದಯವಿಟ್ಟು ಈ ಕೆಳಗಿನ ಮಾಹಿತಿಯನ್ನು ಓದಿ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರೊಂದಿಗೆ ಚರ್ಚಿಸಿ. ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಬಹುದು. ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನೀವು ಒಪ್ಪಿದರೆ, ನಿಮ್ಮಿಂದ ಅಥವಾ ನಿಮ್ಮ ಅಥವಾ ಇಬ್ಬರ ಜವಾಬ್ದಾರಿಯುತ ವ್ಯಕ್ತಿಯಿಂದ ನಾವು ಮಾಹಿತಿಯನ್ನು (ಪ್ರೊಫಾರ್ಮಾದ ಪ್ರಕಾರ) ಸಂಗ್ರಹಿಸುತ್ತೇವೆ. ಸಂಬಂಧಿತ ಇತಿಹಾಸವನ್ನು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು. ಸಂಗ್ರಹಿಸಿದ ಈ ಮಾಹಿತಿಯನ್ನು ಪ್ರಬಂಧ ಮತ್ತು ಪ್ರಕಟಣೆಗೆ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಲಾದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸುವುದಿಲ್ಲ. ನಿಮ್ಮ ಗುರುತು ಬಹಿರಂಗಗೊಳ್ಳುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವನ್ನು ಸಾಂಸ್ಥಿಕ ನೈತಿಕ ಸಮಿತಿಯು ಪರಿಶೀಲಿಸಿದೆ ಮತ್ತು ಸಾಂಸ್ಥಿಕ ನೈತಿಕ ಸಮಿತಿಯ ಸದಸ್ಯರನ್ನು ಸಂಪರ್ಕಿಸಲು ನೀವು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ಈ ಅಧ್ಯಯನವನ್ನು ಒಪ್ಪಿಕೊಳ್ಳಲು ಯಾವುದೇ ಬಲವಂತವಿಲ್ಲ. ನೀವು ಭಾಗವಹಿಸಲು ಬಯಸದಿದ್ದರೆ ನೀವು ಪಡೆಯುವ ಕಾಳಜಿ ಬದಲಾಗುವುದಿಲ್ಲ. ಈ

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನೀವು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪಿಕೊಂಡರೆ ಮಾತ್ರ ನೀವು ಹೆಬ್ಬೆರಳು ಅನಿಸಿಕೆಗೆ ಸಹಿ / ಒದಗಿಸುವ ಅಗತ್ಯವಿದೆ.

ಗೌಪ್ಯತೆ

ನಿಮ್ಮ ವೈದ್ಯಕೀಯ ಮಾಹಿತಿಯನ್ನು ಅಧ್ಯಯನ ವೈದ್ಯರು ಮತ್ತು ಸಿಬ್ಬಂದಿ ಗೌಪ್ಯವಾಗಿಡುತ್ತಾರೆ ಮತ್ತು ಸಾರ್ವಜನಿಕವಾಗಿ ಲಭ್ಯವಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಮೂಲ ದಾಖಲೆಗಳನ್ನು ನಿಮ್ಮ ವೈದ್ಯರು ಅಥವಾ ನೈತಿಕ ಪರಿಶೀಲನಾ ಮಂಡಳಿಯು ಪರಿಶೀಲಿಸಬಹುದು. ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ / ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ದಯವಿಟ್ಟು ಸಂಪರ್ಕಿಸಿ

ಡಾ. ಕಾಂಚುಬೊಯಿನಾ ಜ್ಞಾನ ಕಿರಣ್ ಥೇಜಾ,

ಆರ್ಥೋಪೆಡಿಕ್ಸ್ ಇಲಾಖೆ,

SDUMC, ಕೋಲಾರ

ಸಂಪರ್ಕ ಸಂಖ್ಯೆ: 7406618950

ANNEXURE II: INFORMED CONSENT

I Mr./Mrs. __________ have been explained in my own understandable language, that I will be included in a study which is **“EVALUATION OF FUNCTIONAL OUTCOME OF COMPLEX PROXIMAL HUMERUS FRACTURE TREATED WITH HEMI ARTHROPLASTY”**

I have been explained that my clinical findings, investigations, postoperative findings will be assessed and documented for study purpose.

I have been explained my participation in this study is entirely voluntary, and I can withdraw from the study any time, and this will not affect my relationship with my doctor or the treatment for my ailment.

I have been explained about the interventions needed possible benefits and adversities due to interventions, in my own understandable language.

I have understood that all my details found during the study are kept confidential and while publishing or sharing of the findings, my details will be masked.

I have principal investigator mobile number for enquiries.

I in my sound mind give full consent to be added in the part of this study.

Signature of the patient:

Name:

Signature of the witness:

Name:

Relation to patient:

Place:
Date:

ಮಾಹಿತಿ ಕಾನ್ಸೆಂಟ್ ಫಾರ್ಮ್

ನಾನು ಶ್ರೀ / ಶ್ರೀ. __________ ಅನ್ನು ನನ್ನ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ, ಇದು "ಹೆಮಿ ಆರ್ತ್ರೋಪ್ಲ್ಯಾಸ್ಟಿ ಯೊಂದಿಗೆ ಅಭಿವೃದ್ಧಿಪಡಿಸಿದ ಕಾಂಪ್ಲೆಕ್ಸ್ ಪ್ರಾಕ್ಸಿಮಲ್ ಹ್ಯೂಮರಸ್ ಫ್ರ್ಯಾಕ್ಚರ್ನ ಕ್ರಿಯಾತ್ಮಕ ಕಾರ್ಯದ ಮೌಲ್ಯಮಾಪನ" ಎಂಬ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನನ್ನು ಸೇರಿಸಲಾಗುವುದು.

ನನ್ನ ಕ್ಲಿನಿಕಲ್ ಆವಿಷ್ಕಾರಗಳು, ತನಿಖೆಗಳು, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರದ ಸಂಶೋಧನೆಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಅಧ್ಯಯನದ ಉದ್ದೇಶಕ್ಕಾಗಿ ದಾಖಲಿಸಲಾಗುತ್ತದೆ ಎಂದು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಭಾಗವಹಿಸುವಿಕೆಯು ಸಂಪೂರ್ಣವಾಗಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ ಎಂದು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ, ಮತ್ತು ನಾನು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು ಮತ್ತು ಇದು ನನ್ನ ವೈದ್ಯರೊಂದಿಗಿನ ನನ್ನ ಸಂಬಂಧ ಅಥವಾ ನನ್ನ ಕಾಯಿಲೆಗೆ ಚಿಕಿತ್ಸೆಯ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರುವುದಿಲ್ಲ.

ನನ್ನ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ, ಮಧ್ಯಸ್ಥಿಕೆಗಳ ಕಾರಣದಿಂದಾಗಿ ಸಂಭವನೀಯ ಪ್ರಯೋಜನಗಳು ಮತ್ತು ಪ್ರತಿಕೂಲತೆಗಳ ಅಗತ್ಯವಿರುವ ಮಧ್ಯಸ್ಥಿಕೆಗಳ ಬಗ್ಗೆ ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಕಂಡುಬರುವ ನನ್ನ ಎಲ್ಲಾ ವಿವರಗಳನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗಿದೆ ಮತ್ತು ಸಂಶೋಧನೆಗಳನ್ನು ಪ್ರಕಟಿಸುವಾಗ ಅಥವಾ ಹಂಚಿಕೊಳ್ಳುವಾಗ, ನನ್ನ ವಿವರಗಳನ್ನು ಮರೆಮಾಚಲಾಗುತ್ತದೆ ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ವಿಚಾರಣೆಗಾಗಿ ನನ್ನ ಬಳಿ ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ ಮೊಬೈಲ್ ಸಂಖ್ಯೆ ಇದೆ.

ಈ ಅಧ್ಯಯನದ ಭಾಗದಲ್ಲಿ ಸೇರಿಸಲು ನನ್ನ ಸಂಪೂರ್ಣ ಮನಸ್ಸಿನಲ್ಲಿ ನಾನು ಸಂಪೂರ್ಣ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ.

ರೋಗಿಯ ಸಹಿ:

ಹೆಸರು:

ಸಾಕ್ಷಿಯ ಸಹಿ:

ಹೆಸರು:

ರೋಗಿಗೆ ಸಂಬಂಧ:

ಸ್ಥಳ:

ದಿನಾಂಕ:

ANNEXURE III: PROFORMA

Case no:

IP no:

TITLE:

"EVALUATION OF FUNCTIONAL OUTCOME OF COMPLEX PROXIMAL HUMERUS FRACTURE TREATED WITH HEMI ARTHROPLASTY - A PROSPECTIVE STUDY"

1. BASIC DATA

- Name
- Age/Sex
- Address
- Mobile No.
- Date of Procedure
- Date of Admission/OP
- Date of Discharge

History:

Mechanism of injury:

General physical examination:

Vitals: Pulse: B.P:

RR: Temp:

Systemic examination:

- CVS:
- RS:
- PS:
- CNS:

Preexisting systemic illness:

- Diabetes/Thyroid disorder/ Cervical Spine/ CVS/RS/ CNS/locomotor/ TB/ anemia/ Hypertension/ malnutrition/others

Local examination:

- Side : Left/Right/Bilateral
- Deformity : Present/Absent
- Swelling : Present/Absent
- Tenderness : Present/Absent
- ROM @ shoulder : Full / Restricted
- Distal sensation : Present/Absent
- Distal pulsation : Palpable /Absent
- Any other associated fractures:

RADIOLOGICAL INVESTIGATIONS:

- X ray with shoulder AP and AXILLARY VIEW.

2. DIAGNOSIS:

3. INVESTIGATIONS:

- CBC,
- BT,
- CT,
- Blood grouping
- Blood urea,
- serum creatinine,
- RBS
- HIV, HBsAg status

4. TREATMENT:

OPERATIVE TREATMENT: HEMIARTHROPLASTY

- Operations date –
- Type of anesthesia:
- Approach used:
- Implant used:

5. POST PROCEDURE

- Observation in surgical ICU
- Immobilization of shoulder
- NSAID’s
- Antibiotics Prophylactic/therapeutic/Nil

Complications:

Early:

Delayed:

Late:

Local complications

1. Necrosis of skin
2. Infection: a) suspected/established.

   b) superficial/deep.

   c) mild/moderate/severe.
3. Hematoma
4. Others

Further treatment of complications

None / Hematoma aspirated / Open dressing / Debridement / Suction irrigation / Plastic / Procedure / Physiotherapy.

6. TIME OF DISCHARGE:

Rom assessment

Overall functional assessment according to DASH score and VAS score

Complications

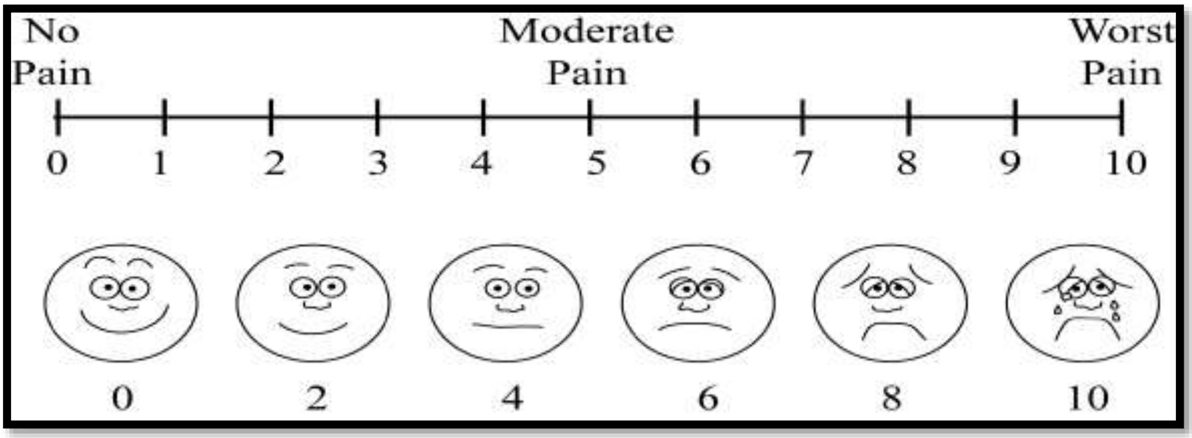
1. Systemic: Healed/Improved/Unchanged/Dies/Nil
2. Local: Healed/Improved/Unchanged/Nil

RANGE OF MOTION:

MOVEMENT	1 MONTH	3 MONTHS`	6 MONTHS
FLEXION			
EXTENSION			
ADDUCTION			
ABDUCTION			
INTERNAL ROTATION			
EXTERNAL ROTATION			

TOTAL DAS SCORE	1 MONTH	3 MONTHS`	6 MONTHS

TOTAL VAS SCORE	1 MONTH	3 MONTHS`	6 MONTHS



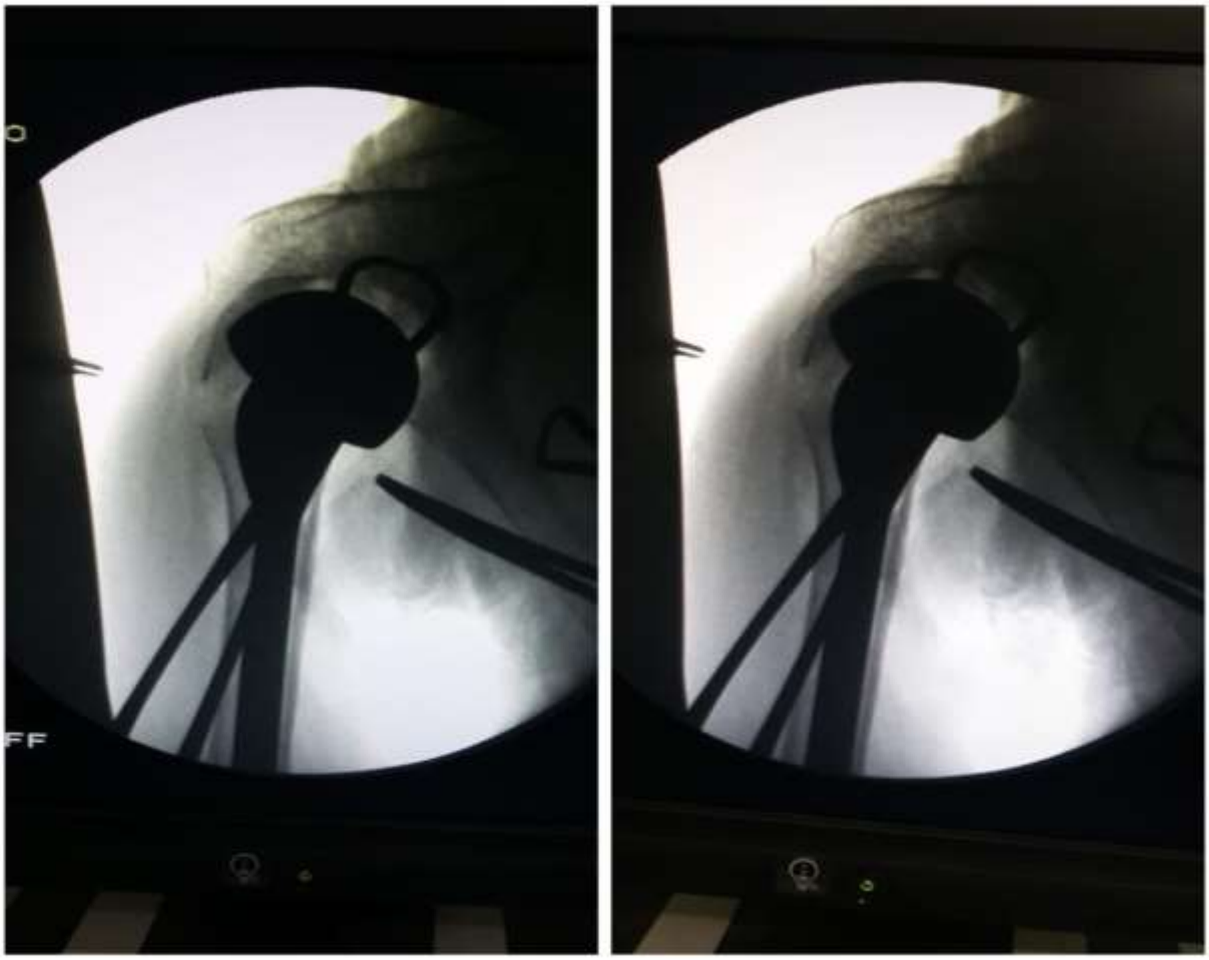
ANNEXURE IV: IMAGES

OT EQUIPMENTS

INTRA OP IMAGES PAINTING AND MARKING

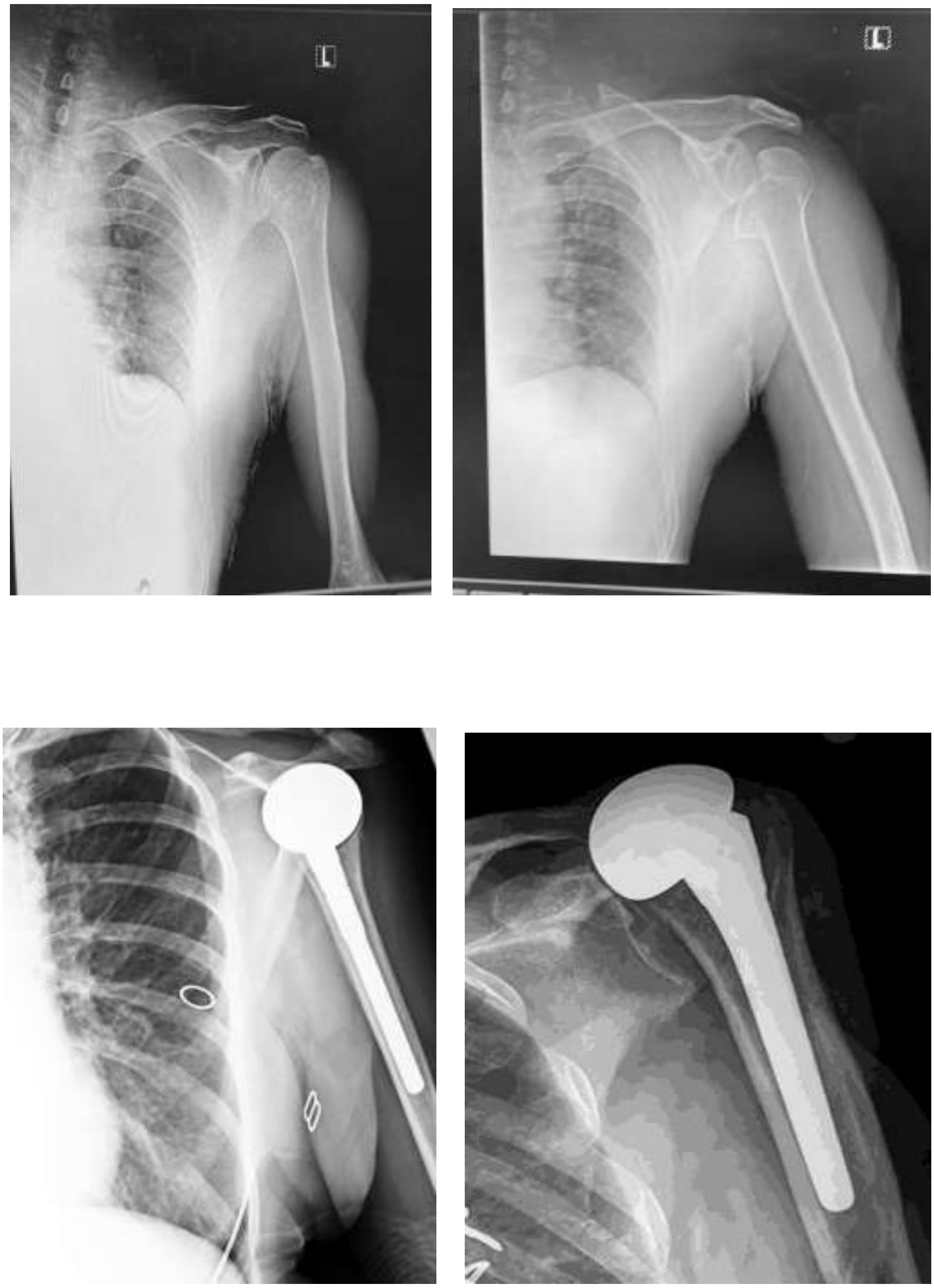
INCISION AND IMPLANT

FLUROSCOPY IMAEGS



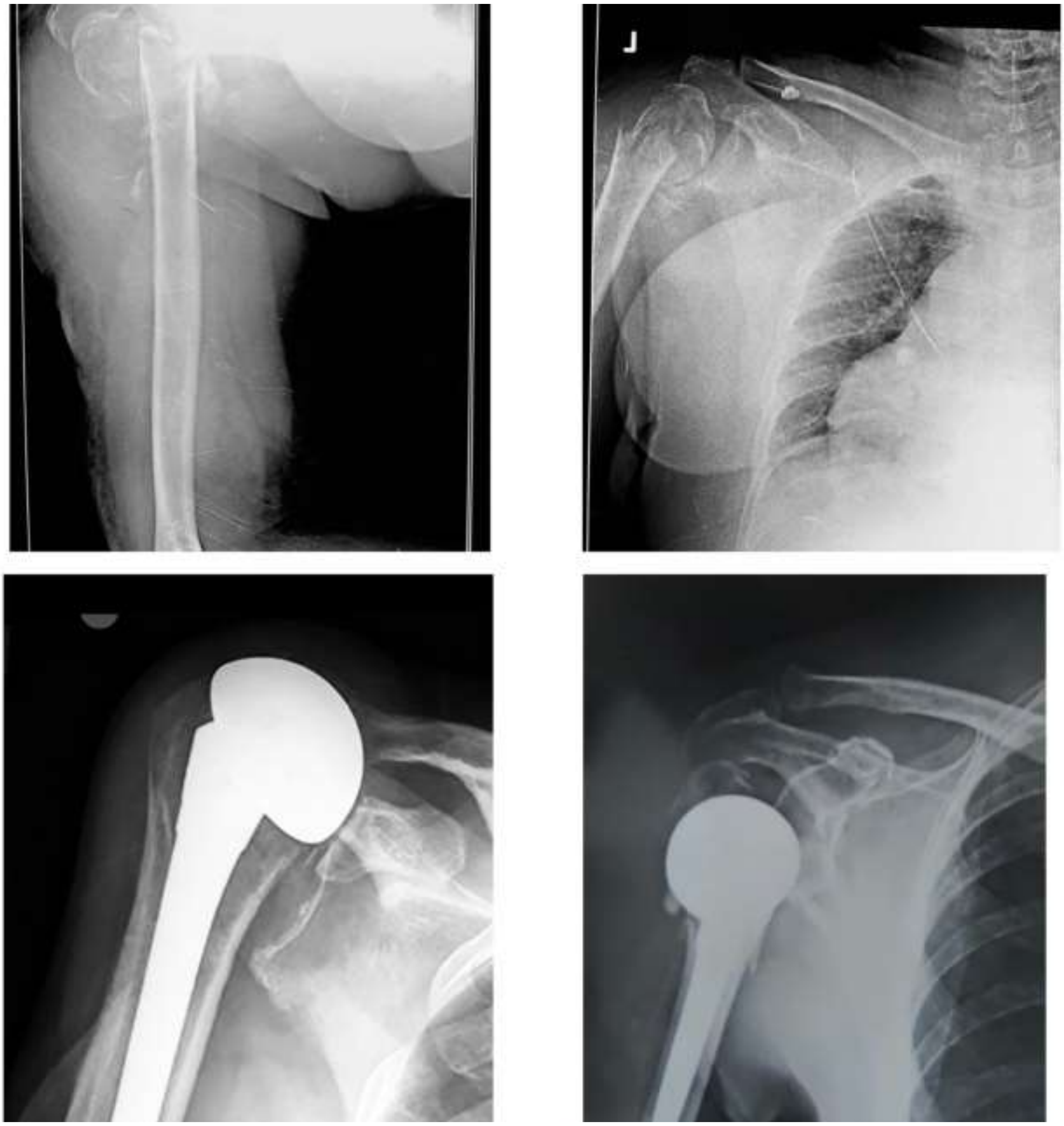
DR. MUKERJI'S PROSTHESIS

Pre-op and post op X-rays case 1



Follow up images case 1

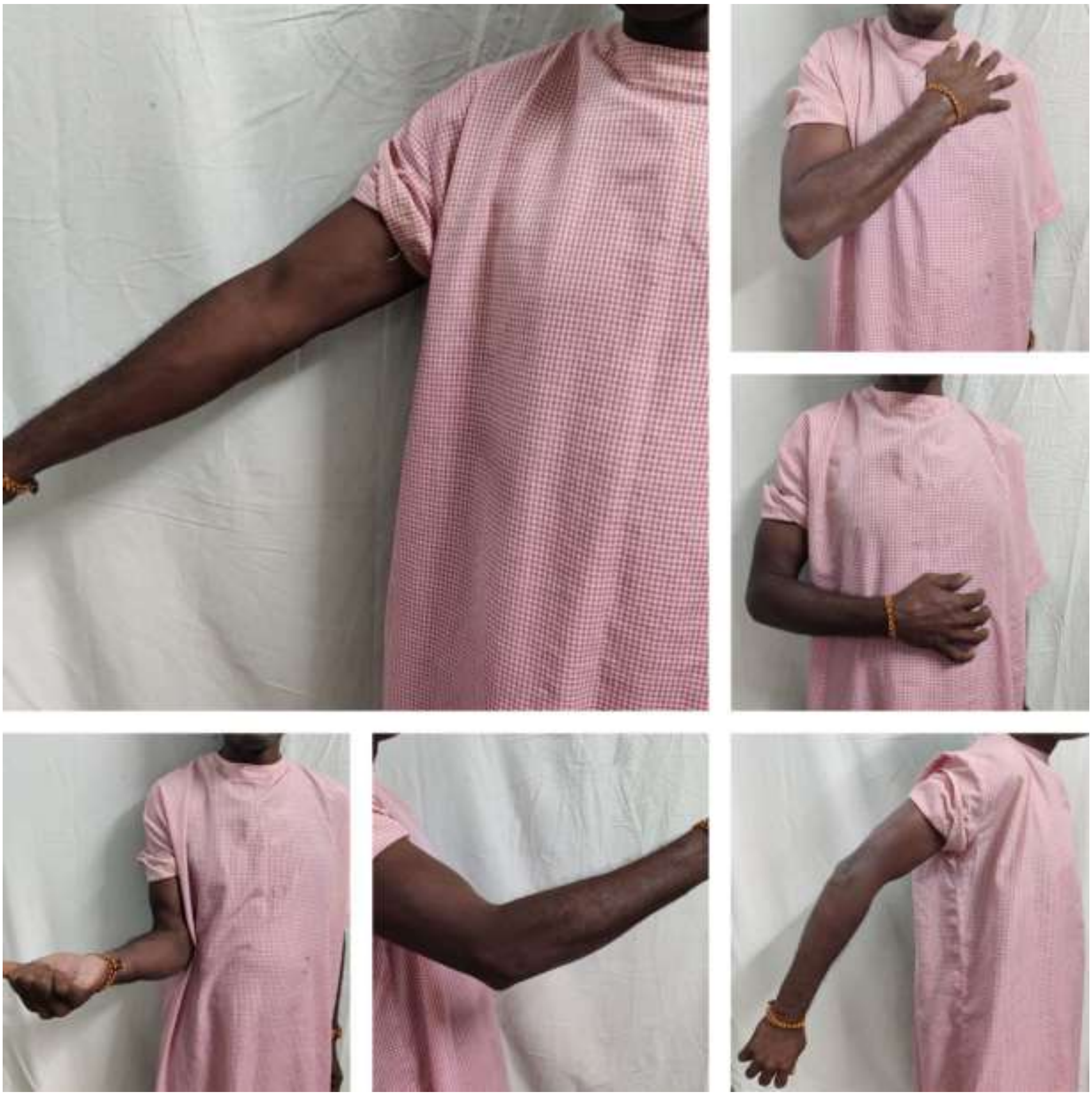
Pre op and post op X-rays case 5



Follow up images case 5

Pre op and post op X-rays case 3

Follow up images of case 3



ANNEXURE V: MASTERCHART

SL NO	NAME	AGE	SEX	UHID	MODE	SIDE	DIAGNOSIS	TREATMENT GIVEN	TYPE OF ANESTHESIA	APPROACH	COMPLICATIONS	FOLLOW UP	DASH SCORE 1ST MONTH	DASH SCORE 3RD MONTH	DASH SCORE 6TH MONTH	VAS SCORE 1ST MONTH	VAS SCORE 3RD MONTH	VAS SCORE 6TH MONTH
1	HANUMANTHAPPA	53	MALE	946224	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	68	44	20	5	3	1
2	YASHWANTH	56	MALE	943743	SLIP AND FALL	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	72	42	19	5	3	1
3	DORA SWAMY	61	MALE	843758	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	59	38	14	6	4	0
4	MANASA	56	FEMALE	943322	SLIP AND FALL	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	58	33	9	7	3	1
5	POORNIMA	60	FEMALE	943780	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	49	29	10	7	3	0
6	ANANDAMMA	68	FEMALE	943230	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	53	24	8	6	4	1
7	BASAPPA	58	MALE	943160	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	42	19	9	5	3	1
8	SYED KHALEEL	56	MALE	847527	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	40	20	7	5	3	1
9	VARALAKSHMI	65	FEMALE	146220	SLIP AND FALL	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	68	44	18	6	4	0
10	JAYALAKSHMAMMA	52	FEMALE	923754	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	72	42	14	7	3	0
11	SAROJA BHAI	65	FEMALE	941499	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	RESPIRATORY DISTRESS	6 MONTHS	59	38	14	7	3	1
12	RAMAPPA	54	MALE	844139	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	58	33	9	6	4	0
13	CHANDHAN	51	MALE	944131	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	49	29	10	5	3	1
14	LAVANYA	60	FEMALE	942119	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	53	24	8	5	3	1
15	ARJUN	54	MALE	844128	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	42	19	9	6	4	0
16	PAVITHRA	55	FEMALE	944181	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	40	20	7	7	3	1
17	SOMANATH	60	MALE	944146	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	68	44	10	5	3	0
18	RAGAVAIAH	60	MALE	943140	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	59	38	12	5	3	1
19	VISHWANATH	62	MALE	844197	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	58	33	9	6	4	0
20	ASHWATHAPPA	62	MALE	939022	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	49	29	10	7	3	0
21	SHYAMALAMMA	58	FEMALE	839070	SLIP AND FALL	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	53	24	8	5	3	1
22	RAMESH	62	MALE	793051	RTA	RIGHT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	42	19	0	5	2	0
23	CHANDRAPPA	57	MALE	839054	SLIP AND FALL	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	40	20	0	6	3	1
24	MOHAMMED KHALEEI	66	MALE	839054	RTA	LEFT	CLOSED DISPLACED RIGHT PROXIMAL HUMERUS FRACTURE	SHOULDER HEMI	GA	DELTO PECTORAL	NIL	6 MONTHS	58	33	0	7	4	1