"PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION & INTERNAL FIXATION"

Dissertation Submitted to

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY

CHENNAI

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M.S. DEGREE - BRANCH II

ORTHOPAEDIC SURGERY

Reg. No. : 221712006

MADRAS MEDICAL COLLEGE

INSTITUTE OF ORTHOPAEDICS AND TRAUMATOLOGY

RAJIV GANDHI GOVT. GENERAL HOSPITAL

CHENNAI

MAY -2020

CERTIFICATE

This is to certify that this dissertation "**PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION & INTERNAL FIXATION"** is a bonafide record of work done by **Dr. B. MANIMARAN,** during the period of his post graduate study under guidance and supervision in the INSTITUTE OF ORTHOPEDICS AND TRAUMATOLOGY, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai – 600 003, in partial fulfilment of the requirement for **M.S. ORTHOPAEDIC SURGERY** degree Examination of The Tamilnadu Dr. M.G.R. Medical University to be held in May 2020.

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DECLARATION

I declare that the dissertation entitled **"PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION & INTERNAL FIXATION"** submitted by me for the degree of MS ORTHO is the record work carried out by me during the period of my post graduate under the guidance of **Prof. A. PANDIASELVAN** MS Ortho., D. Ortho., Professor of Orthopaedics, Institute of Orthopaedics and Traumatology, Madras Medical College, Chennai. This dissertation is submitted to the Tamilnadu Dr. MGR Medical University Chennai, in partial fulfillment of the university regulations for the award of **MS Degree in Orthopaedics (Branch II)** examination to be held in May 2020.

Signature of the candidate

Place :

Date :

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Signature of the Guide
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INSTITUTIONAL ETHICS COMMITTEE
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CERTIFICATE OF APPROVAL

To
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Dear Dr.B.Manimaran,

The Institutional Ethics Committee has considered your request and approved your study titled **"PROSPECTIVE & RETROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF GLENOID AND PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION & INTERNAL FIXATION " - NO.10042018**

The following members of Ethics Committee were present in the meeting held on **03.04.2018** conducted at Madras Medical College, Chennai 3

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13. Tmt.Arnold Saulina, MA.,MSW., :Social Scientist
14. Thiru K.Ranjith, Ch- 91 : Lay Person

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

6/4/18

Member Secretary – Ethics Committee

PLAGIARISM CERTIFICATE

This is to certify that this dissertation work titled **"PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION AND INTERNAL FIXATION"** of the candidate **Dr. B. Manimaran** with Registration no**. 221712006** for the award of degree in M.S. in the branch of Orthopaedics. I personally verified the Urkund.com website for the purpose of plagiarism check. I found that uploaded thesis file contains introduction to conclusion pages and result shows 6% of plagiarism in the dissertation.

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Instances where selected sources appear:

25

ABBREVATIONS

1. ROM- Range of movements
2. CPM- Continous passive motion
3. AP- Antero posterior
4. DOA- Date of admission
5. DOS- Date of surgery
6. IS- Infraspinatus
7. OP- Operative
8. M-Male
9. F- Female

TABLE OF CONTENTS

AIMS AND OBJECTIVES

To assess the functional outcome after treatment of periglenoid fractures of scapula with open reduction and internal fixation.

INTRODUCTION

The scapula is known as the shoulder blade. It articulates with the humerus at the glenohumeral joint, with the clavicle at the acromioclavicular joint and with the thorax at the scapulothoracic joint, thereby the scapula connects the upper extremity and axial skeleton. Full range of movements at the shoulder joint requires movement at all three articulations. Fractures of scapula accounts for 3-5% of all fractures about the shoulder, are most often caused by high energy trauma and are frequently associated with multiple trauma. Among the scapular fractures, glenoid neck fractures account for 5%. Significantly displaced glenoid neck fractures and glenoid neck fractures associated with clavicle fracture (floating shoulder), acromio-clavicular joint disruption, coraco-clavicular and coraco-acromion ligament injury, coracoid and acromion process fractures, humerus fracture leads to glenohumeral joint instability thereby affects the range of movements at the glenohumeral joint. Early surgical intervention with Recon platting and early rehabilitation significantly improves glenohumeral joint function.

ANATOMY OF SCAPULA:

The scapula forms the posterior part of the shoulder girdle. It is a flat, triangular bone. It has two surfaces, three borders, and three angles[1,2].

SURFACES:

1. COSTAL SURFACE:

The costal surface or ventral surface has a broad concavity, known as the subscapular fossa. The fossa is separated from the vertebral border by smooth triangular areas at the medial and inferior angles. At the upper part of the fossa is a transverse depression, where the bone appears to be bent onitself along a line at right angles to and passing through the center of the glenoid cavity, forming the subscapular angle.

2. DORSAL SURFACE:

The dorsal surface, near the axillary borderabout 2.5 cm above the inferior angle gives attachment to a fibrous septum, which separates the Infraspinatus from the Teres major and Teres minor. The surface between the ridge and the axillary border is crossed near its center by the scapular circumflex vessels[2,3]. It also gives attachment to the Teres minor. Its lower third has a broader area which gives origin to the Teres major, and over which the Latissimus dorsi glides.The broad and narrow portions are separated by an oblique line, which runs from the axillary border, downward and backward, to meet the elevated ridge, to which is attached a fibrous septum which separates the Teres muscles from each other.

FIG 1: COSTAL SURFACE

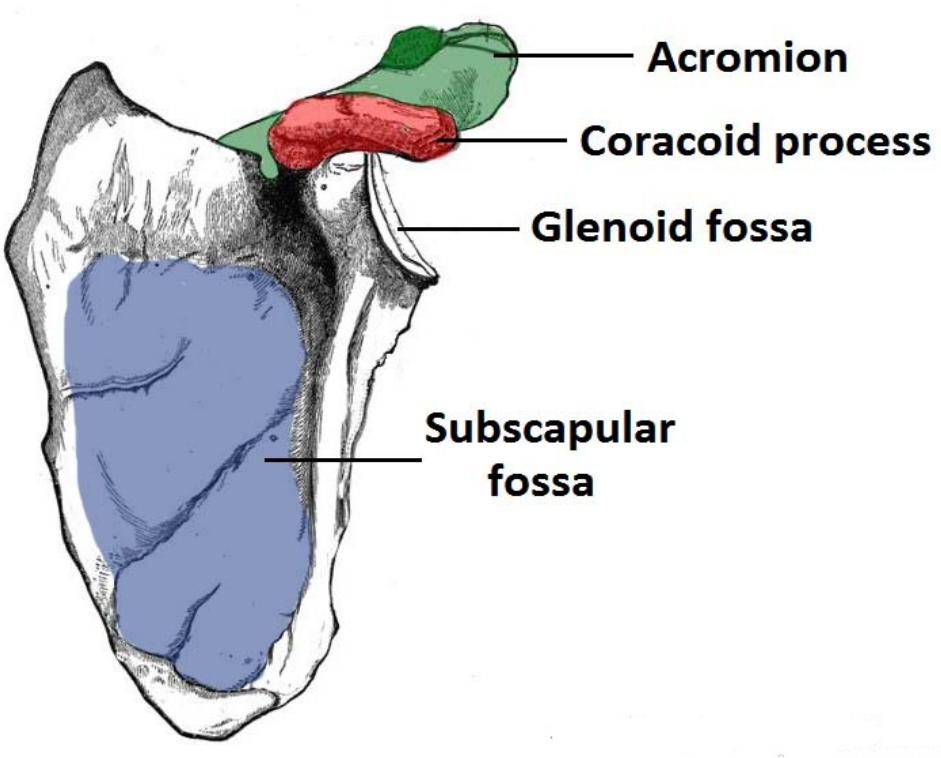


FIG 2: DORSAL SURFACE

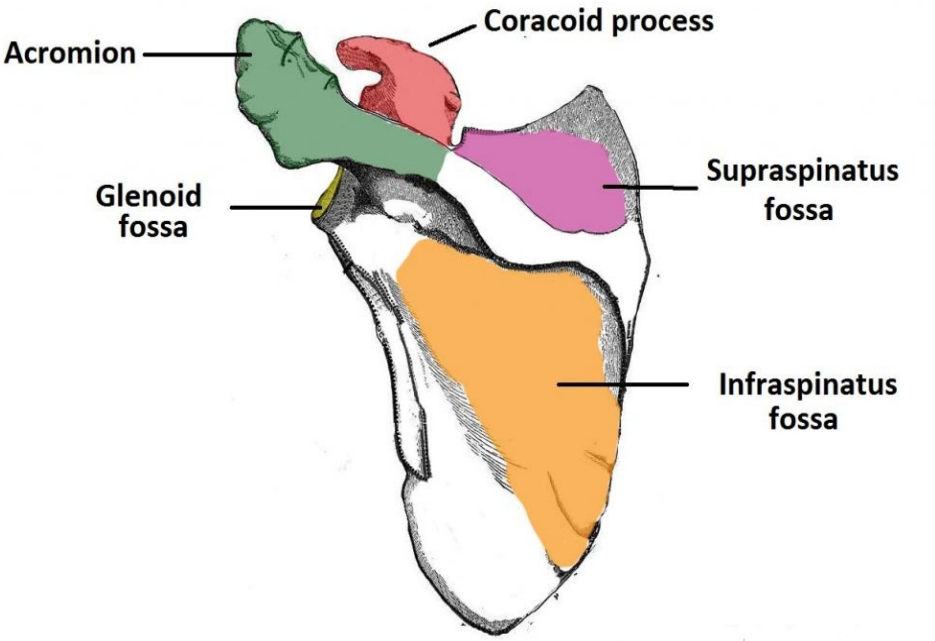
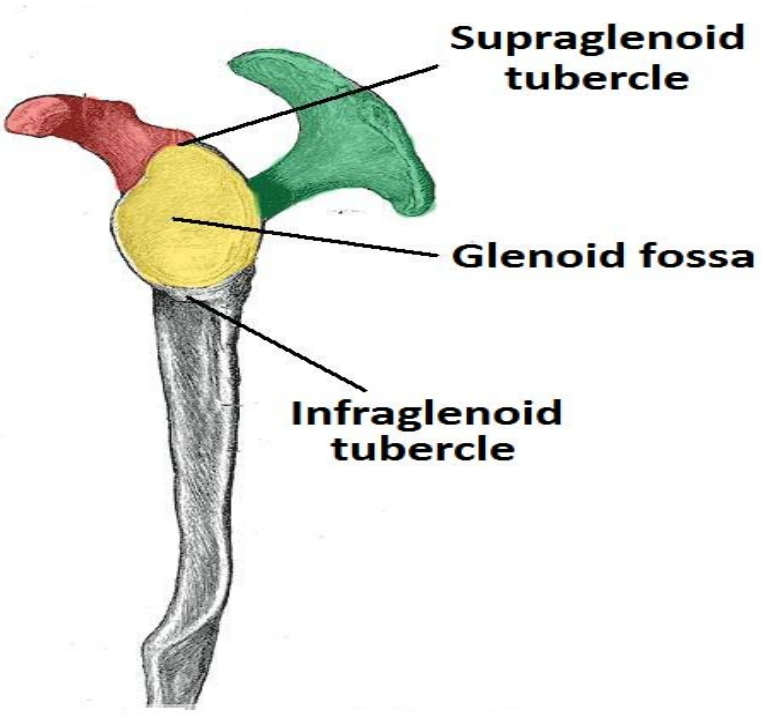


FIG 3 : LATERAL SURFACE



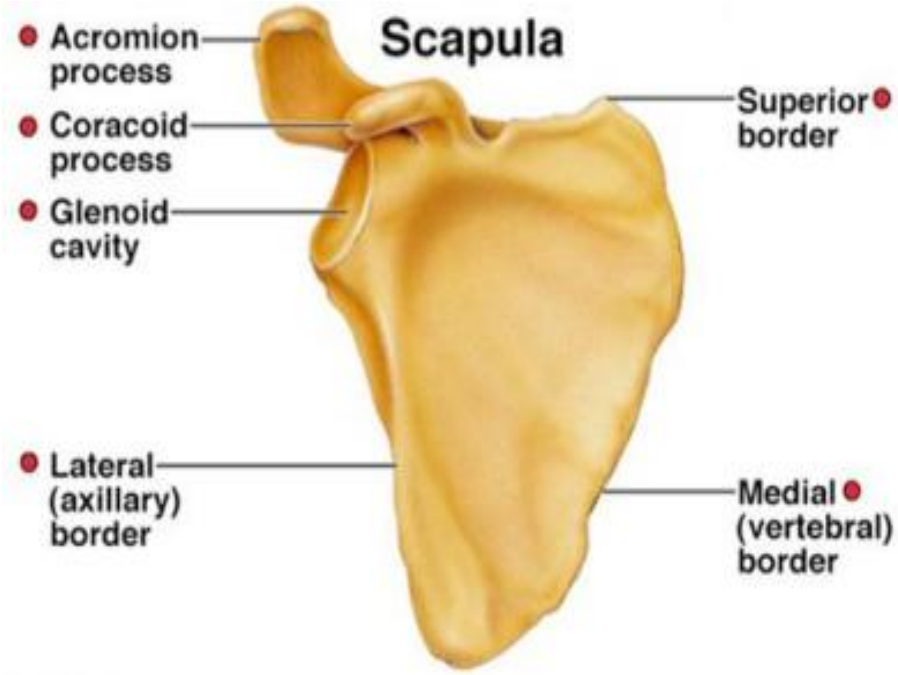
BORDERS OF SCAPULAE:

The superior border is the shortest and thinnest which is concave extending from the medial angle to the base of the coracoid process. Its lateral part has adeep semicircular notch -the scapular notch process[1,2]. This notch is converted into a foramen by the superior transverse ligament through which passes the suprascapular nerve.

The axillary border is the thickest of the three. It begins at the lower margin of the glenoid cavity, and passes obliquely downward and backward to the inferior angle. Immediately below the glenoid cavity there is a rough impression called as the infraglenoid tuberosity, about 2.5 cmlong. This gives origin to the long head of the Triceps brachii. The inferior third is thin and sharp, to which is attached a few fibers of the Teres major behind, and the Subscapularis in front.

The vertebral border is the longest of the three, and extends from the medial to the inferior angle. This border has an anterior, a posterior lip, and an intermediate narrow area. The anterior lip gives attachment to the Serratus anterior. The posterior lip gives attachment to the Supraspinatus above the spine, the Infraspinatus below the spine. The area between the two lips gives attachment to the Levator scapulae above the triangular surface and to the Rhomboideus minor on the edge of that surface, and to the Rhomboideus major below it[2,3,4].

FIG 4 : BORDERS OF SCAPULA



ANGLES OF THE SCAPULAE[3,4]:

The Medial angle:

- Thin,smooth 2junction of the superior and vertebral borders
- Gives attachment to a few fibers of the Levator scapulae.

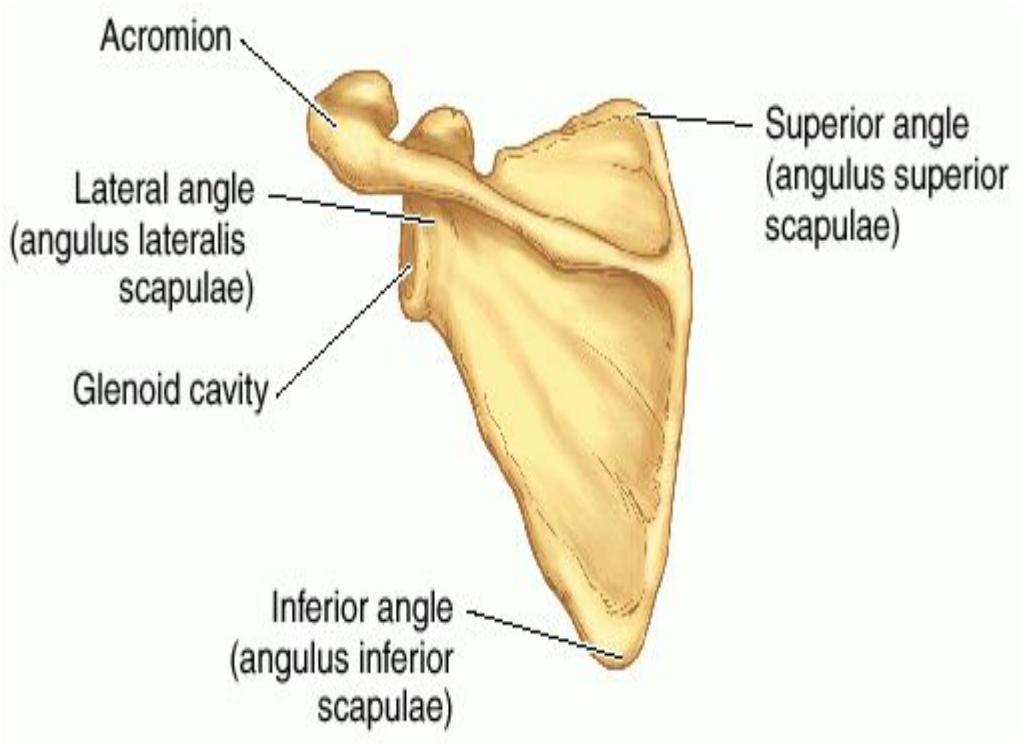
The Inferior angle:

- Thick and rough
- Formed by the union of the vertebral and axillary borders
- Gives attachment to the Teres major and to a few fibers of the Latissimus dorsi.

The Lateral angle:

- Thickest part of the bone, also called as head of the scapula.
- Shallow pyriform, articular surface, the glenoid cavity,which articulates with the head of the humerus.
- Its margins are slightly raised and gives attachment to a fibrocartilaginous structure called the glenoids labrum[1,4].
- Its apex has an elevation called the supraglenoid tuberosity, which gives attachment to the long head of the Biceps brachii.
- The neck of the scapula is the slightly constricted portion which surrounds the head.

FIG 5: ANGLES OF THE SCAPULA



BONY PROMINENCES OF SCAPULA

The Spine[5] **:**

- The spine is a prominent plate of bone, which separates the supraspinatous fossa from the infraspinatous fossa.
- It is triangular, and flattened from above downward and its apex is directed toward the vertebral border.
- It has two surfaces and three borders.
- **Superior surface** is concave, contributes to the supraspinatous fossa and gives origin to part of the Supraspinatus.
- **Inferior surface** forms part of the infraspinatous fossa, gives origin to a portion of the Infraspinatus.

- **Anteriorborder** is attached to the dorsal surface of the bone.
- **Posterior border,** or **crest of the spine,** is broad, and has two lips.
- The Trapezius is attached to the superior lip and deltoid is attached to the whole length of the inferior lip.
- **Lateral border** or **base,** is the shortest, slightly concave; edges are thick and round, is continuous above with the under surface of the acromion, below with the neck of the scapula.
- Forms the medial boundary of the great scapularnotch, which connects the supraspinatous and infraspinatous fossa.

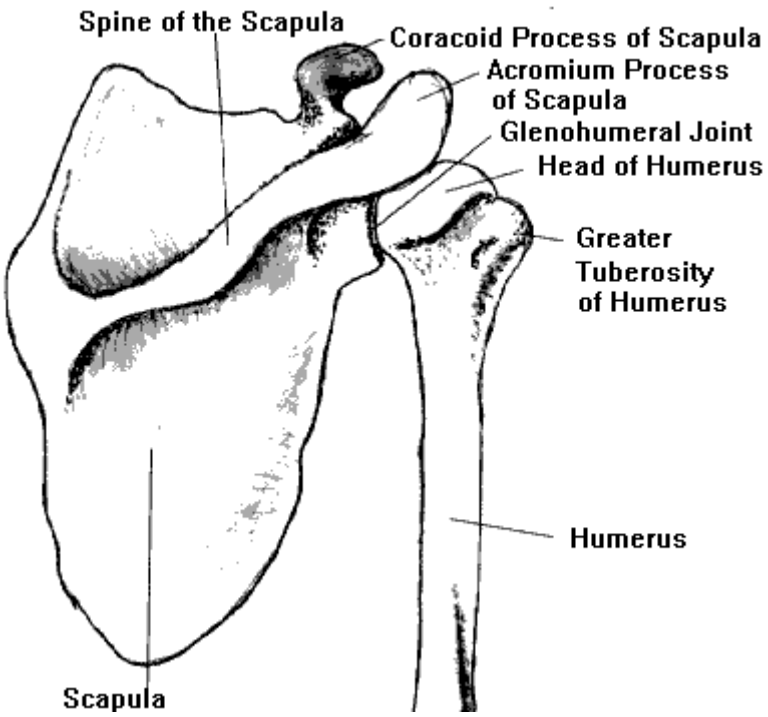
The Acromion Process[3,4,5]

- Large, somewhat triangular or oblong process, flattened from behind forward.
- **Superior surface** directed upward, backward, and lateralward; gives attachment to some fibers of the deltoid, and in the rest of its extent is subcutaneous.
- **Inferior surface** is smooth and concave. Its lateral border is thick, irregular, and gives attachment to deltoid tendon. Medial border is short, concave, gives attachment to a portion of the Trapezius.

The Coracoid Process[4,5]:

- Thick curved process attached by a broad base to the upper part of the neck of the scapula.
- The ascending portion, has a smooth concave surface, across which the Subscapularis passes.
- The horizontal portion is flattened and gives attachment to the Pectoralis minor; medial and lateral borders are rough; the former gives attachment to the Pectoralis minor and the latter to the coracoacromial ligament
- On the medial part of the root of the coracoid process is a rough impression for the attachment of the conoid ligament and an elevated ridge for the attachment of the trapezoid ligament.

FIG 6 : BONY PROMINENCES OF SCAPULA



Ossification[6,7]:

- The scapula is ossified from seven or more centers: one for the body, two for the coracoid process, two for the acromion, one for the vertebral border, and one for the inferior angle.
- Ossification of the body begins about the second month of fetal life, by the formation of an irregular quadrilateral plate of bone, immediately behind the glenoid cavity.
- At birth, a large part of the scapula is osseous, but the glenoid cavity, the coracoid process, the acromion, the vertebral border, and the inferior angle are cartilaginous.
- From the fifteenth to the eighteenth month after birth, ossification takes place in the middle of the coracoid process, which as a rule becomes joined with the rest of the bone about the fifteenth year.

- Between the fourteenth and twentieth years, ossification of the remaining parts takes place in quick succession.
- The upper third of the glenoid cavity is ossified from a separate center (subcoracoid), which makes its appearance between the tenth and eleventh years and joins between the sixteenth and the eighteenth.
- These various epiphyses are joined to the bone by the twenty-fifth year.

MUSCLES OF THE SCAPULAR REGION[4,5,8]

The muscles of the scapular region join the upper limb to the posterior trunk and facilitate many movements at the shoulder. They can be divided into three groups:

<table>
<tr><th>SUPERFICIAL EXRINSIC MUSCLES</th><th>DEEP EXTRINSIC MUSCLES</th><th>DEEP INTRINSIC MUSCLES</th></tr>
<tr><td>Trapezius</td><td>Levator scapulae</td><td>Deltoid</td></tr>
<tr><td rowspan="5">Latissmus dorsi</td><td>Rhomboid major</td><td>Supraspinatus</td></tr>
<tr><td rowspan="4">Rhomboid minor</td><td>Infraspinatus</td></tr>
<tr><td>Teres minor</td></tr>
<tr><td>Subscapularis</td></tr>
<tr><td>Teres minor</td></tr>
</table>

- The Deep intrinsic muscles are the true muscles of the shoulder joint; these muscles converge from the scapula on to the humerus and surround the shoulder joint.

- Supraspinatus, infraspinatus and Teres minor – extend from the posterior surface of the scapular blade to be inserted into the three impressions on the greater tubercle of the humerus.
- Subscapularis passes from the thoracic surface of the scapula to the lesser tubercle and Teres major from the inferior angle of scapula to the shaft of humerus.

SUBSCAPULARIS:

ORIGIN: Medial two thirds of the costal surface of scapula and the intermuscular septum which ridges on the bone.

INSERTION: Lesser tubercle of the humerus.

NERVE SUPPLY: Upper and lower subscapular nerves (C5,C6) from posterior cord of brachial plexus.

ACTION: With the other short scapular muscles, subscapularis gives stability to the shoulder joint, assisting in fixation of the upper end of humerus during movements of wrist, elbow,and hand. Medial rotator of the humerus.

SUPRASPINATUS:

ORIGIN: Arises from the medial two thirds of the supraspinatus fossa of the scapula.

INSERTION: Upper part of the greater tubercle of the humerus.

NERVE SUPPLY: Suprascapular nerve (C5,C6)

ACTION: Along with Deltoid, assists in the abduction of the shoulder joint.

TEST: The arm is abducted against resistance and the muscle palpated above the scapular spine.

INFRASPINATUS:

ORIGIN: Medial two thirds of the infraspinatus fossa and deep surface of infraspinous fascia.

INSERTION: Central facet of the greater tubercle of the humerus, between the supraspinatus above and Teres minor below.

NERVE SUPPLY: Suprscapular nerve (C5,C6)

ACTION: Stability to the shoulder joint and powerful lateral rotator of the humerus.

TEST: With elbow flexed and held in to the side the forearm is moved against resistance and the muscle in palpated below the scapular spine.

TERES MINOR:

ORIGIN: Arises from an elongated oval area on the dorsal surface of axillary border of the scapula.

INSERTION: Lowest facet of the greater tubercle of the humerus.

NERVE SUPPLY: Posterior branch of axillary nerve (C5,C6)

ACTION: Lateral rotator and weak adductor of humerus; stabilizes the shoulder joint along with other muscles. Along with teres major, it holds down the head of the humerus against the upward pull of the deltoid, during abduction of the deltoid.

TERES MAJOR:

ORIGIN: Oval area on the dorsal surface of the inferior angle of the scapula.

INSERTION: Medial lip of the intertubercular sulcus of the humerus.

NERVE SUPPLY: Lower subscapular nerve (C5.C6)

ACTION: Along with other muscles assists in movement of the shoulder joint. Acting alone it is an adductor and medial rotator of the humerus and helps to extend the flexed arm. With teres minor it holds down the head of the humerusagainstthe upward pull of the deltoid, during abduction of the deltoid.

TEST: The abducted arm is adducted against resistance, the muscle is seen and felt from behind the posterior axillary fold above the latissmus dorsi.

INFRASPINATUS FASCIA:

The infraspinatus and teres minor muscle lie deep to the strong membrane which is firmly attached to the bone at the margins of these muscles.

It is attached above to the lower border of the scapular spine beneath the deltoid muscle.

Thefascia does not cover teres major. The fascia is a landmark in surgical exposure in this region and in fracture of the scapular blade, the resulting hematoma is confined beneath the fascia, producing a characteristic swelling limiting to the margins of the bone.

DELTOID:

ORIGIN: The muscle arises from the anterior border and upper surface of the lateral one third of the clavicle,from the whole of lateral border of acromion and from the inferior lip of the crest of scapular spine.

INSERTION: Deltoid tuberosity of the humerus

NERVE SUPPLY: Axillary nerve (C5,C6)

ACTION: Along with supraspinatus, deltoid abduct the arm by the multipennate acromion fibres. The anterior fibres assist pectoralis major in flexing and medially rotating the arm. Posterior fibres assist latissmus dorsi in extending the arm and lateral rotation.

TEST: The arm is abducted againssst resistance, muscle is seen and felt.

NERVE SUPPLY OF SCAPULA[8]:

- The skin of the scapular region receives sensory supply from the medial branches of the posterior rami of cervical nerves C4 to C8 and thoracic nerves T1 to T6[2,3,4].
- The skin over the lateral scapular area overlying the deltoid muscle is innervated by branches of the superior lateral cutaneous nerve of arm, which is a branch of the axillary nerve.
- Motor innervation to the muscles of the scapular region is by branches of the brachial plexus:
    - Dorsal scapular nerve
    - Supra scapular nerve
    - Four other nerves to this region[4] (the superior and inferior subscapular, thoracodorsal, and axillary) are branches of the posterior cord and supply the subscapularis, teres major, latissimus dorsi, deltoid, and teres minor muscles.

BLOOD SUPPLY [7,8]:

- Network of arteries, which form the scapular anastomosis
- Muscles medial and superior to the scapula receive blood from the dorsal scapular, transverse cervical, and suprascapular artery
- Muscles anterior and lateral to the scapula are supplied by the subscapular, circumflex scapular, and posterior circumflex humeral arteries.
- The extensive arterial anastomosis at the scapular region provides a collateral.

FIG 8: BLOOD SUPPLY TO SCAPULA

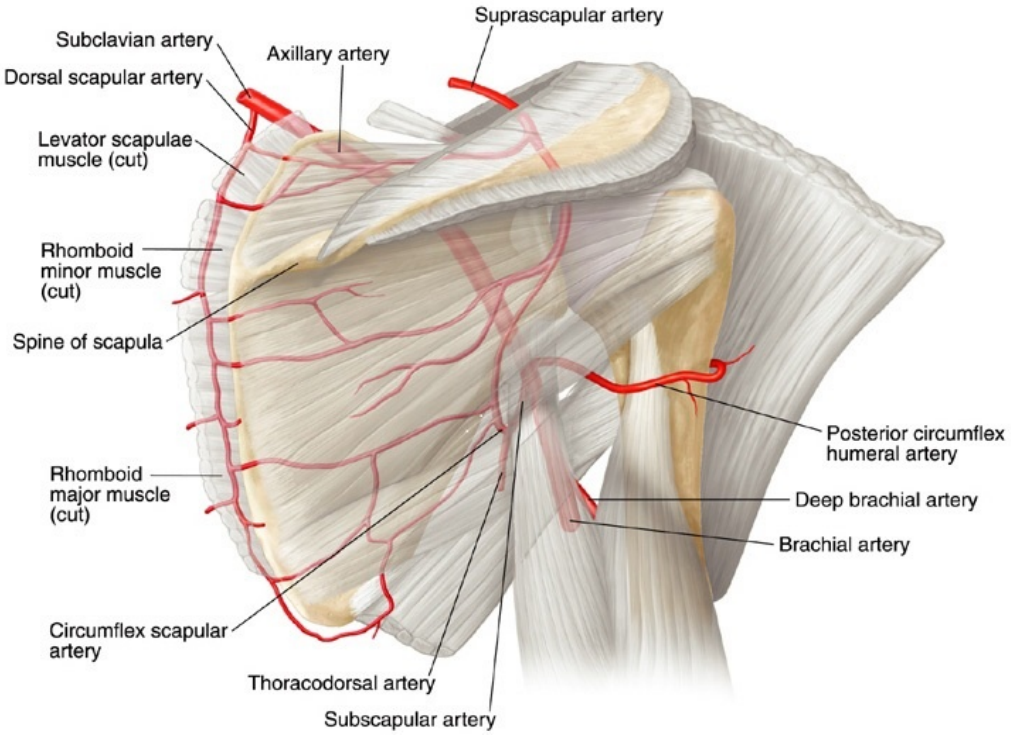
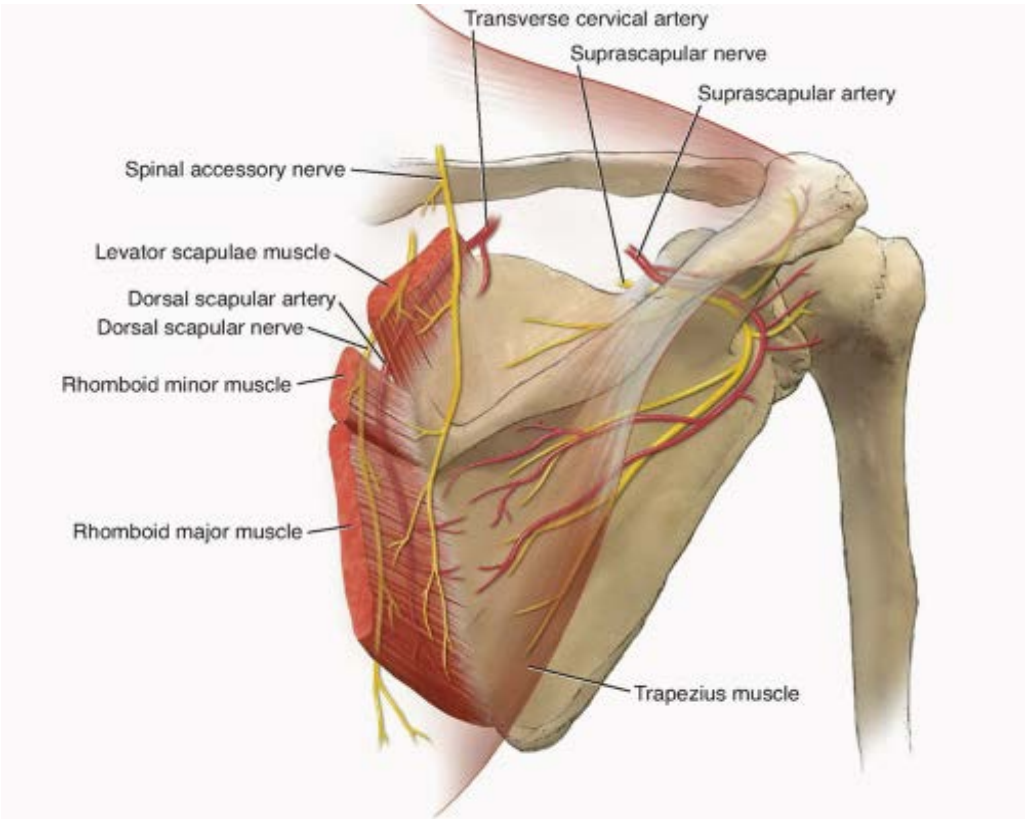


FIG 9 : NERVE SUPPLY OF SCAPULA



THE GLENOHUMERAL JOINT [9,10] :

INTRODUCTION:

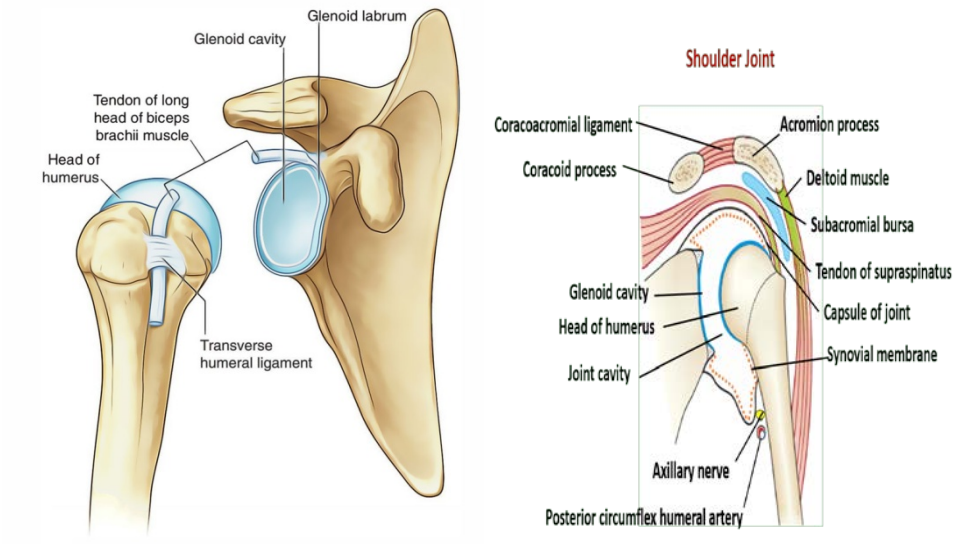
- The glenohumeral joint is structurally a ball and socket, synovial joint and functionally is considered a diarthrodial, multiaxialjoint.
- The glenohumeral articulation involves the humeral head with the glenoid cavity of the scapula, and it represents the major articulation of the shoulder girdle.
- Also includes minor articulations of the sternoclavicular, acromioclavicular joint and scapulathoracic joint.
- The static and dynamic stabilizing structures allow for extreme degrees of motion in multiple planes of the body.

STRUCTURE:

- The glenoid cavity is a shallow osseous element that is structurally deepened by a fibrocartilaginous rim, the glenoid labrum.
- It's a complex, dynamic, articulation between the glenoid of the scapula and head of the humerus.
- The glenohumeral joint is enclosed by a joint capsule which encapsulates the structures of the joint in a fibrous sheath. Structurally the joint capsule wraps around the anatomical neck of the humerus to the rim of the glenoid fossa, except inferiorly.
- The capsulolabral complexes include important characteristic thickened bands that constitute the glenohumeral ligaments. Coraco humeral ligament is strong ,which runs from the base of the coracoids process to the front of the greater tubercle blending with the capsule.
- At the upper end of the intertubercular sulcus the capsule bridges the gap between the greater and lesser tubercle, being here named the transverse humeral ligment.

- The capsule is the thick and strong but it is very lax, a necessity in a joint so mobile as this.
- The synovial membrane is attached around the glenoid labrum and lines the capsule. It is attached to the articular margin of the head of the humerus and covers the bare area of the surgical neck lies within the capsule at the upper end of the shaft.
- It herniates through the hole in front of the capsule to communicate with the subscapularis bursa.

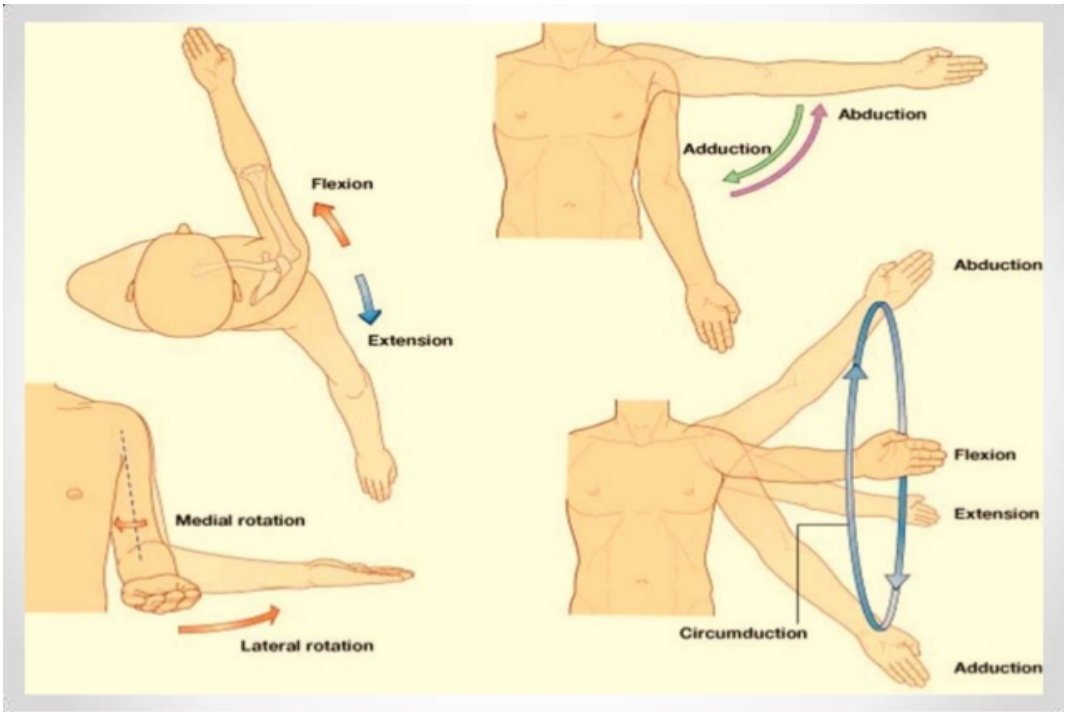
FIG 10: THE GLENOHUMERAL JOINT



MOVEMENTS OF THE GLENOHUMERAL JOINT:

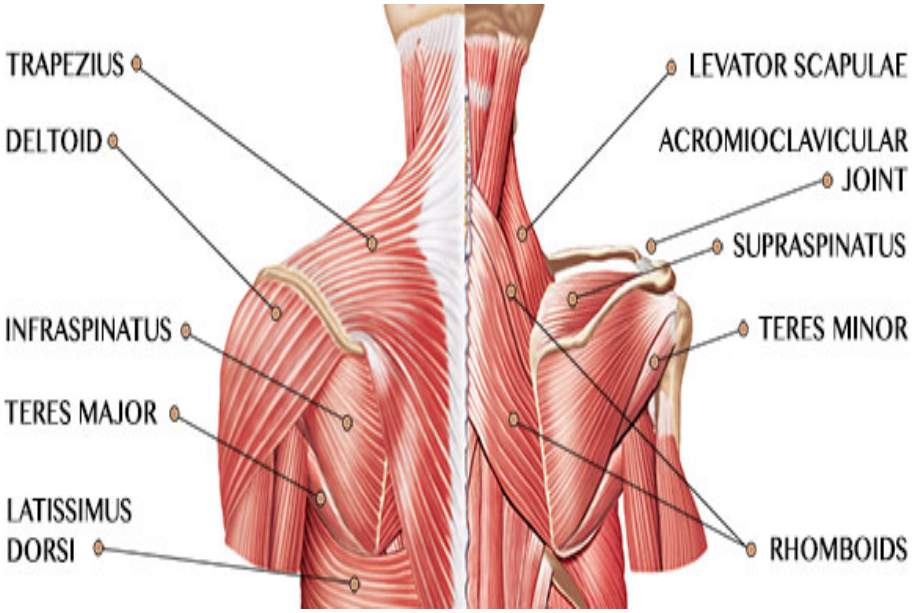
1. Flexion
2. Extension
3. Adduction
4. Abduction
5. Internal rotation
6. External rotation
7. Circumduction

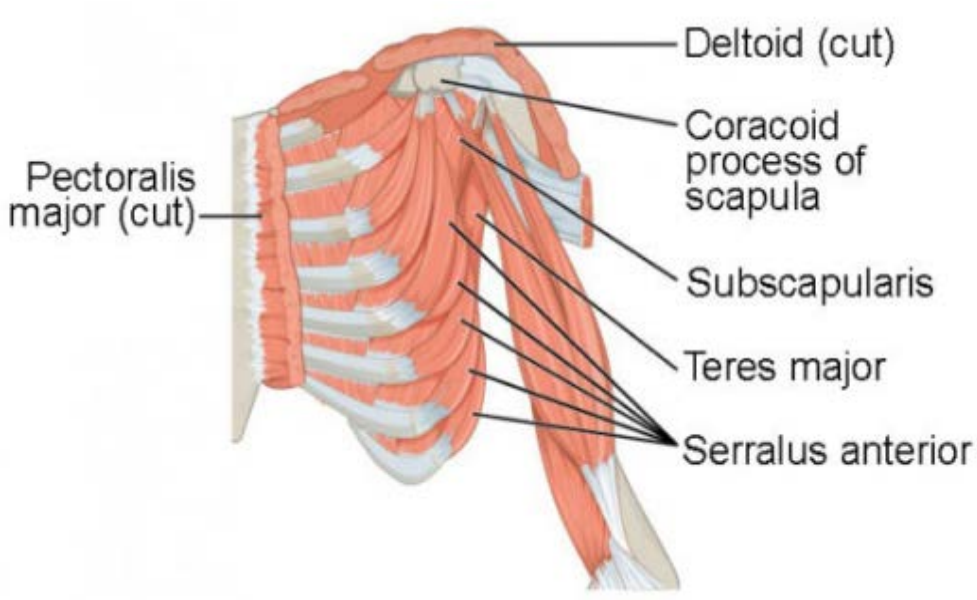
FIG 11: RANGE OF MOVEMENTS



MOVEMENTS	MUSCLES INVOLVED
FLEXION	Clavicular head of pectoralis major, anterior fibres of deltoid
	Coracobrachialis, short head of biceps
EXTENSION	Latissmus dorsi Teres major Posterior fibres of deltoid
ABDUCTION	Supraspinatus: first 15 degrees Deltoid: 15- 90 degrees Trapezius and Serratus anterior:90-180 degrees
ADDUCTION	Pectoralis major Latissmus dorsi Teres major
EXTERNAL ROTATION	Infraspinatus Teres minor
INTERNAL ROTATION	Subscapularis Teres major Latissmus dorsi and pectoralis major

FIG 12: MUSCLES INVOLVED IN GLENOHUMERAL JOINT MOTION





FRACTURES OF SCAPULA [11,12]

INTRODUCTION:

Fractures of scapula accounts for 3-5% of all fractures about the shoulder, are most often caused by high energy trauma, and are frequently associated with multiple trauma. Almost all scapular body fractures were treated non operatively with 86% of good to excellent results; scapular neck and isolated glenoid fracture were most often treated operatively with good to excellent results in 76% and 82% respectively [13,14].

INCIDENCE [15]:

- 1% of all the fractures
- >90% insignificantly displaced
- Body and spine 70%
- Glenoid process 15% (cavity 10%, neck 5%)
- Acromion process 8%
- Coracoid process 7%

GLENOID FRACTURES (INTRA ARTICULAR)[16]:

Glenoid fractures should be treated as all other intraarticular fractures and reduced and stabilized when significant (>4mm) displacement exists through the articular surface that leads to joint subluxation and incongruency[10].

- Fractures of glenoid cavity make upto 10% of scapular fractures.
- More than 90% of fractures are insignificantly displaced and are managed non operatively.
- Significant displaced fracture require surgical treatment.

GOSS – IDE BERG CLASSIFICATION OF GLENOID CAVITY FRACTURE[17,18]:

TYPE IA	Anterior rim fracture
TYPE IB	Posterior rim fracture
TYPE II	Fracture line through glenoid fossa exiting scapula laterally.
TYPE III	Fracture line through glenoid fossa exiting scapula superiorly.
TYPE IV	Fracture line through glenoid fossa exiting scapula medially.
TYPE V-A	Combination of II AND IV
TYPE V-B	Combination of III AND IV
TYPE V-C	Combination of II,III, AND IV
TYPE VI	Severe comminution

FIG 13: IDE BERG CLASSIFICATION

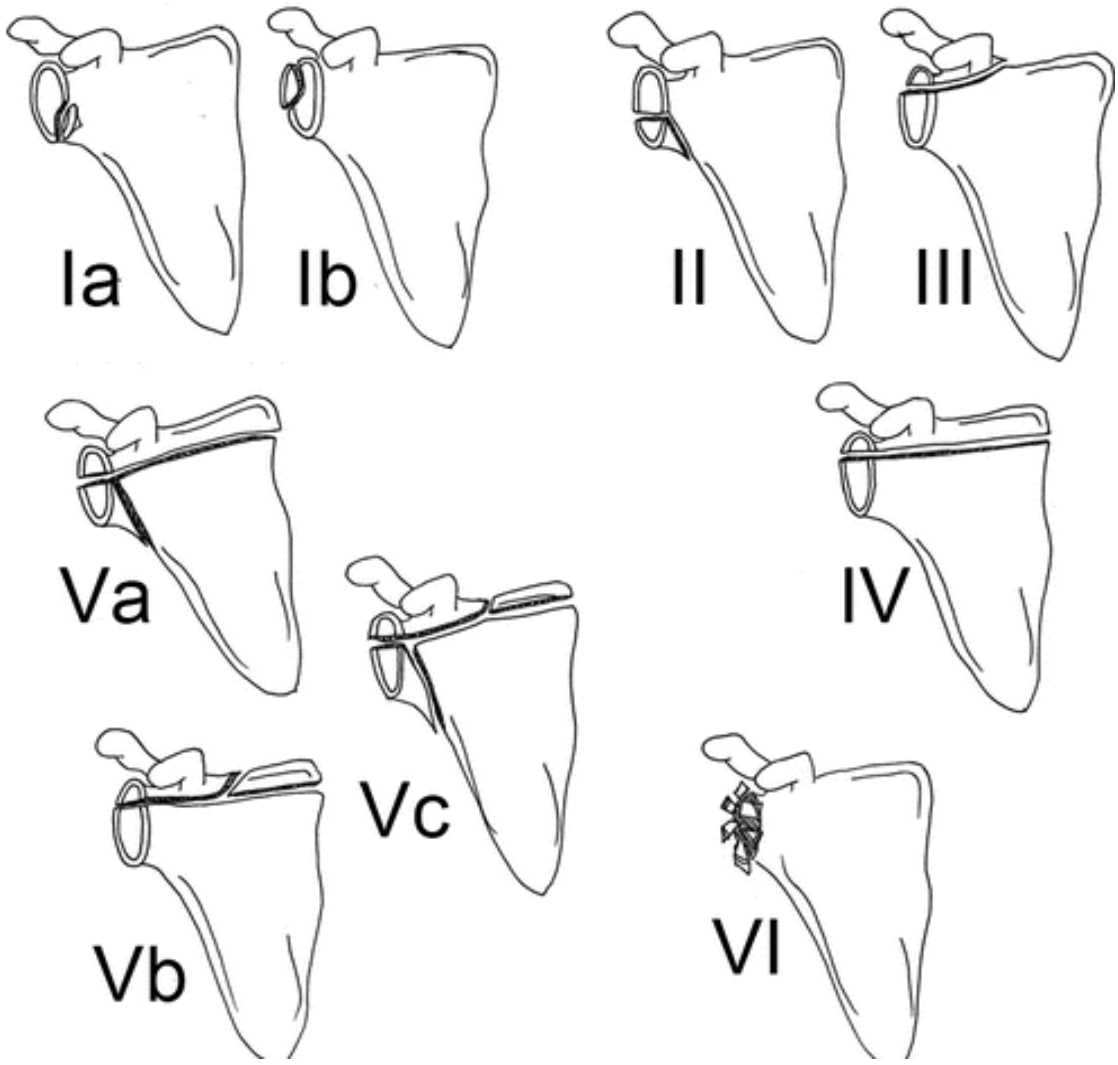
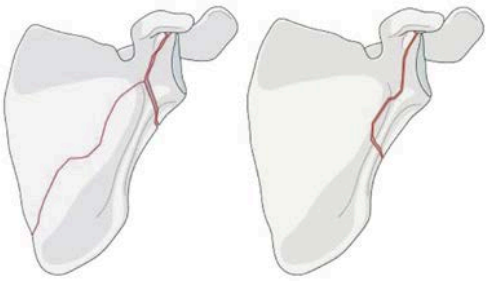
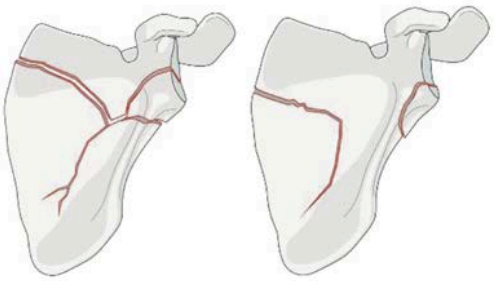


FIG 14: AO –CLASSIFICATION OF GLENOID FRACTURES

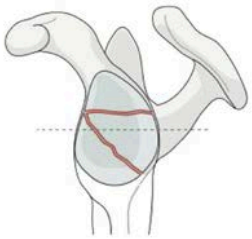
F0 = Fracture of the articular segment, not through the glenoid fossa (the fossa is not attached to any part of the scapula body)



F1 = Simple pattern: rim, transverse, oblique fracture (fracture involves the glenoid fossa)



F2 = Multifragmentary joint fracture (fracture involves the glenoid fossa with three or more articular fragments)



SURGICAL INDICATIONS FOR GLENOID FRACTURES:

GLENOID RIM FRACTURES[12]

Unstable glenohumeral articulation:

- Displacement of fragment>or equal to 10mm
- Involvement of more than or equal to one fourth of glenoid cavity anteriorly
- Involvement of more than or equal to one third of glenoid cavity posteriorly

GLENOID FOSSA FRACTURES

- Articular step of more than or equal to 5mm
- Unstable glenohumeral articulation
- Severe separation of fragments

SCAPULAR NECK FRACTURES (GLENOID NECK – EXTRA ARTICULAR)[12,13]:

Scapular neck fractures with significant displacement that causes malunion and pain should undergo operative management. Medialisation of glenoid and lateralization of scapular border are seen with significantly displaced scapular neck fractures that are malunited. The Glenopolar angle is used as a criteria for determining treatment. This angle is formed by a line drawn from inferior pole of glenoid fossa upto the superior pole and a second line drawn from the superior pole glenoid fossa down through the inferior most angle if the scapular body, Normal gleno polar angle is 30- 40 degree.

CAUSES OF GLENOID NECK FRACTURES[13]:

- A direct blow over the anterior or posterior aspect of shoulder.
- A fall on outstrectched arm with impaction if humeral head against the glenoid process
- Rarely force applied on the superior aspect of shoulder complex
- The stability of the glenoid neck is primarily osseous, specifically its junction medially with its scapular body.
- Secondary support by its attachment superiorly to the clavicle, acromioclavicular joint, coracoid process, coraco-acromial and coraco-clavicular ligament.

SIGNIFICANTLY DISPLACED GLENOID NECK FRACTURES:

- Mediolateral translational displacement > or equal to 1cm.
- Anteroposterior angular displacement > or equal to 40deg.
- Decrease in the glenopolar angle to < 20deg.

CLASSIFICATION OF GLENOID NECK FRACTURES[14]:

1. TYPE I: Non angulated,non displaced

2. Type IIa: Mediolateral translational displacement

>than or equal to 1cm

3 .TYPE IIb: Anteroposterior angular displacement > or equal to 40 deg.

SURGICAL INDICATIONS:

- Type I glenoid neck fractures managed conservatively.
- Type II glenoid neck fractures needs open reduction and internal fixation.
- Type II glenoid neck fractures associated with clavicle fracture (floting shoulder), acromioclavicular joint disruption, coracoclavicular and coracoacromion ligament injury, coracoid process, acromion process fracture, humerus fracture needs open reduction and internal fixation.

SURGICAL APPROACH FOR GLENOID AND PERIGLENOID FRACTURES.

JUDET APPROACH[15,16]:

One of the most practical posterior approach to the shoulder joint and scapula is the Judet approach. The interval between the infraspinatus (suprascapular nerve innervated) and Teres minor (Axillary nerve innervated) muscles can be extended medially, exposing a large portion of inferior half of the scapula.

MODIFIED JUDET APPROACH[17,18,19]:

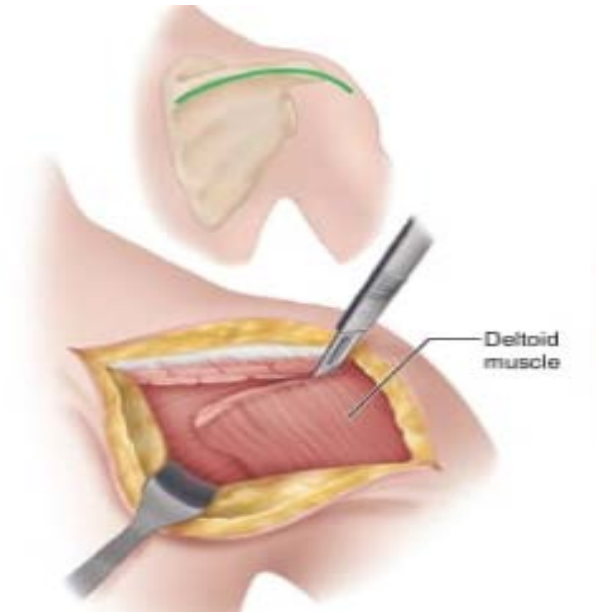
- Begin the skin incision just lateral to the tip of the acromion, pass it medially and posteriorly along the border of the acromion, curve it slightly distal to the spine of scapula and end it at the base of spine of scapula.

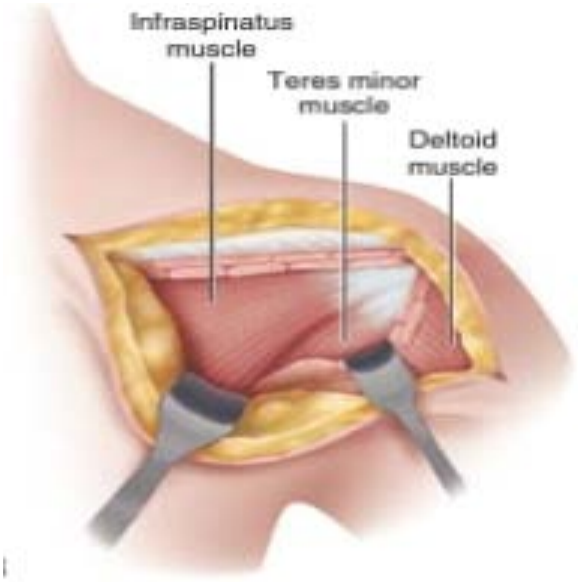
- Reflect the skin and the fascia, expose the origin of deltoid musle from the spine of scapula. Detach this part of deltoid from bone by subperiosteal dissection, and reflect it distally and laterally, taking care to avoid injury to the axillary nerve and vessels as they emerge from quadrangular space and enter the muscle. As a precaution against injuring this nerve, do not retract the deltoid muscle distal to the teres minor muscle, and to avoid injuring the suprascapular nerve, do not enter the infraspinatus muscle.

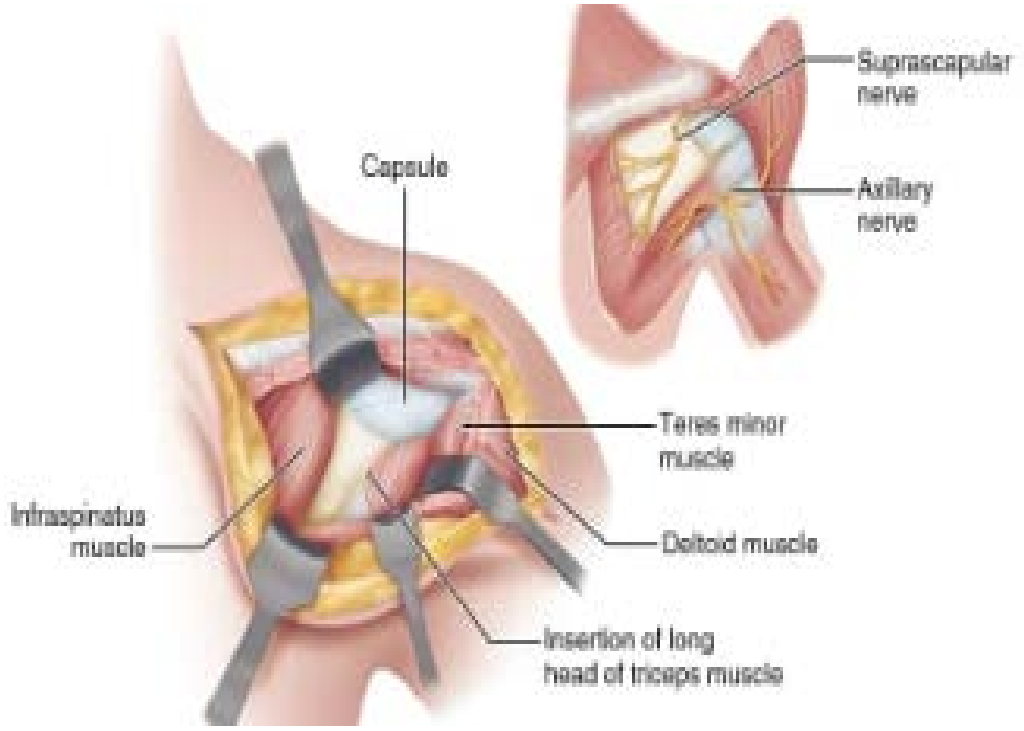
- After reflecting the deltoid expose the posterior surface of the joint capsule by detaching the inferior two thirds of the infraspinatus tendon near its insertion on the humerus and reflecting the detached part medially.

- Alternatively, the posterior part of the joint can be exposed by an oblique incision between infraspinatus and teres minor muscles and then opening the joint capsule by a longitudinal or transverse incision or by a combination of both as needed. The interval between infraspinatus and teres minor muscles can be extended medially, exposing more of the inferior scapula for fracture fixation. Extend the incision distally along the medial border of the scapula if necessary.

FIG 14: MODIFIED JUDET APPROACH



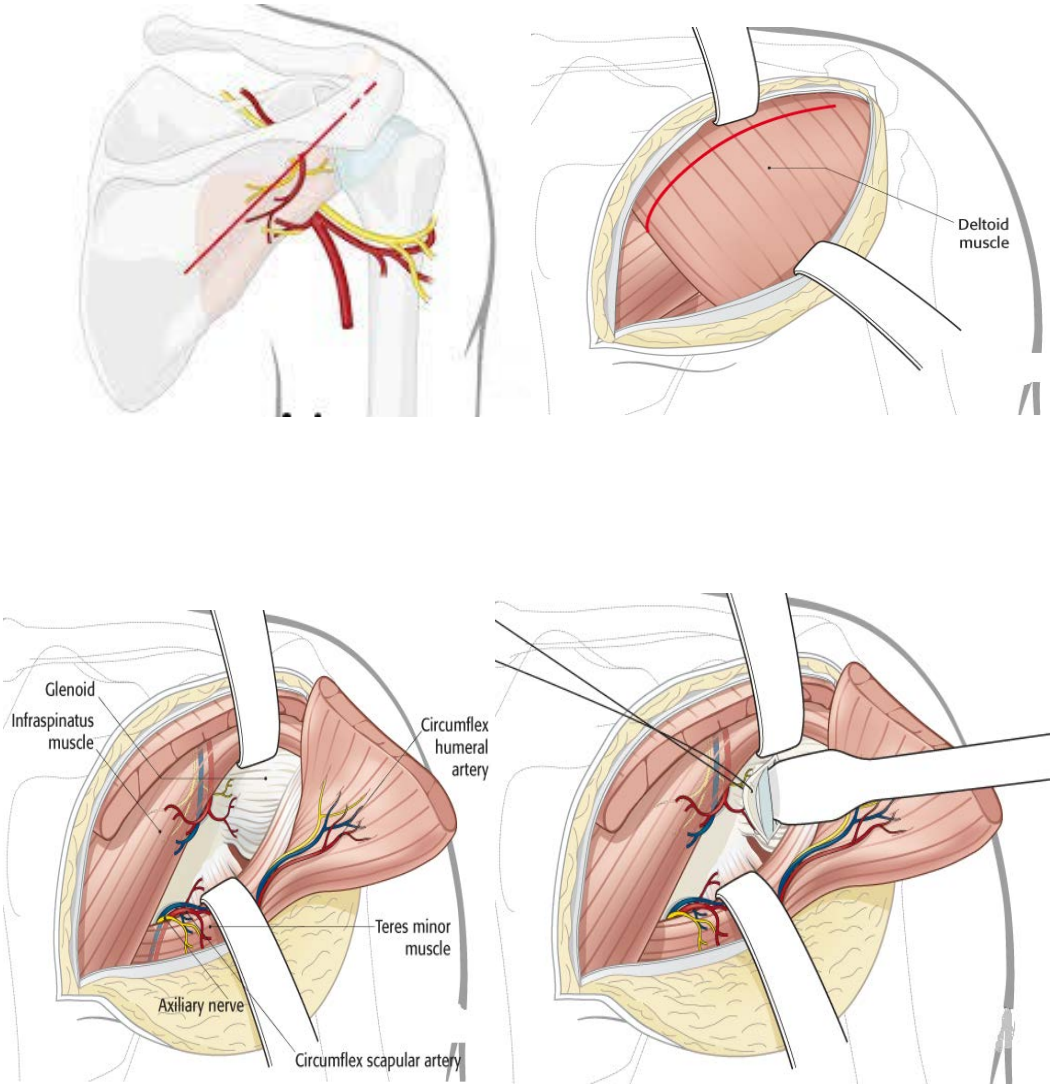



Suprascapular nerve
Axillary nerve
Capsule
Teres minor muscle
Infraspinatus muscle
Deltoid muscle
Insertion of long head of triceps muscle

<u>AO APPROACH</u> (POSTERIOR)[20,21]:

- The incision is made starting at the tip of the acromion posteriorly and proceeds towards the scapular angle parallel to the lateral border of scapula. The extent of the incision will depend on the amount of exposure required.Make sure to leave a small tissue border to facilitate subsequent reattachment. Using sharp dissection, divide the deltoid from its insertion into the scapular spine and base of the acromion. Continue freeing the deltoid muscle so that it can be reflected laterally. Avoid damaging the axillary nerve and posterior circumflex artery laterally. In order to expose lateral margin of scapula, identify the interval between the infraspinatus and teres minor. Open the interval and separate the infraspinatus and teres minor and expose the posterior capsule of the joint and the axillary border of scapula. In elevating these muscles be careful not to damage their nerve supply.

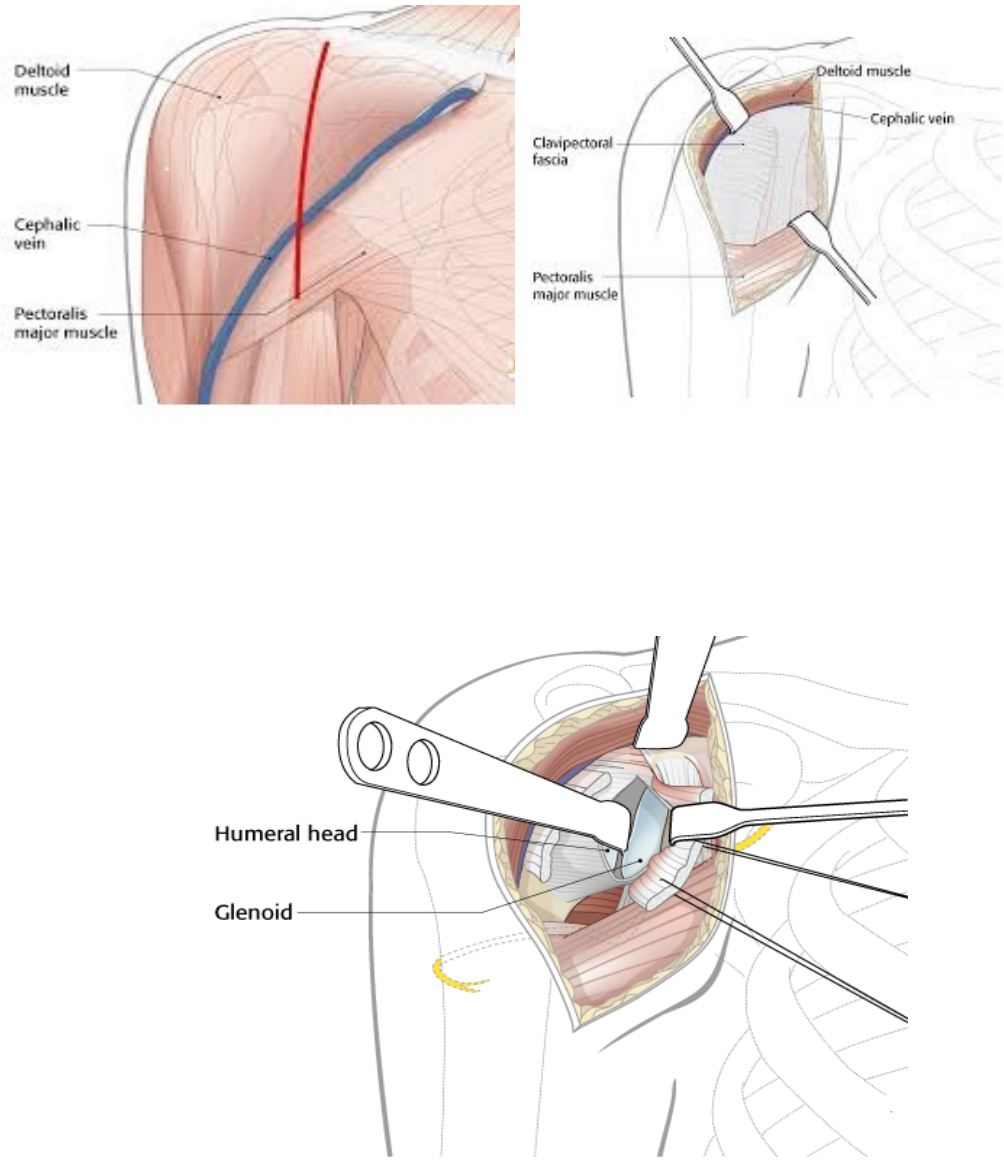
FIG 15: POSTERIOR SURGICAL APPROACH



DELTO PECTORAL APPROACH[22]:

- This approach is used for anterior glenoid rim fractures.
- The incision over the anterior aspect of acromioclavicular joint, passing it medially along the anterior one third of the lateral margin of clavicle and distally along the anterior margin of the deltoid muscle to a point two thirds the distance between its origin and insertion.
- Expose the anterior margin of deltoid. The cephalic vein and the deltoid branches of thoracoacromial artery lie in the interval between the deltoid and the pectoralis major muscles (the deltopectoral groove),and although the cephalic vein may be retracted medially along with a few fibres of the deltoid muscle, it may be damaged during the operation. Ligating this vein proximally and distally as soon its reach may be indicated.
- Laterally reflect the anterior part of the deltoid muscle to expose the structures around the coracoid process and anterior part of joint capsule.
- To expose the deep aspects of the shoulder joint more easily, including the anterior margin of glenoid. Incise the periosteum of the superior aspect of the coracoid, cut the bone and reflect medially and distally the tip of the bone along with attached origins of the coracobrachialis,the pectoralis minor, and the short head of biceps.
- For wider exposure, divide the subscapularis at its musculotendinous junction about 2.5cm medial to its insertion into the lesser tuberosity, separate the tendon medially from the underlying capsule and expose the glenoid labrum.

FIG 16: DELTOPECTORAL APPROACH



CLINICAL EVALUATION OF GLENOID AND PERIGLENOID FRACTURES[23,24,25]

Most fractures involving the scapula are diagnosed based on history and physical examination. Patient usually presents with complaints of pain swelling and inability to move the shoulder joint. It is important to obtain the detailed history regarding mechanism of injury since severity of trauma differs among younger and aged. Scapular fractures are due to high energy trauma, mostly associated with multiple injuries.

During physical examination typical fracture signs like swelling, crepitus, contusion, abnormal mobility and painful shoulder joint movements are seen. It is mandatory to exclude neurovascular injuries.

Radiological evaluation forms the basis of most of the classification system used to assess scapular fracture, and it also plays a critical role in choosing various treatment modalities.

RADIOLOGICAL ASSESSMENT INCLUDES:

Fractures often detected incidentally on chest radiograph[23,24]

Scapular trauma series:

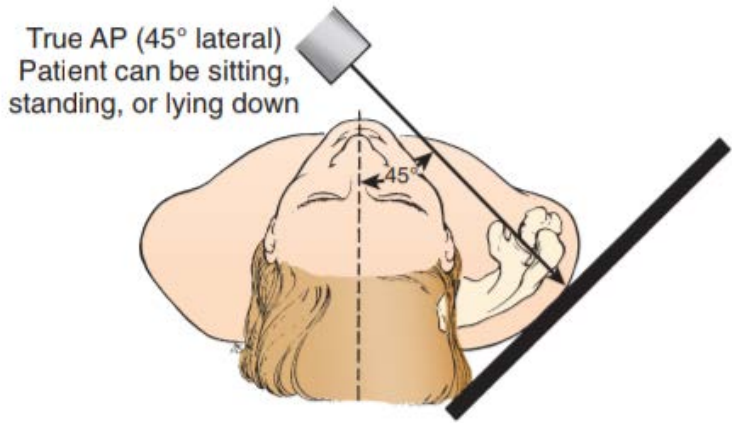
- AP and lateral view of scapula
- Axillary view of gleno humeral joint
- Weight bearing view of shoulder
- CT with and without reconstructions 3-Dimensional CT.

SPECIAL VIEWS FOR SCAPULA:

1. True antero posterior view
2. Axillary lateral view
3. Scapulo lateral view (or) Y – lateral view
4. Apical oblique view
5. West point axillary lateral view

TRUE ANTERO POSTERIOR VIEW:

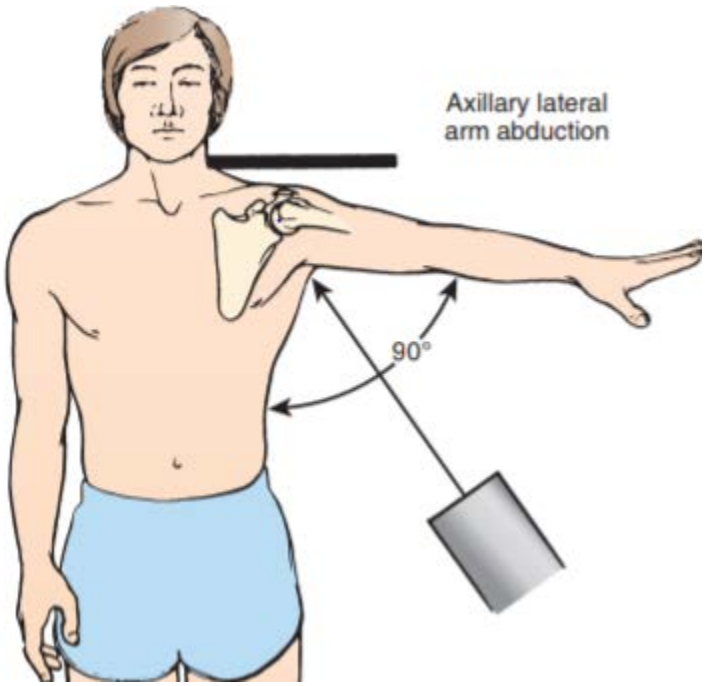
- Supine or erect posture with arm at the side or sling position.
- X-ray cassette placed posterior to the scapula and glenohumeraljoint.
- To obtain true antero postereior view of glenohumeral joint x-ray beam must be angled 45 degrees from midline or patient can rotate the body till the scapula is parallel to x ray cassette.
- This view demonstrates glenoid profile clearly.



AP VIEW **TRUE AP VIEW**

AXILLARY LATERAL VIEW:

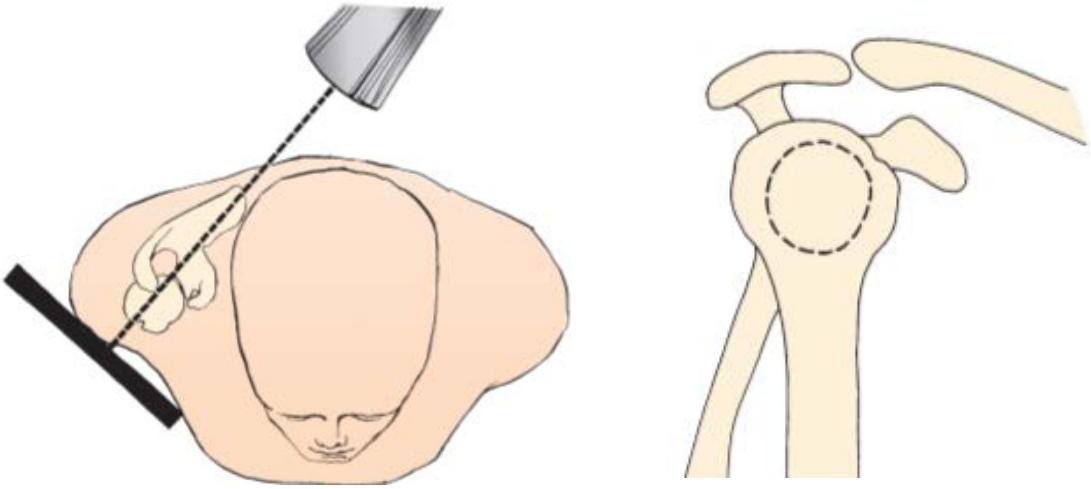
- Patient in supine or erect posture
- Arm abducted to 70 – 90 degrees
- X ray beam directed into the axilla with x ray cassette placed superior to the patient shoulder
- Provides excellent visualization of glenoid and humeral head
- Dislocations are easily identified and compression fracture of fractures of humeral head, glenoid rim fractures, fractures of coracoid and acromion are visualized.



SCAPULO LATERAL (OR) Y- LATERAL VIEW

- A line is drawn over the spine of scapula using a marking pen
- X ray beam parallel to this line over the skin, directed at the cassette which is placed perpendicular to the line at the antero lateral shoulder
- Lateral projection of scapula form a Y- shape
- Upper arms of Y are formed by coracoids process anteriorly and scapular spine posteriorly
- Vertical portion of Y- formed by body of scapula
- Intersection of the 3 limbs of the Y lies the glenoid fossa
- This view visualizes joint dislocation, fractures of coracoid, spine of scapula and body of scapula.

SCAPULO LATERAL VIEW



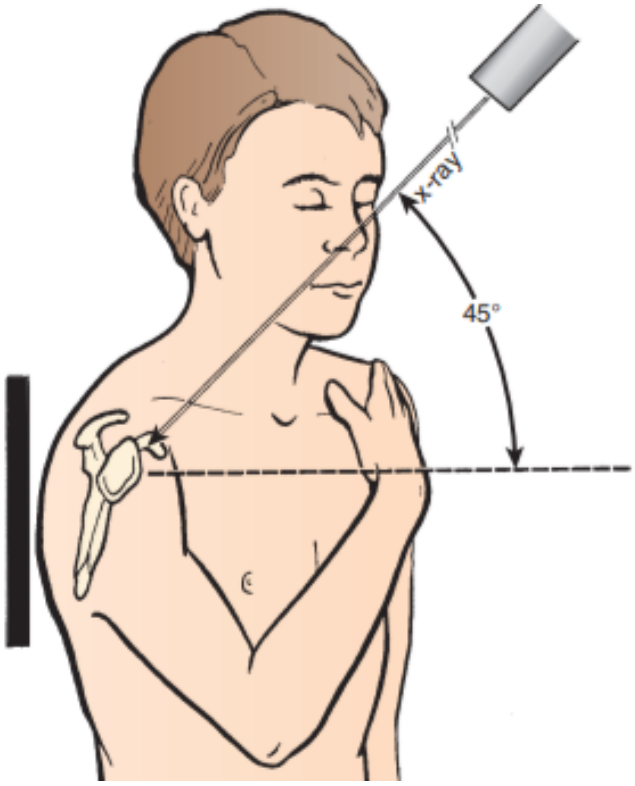
VELPEAU AXILLARY LATERAL VIEW:

- Modification of axillary lateral view
- Injured shoulder still in a sling without abduction
- Patients stands or sits at the end of radio graph table and leans backwards 20-30 degrees
- X ray cassette is placed on the table directly beneath the shoulder
- X-ray beam passes vertically from superior to inferior through the shoulder joint on to the cassette

APICAL OBLIQUE VIEW:

- Patient may be seated or supine posture
- The cassette is placed posteriorly parallel to the spine of scapula
- X ray beam directed through the gleno humeral joint towards the cassette at an angle of 45 degree to the plane of thorax and also tilted 45 degree caudally
- This view identifies glenohumeral dislocation and subluxation and also clearly defines antero-inferior, postero- superior rims of glenoid.

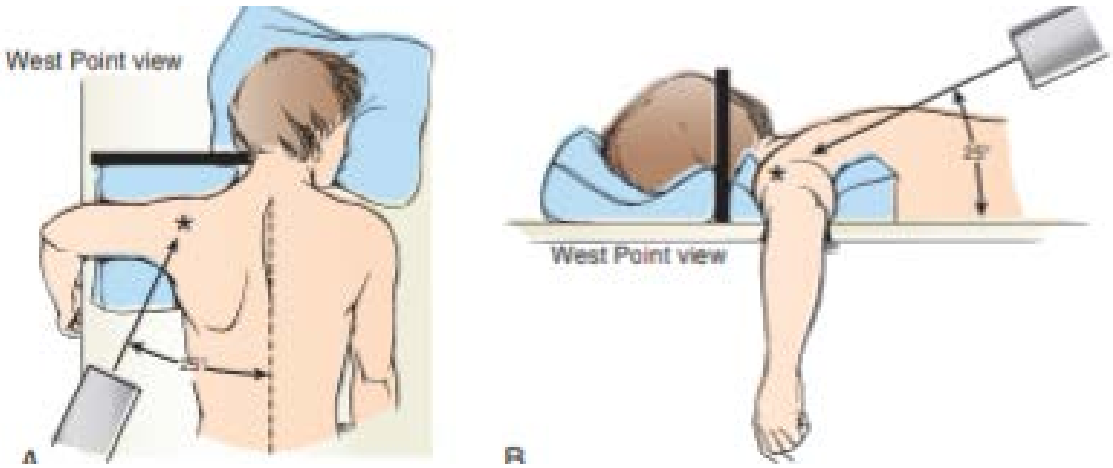
APICAL OBLIQUE VIEW



WEST POINT AXILLARY LATERAL VIEW:

- Patient in prone position on the radiography table
- The affected shoulder rested on a pad raising about 8cm from the table surface.
- Patients head and neck turned to the opposite side of fracture.
- The cassette held against the superior aspect of the shoulder, x ray beam is centred at the axilla with 25 degree of downward angulation from the horizontal and 25 degree medial angulation from the midline
- Resultantx ray gives a tangential view of antero- inferior rim of glenoid
- Mainly visualizes glenoid rim fractures

WEST POINT AXILLARY VIEW



MECHANISM OF INJURY

- Scapular fractures including the glenoid fossa, occur secondary to high impact blunt trauma[8,10] and are often associated with other injuries.
- The glenoid fossa can be fractured when a high velocity blunt force causes the humeral head to impact the glenoid cavity.
- These fractures are typically transverse and occur along the direction of impact of force.
- Glenoid avulsion and rim fractures are more common and usually associated with an anterior shoulder dislocation, commonly occurs as a sporting injury and low impact trauma or fall[8,10,12,13].

REVIEW OF LITERATURE

EPIDEMIOLOGY:

Fractures of scapula are relatively uncommon. They constitute 1% of all fractures and 3-5 % of all shoulder girdle fractures. They generally due to high energy trauma and are associated with other injuries. More than 90% fractures are insignificantly displaced. Among the scapular fractures, body and spine of scapula fractures constitute 70%, fracture of glenoid process constitutes 15%, acromion process fracture 8% and coracoid process constitutes 7%.

Scapular fractures are conventionally treated non surgically. Nordqvist Et Al[31], reviewed surgical outcome of 68 scapular fractures, which were followed upto 14 years.

He concluded that, 51 patients had good surgical outcome, 17 patients had poor outcome; 20 patients had some form of residual deformity. His analysis highlights that patients who underwent non operative treatment for scapular fractureshadsignificant difficulties, concluding that surgical management must indicated when necessary.

Hardegger et al[32,33],1984 studied 23 glenoid fractures and 10 scapular neck fractures requiring surgical treatment. He classified the study patients into 2 major groups, 1st group includes stable fracture of body and neck, minimally displaced fractures of apophysis was managed conservatively; 2nd group includes unstable fractures of glenoid or scapular neck and significantly displaced fractures of apophysis was managed surgically. 79% patients had good outcome with a follow up of 1.5 – 15 years.

Adas et al[34], 1991, studied a series of 148 fractures in 116 scapula, reporting surgical management for 8 scapular neck fractures. Adas classified the study group and in his follow up study which included 16 patients having displaced scapular neck fractures, he noted weakness during abduction and

subacromial pain. He also concluded that displaced scapular neck fractures can not be managed conservatively.

Francis et al[35] ,1979 studied 4 patients with fracture of glenoid who were managed surgically. At follow up,3 out of 4 patients had good outcome and 1 patient had poor outcome.

Freund – Lich et al[36],1986 described a patient with comminuted glenoid fracture having large displaced glenoid fossa fragment. The patient was initially treated conservatively, but due to significant rotational displacement and persistent pain, patient underwent surgical fixation. The patient demonstrated good functional outcome on an 1 year follow up.

Ideberg et al[37],1987 reported 200 glenoid fractures, being the largest series in the literature. His study proposed the classification of scapular fractures which was further elaborated by Bose. Among 130 anterior glenoid rim fractures, 3 patients with conservative management developed chronic shoulder subluxation and secondary osteoarthritis. 11 patients with anterior glenoid rim fractures had undergone surgical repair, resulted with 6 good surgical outcome and 5 with uncertain outcome.30 transverse fractures through the glenoid fossawhich were managed conservatively were associated with articular irregularity. Fractures of body and spine of scapula mostly require surgical repair to reduce residuals defects.

Harmon Davis and Francis et al[38,39],described fractures of spine and body of scapula with significant comminution associated with limited mobility. Associated unstable fractures of glenoid neck, concomitant clavicle fractures, acromioclavicular joint disruptions increase the risk of fracture segment displacement requiring surgical management.

Herscovici et al[40], demonstrated that scapular fractures associated with ipsilateral clavicle fracture or AC joint disruption termed as 'Floating shoulder' requires operative management.

Mcghan , Lind Holm and Leven et al[41,42], recommended conservative management for all glenoid neck fractures for which they proposed meagre evidences.

Nordquist and Petersson et al[43] studied 37 glenoid neck fractures managed conservatively and showed the functional outcome to be poor in 32%. They believed that in certain fractures early surgical fixation might had improved surgical outcome.

Miller and Ada et al[44], reviewed retrospectively 16 displaced glenoid neck fractures and showed that 20% patients had decreased range of motion,50% were associated with pain,40% had weakness with exertion. They also demonstrated these patients had shoulder abductor weakness and subacromial pain. They recommended Open reduction and internal fixation for glenoid fractures that are displaced.

Hardegger et al[45], demonstrated that among 5 patients who underwent surgical management for displaced glenoid neck fractures , showed good to excellent results in 4 cases (79%). They also agreed with Judet[46], Mogerl[47], Ganz and Noesberger[48] and Tscherneand Christ[49] that surgical intervention of glenoid neck fractures reduces disability and yields good results.

Fischer, Gagney et al[50], demonstrated good results in only 1 patient out of 12 who underwent conservative treatment for displaced glenoid neck fractures, so he concluded that Open reduction with internal fixation will be required in displaced glenoid neck fractures.

Surgical fixation for unstable scapular neck fractures is strongly recommended.

Ada et al[42], suggested that surgical management is needed for scapular neck fractures with >40 degree angular displacement or more 1 cm displacement of glenoid surface. He also suggested that apophysial fractures with >5- 8mm displacement will require surgical reduction.

Miller and Ada et al, showed that glenoid neck fracture with >40 degree angular displacement in coronal or transverse plane is unacceptable.

Batman and Depalma et al[52], suggested that glenoid neck fractures with excessive angular displacement will result in glenohumeral instability and leads to overall shoulder dysfunction.

Indications for fixation of glenoid neck fractures based on literature are:

A. For Intra articular glenoid fractures:

Any displaced fracture of glenoid surface with >5mm gap in articular surface, displacement >1cm and >25% of aricular surface involvement, subluxation of humeral head with fracture fragment.

B. For Extra articular fractures:

Scapular neck fractures with >40 degree angulation or with >1cm medialisation or gleno polar angle (GPA) <20 degree or >40 degree, floating shoulder, displaced acromial fractures.

The direction and extent of surgical exposure depends on where the fracture is located. Anterior glenoid rim fractures are treated with open reduction and internal fixation using deltopectoral approach.

Depalma et al[53,58] demonstrated that the anterior glenoid rim fracture fragment is always attached to the capsule, so capsule should be resorted to its anatomical position by mobilization. The fragment is reduced with K-wire and then fixed with screws. Smaller fragments are stabilized using sutures.

The majority of scapular fractures are easily approached posteriorly and therefore posterior approach is recommended.

Jefry F Klassen, GossTP et al[54], demonstrated with a straight vertical incision, tissue flaps can be raised, then deltoid muscle is detached from spine of scapula,following which the interval between teres minor and infraspinatus is developed, most of the scapula is exposed so that a posterior rim fragment or a comminuted glenoid fossa fracture with extension into scapular body can be reduced.If Glenoid fossa fracture exists, buttress plate or neutralisation plate is fixed.

Glenoid neck fractures, type 2 are usually approached posteriorly for surgical fixation. The position for posterior approach is a lateral decubitus position. Incision is made over lateral 1/3rd of spine of scapula along the posterior aspect of acromion to its lateral tip and then distally for additional 2.5cm.Posterior deltoid is dissected from the spine of scapula and acromion process. The interval between infra spinatus and teres minor is developed to expose the lateral border of scapula and postero inferior aspect of glenoid neck, further exposure may warrant tenotomy of infraspinatus muscle[55].The supra scapular nerve, axillary nerve and posterior circumflex humeral vessels are protected in this approach.

Harmer et al[59], demonstrated in a cadaveric study that modified Judet approach although exposed only 20% of the area that exposed in Classical Judet approach, but still allows access to important landmarks for reduction and internal fixation, with limited soft tissue excision.

Hardegger et al and Kavanagh et al[60,61] used a vertical incision from the acromion process to the inferior scapular angle, but the posterior deltoid cannot be released in this approach, thereby making high glenoid and intra articular fractures difficult to identify.

Kligman and Roffman et al[62] described a novel approach to intra articular glenoid fracture with incision along the scapular spine, dissecting the posterior deltoid, inferiorly retracting the same. Intraarticular part of deltoid is

then visualized by rotator cuff tendon incision and retraction, but this approach allows poor exposure of glenoid neck and body of scapula.

Ebraheim et al[62,63], proposed an surgical approach, with a skin incision along the spine of scapula followed by vertical extension at the lateral border of scapula. A fascia flap is being raised medially, which then exposes the scapular musculature. This approach uses a ‘reverse Judet’ incision over the skin.

The modified Judet approach uses the original Judet incision which is more familiar, has limited muscle dissection, complete joint exposure there by allowing adequate exposure, reduction and fixation for almost all types of glenoid and glenoid neck fractures.

Egol, Conor, Karunakar et al[64], demonstrated that the modified Judet approach and the positioning does not allow adequate exposure to clavicle which is associated with ‘floating shoulder’. If surgical fixation for clavicular fracture is needed, then prior or after fixation of scapula is suggested with patient put on beach chair or lateral position.

Willian t Obremsky, Jeffery R Lyman et al, in their study concluded that standard approach for scapular fracture fixation is Judet approach. The modification of this standard approach is that infraspinatus muscle is not dissected out of the scapular fossa, the modified Judet approach allows better access to all fracture patterns, both intra articular and glenoid fractures with limited dissection, with minimal risk to suprascapular and axillary nerve.

Adam FF, Ganz R, Noesberger B et al[48], observed infection, heterotrophic ossification and infraspinatus nerve palsy following surgical reduction and fixation for scapular fractures.

Lantry et al[65], in his study observed that implant was often contributing factor for the complications and implant exit was done in 7% of patients.

Scheibel et al[66], reported in his study of 10 patients that ORIF for glenoid neck fractures involving >25% of articulating area were associated

with early, high complication rate with one patient developing implant loosening and three patients developing persistent pain because of screw impingement, cartilage damage, which necessitates revision surgery.

Constant C.R, Murley A.H et al[67],1987 proposed a clinical method for functional assessment of shoulder following various shoulder pathologies, which is related to two subjective aspects- pain and activity of daily living (ADL) and two objective aspects- range of movements (ROM) and strength. The subjective component can be given upto a score of 35 and objective 65, giving a total maximum score of 100. Pain and ADL are answered by the patient where as ROM and strength are assessed by Orthopedician or physiotherapist.

K.A.R Kemp,D.M.Sheps, Richard et al[68], demonstrated the reliability of Constant- Murley score and responsiveness in the assessment of various shoulder interventions. Their study clearly showed the score is responsive to detect improvement after shoulder intervention following various shoulder pathologies. Their evaluation also demonstrated a good reproducibility, responsiveness and construct validity of the scores. The Constant-Murley score correlates with shoulder specific questionnaire (grade of recommendation B).

Bozkurt et al[69], demonstrated strong positive correlationbetween a reduced Glenopolar angle and Constant score in 18 extra articular scapular fractures that were conservatively managed.

Kim et al[70], showed statistically significant improvements when evaluated using Constant Murley score in patients with glenopolar angle >30 degree when compared to patients with Glenopolar angle <30 degree.

MATERIAL AND METHODS

This is a prospective study to evaluate the functional outcome of fractures of periglenoid of scapula treated with open reduction and internal fixation. The study period was from March 2018 to November 2019 at Institute of Orthopedics and Traumatology, Madras Medical College, Rajiv Gandhi Government hospital, Chennai. This study was approved by department and institute ethical committee.

In this study the patients were included as per the following criteria:

INCLUSION CRITERIA:

- Patient diagnosed with fracture of periglenoid of scapula
- Type II glenoid neck fractures
- Type II glenoid neck fractures associated with clavicle fracture(floting shoulder) acromioclavicularjoint disruption, coracoclavicular and coracoacromion ligament injury, coracoid process, acromion process fracture and humerus fracture.
- **GLENOID RIM FRACTURES**

Unstable glenohumeral articulation:

- Displacement of fragment>or equal to 10mm
- Involvement of more than or equal to one fourth of glenoid cavity anteriorly
- Involvement of more than or equal to one third of glenoid cavity posteriorly

- **GLENOID FOSSA FRACTURES**

- Articular step of more than or equal to 5mm
- Unstable glenohumeral articulation
- Severe separation of fragments
- Age > 18years

EXCLUSION CRITERIA:

- Those who are not willing for the study
- Soft tissue defect not suitable for primary closure
- Patient with local and systemic infection
- Medically unstable patients
- Age < 18years

Patients with the above mentioned criteria were excluded from the study. Patients arriving to the trauma ward of this hospital were initially, managed by shoulder immobilization either with shoulder immobilizer or arm sling.

These patients were further evaluated with the following radiological investigation of the involved scapula:

- AP and lateral view of scapula
- Axillary view of gleno humeral joint
- Weight bearing view of shoulder
-
- CT with and without reconstructions 3-Dimensional CT.
- Computed tomography with 3-D reconstruction was useful in selected cases where there was difficulty in identifying the fracture line with plain X-rays.

After diagnosing the periglenoid fracture and if the patient falls under the inclusion criteria they were informed about the study and planned for the surgical intervention after obtaining informed written consent.

A total of 10 patients were prospectively followed during the study period of 18 months. The follow up period ranges from 3 months to 20 months, including 8 male and 2 female patients, with mean age of 41years with glenoid and periglenoid fractures. All the patient underwent ORIF with Recon Plate.

All patients underwent ORIF under General anaesthesia.

The surgical approach followed were Modified Judet for 8 cases and AO approach for 2 cases.

SURGICAL APPROACH

MODIFIED JUDET APPROACH:

8 patients under went modified Judet approach. There were put in lateral decubitus position under general anaesthesia. Under strictaseptic precautions the following procedure was done.

- Begin the skin incision just lateral to the tip of the acromion, pass it medially and posteriorly along the border of the acromion, curve it slightly distal to the spine of scapula and end it at the base of spine of scapula.

- Reflect the skin and the fascia, expose the origin of deltoid musle from the spine of scapula. Detach this part of deltoid from bone by subperiosteal dissection, and reflect it distally and laterally, taking care to avoid injury to the axillary nerve and vessels as they emerge from quadrangular space and enter the muscle. As a precaution against injuring this nerve, do not retract the deltoid muscle distal to the teres

minor muscle, and to avoid injuring the suprascapular nerve,do not enter the infraspinatus muscle.

- After reflecting the deltoid expose the posterior surface of the joint capsule by detaching the inferior two thirds of the infraspinatus tendon near its insertion on the humerus and reflecting the detached part medially.

- Alternatively, the posterior part of the joint can be exposed by an oblique incision between infraspinatus and teres minor muscles and then

MODIFIED JUDET APPROACH

POSITIONING

SKIN INCISION- ALONG THE BASE OF SPINE OF SCAPULA

INCISION EXTENDED DOWNWARDS

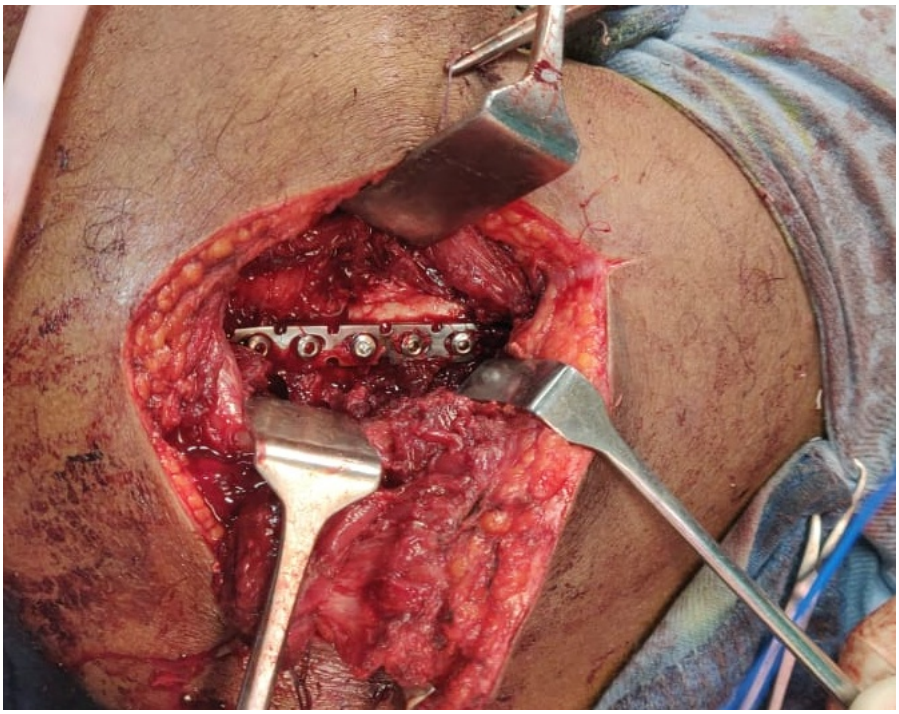
INTERVAL BETWEEN INFRASPINATUS &

TERES MINOR IDENTIFIED

STAY SUTURE FOR INFRASPINATUS TENDON

FRACTURE SITE EXPOSED

FRACTURE REDUCED WITH RECON PLATE



SKIN CLOSURE

- Opening the joint capsule by a longitudinal or transverse incision or by a combination of both as needed. The interval between infraspinatus and teres minor muscles can be extended medially, exposing more of the inferior scapula for fracture fixation. Extend the incision distally along the medial border of the scapula if necessary.

- The fracture site was exposed, fracture reduced and fixed with Recon Plate with 3.5mm cortical screws.

- Finally the wound is closed with suction drain and sterile dressing.

AO APPROACH:

2 cases underwent AO approach. There were put in lateral decubitus position under general anaesthesia. Under strict aseptic precautions the following procedure was done.

- The incision is made starting at the tip of the acromion posteriorly and proceeds towards the scapular angle parallel to the lateral border of scapula. The extent of the incision will depend on the amount of exposure required. Make sure to leave a small tissue border to facilitate subsequent reattachment. Using sharp dissection, divide the deltoid from its insertion into the scapular spine and base of the acromion. Continue freeing the deltoid muscle so that it can be reflected laterally. Avoid damaging the axillary nerve and posterior circumflex artery laterally. In order to expose lateral margin of scapula, identify the interval between the infraspinatus and teres minor. Open the interval and separate the infraspinatus and teres minor and expose the posterior capsule of the joint and the axillary border of scapula. In elevating these muscles be careful not to damage their nerve supply.

- After exposing the fracture, the fracture site was reduced with Recon Plate with 3.5mm cortical screws

IMPLANTS AND INSTRUMENTS REQUIRED

- Kirshner wire (1.5mm and 1.8mm)
- Drill bit (2.5mm and 2.7mm)
- Screw driver (3.5mm)
- Cortical screws (3.5mm)
- Recon plates of all available sizes

COMPLICATIONS:

- Screw penetration into the joint
- Axillary nerve and artery injury
- Suprascapular nerve and artery injury
- Rotator cuff injury

POST OPERATIVE PROTOCOL:

Postoperative immobilization was done with arm sling

PHASE 1- Early motion phase (0-5 weeks)

a. Passive range of movements initiated in first week
b. CPM plays a vital role in early mobilization and rehabilitation of shoulder joint. Shoulder CPM machine will be set at an angle of 60-120 degrees for forward and lateral elevation and 60 degrees for external rotation, 30 degrees for internal rotation, depending upon patient comfort and post operative findings. CPM should be done optimally 2 hours at a time, 3 times a day.
c. Pendulum exercises with active assisted range of movements, allowing flexion upto 140 degree initiated in second week.
d. Isometric exercises with active assisted range of movements started during 3- 4^{th} week

PHASE 2- Active motion phase (4-12 weeks)

a. Active range of movements and full passive range of movements started by 4-6weeks
b. Early resisted range of movements and if patient can tolerate pain weight bearing initiated by 8^{th} week.

PHASE 3 – Strengthening and Stretching (>12 weeks)

Isotonic strengthening exercises with weight lifting initiated.

THE CONSTANT- MURLEY SCORE

The shoulder functions were assessed using standard Constant-Murley score proforma at six weeks, three months and six months.

The Constant-Murley score includes the following 4 major categories for assessing shoulder function both subjectively and objectively.

CATEGORIES	SCORES
Pain	15
Activity of daily living	20
Range of movements	40
Strength	25
Total	100

Pain and activities of daily living are subjective measures whereas strength and range of motion are objective measures.

Pain: The patient is asked to tick on 15cm scale to assess the pain felt during last 24hrs. Anchors towards left denote no pain with score of 15 and towards right denotes intolerable pain with score of 0.

Activity of daily living: The subjective capability to perform all the activities of daily living over the past 1week is recorded. It has got 2 subdivisions.

ACTIVITY OF DAILY LIVING (Total score 20)	SCORE
ACTIVITY	
Full work	4
Full recreation	4
Unaffected sleep	2
POSITION OF ARM FOR TASK	
Up to waist	2
Up to xiphoid	4
Up to neck	6
Up to top of head	8
Above the head	10

RANGE OF MOTION: Only active range of movements are considered to assess shoulder function. Goniometer is used to assess range of movements in two planes: Forward elevation and lateral elevation. For rotational movements, the extent of placing the upper limb at relevant position like head, neck and trunk are used.

RANGE OF MOTION	SCORE
1.FORWARD ELEVATION	
0-30 DEGREE	0
31-60 DEGREE	2
61-90 DEGREE	4
91-120 DEGREE	6
121-150 DEGREE	8
151-180 DEGREE	10
2.LATERAL ELEVATION	
0-30 DEGREE	0
31-60 DEGREE	2
61-90 DEGREE	4

RANGE OF MOTION	SCORE
91-120 DEGREE	6
121-150	8
151-180	10
3.EXTERNAL ROTATION	
Hand behind head with elbow held forward	2
Hand behind head with elbow held back	2
Hand on top of head with elbow held forward	2
Hand on top of head with elbow held back	2
Full elevation of arm	2
4. INTERNAL ROTATION	
Dorsum of hand to lateral thigh area	0
Dorsum of hand to buttock region	2
Dorsum of hand to lumbosacral region	4
Dorsum of hand to waist	6
Dorsum of hand to 12^{th} dorsal vertebral level	8
Dorsum of hand to interscapular level	10

STRENGTH: A Dynamometer is used to measure the strength of operated shoulder .A total of three attempts are made and the best of which is recorded from 0-25 points. If strength is measured in kilograms, score is calculated by multiplying with factor 2.2.

The final functional outcome is calculated using the Constant-Murley score as graded.

1. Poor (0-55)
2. Moderate (56-70)
3. Good (71-85)
4. Excellent (86-100)

CASE ILLUSTRATION

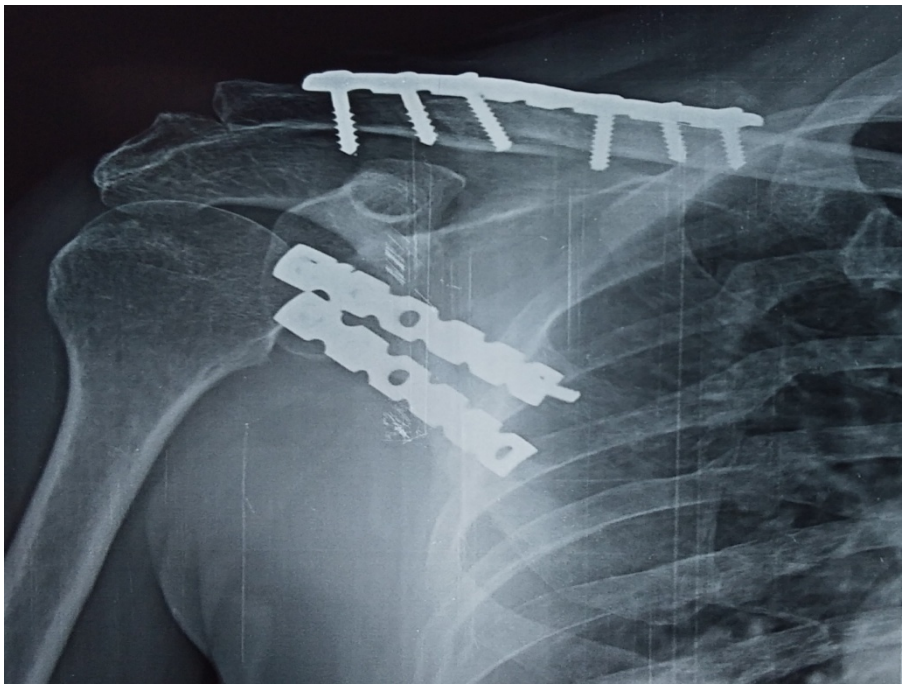
CASE ILLUSTRATION

CASE 1:

NAME	**Mr. Jahir Hussain**
AGE/SEX	**51/M**
IP NO	**1651**
DATE OF ADMISSION	**04/01/2018**
DATE OF SURGERY	**05/02/2018**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**glenoid neck fracture with clavicle fracture middle 1/3rd (floating shoulder) Right**
PROCEDURE DONE	**ORIF with Recon plate fixation for glenoid neck fracture and anatomical plating for clavicle fracture**
CONSTANT- MURLEY SCORE	**62**
FUNTIONAL OUTCOME	**MODERATE**

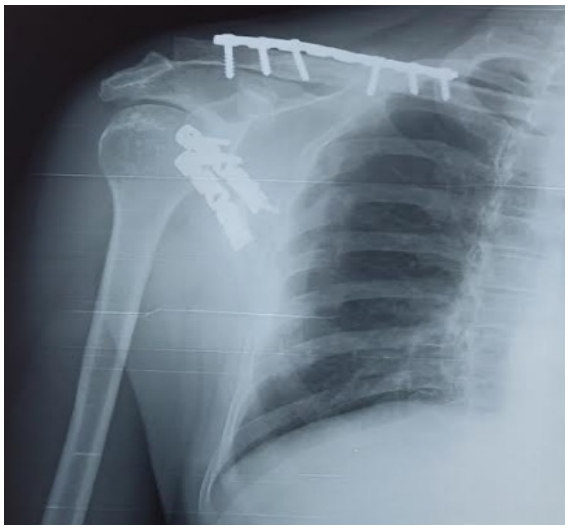
PRE OP X RAY

POST OP X RAY



POST OP SCAR

1ST FOLLOW UP X RAY- 28/03/2018



2ND FOLLOW UP X-RAY

O7.11.2018

ROM

ROM

CASE 2:

NAME	**Mr. Vengatesan**
AGE/SEX	**40/M**
IP NO	**1856**
DATE OF ADMISSION	**04/01/2018**
DATE OF SURGERY	**08/02/2018**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Neck of glenoid fracture with closed shaft of humerus middle 1/3rd right.**
PROCEDURE DONE	**ORIF with Recon plating for glenoid neck fracture of scapula and ORIF with narrow DCP fixation of shaft of humerus fracture.**
CONSTANT- MURLEY SCORE	**60**
FUNCTIONAL OUTCOME	**MODERATE**

PRE OP XRAY

PRE OP CT

SHOULDER IMMOBILISATION

POST OP XRAY POST OP SCAR

1ST FOLLOW UP XRAY

14.03.2018

2ND FOLLOW UP XRAY

22.08.2018

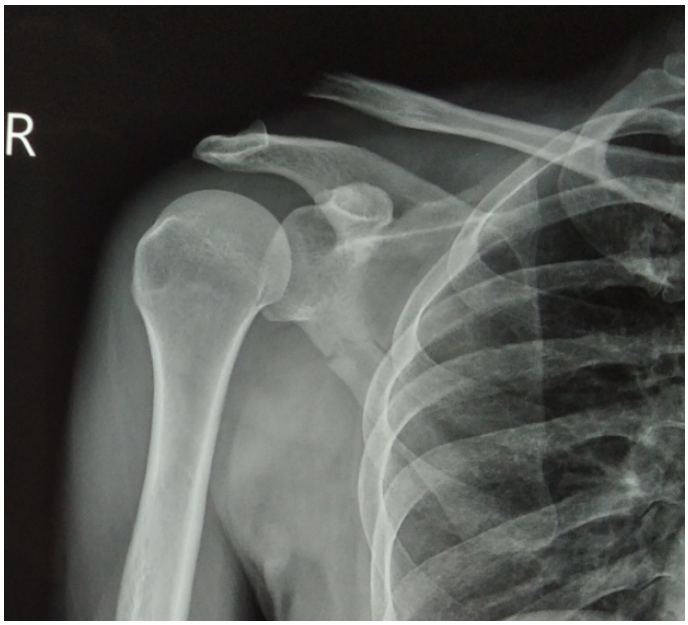
ROM

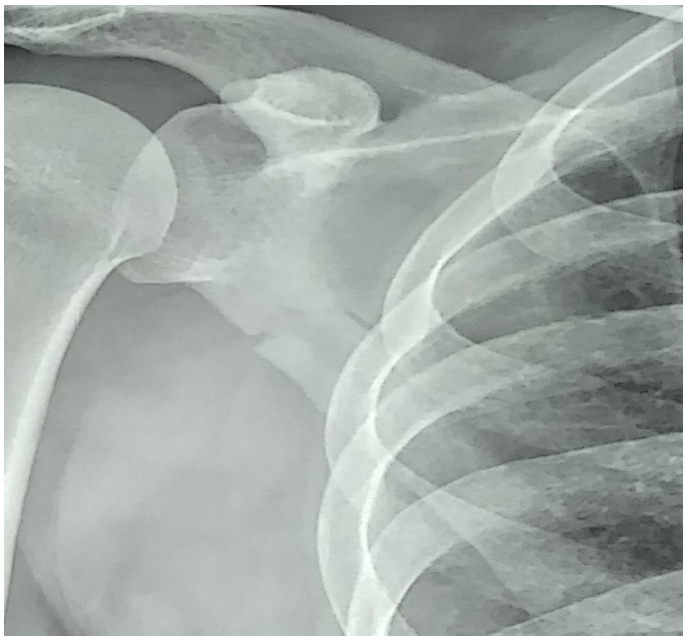
ROM

CASE 3:

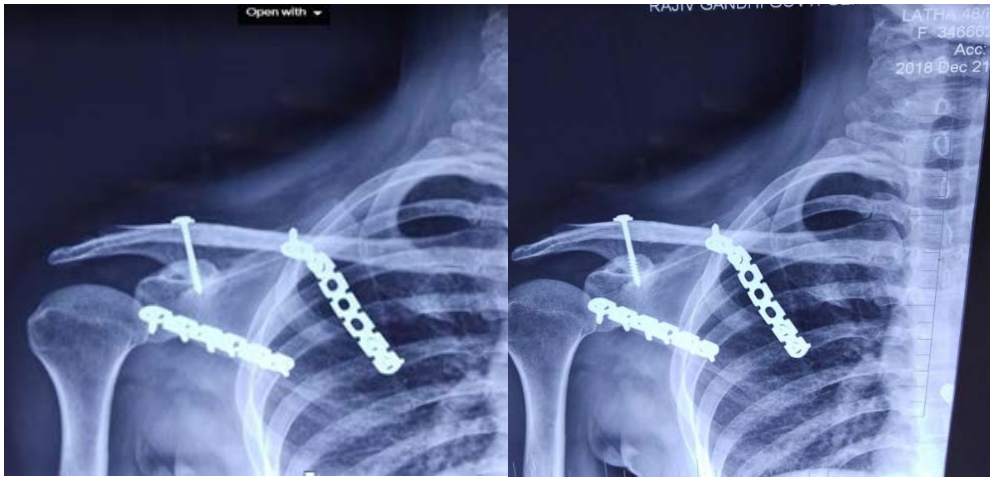
NAME	**Mrs. Latha**
AGE/SEX	**45/F**
IP NO	**101288**
DATE OF ADMISSION	**11/09/2018**
DATE OF SURGERY	**24/11/2018**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with body of scapula fracture and acromioclavicular joint disruption-right.**
PROCEDURE DONE	**ORIF with Recon plate fixation for glenoid neck fracture and body of scapula fracture and cancellous screw fixation for acromioclavicular joint disruption**
CONSTANT- MURLEY SCORE	**76**
FUNCTIONALOUTCOME	**GOOD**

PRE OP X-RAY





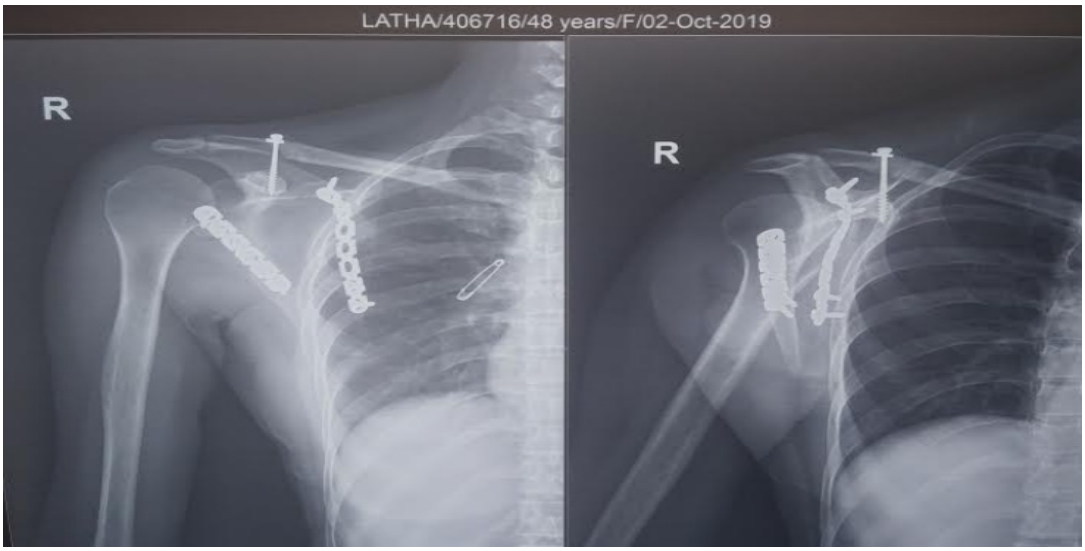
POST OP X RAY **1ST FOLLOW UP XRAY 21.12.2018**



2NDFOLLOW UP X-RAY

01.05.2019

3RD FOLLOW UP X RAY, 02.10.2019



SHOULDER MOBILISATION EXERCISE

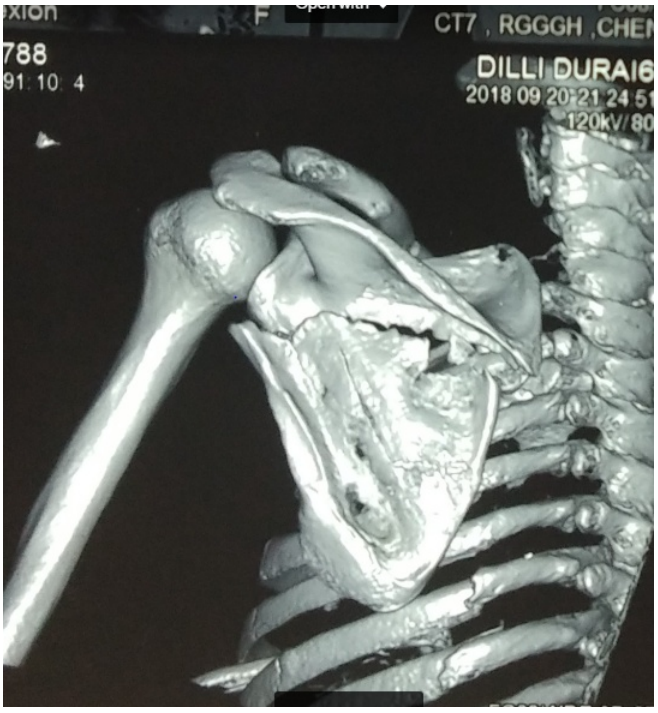
ROM

CASE 4:

NAME	**Mr. Dilli durai**
AGE/SEX	**45/m**
IP.NO	**110300**
DATE OF ADMISSION	**20/10/2018**
DATE OF SURGERY	**26/10/2018**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture left and closed fracture clavicle left, middle 1/3rd (Floating shoulder)**
PROCEDURE DONE	**ORIF with Recon plate fixation for glenoid neck fracture and anatomical plate fixation for clavicle fracture.**
CONSTANT- MURLEY SCORE	**93**
FUNCTIONAL OUTCOME	**EXCELLENT**

PRE OP X-RAY:

PRE OP CT



POST OP X-RAY **POST OP SCAR**

1ST FOLLOW UP X-RAY, 21.11.2018

2ND FOLLOW UP X-RAY, 29.08.2019

ROM

ROM

CASE 5:

NAME	**Mr. Praveen**
AGE/SEX	**26/M**
IP.NO	**130561**
DATE OF ADMISSION	**25/11/2018**
DATE OF SURGERY	**30/11/2018**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture with body of scapula fracture -left**
PROCEDURE DONE	**ORIF with recon plating for Glenoid neck fracture**
CONSTANT- MURLEY SCORE	**91**
FUNCTIONAL OUTCOME	**EXCELLENT**

PRE OP X-RAY **PRE OP CT**

SHOULDER IMMOBILISATION

POST OP X RAY

POST OP SCAR

1ST FOLLOW OP XRAY

28.12.2018

2NDFOLLOW UP X-RAY

14.02.2019

ROM

ROM

CASE 6:

NAME	**Mrs. Rangammal**
AGE/SEX	**48/F**
IP.NO	**41455**
DATE OF ADMISSION	**14/04/2019**
DATE OF SURGERY	**15/05/2019**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with body of scapula fracture – Right**
PROCEDURE DONE	**ORIF with Recon plate fixation for Glenoid neck fracture and body of scapula fracture**
CONSTANT- MURLEY SCORE	**72**
FUNCTIONAL OUTCOME	**GOOD**

PRE OP XRAY

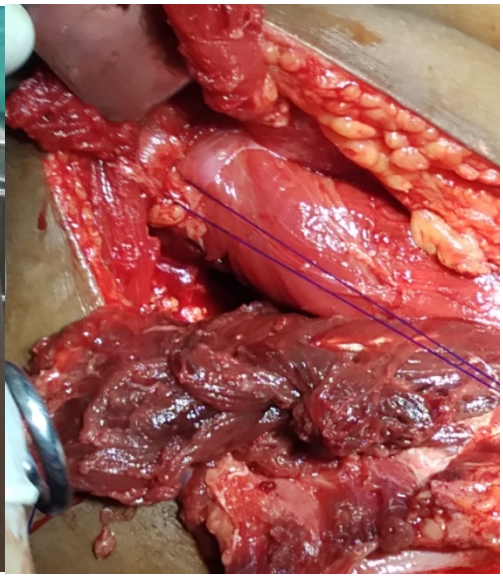
PRE OP CT

PRE OP CT

POST OP X-RAY

POST OP SCAR

INTRA OP



1ST FOLLOW UP X RAY 05.06.2019

2ND FOLLOW UP X RAY, 21.08.2019

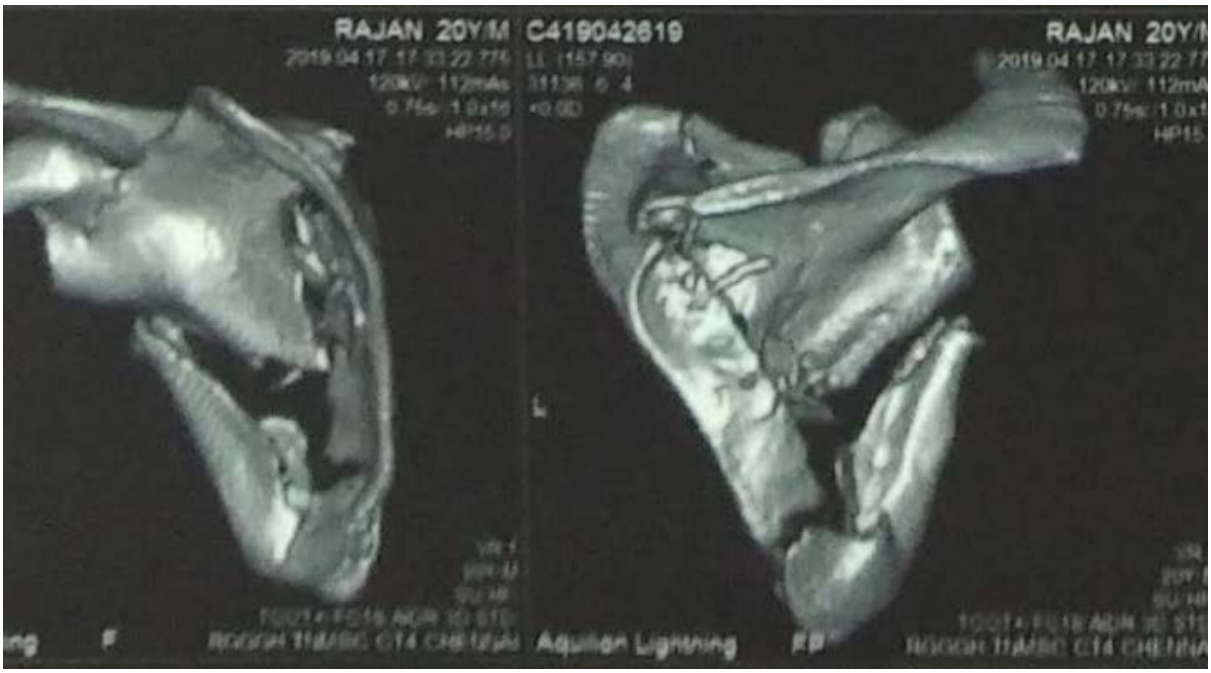
ROM

CASE 7:

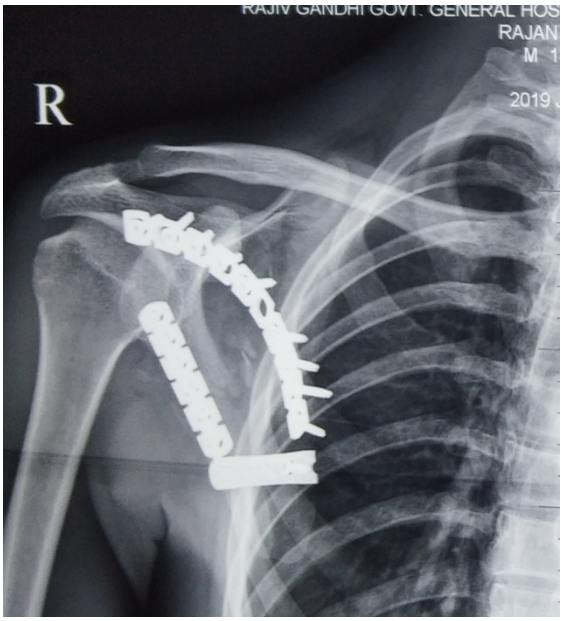
NAME	**Mr.Rajan**
AGE/SEX	**20/M**
IP.NO	**34700**
DATE OF ADMISSION	**17/04/2019**
DATE OF SURGERY	**22/04/2019**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with body of scapula fracture – Right**
PROCEDURE DONE	**ORIF with Recon plate fixation for Glenoid neck fracture and body of scapula fracture**
CONSTANT- MURLEY SCORE	**87**
FUNCTIONAL OUTCOME	**EXCELLENT**

PRE OP XRAY

PRE OP CT



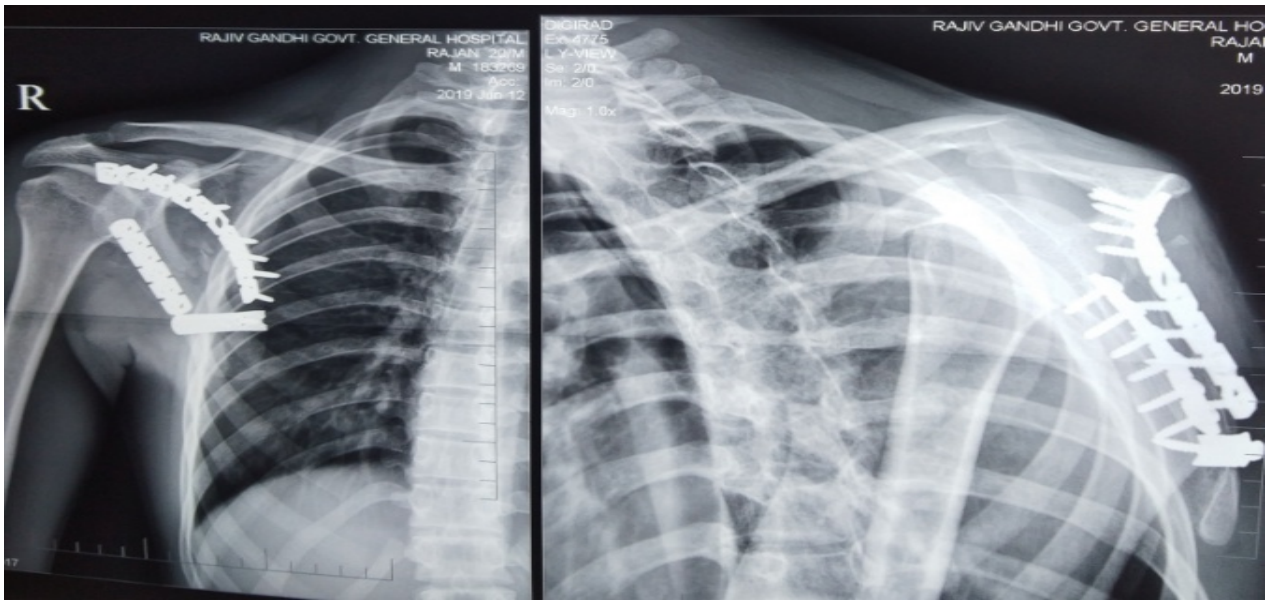
POST OP X RAY



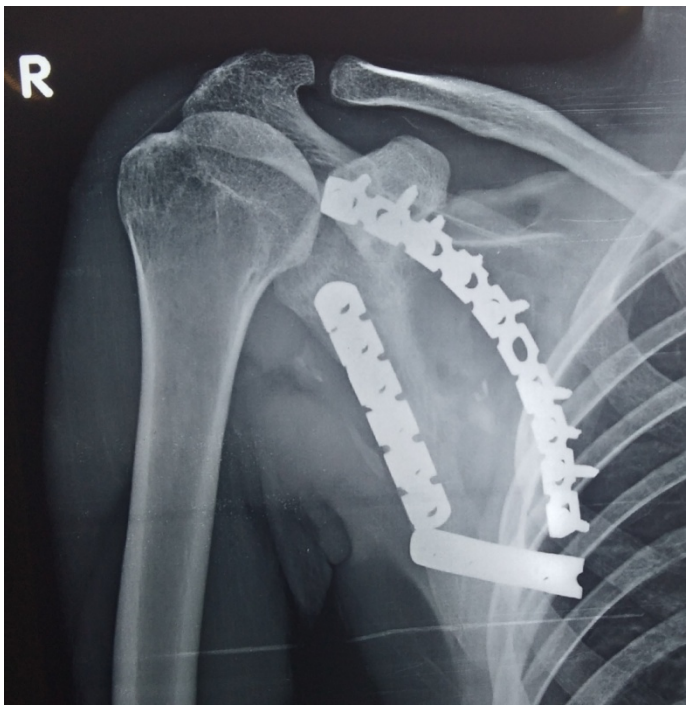
INTRA OP

POST OP SCAR

1ST FOLLOW UP X-RAY, 12.06.2019



2ND FOLLOW UP X RAY, 07.08.2019



ROM

CASE 8:

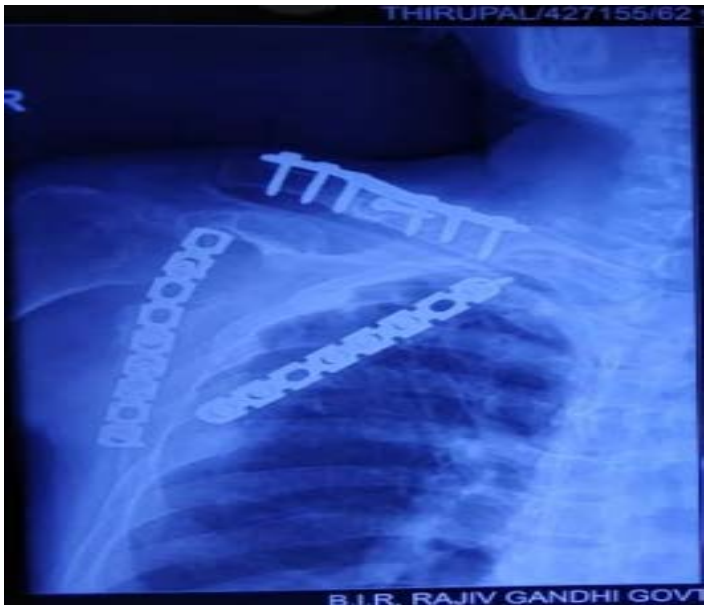
NAME	**Mr.Thirupal**
AGE/SEX	**45/M**
IP.NO	**45077**
DATE OF ADMISSION	**24/04/2019**
DATE OF SURGERY	**03/05/2019**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with body of scapula fracture with clavicle # middle 1/3rd– Right (Floating Shoulder)**
PROCEDURE DONE	**ORIF with Recon plate fixation for Glenoid neck fracture, body of scapula fracture and anatomical locking plate for clavicle.**
CONSTANT- MURLEY SCORE	**45**
FUNCTIONAL OUTCOME	**POOR**

PRE OP XRAY

POST OP X RAY

1ST FOLLOW UP X RAY

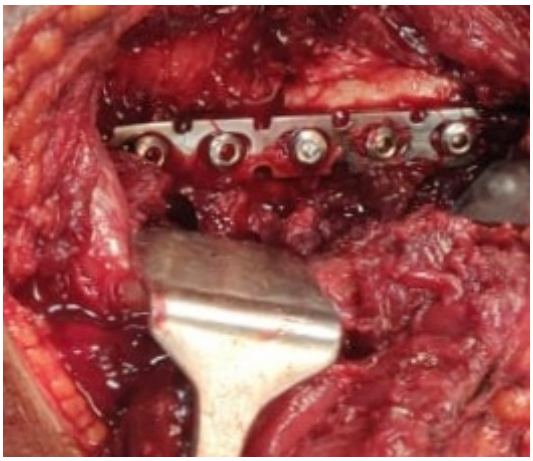
03.07.2019



2ND FOLLOW UP X RAY

17.09.2019

INTRA OP



ROM

CASE 9:

NAME	**Mr.Nithya nandha**
AGE/SEX	**46/M**
IP.NO	**73196**
DATE OF ADMISSION	**04/07/2019**
DATE OF SURGERY	**29/07/2019**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with spine of scapula fracture - Right**
PROCEDURE DONE	**ORIF with Recon plate fixation for Glenoid neck fracture and spine of scapula fracture**
CONSTANT- MURLEY SCORE	**72**
FUNCTIONAL OUTCOME	**GOOD**

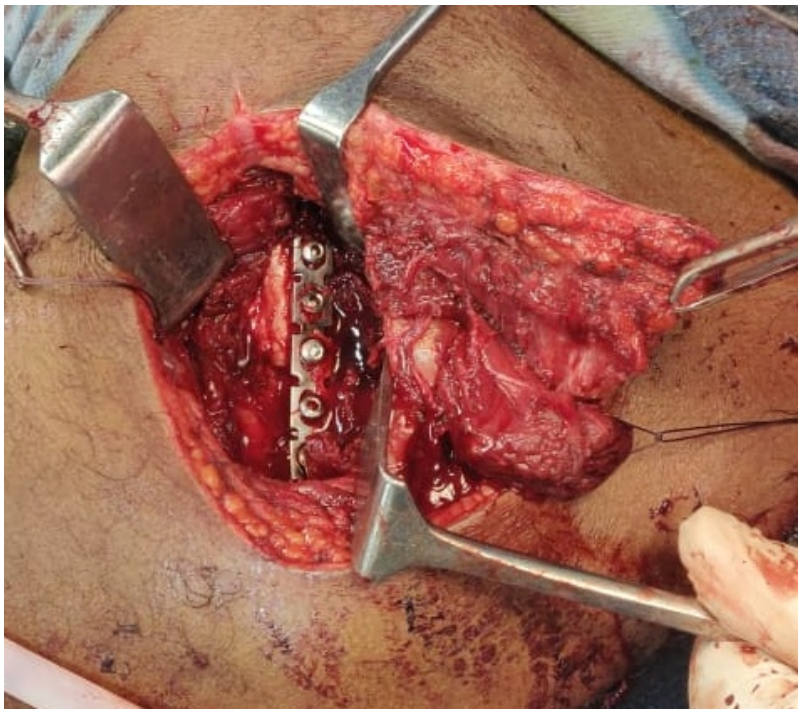
PRE OP X-RAY

POST OP X RAY

INTRA OPPOSITIONING

INTRA OP

INTRA OP

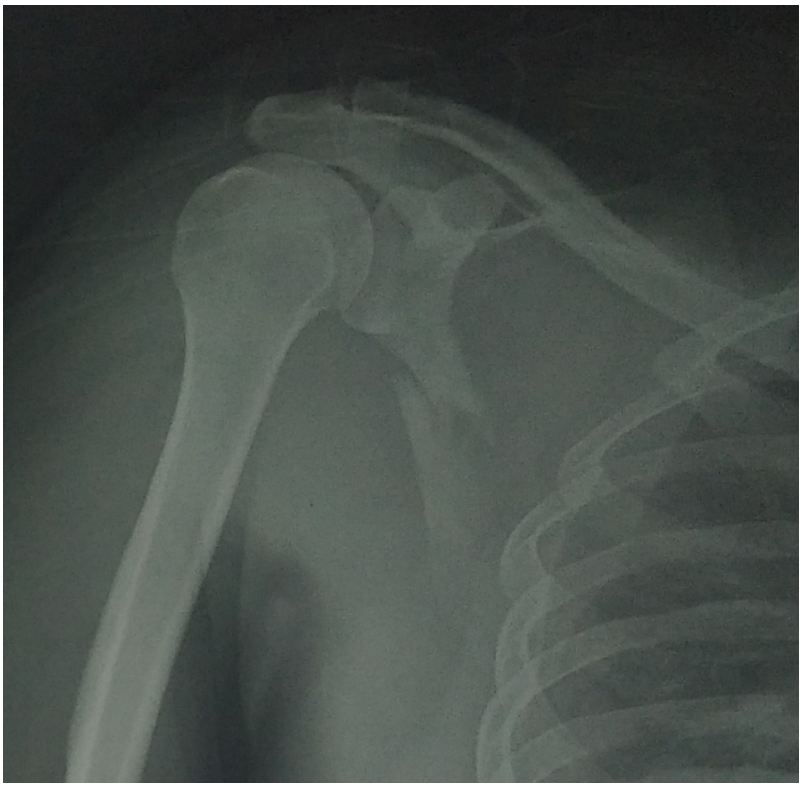


POST OP SCAR

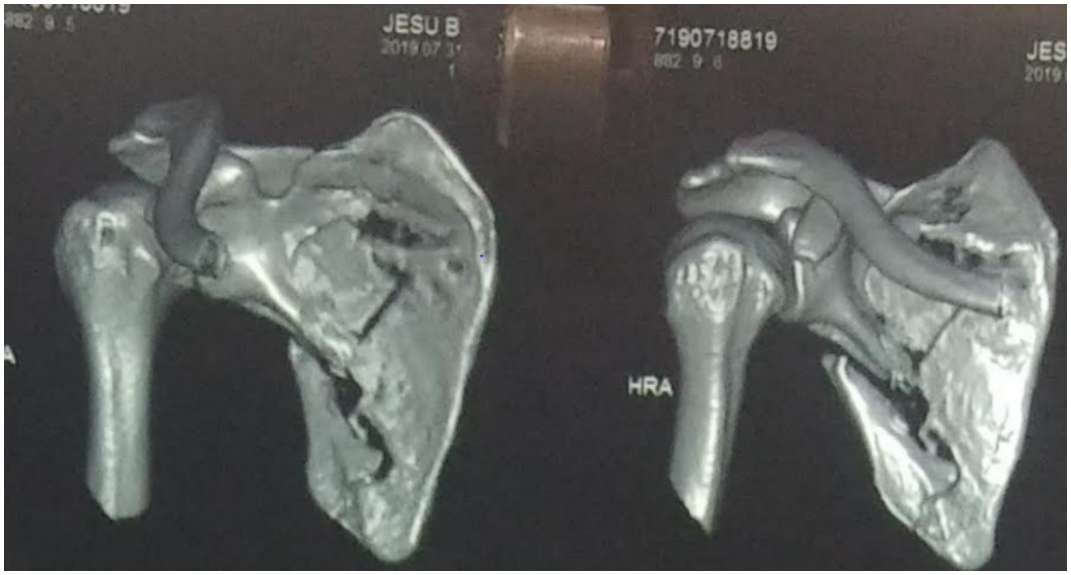
CASE 10:

NAME	**Mr.Jesu Brito**
AGE/SEX	**28/M**
IP.NO	**84027**
DATE OF ADMISSION	**31/07/2019**
DATE OF SURGERY	**10/08/2019**
MODE OF INJURY	**Road traffic accident**
DIAGNOSIS	**Glenoid neck fracture of scapula with spine of scapula fracture - Right**
PROCEDURE DONE	**ORIF with Recon plate fixation for Glenoid neck fracture and spine of scapula fracture**
CONSTANT- MURLEY SCORE	**74**
FUNCTIONAL OUTCOME	**GOOD**

PRE OP X RAY



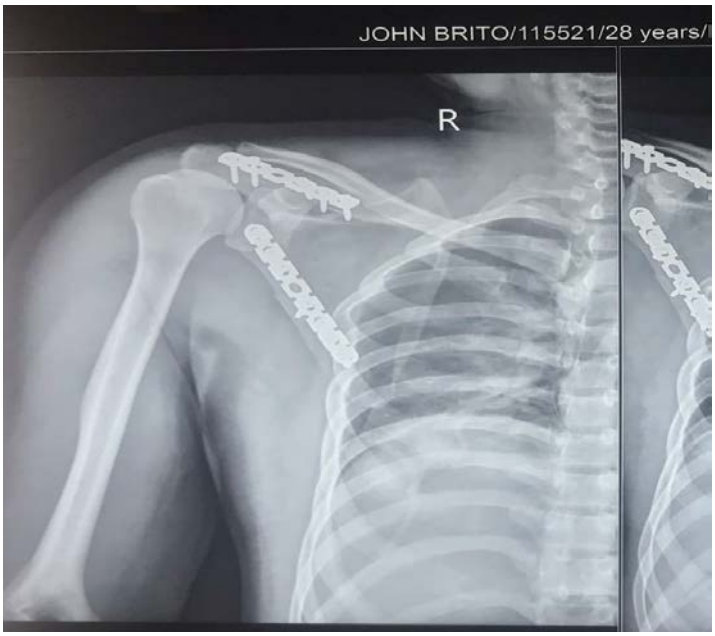
PRE OP CT



POST OP X-RAY

POST OP SCAR

1ST FOLLOW UP X-RAY, 23.10.2019



ROM

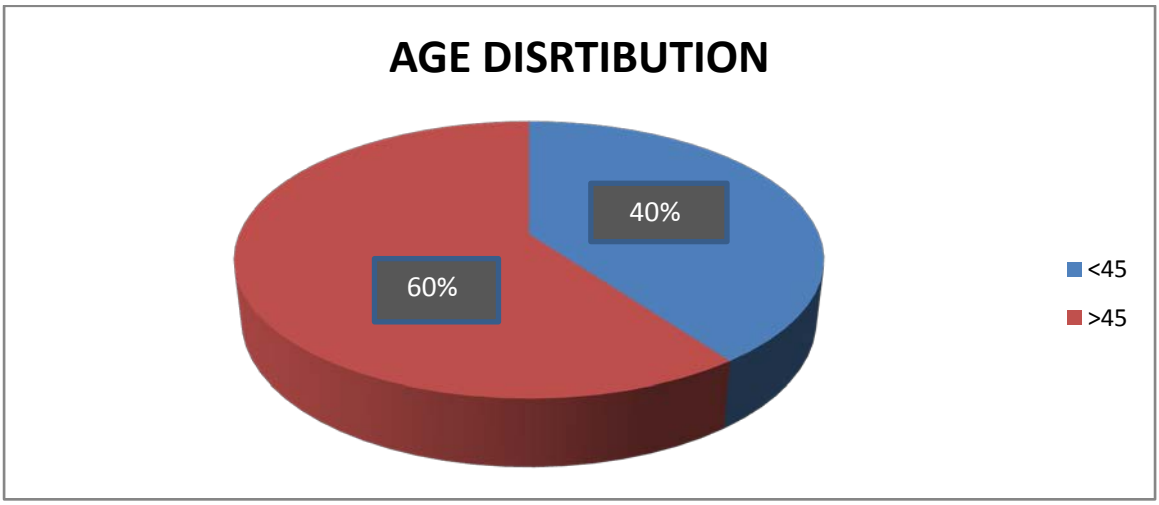
ROM

ROM

RESULTS AND OBSERVATION

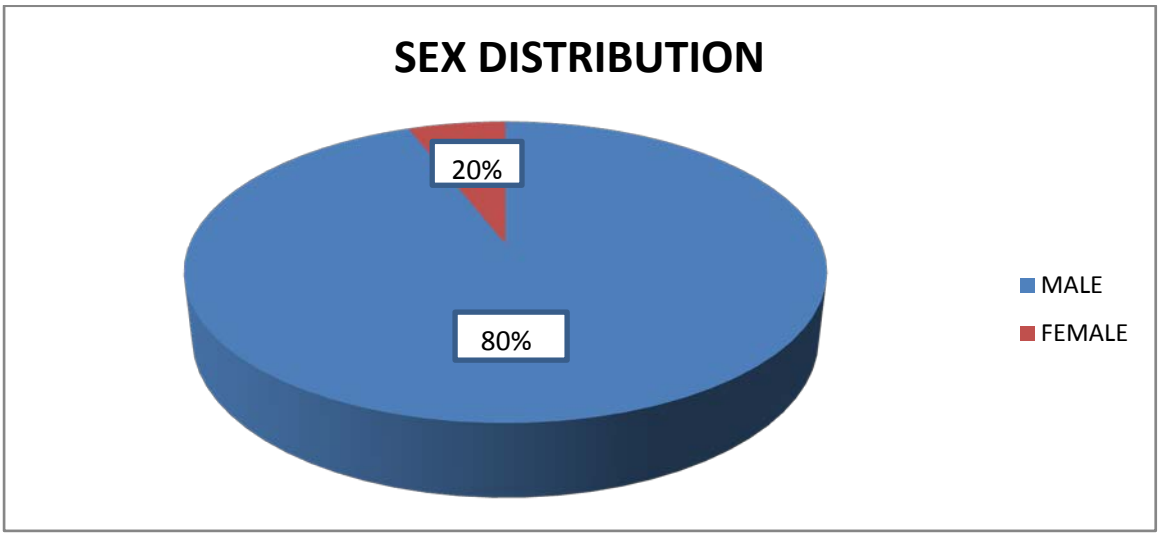
AGE DISTRIBUTION

AGE IN YEARS	NO. OF PATIENTS	PERCENTAGE
<45	4	40%
>45	6	60%



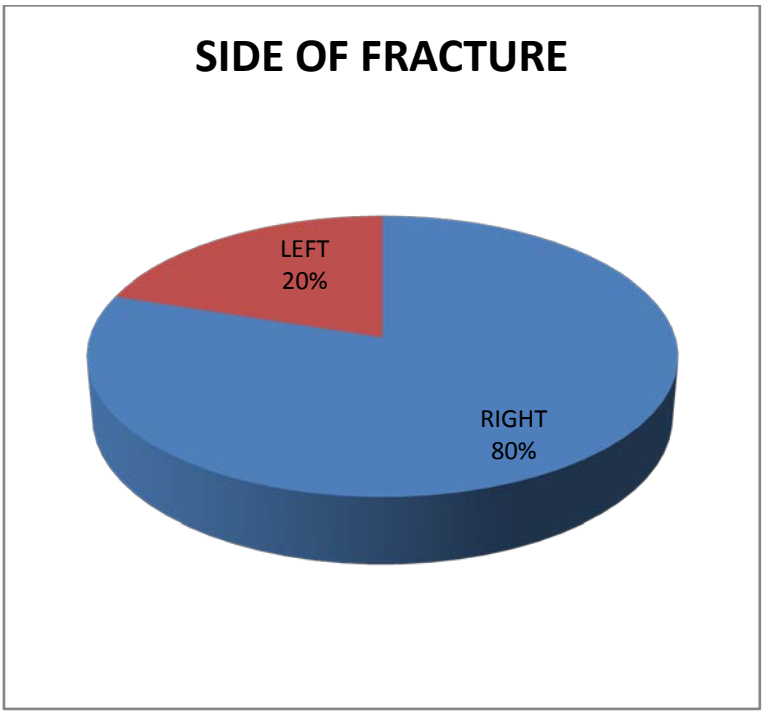
SEX DISTRIBUTION

SEX	NO.OF PATIENTS	PERCENTAGE
MALE	8	80%
FEMALE	2	20%



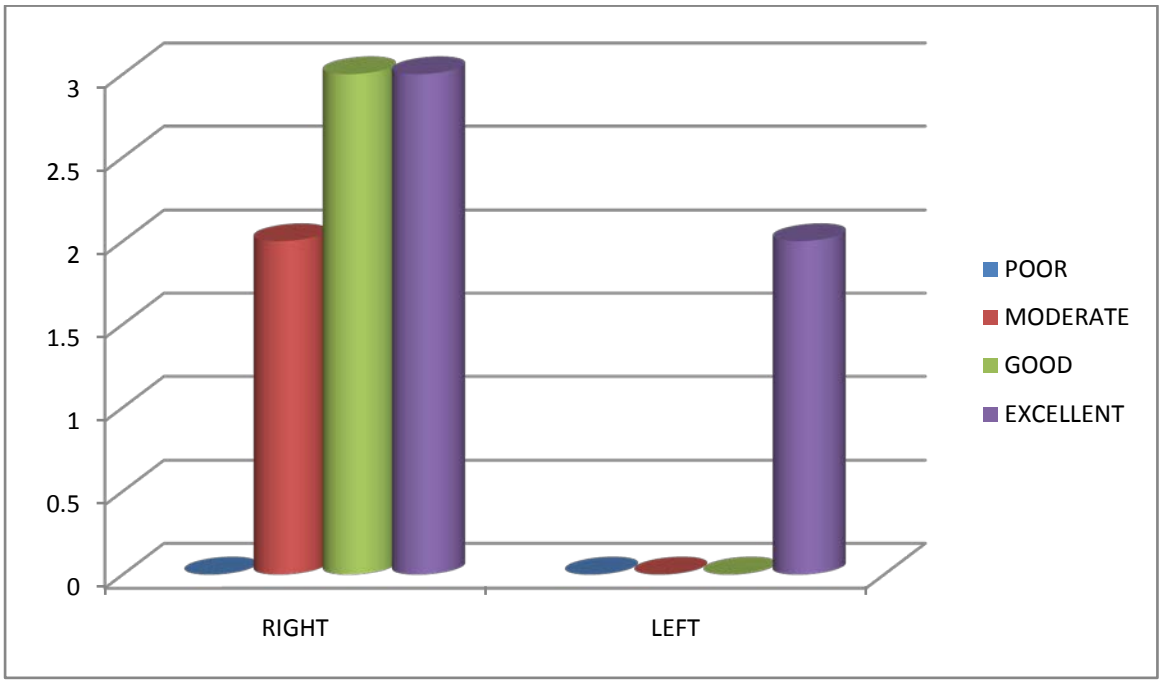
SIDE OF FRACTURE

SIDE OF FRACTURE	NO. OF PATIENTS	PERCENTAGE
RIGHT	8	80%
LEFT	2	20%



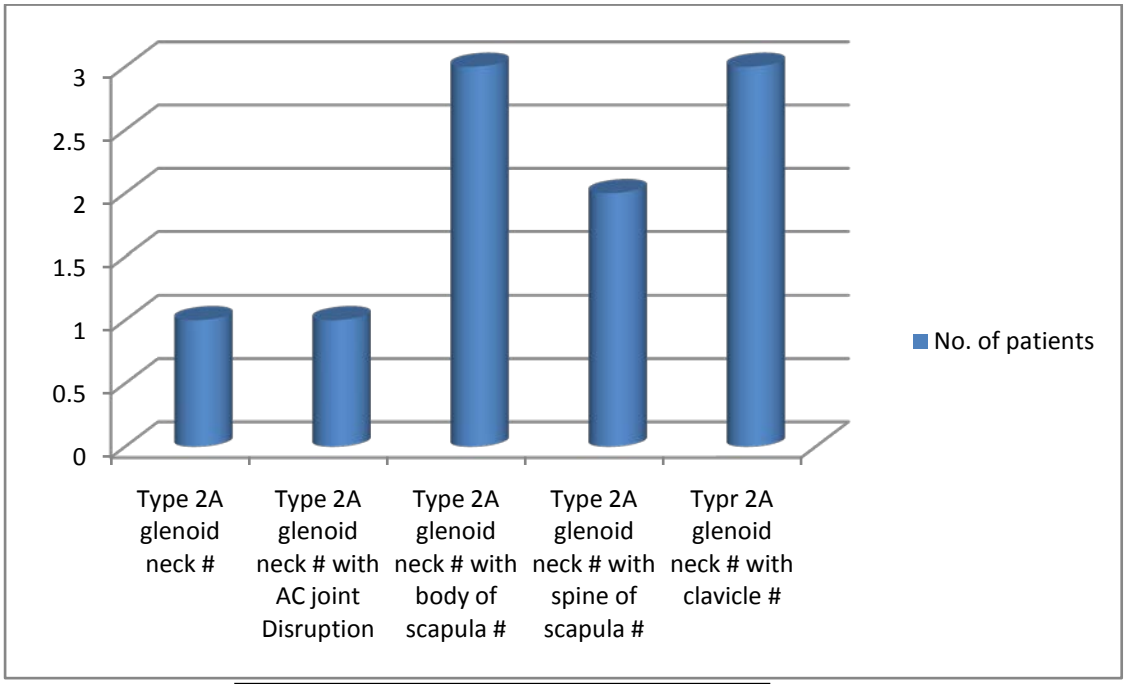
SIDE OF FRACTURE AND CLINICAL OUTCOME

SIDE	FUNCTIONAL OUTCOME			
	POOR	MODERATE	GOOD	EXCELLENT
RIGHT	0	2	3	3
LEFT	0	-	-	2



INDICTATIONS FOR SURGERY

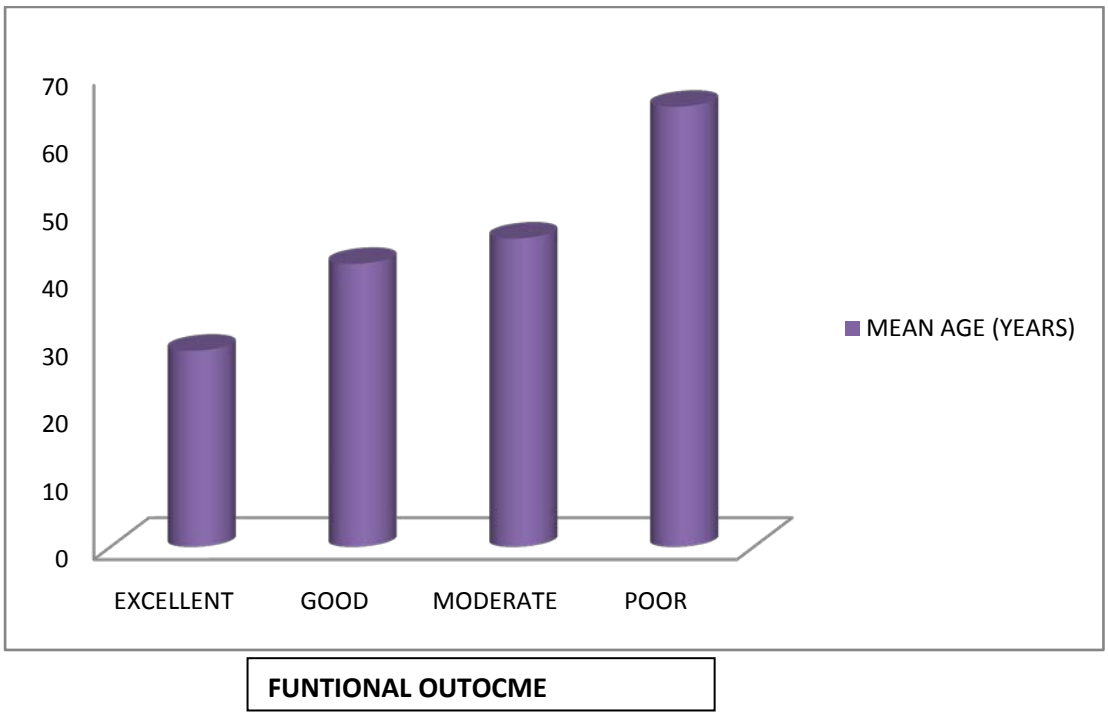
INDICATION	NO.OF PATIENT
TYPE 2A GLENOID NECK FRACTURE	1
TYPE 2A GLENOID NECK FRACTURE WITH AC JOINT DISRUPTION	1
TYPE 2A GLENOID FRACTURE WITH BODY OF SCAPULA FRACTURE	3
TYPE 2A GLENOID NECK FRACTURE WITH SPINE OF SCCAPULA FRACTURE	2
TYPE 2A GLENOID NECK FRACTURE WITH CLAVICLE FRACTURE	3



INDICATIONS FOR SURGERY

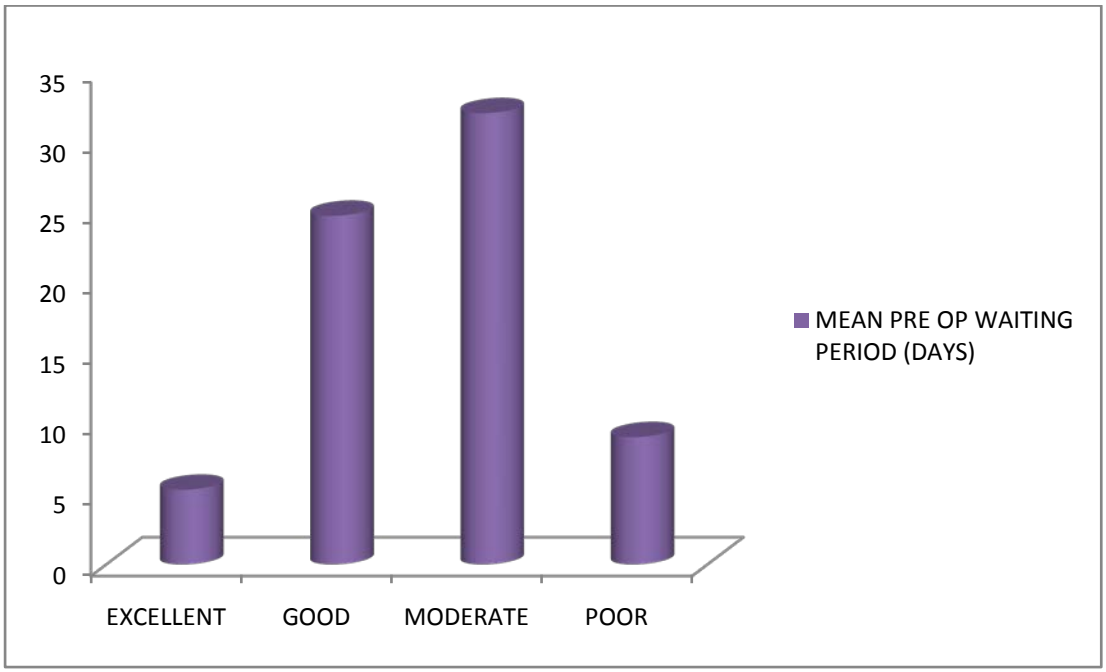
MEAN AGE AND FUNCTIONAL OUTCOME

MEAN AGE (years)	FUNCTIONAL OUTCOME
29	Excellent
41.75	Good
45.50	Moderate
65	Poor



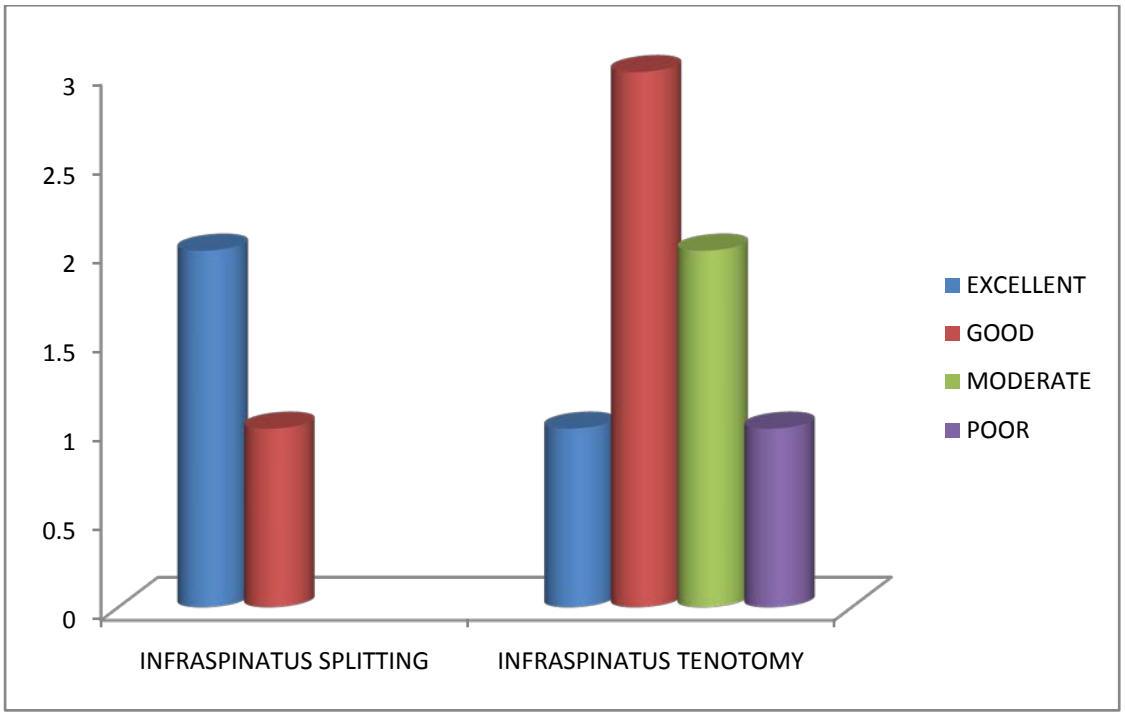
PRE OP WAITING PERIOD AND FUNCTIONAL OUTCOME

MEAN PRE OP WAITINGPERIOD (days)	FUNCTIONAL OUTCOME
5.3	Excellent
24.75	Good
32	Moderate
9	Poor



SURGICAL APPROACH AND FUNCTIONAL OUTCOME

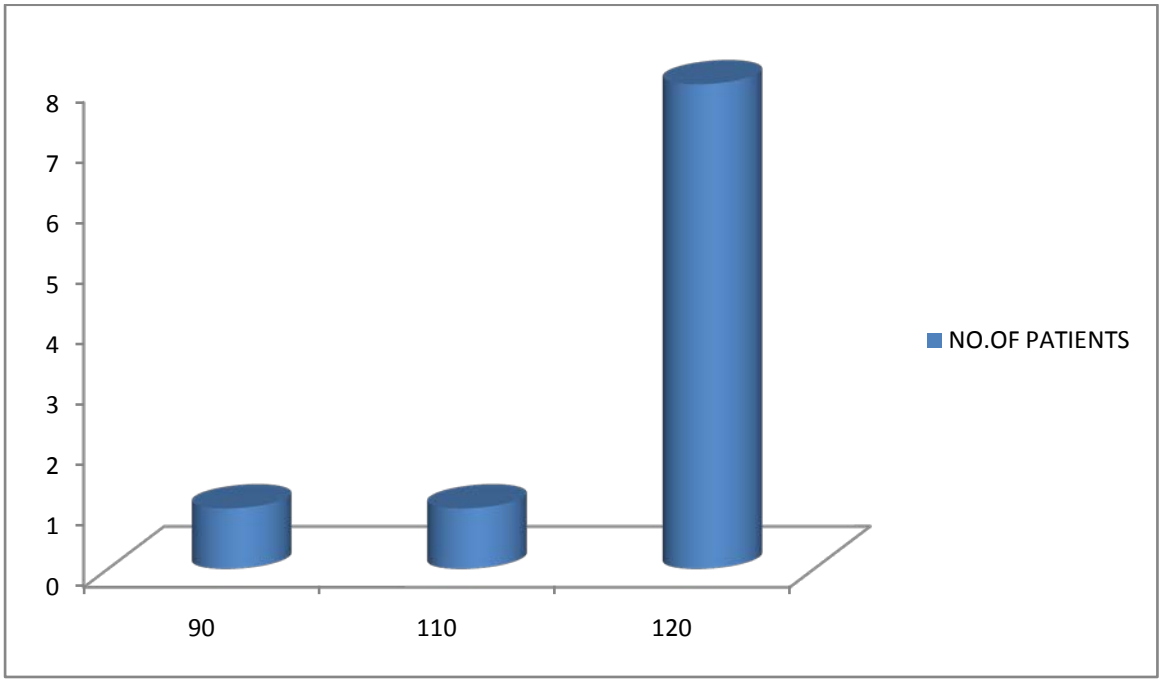
FUNCTIONAL OUTCOME	INFRASPINATUS SPLITTING APPROACH	INFRASPINATUS TENOTOMY APPROACH
EXCELLENT	2	1
GOOD	1	3
MODERATE	-	2
POOR	-	1



SURGICAL APPROACH

DURATION OF SURGERY

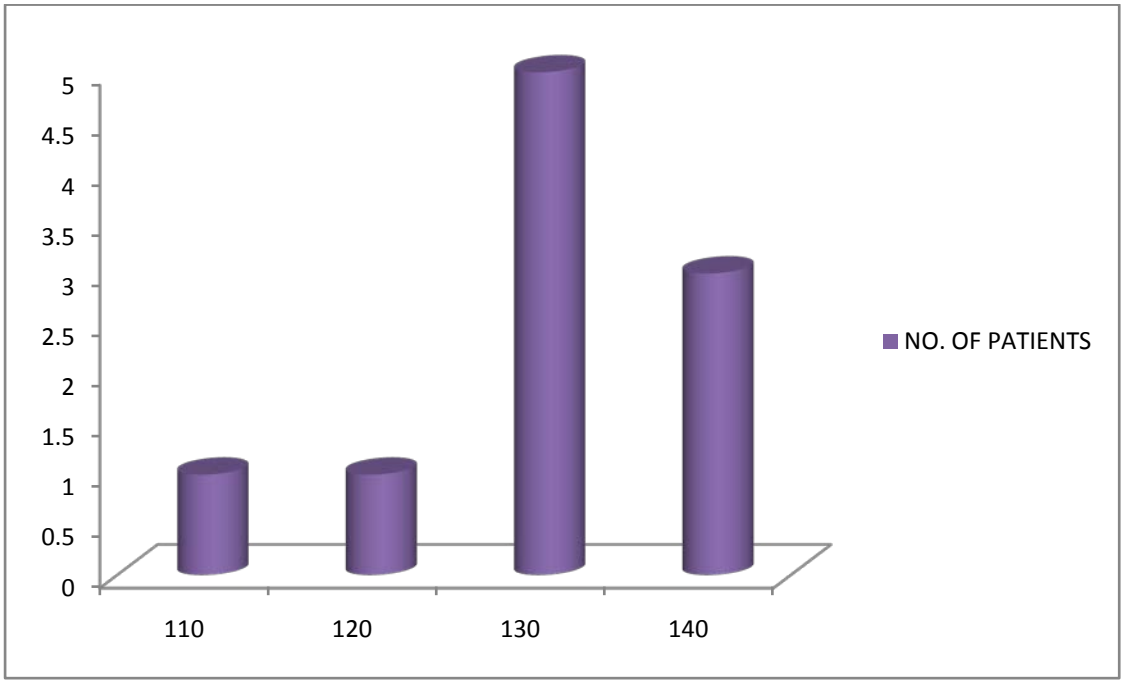
DURATION OF SURGERY (in mins)	NO.OF PATIENTS
90	1
110	1
120	8



DURATION OF SURGERY (in minutes)

SURGICAL BLOOD LOSS

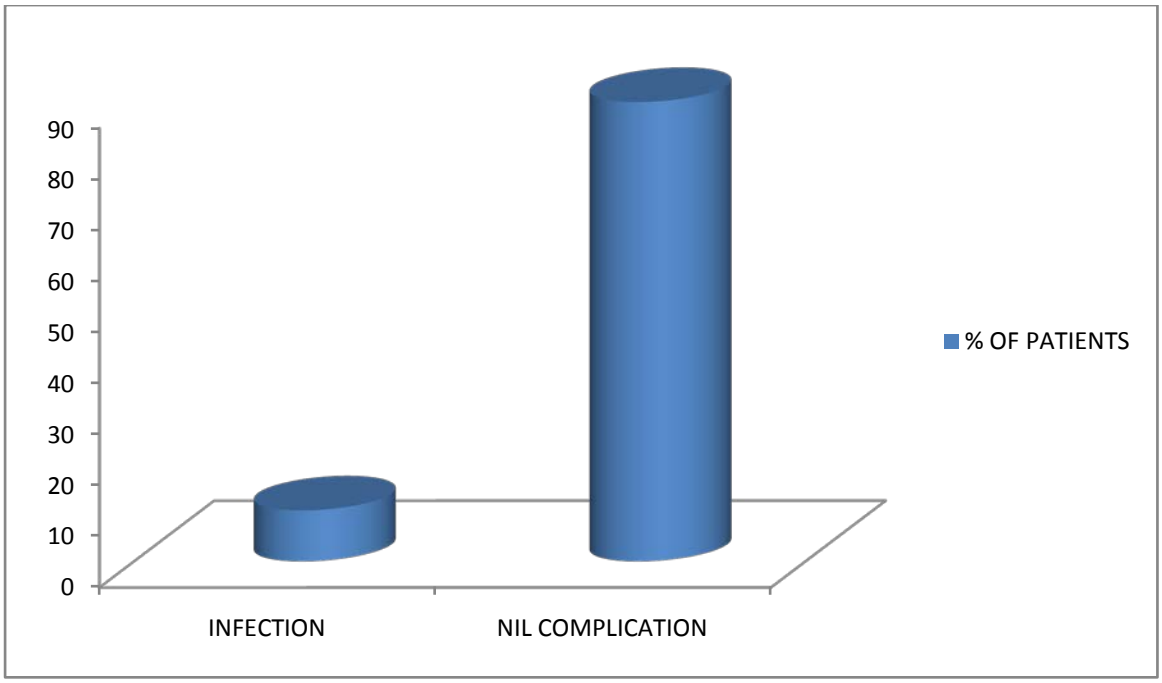
SURGICAL BLOOD LOSS (in ml)	NO.OF PATIENTS
110	1
120	1
130	5
140	3



SURGICAL BLOOD LOSS (in ML)

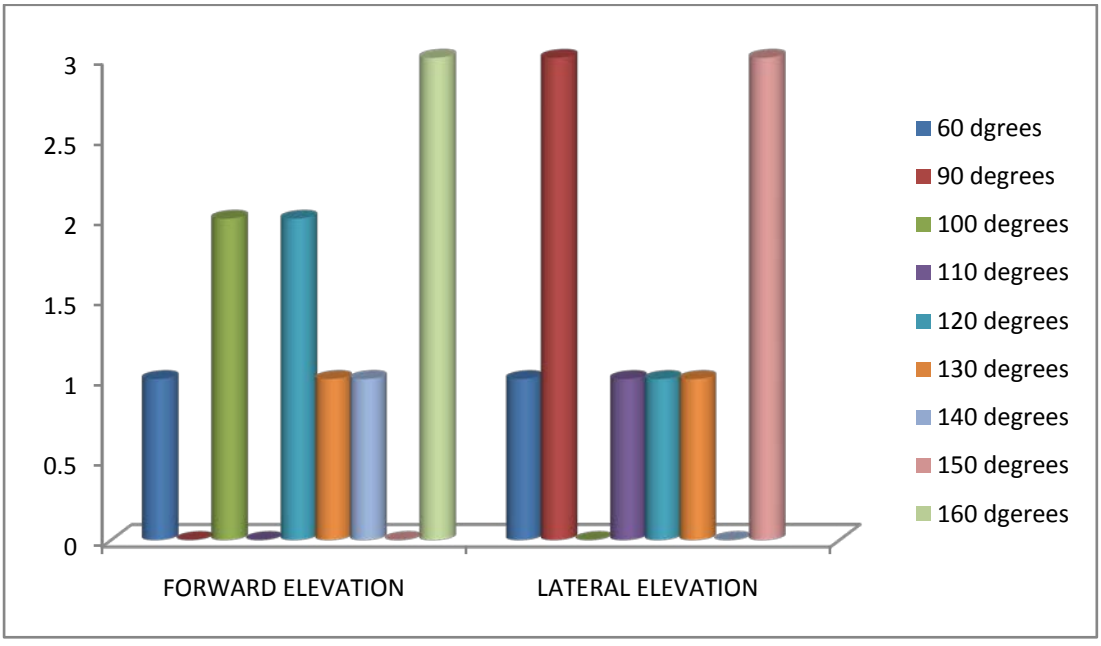
SURGICAL COMPLICATION

SURGICAL COMPLICATION	% OF PATIENTS
INFECTION	10%
NIL	90%



RANGE OF MOVEMENTS

RANGE OF MOVEMENTS			
FORWARD ELEVATION (in degrees)	**NO. OF PATIENTS**	**LATEERAL ELEVATION (in degrees)**	**NO. OF PATIENTS**
60	**1**	**60**	**1**
100	**2**	**90**	**3**
120	**2**	**110**	**1**
130	**1**	**120**	**1**
140	**1**	**130**	**1**
160	**3**	**150**	**3**

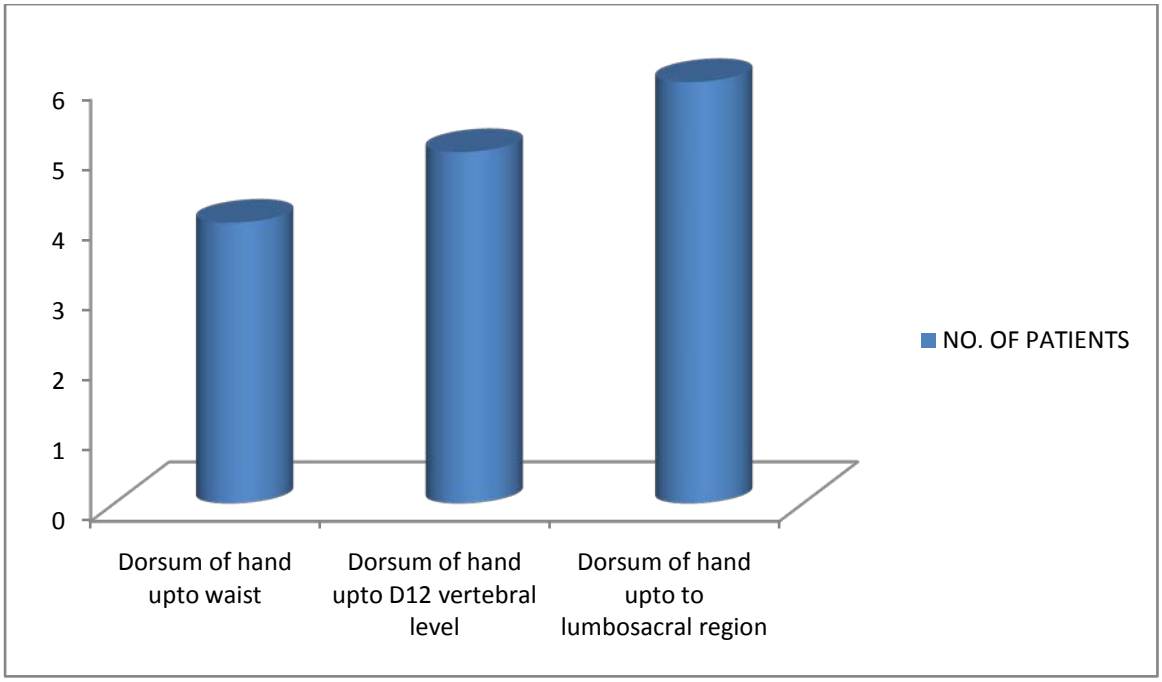


RANGE OF MOVEMENTS

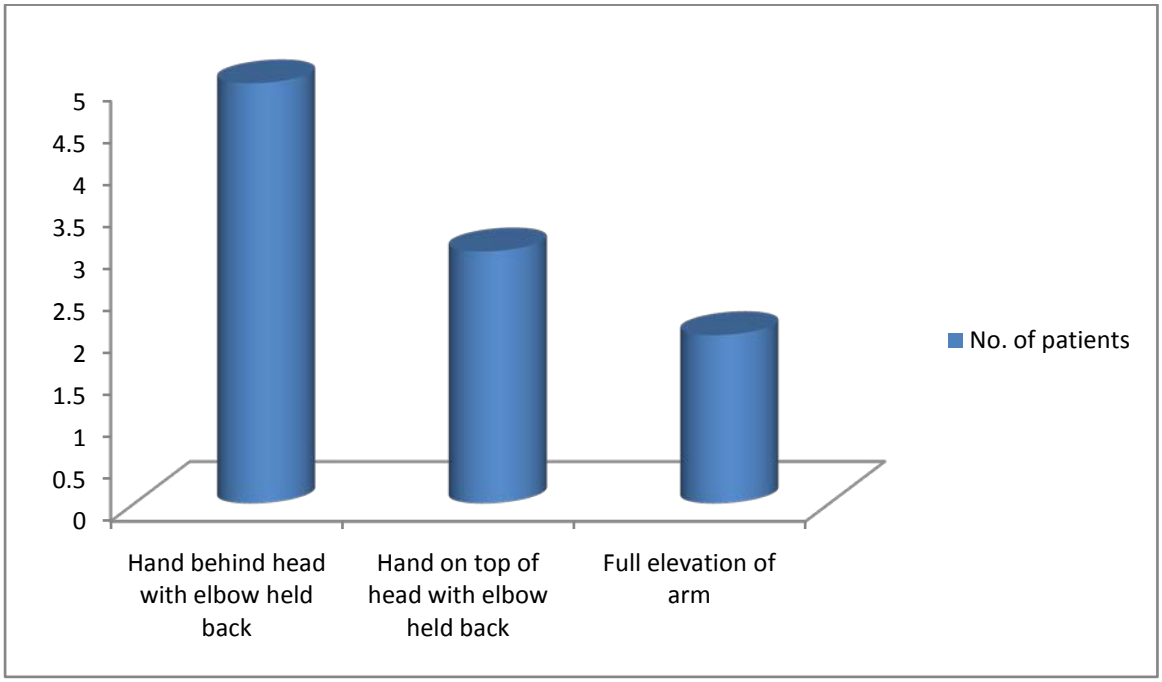
RANGE OF MOVEMENTS

INTERNAL ROTATION		EXTERNAL ROTATION	
RANGE	**NO. OF PATIENTS**	**RANGE**	**NO.OF PATIENTS**
DORSUM OF HAND UPTO WAIST	4	HAND BEHIND HEAD WITH ELBOW HELD BACK	5
DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	5	HAND ON TOP OF HEAD WITH ELBOW HEAD BACK	3
DORSUM OF HAND UPTO LUMBOSACRAL REGION	1	FULL ELEVATION OF ARM	2

RANGE OF MOVEMENTS – INTERNAL ROTATION



RANGE OF MOVEMENTS – EXTERNAL ROTATION



DISCUSSION

The prevalance of scapula fractures is on the increasing trend due to road traffic accidents. Fractures of scapula accounts for 3-5% of all fractures about the shoulder most often caused by high energy trauma and are frequently associated with multiple trauma. Scapular fractures are mostly associated with rib fractures 52%, clavicular fractures 22%, spine fracture 29%,brachial plexus injury 5%, pneumohemothorax 35%, head injuty 35% and vascular injury 11%. Most scapular fracturesare managed conservatively. Although outcomes are generally good, not all scapular fractures heal uneventfully and there has been a resurgence of interest in determining which patient would benefit from operative treatment.

Operative management is indicated for certain unstable glenohumeral articulation like glenoid rim fracture- displacement of fragment > or equal to 10mm, fracture involving 25% of glenoid cavity, articular step of more than 5mm and displaced glenoid neckfractures like mediolateral translatonal displacement of >1cm, AP angular displacement >40 degree, decrease in glenopolar angle <20degree. Operative management of above conditions improve glenohumeral joint stability which improve range of movements of shoulder joint.

A total of 10 patients have participated in our study. The age group range from 20-65 years.The mean age is 36.5 years which includes 8 males and 2 females. The follow up period ranges from 3 months to 20 months. Most of our patients hadfloating shoulder 30%, type 2A glenoid neck fracture with body of scapula fracture 30%, type 2A glenoid neck fracture with spine of scapula fracture 20%, type 2A glenoid neck fracture with AC joint disruption 10%, type 2A glenoid neck fracture 10%.

30% of patients were associated with multiple rib fractures, hemothorax and were managed with intercostal drainage. 30% of patients were associated

with long bone fractures treated with internal fixation. In our study we have observed that RTA is the most common cause for scapular fractures.

In our study, period between the day of injury to day of operative management ranges from 5days to 43days, and mean waiting period for surgery is 18.8days. Patients who underwent early intervention had good surgical outcome compared to those who underwent late intervention. In our study 3 out of 10 patients had excellent surgical outcome, in whom mean waiting period for surgery was 5.3 days. 4 out 10 patients had good surgical outcome, in whom mean waiting period for surgery was 24.7 days. 2 out of 10 patients had moderate surgical outcome, in whom mean waiting period for surgery was 32 days. This indicates, early surgical intervention and early shoulder mobilisation gives excellent and good results.

In our study, all patients with glenoid and glenoid neck fractures underwent radiological evaluation with AP and lateral view of scapula, Axial view of glenohumeral joint (if possible) and CT scapula with or without 3D reconstruction. After radiological investigation, all the patients underwent shoulder immobilisation with shoulder immobiliser or cuff and collar.

In our study only those patients who had clear cut indication for surgery were further evaluated, assesed for anaesthesia and posted for surgery. On tha day of surgery, all patients received general anaesthesia and laterally positioned with operative side up. In our study, 8 out of 10 patients underwent Modified Judet’s approach, whereas 2 out of 10 patients underwent AO approach; In 7 out of 10 patients fracture site was exposed by cutting the infraspinatus tendon and applying stay sutures whereas in 3 out of 10 patients infrapinatus muscle was retractedand then the fracture was reduced with Recon plate with 3.5mm cortical screws.

The mean operating time was 116 mins and the mean blood loss was 130ml. After one week of surgery, all patients in the study underwent passive shoulder mobilisation exercise and followed by pendulum exercise with active

assisted range of movements in the 2nd week. 3rd to 4th week patients underwent isometric exercisealong with assisted range of movements. During the 8th week, early resisted range of movements with weight bearing was initiated and isotonic exercises were started by 12th week.

Shoulder CPM should be started during first phase of rehabilitaton with 60-120 degrees for forward and lateral elevation, 60 degrees for external rotation and 30 degrees for internal rotation depending upon patient comfort and post operative findings. As shoulder CPM machine was not available in our institution we were not able to initiate CPM during early rehabilitation phase. If CPM has been started in the early rehabilition phase,then functional outcome of the shoulder joint would have been much better than the present outcome. Instead of CPM we have initiated early passive and active assisted mobilisation during the early rehabilitation phase.

In our study, functional outcome of glenohumeral joint was assesed by th Constant- Murley Score.The average score is 72.2.Three patients (30%) had excellent outcome, 4 patients (40%) had good outcome, 2 patients (20%)had moderate outcome and 1 patient (10%) had poor outcome. The poor outcome among 1 out of 10 patients may be attributed to the associated surgical site infection and delay in shoulder mobilization.

The study concluded that for a successful functional outcome, selection of patients with a clear indication for surgery is of vital importance and earlier the surgical interventionfollowed by shoulder mobilisation is necessary for an excellent surgical outcome.

With the above observation we are suggesting operative mangement for glenoid and periglenoid fractures having clear indication with Recon plate fixation with 3.5mm cortical screws.

LIMITATIONS OF THE STUDY

1. Constant- Murley score is more subjective
2. Some patients did not come for follow up at regular intervals, so intervention for adequate rehabilitation was difficult.

CONCLUSION

Most of the scapular fractures are managed conservatively. Periglenoid fractures with specific surgical indications like mediolateral displacement, anteroposterior angulation and those associated with acromioclavicular joint disruption, coracoid process and acromio process fracture,clavicle fracture (floating shoulder) and humerus fracture are treated with internal fixation using Reconstruction plate and 3.5mm cortical screws. The main advantage is to provide fracture stability which allows early mobilisation of shoulder joint and thereby improves edema,wound healing, early ambulation and glenohumeral joint functional outcome of the patient.

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PROFORMA

NAME :

AGE/SEX:

OCCUPATION :

I.P.No :

D.O.A :

D.O.S :

D.O.D :

MODEOFINJURY :

DIAGNOSIS :

ASSOCIATED INJURY:

SURGERY :

DURATION :

POSITION :

POST-OP INFECTION :

REHABILITAION:

FIRST FOLLOW UP:

SECOND FOLLOW UP:

RANGE OF MOVEMENTS:

CONSTANT- MURLEY SCORE:

FUNCTIONAL OUTCOME:

PATIENT CONSENT FORM

Study Title: **"PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE OF**

PERIGLENOID OF SCAPULA TREATED WITH OPEN REDUCTION AND

INTERNAL FIXATION"

Study Center: **Institute of Orthopaedics and traumatology, Rajiv Gandhi Govt. General Hospital,**

Madras Medical College, Chennai- 3

Participant Name:

Age/Sex:

I.P.No. :

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my satisfaction.

I have been explained about the pitfall in the procedure. I have been explained about the safety, advantage and disadvantage of the technique.

I understood that my participation in the study is voluntary and that I am free to withdraw at anytime without giving any reason.

I understand that investigation, regulatory authorities and the ethics committee will not need my permission to look at my health records both in respect to current study and any further research that may be conducted in relation to it, even if I withdraw from the study.

I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law.

I agree not to restrict the use of any data or results that arise from the study.

Date : **Signature / Thumb impression of Guardian**

Place :

Patient Name and address :

Signature of the investigator:

Name of the investigator: Dr.B.MANIMARAN

INFORMATION SHEET TO PATIENTS

Principle Investigator: Dr. B. Manimaran

Participant Name:

We are conducting study on – “Prospective study of functional outcome of fracture of periglenoid of scapula treated with open reduction and internal fixation” among patients attending the Institute of orthopaedics and Traumatology, Rajiv Gandhi Government General Hospital, Chennai- 3 and for that your specimen may be valuable to us.

The purpose of this study is to evaluate and analyse the functional outcome. We are selecting certain cases and if you are found eligible,we may use your radiographs, blood samples, CT to evaluate the outcome of the treatment which in any way do not affect your final report or management.

All the procedures are free of cost and there will be no side effects. The privacy of the patients in the research will be maintained through out the study. In the event of any publication or presentation resulting from the research, no personally indentifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or withdraw from the study at anytime. Your decision will not result in any loss of benefits to which you are entitlied.

The results of special study may be intimated to you at the end of the study period or during the study if anything is found abnormal, which may aid in the management.

SIGN OF INVESTIGATOR SIGN OF PARTICIPANT

DATE/PLACE:

NAME OF PATIENT :

DATE OF SCORING :

PERIOD OF SCORING : 3 / 6 / 12TH MONTH

CONSTANT SHOULDER SCORE

A. Pain (/15): Average (1 + 2)

1. Do you have pain in your shoulder (normal activities)?

No =15 pts.
Mild pain = 10 pts,
Moderate = 5 pts,
Severe or permanent = 0.

2. Linear scale:

If "0" means no pain and "15" is the maximum pain you can experience, please circle where is the level of pain of your shoulder. (Points given are inverse to the scale. E.g. level 5 in the scale means 10 points)

Level of pain

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Points

B. Activities of daily living (/20) Total (1 + 2 + 3 + 4)

1. Is your occupation or daily living limited by your shoulder? -----
No = 4, Moderate limitation = 2, Severe limitation = 0

2. Are your leisure and recreational activities limited by your shoulder? -----
No = 4, Moderate limitation = 2, Severe limitation = 0

3. Is your night sleep disturbed by your shoulder? -----
No = 2, Sometimes = 1, Yes = 0

4. State to what level you can use your arm for painless, reasonably activities. -----
Waist = 2, Xiphoid (sternum) = 4, Neck = 6, Head = 8, Above head = 10

C. Range of movement (leave this for the doctor or physiotherapist) **(/40): Total (1 + 2 + 3 + 4)**

FORWARD FLEXION	SCORE	ABDUCTION
0-30	**0**	0-30
31-60	**2**	31-60
61-90	**4**	61-90
91-120	**6**	91-120
121-150	**8**	121-150
>150	**10**	>150

EXTERNAL ROTATION	SCORE	INTERNAL ROTATION
Hand behind head & elbow forward	**2**	Thigh
Hand behind head & elbow back	**4**	Buttock
Hand above head & elbow forward	**6**	SI joint
Hand above head & elbow back	**8**	Waist
Full elevation of arm	**10**	Between shoulder blades

D. Power (/25): Points: average (kg) x 2 = D

First pull: Second pull: Third pull: Fourth pull: Fifth pull:

Average pulls:

TOTAL SCORE: ------/100

MASTER CHART

SL.NO.	NAME	AGE	SEX	IP.NO.	D.O.A	D.O.S	SIDE	DIAGNOSIS & INDICATION	OCCUPATION	COMORBIDITY	ASSOCIATED INJURY
1	ZAHIR HUSSAIN	51	M	1651	04.01.2018	05.02.2018	RIGHT	FLOATING SHOULDER	TAILOR	NIL	MULTIPLE RIB # WITH HEMOTHORAX RIGHT
2	VENGADESAN	40	M	1856	04.01.2018	08.02.2018	RIGHT	TYPE 2A GLENOID NECK #	ELECTRICIAN	NIL	MULTIPLE RIB # WITH HEMOTHORAX RIGHT WITH SHAFT OF HUMERUS #
3	LATHA	45	F	101288	08.11.2018	24.11.2018	RIGHT	TYPE 2A GLENOID NECK # WITH AC JOINT DISRUPTION	HOME MAKER	NIL	NIL
4	DILLI DURAI	45	M	110300	20.10.2018	26.10.2018	LEFT	FLOATING SHOULDER	BUISNESS	NIL	NIL
5	PRAVEEN	22	M	130561	25.11.2018	30.11.2018	LEFT	TYPE 2A GLENOID NECK # WITH BODY OF SCAPULA #	DRIVER	NIL	NIL
6	RANGAMMAL	48	F	41455	14.04.2019	15.05.2019	RIGHT	TYPE 2A GLENOID NECK # WITH BODY OF SCAPULA #	HOME MAKER	NIL	NIL
7	RAJAN	20	M	34700	17.04.2019	22.04.2019	RIGHT	TYPE 2A GLENOID NECK # WITH BODY OF SCAPULA #	STUDENT	NIL	CLOSED # TIBIA DISTAL 1/3RD RIGHT
8	THIRUBAL	65	M	45077	24.04.2019	03.05.2019	RIGHT	FLOATING SHOULDER	RETIRED EMPLOYEE	NIL	CLOSED # BOTH BONE FOREARM RIGHT
9	NITHYAANADHA	46	M	73196	04.07.2019	29.07.2019	RIGHT	TYPE 2A GLENOID NECK # WITH SPINE OF SCAPULA #	DAILY LABOURER	NIL	NIL
10	JESU BRITTO	28	M	84027	31.07.2019	10.08.2018	RIGHT	TYPE 2A GLENOID NECK # WITH SPINE OF SCAPULA #	DAILY LABOURER	NIL	MULTIPLE RIB # WITH HEMOTHORAX RIGHT

SL.NO.	NAME	AGE	SEX	PRE OP WAITING PERIOD	SURGICAL APPROACH	INFFRASPINATUS(IS) TENOTOMY/ SPLITTING	DURATION OF SURGERY
1	ZAHIR HUSSAIN	51	M	30 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
2	VENGADESAN	40	M	34 DAYS	MODIFIED JUDET	IS - TENOTOMY	110MINS
3	LATHA	45	F	34 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
4	DILLI DURAI	45	M	6 DAYS	MODIFIED JUDET	IS - SPLITTING	120MINS
5	PRAVEEN	22	M	5 DAYS	MODIFIED JUDET	IS - SPLITTING	90MINS
6	RANGAMMAL	48	F	30 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
7	RAJAN	20	M	5 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
8	THIRUBAL	65	M	9 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
9	NITHYAANADHA	46	M	25 DAYS	MODIFIED JUDET	IS - TENOTOMY	120MINS
10	JESU BRITTO	28	M	10 DAYS	AO- VERTICAL INCISION	IS - SPLITTING	120MINS

SL.NO.	NAME	AGE	SEX	FORWARD ELEVATION	LATERAL ELEVATION	INTERNAL ROTATION	EXTERNAL ROTATION	COMPLICATIONS	CONSTANT - MURLEY SCORE	OUTCOME
1	ZAHIR HUSSAIN	51	M	100	90	DORSUM OF HAND UPTO WAIST	HAND BEHIND HEAD WITH ELBOW HELD BACK	NIL	62	MODERATE
2	VENGADESAN	40	M	100	90	DORSUM OF HAND UPTO WAIST	HAND BEHIND HEAD WITH ELBOW HELD BACK	NIL	60	MODERATE
3	LATHA	45	F	120	110	DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	HAND ON TOP OF HEAD WITH ELBOW HELD BACK	NIL	76	GOOD
4	DILLI DURAI	45	M	160	150	DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	FULL ELEVATIONOF ARM	NIL	93	EXCELLENT
5	PRAVEEN	22	M	160	150	DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	FULL ELEVATIONOF ARM	NIL	91	EXCELLENT
6	RANGAMMAL	48	F	120	90	DORSUM OF HAND UPTO WAIST	HAND BEHIND HEAD WITH ELBOW HELD BACK	NIL	72	GOOD
7	RAJAN	20	M	160	150	DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	HAND BEHIND HEAD WITH ELBOW HELD BACK	NIL	87	EXCELLENT
8	THIRUBAL	65	M	60	60	DORSUM OF HAND TO LUMBO SACRAL REGION	HAND BEHIND HEAD WITH ELBOW HELD BACK	INFECTION	45	POOR
9	NITHYAANADHA	46	M	130	120	DORSUM OF HAND UPTO WAIST	HAND ON TOP OF HEAD WITH ELBOW HELD BACK	NIL	72	GOOD
10	JESU BRITTO	28	M	140	130	DORSUM OF HAND UPTO D12 VERTEBRAL LEVEL	HAND ON TOP OF HEAD WITH ELBOW HELD BACK	NIL	74	GOOD