

**Comminuted fracture of body of scapula with fracture infra-glenoid neck, fixation with conventional 3.5 reconstructive locking plate and locking compressive T plate, 2 years follow up: A Case Report and Review.****Authors:-** Nishant N Gholap<sup>1</sup>, Amar Vishal<sup>2</sup>, Manikanta Swamy R<sup>3</sup>, A. Ravi Kiran<sup>4</sup>, Jaladi Syam Priya<sup>5</sup>, SM Bhargav<sup>6</sup>, V Dev Manohar<sup>7</sup>, Robin Cheko Raju<sup>8</sup>, Korrapati Siva Naglakshmi<sup>9</sup>, Peyyala Ravindranath<sup>10</sup><sup>1</sup>Associate Professor, <sup>2</sup>Professor and Head, <sup>3</sup>Assistant Professor, <sup>6,7,8</sup>Resident, <sup>9,10</sup>Intern, Dept of Orthopedics, KIMS & General Hospital, Amalapuram, Andhra Pradesh, India.<sup>4</sup>FISS Spine Surgery, Mallika Spine Centre, Guntur, Andhra Pradesh, India.<sup>5</sup>Assistant Professor, Katuri Medical College, Guntur, Andhra Pradesh, India.**Abstract****ABSTRACT****INTRODUCTION**

Incident of scapula fracture is 1% of all fractures and 3-5% in fractures of shoulder girdle. Scapula fracture occurs in high energy trauma in young and low energy fractures in elderly patient. 95% scapula fractures are managed conservatively and there are high chances of asymptomatic malunion, rotator cuff dysfunction, impingement and scapulothoracic dyskinesia. Conservative management in scapula fracture with floating shoulder, Superior Shoulder Suspensory Complex (SSSC) injury & multiple rib fractures, delay in rehabilitation and compromises the functional result. There are no specific guidelines found regarding the surgical management of scapula fracture associated with clavicle fracture (Floating shoulder) and surgical treatment in these cases remains controversial. However, the open reduction and internal fixation (ORIF) of scapula fractures in such cases, the results are superior compared to conservative management in view of pain, stiffness and functional outcome with minimal complications. Scapula fracture fixation surgery is considered rare and technically demanding in South Asian country like India and hence, we are presenting a case of young patient with poly trauma with ipsilateral significantly displaced clavicle midshaft fracture, extra articular comminuted displaced scapular body and infra glenoid fracture with multiple rib fractures. Considering his young age, job and to reduce his morbidity due to pain and disability, we offered him ORIF of scapula body and glenoid neck with conventional 3.5 reconstructive plate & locking compressive plate (LCP) and 'anatomically precontoured LCP' for clavicle midshaft comminuted fracture. Within one month of operation, patient recovered all the function of shoulder with good power and resumed his carpentry work with no complications. Uniqueness of this case is we have used conventional 3.5 reconstructive locking plate as the classical Boomerang plate was not available and we got optimum functional result.

**CASE REPORT:**

33-year-old patient, carpenter by occupation with history of road traffic accident. Patient was travelling on two-wheeler and dashed by four-wheeler, sustained head injury, right side chest injury, and difficulty in movement of left shoulder with no distal neurodeficit. Patient admitted in ICU and investigated. CT scan chest showed right side 4th, 5th, 6th rib fracture with minimal hemopneumothorax. X-rays of clavicle showed fracture mid shaft clavicle displaced and fracture scapula body, infra glenoid neck extra articular fracture, lateral wall fracture, medial wall fracture near superior angle. A 3D CT scan of scapula done to evaluate scapula fracture in detail.

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**Corresponding Author : Nishant N Gholap****Associate Professor, Dept of Orthopedics, KIMS & General Hospital, Amalapuram, Andhra Pradesh, India. Email: [nishantngholap@yahoo.co.in](mailto:nishantngholap@yahoo.co.in)**

As the patient also has displaced clavicle shaft fracture along with 3 ribs fracture at right side with mild hemopneumothorax, decision of fixation of shaft of clavicle and fixation of lateral and medial border of scapula was taken. First clavicle shaft fracture fixation done in a standard manner in supine position and anatomical clavicle LCP fixation performed. Patient was then given lazy lateral position Judet approach was planned. ORIF of scapula body and neck fracture then carried out with LCP. Closure done in layers. Passive range of movement started day 1 post op and active assisted range of movement started as per comfort of patient. Deep breathing exercises and bed sided movement started day one. Aggressive physiotherapy sessions were given for 2 weeks thereafter.

**CLINICAL DISCUSSION:** Scapula displaced fracture at or below the glenoid neck associated displaced fracture of body along with same side multiple ribs fracture and clavicle displaced fracture all together produces morbidity due to pain, stiffness and functional disability. There are no specific guidelines regarding fixation of these fractures in same sitting. Surgical treatment for significantly displaced fractures of scapula and clavicle in the form of ORIF on their own merits yielded superior result compare to conservative management with less complications. The duration of recovery and to return to work place in a very short period of time in operative cases compare to conservative management reported in few case studies.

**CONCLUSION:** In a young poly trauma patient with scapula body fracture displaced, with ipsilateral clavicle fracture displaced and ipsilateral multiple rib fractures associated with hemopneumothorax, fixation of clavicle and fixation of scapula body fracture (floating shoulder) by ORIF with plate and screw, significantly reduces patient's morbidity due to pain, stiffness & functional disability & gives dramatic functional outcome in a very short period of time compare to conservative management with less complications.

**KEY WORDS:** Ipsilateral Scapula body and clavicle fracture, floating shoulder, Locking Recon plate, T plate, Functional Result.

## INTRODUCTION

Incident of scapula fracture is 1% of all fractures, 3-5% in fractures of shoulder girdle & 7.7% of all upper extremity fractures treated.<sup>1</sup> Stress fractures of spine and acromion process are common in reverse shoulder arthroplasty cases due to inferior placement of glenoid part. Annual incidence is 10/100000.<sup>2</sup> Scapula fracture occurs in high energy trauma in young and low energy fractures in elderly patient. 50% in vehicle accident and 20% in Pedestrian injury. 80-90% associated with other injuries. There is 15% mortality rate & 5-13% incident of brachial plexus injury. Electric shock and seizures can cause scapula fractures

because of large muscle forces acting on scapula.<sup>3</sup> Common age group is 25-50 years (M: F 49:6) Incidence of body fractures 45%, glenoid process 35%, acromion process 8% and coracoid process 7%. It is also associated with clavicle fractures, multiple rib fractures, humerus fractures, head injury, abdominal and pelvis injury and mortality is high in such cases and hence scapula fracture is considered as a prognostic factor in a polytrauma patient. Occupational hazard as a cause of scapula fracture in infra-structure developing projects due to cheap ways of transportation and lack of preventive measure at work place is documented. 95% scapula fractures are managed conservatively and there are high chances of asymptomatic malunion, rotator cuff dysfunction, impingement and scapulothoracic dyskinesia. In the literature, fracture of scapula is managed conservatively by most of the orthopaedicians. But it causes delay in rehabilitation and compromises the functional result in early phase of treatment. There is no specific guideline regarding the management of scapula fracture alone or associated with ipsilateral multiple rib fractures, clavicle fracture (floating shoulder) Therefore, all scapula fractures management depended upon its own merits and demerits. However, the open reduction and internal fixation of scapula fractures (ORIF), results are superior compared to conservative management in view of pain, stiffness and functional outcome with minimal complications. Scapula fracture fixation surgery is rare and hence, we are presenting a young poly trauma patient with head injury, chest injury (right side 4 rib fractures with mild hemopneumothorax) and ipsilateral displaced clavicle midshaft fracture and extra articular comminuted significantly displaced scapula body fracture and infraglenoid neck fracture. To reduce his morbidity due to pain and disability, to avoid complications related to double disruption of superior shoulder suspensory complex (SSSC), we offered him ORIF of scapula body and glenoid neck with conventional reconstructive plate, T shaped locking compressive plate (T-LCP) and anatomically precontoured LCP for clavicle midshaft comminuted fracture at the same sitting. Within one month of operation, patient recovered all the function of shoulder with good power and resumed to his carpentry work with no complications till date.

## CASE REPORT

33-year-old patient carpenter by occupation with history of road traffic accident. Patient was travelling on two-wheeler and dashed by four-wheeler sustained head injury, left side chest injury, clavicle and scapula fracture on the left side. Patient admitted in ICU and CT scan of brain and chest was done along with x rays of scapula and clavicle. Ct scan brain was normal and CT scan chest showed left side 4th,5th,6th rib fracture with minimal hemopneumothorax. X-rays of clavicle showed fracture mid shaft clavicle comminuted & displaced and fracture scapula body, infraglenoid neck with lateral wall and medial wall fracture near superior angle. 3D CT scan of scapula shows infra glenoid neck fracture and comminuted fracture of scapula body along with medial and lateral wall fracture. It is Ideberg type 6 fracture of scapula. As the patient also have clavicle shaft fracture, suspecting SSSC injury along with ipsilateral 3 ribs fracture, decision of fixation of shaft of clavicle and fixation of medial and lateral border including infra glenoid extra articular of scapula was taken. Patient was taken for surgery under anesthesia. Supra clavicle block was given. Detail surgical Technique: First clavicle shaft fracture fixation done in a standard manner in supine position and anatomically precontoured clavicle LCP osteosynthesis was done. Wound closure and dressing done. Patient was then given lazy lateral position and painting and draping of left scapular region done. Ioban adhesive cover applied to the operative area. Medial, lateral and superior border marked and c arm positioning done to visualize shoulder joint, medial and lateral border of scapula. Judet posterior approach for scapula was planned. A boomerang incision taken starting at the spine of scapula from lateral to medial side of scapula then curved downward along the medial border of scapula till inferior angle of scapula. Skin, fascia incised and deltoid raised from its attachment of spine. Trapezius fibers raised from the superomedial angle. Infraspinatus and teres minor raised with periosteum and cautery en mass from medial border to lateral border to avoid neurovascular injury. Dissection was carried out till the lateral border and inferior portion of glenoid.

Reduction at the lateral border infra glenoid extra articular area carried out and locking T plate osteosynthesis performed at the lateral border and posterior aspect of glenoid. A 3.5 locking reconstruction plate premolded in the form of Boomrang and fixed to spine of scapula superiorly and to the medial border of scapula after reduction of medial border and superiomedial corner of scapula. Stability of fixation checked under C- arm. Central comminuted fractures of body were reduced & fixed with vicryl 2-0. Muscle mass of infraspinatus sutured back in place along with repair of trapezius meticulously, and closure done in layers. A universal shoulder immobilizer given post op. Passive range of movement started day 2 post op and active assisted range of movement started as per comfort of patient. Deep breathing exercises and bed sided movement started day 2. Suture removed on day 14. After 2 weeks, physiotherapy at left shoulder girdle given along with spirometry and chest physiotherapy (Fig 1-8).



Figure 1:- X ray image AP & Axillary view



Figure 2:- 3D-CT images of scapula.



Figure 3 :- Pre-Operative Planning Image and Boomerang type incision.



Figure 4 :- Intra-operative Images

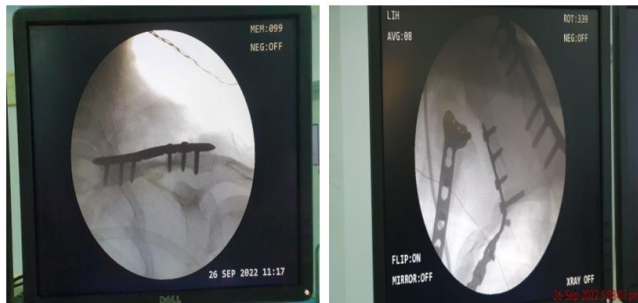


Figure 5:- Intraoperative C-Arm Images

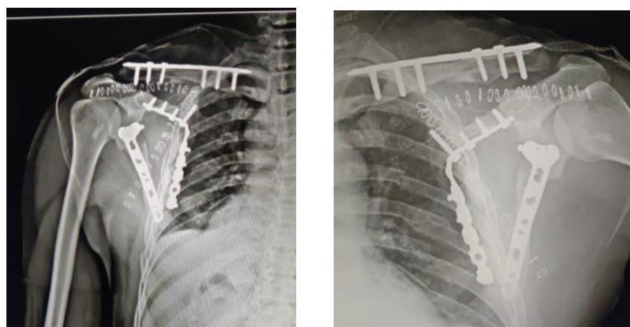


Figure 6:- Post Surgery x rays



Figure 7:- Post Surgery Scar- Clavicle and Scapula



Figure 8:- Post-Operative Range of Motion

## DISCUSSION

Scapula is a Latin word meaning ‘Small Garden trowel’ or ‘small shovel’. Scapula lies at 45 degrees to coronal plane on the posterior surface of chest. It has 4 processes glenoid, spine, acromion and coracoid. It consists of a body or blade, neck and glenoid articular surface & 3 borders medial, lateral and superior. Scapula gives attachment to 18 muscles attached to spine, chest, clavicle and humerus. Scapula provides rotational movement at upper extremity and abduction and rotation at glenohumeral joint. Scapula enclosed in fibromuscular envelope of rotator cuff muscles and suspended on thorax by muscular attachments. The energy absorbed by scapula is through upper extremity and by direct blow on the chest.<sup>4</sup> Most of the fracture fragments remain in place due to its muscle coverage and hence preserving the blood supply and lessen the chances of nonunion. The superior shoulder suspensory complex (SSSC) consists of coraco-clavicle, acromio-clavicle, coraco-acromial ligaments, coracoid, acromion, spine and glenoid process and distal third of clavicle. Single or double disruption of SSSC can cause significant morbidity and poor functional result if not treated appropriately. This means if there is significant displacement of clavicle and scapula fractures, then both scapula and clavicle need to be fixed surgically for optimum result in young active patient. At present there is no meta-analysis available addressing these issues. First study of scapula fracture was by Trought Karl August Vogt in 1799.<sup>5</sup> Earliest description of scapula fractures published in 1805 by PJ Dassault’s ‘Treatise on fractures and luxation.’<sup>6</sup> Lambotte described fixation of scapula fracture in his book in 1913.<sup>7</sup> First official publication on ORIF for fracture scapulae was in 1939.<sup>8</sup>

Clinical examination to be carried out in supine, lateral and prone position. As the scapula fracture is associated with high energy trauma in young patient, proper ATLS protocol to be followed up. Skin-color, bluish discoloration, ecchymosis, blister to be noted. Crepitation, decrease in range of movement, chest evaluation for rib fractures, pneumothorax and haemothorax and cervical spine injury to be ruled out. It’s mandatory to check carotid pulse, radial pulse and detailed neurological evaluation to rule out brachial plexus injury. High incidence of rupture of carotid artery reported in literature, in case of scapula fracture. Head injury, chest, abdominal pelvic and spine injuries to be ruled out at first visit. Dedicated trauma team

approach to be taken as suggested by WHO in 1978 for effective high-quality care and better patient outcomes. Injury severity score (ISS) and new injury severity score (NISS) are higher in scapula fracture patient. There is 43% chance of missing scapula fracture on normal chest x ray. Dedicated true Ap and Lateral view in plane of scapula requires. Axillary lateral view requires to rule out glenoid fractures. Other view like Velpeu axillary view if patient has severe pain, Stryker notch view for coracoid fracture and apical oblique view and West point view for glenoid rim fractures to be done for detail assessment. Weight carrying AP view for SSSC injury recommended. 3D CT scan is required for more complex injuries and for planning of treatment. There is a greater number of scapula fracture detected because of involvement of HRCT chest in trauma protocol. Digital subtraction CT scan of humeral head and chest gives detail analysis of Scapula fracture and helps in planning of the treatment. Scapulothoracic dissociation detected by asymmetric separation of the medial border of scapula from the midline on CT or chest x ray(17). MRI scan indicated if there is ligament injury suspected. First classification of scapula fracture is by Jean-Louis Petit includes body, neck and processes.<sup>9,10,11</sup> AO/OTA classification consists of 1 4 (A) -processes, 1 4(B)-body, 1 4 (C) -intra articular glenoid fossa fractures. Ideberg classification consists of Type I (a) anterior rim fracture (b) posterior rim fracture, Type II fracture line extending from transverse to lateral margin, Type III fracture line extending from transverse to superior border, Type IV fracture line extending from transverse to medial border, Type Va combination of type II & IV, Type Vb combination of fracture III & IV, Type Vc combinations of type II, III, IV Type VI severe comminution of glenoid or body. This classification does not take into consideration of associated dislocation and ipsilateral fracture of clavicle, multiple rib fractures and proximal humerus fracture.<sup>12,13,14</sup> Goss et al later modified it and added SSSC-floating shoulder.<sup>15</sup> Appropriate classification is yet to be found. Most publications lack clarity in terms of correct indications for surgery. Each case to be considered on its own merits for surgical treatment. Fracture scapula in association with ipsilateral multiple rib fractures, ipsilateral displaced clavicle fracture (floating shoulder) and proximal humerus fracture, double disruption of SSSC are the main indications of surgical management of scapula fracture if there is severe displacement present. Significant displacement is associated with poor long-term results. Aim of fixation is to reduce pain and

disability. Undisplaced/minimally displaced fractures-90% conservative management with universal shoulder immobilizer for 6 weeks and mobilization after that period can give good result. Intra articular surgical indications consist of articular step off > 5mm, associated glenohumeral instability, anterior rim fracture >25% of articular surface, posterior rim fracture >33% of articular surface. Extra articular body and neck fracture surgical indications(2) consists of angular deformity >40-degree, lateral border offset >15mm plus angular deformity >35-degree, lateral border offset >20mm & glenopolar angle <22 degree on true Grashay AP X-ray. Glenopolar angle first described in 1992 by Herscovinci. It is defined as the angle between the line drawn from superior pole to inferior pole of glenoid and line from superior pole to inferior most point of scapula. It measures around 45 degrees. Decrease in the angle less than 22 degree, suggest medialization of glenoid. Glenoid inclination angle is defined as the angle made by a perpendicular line drawn on glenoid surface and perpendicular line drawn on tangential line on medial border. It measures around 20 degrees. Increase in this angle suggest caudal shift of glenoid. Study shown operative patient has excellent functional result in long run. Joint stability and neurovascular injury, are the main factors for operative treatment. Injuries that compromise glenohumeral or scapulothoracic movement can be considered for surgical fixation. The other rare indication is scapulothoracic dissociation in which scapula gets separated from the dorsum of thoracic wall and shifted lateral side and associated with 10% mortality rate.<sup>16,17</sup> There is 10% incident of complications of surgery. Weakness in shoulder external rotation due to trauma to axillary nerve supplying teres minor muscle during exposure of teres minor muscle during surgery is one of them, along with damage to supra scapular nerve and vessels. Glenoid fossa fracture with displacement of > 5mm is the indication for surgery as reported by Soslowsky.<sup>18,19,20</sup> Cases like glenoid fracture with instability of humeral head surgery is indicated Zloosdosky reported 82% good result. Significantly displaced glenoid neck fracture if treated conservatively gives poor result reported by Nordqvist study of 37 cases.<sup>17</sup> 1cm translation or 40-degree angulation at glenoid neck fracture in AP plane can be considered for surgery. Severely displaced body fracture is an indication for surgery.<sup>22</sup> Associated fracture of clavicle and rib fracture more than 3 is a major cause of functional disability later. Lazy lateral position is used more commonly for fixation of scapula. Judet and

modified Judet, are the two standard approaches available for fixation of spine, glenoid neck, posterior glenoid rim and body. Anterior approach can be used for fixation of anterior glenoid rim. Conventional reconstructive plate, T buttress plate and Boomerang plate(AO, Synthes) available for fixation of body of scapula. Herbert screw can be used for intra articular glenoid rim fractures. In Judet approach, incision is taken along the spine and along the medial border in a shape like boomerang. Deltoid muscle elevated from spine. Trapezius elevated with vicryl stich from superomedial angle of scapula and later it can be stitched back at its place.<sup>23,24,25</sup> Infraspinatus and teres minor muscles are elevated en mass subperiosteally till lateral border and care has to be taken not to disturb the neurovascular structure. In case of modified Judet approach a transverse incision is taken over the body of scapula and interval between infraspinatus and teres minor to be developed and axillary nerve to be protected.<sup>26</sup> Infection chances are minimal as the scapula is highly vascular structure. Getting small screw length is a problem but can be solved by ordering specially for the case if the surgery is elective one. Closure to be done in layers. Physiotherapy active assisted to be started with day 1 post op and Aggressive physiotherapy to be given to avoid post op stiffness. Functional status of shoulder, assessed by 'Constant and Murley scoring system' most commonly used in case of shoulder injury was excellent in this case after one month. It consists of Pain 25 points, Activity of daily living 20 points, Mobility 40 points, Strength 25 points; Total 100 points. It is graded as 85-100 excellent,70-84 good ,55-69 satisfactory and below 54 is poor. Fixation of scapula and clavicle (ORIF) yields good result compare to conservative method reported in some case studies. We have got excellent result in this patient.

## CONCLUSION

Fracture scapula indicates very high energy trauma and high rate of mortality due to other organ damage at the same time. In case of young polytrauma patient with multiple rib fracture, associated with clavicle fracture which is displaced and if there is glenoid neck fracture with displacement of body fracture, surgical intervention with fixation of clavicle and scapula both in same sitting, yields excellent outcome in terms of pain relief, less stiffness and good functional recovery dramatically, in a very short period of time and improves cardiopulmonary

function because of early mobilization of shoulder and chest if associated with multiple rib fracture. Meta analysis is required in future to assess early functional ability and to form the guidelines for complex injury and regarding surgical fixation of scapula and clavicle (ribs if required) in same sitting. Phosphaturic mesenchymal tumor of the ethmoid sinus is a rare entity associated with tumor-induced osteomalacia. Early recognition, imaging, and surgical excision are crucial for effective management and symptom resolution. This case underscores the need for heightened awareness of PMT as a differential diagnosis in hypophosphatemia.

## Conflict Of Interest

None

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None

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**Author Contribution:-** N.N.G., A.V., M.S.R., A.R.K., J.S.P.: Conceptualized, supervised, revised, and edited the manuscript. S.M.B., V.D.M., R.C.R., K.S.N., P.R.: Wrote the original draft, revised, and edited the manuscript.

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