

The Assessment of Functional and Radiological Outcome of Scapular Body Fracture Treated With Open Reduction and Internal Fixation Using Plate Osteosynthesis

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ABSTRACT

Background: The study examines various factors influencing clinical outcomes among participants who underwent plate fixation for scapular body fracture. These factors are essential for understanding the post operative functional and radiological outcomes.

Methods: 20 participants were included in this study. Data were collected on age distribution, gender distribution, time to union of injury, constant scores, and Gleno-Polar angles. Comparative analysis was done to evaluate the impact of variables on study outcomes.

Results: The age distribution showed that 65% of participants were under 45 years and 35% were 45 years or older. The gender distribution revealed a predominantly male cohort (80%). Follow-up durations varied, with most participants followed up for a total duration of 1 year. The constant scores ranged from 76 to 94, showing showing good and excellent outcome. GPAs ranged from 33° to 43° , reflecting restoration of anatomical alignment.

Conclusion: Patients with indication for surgery undergoing plate fixation along with early mobilisation post operatively have shown better functional and radiological outcomes in comparison to conservative management of scapular fractures.

Keywords- Scapular body fracture, Posterior Modified Judet Approach, Gleno-polar angle, Time to fracture union, Constant-Murley shoulder score

I. INTRODUCTION

Scapular fractures, rare but complex, are crucial for shoulder function. They make up about 1% of all fractures and 3-5% of shoulder fractures. ⁽¹⁾ The scapula, also known as the shoulder blade, is crucial for upper limb movement and shoulder function. It serves as an attachment point for various muscles that are integral to shoulder and arm mobility ⁽²⁾ .Consequently, fractures of the scapula can significantly impact shoulder function and overall arm mobility. Among scapular fractures, those involving the scapular body are particularly concerning due to the extensive muscular attachments and the scapula's contribution to shoulder mechanics. The scapular body forms the central portion of the scapula and provides structural support and stability to the shoulder girdle. A fracture in this region can disrupt the balance and coordination of shoulder movements, leading to significant functional impairment if not properly treated. Studies by ⁽³⁾ emphasize the

importance of maintaining the anatomical integrity of the scapula for optimal shoulder function. Traditionally, many scapular fractures have been managed conservatively with satisfactory outcomes. Conservative management typically involves immobilization using slings or braces, followed by gradual rehabilitation to restore shoulder function. This approach is often successful for minimally displaced fractures, where the bone fragments remain in relatively good alignment and the risk of complications is low ⁽⁴⁾. However, displaced fractures, especially those involving the body of the scapula, often require surgical intervention to restore normal anatomy and function. Displacement of fracture fragments can lead to malalignment, which in turn can cause long-term complications such as malunion, nonunion, or chronic pain due to mechanical dysfunction ⁽⁵⁾. Therefore, surgical intervention is often necessary to achieve optimal outcomes in cases of significant displacement. ORIF has become a widely accepted method for treating significantly displaced and angulated scapular body fractures ⁽⁶⁾. ORIF involves the surgical exposure of the fracture, precise alignment (reduction) of the bone fragments, and stabilization using plate and screw fixation. This technique aims to achieve anatomical reduction, restore shoulder function, and minimize risk of long-term complications such as malunion, nonunion, or chronic pain ⁽⁷⁾. These objectives are critical in understanding the effectiveness of ORIF as a treatment modality for scapular body fractures. By assessing clinical outcomes, functional recovery, complications, and patient satisfaction, this study aims to provide a comprehensive evaluation of ORIF in managing these complex injuries. This study is significant as it provides a comprehensive evaluation of the postoperative outcomes of ORIF for scapular body fractures, which can inform clinical practice and guide decision-making. Given the rarity of these fractures, detailed data on surgical outcomes are limited. Therefore, this research contributes valuable insights into the efficacy and safety of ORIF, ultimately aiming to improve patient care and outcomes ⁽⁸⁾. The study also addresses the gap in literature regarding long-term functional outcomes and patient satisfaction following ORIF for scapular body fractures. By systematically analysing functional and radiological⁽⁹⁾ results, this research can help refine surgical techniques and postoperative care protocols. Understanding the factors that contribute to successful outcomes can aid in developing best practices for managing scapular body fractures and improving patient quality of life.

II. MATERIALS AND METHODS

Our study is a prospective analysis of a total of 20 participants followed up at our institute who underwent ORIF for body of scapula fractures over a period of 1 and half years, and a total period of follow up of one year for all patients.



Fig. 1 : Zdrakovic and Damholt Type-1 fractures at the body of the scapula

Our study group only included patients having clear indication for surgery and in this case we included Zdravkovic and Damholt type-1 scapular body fractures, Fractures with Glenopolar angle $\leq 22^\circ$ or angular deformity $\geq 45^\circ$, Displacement of more than or equal to 20 mm, Fractures with displacement of more than 15 mm with an angular deformity of more than 30° or Displacement of more than 10 mm with double disruption of shoulder suspensory complex. Patients with undisplaced fractures, Old fracture after failed plating, Open scapular fractures and Fractures with articular involvement or segmental bone loss were excluded from our study.

A. PRE OPERATIVE WORKUP :

Patient related data, surgery, postoperative period and followed up data were collected for all patients. Patient data includes age, gender, mechanism of injury, medical comorbidities & health status. Surgical data included X-Rays- Antero posterior (Figure 2) and scapular 'Y' view along with CT scan (Figure 3) to assess the fracture type to determine the surgical plan and surgical approach required for fixation.



Fig. 2 : Scapular Body Fracture with Gleno-Polar angle of less than 22°

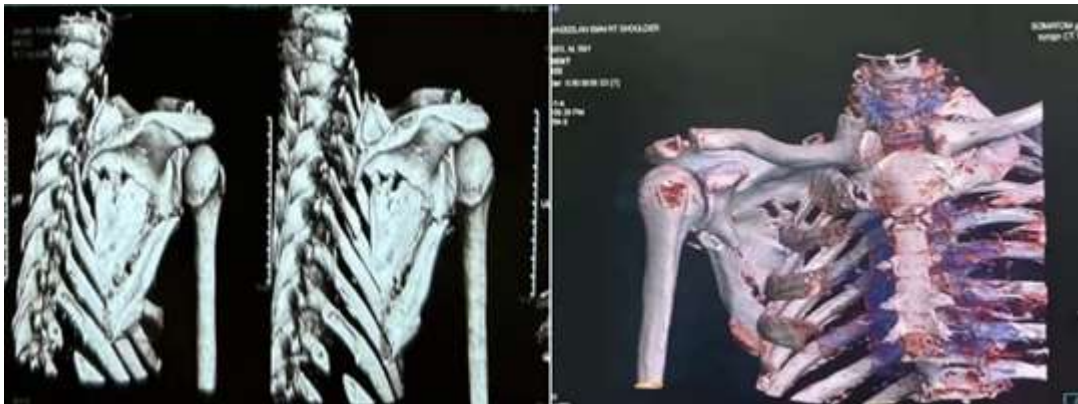


Fig. 3 : CT scan with 3D reconstruction showing comminuted fracture of scapular body and spine with displacement along with an undisplaced fracture of clavicle and multiple rib fractures

B. SURGICAL APPROACH :

Posterior Modified Judet approach was used for fixation with patient in a floppy lateral position. The incision started from postero-lateral angle of acromion, extending down along the spine of scapula to the medial border. Trapezius fibers were incised, retracted, and posterior deltoid belly cut for visibility. Inter muscular interval (Figure 4) provides exposure of scapular neck, lateral border, and posterior glenoid. Mini-fragment screws/plates (LC-DCP, Reconstruction plates and anatomically pre-contoured scapula plates) were the commonly used devices for fixation. Infraspinatus muscle was repaired at the medial border. Wound closed in layers with drain being placed deep to the muscle envelope.

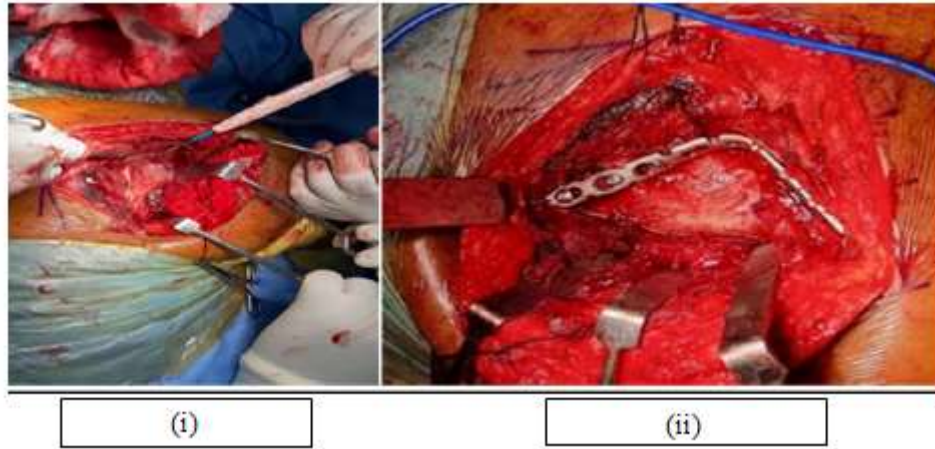


Figure 4 (i): Intra operative picture showing inter muscular interval between the Infraspinatus muscle and Teres Minor muscle

(ii) : Reconstruction plating was done with plate placement over inferior border of spine of scapula and pre contoured to lie on the scapula medial border

C. POST OPERATIVE PHASE :

Post operative data included Gleno-polar angle and time to fracture union seen on follow up radiographs (Figure 5), constant murley score, ROM (Figure 6 and 7) at six weeks, three months, six months and one year. Post operative rehabilitation protocol included: PHASE 1- Passive mobilisation phase (0-5 weeks), PHASE 2- Active ROM phase (4-12 weeks) and PHASE 3 – Isometric strengthening exercises and Stretching (>12 weeks).

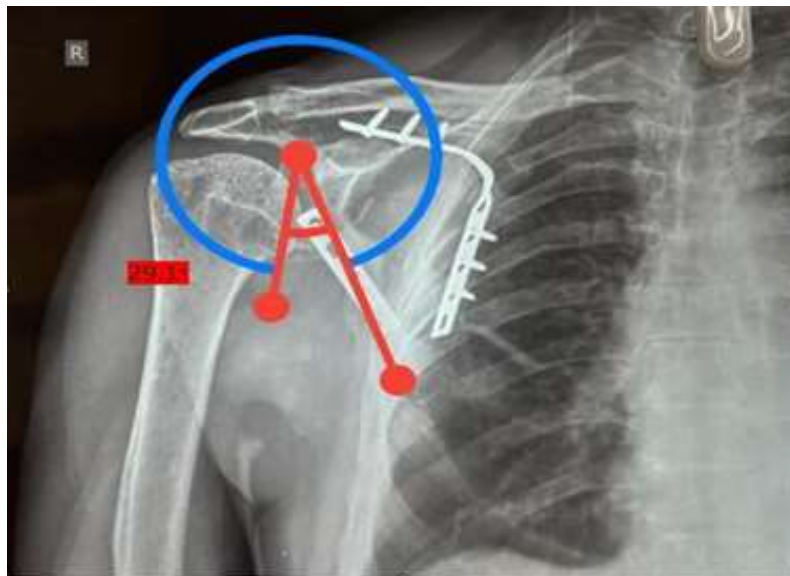


Figure 5: Post Operative X-Ray showing improved Gleno-Polar angle of 29°

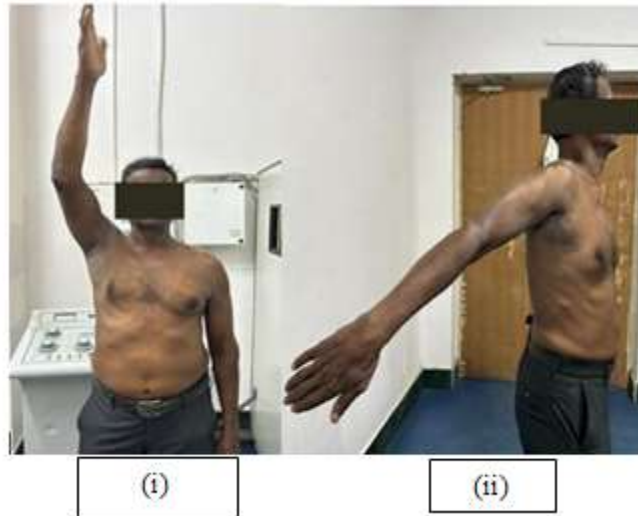


Figure 6: Range of movements at 3 months

- (i) : Forward Flexion
- (ii) : Backward Extension

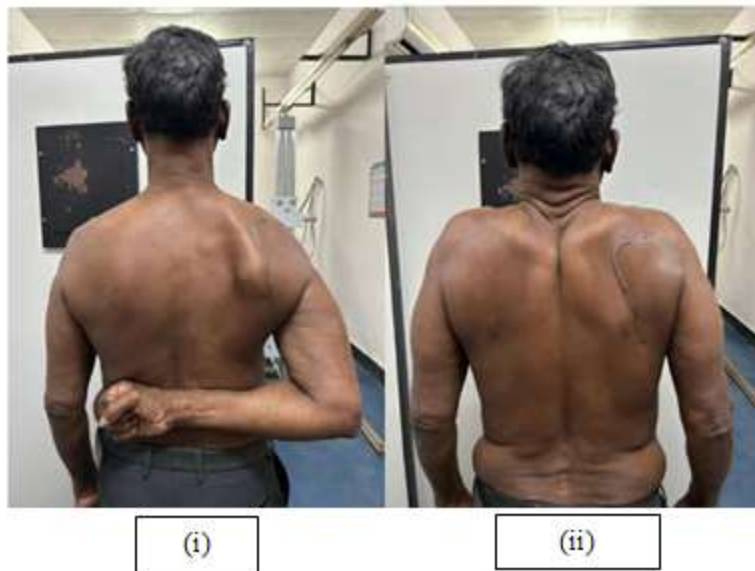


Figure 7: Range of movements at 3 months

- (i) : Excellent Internal Rotation
- (ii) : Shrugging of shoulders

D. THE CONSTANT- MURLEY SHOULDER SCORE :

Functional outcome of the shoulder joint was assessed using Constant-Murley score at regular intervals, categorizing function subjectively and objectively in 4 ways which includes pain(15), activities of daily living affected(20), ROM(40) and strength measurement(25). The Constant score categorizes outcomes as : Poor (0-55), Moderate (56-70), Good (71-85) and Excellent (86-100).

III. PATIENT DETAILS AND RESULTS

S.No.	AGE/ GENDER	MODE OF INJURY	TIME TO UNION (weeks)	PRE- OP GPA	POST OP GPA	CONSTANT- MURLEY SCORE	OUTCOME
1.	68/M	RTA	6	22	35	91	Excellent
2.	41/M	RTA	6	18	38	86	Excellent
3.	40/F	RTA	6	20	35	76	Good
4.	64/M	RTA	6	19	40	80	Good
5.	65/F	RTA	6	19	33	78	Good
6.	43/M	RTA	6	22	40	80	Good
7.	28/F	RTA	8	18	43	93	Excellent
8.	43/M	RTA	8	19	35	89	Excellent
9.	38/F	RTA	6	22	43	83	Good
10.	44/F	RTA	7	20	35	89	Excellent
11.	40/F	RTA	6	21	36	90	Excellent
12.	50/F	RTA	7	19	38	94	Excellent
13.	43/M	RTA	6	20	37	92	Excellent
14.	44/M	RTA	7	18	41	90	Excellent
15.	44/F	RTA	8	21	33	91	Excellent
16.	67/M	RTA	6	22	42	86	Excellent
17.	42/M	RTA	7	18	40	81	Good
18.	39/F	RTA	8	20	33	80	Good
19.	63/M	RTA	8	21	40	78	Good
20.	60/F	RTA	6	22	41	82	Good

IV. DISCUSSION

The frequency of scapula fractures is rising as a result of traffic accidents, which are frequently caused by high energy injuries and are linked to numerous injuries. Scapula fractures may be related to 52% of rib fractures, 22% of clavicle fractures, 29% of spine fractures, 5% of brachial plexus injuries, 35% of pneumo-hemothorax injuries, trauma to the head, and 11% of neurovascular injuries. The majority of scapular fractures are treated with conservative management⁽¹⁰⁾. Even while scapular fractures usually heal well, not all of them do, and there is renewed interest in identifying which patients will benefit from surgical intervention⁽¹¹⁾. In our study, Operative management is indicated for Zdravkovic and Damholt type-1 fractures, Fractures with Glenopolar angle $\leq 22^\circ$ or angular deformity $\geq 45^\circ$, displacement of more than 20 mm, Fractures with displacement of more than or equal to 15 mm with an angular deformity of more than 30° , Displacement of more than 10 mm with dual disruption of the shoulder suspensory complex. Operative intervention over the aforementioned circumstances increase the stability of the glenohumeral joint, which increases the range of motion in the shoulder joint. In our study, all patients with scapular body fracture underwent radiological evaluation with AP and scapular 'Y' view and CT scan with 3D reconstruction⁽¹²⁾. Following radiological examination, all patients had their shoulders immobilised using a collar and cuff or shoulder immobiliser. Only patients with a need for surgery were sent for additional evaluation, anaesthesia assessment, and surgery. All patients received general anaesthesia and put in floppy lateral position with affected side up. All patients in our study were operated using the posterior modified Judet's approach. Following surgery, all study participants completed passive shoulder mobilisation exercises for one week, and in the second week, they engaged in pendulum exercises with active aided range of motion. Patients received aided range of motion and isometric exercise throughout the third and fourth week of treatment. Early resisted range of motion with weight bearing was introduced in the eighth week, and by the twelfth week, isotonic activities were begun. During the early stages of the rehabilitation process, we started early passive and active aided mobilisation⁽¹³⁾.

Total 20 patients were included in this study and results were interpreted under age, gender, time to union, gleno-polar angle, ROM and constant shoulder score. The age distribution of the study participants reveals that 65% were under 45 years of age, with a frequency of 13 individuals. In contrast, 35% of the participants were 45 years or older, totaling 7 individuals. In a study

involving 20 participants, gender distribution was observed with 16 individuals identifying as male (80%) and 4 as female (20%). This distribution reflects a predominantly male cohort within the sample. During the one-year study period, participants were monitored regularly after surgery. Serial X-Rays done showed that 11 individuals (55%) signs of fracture union by 6 weeks, 4 (20%) at 7 weeks, and 5 (25%) at 8 weeks. The functional outcome was evaluated using the constant shoulder score⁽¹⁴⁾ exhibiting a range from 76 to 94. This study showed 9 participants with good outcome and 11 participants showing excellent functional outcome. The Gleno-Polar angles of the 20 study participants range from 33⁰ to 43⁰ post operatively showing restoration of anatomical alignment post surgical fixation. This distribution highlights a varied spectrum of GPAs among the participants post operatively owing to the different fracture types and extent of injury⁽¹⁵⁾. In all 20 patients there was no major complications and 4 patients showed minor complication of wound site infection which was treated with iv antibiotics and regular dressing showing good wound healing. The study came to the conclusion that for a successful surgical outcome, patient selection, the severity of the fracture, and early surgical intervention followed by shoulder mobilisation are essential.

V. CONCLUSION

The majority of scapular fractures don't require surgery, with operative intervention for body fractures based on displacement and deformity. Surgery restores glenoid orientation, shoulder balance, muscular function, and fracture stability. Early mobilization and improved functional outcomes are benefits of surgical management, which carries low risk and superior results compared to conservative approaches for scapular fractures.

VI. FINANCIAL SUPPORT

There was no outside funding for this study

VII. INFORMED CONSENT

Consent of all the patients have been obtained for publishing their details in a case series.

VIII. CONFLICT OF INTEREST

No conflicting interests are acknowledged by the author.

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X. AUTHOR'S CONTRIBUTION

Formal analysis, writing, data collection, supervision, methodology, and resources: Professor Dr. Vijay Narasimman Reddy

Writing, Investigation, Resources, Analysis, Draft preparation, Review and Editing: Dr Syed Nihal. A

Composing, Research, Materials, Evaluation, Data Gathering, Assessment, and Guidance: Dr. Mervin Rosario

Each author has read the document and given their consent to submit it.

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