

RESULTS OF THE SURGICAL TREATMENT OF ARTICULAR SCAPULAR FRACTURES

RESULTADOS DO TRATAMENTO CIRÚRGICO DAS FRATURAS ARTICULARES DE ESCÁPULA

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ABSTRACT

Introduction: Scapular fractures are rare injuries and are often associated with high-energy trauma, with joint fractures accounting for only 15% of all scapular fractures. Surgical treatment is indicated for fractures with large deviations and with joint instability. **Objective:** This study evaluates the clinical and functional results after surgical treatment of scapular fractures. **Methods:** Eight patients with scapular fractures were surgically treated between 2013 and 2019. For indication for surgical treatment, mediolateral deviations, glenopolar angle, angular deviations and joint deviations greater than 4 mm were taken into account. Radiographic results of consolidation, range of motion, functional score and visual analogue pain scale were obtained. **Results:** In the mean follow-up of twenty-nine months (13–40 months), all patients presented fracture consolidation. The mean UCLA score was 29 points (with 75% good results and 25% moderate results). Regarding the range of motion, the mean elevation was 146° (ranging from 110° to 60°), lateral rotation of 62° (36–80°) and medial rotation at the level of T7 (T6–T10). The final VAS mean was 2.3. All patients returned to the pre-injury level at work. **Conclusion:** In this series of cases, surgical treatment of scapular articular fractures provided satisfactory results with low rates of complications, showing to be an option in selected cases of deviated fractures. **Level of Evidence IV, Case Series.**

Keywords: Scapula. Glenoid Cavity. Shoulder Joint.

RESUMO

Introdução: As fraturas de escápula são lesões raras e muitas vezes associadas a traumas de alta energia, sendo que as fraturas articulares correspondem a apenas 15% de todas as fraturas escapulares. O tratamento cirúrgico é indicado para fraturas com grandes desvios e com instabilidade articular. **Objetivo:** Avaliar os resultados clínicos e funcionais após o tratamento cirúrgico das fraturas de escápula. **Métodos:** Oito pacientes com fraturas da escápula foram tratados cirurgicamente entre o período de 2013 e 2019. Para indicação do tratamento cirúrgico, levou-se em consideração os desvios mediolaterais, ângulo glenopolar, desvios angulares e desvio articular maior que 4 mm. Resultados radiográficos de consolidação, arco de movimento, escore funcional e escala visual analógica de dor foram obtidos. **Resultados:** No seguimento médio de 29 meses (13–40 meses), todos os pacientes apresentaram consolidação da fratura. A média do escore UCLA foi de 29 pontos (sendo 75% de resultados bons e 25% de resultados moderados). Com relação ao arco de movimento, a elevação média foi de 146° (variando de 110° a 160°), rotação lateral de 62° (36–80°) e rotação medial no nível de T7 (T6–T10). A média final do EVA foi de 2,3. Todos os pacientes retornaram ao nível pré-lesão de trabalho. **Conclusão:** Nesta série de casos, o tratamento cirúrgico das fraturas da escápula com envolvimento articular proporcionou resultados satisfatórios com baixa taxa de complicações, mostrando ser uma opção em casos selecionados de fraturas desviadas. **Nível de Evidência IV, Série de Casos.**

Descritores: Escápula. Cavidade Glenoide. Articulação do Ombro.

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INTRODUCTION

Scapula fractures are rare injuries, representing about 3% of all fractures of the shoulder girdle and 1% of all fractures of the human body. Most affect the body and spine (70%) and 15% of cases affect the glenoid cavity.¹ Generally, it affects the young and middle-aged male

population, victims of high-energy trauma. Associated injuries are common, especially costal cartilage fractures, clavicle fractures, and lung lesions. A total of 90% of scapula fractures undergo conservative treatment, however, in some cases, they can lead to poor results, causing osteoarthritis and eventually glenohumeral joint instability.^{2–4}

All authors declare no potential conflict of interest related to this article.

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As they are rare injuries, the literature on the subject is relatively scarce, especially in relation to the surgical treatment of fractures affecting this joint.^{1,5-7}

This study aims to present functional and radiographic results of the surgeries performed in patients with articular scapular (neck and glenoid) fractures, according to Ideberg-Goss and AO classifications.^{8,9}

METHODS

This study was approved by the Research Ethics Committee of the institution and all participants signed an informed consent form. From January 2013 to May 2019, 16 patients from a trauma center or the authors' private clinic presented scapular fractures, eight of which were included in the study, as they presented joint fractures with indication for surgery (Figures 1, 2, and 3).

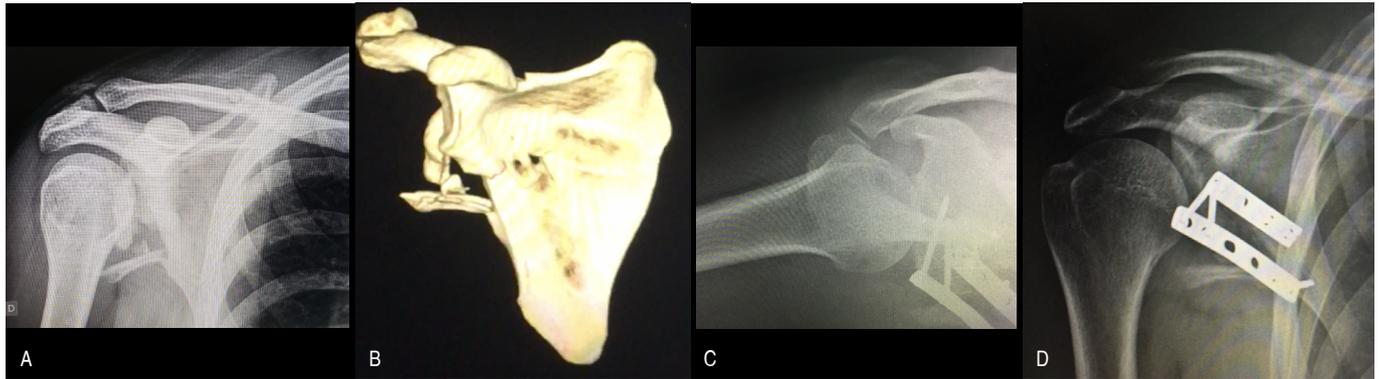


Figure 1. A: Anteroposterior (AP) radiograph of a 33-year-old patient with AO type 14F1.2 fracture; B: Computed tomography scan with 3D reconstruction; C and D: Postoperative AP and axillary radiographs, respectively, of a patient subjected to fixation of small fragments with two dynamic compression plates (DCP).

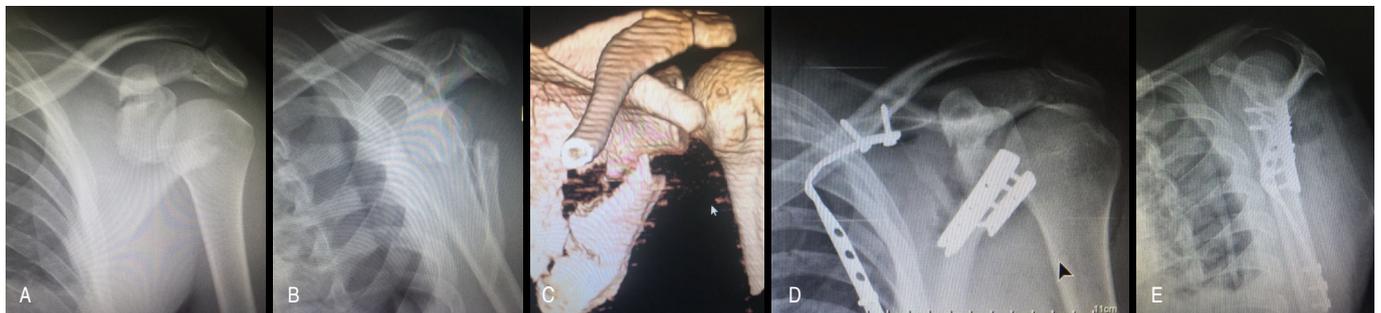


Figure 2. A: Anteroposterior radiograph of the shoulder of a 28-year-old patient with AO type 14F1.2 fracture; B: Perfil radiograph shoulder showing a translation greater than 100%; C: Computed tomography scan with 3D reconstruction; D and E: Postoperative AP and profile radiographs highlighting the fixation of small fragments with plates on the lateral and medial borders of the scapula.



Figure 3. A: Anteroposterior radiograph of the shoulder of a 55-year-old patient with AO type 14F1.3 fracture. B and C: Computed tomography scan with 3D reconstruction highlighting the affected medial border of the scapula; D, E, and F: Postoperative AP and perfil radiographs of the shoulder, highlighting the fixation of the lateral and medial borders of the scapula, with fixation of the clavicle.

All patients were subjected to fixation via posterior approach: three patients via classic or modified Judet approach (without elevation of the infraspinatus muscle), four patients via mini-open lateral approach (according to Peter Cole), and one patient via combined posterior and anterior (deltopectoral) approach (Figure 4).¹⁰⁻¹²

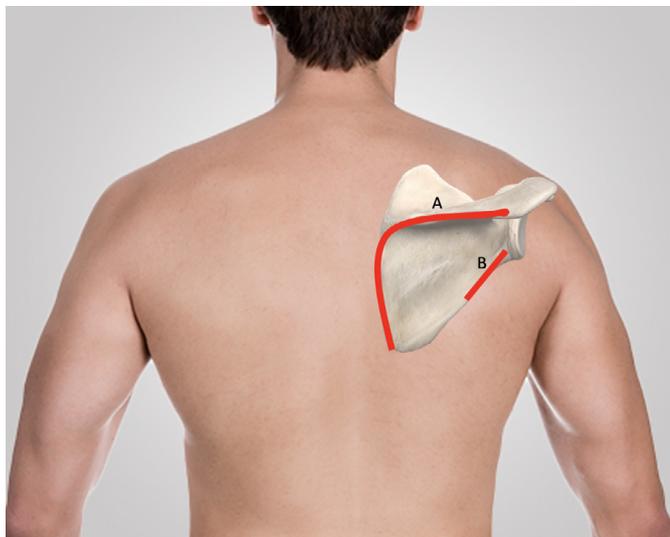


Figure 4. Photograph of the scapular region showing the Judet (A) and mini-open lateral (B) approaches.

The criteria used for indication for surgery were:

- Deviation greater than 4 mm.
- 100% translation on profile radiograph of the shoulder.
- Medialization or lateralization greater than 1 cm on AP radiograph of the shoulder.
- Glenopolar angle (GPA) < 2°.
- Scapular neck angle > 40°.
- Involvement of the superior shoulder suspensory complex at two or more sites, according to Goss.

The fixation was made with reconstructions plates of small (3.5 mm) and mini (2.7 mm) fragments (DCP - dynamical compression plates). All patients were evaluated regarding the neurovascular aspect. The preoperative imaging evaluation was made by true AP, perfil scapular, and axillary radiographs. Patients were subjected to computed tomography scan with 3D reconstruction. Fractures were classified according to Ideberg-Goss and AO classifications (Figure 5).^{8,9,13}

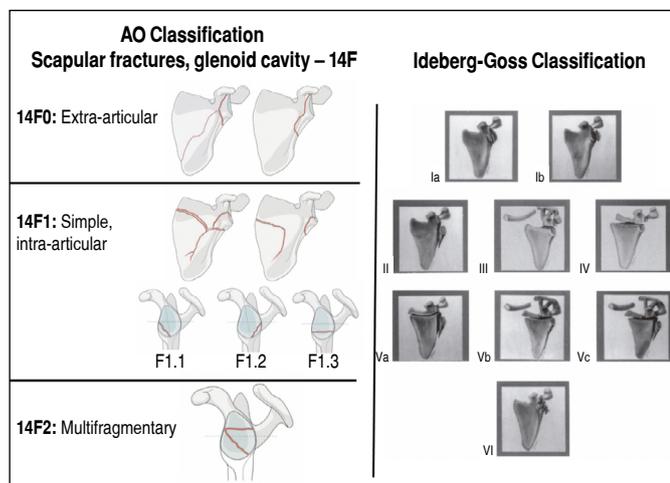


Figure 5. Classifications used: AO and Ideberg-Goss.

Surgical technique

The choice of approach was based on the fracture pattern and degree of fragmentation of the joint. For coracoid process fractures with intra-articular fragments, the anterior (deltopectoral) approach was performed. For posterior approaches, both the classic or modified Judet approach (without elevation of the infraspinatus muscle) or Peter Cole's mini-open scapular lateral approach were used. In the classical Judet approach, the infraspinatus and teres minor muscles were elevated in its medial regions. The space between the teres minor and infraspinatus muscles allowed a direct visualization of the joint after arthrotomy and fixation of posterior glenoid fragments, as well as of the lateral border of the scapula.

The patient's position was lateral decubitus when the posterior or anterior and posterior approaches were performed. Reconstruction plates or DCPs of small or mini fragments were used.

Rehabilitation

In the postoperative period, patients were immobilized with a simple sling for analgesia and encouraged to begin assisted passive and active movement the day after surgery. Antibiotic prophylaxis was performed for 24 hours with first-generation cephalosporin. Patients who underwent the anterior (deltopectoral) approach, in which the minor tuberosity was removed from the subscapularis muscle and it was subjected to tenorrhaphy, used the sling for four weeks. For those patients, external rotation was limited to 30° in the first four weeks after surgery.

The goal was to recover the entire range of motion by the second month after surgery. Strengthening exercises started in the second month after surgery and patients were allowed to return to work activities three months after surgery.

Postoperative evaluation

Perfil, axillary, and AP radiographs of the shoulder (Grashey view) were performed during postoperative appointments. For all patients, in order to assess the success of the reduction and restoration of the articular surface, pre- and postoperative images were compared between themselves and with the contralateral side. Fracture healing was defined as bone filling of the fracture line and clinically based on the patient's function and pain. The range of motion was assessed by a goniometer. The medial rotation was measured based on the highest point that the thumb of the operated limb could reach, considering some anatomical landmarks (T3: scapular spine; T8: inferior angle of the scapula; L1 iliac crest).

RESULTS

The mean age was 39 years old (28–62 years old). Eight patients were men. The mean time between trauma and surgery was 16 days (11–33 days).

All cases presented fracture healing. The mean follow-up period was 26 months (6–40 months). The mean UCLA score was 29 points (75% were good results and 25% were moderate results). The mean visual analog scale (VAS) for pain was 2.4 (0–4). The mean elevation was 146° (110–160°). The mean lateral rotation was 62° (36–80°). The mean medial rotation was T7 (T6–T11) (Table 1).

Regarding associated lesions, the most common were costal cartilage fractures (four patients) and clavicle fractures (three patients).

All patients returned to their pre-injury work activities.

Table 1. Data from eight patients, with a mean age of 39 years old, mean UCLA score of 29, and mean VAS of 2.4.

Case	Age	Follow-up period (months)	AO Classification	Ideberg Classification	UCLA	VAS	Range of motion		
							Elevation	Lateral rotation	Medial rotation
1	33	40	14F1.2	Ib	32	0	160	80	T6
2	28	38	14F1.3/14FB1	II	31	1	150	60	T7
3	55	32	14F1.3	II	28	4	130	45	T10
4	38	36	14F1.2/14B1	IV	27	4	140	70	T7
5	31	28	14F1.2/14B1	IV	29	2	160	80	T6
6	33	18	14F0	II	32	2	160	80	T6
7	33	13	14F1.3/14B2/14A2	III	28	3	160	45	T9
8	62	6	14F2/14A3	Vc	26	3	110	36	T11
MEAN	39	26			29	2.4	146	62	70

Patients presented no complications such as pseudarthrosis or loss of reduction, however, we observed a case of superficial infection (infected hematoma), which was resolved with first-generation cephalosporin for seven days. Two patients evolved with infraspinatus muscle atrophy, but without clinical repercussion regarding the range of motion. For these two patients, the suprascapular nerve might have suffered injury due to the fragment pattern of the glenoid neck fracture.

DISCUSSION

Currently, no consensus exists regarding the treatment of scapula fractures.^{9,14} The conservative treatment is usually used in most cases, however, fractures with significant deviation may cause adverse functional results, causing osteoarthritis. For these fractures, surgical treatment is recommended.^{15,16}

Restoring joint congruence and stability is critical for long-term satisfactory functional results. The fixation of the lateral border is the first step in surgeries, followed by the fixation of the medial border of the body of the scapula to neutralize shear and rotational forces. In 1991, Ada and Miller observed excellent results in the surgical treatment of eight patients with scapula fractures.¹⁷ For Schandelmaier

et al., evaluating 22 patients subjected to internal fixation, 82% of the results were satisfactory.¹⁴ Giordano et al. evaluated 15 patients who underwent fixation of scapular fractures and 86% of the results were excellent.¹⁸ In our study, 75% of the results were good and 25% were moderate, with a mean UCLA score of 29 points. Patients with the worst scores were those with multifragmentary articular fractures and fractures of the inferior border of the glenoid.

For Anavian et al., 27 of 30 patients with surgically treated joint fractures presented satisfactory results when returning to activities at the same pre-injury level—only four patients reported occasional moderate pain.¹⁵ Mayo et al. observed good and excellent results in 22 of 27 patients with surgically treated glenoid deviated fractures.¹⁹ In our study, the mean visual analog scale for pain was 2.4 and all patients returned to pre-injury work activities—only two reported occasional use of anti-inflammatory medication.

All patients were subjected to fixation via posterior approach: three via classic or modified Judet approach, four via mini-open lateral approach (according to Peter Cole), and one via combined posterior and anterior approach.^{11,12} The patient who underwent the anterior approach presented an AO type 14F1.3 fracture with a horizontal line at the glenoid equator, thus we inserted two screws in cephalocaudal direction through the base of the coracoid process. Hardegger, Simpson, and Weber performed a vertical incision from the acromion to the inferior angle of the coracoid process, however, it is contraindicated when facing Ideberg types IV, V, and VI fractures.^{20–22} During surgery, we initially tried to fix the lateral border of the scapula with direct visualization of the articular fragment through the opening of the posterior shoulder capsule. Then, in cases with extension of the fracture to the body of the scapula, we fixed the medial border. The limitations of our study were the limited number of patients and the fact of being a retrospective study without control group. However, it addresses an unusual type of fracture, especially joint fractures, which corresponds to 15% of all scapular fractures. Indications for surgery were based on criteria established in the literature and the poor results of joint fractures treated conservatively.^{2,3}

CONCLUSION

In our series of cases the surgical treatment of articular scapular fractures presented good functional results with a small rate of complications, proving to be an option in selected cases of articular glenoid fractures. Multifragmentary articular fractures and fractures with inferior fragment presented worse functional results.

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