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REHABILITATION INTERVENTION TO RESTORE THE FUNCTIONALITY OF THE SHOULDER WITH SCAPULAR FRACTURE - CASE REPORT

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Abstract: *This report presents an individualized physical therapy program and the therapeutic results for a 36-year-old man with a posttraumatic left scapular body fracture with minimal displacement and without ribs fractures scapular fracture. Because the glenoid fossa was intact, conservative treatment was recommended. Patient reports arm activities dysfunctions. The rehabilitation was conducted in an outpatient physical therapy clinic from Craiova under direct supervision for 12 weeks. At the end of the follow-up period the level of pain was considerably decreased. Despite the functional deficit from the beginning of the rehabilitation program, normal function was restored. The patient was fully involved and cooperative during the physical therapy session.*

Key words: *scapula body fracture; rehabilitation management, physical therapy, functionality.*

1. Introduction

The shoulder is a complex joint. No other joint has such high mobility, a characteristic present at the expense of stability. This freedom of movement is due to the laxity of the joint capsule and also to the fact that the shoulder is a complex joint consisting of two functional units: scapulohumeral and scapulothoracic.

The biomechanics and the shape of the joint components are the result of the evolution of the human to bipedal walking and the development of hands variety of functional activities, such as throwing a ball, lifting and carrying weights or personal hygiene, etc.

The scapula is a triangular shaped bone located posteriorly. The mechanism of scapular fractures is always a high-energy trauma [4] and are usually accompanied by others other traumatic injuries [15]. As a way of production, Limb D. [7] points out that the fracture occurs in young people through high-energy mechanisms with significant associated injuries to the

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chest, spine, head and abdomen. In the elderly, the same author points out that the production mechanisms can have low energy and are frequently associated with fracture of the proximal humerus [7]. Studies report up to 90% of fractures mainly involve a vehicle with motor [9]. On a 10 year survey period of military personnel Roberts, D.C. et al. [11] reported a 7.7% percentage of scapular fractures of all upper limb fracture.

The fracture may occur in the context of a multiple trauma condition, the diagnosis may be delayed because it may be associated with other serious or multiple injuries that are life-threatening and require immediate medical attention. A frequency study from 1994 to 2002 shows an 80-95% of association of scapular fractures with other injuries in subjects from trauma centers in the United States [1], but the epidemiology of these lesions is changing [7].

Symptoms and therapeutic management of scapular fractures (SF)

Fractures can occur in different anatomical areas of the scapula: body, scapular neck, glenoid, acromion or coracoid. Half of these fractures involve the scapular body and spine. [5]

Clinically, a person with SF (without other bone fractures) presents severe pain in the postero-upper part of the chest or shoulder, occurring immediately after trauma. The pain is amplified by arm movements or even deeper breathing which leads to a significant decrease in functionality especially if the fracture involves the dominant arm. Active movements in the shoulder joint can have very low values or be even zero. Radiological confirmation and classifications help to establish the therapeutic decision and protocol. Due to the thick and strong support provided by the soft tissues surrounding the bone and the support provided by the costal plane, displacement is minimal and thus surgical treatment is rarely indicated [8].

The current management of complex shoulder injuries involves surgical fixation strategies, there are also studies that show results as good or even superior to conservative treatment [2], [15] but each case should be evaluated clinically, functionally, and imaging very carefully [7] and the clinical reasoning should be always individualised.

Non-surgical treatment consists mainly of orthotics, mild analgesics, and early ROM exercises. An adverse reaction or complication recognized by specialists in the case of wearing the orthosis is *adhesive capsulitis or frozen shoulder. As a side effect of the non-surgical treatment, it is emphasized in literature the shortening and medialization of the scapular body* [12].

According to Kannan, S., et al. [6] there is no agreement in the literature regarding the management of this type of fracture and they believe that there are no significant advantages between the two types of therapeutic approaches. *The study by Rollo et al.* [12] *point out that surgery for extra-articular scapular fractures may achieve better functional results in the short term (3-6 months) than conservative treatment, but results are similar after 12 months.*

2. Material and Methods

2.1. Participant

This case study aims to present the therapeutic evolution of a right-handed 36-year-old subject, who suffered a fracture of the scapular body following a fall on the ski slope.

Following the trauma, he was examined in the orthopedic clinic as an emergency and was recommended imaging investigations of the left shoulder. Based on the X-ray (Fig.1) and CT results of the scapular girdle/scapular joint and the clinical examination, the diagnosis of *left scapular body fracture in the posttraumatic context* was established.

Fig. 1*. The initial AP shoulder radiograph*

Scapulo-humeral and acromio-clavicular joint showed no changes. The subject did not present injuries to the ipsilateral shoulder girdle, rib fractures, pneumothorax or associated pulmonary contusions.

Based on imaging results, the location of the extraarticular fracture of bone body, according to AO/OTA classification system the fracture was 14B [10].

2.1. Prerehabilitation stage

The subject did not present any other fractures or complications, his clinical condition was good and the orthopaedists decided that he should follow a conservative treatment of physical therapy (PT) after 2 weeks of fixation in an orthosis including at night, during sleep. The orthopaedist's contraindications were not to lift weights or make overhead movements for a period of about 2 months. The patient was advised to mobilize neighbouring joints immediately (elbow, forearm, hand).

He presented himself in the PT clinic in Craiova, one week after the trauma for a preliminary discussion. He gave his written informed consent to the University of Craiova for the use of his medical data, pictures and results obtained after the therapy for the publication.

Together with the therapist he discussed the process and steps of treatment, the way to control the pain that had a value of 5 on the VAS scale when he uses medication. He was advised how to

control perilesional edema using ice-packs for 15 minutes every few hours.

In general, the subject reported that resting with his shoulder in a neutral position relieved symptoms, and nonsteroidal anti-inflammatory drugs and analgesics helped him during sleep.

The therapist advised him how to support the injured hemithorax during supine sleep by placing a pillow under the arm and under the shoulder. Or how to support the left side on a pillow placed under the chest when sleeping on the right side.

The subject was advised to practice movements for the elbow, wrist, and hand for the period of wearing the orthosis, 2 times a day, in the morning and in the evening, in 3 series with 20 repetitions each to maintain the integrity and function of the muscles and joints of the upper limb. The indications were that all wrist movements should be done with the elbow at 90°, fixed next to the body to avoid movements of lifting or mobilizing the scapula: *external rotation and abduction are contraindicated*.

The subject was instructed to try to maintain as high a level of activity as possible (e.g. walking more than 1 hour per day) to maintain his fitness level and participation in his social life, aspects that should not be overlooked. The subject was cooperative and showed interest in all information provided.

3. Functional Assessment 2 Weeks after Trauma

At the beginning of PT, 2 weeks after the accident, the subject presented postural changes: kyphosis, the shoulder projected anteriorly, marked atrophy of the muscle belt of the left upper limb. He showed no signs of damage to the brachial plexus or periscapular vascular structures.

During the initial evaluation, the subject's chief complaint was left shoulder pain (see VAS score Tabel 1) He also described crepitus and tenderness around the shoulder joint.

The subject's therapeutic objectives were*:*

1) pain control,

2) increase active mobility,

3) regain the ability to continue practicing self-care activities

4) return to work activities,

5) return to practice leisure sports.

The rehab program consisted of five individualised treatment sessions per week, lasting 1 hour, for 3 months and the continuation of the exercise program at home with subsequent changes in complexity, depending on the clinical evolution. The therapeutic program took place in front of the mirror for posture awareness. The principle of progression according to the painful symptomatology was respected.

The main goal of PT was to make the subject understand and teach the correct movements, to relax, to understand how to exercise even if pain increase, not to develop kinesiophobia.

The objectives of the PT were:

1) pain control,
2) restore the mobility of the shoulder joint,
3) restore the stability of the left scapular girdle muscles,
4) improve coordination,
5) restore the global functional abilities of the upper limb.

During each treatment session, the subject reported how he tolerated the home exercises and whether he noticed any changes in pain or function.

3.1. Exercises in the first 2 weeks of PT

•Manual therapy was introduced for the sternoclavicular and acromioclavicular joints mobilization.

• Auto passive mobilization exercises (depending on the pain level) Codman or Pendulum with forwards/backward, side to side, and circles movements. The pace of the movements was very slow. From orthostatism, with the body bent slightly forward, the left forearm supported at the level of the elbow with the left hand, perform pendulum movements for 1-2 minutes as long as the symptoms do not change. At the end of the 2 weeks, 2 minutes was reached without further increase in pain.

•Flexion and extension exercises of the elbow joint, 3 series with 10 repetitions from standing or sitting.

•Assisted active mobilizations of the shoulder with 0° abduction and external rotation, isometric exercises to maintain mobility.

3.2. Exercises in the week 3-6 of PT

All previous exercises were continued.

•Active mobilizations of the shoulder, isometric exercises to maintain mobility with 0° abduction, internal rotation and external rotation.

An ease in their realization was noted. The number of repetitions increased.

3.3. Exercises in the week 6-12 of PT

• To the previous exercises were added closed kinetic chain exercises, scapular stabilization techniques.

•Active-assisted abduction with the help of a stick, with the progressive distance of the left arm from the body, with the shoulders at the same level, as much as was comfortable continued with active abduction.

•Active assisted external rotation with the elbow at 90° next to the body holding a stick in both hands, with the right arm push to the left, slightly moving the left hand for 5 seconds to the side of the body.

4. Results and Discussion

Several evaluations were carried out: 2 weeks after the trauma when the therapy started (T1), after 1 month of PT (T2), after 2 months of PT (T3) and three months follow-up (T4).

Assessment of active range of motion of the glenohumeral joint (GHJ) was measured with a standard goniometer (Table 1). Movements were significantly limited in all planes at the beginning of therapy, later they approached the normal values, which was also demonstrated by the increase in functional scale scores (Table 2). In Figures 2, 3 and 4, the patient's active movements can be seen at T2 and T3.

Table 1

Active range of motion measures for glenohumeral joint

Degrees of mobility GHJ	T1	T2	T3	Q4
Flexion	0	25	90	130
Internal rotation	0	35	Normal	Normal
External rotation	-	0	25	70
Abduction	-	22	90	130

In PT evaluation of arm functional movements (like hand on the head, hand on the opposite shoulder, hand on the lombar spine) can be noted with can and cannot. But a functional procentual score is more accurate and can be implementing. The subject was assessed with the VAS Scale to assessment left shoulder pain and the Quick DASH (Disability of Arm, Shoulder and Hand) score and we use an online free calculator (OrthoToolKit) to obtain the disability score.

For our subject, the functional evaluations at the selected moments demonstrate the therapeutic evolution and are summarized in Table 2. To our knowledge there is no scale that assesses the functionality of the shoulder with SBF.

Table 2

Functional outcome measures

Measures		T1	T2	T3	T4
VAS	rest	5	3-4	2	0
	activity	10	8	4	2
Quick DASH		88.6/100= 88.6%	77.3/100=77.3 %	43.2/100=43.2%	0.0/100=0.0%

Despite the functional deficit from the beginning of the rehabilitation program left arm normal function was restored after 3 months of individualized physical therapy, 14 weeks after the traumatic incident suffered by the subject.

Risk of death occurs when SF is associated with associated ipsilateral lung injury [13] when significantly associated rib fractures [14].

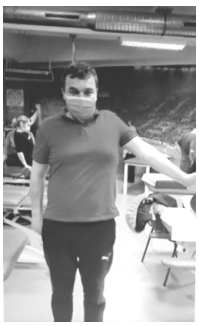

Fig. 2. *Active mobility T2*

Fig.3 and 4 *Active mobility T3*

Satisfactory outcomes are reported with nonoperative treatment of displaced scapular body fractures [3]. or suprascapular neuropathy [17].

Our case even if does not present the mentioned complication could not achieve good results if the program if the therapeutic program was not based on two important pillars: subject motivation and implication and therapist knowledge. He had the support of the family with self-care and the home exercises also an important positive factor for motivational level. The subject reported that his goals were met for pain control

and mobility of his arm (demonstrated by VAS value in T3 and T4 compared with T1).

In principle, scapular fractures should heal without being followed by a significant disability [7], but these positive results can be reached if the patient is fully implicated and cooperative during all the physical therapy session.

5. Conclusions

Rehabilitation in the case of scapular fractures requires specific and effective approaches, and is based on a good knowledge of the physiology and pathology of this joint in order to achieve the regression or disappearance of symptoms that limit functionality.

This type of fracture is rare, and physical therapy management can pose difficulties especially in terms of pain management during exercise and clinical symptoms due to immobilization and muscle atrophy or stiffness. Although only the shoulder body blade is affected, the arm functionality decreases.

The stages of the therapeutic program must be strictly followed. It is possible that our subject maintained a good motivational level and a very good adherence to the indicated therapy because he was a young man, without other health problems; previously he was active, practicing various recreational sports activities.

It takes a strong motivation, a conscious and active participation for the subject to follow a program that lasts a long time and is associated with a functional self-rehabilitation program taking place when the subject still presents symptoms such as pain.

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References

1. Baldwin, K.D., Ohman-Strickland, P., Mehta, S., Hume, E.: *Scapula fractures: a marker for concomitant injury? A retrospective review of data in the National Trauma Database*. In: The Journal of trauma, vol. 65, (2) 2008, p. 430-435. https:// doi: 10.1097/TA. 0b013e31817fd928
2. Dienstknecht, T., Horst, K., Pishnamaz, M., et al.: *A meta-analysis of operative versus nonoperative treatment in 463 scapular neck fractures*. In: Scandinavian journal of surgery: SJS: official organ for the Finnish Surgical Society and the Scandinavian Surgical Society, vol. 102,2, 2013, p. 69-76. https://doi.org/10.1177/1457496913482251
3. Dimitroulias, A., Molinero, K.G., Krenk, D.E., et al.: *Outcomes of nonoperatively treated displaced scapular body fractures*. In: Clinical orthopaedics and related research, vol. 469, no. 5, 2011, p. 1459-1465. https://doi.org/10.1007/s11999-010-1670-4
4. Friederichs, J., Morgenstern, M., Bühren, V.: *Scapula fractures in complex shoulder injuries and floating shoulders: a classification based on*

displacement and instability. In: J Trauma Manag Outcomes, 2014, p. 8-16. https://doi.org/10.1186/1752-2897-8-16

5. Goss, T.P.: *The scapula: coracoid, acromial, and avulsion fractures*. In: American journal of orthopedics (Belle Mead, N.J.), vol. 25*,* no.2, 1996, p. 106–115.
6. Kannan, S., Singh, H. P., Pandey, R.: *A systematic review of management of scapular fractures.* In: Acta orthopaedica Belgica, vol. 84(4), 2018, p. 497–508.
7. Limb D.: Scapula fractures: a review. *EFORT open reviews*, vol. 6, no. 6, p. 518–525. https://doi.org/ 10.1302/ 2058-5241.6.210010
8. McAtee, S.J.: *Low-energy scapular body fracture: a case report*. In: American journal of orthopedics (Belle Mead, N.J.), Vol. 28, no. 8, 1999, p. 468–472.
9. McGahan, J. P., Rab, G. T., Dublin, A.: *Fractures of the scapula*. In: Journal of Trauma and Acute Care Surgery, Vol. 20, no.10, 1980880-883.
10. Meinberg, E., Agel, J., Roberts, C., et al. : *Fracture and Dislocation Classification Compendium–2018*. In: J Orthop Trauma., 2018, vol. 32, no.1, p. 101–104. https://doi.org/ 10.1097/BOT.0000000000001063.
11. Roberts, D. C., Power, D. M., and Stapley, S. A.: *A review of 10 years of scapula injuries sustained by UK military personnel on operations*. In: BMJ Military Health, Vol*.* 164 no. 1, 2018, p. 30-34. https://doi. org/10.1136/jramc-2017-000773
12. Rollo, G., Huri, G., Meccariello, L., et al.: *Scapular body fractures: Short-term results of surgical management with extended indications*. In: Injury, Vol. *52* no. 3, 2021, p. 481-486. https://doi.org/10.1016/j.injury.2020. 09.006
13. Thompson, D.A., Flynn, T.C., Miller, P.W., Fischer, R.P.: *The significance of scapular fractures.* In: The Journal of trauma, Vol. *25* no. 10, 1985, p. 974–977. https://doi.org/ 10.1097/ 00005373-198510000-00008
14. Veysi, V. T., Mittal, R., Agarwal, S., et al.: *Multiple trauma and scapula fractures: so what*?. In: The Journal of trauma, Vol. *55* no. 6, 2003, p. 1145–1147. https://doi.org/10.1097/ 01.TA.0000044499.76736.9D
15. Villers, J.F., Burch, J., Scheller, M., Huang, H.H.: *Physical therapy prehabilitation on a reverse total shoulder replacement candidate: a case study.* In: Journal of physical therapy science, Vol. 32, no. 2, 2020, p. 197–205. https://doi.org/10.1589/ jpts.32.197
16. Voleti, P. B., Namdari, S., and Mehta, S., et al.: Fractures of the scapula. *Advances in orthopedics*, Vol. *2012*, 2012, ID 903850. https:// doi.org/10.1155/2012/903850
17. Waldhelm, A., St. Charles W.L., Curtis R.J., et al.: *Rehabilitation of a College Football Player Following a Scapular Fracture with Suprascapular Neuropathy*. In: Physiother Rehabil Vol. 4, no 1. 2019, p. 166-168.