

## Case report

## Acute traumatic quadrilateral space syndrome following scapula fracture



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## ABSTRACT

The acute tunnel syndrome of the quadrilateral space of Velpeau is a very rare entity in which the axillary nerve and the posterior humeral circumflex artery experience brutal compression in shoulder injuries. We report the case of a burst fracture of the right scapula with great displacement of the lateral border occasioning a total isolated paralysis of the right axillary nerve by axillary nerve compression. The lateral scapula border fracture was reduced and stabilized with neurolysis of the axillary nerve through a posterior approach. The recovery of the axillary nerve occurred in ten weeks. Our case is original, not only because of the rarity of isolated axillary nerve injury following scapula fractures without shoulder dislocation, but also because the compression of the axillary nerve by bone impingement could be undiagnosed and comprise prognosis.

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## 1. Introduction

The acute tunnel syndrome of the quadrilateral space of Velpeau is a very rare entity in which the axillary nerve and the posterior humeral circumflex artery experience brutal compression in shoulder injuries. It is defined as the clinical translation of a conflict container – content between the axillary neurovascular pedicle during its passage in the lateral axillary space.<sup>1,2</sup> In the chronic form, the ductal syndrome occurs from anatomical, tumoral or degenerative locoregional causes.<sup>1</sup> In traumatic cases, the most common aetiology of acute axillary nerve palsy is anterior glenohumeral dislocations. Very few cases of acute traumatic isolated compression of the axillary nerve in the lateral axillary space by a scapula bone splinter have been reported in the literature.<sup>3</sup>

## 2. Case presentation

We report the case of a 26-year-old right-handed female patient with no medical history, victim of a road accident resulting in chest trauma associated with scapular belt trauma.

Clinical examination revealed poorly systematized pain of the right shoulder and loss of sensitivity of the shoulder stump.



**Fig. 1.** Preoperative standard radiography of the shoulder showing a fracture of the lateral pillar of the Scapula.

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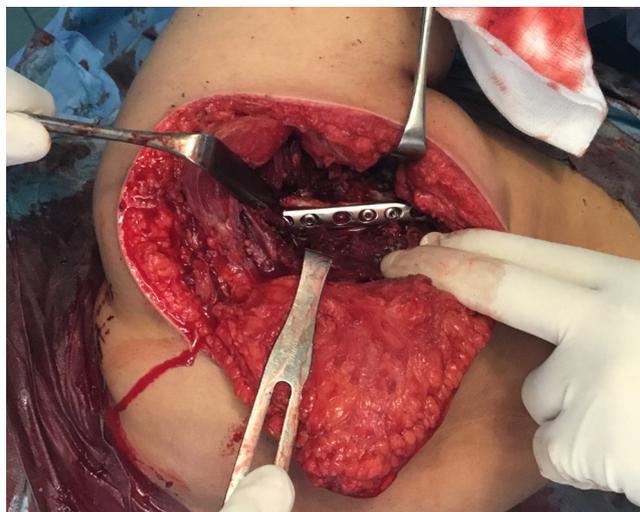
E-mail address: [sabri.mahjoub@rns.tn](mailto:sabri.mahjoub@rns.tn) (S. Mahjoub).



**Fig. 2.** 3D CT reconstruction of scapula: (a) Anterior view of a burst fracture of the Scapula and displacement of the lateral pillar, (b) Posterior view of a burst fracture of the Scapula and displacement of the lateral pillar.



**Fig. 3.** Posterior approach with installation in lateral decubitus with right limb on an armrest.



**Fig. 4.** Peroperative view of the synthesis of the lateral pillar of the scapula and axillary nerve neurolysis.

Deficiency of deltoid muscle function was assessed by a positif deltoid extension lag sign test. The diagnosis of complete paralysis of the axillary nerve was retained.

The initial lesion report found a total and complete right pneumothorax that was drained as well as a complex and complicated lesion of the right scapular girdle. The standard radiological assessment showed a displaced fracture of the lateral pillar of the scapula (Fig. 1). Computed tomography scan objectified a burst fracture of the scapula body with significant displacement of the lateral pillar; tilted laterally and posteriorly behind the humerus surgical neck associated with a fracture of the coracoid process and a fracture of the acromion (Fig. 2a and b).

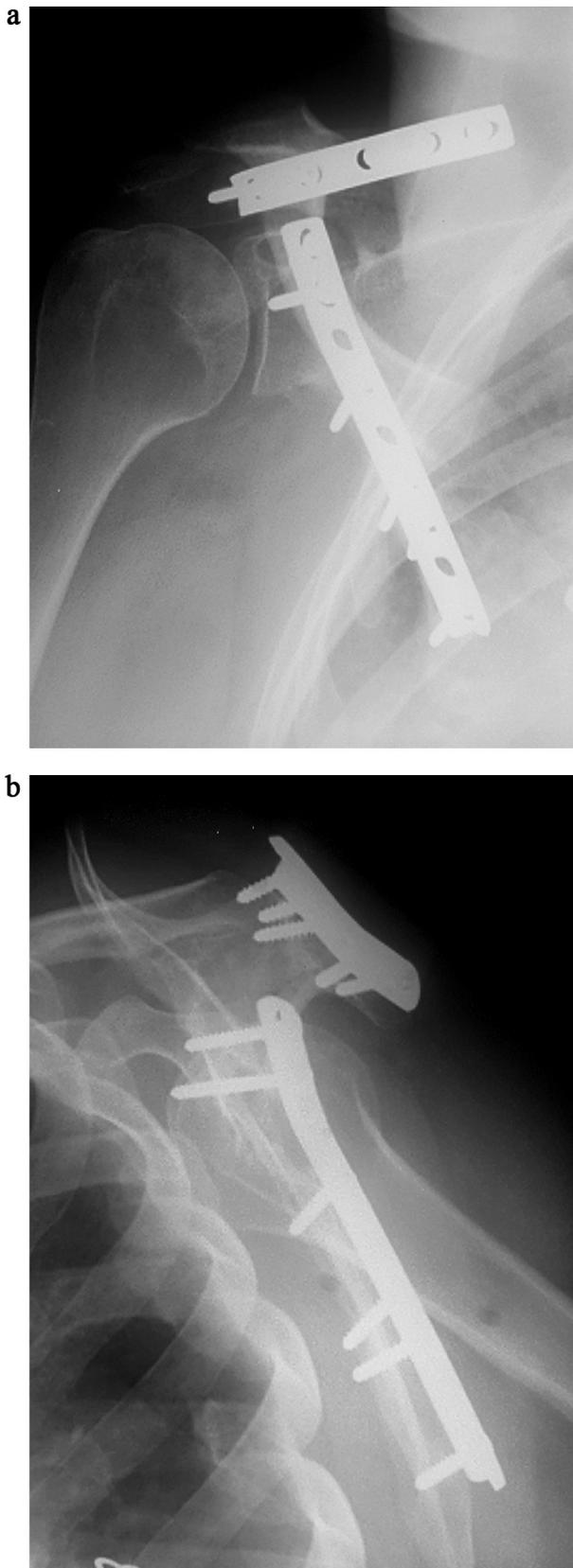
Axillary nerve palsy was confirmed by an electromyogram and the patient was operated on after three weeks of trauma after stabilizing her respiratory status.

The patient was installed in a left lateral decubitus position. The scapula was approached by a combined posterior approach (Fig. 3): a horizontal incision along the spine of the scapula and the posterior border of the acromion to extend beyond the postero-external angle of the acromion, associated with a direct posterior intermuscular approach between the infraspinatus muscle and the teres minor muscle. The deltoid was detached from the posterior edge of the acromion which was reduced and synthesized by a plate. By the posterior intermuscular approach, the surgical exploration revealed an axillary nerve contused and compressed by the lateral pillar of the scapula. Access allowed neurolysis of the axillary nerve; reduction and synthesis by a plate (Fig. 4).

The postoperational follow-up was simple. The shoulder was immobilized in a sling for 4 weeks followed by a progressive rehabilitation. Recovery of sensitivity and active motor skills occurred at 10 weeks postoperatively. Bone healing was achieved after 6 weeks. (Fig. 5a and b). The Quick Dash score and the Constant shoulder score<sup>4</sup> at the 4th month were respectively 9.1 / 100 and 92/100.

### 3. Discussion

Described by Cahill and Palmer for the first time in 1983, the ductal syndrome of Velpeau's quadrilateral space mainly affects the axillary nerve.<sup>1</sup> This space is limited by the teres minor above, the teres major below, the long portion of the triceps inside and the surgical collar of the humerus outside.<sup>2</sup>



**Fig. 5.** (a) postoperative anteroposterior radiographic assessment of the synthesis of the acromion and the lateral pillar of the scapula (b) postoperative lateral radiographic assessment of the synthesis of the acromion and the lateral pillar of the scapula.

Isolated acute involvement of the axillary nerve is uncommon in shoulder trauma. It is reported to be less than 6% of all plexus injuries.<sup>5</sup> Most often, axillary nerve injury is combined with that of the suprascapular nerve, radial nerve and / or musculocutaneous nerve.<sup>6</sup>

Anterior glenohumeral dislocations, by a mechanism of elongation, constitute the predominant aetiology. It is estimated to occur between 19% and 55% in the different cases followed by the fractures of the neck of the humerus and most rarely fractures of the scapula, in which the main mechanism is compression or less often section.<sup>5</sup>

The physical examination is usually reliable for diagnosing the nerve palsy. Paresthesia or anesthesia over the lateral aspect of the shoulder and paralysis of the deltoid muscle is frequently found. Deltoid muscle atrophy will only be found in chronic ductal compressions with axillary neuropathy.

Conventional 2D and 3D CT examinations are commonly performed in the setting of acute trauma. CT allows detailed characterization of bone, joint, muscle, or ligament injury at the shoulder girdle and is particularly helpful with identification of radiographically occult injuries. Thus, CT is more reliable and accurate for the detection and staging of scapular injuries than standard radiographs are; especially in case of coracoid process, glenoid, and scapular neck fractures.

The electrical exploration of the axillary nerve is optional. It is operator-dependent and should in no way delay the surgical treatment.

Management of nerve lesions depends on the lesional balance and the initial trauma mechanism. In case of nerve elongation, spontaneous recovery can occur and treatment is mainly orthopedic with a fairly complete recovery rate. In contrast to nerve palsy by an elongation mechanism, the axillary nerve root canal syndrome by an acute traumatic compression mechanism must be surgically treated in order to increase the possibilities of deficit recovery.<sup>7–9</sup> The treatment in this case must obey both objectives: fracture reduction and osteosynthesis as well as nerve neurolysis. The posterior approach of the scapular girdle allows a good exposure of the lateral pillar of the scapula and the quadrilateral space of Velpeau and thus allows bone synthesis and nerve decompression.<sup>7</sup>

Thus, in case of acute traumatic nerve compression, nerve conduction recovery after surgical decompression is almost always obtained. Delay of recovery depends on the delay of neurolysis. It was of 10 weeks with our patient. However, in case of chronic compressions and nerve sections, recovery is random and incomplete, leading to persistent axillary neuropathy.<sup>6</sup>

Surgical management should specify the mechanism of injury through exploration, proceed to fracture osteosynthesis, and perform neurolysis in case of compression. In case of nerve section surgical options include nerve suture or grafting.

#### 4. Conclusion

Acute traumatic quadrilateral space syndrome following scapula fracture is a rare entity.<sup>3</sup> The clinical diagnosis is easy but may go unnoticed during complex trauma of the scapular belt and especially in the context of polytrauma. The associated lesions of the brachial plexus should not be overlooked, especially vascular lesions, which can be life-threatening. The treatment is always surgical involving osteosynthesis associated with exploration, neurolysis and possibly repairs of nerve damage. The functional and clinical outcome depends on the mechanism of injury, speed and quality of care.

## References

1. Cahill BR, Palmer RE. Quadrilateral space syndrome. *J Hand Surg.* 1983;8(January (1)):65–69.
2. McClelland D, Paxinos A. The anatomy of the quadrilateral space with reference to quadrilateral space syndrome. *J Shoulder Elbow Surg.* 2008;17(January-February (1)):162–164.
3. Chamata E, Mahabir R, Jupiter D, Weber RA. Prevalence of brachial plexus injuries in patients with scapular fractures: a national trauma data Bank review. *Plast Surg (Winter).* 2014;22(4):246–248.
4. Fialka C, Oberleitner G, Stampfl P, Brannath W, Hexel M, Vecsei V. Modification of the constant-murley shoulder score-introduction of the individual relative constant score individual shoulder assessment. *Injury.* 2005;36(October (10)):1159–1165.
5. Safran MR. Nerve injury about the shoulder in athletes, part 1: suprascapular nerve and axillary nerve. *Am J Sports Med.* 2004;32(April-May (3)):803–819.
6. de Laat EA, Visser CP, Coene LN, Pahlplatz PV, Tavy DL. Nerve lesions in primary shoulder dislocations and humeral neck fractures. A prospective clinical and EMG study. *J Bone Jt Surg Br.* 1994;76(May(3)):381–383.
7. Hardegger FH, Simpson LA, Weber BG. The operative treatment of scapular fractures. *J Bone Jt Surg Br.* 1984;66(Nov (5)):725–731.
8. Neuhaus V, Bot AG, Guitton TG, et al. Scapula fractures: interobserver reliability of classification and treatment. *J Orthop Trauma.* 2014;28(March (3)):124–129.
9. Zlowodzki M, Bhandari M, Zelle BA, Kregor PJ, Cole PA. Treatment of scapula fractures: systematic review of 520 fractures in 22 case series. *J Orthop Trauma.* 2006;20(March (3)):230–233.