

# Scapulothoracic dissociation: a devastating “floating shoulder” injury

Luigi Branca Vergano, Mauro Monesi

U.O. Ortopedia e Traumatologia, Ospedale M. Bufalini, Cesena (FC)

**Summary.** *Background and aim of the work:* The term “floating shoulder” was used in a previous paper to describe lesions of at least two components of the SSSC (superior shoulder suspensory complex), a bony-ligamentous structure of the shoulder girdle. Following this article other types of floating shoulder were described, including scapulothoracic dissociation (STD), a rare lesion with potentially devastating consequences, with detachment of the scapular body from the thoracic wall, with following lateralization of the scapula, fracture of the clavicle or injury of the adjacent sterno-clavicular or acromion-clavicular joints. Prognosis and outcome are also negatively influenced by secondary vascular and neurologic injuries. *Methods:* We review the literature on this lesion and we describe two patients with STD, their treatment and outcome. *Results:* Reviewing the literature and analysing our cases, we point out that the STD is often associated with serious general lesions and is indicative of an high-energy trauma. The consequences can be disabling for the upper limb (20% amputation, 50% flail limb) or for the general status of the patient (10% mortality). *Conclusions:* STD must be timely recognized and subsequently properly treated, to avoid the associated general and local injuries (vascular) and subsequently the musculoskeletal lesions. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** scapulothoracic dissociation, high-energy trauma

## Background and aim of the work

The ‘floating shoulder’ is a lesion consisting of ipsilateral fractures of the clavicle and glenoid neck. It was first described by Ganz and Noesberger in 1975 (1). Subsequently, Goss expanded their definition by describing it as a ‘double disruption’ of the superior shoulder suspensory complex (SSSC) (2).

Oreck et al. in 1984 describe scapulothoracic dissociation (STD) as a rare variant of the floating shoulder, with potentially debilitating consequences. STD consists in a complete disruption of the scapulothoracic articulation with lateral scapular displacement (3-5). Patients usually come to observation with massive soft-tissue swelling of the shoulder due to haematoma and edema, and gross instability of the joint, together with anterior bony or ligamentous lesions such as acromioclavicular separation, displaced clavicular fracture

and sternoclavicular disruption (6). Muscular tears (deltoid, pectoralis minor, rhomboid, elevator scapula, latissimus dorsi and trapezius) may also occur (3).

STD always follows an high-energy trauma, more often a motor vehicle accident, and the mechanism of injury is probably the traction caused by a blunt force to the shoulder girdle. It is associated with other body lesions, thoracic trauma in primis, and in 80-90% of the cases with local neurovascular injuries such as plexus or cervical roots avulsion and rupture of subclavian or axillary vessels (3, 4). No open skin wounds are usually found, although open STD has been described (7).

Patients with STD often have a poor functional outcome: 10% die from concomitant traumatic injuries (8). Survivors in 50% of cases have a flail extremity and in 20% of cases require amputation of the upper limb (9).

## Methods

We analyse two cases of STD.

### Case 1

G.G., male, 50 years old

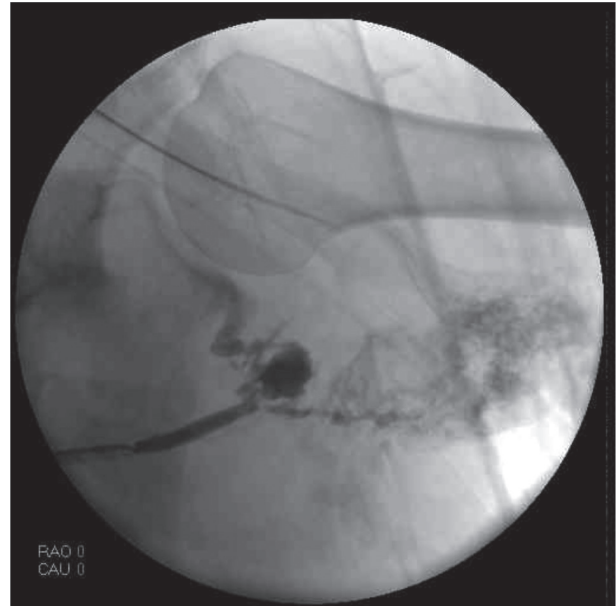
The patient was referred to our hospital after colliding with a car while riding his motorcycle. He was haemodynamically unstable. After initial x-ray and resuscitative manoeuvres (fluid and blood infusion, intubation, left chest tube), the total body CT scan revealed a subdural haematoma, fractures of C7, T3, T4, T11, T12, left lung contusion, left apical pneumothorax, bilateral fracture of XII rib, left sternoclavicular separation, and scapulothoracic dissociation (Fig. 1) with complete interruption of axillary artery. The left upper limb was cold and pulseless.

The patient was immediately treated for the vascular injury. Angiography (Fig. 2) with endovascular recanalization was tried, unsuccessfully; therefore an axillo-brachial by-pass with autologous saphenous vein graft was done. The brachial plexus was completely disrupted and a large haematoma was evacuated from the axilla. He was then taken to ICU for observation and continued resuscitation.

On 1<sup>st</sup> post-op day, as a compartment syndrome after revascularization was present, volar and dorsal fasciotomies of the left upper limb were done. Following an infection of the fasciotomy wounds, an above-the-elbow amputation was redeemed necessary because of wet gangrene.



**Figure 1.** CT 3d reconstruction: left scapulothoracic dislocation



**Figure 2.** Angiography showing bleeding from complete lesion of the axillary artery

The neurosurgeons performed cervical and dorsal decompression and fixation (incomplete tetraplegia). The patient was also treated surgically for a right wrist fracture and conservatively for a right undisplaced tibial plateau fracture.

The patient underwent an i.v. antibiotic treatment for sepsis while in hospital.

The patient was discharged 50 days after admission and transferred to a neurologic rehabilitative hospital.

### Case 2

M.X., female, 23 years old

The patient was victim of a high speed car accident, ejected from the car. Because of intense dyspnea she was intubated on the scene and bilateral hemithorax decompression was performed.

On arrival at our hospital she was haemodynamically stable: X-Ray (ATLS protocol) and total body CT scan detected bilateral lung contusion with bilateral pneumothorax, D8-D9 disc lesion, grade I spleen contusion, left forearm fracture, subluxation of the left knee, left clavicle fracture (middle third), scapulothoracic dissociation (Fig. 3) and a mandibular fracture. The clinical evaluation of the left upper limb revealed

a normal radial and ulnar artery pulse; no neurological impairment was noted after the extubation in ICU.

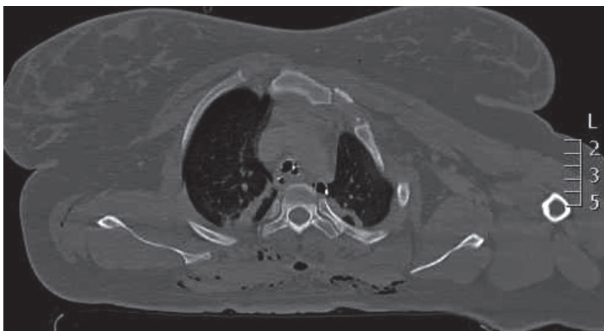
In the course of the following days the patient underwent surgery to fix the dorsal spine, the mandibular fracture, the left forearm fracture and the knee subluxation. We also provided the open reduction and internal fixation of the left clavicle fracture with a 3.5 plate (Fig. 4).

On the 5<sup>th</sup> day the patient was transferred to the ICU of her local hospital.

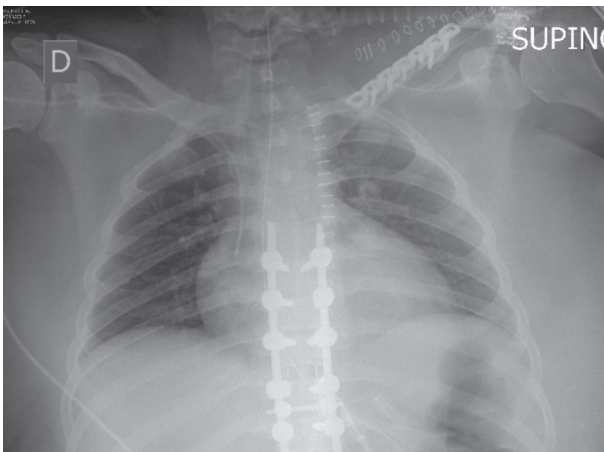
The patient was contacted by telephone 18 months after the hospital admittance. She was asked to answer the DASH score questions and she scored 14.2, revealing a satisfying shoulder functionality, with only mild limitation in some overhead activities.

## Results

Reviewing the literature and our cases, we find overlapping data.



**Figure 3.** CT axial cut: left scapulothoracic dislocation



**Figure 4.** x-ray of post-operative plating of the left clavicle

First of all, STD is always caused by high-energy trauma and patients always need an emergency cardiopulmonary resuscitation in accordance with the ATLS protocol. Given the high probability of associated life-threatening injuries with STD, these injuries must be the first evaluated and treated.

Once the STD is recognized it is necessary to rule out any lesion of the subclavian or axillary vessels and of the brachial plexus. The latter is very difficult to evaluate because these patients are often sedated or intubated, but an accurate and prompt diagnosis is essential both for the prognosis and for a surgical decision in case of complication (amputation versus salvage of the limb).

In some cases Magnetic Resonance Imaging (MRI) may be used to reveal lesions of the cervical roots or of the brachial plexus, or their consequences such as pseudomeningocele. Upper extremity electromyography (EMG), even with some limitations, can be helpful in detecting the involved nerve roots; this study should be done at least three weeks after injury (3, 11). The repair of a plexus rupture in STD is seldom described in the literature(6).

In line with what appears in literature, our cases have different outcomes: one patient was amputated above the elbow, the second reached complete healing with good functionality of the upper limb. Regarding the functional outcome, the worst prognostic factor is an arterial rupture, followed by the complete avulsion of the brachial plexus (3, 9). A venous lesion may be treated by ligation without any consistent consequences (12).

After salvage of the limb, orthopaedic surgery would be the next step. The musculoskeletal injuries described about the shoulder girdle involve a clavicle fracture in 55%, acromion-clavicular joint separation in 25%, and sterno-clavicular joint separation in 20% (10). In case of clavicle fracture open reduction and internal fixation with a plate is the gold standard. In case of acromioclavicular or sterno-clavicular separation a strong construct is needed, different from standard fixation of a dislocation (10). The stabilization of the shoulder is also needed after a vascular repair procedure to protect the vessel.

An early above-the-elbow amputation can sometimes modify the clinical trend and the prognosis of the patient. In case of patients' refusal, a delayed am-

putation has to be considered, especially in absence of any clinical and EMG recovery, to avoid further delay in the rehabilitation program. This operation can decrease the causalgia, especially if the symptoms last for less than one year (12).

## Conclusions

STD is a devastating and potentially debilitating injury, with different musculoskeletal and neurovascular injuries. Zelle (9) classified STD in 4 types; type 1 with musculoskeletal lesion alone while the others classified according to increasing neuro-vascular lesions.

On initial x-rays a scapula that does not overlap the thoracic wall (usually ribs 2-7) is highly suspicious of a STD: this image means a lateralization of the scapular body (11). An attempt to measure the distance between the medial border of the scapula and the midline of the spine proved to be difficult and not precise. The axial view of the CT scan proves to be paradigmatic, revealing a separation of scapular body from the thoracic wall, with lateralization compared to the contralateral (Fig. 3).

STD might be overlooked, because of the often severe associated injuries, or underdiagnosed and treated as a "common" clavicular fracture. In fact, initial chest radiographs are often not properly aligned in a true anteroposterior position, and sometimes it is difficult to identify the lateral deviation of the scapula, pathognomonic sign of this condition. The result of a "missed diagnosis" of STD is lack of treatment of potentially life-threatening vascular lesions or a non correct treatment of the damaged shoulder girdle.

After adequate resuscitation, the initial treatment of STD should be the repair of eventual vascular lesions, that can lead to the haemodynamic instability of the patient and must therefore be urgently addressed.

We strongly recommend the fixation of the clavicle fracture or of the adjacent joint separation in case of STD; there is always a gap between the medial and the lateral stump of the fracture due to the lateralization of the whole upper limb. This gap could easily lead to a non-union if not surgically treated. Open reduction and internal fixation with a compression plate should be preferred to an intramedullary device, the latter giving less stability and no compression to the fracture.

An upper limb amputation always leads to an extremely low quality of life, and every attempt to salvage should be done. On the other hand the general status, the vascular and neurologic problems, and the bacterial colonization may strongly recommend a radical treatment; in this case the amputation should be promptly done, avoiding further complication of the general status. Furthermore early amputation can be associated with quicker back to work and better pain relief (3).

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Correspondence:

Luigi Branca Vergano,

Via De Gasperi 61, 47521 Cesena (FC)

E-mail: luigibrancavergano@hotmail.com