Bilateral scapular fractures in adults

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Abstract

Purpose Bilateral scapular fracture is a very rare injury. Most of these fractures result from electrical shock or epileptic seizure. We treated six patients with such injuries, all of them caused by direct violence. The aim of this study was to report on the patients and to present an overview of the cases published so far.

Methods Between January 2011 and August 2012, we treated six patients with bilateral scapular fractures (four men and two women, age range 20–78 years). Another 11 cases were found in the literature. All cases were analysed in terms of injury mechanism, fracture pattern and the manner of diagnosis.

Results Our six patients increased the total number of recorded cases to 17 and the number of patients with traumatic bilateral scapular fractures from four to ten. In five of our cases, the injuries were classified as being the result of high-energy trauma. Computed tomography (CT) examination of the affected scapulae was performed in all six cases, in five in combination with 3D CT reconstruction; in one polytraumatised female patient, only axial CT scans were obtained. In all five high-energy trauma cases, bilateral fracture of the scapular body was recorded, of which one was classified as open. Four of the 11 cases found in the literature were caused by direct violence:

in six patients, the fractures resulted from muscle spasms associated with epileptiform seizure or electrical shock, and one patient suffered a pathological fracture associated with amyloidosis. The most frequently recorded fracture in all 17 patients (34 fractures) was of the scapular body, i.e. 24 fractures, followed by 12 fractures of the glenoid fossa.

Conclusion According to data in the literature, bilateral scapular fracture is a rare injury. One reason may be that the potential incidence is often neglected. With the increasing number of patients with polytrauma, the potential for scapular fracture should always be taken into account, together with the fact that this injury may be bilateral. Of vital importance in diagnosing these injuries is CT scanning, including 3D CT reconstructions.

Introduction

Bilateral scapular fracture is a very rare injury that was first described in 1946 [1]. Since then, we have found 11 single case reports in the literature discussing this problem [1–11]. Most fractures resulted from electrical shock or epileptic seizure [2, 4, 5, 7, 8, 10]. We treated six patients with such injuries, all caused by direct violence. The aim of this study was to report on our patients and present an overview of the cases published so far.

Materials and methods

Between January 2011 and August 2012, we treated six patients (age range 20–78 years) with bilateral scapular fractures (four men and two women). We analysed fracture type, associated injuries, injury mechanism and treatment methods, although treatment results were not the subject of this study.

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Table 1 Case summary of our six patients

	Authors' case 1	Authors' case 2	Authors' case 3	Authors' case 4	Authors' case 5	Authors' case 6
Age (years)	27	20	78	47	31	31
Gender	M	M	F	F	M	M
Fx mechanism	Car accident	Fall from height	Fall during walk; anterior GH dislocation	Car accident	Fall from height during paragliding	Motorcycle accident
Radiodiagnostics	Plain radiograph 3D CT	Plain radiograph 3D CT	Plain radiograph 3D CT	Plain radiograph CT axial scans	Plain radiograph 3D CT	Plain radiograph 3D CT
Type of scapular fx right side	Open fx of body + inferior glenoid fossa	Body fx	Anterior glenoid rim fx	Body fx	Body fx	Inferior glenoid fossa + body fx
Type of scapular fx left side	Coracoid + supraspinous fossa fxs	Body fx	Anterior glenoid rim fx	Body fx	Body fx	Inferior glenoid fossa + body fx
Associated injuries	Multiple rib fxs, pneumothorax, avulsion of the apex of the C2 dens and fx of the adjacent occipital condyle, fx of 4th and 5th thoracic vertebrae, fissure of the skull base, brain contusion	Fxs of 8th to 10th ribs, tension pneumothorax, liver contusion, fx of 5th and 7th cervical vertebrae, fx of transverse processes of 10th and 11th thoracic and 1st lumbar vertebrae, stable fx of the pelvis	0	Fx of the left clavicle, multiple rib fx, lung contusion, subdural haematoma, fx of 5th and 6th thoracic vertebrae with paraplegia	Fx ribs, lung contusion	Open complex fx of the left foot and ankle, perilunar dislocation of the left wrist
Treatment	Conservative	Conservative	Operative right; conservative left	Conservative	Conservative	Conservative
Radiological result of scapular fx	Healed	Healed	Healed	Healed	Healed	Not known yet
F-U (months)	12	6	8	4	6	1 month

M male, *F* female, *F-U* follow-up, *fx* fracture, *GH* glenohumeral

Results

All followed up characteristics are summarized in Table 1. Types of fractures are documented by Figs. 1, 2, 3, 4, 5 and 6.

In five of six cases, the injuries were regarded as being the result of high-energy trauma (cases 1, 2, 4, 5 and 6), with four of them being polytrauma (cases 1, 2, 4 and 5) and one low-energy trauma (case 3).

CT examination of scapulae was performed in all six cases, with five in combination with 3D CT reconstruction; in one polytraumatised female patient (case 4), only transverse (axial) CT scans were obtained. In all five high-energy trauma cases, scapular fractures were diagnosed after initial full-body CT scanning. In patient 3 with low-energy trauma, a radiograph of the shoulders was first taken, which showed bilateral fractures of the anterior glenoid rim; therefore, additional CT examination, including 3D CT reconstruction, was indicated.

In three high-energy trauma cases, we recorded symmetrical fractures of scapular bodies, and in one high-energy trauma (case 6), symmetrical fractures of both glenoid fossae and scapular bodies. In one high-energy trauma (case 1), we recorded a partially asymmetrical injury complex, i.e. fracture of the scapular body combined with a fracture of the inferior glenoid fossa on the right side and of the supraspinous part of the scapular body, and extra-articular fracture of the coracoid base on the left side. In all five high-energy trauma patients, the injury involved scapular bodies. All four polytraumatised patients sustained rib fractures, which were associated with lung injury in three.

All scapular fractures but one were treated nonoperatively. In patient 3 with persistent anterior subluxation of the humeral head, osteosynthesis of the right glenoid fossa was performed eight days after the injury via a deltoid–pectoral approach, including open reduction and fixation with screws and a small plate.

Discussion and literature overview

Bilateral scapular fractures are relatively rare [12–17]. In addition to 11 previously published cases in adults (Table 2), we found another three cases reported in small children [18–20] and five cases found during archaeological excavations [21]. Some studies dealing with injuries of the scapula mention bilateral fractures, but give no detailed description [12, 13, 17, 21, 22].

The first to describe bilateral scapular fractures was Heatly et al. [1] in 1946. His was a case of a 30-year-old truck driver who was involved in a motor vehicle accident. Radiography after the injury showed bilateral fractures, combined on the right side with a fracture of the scapular neck. After more than 30 years, in 1979, Tarquinio et al. [8] described another case of a 41-year-old man who sustained nontraumatic bilateral scapular fractures involving the body and base of the glenoid as a result of electrical shock injury. Subsequently, another nine cases of bilateral scapular fractures were reported from 1988 to 2011 (Table 1). Four of 11 cases were caused by direct violence [1, 3, 6, 11]; in six patients, the fractures resulted from muscle spasms associated with epileptiform seizure or from electrical shock injury [2, 4, 5, 7, 8, 10]; one patient suffered a pathological fracture associated with amyloidosis [9]. The causes of fractures in four trauma patients resulting from direct violence were different: Heatly et al. [1] and Williamson [11] described fractures sustained in motor vehicle accidents. Hegglang [6] recorded bilateral fractures of the anterior rim of the glenoid fossa with anterior subluxation of both humeral heads in a 42-year-old weightlifter. Christofi et al. [3] described bilateral fractures of the scapular bodies in a 73-year-old patient, combined on the left side with a fracture of the scapular neck, after a fall when walking. None of these four cases was a polytrauma patient, and

Fig. 1 Patient 1, 3D computed tomography (CT) reconstructions; anterior views show combined fracture of inferior glenoid fossa and right scapular body and fracture of coracoid process and supraspinous part of the left scapular body. **a** Right scapula, **b** left scapula

Fig. 2 Patient 2, 3D computed tomography (CT) reconstruction; posterior view shows bilateral fracture of scapular body

Fig. 4 Patient 4, computed tomography (CT) axial scans show bilateral fracture of scapular body, fractured ribs, thoracic spine fracture and lung contusion

only two were high-energy trauma patients. In the six nontrauma patients with bilateral scapular fractures resulting from muscle spasms, four were caused by electrical shock injury, one by metabolic imbalance associated with end-stage renal disease and hyperparathyroidism [10] and one by hypoglycaemia [4]. In one case, a 68-year-old patient on long-term renal dialysis sustained bilateral fractures of the acromion due to amyloid infiltration [9].

In all the 11 adult cases previously published, diagnosis of injuries was based on radiographic examination that was, in five cases, combined with axial CT scans [3–7] but without 3D CT reconstructions. In one case [9], soft periarticular tissue was examined by magnetic resonance imaging (MRI). Symmetrical fractures of the scapula were sustained by all seven patients with indirect mechanisms of injury and by two patients with fractures caused by direct violence. The most frequent injury pattern affected the scapular body, in a total of 14 cases, of which six were simple fractures, five were in combination with a fracture of the glenoid and three were in combination with a fracture of the scapular

neck. An isolated fracture of the glenoid, associated with dislocation of the humeral head, was recorded twice (in one patient), two fractures of the superior border of the scapula (supraspinous fossa) were reported and four fractures involved the processes of the scapula (two of them the acromion; two the coracoid).

Of the 22 described fractures, only two were operated upon [1, 6]. Due to a marked displacement of the scapular body and neck, Heatly et al. [1] performed open reduction and fixation with wire. Hegglund [6] described an open reduction and fixation of a glenoid fracture using two screws. The authors reported fracture healing in all 11 patients, with very good functional results. The follow-up period ranged between two months and two years (Table 1).

We are probably the first to have recorded more than one case of bilateral scapular fractures and the first to describe in detail a bilateral fracture of the scapula in polytraumatised patients, including an open scapular fracture. Our six patients increase the total number of recorded cases to 17 and the number of patients with traumatic bilateral scapular fractures to ten. The most frequently recorded fracture in all 17 cases was that of

Fig. 3 Patient 3, 3D computed tomography (CT) reconstruction of scapulae; lateral views show bilateral fracture of anteroinferior rim of glenoid fossa. **a** Right scapula, **b** left scapula

Fig. 5 Patient 5, 3D computed tomography (CT) reconstructions; posterior views show bilateral fracture of scapular body. **a** Left scapula, **b** right scapula

the scapular body, i.e., 24 instances, followed by 12 glenoid fractures. Under normal circumstances, our two patients with combined displaced fractures of the inferior glenoid fossa and scapular body (cases 1 and 6) would have been candidates for operation. However, the operation was contraindicated, once due to an open fracture and once due to lack of patient compliance.

Difficulties in diagnosing scapular fractures in polytraumatised patients were pointed out by Tadros et al. [23]: “Associated injuries overshadowed the scapula on chest trauma radiographs. If CT did not cover the whole scapula, some fractures might not be shown”. However, he did not mention bilateral fractures. Outstanding in this respect is the study by Uzkeser et al. [24]. In a group of 1,039 patients with high-impact blunt trauma, these authors recorded a scapular fracture in 42 cases (4 %), of which 25 % were overlooked on CT scans. In

three cases, the authors found bilateral fractures of the scapula, of which two had been sustained in motor vehicle accidents and one after a fall from a height. All three injuries were missed during primary examination in the emergency department and diagnosed only later. No additional details concerning these three cases were specified by authors.

Experience shows that CT scanning plays an indispensable role in diagnosing scapular fractures in polytraumatised patients. However, the exact type of fracture can be determined only on the basis of 3D CT reconstruction. As these reconstructions are not able to reveal all fracture lines in undisplaced fractures, it is necessary to analyse both axial CT scans and 3D CT reconstructions [13, 25, 26].

The prognostic relevance of scapular fractures in polytraumatised patients is the subject of widespread debate [23, 24, 27]. Some authors state that polytraumatised patients

Fig. 6 Patient 6, 3D computed tomography (CT) reconstructions; posterior views show bilateral combined fractures of inferior glenoid fossa and scapular body. **a** Left scapula, **b** right scapula

Table 2 Literature overview, bilateral scapular fractures

Author and year of publication	Age (years)	Scapular fx type, right side	Scapular fx type, left side	Fx mechanism	Radiodiagnostics	Radiological result	F-U (months)
Heatly et al. 1946 [1]	30	Body + surgical neck fx	Body fx	Car accident	Plain radiograph	NA	3
Tarquino et al. 1979 [8]	41	Body + glenoid fossa fx	Body + glenoid fossa fx	Electric shock	Plain radiograph	Healed	NA
Beswick et al. 1982 [2]	43	Body + glenoid fossa fx	Body + glenoid fossa fx	Electric shock	Plain radiograph	Healed	6
Williamson 1988 [11]	17	Body superior border fx	Body superior border fx	Motorcyclist accident	Plain radiograph	NA	NA
Wertheimer 1990 [10]	21	Body fx	Body fx	Biochemical imbalance-induced convulsion	Plain radiograph	Healed	12
Dumas 1992 [5]	46	Body + neck fx	Body + neck fx	Electric shock	Plain radiograph CT axial scans	Healed	2
Heggland 1997 [6]	42	Glenoid rim fx	Glenoid rim fx	Bench press (anterior GH dislocation)	Plain radiograph CT axial scans	Healed	12
Cottias et al. 2000 [4]	33	Coracoid fx (+ proximal humerus)	Coracoid fx (+ proximal humerus)	Hypoglycemia-induced convulsion (GH luxation)	Plain radiograph CT axial scans	Healed	24
Kotak et al. 2000 [7]	51	Body fx	Body fx	Electric shock	Plain radiograph CT axial scans	NA	3
Yamamoto et al. 2001 [9]	68	Acromion fx	Acromion fx	Spontaneously (amyloid arthropathy)	Plain radiograph MR	NA	NA
Christofi et al. 2008 [3]	73	Body fx	Body + glenoid fossa fx	Low-energy mechanical fall	Plain radiograph CT axial scans	NA	4

fx fracture, GH glenohumeral, F-U follow-up, CT computed tomography, MR magnetic resonance, NA not available in text

with a scapular fracture have more severe injuries and higher mortality rates, whereas other authors claim that such patients have more severe injuries to the chest but a lower mortality rate.

Conclusion

According to data in the literature, bilateral scapular fracture is a rare injury complex. One of the reasons may be that their potential incidence is often neglected. With the increasing number of patients with polytrauma, the potential for scapular fracture should always be taken into account, together with the fact that this injury may be bilateral. Of vital importance in diagnosing these injuries is CT scanning, including 3D CT reconstructions.

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