CASE REPORT – OPEN ACCESS

International Journal of Surgery Case Reports 13 (2015) 106–111

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Combined displaced fracture of the lesser humeral tuberosity and the scapular spine: A case report

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ARTICLE INFO

Article history:
Received 28 March 2015
Received in revised form 16 June 2015
Accepted 27 June 2015
Available online 9 July 2015

Keywords:
Lesser humeral tuberosity fracture
Scapular spine fracture
Open reduction
Internal fixation
Deltopectoral approach
Constant score

ABSTRACT

Introduction Combined displaced fractures of the lesser humeral tuberosity and the scapular spine are highly uncommon and have not been previously reported in literature.
CASE PRESENTATION: The authors report a novel case of a 24 year-old male who sustained displaced fractures of the lesser humeral tuberosity and the scapular spine. Open reduction and internal fixation (ORIF) was performed with a LCP T-plate for the lesser tuberosity and with a LCP Distal Humerus Plate for the scapular spine. At one year, both fractures healed in anatomical alignment and the patient achieved good range of motion and a Constant score of 94 points.
DISCUSSION: While isolated fractures of the scapular spine and the lesser tuberosity can be treated conservatively, combination fractures as in the present case are highly unstable. While sufficient evidence is lacking to favor surgical treatment over conservative management, ORIF provided sufficient stability for early mobilization and led to good clinical results.
CONCLUSION: Based on the favorable outcome of our case, we provide useful recommendations for surgeons faced with similar injuries.

1. Introduction

Isolated humeral fractures of the lesser tuberosity (LTF) as well as fractures of the scapular spine (SSF) occur rarely and usually result from high-energy trauma [1,2]. SSF are often associated with concomitant neurovascular injuries [3,4], whereas LTF are most commonly accompanied by multi-fragment fractures of the proximal humerus or appear as a result of a posterior dislocation of the glenohumeral joint [5,6].

This report presents a rare case of combined, displaced LTF and SSF. We describe the mechanism of injury, the diagnostic work-up and the surgical treatment for this uncommon fracture type, and provide recommendations for surgeons faced with similar injuries.

2. Case report

A 24-year old male patient fell over the handlebars of his bicycle onto the left side of his body with his left arm extended and elevated. He immediately felt severe pain in his left shoulder. An anteroposterior (AP) radiograph (Fig. 1) and CT scans (Fig. 2) revealed left-sided displaced LTF and SSF, without any signs of posterior dislocation of the glenohumeral joint. The dislocation of the scapular spine was greater than 5 mm. For the lesser tuberosity, the dislocation was over 1.5 cm at the medial border. Additionally, plate osteosynthesis of a fractured left clavicle four years prior to this incident was revealed in the patient's history and on the radiograph.

Prior to presenting at our clinic, the patient was treated at another hospital using a conservative approach with a Gilchrist sling. Three days later, the patient presented to our clinic for a second opinion. As a consequence of our findings, which were based primarily on the position of fragments as clearly shown on the radiograph/CT images as well as the active lifestyle of the patient, we offered surgical treatment to which the patient gave his informed consent. Under general anaesthesia, the patient was placed in a beach chair position. Firstly, the LTF was exposed using a deltopectoral approach and mobilized with the subscapularis tendon being intact; this was possible because the fracture was not comminuted and was similar to a two-part proximal humerus fracture. Intraoperative findings confirmed the involvement of the bicipital groove. Therefore, a biceps tenotomy was performed. Because of sulcus intertubercularis involvement, a biceps tenodesis was also completed. No intra-articular involvement of the fracture was found upon inspection. Stay sutures were used for anatomical reduction of the fragment (Fig. 3a and b). The fragment was temporarily held in position with a 1.6 mm Kirschner wire

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http://dx.doi.org/10.1016/j.ijscr.2015.06.035

Fig. 1. Preoperative anteroposterior radiograph showing fractures of the lesser tuberosity and scapular spine. Plate fixation of a clavicle fracture sustained four years prior to the current trauma was intact.

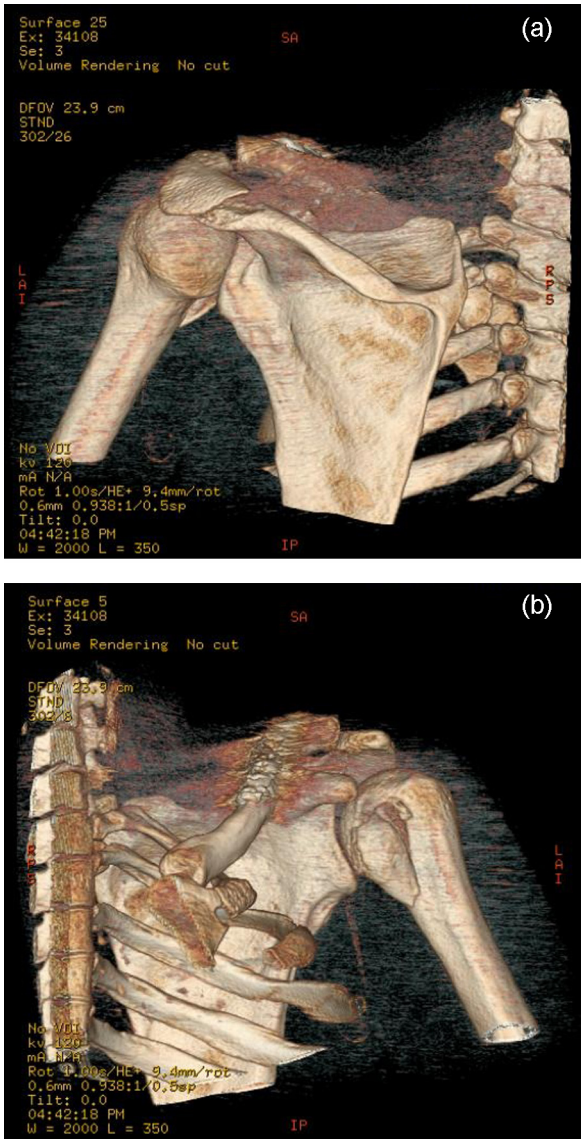

Fig. 2. Three-dimensional computer tomography scans of the (a) scapular spine and (b) lesser tuberosity fractures.

as well as tenaculum forceps. Definitive fixation was performed with a 3.5 mm 5-hole LCP T-plate (Synthes AG, Switzerland), which achieved anatomic reduction and stable fixation (Fig. 3c). After soft tissue tenodesis of the long head of the biceps, the wound was closed over a Redon drain.

For the scapular spine, a transverse incision with subperiostal preparation of the trapezius muscle was made to expose the fracture site. The SSF was reduced in its anatomical position with tenaculum forceps. Internal fixation was then performed with a 3.5 mm 5-hole LCP Distal Humerus Plate dorsolateral right (Synthes AG, Switzerland) (Fig. 3d). A lag screw over the plate was used to gain additional fracture compression. The wound was closed and the patient's arm was placed in a Gilchrist sling. Postoperative radiographs showed anatomically reduced LTF and SSF. Physiotherapy rehabilitation started the day after surgery with pendulum exercises. The patient was released from the hospital three days after surgery. Active assistive mobilization was performed during the first three months. Resistive exercises were then added. Abduction was limited to 90° and external rotation was limited to 25° for six weeks in order to avoid displacement forces on the fracture sites. Three months post-surgery, both fractures healed anatomically with the patient's range of motion already within normal limits, except for restricted internal rotation. The patient successfully returned to sports at that time. The 3-month postoperative Constant score [7] was 65 points out of 100 and improved to 94 points at one year. After one year, abduction strength for the left and right arm was 10 kg and 11.5 kg, respectively. Only internal rotation remained limited at one year (Fig. 4). Both fractures were healed with all implants intact (Fig. 5); the patient did not agree to the proposed implant removal to increase internal rotation as he was satisfied with the result.

3. Discussion

Fractures of the scapula are rare and make up less than 1% of all fractures [1]. Only about one in 20 scapular fractures involves the scapular spine [8], which are usually associated with concomitant injuries [3,4] such as rib or skull fractures, pneumothorax, and injuries to neurovascular structures. Alongside these associated injuries, the diagnosis of SSF can be easily missed and lead to poor results. Ada and Miller, [9] reported that 63% of patients with SSF still had pain and 45% showed decreased range of motion at the 15 months follow-up. Therefore, proper diagnosis and treatment of SSF is crucial. Plain radiographs should include a scapula Y view as well as AP and axillary views [10]. In addition to plain radiographs, CT scans provide detailed information about the fracture type and represent a useful diagnostic asset [11].

While SSF are handled conservatively in most cases, surgical treatment has been recommended for displaced fractures of more than 9–10 mm [1,9]. Jones and Sietsema, [12] reported that surgical treatment should be reserved for displacement of more than 20 mm, however we believe that a lower threshold for internal fixation may be appropriate considering reports of nonunion after

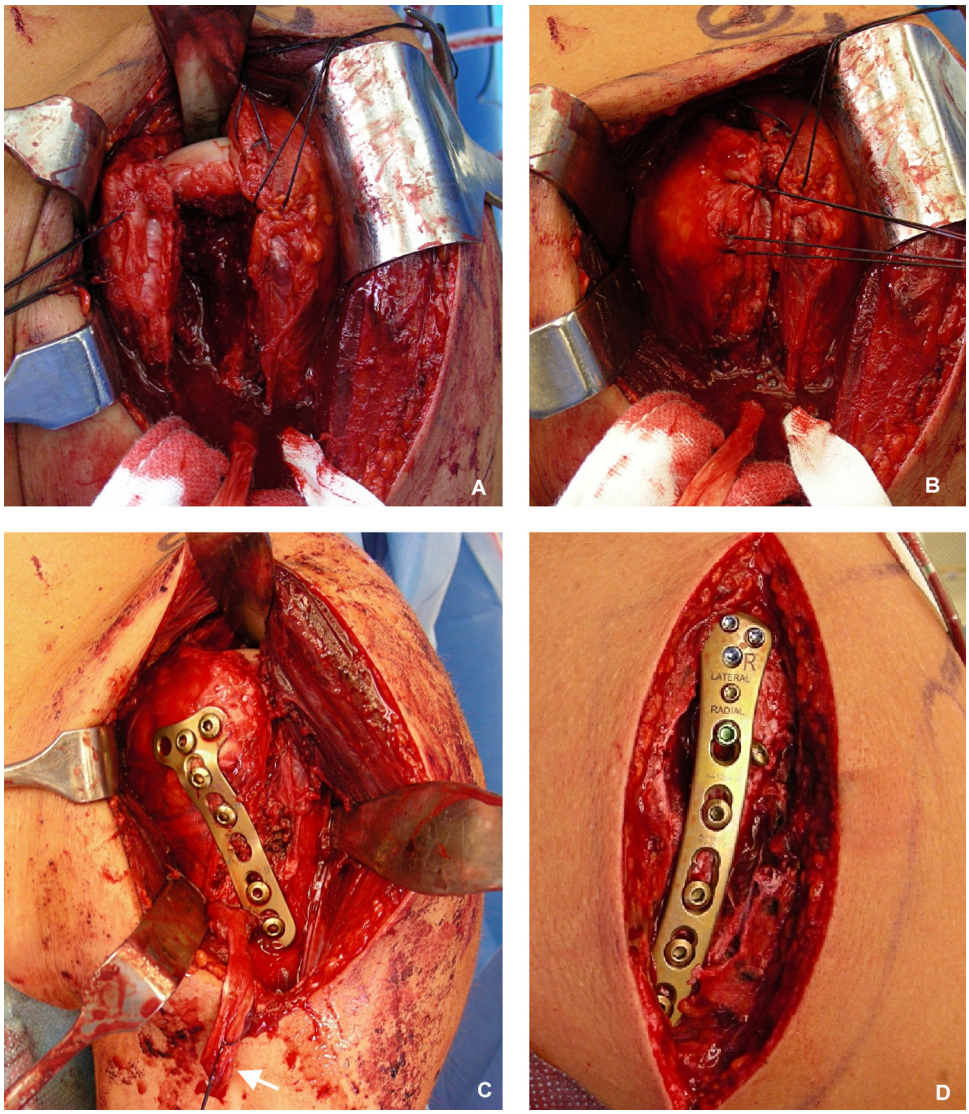

Fig. 3. Intraoperative view of the (A) exposed lesser humeral tuberosity fracture, (B) open reduction with stay sutures, and (C) internal fixation with the 5-hole LCP T-plate: white arrow indicates the tenotomy of the long head of the biceps. (D) ORIF of scapular spine fracture with LCP Radial Distal Humerus Plate.

conservative treatment [9,13]. In our case, the dislocation of the SSF was smaller than 10 mm and as an isolated injury, conservative treatment would have been most appropriate. In combination with the LTF though, we decided to perform surgical intervention.

Surgical treatment options for SSF include tension band wiring for fractures close to the acromion as well as plate fixation for more medially located fractures. We recommend the LCP Distal Humerus Plate as used in our case because it provided a perfect fit for the scapular spine, and it is strong enough to hold reduction and neutralize bending forces.

Like fractures of the scapular spine, LTF usually result from high-energy trauma [2]. The reported mechanism for most of these injuries is described as an avulsion fracture of the subscapularis [14], and is often accompanied by a posterior dislocation of the glenohumeral joint [15]. In our case though, the direct impact of the fall seems to have caused the fracture since the fragment was too large to be considered an avulsion fracture. This injury was a two-part fracture of the proximal humerus with medial dislocation of more than 15 mm and thus we recommended surgery.

The diagnosis of LTF can also be missed. While we were able to diagnose the fracture with an AP radiograph in our case, an additional axillary view may be necessary to detect small fragments [16] and avoid misdiagnosis of the injury as a calcification or osseous Bankart lesion [17]. CT scans are helpful in assessing the extent of the fracture and any possible concomitant injury to the bicipital groove.

Isolated LTF can be treated either conservatively or surgically. Levine et al. recommend a surgical approach if the fragment is displaced more than 5 mm or angulated more than 45°, if conservative treatment failed, or if mobility of the glenohumeral joint is restricted [6]. Good clinical results have previously been published after conservative treatment [19]. Nonetheless, Caniggia et al., [18] reported decreased external rotation in two patients, while Shibuya and Ogawa, [14] describe one case of nonunion. Ogawa and Takahashi, [19] reported ten cases of LTF; five patients were treated with internal fixation and four of them showed excellent results, whereas the outcomes of only two of five conservatively treated patients were excellent. Given these results, no definitive statement can be made on whether surgical treatment of LTF should be

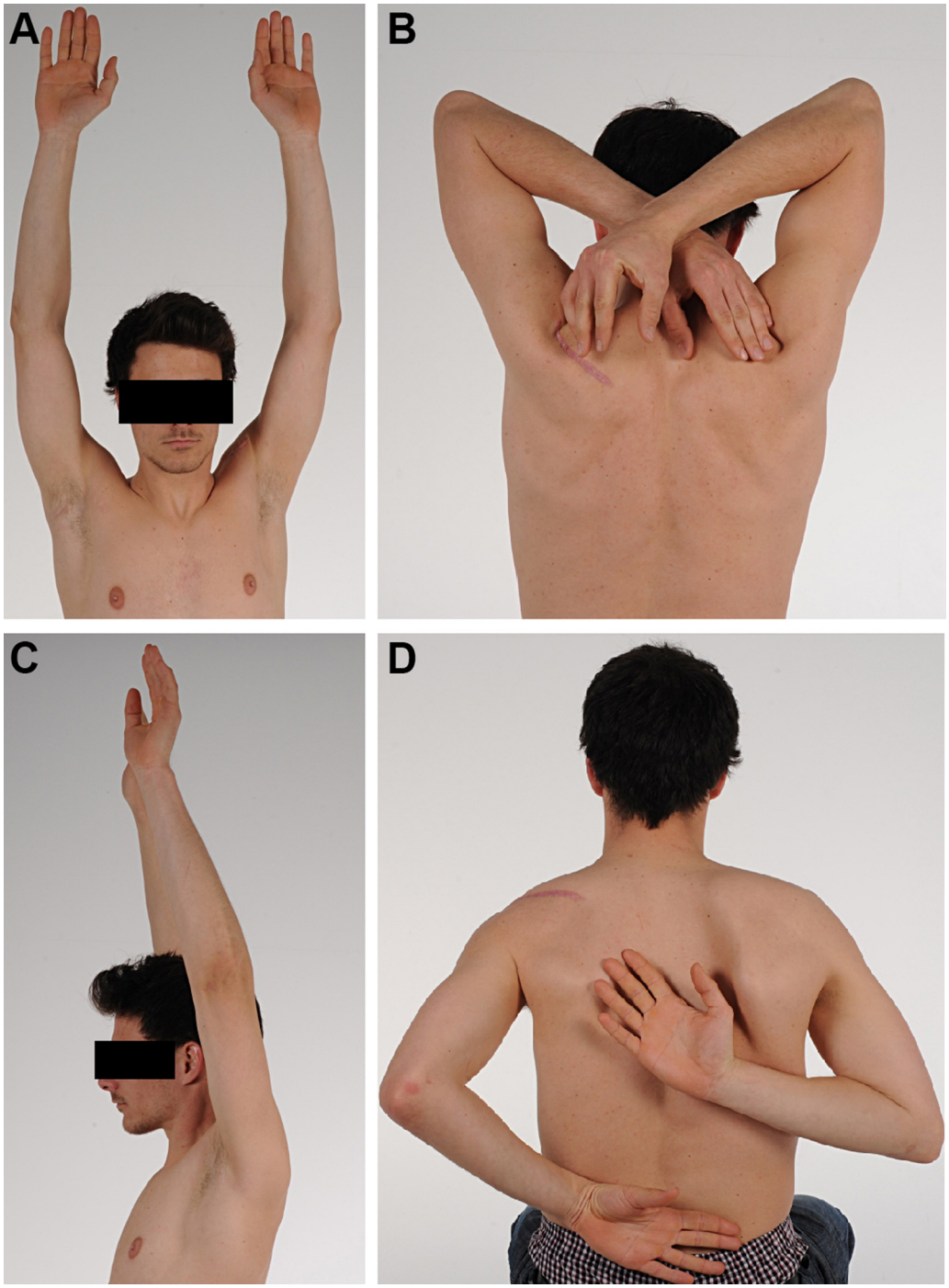

Fig. 4. Six-month postoperative clinical outcome for the patient revealing limited internal rotation (D).

the standard method. However, internal fixation certainly seems to be a highly effective treatment option especially for displaced fractures.

Open reduction with interfragmentary screws, sutures, suture anchors [6,19] or by excision of the fragment and subsequent refixation of the subscapularis with transossary sutures [20] can be used in cases of small fragments. Scheibel et al., [16] reported a case of arthroscopic refixation of a LTF. Due to the size of the fragment in our patient, we performed ORIF with a 3.5 mm LCP T-plate. In retrospect, the use of a smaller plate or screws only may have also been possible. We chose plate fixation over a solitary screw fixation method because we expected to achieve greater stability during rehabilitation, so as to prevent possible failure of reduction.

A similar fracture pattern has only been described once in literature thus far to our knowledge [5]. Hayes et al. reported a case of a 28-year-old male who suffered a biking accident which resulted in a posterior glenohumeral dislocation and subsequent avulsion of the lesser tuberosity as well as a displaced fracture of the base of the acromion caused by the bike hitting the patient's back after the fall [5]. Due to the size of the lesser tuberosity fracture and the mechanism of injury reported by the patient, the LTF seems to have been caused by a direct blow as a result of the fall onto

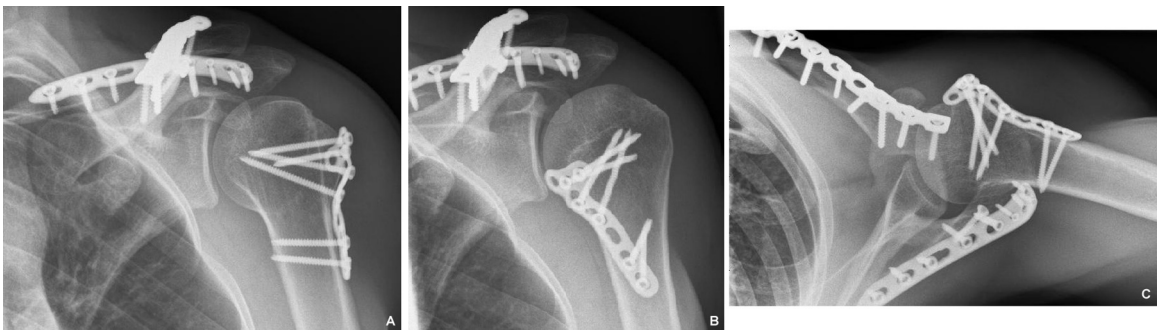

Fig. 5. One-year postoperative anteroposterior (A: external rotation; B: internal rotation) and axillary view (C) radiographs after ORIF with a 5-hole LCP T-plate and distal humerus plate for the lesser tuberosity and scapular spine, respectively.

the left side with the arm elevated—rather than by avulsion of the subscapularis muscle. Other than reported in the previous literature [5], the bike did not hit the patient in the back after the fall to cause the SSF. Hence, the SSF possibly resulted from compression forces on the scapula when the patient landed on the ground. This type of fall might have caused a clavicle fracture if it would not have been for the implanted clavicle plate. The influence of the latter on the injury mechanism in the presented case can only be speculated though. We do think it is noteworthy to mention the clavicle plate yet, since this combination injury has not been reported before and could present a possible complication following clavicle fractures successfully treated with plate osteosynthesis.

4. Conclusion

The combination of these two fracture types is very rare and to our knowledge, has not been previously reported in the literature. We cannot confirm whether prior osteosynthesis of the clavicle may have contributed to this type of injury. As plate fixation of the clavicle is a common procedure, physicians could potentially be confronted with similar types of injuries especially in active patients. While isolated fractures of the scapular spine and lesser tuberosity can be handled conservatively in some cases, we believe ORIF was an appropriate treatment option for our patient, which led to excellent clinical results according to the Constant score.

Conflict of interest

Support was provided by the Schulthess Clinic. The authors did not receive any outside funding, grants or additional benefits for the work involved with this report.

Funding

No funding was involved regarding this case report.

Ethical approval

Our institutional review board does not require ethical approval for case reports. Only informed consent of the patient is necessary and was obtained.

Consent

The patient gave his consent to publication of this article.

Author contribution

Michael Hackl: Data collection, analysis and interpretation; writing the paper.

Holger Durchholz: Study design, data collection, analysis and interpretation; writing the paper.

Fabrizio Moro: Study design, data interpretation; critical review of the manuscript.

Guarantor

Michael Hackl.

Ethical standards

Patient's informed consent has been obtained to publish this report.

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