Anterior Shoulder Dislocation with Concomitant Fracture of *processus coracoideus and tuberculum majus humeri* – Case Report

Predná luxácia ramena s konkominantnou zlomeninou *processus coracoideus* a *tuberculum majus humeri* – kazuistika

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SUMMARY

Glenohumeral joint is the most frequently dislocated joint of the human body. Concomitant fractures of the coracoid process and tuberculum majus in humeral dislocation of the shoulder joint are rarely described. Concomitant fractures are results of a significant contraction of the surrounding muscles and rotator cuff during a cerebral paroxysm. Due to the small number of cases, the treatment of such injuries is not simple and it is based on an algorithm for treatment of isolated injuries of these anatomical structures.

In this case report, we describe a concomitant fracture of the coracoid process and tuberculum majus during an anterior shoulder dislocation in 25-year-old patient after an epileptic seizure. The injury was treated in our department surgically, with a good functional result. The absolute Constant score for the operated arm is 95 points, the relative Constant score is 97%, DASH score 0, VAS score 0.

INTRODUCTION

The glenohumeral joint (GHJ) is the most frequently dislocated joint of the human body. Incidence of its dislocation is reported around 45%, of which up to 85% is anterior dislocation of GHJ (17).

A concomitant fracture of the *tuberculum majus humeri* (TM) is reported in 20% of cases on average (range 15.5–25%) of anterior dislocation of GHJ (10).

The incidence of coracoid fractures in scapular fractures ranges from 3–13%. The incidence of a combination of coracoid fracture and anterior GHJ dislocation is absent in the literature: so far only 22 similar cases have been reported (17, 22).

Anterior dislocation of the shoulder associated with a fracture of the coracoid process and tuberculum majus is described in the literature as extremely rare.

CASE REPORT

In June 2020, a 25-year-old patient was treated in the orthopaedic department of Skalica hospital. The patient is being monitored at the neurology department since his birth for intracerebral haemorrhage followed by the development of epileptic seizures that are persistent despite therapy.

The patient was treated in our department after one of epileptic seizures for an anterior dislocation of the left humerus in the glenohumeral joint with a concomitant fracture of *tuberculum majus humeri* (Neer 4, Hertel 3) and the coracoid process fracture (Ogawa gr. II, Eyres II). It was diagnosed by X-ray. The patient was already without neurological symptoms at the time of our treatment. After diagnosing the injury, we performed an immediate and gentle reposition using a FARES manoeuvre after application of local anaesthetic. After the repositioning we also performed a CT scan.

On CT scans we found that fragments dislocation of the coracoid process larger than 1 cm and tuberculum majus larger than 0.5 cm persisted. Therefore an open fixation of fracture fragments was indicated to the patient. We admitted the patient to the ward on the day of the injury and performed the operation the following day after a standard preoperative preparation.

We operated under the standard aseptic conditions under general anaesthesia through the delto- pectoral approach using an X-ray (C arm). We fixed the fragment of the coracoid process with two 3.0 mm lag screws and the fragment of the tuberculum majus with two 3.5 mm lag screws. Postoperatively, we fixed the whole limb in the permanent Gilchrist's bandage (even at night) with a permission to take off the fixation during hygiene. After the suture extraction (10th postoperative day), we allowed the patient pendulum movements 2-3 times a day but we continued with the fixation of the limb.

Six weeks after surgery, there were visible signs of fracture healing on X-rays and physiological stability of GHJ so we removed the fixation and allowed exercise to the maximum with the gradual limb load. The patient's rehabilitation was only individual.

More than a year after the operation, the patient has fully restored left shoulder mobility and the limb is fully functional. The patient feels pain only during a longer lifting of heavier loads (over 10–15 kg), the stability of the shoulder joint is physiological and X-ray shows anatomical healing of the fracture. Osteosynthetic material doesn't show signs of failure in the X-rays and it does not cause problems to the patient, so we did not in-

Fig. 1. X-ray of left shoulder directly after epileptic seizure.

dicate its removal. The absolute Constant score for the operated arm is 95 points, the relative Constant score is 97%, DASH score 0, VAS score 0.

DISCUSSION

Concomitant fractures of the coracoid process and tuberculum majus in shoulder dislocation are described extremely rarely. We only know of 10 similar cases described in the literature of which 1 case is bilateral in one patient and 7 cases are associated with a fracture of the anterior edge of the glenoid (8, 11, 15, 20).

A case from Britain was described after a fall in epileptic seizure. Due to the satisfactory position of both fragments, the patient was treated conservatively with a full function and stability restoration of the shoulder 6 months after the injury (11).

The described bilateral case from France occur after a fall due to hypoglycaemia in a diabetic person. Left shoulder remained stable after reduction and the fragments were in the correct position, so this side was treated conservatively with bandage and subsequently rehabilitated 3 weeks after the injury. The right shoulder remained in a subluxation position after a reduction. Therefore surgical treatment was indicated including fixation of the tuberculum majus fragment with two cannulated screws and Latarjet osteoplasty using the coracoid process fragment for glenoid anterior fracture. Two years after trauma, the function of both shoulder joints was fully restored as well as the physiological stability (8).

Because of the case studies described so far, there still no algorithm for treating concomitant fracture of processus coracoideus and tuberculum majus humeri. Treatment of this types of injuries consist from the surgical steps of treating isolated fractures considering the stability of the GH joint.

The coracoid process is part of the superior shoulder suspensory complex (S.S.S.C.) defined by Goss (12). Although the author and the other studies emphasize its importance and the need for reconstruction (1, 7, 17) in the literature, we also encounter the view that the importance of S.S.S.C. is overrated (3, 14).

Isolated fractures of the coracoid process type Ogawa gr. I a gr. II are indicated for conservative therapy and the only absolute indication for surgical treatment is a fracture gr. II in athletes.

In numerous injuries of the S.S.S.C complex and in fractures of the coracoid process gr. I, surgical treatment is indicated. Surgical treatment is also recommended for dislocations of fragments larger than 5 mm (14, 21). There is a general consensus in the indication for surgical treatment in the dislocation of coracoid process fragments 1 cm and larger.

It is recommended to reconstruct the *tuberculum majus* (TM) in case of its dislocation larger than 3-5mm (16, 23). Bono et al. emphasized the importance of the rotator cuff (RM), especially *m. supraspinatus* and also *m. deltoideus* in relation to the dislocation of the large humerus in his in vitro study which stated that even a minimal dislocation of the large tubercle by 0.5 cm leads to a signif-

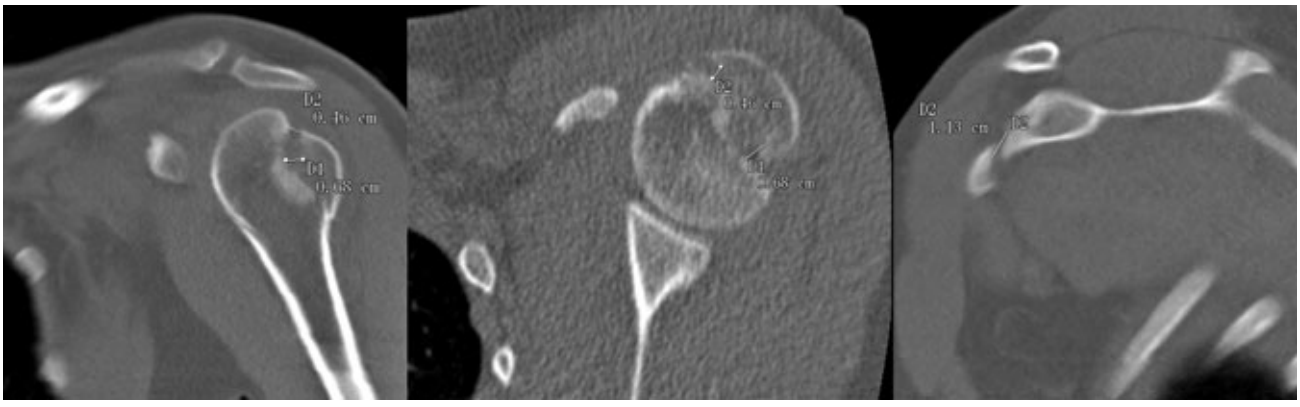

Fig. 2. CT scan of the left arm with fragments distance.

icant increase in the need for muscle strength to abduct the shoulder. This increases continuously with greater dislocation or translation of fragments (4). The relationship between TM dislocation and RM tear is also a frequent reason for revision of a *tuberculum majus humeri* fracture, especially in the case of anterior GH joint dislocation (19). At the same time, an improperly treated fracture of the coracoid process with anterior dislocation can lead to recurrence of the GH joint dislocation (18, 23).

It is recommended to use two 3.5 mm lag screws in the reconstruction of the fractures of the coracoid process (3). The use of the tension band wiring is also described (15). In the TM reconstruction, screws of appropriate fragment size or tension band wiring are used, while tension band wiring has better biomechanical properties (6, 17).

Our case report was a clear diagnosis based only on X-ray imaging. In practice, the bone lesions of the upper limb girdle are overlooked or incorrectly diagnosed, so a CT scan should be added as standard (2, 5).

The mechanism of a fracture of the *processus coracoideus* remains unclear. Most opinions are based on the theory that the formation of fractures can be caused by muscle tension, alternatively it can be caused by shear forces between the scapula and the collarbone and also isolated rupture of lig. coracoclaviculare with abruption of processus coracoideus. The last two mechanisms being applied mainly to fractures of the Ogawa gr. I. (14). Bartoníček considers direct violence acting on the coracoid process to be the main mechanism of the fracture. He considers muscle tension to be a less common mechanism mainly due to the anatomical strengthening of the base of the coracoid process by the surrounding ligaments. Furthermore, he describes conditions where the anterior shoulder dislocation was responsible for the fracture. In these cases the humerus hit the process directly (3).

Fig. 3. CT scan with 3D reconstruction.

The mechanism of *tuberculum majus* fracture is not yet well described. Fei Dai et al. in his study described, based on Mutch's classification of tuberculum majus fracture, two mechanisms of these fractures based on the degree of extrarotation of the humeral head and the size of the joint space.

If the extrarotation is significant, the humeral head strikes the anterior or the lower edge of the glenoid and the fragments of the large tuberculum are substantial, they correspond to the "split fracture" type. If the extrarotation is insufficient due to a significant rotator cuff contracture or the humeral head strikes the lower edge of the glenoid, the fragment is small, and fracture correspond to the types "avulsion fracture" or "depression type". High-energy injuries with low extrarotation of

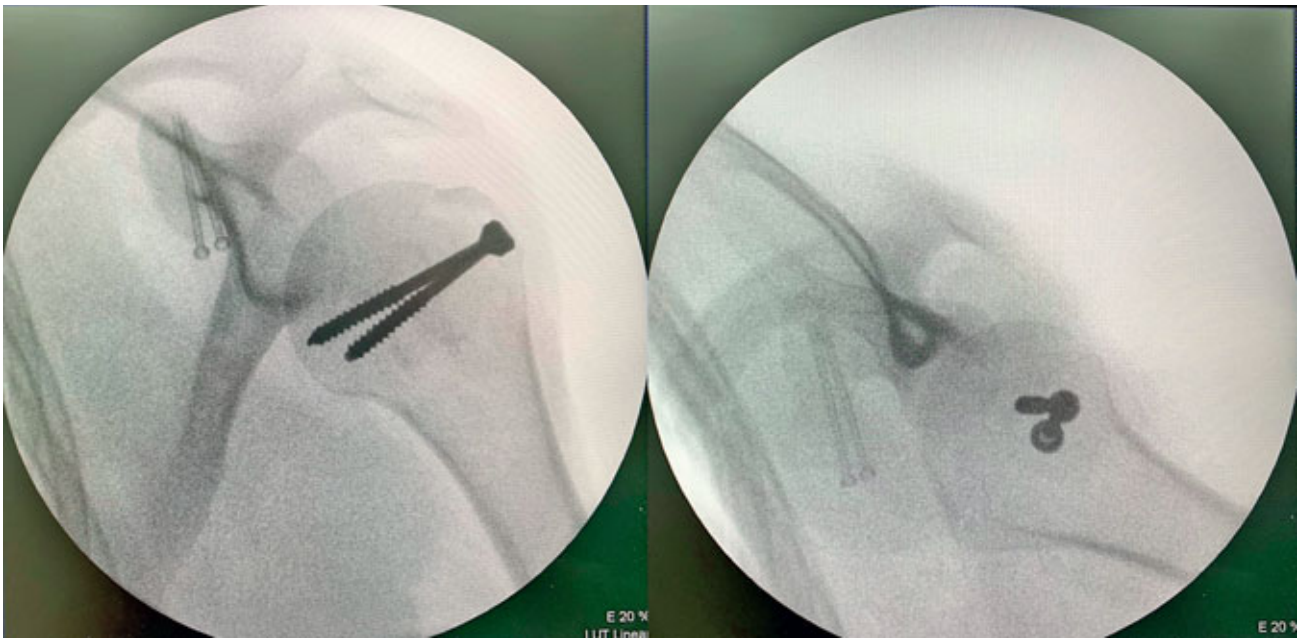

Fig. 4. Intraoperative X-ray and fixation of coracoid process fragment with two 3.0 mm lag screws and the fragment of the tuberculum majus with two 3.5 mm lag screws.

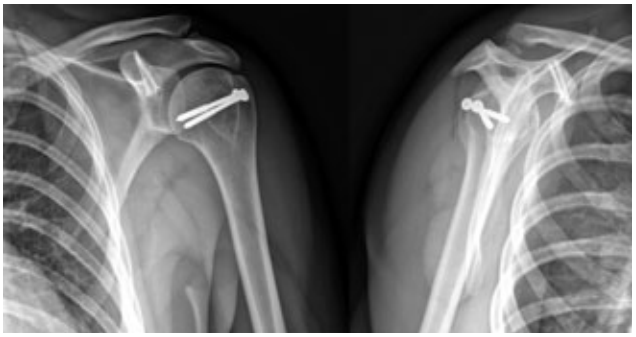

Fig. 5. Result on X-ray more than one year after operation.

the humeral head can also lead to large fragments of the glenoid (9, 13).

Based on the available information anterior shoulder dislocation with a concomitant fracture of the coracoid process and tuberculum majus is a rare type of injury. We believe that it occurs under specific conditions such as epileptic and hypoglycemic seizures associated with tonic seizures with marked muscle contracture. Effect of contraction of *m. infraspinatus* is an extrarotation of the arm. Parallel contracture of *m. pectoralis major* and *m. latissimus dorsi* dislocates the humeral head. With a significant contracture of the rotator cuff, it becomes inflexible and a fracture of the tuberculum majus occurs. The fracture of the coracoid process is in this case caused by the traction of contracted *m. biceps brachii* and come independently of the tuberculum majus fracture. However, our hypothesis of the described type of injury have to be verified by further observations and also biomechanically in vitro.

Fig. 6. Clinical result.

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