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## Case report

# Avulsion fracture of the supinator crest as an indication for a sustained posterolateral (sub)luxation of the elbow. A case report, anatomical evaluation and review of the literature

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## ABSTRACT

The treatment of elbow injuries can be challenging because of the complexity of both anatomy and pathology. We present a rare traumatic avulsion fracture of the supinator crest of the ulna in a 37-year-old patient. Conservative treatment in a long arm cast for four weeks led to satisfactory results. Reproduction of the fracture on a cadaveric elbow clarified that the avulsed fragment holds the insertion of the lateral ulnar collateral ligament (LUCL). The mechanism of trauma that causes this fracture is a posterolateral (sub) luxation of the elbow, which usually causes the LUCL to rupture, but in rare cases the insertion of this ligament can be avulsed. A posterolateral (sub) luxation of the elbow can lead to chronic posterolateral rotational instability and therefore the stability of the elbow should be taken into account in the treatment of patients with such a fracture. A review of the literature concluded that this fracture often is associated with other injuries to the elbow and that it is easily missed on conventional AP and lateral radiographs. CT or MRI imaging and a radial head-capitellum view radiograph can be beneficial. Both conservative and operative treatments have been described with good clinical results.

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## 1. Introduction

Treatment of elbow injuries can be challenging because of the complexity of both anatomy and pathology. We present an uncommon injury of the elbow – an avulsion fracture of the supinator crest. A reproduction of this fracture on a human cadaver gives clarity on which structures are involved and accordingly we describe a possible mechanism of injury.

### 1.1. Case report

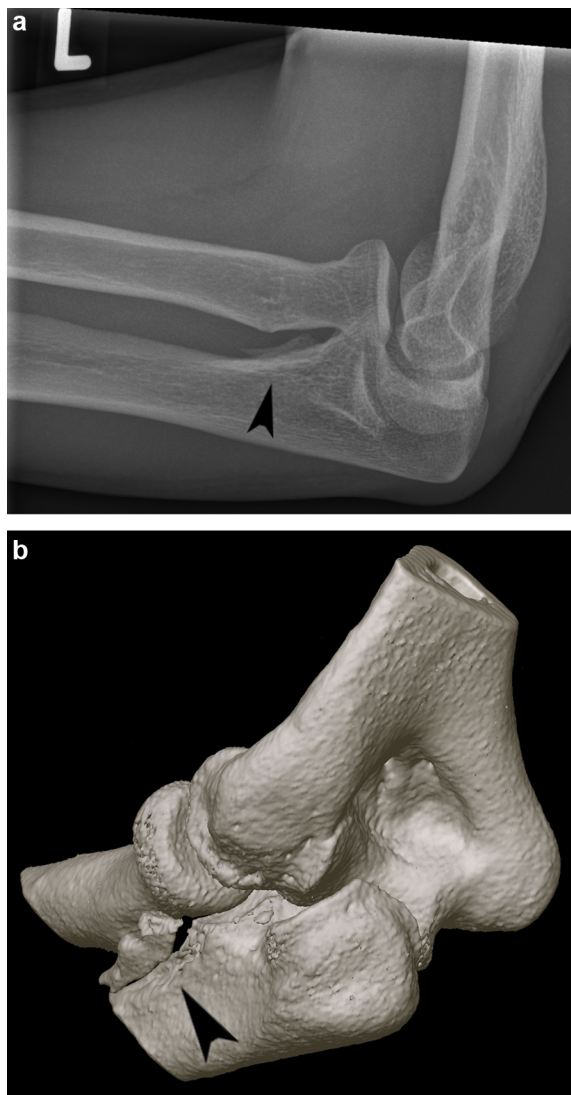
A 37-year-old man was treated in our emergency department after he fell with his bicycle on his left arm. On physical examination, there was a hematoma and tenderness to palpation on the lateral side of his elbow and crepitus during pro- and supination. Besides five degrees of elbow extension deficit compared to the contralateral side, the range of motion was normal. Further clinical tests showed no varus or valgus instability and a negative pivot shift test. Conventional AP and lateral radiographs of the elbow were normal but the radial head-capitellum view revealed an osseous fragment on the ventral aspect of the proximal ulna (Fig. 1a). A

CT-scan showed that the fragment measured 30 by 4 mm and originated from the supinator crest (SC) of the ulna. The fragment was slightly displaced radially (Fig. 1b). A long arm cast was applied with the elbow flexed in 90 degrees and the wrist in neutral position. MR Imaging revealed the fracture was located at the ulnar insertion of the lateral collateral ligament complex (LCLC), and the ligamentous part of the lateral ulnar collateral ligament (LUCL) was intact. It also showed bone oedema of the radial head and the capitellum. One week later, the patient was re-examined and again the elbow was found to be stable. Cast immobilisation was continued for a total of 4 weeks after which physiotherapy was started. Three months after the injury there were no complaints, a full range of motion and a stable elbow. Radiographs showed union of the fracture. Fifteen months after injury, the patient complained about an unpleasant feeling during push-ups and pushing away weights with a supinated forearm. Physical examination revealed a full range of motion, no tenderness to palpation and a stable elbow. Because of the mild character of the complaints, the patient chose not to undergo any further evaluation.

### 1.2. Functional anatomy and pathophysiology

To obtain a better understanding of the aetiology and affected structures in our case, we studied a right arm of an embalmed cadaveric specimen. After removal of the anconeus muscle, the SC

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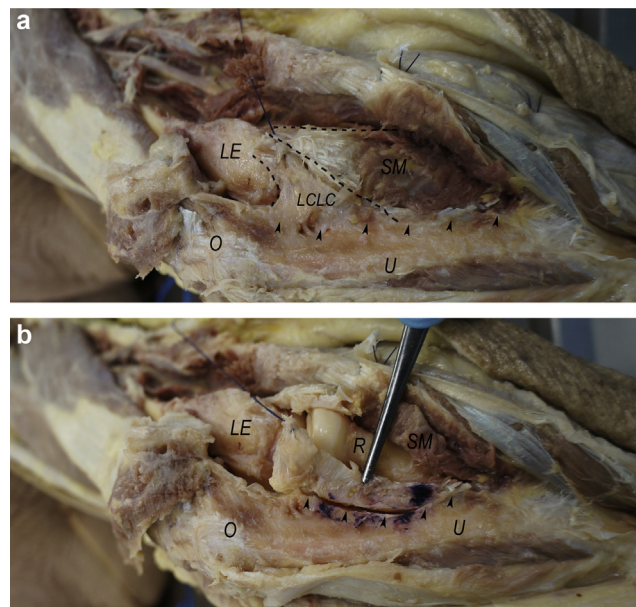


**Fig. 1.** a: a radial head-capitulum view radiograph showing a bony fragment between the proximal ulna and the radial shaft; b: a posterolateral view of the CT-scan 3D reconstruction showing the exact position of the supinator crest avulsion fracture at the lateral proximal ulna.

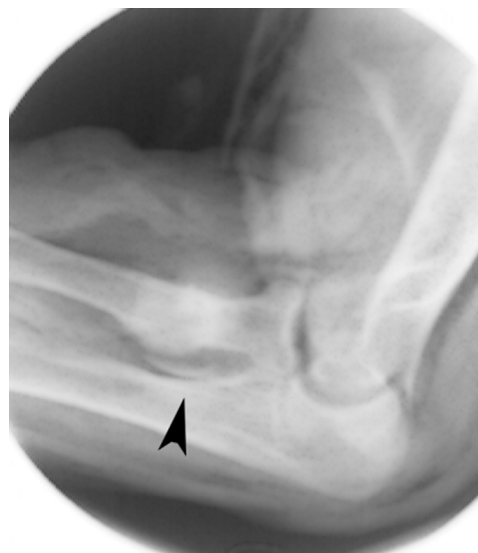
was visible with its LUCL insertion and the supinator tendon origin (Fig. 2a). We produced an avulsion fracture by an osteotomy with the same dimensions as in our case (Fig. 2b). The reproduced fragment contained the complete LUCL insertion and part of the origin of the supinator muscle. We confirmed the similarity by comparing a fluoroscopic image of the cadaver elbow with the clinical radiographs (Fig. 3).

The LCLC usually consists of the lateral collateral ligament (LCL), the annular ligament (AL), the accessory lateral ligament (ALL) and the LUCL (Fig. 4) [1–3]. The LUCL originates at the lateral epicondyle of the humerus and runs towards the insertion on the SC of the ulna which on average is 44 mm long [4,5].

The elbow contains static and dynamic stabilizers. Primary static stabilizers are the ulnohumeral articulation, the medial collateral ligament (MCL) and the LCLC of which the LUCL is the most important stabiliser. Secondary static stabilizers are the radial head, the flexor, extensor and supinator ligamentous attachments and the elbow capsule. The muscles that run along the elbow joint act as dynamic stabilizers [6]. An insufficient lateral complex can result in an acute or chronic posterolateral rotational instability (PLRI). This type of elbow instability is well described in the literature [6–13].



**Fig. 2.** a: the lateral side of a right cadaveric specimen elbow. The anconeus muscle is resected, presenting the lateral epicondyle (LE), the olecranon (O) and more distally the ulna (U). The LCLC is shown in close relation with the supinator muscle (SM) of which the outer fascia is opened to expose the muscle fibers. The dotted lines present the outlines of the LCLC and the SM. The arrows represent the insertion of the LCLC and the SM on the supinator crest; b: the reproduction of the supinator crest fracture (marked by the arrows) with the insertion of the complete LCLC and part of the origin of the proximal part of the supinator muscle (SM). For orientation purposes the radius (R) is exposed by incising the LCLC and the SM.



**Fig. 3.** A radial head-capitulum view fluoroscopy image of the cadaveric specimen after recreation of the fracture. The arrow indicates the recreated avulsion fracture.

The chronic phase of a mild PLRI causes pain at the lateral or medial side of the elbow or gives an unpleasant or unstable sensation when the lower arm is supinated or valgus stress and axial loading is applied.

## 2. Discussion

Our patient presented with an uncommon isolated and minimally displaced avulsion fracture of the SC. Conservative treatment with a long arm cast gave satisfactory results. No known studies described the effect of an isolated fracture of the SC on elbow

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