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Case Report

Surgical fixation of ulnar coronoid process fractures via mesh plate: A case report

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ABSTRACT

Introduction: The coronoid process of the ulna is the primary stabilizer of the elbow joint. There has not yet been an accurate off-the-shelf dedicated implant because fragments of coronoid process fractures are often small and diverse. The variable angle locking compression mesh plate 2.4/2.7 (Depuy Synthes, West Chester, PA, USA) acts as a versatile, low-profile implant that can be cut to suit the specific fracture pattern and fits anatomically.

Case presentations: We report two cases of Regan–Morrey type II ulnar coronoid process fractures in terrible triad elbow injuries. In both cases, persistent instability was fluoroscopically diagnosed after repair of the lateral structures. We performed osteosynthesis for the ulnar coronoid process fractures using a mesh plate, which we cut into a rhombus-like shape and used as a buttress plate. Here we report the good results obtained thereof.

Conclusion: Considering our positive experience with using mesh plates, the mesh plate may be a good method of fixation for ulnar coronoid process fractures.

Introduction

The treatment of elbow injuries is always complex and it is often difficult to achieve consistent results due to fracture diversity and the instability of the elbow with severe trauma [1]. The coronoid process plays an important role in preventing anteroposterior translation of the ulna.

Various treatments have been proposed for repairing coronoid process fractures [2,3]; however, there is not yet an accurate off-the-shelf dedicated implant because fragments of coronoid process fractures are often small and diverse [3]. The variable angle locking compression mesh plate 2.4/2.7 (DePuy Synthes, West Chester, PA, USA) acts as a versatile, low-profile implant.

This plate is characterized by an ability of being cut according to the specific fracture pattern such as greater tuberosity fracture, oblique fracture of the manubrium sterni and acromion fracture, and anatomical fitting [4–6].

Here, we report two cases of coronoid process fracture in a terrible triad elbow injury operated using a mesh plate and their good results.

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Case reports

Case 1

A 43-year-old, right hand dominant man presented to the emergency department after falling to the ground from a truck. Initial examination revealed swelling and hematoma over the medial and lateral aspects of the right elbow with a limited range of movement due to pain and swelling. There was no posttraumatic paralysis in the right upper extremity. Plain radiography of his right elbow revealed an anterior bony fragment of the ulnar coronoid process (Fig. 1) and a distal radial fracture. Computed tomography (CT) scan revealed humeroulnar subluxation and fragments (6 mm in length) of the anteromedial facet of the ulnar coronoid process (Regan–Morrey type II or O'Driscoll type II subtype 2) [7,8] (Fig. 1). After recovering the wound and reducing swelling of the elbow, invasive osteosynthesis was performed 14 days after the injury. Under axillary block, we primarily treated the distal radial fracture. Second, the elbow joint was addressed. The lateral elbow joint was approached using the Kaplan approach [9]. The lateral collateral ligament (LCL) and common extensor origin were repaired with four all-suture anchors (JuggerKnot, 1.4 mm; Zimmer Biomet®, Warsaw, IN, USA). After repairing the lateral structures, persistent instability was diagnosed fluoroscopically through a full range of elbow motion. We approached and exposed the coronoid fracture via the medial "over the top" approach splitting the flexor-pronator mass as described by Hotchkiss [10]. During this approach, we identified and avoided the antebrachial cutaneous nerve, while we

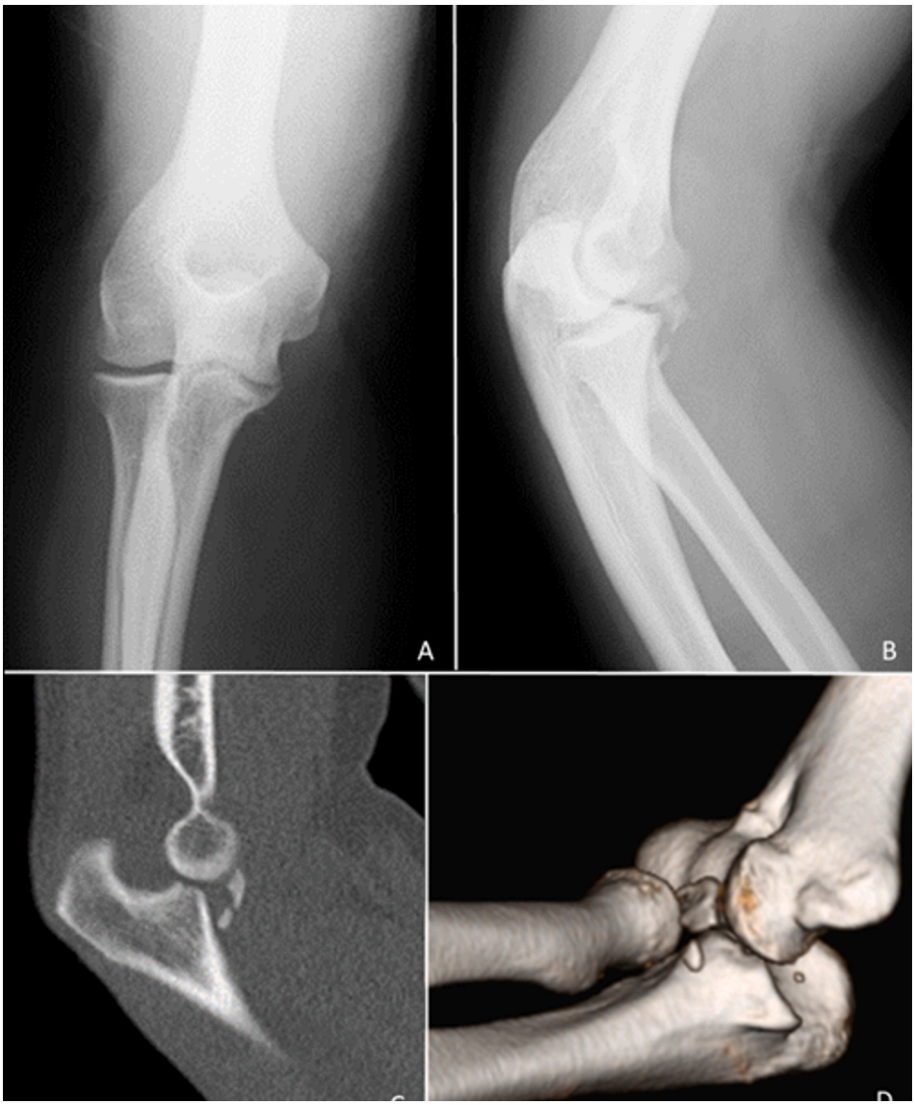

Fig. 1. Anteroposterior (A) and lateral (B) plain radiographs of the elbow. Lateral radiograph shows an anterior bony fragment of ulnar coronoid process.
Computed tomography revealed humeroulnar subluxation and fragments of the anteromedial facet of the ulnar coronoid process (C, D).

identified and protected the ulnar nerve prior to deep dissection. After exploring the coronoid fracture, preliminary reduction with K-wires was performed, followed by definitive fixation with a mesh plate. We cut this plate in a rhombus-like shape and used it as a buttress plate (Fig. 2). The plate was attached using three 2.4 mm locking screws, one of which was inserted to catch a bone fragment. We repaired the medial collateral ligament (MCL) and common flexor origin with four 1.4 mm JuggerKnots. Postoperatively, the patient's arm was immobilized in a long arm cast for 2 weeks and gentle mobilization of the elbow was initiated using a non-hinged elbow brace for 4 weeks with gradual progression to passive and active-assisted range of motion exercises as tolerated. An active range of motion and strengthening exercises were permitted from the 6th week onwards. At 12 months postoperatively, the elbow range of motion was 135° in flexion and −20° in extension. There was no limitation in forearm pronation or supination. There was no joint line narrowing and osteophytosis at the humeroulnar and humeroradial joints on standard anteroposterior and lateral radiographs. The Mayo Elbow Performance Score was 95.

Case 2

A 42-year-old, right-dominant man presented to the emergency department after falling from a stepladder onto his right hand on the ground. Initial examination revealed bleeding from a pinhole-sized open wound on the medial aspect of his right elbow and no paralysis in his right upper extremity. Plain radiography revealed posterior dislocation of the right elbow and the bony fragments of a coronoid fracture (Fig. 3). A CT scan revealed ulnar coronoid process fracture (Regan–Morrey type II or O'Driscoll type I subtype 2 tip fracture approximating 40–50% of the total coronoid height) [7,8] and a radial head fracture (Mason–Morrey type IV) [11] (Fig. 3). Fourteen days after the injury, surgical treatment was performed after the swelling had subsided. Under general anesthesia in the supine position, the lateral elbow joint was approached using the extensile Kaplan approach [9]. The LCL had completely avulsed from the lateral humeral condyle. We approached the radial head by cutting the anterior capsule and fixed it using three headless compression screws (Acutrak 2 Micro; Acumed, Hillsboro, OR, USA). After reducing the humeroradial joint, the ruptured LCL and extensor origin were repaired using four 1.4 mm JuggerKnots. After repairing the lateral structures, persistent instability was diagnosed fluoroscopically, and we approached and exposed the coronoid fracture via the medial “over the top” approach [10]. Preliminary reduction with K-wires was performed, in a versatile, low-profile manner, and used as a buttress plate (Fig. 4). Three 2.4 mm locking screws were used for plate fixation, one of which was inserted to catch a bone fragment. An extra headless compression screw (Acutrak 2 Micro) was used to fix the proximal small bone fragment directly.

We repaired the MCL and common flexor origin with four 1.4 mm JuggerKnots. Postoperatively, the patient's arm was immobilized in a long arm cast for one week and he was started on gentle mobilization of the elbow with a hinged elbow brace for 4 weeks with gradual progression to passive and active-assisted range of motion exercises as tolerated. Active range of motion and strengthening

Fig. 2. Anteroposterior (A) and lateral (B) plain radiographs showing postoperative findings of the ulnar coronoid process fracture.

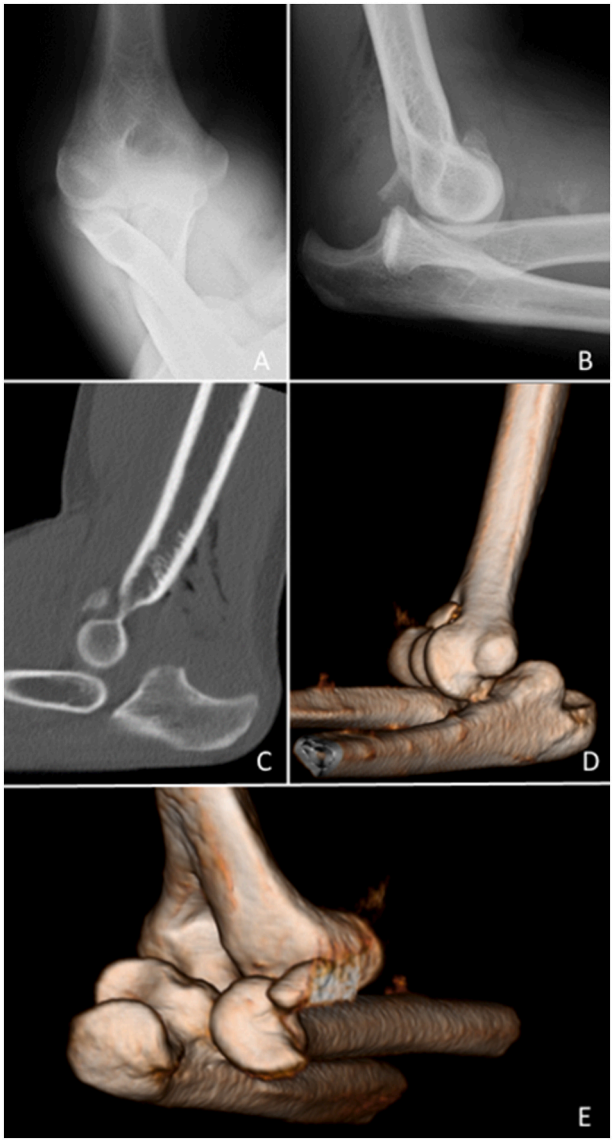

Fig. 3. Anteroposterior (A) and lateral (B) plain radiographs revealing elbow dislocation with bony fragments. Computed tomography scan revealed elbow dislocation with Regan–Morrey type II ulnar coronoid process fracture (C, D), and radial head fracture (E).

exercises were permitted from the 6th week onwards. The range of motion of the elbow was 135° in flexion, −10° in extension, 80° in pronation, and 90° in supination at 24 months postoperatively. There was no joint line narrowing and osteophytosis at the humeroulnar and humeroradial joints on standard anteroposterior and lateral radiographs. The mean Mayo Elbow Performance Score was 95.

Discussion

Here, we report on the clinical management of ulnar coronoid process fractures via osteosynthesis using a mesh plate and the good results thereof. This versatile and low-profile plate may be effective in fixing small fragments of the ulnar coronoid process.

Internal fixation of the coronoid process is recommended when the fracture involves either the base (Regan–Morrey or O'Driscoll type III) or the anteromedial facet (O'Driscoll type II) [12]. If persistent instability is demonstrated in the setting of a coronoid tip fracture (Regan–Morrey type II fracture or O'Driscoll type I subtype 2 tip fracture approximating 50% of the total coronoid height), as seen in case 2, internal fixation of the coronoid process is needed, although a majority of terrible triad injuries comprising fractures involving less than 50% of the coronoid tip are left unfixed [13].

The optimal treatment for coronoid fractures remains controversial [12]. Options for operative management include the suture lasso technique, suture anchors, lag screws, or plates, and it is important to achieve sufficient fixation for early rehabilitation [3]. For

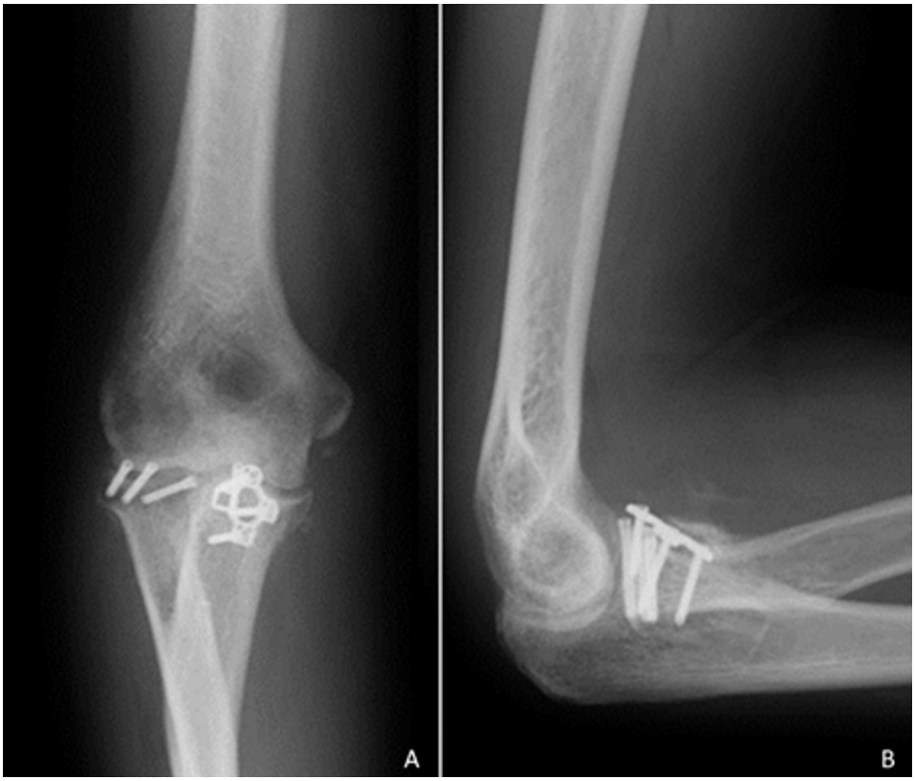

Fig. 4. Anteroposterior (A) and lateral (B) plain radiographs showing postoperative findings of the ulnar coronoid process fracture and radial head fracture.

comminuted multi-fragment fractures, neither the suture technique nor screws can provide sufficient fixation and are associated with a higher prevalence of malunion and nonunion [2,3]. Although accurate off-the-shelf plates have not yet been developed, internal fixation with mini plates is an effective method for early functional exercise as it provides sufficient stability and improved functional outcomes in the treatment of Regan–Morrey types II and III ulna coronoid fractures [3,14]. In our opinion, the mesh plate is also effective in stipulating rigid fixation in terms of a low-profile plate similar to the mini plate and 2.4 mm small screws. If needed, additional smaller screws can be used for fragment fixation in the space of the mesh plate. We cut the mesh plate in a rhombus-like shape and bent it anatomically for each ulnar coronoid process in our two cases. The mesh plate can be cut into any shape required for the specific fracture pattern.

This feature might be suitable for repairing complex-shaped fractures, such as coronoid process fractures.

Conclusion

We report two cases of coronoid process fracture in a terrible triad elbow injury operated using mesh plates and the good results thereof. Since we reported only two cases, a large number of cases need to be studied to assess the efficacy or cost analysis of this plate for internal fixation of the coronoid process fractures.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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