Coronoid Reconstruction Using the Excised Radial Head in Complex Elbow Trauma: A Surgical Tip

A Kanawati, P Lorentzos, M Anderson, T Bell

Citation

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Abstract

Complex elbow trauma and instability are challenging injuries to treat (1). They can range from simple dislocations with purely ligamentous injury, which are usual stable injuries, to complex fracture-dislocations with gross instability (2). We present a case of a rare Monteggia Type IIA fracture with a comminuted radial head and coronoid fracture, and ulnohumeral dislocation, treated with open-reduction and internal fixation of the proximal ulna, radial head replacement, coronoid reconstruction using the excised radial head fragment, and lateral collateral ligament repair. Coronoid reconstruction using the excised radial head has only rarely been described in the orthopaedic literature (3-5), but our case is unique in that adequate stability of the elbow was achieved intraoperatively to permit immediate range of motion of the elbow.

INTRODUCTION

Complex elbow trauma and instability are challenging injuries to treat (1). They can range from simple dislocations with purely ligamentous injury, which are usual stable injuries, to complex fracture-dislocations with gross instability (2). We present a case of a rare Monteggia Type IIA fracture with a comminuted radial head and coronoid fracture, and ulnohumeral dislocation, treated with open-reduction and internal fixation of the proximal ulna, radial head replacement, coronoid reconstruction using the excised radial head fragment, and lateral collateral ligament repair. Coronoid reconstruction using the excised radial head has only rarely been described in the orthopaedic literature (3-5), but our case is unique in that adequate stability of the elbow was achieved intraoperatively to permit immediate range of motion of the elbow.

CASE PRESENTATION

A 55-year-old female presented to a regional Sydney teaching hospital after sustaining a fall onto her outstretched right hand. Her injury was isolated. She had a medical background of hypertension and obesity and she is right hand dominant. On examination, there was marked deformity of the right elbow, however no neurologic or vascular compromise was detected and the injury was closed. She underwent plain X-ray examination, which revealed a Bado Type II fracture of the proximal ulna with a comminuted and displaced coronoid process, as well as a Mason Type IV radial head fracture.

Figure 1

Figure 1:Plain radiographs of the elbow revealing a comminuted proximal ulna fracture and comminuted radial head fracture

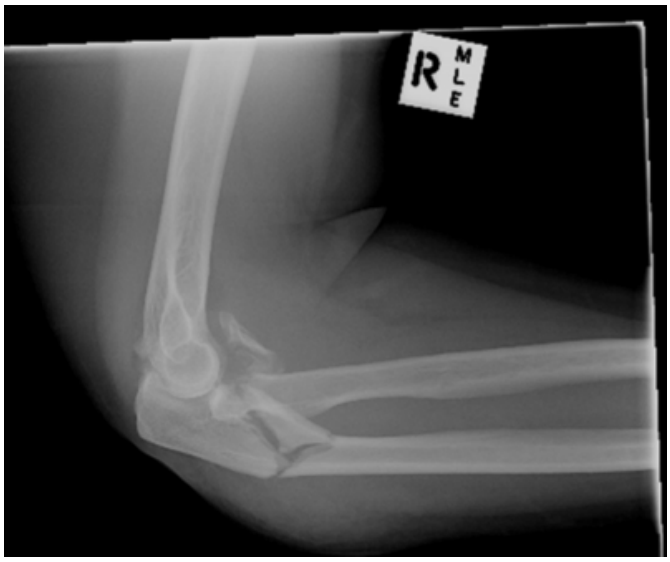
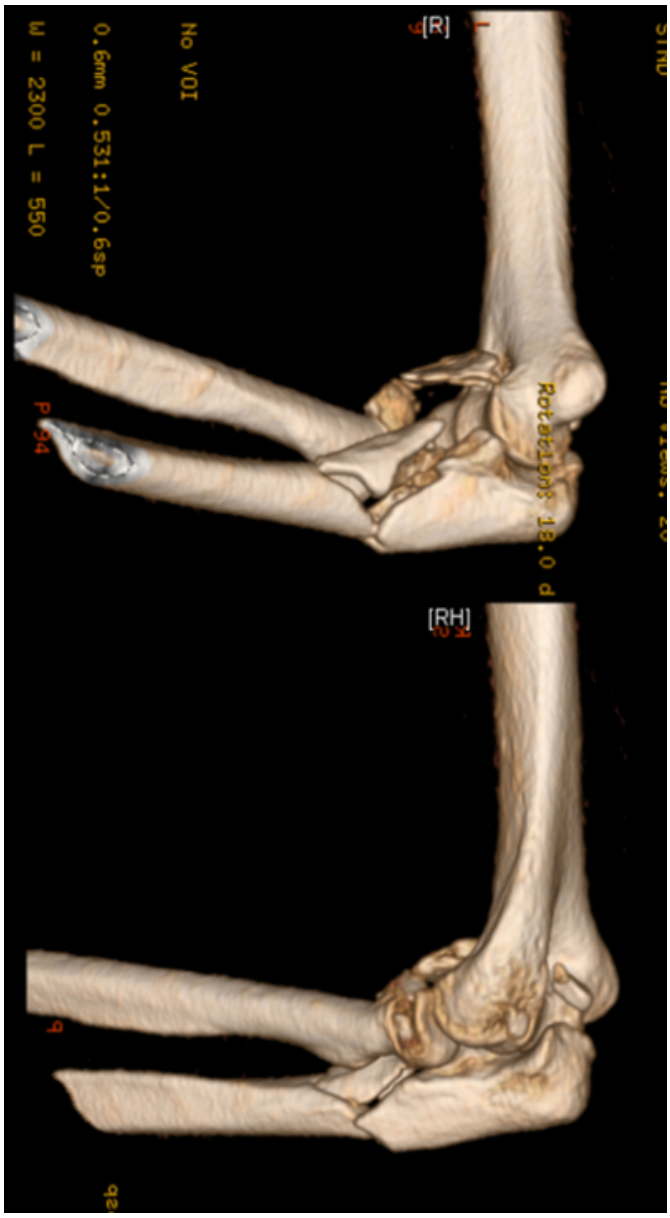


Figure 2

She was placed into a long arm plaster splint and a CT scan was performed to gain a better understanding of the fracture patterns and assist in pre-operative planning. A posterior dislocation of the elbow was suspected when the CT scan revealed a radial head fracture fragment located in the posterior elbow olecranon fossa.

Figure 3

Figure 2:3D reconstruction of the right elbow CT

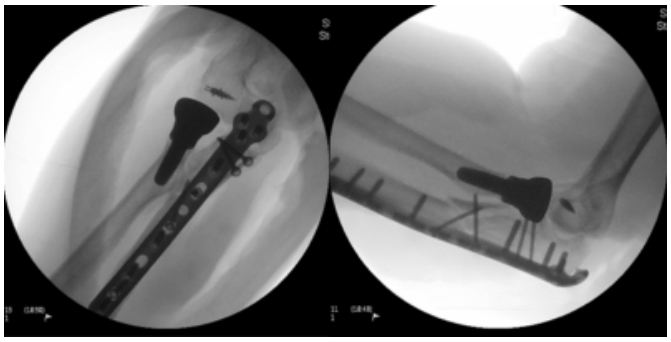


The patient underwent surgery using a universal posterior approach to the elbow, with medial and lateral flaps raised to access the medial and lateral aspect of the elbow. Open-reduction and internal fixation of the proximal ulna was achieved by using an Acumed 3.5mm locking plate. The radial head was not amenable to reconstruction, so radial head arthroplasty was performed using an Acumed Radial Head Replacement. Stability was reassessed intraoperatively with the aid of fluoroscopy. The elbow demonstrated persistent posterior instability with extension less than 50 degrees. The coronoid process demonstrated a complex multi-fragmentory fracture, not amenable to fixation. As a result, the fragments were excised and coronoid

reconstruction was performed using the excised radial head. Fixation was achieved using two 2.7mm cortical screws from the posterior border of the proximal ulna. The lateral collateral ligament was repaired with one 3.5mm Twinfix suture anchor using a running locking stitch (Smith and Nephew). The MCL was found to be intact. Elbow stability was reassessed, and found to be stable throughout a full arch of motion.

Figure 4

Figure 3:Intraoperative image intensification of the right elbow, showing internal fixation of the ulna, radial head replacement and a bone anchor securing the LCL. The radial head fragment was fixed with 2 screws medial to the ulna plate.



The patient started supervised range of motion exercises immediately. At the 6-week mark, the fracture site was non-tender, the hardware was not prominent and there were no signs of infection. During the 6-month follow up, the patientâ™s range of motion was functionally satisfactory with 30-125 degrees flexion arc, 50 degrees of supination and 50 degrees of pronation.

CT scans at 12 months follow up showed union of the radial head to the coronoid.

Figure 5

Figure 4:CT scan at 12 months showing union of the radial head to the coronoid

DISCUSSION

Elbow dislocations are categorized as simple or complex. A simple dislocation of the elbow is a capsule-ligamentous injury with no fractures, while 10 to 15% of dislocations are described as complex, involving associated bony injuries (2). It has been postulated that trauma to the elbow represent a continuum of injury manifest in a number of different fracture patterns (6). Elbow dislocations with associated radial head and coronoid fractures are referred to as Terrible Triad injuries because of their historically poor outcomes (7). A rare variant with a proximal ulna fracture involving the coronoid and posterior fracture-dislocation of the radial head has been described and referred to as a Type II Monteggia variant (8), and is particularly complex as it threatens the integrity of both elbow flexion and extension as well as forearm rotation(8).

Fractures of the proximal ulna with dislocation of the proximal radioulnar joint have are known as Monteggia fractures. The most common mechanism of injury for this type of injury is usually a fall on the outstretched hand with the arm abducted. Bado (9) classified them into four types according to the direction of displacement of the head of the radius and the angulation at the site of the fracture of the ulna. Bado Type II (posterior dislocation of the radial head) is the most common in adults, and often associated with radial head and even coronoid fractures. Jupiter (8) further

subclassified these Bado Type II fractures based on their location on the ulna: Type IIA involves the coronoid process, IIB are fractures of the metaphysis just distal to the coronoid process, IIC are fractures of the ulna shaft, and IID are complex and multifragmented proximal ulna fractures. Jupiter also described a variant, with an anterior triangular or quadrangular fracture fragment at or near the level of the coronoid, referred to as a Monteggia lesion (8). Strauss et al (10) also described a rare variant of the Type II Monteggia lesion associated with ulnohumeral dislocation and poor functional results.

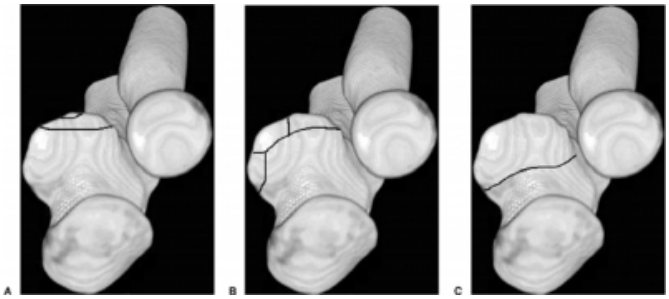
Strauss (10) found that for patients with a Monteggia lesion with ulnohumeral dislocation the mean post-operative elbow flexion was to 120 degrees (100 to 140) and extension lacked a mean of 25 degrees (10 to 45). The mean pronation was 50 and supination was 55. Posterior ulnohumeral instability led to poorer functional outcomes with a lower Broberg-Morrey index score and a higher DASH standardized symptom score Ring et al (11) found that patients with Bado Type II fractures with an associated coronoid fracture had a higher prevalence of unsatisfactory results, as compared to patients who did not have a coronoid fracture.

Fractures of the coronoid are associated with the most challenging traumatic elbow instabilities. It has been referred to as the keystone of the elbow– a critical element for stable, effective elbow function (12). Studies have also shown that in association with radial head fractures and lateral collateral ligament injuries, even small coronoid fractures could destabilize the elbow (12). The coronoid acts with the radial head to form an anterior buttress of the elbow, preventing posterior subluxation or dislocation, and also acts to ensure rotatory stability of the elbow.

There are two common classifications of coronoid fractures; that of Regan and Morrey (13) and that of Oâ™Driscoll (14). Regan and Morreyâ™s classification is based on fracture size (from type 1- avulsion of the tip to type 3- involving >50% of the coronoid process), whereas Oâ™Driscollâ™s describes the fragmentation pattern. The groups are further divided into subtypes based on the severity of coronoid involvement. Our patient had a type 3 Oâ™Driscoll fracture and was found to be severely comminuted.

Figure 6

Figure 5: Classification of fractures of the coronoid process according to OÃ¢Â™Driscoll et al. (A) Type 1 includes transverse fracture of the tip. (B) Type 2 involves the anteromedial facet of the coronoid process. (C) Type C includes fractures at the base of the coronoid process.



The challenge of treating complex elbow dislocations is achieving adequate sta/bilisation of the elbow to prevent recurrent instability whilst allowing early range of movement of the elbow joint. Recommended treatment for terrible triad injuries is operative (15) to restore stability of the joint, involving fixation of the coronoid fragment, fixation or replacement of the radial head, repair of the LCL complex, and/or application of a hinged external fixator. Recognizing that the anterior coronoid fragment requires stable fixation is critical in achieving an optimal outcome. Reconstruction of the coronoid process using the excised radial head fragment has only been rarely described in the literature (3-5). Our case is unique in that stability of the elbow was achieved so that immediate range of motion exercises could be initiated. The patient treated by Ring et al (3) required supplemental protection with a hinged external fixator, and the patient treated by Esser et al (4). was treated with immobilisation for 3 weeks using a posterior splint.

The inherent instability of these types of injuries has in the past required prolonged immobility of the elbow and as a result, long lasting elbow stiffness and loss of function. Operative treatment with the aim of achieving as stable a joint as possible allows for early range of motion exercise with the aim of preventing this common complication. When to commence range of motion exercises depends on the stability of the elbow; in some patients they may be commenced day 1 post operatively. Adequate range of motion for daily functioning is generally considered to be 30-130degreees for flexion-extension (normal being 0-140deg), with 50 deg of pronation and 50 deg of supination (normal being 80-90 for pronation and 90 for supination).

Treatment options most commonly described for coronoid

fractures are one or two lag screws to fix the fragment, or lasso-type suture placement for smaller fracture fragments, as well as pre-contoured buttress plates (12). Case reports of use of the radial head fragment with its articular surface to reconstruct the coronoid head are rare, with this treatment option usually reserved for severely comminuted coronoid fractures not amenable to usual fixation techniques.

In the previous reports of coronoid reconstruction with radial head, Esser (4) stabilized the elbow for 3 weeks using a posterior splint, while Ring et al (3) found that they needed to stabilize the elbow with temporary hinged external fixation. Kalicke et al (5) used the radial head or iliac crest to reconstruct Broberg and Morey Type III coronoid fractures, but only as a second procedure, and only after persistent subluxation of the elbow joint. These patients only experienced moderate functional outcomes according to the Morey score. These patients were also immobilized for a period after surgery. We were able to primarily use the excised radial head to reconstruct the coronoid, and achieve adequate stabilisation to permit immediate range of motion of the elbow, previously not documented. At 12 months, a follow up CT scan showed a union of the radial head to the coronoid providing an adequate anterior buttress to the elbow.

The radial head fracture is important to treat in order to restore stability to the elbow joint as it provides an anterior and valgus buttress to the elbow. Fractures are classified according to Mason (16). Treatment depends on the pattern of fracture and size of fragment/s. Fixation by fragment screws can be adequate if there are one or two fragments, or excision with replacement if stable reduction is not feasible (2) (e.g. with severely comminuted fractures or associated radial neck fractures). In our patient, a replacement of the radial head was performed.

Using the excised radial head to reconstruct a severely comminuted coronoid post complex elbow dislocation is a viable option in the primary setting, to help achieve optimal functional and prevent chronic instability.

References

1. Tashjian RZ, Katarincic JA: Complex elbow instability. J Am Acad Orthop Surg; 2006; 14: 278-286
2. Mathew PK, Athwal GS, King GJW: Terrible triad injury of the elbow: Current Concepts. J Am Acad Orthop Surg; 2009; 17: 137-151
3. Forthman C, Henket M, Ring DC: Elbow dislocation with intra-articular fracture: The results of operative treatment without repair of the medial collateral ligament. J Hand Surg; 2007; 32A: 1200-1209
4. Rene D, Esser MD: Reconstruction of the coronoid process with a radial head fragment. Othopedics; 1997; 20: 169-171
5. Kalicke T, Muhr G, Frangen TM: Dislocation of the elbow with fractures of the coronoid process and radial head. Arch Orthop Trauma Surg; 2007; 127: 925-931
6. Ring D, Jupiter JB: Current Concepts Review: Fracture dislocations of the elbow. J Bone and Joint Surg; 1998; 80A: 566-580
7. Hotchkiss RN: Fractures and dislocations of the elbow, in Rockwood CA Jr, Green DP, Bucholz RW, Heckman JD. Rockwood and Greenâ™s Fractures in Adults, ed 4; 1996; 1: 929-1024
8. Jupiter JB, Leibovic SJ, Ribbans W, Wilk RM: The posterior Monteggia Lesion: J of Orthopaedic Trauma; 1991; 5: 395-402
9. Bado JL: The Monteggia Lesion. Clin Orthop; 1967; 50: 71-76
10. Strauss EJ, Tejwani NC, Preston CF, Egol KA: The posterior Monteggia lesion with associated ulnohumeral instability. J Bone and Joint Surg; 2006; 88B:84-89
11. Ring D, Jupiter JB, Simpson NS : Monteggia fractures in Adults. J Bone and Joint Surg; 1998; 80A: 1733-1744
12. Ring D: Fractures of the Coronoid process of the ulna. J Hand Surg; 2006; 31A:1679-1689
13. Regan W, Morrey BF: Fractures of the coronoid process of the ulna. J Bone Joint Surg; 1989; 71A: 1348-1354
14. Oâ™Driscoll SW, Jupiter JB, Cohen M, Ring D, McKee MD. Difficult elbow fractures: pearls and pitfalls. Instr Course Lect; 2003; 12: 466-471
15. McKee MD, Pugh DMW, Wild LM, Schemitsch EH, King GJW. Standard surgical protocol to treat elbow dislocations with radial head and coronoid fractures; J Bone Joint Surg; 2004; 86A: 1122-1130
16. Mason ML: Some observations on fractures of the head of the radius with a review of one hundred cases. Br J Surg; 1954; 42: 123-132

Author Information

AJ Kanawati, MBBS UNSW
Orthopaedic Registrar, Blacktown Hospital

P Lorentzos, MBBS USyd
Orthopaedic Registrar, Blacktown Hospital

M Anderson
Medical Student, Westmead Hospital

Tim Bell
Orthopaedic Fellow, Blacktown Hospital