CASE REPORT

Corrective osteotomy through fracture site and internal fixation with headless screws for type I (Hahn-Steinthal) capitellar malunion

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SUMMARY

A 20-year-old woman presented 6 months after an initial injury to her left elbow with pain and restricted movements. She was diagnosed with a type I malunited (Hahn-Steinthal) type of capitellum fracture through radiographic studies. Classically, the treatment has been excision of the fragment, which carries a risk of valgus instability of the elbow and late osteoarthritis. We report a case of malunited type I capitellum fracture, for which corrective osteotomy through fracture site, open reduction and internal fixation was done 6 months following missed trauma. At 24 months follow-up the capitellum fracture had united and the patient has a stable elbow and excellent range of motion. Our case demonstrates that for type I malunited capitellum fractures corrective osteotomy through fracture site and internal fixation rather than excision of the fragment in young can result in successful union and stable elbow.

headless screws in young patients can result in successful union and excellent elbow function.

CASE PRESENTATION

A 20-year-old woman had a fall on to the point of her left elbow from a bike. She consulted a nearby physician, where radiographs were taken and she was told there was no bony injury and a back slab was applied for 1 month. Following splint removal, the patient continued to have pain and severe restriction of elbow flexion.

She presented to us 6 months after the injury with elbow pain and stiffness. Local examination revealed tenderness over the distal end of the humerus and the radial head. Elbow range of motion was between 30° and 60° and pronation-supination was grossly restricted. There were no distal neuro-vascular deficits.

BACKGROUND

Malunited type I capitellum fractures with a block to elbow movements have been traditionally treated with excision of the fragment. However, in young, valgus instability and early osteoarthritis are complicating factors. We state that, corrective osteotomy through fracture site and internal fixation with

INVESTIGATIONS

Radiographs of left elbow showed malunited type I (Hahn-Steinthal) fracture of the capitellum with associated undisplaced fracture of the radial neck with signs of union (figure 1). CT scan with three-dimensional reconstruction confirmed the above findings (figure 2).

Figure 1 Anteroposterior and lateral radiograph of left elbow showing malunited type I (Hahn-Steinthal) type of capitellum fracture with undisplaced fracture of the radial neck with signs of union.

To cite: Jeevannavar SS, Shenoy KS, Daddimani RM. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-009230

Figure 2 (A) Axial, (B) sagittal and (C) three-dimensional reconstruction CT images of left elbow demonstrating malunited Hahn-Steinthal type of capitellum fracture.

TREATMENT

The treatment options, that is, corrective osteotomy through fracture site with open reduction and internal fixation vis-a-vis excision of the malunited fragment, were discussed with the patient. The patient opted for corrective osteotomy, open reduction and internal fixation. Open reduction and internal fixation was done by lateral approach to the elbow. Full thickness flaps were developed and raised subperiosteally from the supracondylar ridges both anteriorly and posteriorly and capsulotomy performed. Radial head fracture was inspected and found to be united. The capitellar fragment was found displaced anterosuperiorly and malunited to the parent humerus. Joint was debrided and fibrous tissue overlying the fracture bed was curetted out to create a raw surface with cancellous bone. The malunited fragment was osteotomised, gently reduced to its original bed and provisionally fixed with a K-wire (figure 3). The reduction was assessed and found to be satisfactory. The capitellar fragment was then definitively fixed with two cannulated Herbert screws passed in anteroposterior direction and countersunk under the articular cartilage.

OUTCOME AND FOLLOW-UP

Postoperatively a back slab was applied and continued for 1 month, after which active exercises of the elbow were initiated. The patient was followed-up regularly and at each follow-up, progressive improvement in the range of motion of elbow was noted along with radiological evidence of fracture union on serial radiographs. At 24 months follow-up, the patient has elbow range of motion of 10° to full flexion, full supination and pronation and a stable elbow (figure 4). x-Ray shows fracture union with no evidence of avascular necrosis (figure 5).

DISCUSSION

Fractures of the humeral capitellum account for 1% of all elbow fractures and 6% of all distal humeral fractures.^{1–3} Associated injuries include fractures of the radial head and neck, posterior dislocation of elbow or tears of the lateral collateral ligament complex are seen in 20% cases.^{2–8} Our case had an associated undisplaced radial neck fracture which was found to be united intraoperatively.

Bryan and Morrey have classified capitellar fractures into three types.^{8,9}

- ▶ Type 1—described by Hahn¹⁰ and Steinthal¹¹ separately and hence called as Hahn-Steinthal type. This involves a large part of the osseous portion and subchondral bone of the capitellum, and hence also called the complete type.
- ▶ Type 2—described by Kocher¹² and Lorenz¹³ separately and hence called as Kocher-Lorenz type. This type of fractures involves articular cartilage with very little subchondral bone attached. They are also called as the incomplete type.
- ▶ Type 3—these are comminuted fractures of the capitellum.

McKee and associates have described the fourth type, that is, the coronal shear type.¹⁴ This is a shearing fracture of the anterior surface of the distal end of the humerus such that the capitellum and a major portion of the trochlea, including the lateral trochlear ridge, become separated as one fragment.

Fractures of the capitellum are rare and can be easily missed if there is no high index of clinical suspicion. Standard anteroposterior and lateral views are sufficient in most cases. However, they can miss type 2 fractures as the extent of subchondral bone involvement may be minimal. Watts *et al*⁸ report that plain radiographs often underestimate the degree of complexity of the fracture and recommend routine use of CT. In our case, there was a Hahn-Steinthal type of fracture of the capitellum without

Figure 3 Intraoperative pictures showing (A) Capitellar fragment (*) malunited to the distal humerus, (B) Capitellar fragment after osteotomy and mobilisation, (C) Reduction and provisional fixation with K-wire.

Figure 4 Clinical photographs at 24 month follow-up showing (A) 10° restriction of extension, (B) full flexion, (C) full pronation and (D) full supination of the left elbow.

any extension medially or posteriorly, as documented by CT scan. Our case reinforces the need for CT scan when the diagnosis of capitellar fractures is difficult on plain x-rays as the fracture was missed initially after the elbow injury.

There are wide varieties of recommendations for treatment of acute capitellum fractures, extending from closed treatment^{14–17} to surgical excision^{18 19} and open reduction internal fixation (ORIF).^{2 5 6 9 20–22} A review of literature suggests a change in the trend in treatment of acute fractures of the capitellum, from excision of the fragment to open reduction and internal fixation. Numerous case series in the past have documented suboptimal results with excision.^{2 6 16 23–25} Excision of the capitellum may be associated with development of elbow instability, especially in cases where there are associated ligamentous injuries.²⁶

Figure 5 Anteroposterior and lateral radiograph at 24 month follow-up showing a united capitellum fracture with no obvious evidence of avascular necrosis.

Excision may be indicated only in elderly patients with low demands.²³

A wide variety of implants have been used to fix the capitellum, ranging from K-wires to headless screws^{21 27–32} to absorbable implants¹ and fine-threaded implants.³³ Herbert screws are widely used as it can be buried underneath the cartilage in subchondral bone.²³ Placing the screws in anterior to posterior direction has been preferred as it is biomechanically better than posterior to anterior directed screws.²³ Also it is said to preserve the blood supply to the capitellum by not disrupting the posterior soft tissues which are usually intact.^{23 29} Internal fixation with resorbable implants for capitellum fractures have also been used with good results and can be considered. The preferred approach for fixation has been the lateral approach.²³ We performed the fixation in lateral approach using two Herbert screws passed in anterior to posterior direction.

There is paucity of literature regarding the treatment of capitellar malunion and to our knowledge till date; there is only one case report of delayed reconstruction of capitellar malunion with excellent functional results.¹ Traditionally, malunited capitellum fractures with a block to elbow flexion have been treated with excision of the fragment.²⁶ We discussed the treatment options, that is, excision vis-à-vis corrective osteotomy and reconstruction with the patient. The advantages and disadvantages of both corrective osteotomy and internal fixation and also excision were explained. As the patient's age and occupational demands necessitated a stable elbow, the patient opted for corrective osteotomy and reconstruction. The possibility of a second surgery, that is, excision of the fragment, in the event of development of avascular necrosis was explained to and accepted by the patient. At 24 month follow-up, the fracture was united with no x-ray evidence of avascular necrosis.

Our case highlights the fact that delayed reconstruction in the form of corrective osteotomy, open reduction and internal

fixation in a malunited type I Hahn-Steinthal type of capitellum fracture can achieve good short-term results in the form of stable elbow and functional range of motion. However, longer follow-up is needed to look for the development of osteoarthritis or avascular necrosis.

Learning points

- ▶ CT scan is essential for diagnosing subtle capitellar fractures.
- ▶ Consider corrective osteotomy through fracture site and internal fixation with headless screws as initial treatment for type 1 malunited capitellum fracture in young rather than excision.
- ▶ Anterior to posterior directed screws are less likely to result in avascular necrosis of the capitellum.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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