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CASE REPORT

Ligamentous reconstruction of the elbow in a 13-year old using a circumferential technique

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Introduction

Elbow dislocations are relatively rare in children. Treatment is usually conservative, however associated injuries are common and may need to be addressed surgically.[12] Controversy exists on the need for surgical treatment of these fractures, but operative treatment is advised if closed reduction is not possible.[16] No guidelines however exist regarding the reduced elbow, which remains unstable.

To date few reports have been published on late lateral reconstructions of the elbow.[3,8,10,17] Nor to our knowledge has delayed medial and lateral reconstruction of the elbow been previously described in a child. In the present report we describe a case of recurrent dislocations of the elbow in a 13-year-old male, necessitating reconstruction of both the medial and lateral ligamentous complexes.

Case report

A 13-year old, right hand dominant boy was referred for the management of recurrent dislocations of his left elbow. He initially sustained a fracture dislocation to this elbow following a fall from a trampoline 9 months earlier. The elbow had dislocated posteriorly and radiographs revealed a Regan–Morrey type I[14] coronoid fracture and a bony avulsion of the humeral insertion of the lateral collateral ligament complex. The elbow was reduced under general anaesthesia and treated conservatively with a long arm cast.

Following this initial trauma, the elbow dislocated a further four times following minor traumas, before being assessed in our clinic. After each dislocation the elbow was reduced under general anaesthesia and the arm was placed in a cast for 6–7 weeks.

The elbow was grossly unstable and motion was painful. There was a fixed flexion deformity of 10° and flexion was limited to 120°. Pronation and supination were normal with the elbow held reduced. There was apprehension with the pivot shift manoeuvre[9] and the chair and push-up signs.[13] There was a soft opening of the medial joint line with a valgus stress. The Mayo Elbow Performance Score[7] was poor with a score of 25 points.

Plain radiographs demonstrated a malunited coronoid fracture, evidence of a humeral avulsion of the lateral collateral ligament and mild ossification of the lateral collateral ligament complex (Fig. 1). The elbow was painful necessitating constant use of oral analgesics, including occasional opioids.

The Gruelich and Pyle method was used to determine the patient's skeletal age. Radiographs of the hand showed an estimated skeletal age of 12 years old and that the patient had reached approximately 85% of his final height. Considering the age of the patient, a conservative non-surgical

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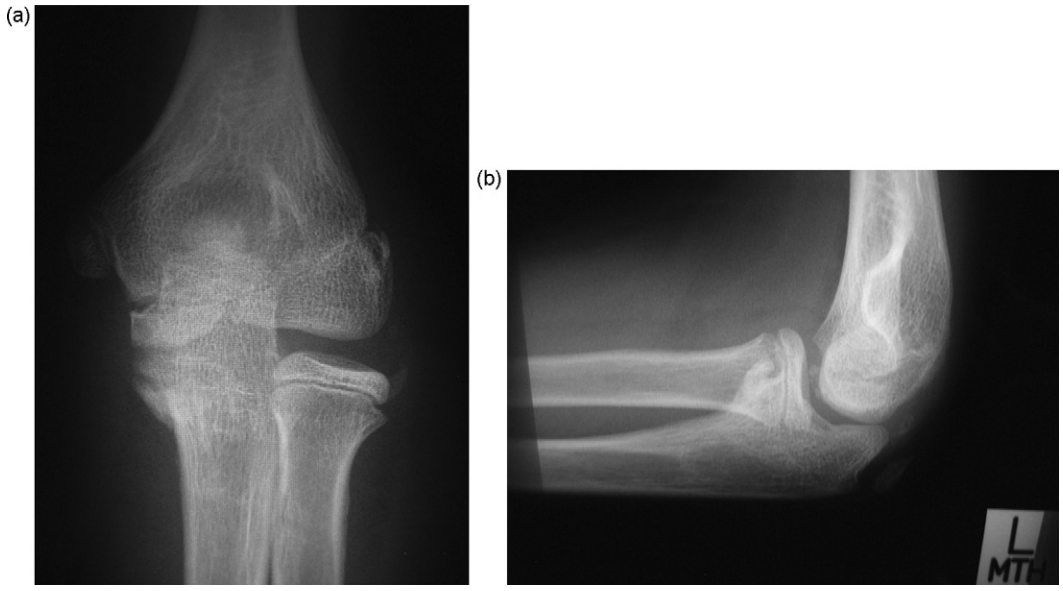

Figure 1 (a and b) AP and lateral preoperative radiographs showing a malunited coronoid fracture, evidence of a humeral avulsion of the lateral collateral ligament and mild ossification of the lateral collateral ligament complex.

approach was advised despite the need for analgesia, which included occasional opioids. At subsequent reviews the patient and his mother stressed that the painful, unstable elbow was severely affecting the patient's activities of daily living, as well as school performance and social life and reconstructive options were discussed with the patient and his mother. The consent for surgery included detailed discussions about potential growth plate arrest, the risk of deformity and the option of delaying the surgery until skeletal maturity. Indications for a surgical procedure included severe pain and gross instability not responding to conservative measures, following multiple dislocations of the elbow.

At 13 months following his initial injury an examination under anaesthetic and diagnostic arthroscopy was performed. The patient had a typically positive pivot shift test.[5,9] This was confirmed using fluoroscopy.[1] In addition the medial joint space could also be seen to open with valgus stress of the elbow.

A standard arthroscopy was performed. In the anterior aspect of the joint could be seen a rent in the lateral capsule at its insertion into the lateral humerus. With a valgus force on the elbow the medial joint line could be seen to open 4 mm, considerably greater than that reported to be normal.[2] With the arthroscope in the posterior midline portal the ulno-humeral joint space could be seen to open to 5 mm in both supination and pronation at 30° of flexion. The arthroscope could be passed from the lateral side of the joint to the medial side via the ulno-humeral articulation. The malunited portion of the coronoid process was removed to prevent potential future impingement.

Following the arthroscopy a midline posterior incision as made over the elbow. The ulnar nerve was visualised and protected throughout the procedure. A medial muscle split was performed and this again confirmed the rupture of the medial collateral ligament.[18] The lateral collateral ligament complex was approached through Kocher's interval.[6,11] There was a rent in the lateral capsule insertion with the entire capsule avulsed as a sheet and similar to what we have reported previously.[4] It was apparent that the lateral capsular sheet is avulsed from the humerus and recurrent lateral instability was due to failure of this sheet to heal to the humerus as it was translated distally onto the capitellar articular surface.

A 4.5 mm drill-hole was made through the axis of rotation on the humerus. Two further tunnels were drilled in the proximal ulna. The first tunnel was drilled from the sublime tubercle medially to the supinator crest laterally. The second tunnel was drilled transversely through the proximal ulna, from the insertion of the posterior band of the medial collateral ligament.

An autograft gracilis tendon was harvested from the ipsilateral leg, with the use of a tendon stripper. The tendon graft was first passed through the humeral tunnel from lateral to medial. Secondly the tendon was passed through the distal ulnar tunnel and again through the humeral tunnel from lateral to medial. This reconstructed the anterior band of the medial collateral ligament and the lateral ulnar collateral ligament. Finally the tendon was passed through the proximal ulnar tunnel and up to the lateral opening of the humeral tunnel where it was sutured to the LUCL reconstruction using Ethibond number 2 (Ethicon, Johnson & Johnson, Somerville, NJ, USA) thereby reconstructing the posterior band of the medial collateral ligament and the posterolateral capsule.

Capsular redundancy was also plicated, using vicryl sutures (Ethicon, Johnson & Johnson, Somerville, NJ, USA).

A plaster slab was applied for 1 week after which the patient was allowed to mobilise the elbow as tolerated. As the joint was very stable the patient was advised to commence mobilisation, but to not place any significant force through the upper limb. At 6 weeks following surgery the patient had regained a functional range of motion. At 6 months the patient was advised that he could return to all sporting activities.

At 24 months follow-up, the patient reported no further episodes of instability. This was despite numerous falls from

Figure 2 (a and b) AP and lateral postoperative radiographs at age 16 showing a normally developing, congruent elbow with evidence of bone tunnels in the humerus and proximal ulna and minor non-progressive ossification of the lateral collateral ligament at 24 months follow-up.

his skateboard. On examination the elbow was stable in all directions. Range of motion was measured with flexion from 9° to 155°, with full pronation and supination. The elbow was pain free and the patient was participating in all school sporting activities without restrictions. The Mayo Elbow Performance Score was excellent with a maximum score of 100. Radiographs demonstrated a normally developing, congruent elbow with evidence of bone tunnels in the humerus and proximal ulna and minor non-progressive ossification of the lateral collateral ligament (Fig. 2). Subjectively, the patient and his mother are very satisfied with the result of the procedure performed.

Discussion

Recurrent dislocation of the elbow in a child is a challenging problem. Optimal timing of a potential surgical intervention is unknown. Development of the growing upper extremity is an issue and although growth centres at the elbow contribute only approximately 20% of the ultimate length of the arm,[16] resulting varus or valgus deformity could have a detrimental effect on the outcome of surgery. Lateral ligament reconstruction has previously been described in children, as part of a larger group of patients[10,17] and in only one case report.[15] Data on the delay between surgery and injury was only supplied in one of the series. There was an average delay of 4 years between injury and surgery in five patients under 18 years of age, with an age range of 10—17 years old. It is not possible to calculate the exact age of the patients from the data provided, but it seems that only one patient had surgery before the age of 18,[10] indicating the tendency to wait until the patient has reached skeletal maturity. The senior author of this paper attempted to do this as well. Despite the excellent result in this single case, we caution the use of ligamentous reconstruction in all paediatric patients with recurrent instability of the elbow. Further experience is required before a recommendation can be made on the effect of complex surgery around the elbow in this age group.

The present review is a rare case of a 13-year-old patient with recurrent dislocations of the elbow. Arthroscopy is valuable in the assessment of elbow instability and demonstrated medial and lateral instability of the elbow. Previously other authors may have considered a separate medial and lateral ligamentous reconstruction. We successfully used a circumferential technique, designed by the senior author to reconstruct stability of the joint using multiple passes with a single continuous tendon graft. Through this technique varus, valgus, posterolateral and posteromedial instabilities are all addressed and all four facets of the greater sigmoid notch are supported by a contralateral limb of the graft. This has the advantage of utilising only one donor tendon, which provides stability against varus, valgus, pronation and supination. We have also utilised this in other complex adult instabilities.

Potential complications such as infection can have a detrimental effect on the developing upper extremity and we would also have preferred to postpone the procedure until the patient was skeletally mature. However, in the case presented, the elbow pathology was severe, with multiple dislocations following minor trauma resulting in a painful and restricted arc of motion. The elbow pathology was not responding to conservative measures and had influenced his socio-psychological function. The use of the circumferential technique in these circumstances successfully restored stability and function of the elbow, without affecting growth and development of the elbow.

Conflicts of interest

None of the authors have any conflicts of interest to declare.

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