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Fractures of the capitellum humeri in adolescents

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Abstract Six children between 11 and 15 years old with a displaced fracture of the capitellum were treated by open reduction and fixation with one small screw. In all cases union occurred. There were no complications and all the children regained normal elbow function. There were no cases of avascular necrosis.

Résumé Six enfants entre 11 et 15 ans ont été traités pour une fracture déplacée du capitellum par réduction ouverte et fixation interne par vis. La consolidation s'est toujours effectuée sans complications et avec une récupération complète de la fonction du coude. Il n'y avait pas de cas de nécrose avasculaire.

Introduction

Although elbow fractures have a high incidence in the pediatric population [14], fractures of the capitellum are seen mostly in adults, and only few reports deal with the treatment in children. These fractures are seen almost exclusively in individuals older than age 12 years [3,7] and indications for surgical treatment of capitellar fractures are poorly defined. This report presents the results of 6 children with a displaced fracture of the capitellum treated by open reduction and internal fixation.

Patients and methods

During a 15-year period 6 adolescents with a fracture of the capitellum humeri were treated at our institution. This represents about 0.4% of all elbow injuries seen in the same period. All fractures corresponded to Type I or Hahn-Steinthal fractures [8]. This type is a coronal shear fracture and involves the major part of the capitellum, typically displaced upwards and forwards (Fig. 1B). There

were 3 boys and 3 girls whose ages ranged from 11 to 15 years (average 13.5 years). The dominant right side was affected in 4 cases. All fractures were caused by a fall on the outstretched hand. Diagnosis in all cases was made on standard roentgenograms of the affected elbow (Fig. 1A,B). There were no other injuries to the fractured elbow. All patients were treated by open reduction and internal fixation. Under general anesthesia an attempt was made at closed reduction but complete reduction could not be achieved in that way. With a pneumatic tourniquet in place a posterolateral incision was made. Further manipulation of the fragment allowed reduction that was held in the corrected position and fixed with one small screw. The screw was inserted in a posteroanterior direction through the posterior surface of the lateral condyle. Protruding of the tip of the screw from the articular surface was avoided (Fig. 2A,B). Care was taken to dissect the posterior surface as little as necessary. Postoperatively the elbow was immobilized in a long arm cast at a right angle with the forearm in neutral position for 3 weeks. All patients had regular follow-up consultation and all returned to a special follow-up consultation.

The follow-up period ranged from 15 years to 14 months (average 4.8 years). All patients had a clinical examination and roentgenographic control. Patients were asked about pain and daily activities. Elbow flexion-extension and pronation-supination were evaluated and compared with the contralateral side. The carrying angle was measured using a goniometer.

Results

All the patients were able to perform normal elbow movements and normal daily activities without pain, but they all mentioned having limited mobility after removal of the plaster cast. Only 1 patient had physiotherapy for 6 weeks. There were no complaints. A clinical examination revealed loss of flexion in 2 patients of 5° and 10°, respectively. There were no cases of varus or valgus angulation and no patient had infection. There were no radiological signs of avascular necrosis or early degenerative changes.

Discussion

The ossification center of the capitellum normally appears at between 1 and 2 years of age and fuses at about the age of 14 years [12]. Fractures of the capitellum are

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Fig. 1A,B Anteroposterior (A) and lateral radiograph (B) of the elbow of a 13-year-old girl with a typical Hahn-Steinthal fracture

Fig. 2A,B Anteroposterior (A) and lateral radiograph (B) after reduction and internal fixation

usually associated with a lateral metaphyseal fragment and this constitutes the lateral condyle fracture in children. This is a relatively frequent fracture and accounts for 10–20% of all elbow fractures in the pediatric population. Fractures of the lateral condyle contain the epiphysis of the capitellum, the lateral epicondyle, a part of the distal humeral metaphysis and possibly a part of the trochlea. This is a Salter-Harris type IV fracture [10] and should not be confused with a true capitellum fracture, which involves only the articular surface of the capitellar epiphysis. Differentiation between a fracture of the lateral humeral condyle and a capitellar fracture is important in respect to treatment [6]. True fractures of the capitellum are rare. Silberstein et al. [12] described some vagaries of the capitellum that may be misdiagnosed as a fracture. The ossification center of the capitellum begins as a sphere and is anteverted approximately 40° and forms an angle of approximately 140° with the humeral shaft. The capitellar epiphysis lies anterior to the humerus, and the physis is wider posteriorly than anteriorly and is likely to be misinterpreted as a separation fracture.

Clinically, a fracture of the capitellum is atypical, with pain, minimal swelling and tenderness on the lateral side of the elbow. The diagnosis is made on the lateral radiograph of the elbow, which shows a characteristic semilunar fragment detached from the humeral condyle and lying anterior to the distal humerus (Fig. 1B). The anteroposterior view may appear normal (Fig. 1A). In this series arthrography as proposed by Drvaric and Rooks [2] was not necessary to make the correct diagnosis.

The cause of this injury is a fall on the outstretched hand. The most commonly accepted mechanism is that transmission of an axial force through the radius shears

off the capitellum in the coronal plane [8]. It seems that cubitus valgus or cubitus recurvatus may predispose the elbow to this injury [7]. This could not be demonstrated in our series.

In adults a variety of treatment methods for capitellar fractures have been described. Options include closed reduction [1,4], excision of the fragment [3,4,6] and open reduction with internal fixation [4,6]. Johansson and Rosman [6] described good results after excision of the capitellar fragment in an adolescent girl. The simplicity of fragment excision is tempting but it may render the elbow unstable [4,13] and is not recommended by the current authors in a young patient. Closed anatomical reduction was not possible in our patients. In open reduction of capitellar fractures in adults a wide variety of techniques of internal fixation are described as there are Kirschner wire fixation [7,9], biodegradable pins [5], fibrin glue [11], cancellous screws or Herbert screws [7,9,13]. A simple and relative stable fixation with 1 small screw was used in our patients. This provided good stability and allowed early active motion after cast removal. Open reduction and internal fixation are thus recommended for displaced capitellar fractures in the pediatric age group.

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