



An atypical case of elbow fracture Bilateral Capitellum Humeri Fracture in a Teenager

Laura COROMINAS, Julia SANPERA, Enrique RODRIGUEZ DE LA RUBIA

Fractures of the capitellum are rare injuries of the elbow rarely seen in adolescents.

We report a case of a 14 year-old boy who sustained a bilateral Hahn-Steinthal type fracture of his capitellum humeri. To our knowledge, such bilateral injury has not been reported before in teenagers.

This paper reviews the literature regarding the epidemiology, classification and management of this rare pediatric capitellar fracture

INTRODUCTION

Fractures of the capitellum humeri are rare injuries of the elbow, which usually result from axial loading of the capitellum by forces transmitted through the radial head (27) as an isolated injury, fractures of the capitellum humeri account for 0.5% to 1% of all elbow injuries (20).

In children under the age of 12, these fractures are even more unusual. (9) The predominantly cartilaginous composition of the capitellum below that age explains its resistance to stress. For this reason, a fall on the outstretched hand, which is the mechanism of injury in most of these cases, is more likely to produce a supracondylar or lateral condylar fracture (12,18). The youngest ever reported patient in the literature has been a 6-year-old with an isolated and unilateral capitellar fracture (25).

The first description of an isolated capitellum fracture was provided by Hahn (11) in 1853 and together with further reports from Kocher (16),

Steinthal (30) and Lorenz (19) a classification of fractures into two types evolved. The classification system accepted at present, which recognizes 4 types, is descriptive and not treatment-directed (27). Type I (Hahn-Steinthal fracture) is a shear fracture involving a large osseous portion of the capitellum in the coronal plane of the distal humerus and a little or none of the trochlea. Type II (Kocher-Lorenz fracture or Mouchet fracture (28) is a superficial osteochondral fracture affecting nearly pure articular cartilage and little or no subcondral bone. Type III was originally described by Brian and Morrey (2). It is a comminuted fracture and the fourth type is a coronal shear fracture involving the capitellum and a portion of the trochlea (20) (Table I, Fig.1).

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- Laura Corominas M.D., Ph.D.
Pediatric Orthopedic Department, Hospital Son Espases, Palma De Mallorca, Spain
 - Julia Sanpera Iglesias, M.D (Year 2 Doctor General Surgery)
Southmead Hospital, North Bristol Hospital Trust Foundation
 - Enrique Rodriguez de la Rubia, M.D.
Orthopedic Department, Clinica Rotger
- Correspondence : Laura Corominas, Pediatric Orthopedic Department, Hospital Son Espases, Carretera De Valdemosa 79, 07012 Palma De Mallorca, Spain
E-mail : lauracorominas1979@gmail.com
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Table I. — Capitellum fracture classification (Bryan and Morrey with Mc Kee modification)

Type I	Large osseous piece of capitellum involved. Can Involve trochlea
Type II	Kocher-Lorenz Fracture Shear fracture of articular cartilage Articular cartilage separation with very little subchondral bone attached
Type III	Broberg- Morrey Fracture Severely comminuted multifragmentary
Type IV	Mc Kee modification Coronal Shear fracture that includes The capitellum and trochlea

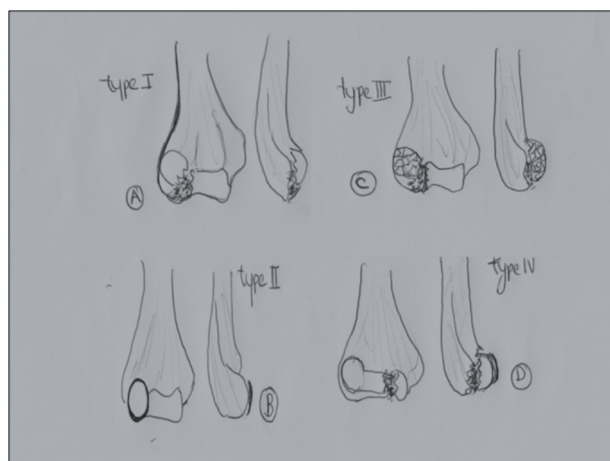


Fig. 1. — Capitellum fracture classification (Bryan and Morrey with McKee modification). Drawn by the authors

Regardless of the classification system used, it is necessary to gain an appreciation of the complexity of the fracture pattern to best prepare for operative treatment of the injury (21). A preoperative tomography scan can help identify this more complex fracture pattern.

A true fracture of the capitellum is an osteochondral fracture and is entirely intra-articular. The epicondyle, the growth plate and the metaphysis are not involved, and the posterior part of the lateral condyle is intact. (9). If such a fracture is undiagnosed and consequently untreated, it could cause substantial disability by limiting elbow motion. (2,5,8,9,10,22). Because this type of fracture is uncommon, evidence-based studies around this subject are insufficient. Furthermore, the decision as

to which is the best treatment remains controversial (1,14,18). Treatment options include closed reduction, open reduction and internal fixation but there is a lack of consensus in the literature regarding optional management (7,20)

We describe the case of a 14-year-old male with bilateral capitellar fractures who was followed for two years. To our knowledge, the bilateral presentation of this type of injury has never been reported in teenagers.

Written informed consent was obtained from patient's aunt (the patient's legal guardian for publication of this case report, and any accompanying images

CASE REPORT

A 14-year-old male presented with pain in both elbows following a fall on his outstretched hands while he was riding a bicycle. The pain was localized around the outer aspects of both elbows and was exacerbated by palpation and movement.

Physical examination revealed a mild swelling and tenderness over the lateral aspect of the distal part of both humeri. The patient was able to supinate and pronate to 90° without difficulty bilaterally, but active flexion and extension were markedly limited by pain. No neurovascular abnormalities were noted. The stability of both elbows was considered to be normal and the valgus stress test was negative.

An oblique radiograph of both elbows was required to appreciate the fracture. Lateral radiographs of the distal part of the left humerus did not reveal a definite fracture (Fig 2A-2B) and anteroposterior

views were not possible, due to the patient's limitation to extend both elbows. However, lateral soft tissue swelling and both anterior and posterior fat pad signs were visible.

The CT scan revealed a 12mm displaced fracture that crossed through the body of the capitellum and extended obliquely in the coronal plane of both elbows. The diagnosis of bilateral Hahn-Steinthal type capitellum fractures was confirmed (Fig 3A-3B). To our surprise, the fracture was identical in both elbows.

Our patient was treated by open reduction and internal fixation. Under general anesthesia, the patient was placed supine, resting both upper extremities on an arm and hand surgical table. With a pneumatic tourniquet in place, a posterolateral

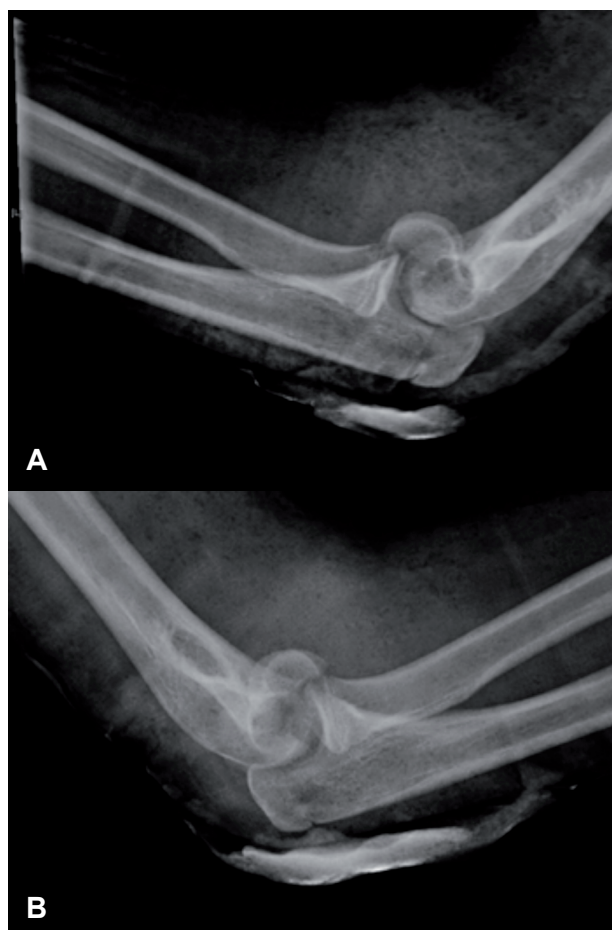


Fig. 2. — The picture shows lateral view of both elbows. A: Right elbow B: Left elbow



Fig. 3. — The CT-Scan shows a displaced fracture of the Capitellum, type Hahn-Steinthal type. A: right elbow B: left elbow. Identical fracture in both elbows.

Kocher-type approach was used to facilitate open reduction. Further manipulation of the fragment allowed reduction, which was held in the correct position with 2 Kirschner wires. To anatomically reduce the capitellar fragment, it was necessary to visualize the proximal metaphyseal edge and trochlear articulation. An intraoperative dynamic examination showed satisfactory stability of the osteosynthesis and anatomic articular congruity. The same surgery was performed on the other elbow.

Postoperatively, the upper extremities were immobilized in long arm casts at a right angle, with the forearm in a neutral position for 4 weeks. The postoperative outcome was uneventful, allowing our patient to leave the hospital 48 hours after surgery.

The follow-up was two years in duration with regular clinical examinations and radiographic control. After plaster removal, the patient followed a 2-month progressive mobilization program guided by a physiotherapist.

Radiographically, signs of consolidation were obvious after 6 weeks (Fig 4A, 4B). At the second month of follow-up, the fracture was considered to be completely healed and our patient had a good range of motion with full flexion, pronation and supination, but lacked 15° of extension. There was no varus or valgus angulation.

The implants were removed after 3.5 months. Five months after the surgery the range of motion was entirely restored. (Fig.5). At two years of follow-up, our patient had no pain, and both elbows had full range of motion, with full flexion and extension, pronation and supination. Moreover, there were no signs of avascular necrosis, physeal arrest or angular deformities in the radiograph. The patient resumed sports activities with no difficulties.

Fig 5 Range of motion of the patient : full extension and full flexion, pronation and supination of both elbows.

DISCUSSION

Fractures of capitellum are usually associated with a lateral metaphyseal fragment, which constitutes the lateral condyle fracture in children (3). Therefore, true capitellar fractures are considered to be rare.

The infrequency of these injuries can be explained through an understanding of the mechanism and the maturation of the distal humerus. The ossification centre of the capitellum normally appears between the ages of 1 and 2 years and fuses at about the age of 14. The most common injury mechanism for capitellum fractures is a fall on an outstretched hand with the radius imparting a shearing force onto the capitellum (8,10,20). The mainly cartilaginous nature of the capitellum prior to age 12 makes this fracture less likely and a supracondylar or lateral condyle fracture more plausible (14,18). As the capitellum grows and ossifies in the older children, it becomes more susceptible to shear injury (18). It is thought that increased valgus and hyper extensibility places the elbow at risk for these injuries (10)

The injury is more commonly reported in females, with a male to female ratio of 1:4 (31). Clinically, a fracture of the capitellum is atypical, with

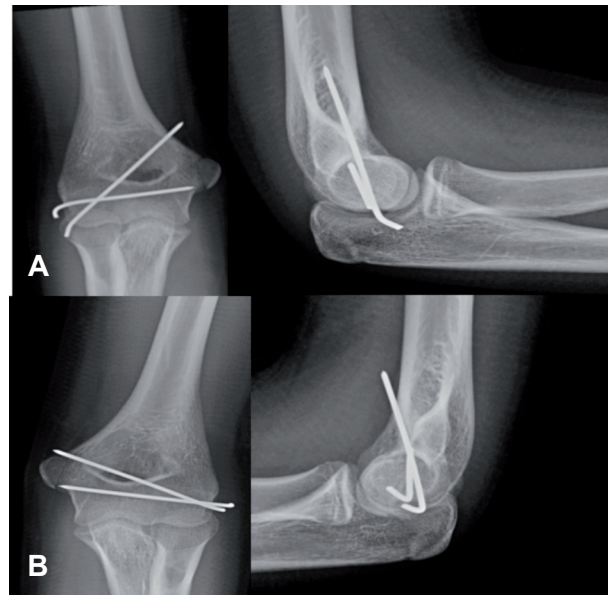


Fig. 4. — The radiological signs of consolidation are showed in the image. 4A:right elbow, 4B left elbow (AP and Lateral views of both elbows)



Fig. 5. — Range of motion of the patient : full extension and full flexion , pronation and supination of both elbows

pain, minimal swelling and tenderness on the lateral side of the elbow (6).

For the diagnosis, a lateral and oblique view of the elbow is essential. A properly taken lateral view usually shows anterior and superior migration of the capitellar fragment. The characteristic finding in the lateral X-ray is the “double arc sign” described by

McKee (20), where there is overlap of the subchondral bone of the displaced capitellum and the lateral trochlea ridge. Nevertheless, visualization of the capitellar fragment is sometimes not possible in the routine views of the elbow. Besides, due to the large cartilaginous component of the distal humerus, especially the medial trochlea, it is not always possible to diagnose a type I or II capitellar injury on plain radiographs until the fracture has actually been opened and visualized. Computed tomography is a more accurate diagnostic tool (15) and is helpful in delineating the extent of the fracture.

The treatment of displaced fractures of the capitellum has been controversial (26) with regards to young children. Historically, some authors proposed excision of the fragment (14), while others favoured open reduction and fixation. The latter comprises a suitable method to maintain joint congruity while allowing an early mobilization. The fixation method used would depend upon the type of fracture, and the experience and skills of the surgeon. Internal fixation devices could consist of: Kirschner wires (23,24), Herbert screws (26) or cannulated cancellous screws (15).

The current literature seems to agree on the fact that type I and type IV fractures should be addressed with some form of reduction and fixation while, type II and III fractures be treated by excision (4). The standard treatment of Kocher-Lorenz-type injuries is excision of the fragment because re-fixation is difficult and in most cases unachievable (27). A similar approach is generally adopted in the management of comminuted type III fractures.

On the other hand, treatment for Hahn-Steinthal type fractures (type I) remains controversial. Before the introduction of the modern internal fixation techniques, closed reduction or early excision of the capitellum fragment were the adopted treatments. Common complications post-reduction or resection of the capitellum were: elbow instability, reduced range of movement and arthritis, unless anatomical positioning of the fragment was attained (27). In order to provide a better and more predictable outcome, a variety of internal fixation methods have been tried over the past three decades. In the literature there are many comparative studies between the use of K wires and Herbert screws in

the fixation of capitellum fractures (18,20,24,26,32). Herbert screws (27) are convenient for two reasons: firstly, they provide interfragmentary compression and remain subarticular and, secondly, removal is unnecessary as opposed to K-wires. Nonetheless, screws may harm the articular surface and split the osteochondral fragment if the piece is very small (26). Otherwise, some reports advocate for the use of cannulated cancellous screws as they also confer rotational stability (15).

In order to reduce the risk of considerable disability following a displaced Hahn-Steinthal type I capitellum fracture such as in the case previously described, it must be anatomically reduced to restore articular congruity. This goal is more often achieved by open reduction and internal fixation. A variety of techniques for internal fixation have been described in the literature: kirschner wires (18,24), biodegradable pins (13,17) and cannulated screws. The latter, are advantageous as (9,29), being subarticular, they provide suitable interfragmentary compression and avoid incongruence, allowing early joint motion. Additionally, they do not need to be removed.

Being this fracture rare, experience around the different fixation methods is lacking. Furthermore, although highly desirable, it is practically impossible, for a medical center to conduct a larger trial in order to compare different treatment options in a randomized and controlled fashion.

Despite the fact that the osteosynthesis with K-wires was not the preferred option of experts in the matter, in our case it conferred a stable synthesis, achieving articular congruity. An intraoperative mobilization was fully achieved, with no signs of limitation. For this reason, we can conclude that as long as consistency of the articular congruity is preserved, the surface is reconstructed and the synthesis is stable, any type of fixation would be valid.

It is important to emphasize that capitellar fractures can be misdiagnosed simply because of inexperience in the interpretation of capitellar fragments and the bizarre appearance of the injury, especially if there is considerable rotation associated with the displacement.

In summary, open reduction and internal fixation are recommended in displaced capitellar fractures in

the paediatric age group, as well as an early mobilization to accomplish a good functional result. And, as with any elbow fracture, it may take months to regain full range of motion.

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