CLINICAL REPORT

The often-missed Kocher-Lorenz elbow fracture

J. Cottalorda, S. Bourelle

Department of Paediatric Orthopaedics Surgery, Lapeyronie Hospital, 371, avenue du doyen Gaston-Giraud, 34295 Montpellier cedex 5, France

Department of Paediatric Surgery, North Hospital, Saint-Etienne, France

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Summary
The authors report a case of an undiagnosed Kocher-Lorenz fracture in a 12-year-old adolescent. The Kocher-Lorenz type fracture involves a superficial osteochondral shell of the capitellum with little underlying bone. Three years after trauma, the patient still complained of throbbing and occasional elbow pain. Radiographic examination revealed a large intra-articular bone fragment mimicking the shape of a "second radial head", between the lateral condyle's ossification center and the radial head. Surgical treatment by fragment excision was performed. Eight years postoperatively, the patient had fully recovered with complete relief of pain. The patient demonstrated full range of motion in all planes. The authors offer a review of the literature on this rare fracture which diagnosis is often delayed.

Case report
A 12-year-old boy presented after having sustained a fall on his right elbow during a gymastics class. Radiographic examination (Fig. 1) was normal however an opacity was found between the ossific nucleus of the lateral condyle and the radial head. The elbow was immobilized in a palmar brachio-ante-brachial cast at 90° of flexion for 3 weeks. A rehabilitation program was initiated after cast removal. No radiographic control was performed after that period and the patient never returned to see his doctor. Three years later, since he experienced pain in his right elbow while carrying heavy objects, he returned to his doctor for further radiographs (Figs. 2 and 3). The child was then referred to us. A thorough questioning revealed that the patient had a history of elbow pain between cast removal and his visit to our unit, contrary to what he had initially reported. The adolescent occasionally felt a throbbing elbow pain. Retrospectively, it was difficult to determine the exact mechanism of the initial trauma. Physical examination revealed crepitus during elbow flexion and extension. The elbow was stable with normal range of motion. The radiographs revealed a large intra-articular osteochondral fragment between the ossific nucleus of the lateral condyle and the radial head (Figs. 2 and 3), which was confirmed by CT scan (Fig. 4). Removal of the fragment was performed through an external approach. The fragment was movable within the joint and could be excised easily. Intra-articular examination could not categorically determine the origin of the fragment. A 3-week cast immobilization was performed.

* Corresponding author. 
E-mail address: jerome.cottalorda@gmail.com (J. Cottalorda).
At 8 years postoperatively, this patient had fully recovered with relief from his painful symptomatology even though he had a hard physical job requiring the use of both his upper limbs. No loss of mobility was observed. There was no sign of elbow laxity. The radial head could be palpated under the skin during pronation-supination movements. Last follow-up radiographs revealed a remodelling of the capitellum and radial head (Fig. 5).

Discussion

Capitellar fractures are well-defined entities. The fracture line lays vertically in the coronal plane and only a small fragment of the articular anterior aspect of the condyle is detached unlike the common pattern of lateral condylar fracture which involves the entire condyle and is a partial articular fracture (type 4 injuries according to the Salter-Harris classification) [1,2]. The growth plate, the posterior aspect of lateral condyle and the metaphysis are never affected in capitellar fractures [3]. The detached fragment is movable within the joint.

Fractures of the capitellum are rare injuries, particularly in children [1,3–8]. The most commonly accepted mechanism of injury is a fall on the outstretched hand with an extended or semi-
The often-missed Kocher-Lorenz elbow fracture

The radial head thus exerts a shearing force on the capitellum [7,9–11]. Since the capitellum is located at the anterior aspect of the lateral condyle, the fragment is typically displaced forwards and upwards (Hahn-Steinthal fracture). Recurvatum of the elbow predisposes to this type of fracture [7]. Fractures of the capitellum mainly occur in adolescents although rare cases have been reported in younger children [5,8]. These fractures are rarely seen in children younger than 12 since such mechanism of injury usually leads to a supracondylar fracture rather than a capitellum fracture in this specific age group due to the cartilaginous composition of the capitellum in children younger than 12 [7]. As the capitellum grows and ossifies in older children, it becomes more susceptible to shear injury [7].

Capitellar fractures have been conventionally classified as types I and II according to the size of the detached fragment. Type I or Hahn-Steinthal fracture is the most frequent one and characterises a shear fracture involving a large osseous portion of the capitellum and occasionally the condylar-trochlear lip. Type I lesion is typically associated with the anterior displacement of the fracture fragment which lays in front of the inferior humeral metaphysis, not displaced forwards but upwards [2,3,7]. Hahn-Steinthal fractures may be associated with: olecranon, radial head, coronoid process and supracondylar fractures [2]. The Kocher-Lorenz, or type II fracture involves a superficial osteochondral shell of the capitellum, which acts as a foreign body and should be thoroughly investigated on radiographs [2,3,7]. According to some authors, this fracture pattern is similar to that osteochondritis dissecans of the elbow [11]. However, most of the information in the available literature involves capitellum fractures of the Hahn-Steinthal type. In the series of Duguet (5 cases) [2], Fowles (6 cases) [1] and Alvarez (14 cases) [11], all capitellar fractures were of the Hahn-Steinthal type. In the series of Letts et al. [7], six out of seven capitellar fractures in the adolescent were Hahn-Steinthal type fractures. As in our observation, only a few cases of Kocher-Lorenz fractures of the capitellum are reported in the literature. The difference between Hahn-Steinthal and Kocher-Lorenz fractures is the size of the capitellum fragment (the entire capitellum and occasionally the condylar-trochlear lip for type I and a small osteochondral fragment for type II). No significant difference regarding the age and mechanism of injury was found between these two fracture types.

Clinical signs are often subtle [2] as in our experience, which might lead to a misunderstanding of this injury [2,3,6,7]. Complete joint-locking is rare. Usually, elbow flexion movements are restricted in Hahn-Steinthal fractures and extension movements in Kocher-Lorenz fractures while pronation-supination are preserved in both cases [2,5,11]. In our observation, flexion and extension as well as pronation-supination were surprisingly normal considering the important size of the osseous fragment. Many authors
report the presence of crepitus as in our case [5]. When considering the bad tolerance of some joint-bodies, the absence of any clinical symptom in this child during a three-year period is quite surprising. Two explanations might be formulated: this joint-body involved a non-load bearing area (however the child was right-handed with a right-sided fracture). The successful joint remodelling (good congruence of the fragment with the radial head) (Fig. 2) may explain the surprising clinical tolerance of such a bulky osseous fragment.

Proper radiographic interpretation often reveals challenging. The lesion might not be visible particularly if the fracture has no osseous fragment. This injury is often misdiagnosed as widely described in the literature [5,7]. An oblique radiograph may be useful in diagnosing these fractures only in the presence of an osseous fragment [8]. When there is any doubt, an arthrogramic or MRI examination could help confirm the diagnosis and determine the actual size and origin of the fragment.

According to Letts et al. [7] the osseous fragment may occasionally be difficult to identify when using a lateral approach to the elbow. The fragment is often located anteriorly and in the presence of a large fragment, Letts et al. [7] advocate the use of an anterior approach to provide better visualization of the fragment and its osseous defect. In the present case, the fragment was indisputably detached from the capitellum as confirmed by the AP radiograph at last follow-up (Fig. 5). However, as reported by Letts et al. [7], intra-articular examination did not help determine with certainty the fragment origin in our patient. Management of capitellar fractures consists in open reduction and internal fixation of the fragment [9,11] or fragment excision when the fragment is small [1,3]. Fixation might be performed with bioabsorbable or cannulated headless compression screws within the articular cartilage [7,12—14]. Percutaneous reduction of capitellum fractures was described [15], but large cartilaginous fragments might prevent proper visualization, under image intensifier, and satisfactory reduction [7]. According to the literature, these fractures have a bad long-term outcome after fragment fixation (particularly with regard to joint mobility), therefore some authors advocate the use of fragment removal rather than surgical fixation. This technique proves reliable in case of delayed management of the fracture [1,3,7,10,11,16]. However, when diagnosis is performed at an early stage, fragment repositioning achieves satisfactory results in adolescents [7]. In our experience, fragment excision was the only available treatment option.

These fractures should be properly diagnosed since lack of treatment could result in a major restriction of elbow flexion. Actually, fracture malunion might create an osseous obstacle [2,8]. Instability of the elbow joint is not reported after isolated fractures of the capitellum, even after complete excision of the capitellum [11].

Conflicts of interest

None.

References