Treatment of radial neck fracture in a child after delayed dislocation by intramedullary pinning – a case report

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ABSTRACT

We present a case of a 10-year old boy with a left radial neck fracture. Missed at first, the fracture was treated with an intramedullary TEN and transient percutaneous reduction of the fracture with a K-wire.

Keywords: radial neck fracture, delayed dislocation, intramedullary pinning, transient percutaneous reduction

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Introduction

Fractures of the radial neck represent about one percent of all pediatric fractures. Approximately 90% of these are metaphyseal injuries with one third affecting the epiphysis. They generally result from a fall on the outstretched arm with the elbow extended and the forearm supinated. (1) According to the most established classification by Judet (2) modified by Métaizeau, (3) the deformation is categorized by the shift of the epiphysis. Non-displaced fractures are classified as grade I. A tilt of the radial head less than 30° equals grade II, angulation between 30° to 60° matches grade III. More tilt equals, grade IVa up to 80° dislocation and IVb above that.

Depending on the degree of radial head displacement the medical treatment is determined. It also affects the long-term results as severe displacement increases the risk of complications, particularly avascular necrosis of the radial head. Pediatric fractures of the elbow in children can be difficult to diagnose. Clinical examination may be deficient considering the presence of diffuse swelling, the absence of localized tenderness and the inability of a growing child to indicate the central point of pain. Moreover radiographs may be not conclusive based on the undetermined ossification in the distal part of the humerus and the proximal part of the radius and the olecranon. Additional diagnostic investigation such as stress radiography, magnetic resonance imaging and ultrasonography is required frequently in order to diagnose the injury precisely. (4,5)

Fractures with a dislocation of less than 30 degrees of the radial head (Judent I-II) generally can be treated by immobilization. For a more severe angulation of the radial head or a dislocation of more than half diameter of the metaphysis a closed reduction should be conducted as they will not adjust spontaneously in general. Immobilisation should be no longer than 14 days to support the revasculation of the radial head through self-contained movement of the elbow joint. (6)

Several surgical methods have been described for open reduction treating fractures which can not be corrected encosed or for those with a higher grade of dislocation of the radial head (Judent III-IV) most associated with unsatisfactory results. (7) Métaizeau for the first time proposed intramedullary pinning as a surgical alternative for the treatment of radial neck fractures. This method allows extracapsular reduction of the fracture using an elastic nail introduced into the medullary canal through a distal metaphyseal entry point. This combines the advantages of a good reduction and a stable fixation and has become the most widely used surgical method.

Case report

A 10-year-old boy sustained a direct trauma on the left elbow after dropping from a slide at a playground and presented at an emergency department. The initial x-ray performed was interpreted as revealing no osseus injury. Due to pain and lack of function a magnetic resonance image of the elbow joint was performed which demonstrated a fracture of the radial neck with an
epiphysis tilt of more than 30° and no signals of early avascular bone necrosis (Fig. 1). Three days after injury the patient was referred to our department for further treatment. Clinical assessment demonstrated a swollen left elbow with reduced range of motion of the affected joint. The arc of flexion-extension was limited (from 20 to 100 degrees of flexion) as well as the arc of supination-pronation (from 30 degrees of supination to 30 degrees of pronation) in consequence of pain. There was no associated neurolovascuar deficiency. Additional radiographs revealed an anterior displacement of the radial head of angulation of more than 30 degrees due to secondary dislocation (Fig. 2 and 3).

An above-the-elbow cast was applied and the patient was prepared for surgery. Under general anesthesia the operation technique used was intramedullary pinning according Métaizeau. A 2 mm titanium elastic nail (TEN) was pushed into the medullary canal of the radius through an incision 2 cm proximal to the distal epiphysis after bending the nail on an average of 30° to get a 3 point bracing support within the bone. Thereon it was hammered upward until its tip reached the displaced epiphysis. A Kirschner wire was pushed into the fracture in pronation of the forearm in order to leverage the fragment percutaneously and the TEN was used to relocate the radial head in anatomic rotation (Fig. 4). Postoperative immobilization by an above-the-elbow cast was applied for two weeks. Physical therapy starting without supination-pronation was performed thereafter.

At a follow up in our department three months post surgery the patient demonstrated no limitation in motion of the elbow joint and felt no discomfort at all activities. The x-ray revealed good bone union without loss of the alignment (Fig. 5 and 6). The TEN was removed in a second surgery after 4 weeks. At a final follow up one month after removal no limitation in movement was noted and radiographic imaging demonstrated full anatomic reduction.

Fig. 1: MRI of the left elbow joint showing a fracture of the radial neck and no signals of early avascular bone necrosis.

Fig. 2: Radiograph of the left elbow a.p. in suboptimal technique because of pain showing the fracture.

Fig. 3: Radiograph of the left elbow in lateral view in suboptimal technique because of pain showing the fracture.

Fig. 4: Flouroscopy of the left elbow showing 'joy-sticking' the radial head with a K-wire.
Discussion

Radial neck fractures in children as in adults are not very frequent and can be challenging in diagnosis and treatment. Depending on the angulation of the radial head is either treated by simple cast immobilisation or the surgical reduction of the displaced head. Most authors divide the angulation in 30 degrees intervals which is considered the limit between casting and reduction if the displacement of the radial head is more than 30 degrees. Most studies have concluded that immobilization with an above-the-elbow cast including a rectangular flexed elbow and a supinated forearm for two weeks time is the adequate treatment for Judet type I and II fractures in adults and children. Physical therapy without supination-pronation should be started at an early stage.

Opinions concerning the modalities of reduction and stabilization for type III and IV fractures differ. Many authors recommend closed reduction with longitudinal traction and turning manipulation of the forearm plus digital pressure over the radial head for fractures with more than 30° of angulation. Métaizeau recommends conservative treatment for a tilt smaller than 45° as long as the residual angulation does not exceed 20°. Fractures of children have the ability to correct a tilt of the anatomic axis among linear growth, there have been reports about spontaneous anatomic reduction for an angulation of the radial head of more than 60 degrees. Nevertheless treatment will not done relying upon this keeping in mind that there might be a delayed dislocation at limiting cases.

Depending on the severity of the fracture the primary treatment should be definitive with anatomic reduction. Long-term damage is random but associated with replicated manipulation of the affected joint. The degree of displacement and the severity of associated injuries such as a dislocation compared with undisplaced olecranon fracture are often related with the energy of the impact. High-energy injuries lead to soft tissue lesion and blood supply damage, increasing the risks of avascular necrosis of the radial head.

Surgical treatment can lead to damage of the soft tissue in accordance with reduced function, particularly in supination and pronation and should be done very carefully. The technique proposed by Métaizeau using an intramedullary K-wire for reduction and fixation of the fracture reported convincing results in Judet grade III and IV fractures.

This method has demonstrated its efficiency as it combines the advantages of a good reduction and a reliable stabilization of the fracture while reducing the risk of neurological and infectious complications. When reduction is not possible, a percutaneous pin can be used to assist the manipulation of the radial head.

Open reduction is considered for comminuted fractures or cases in which closed reduction has failed due to interposition of the capsule or annular ligament between the head and the neck. This method is related to the highest rate of critical complications like necrosis of the radial head, non-union, disturbance of growth or permanent fusion based on further disorder of circulation of the epiphysis and articular capsule and blood supply of the radial head.

Intramedullary pinning as done in the reported case is a reliable method to treat radial head fractures in children revealing good outcome in function in accordance with limited risk of complications. Primary diagnostics should be done carefully and be reviewed thoughtfully as this rare fracture can be difficult to diagnose by standard radiographs.

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Each author certifies that his institution approved the human protocol for this investigation that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.
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References