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Case Report

Management of post-traumatic elbow instability after failed radial head excision: A case report

Georgios Touloupakis, Emmanouil Theodorakis*, Fabio Favetti, Massimiliano Nannerini

Department of Orthopaedics, Aurelia Hospital, Rome, Italy

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ABSTRACT

Radial head excision has always been a safe commonly used surgical procedure with a satisfactory clinical outcome for isolated comminuted radial head fractures. However, diagnosis of elbow instability is still very challenging and often underestimated in routine orthopaedic evaluation. We present the case of a 21-years old female treated with excision after radial head fracture, resulting in elbow instability. The patient underwent revision surgery after four weeks. We believe that ligament reconstruction without radial head substitution is a safe alternative choice for Mason III radial head fractures accompanied by complex ligament lesions.

Introduction

Radial head excision is commonly used for the treatment of comminuted radial head fractures. It is safe and has satisfactory clinical outcome. Nevertheless, when isolated traumatic radial head fracture occurs without dislocation, diagnosis of elbow instability is very challenging and often underestimated in routine orthopaedic evaluation. Mechanistic identification of the clinical impact of trauma during preoperative care is mandatory and requires accurate radiological examination. Technological evolution of implants design and application of best quality materials in elbow surgery currently offer various treatment options. In this paper, we present the management of a case of post-traumatic elbow instability, after failure of radial head excision. According to the current literature, we were able to identify several indications for appropriate diagnosis and treatment.

Case report

A 21-year-old, right-handed female patient presented with a history of fall from a horse on her right outstreched arm. Clinical examination at the emergency department in our hospital found swelling of the affected elbow, intense pain and functional impairment of any elbow joint movement. Radiographical examination in the AP and lateral planes showed a Mason type III capitellum fracture (Fig. 1A and B). A CT scan with 3-D reconstruction was performed for a detailed preoperative planning (Fig. 1C).

The patient underwent surgery for open reduction and internal fixation the next day after clinical examination. A lateral approach to the elbow was performed. Skin incision began 2 cm proximally to the tip of the lateral epicondyle and extended distally for approximately 4 cm towards the Lister's tubercle. We used the superficial interval between the anconeus and the extensor carpi ulnaris muscles. The forearm was kept in pronation to protect and preserve the posterior interosseous nerve. Lateral collateral ligament (LCL) was found to be teared apart and the radial head fragmented and impacted. Open reduction and internal fixation with an anatomic radial neck plate was attempted with a satisfactory reduction and a stable elbow joint. However, osteosynthesis did not contribute to complete stability and the decision for radial head excision was made intraoperatively without a radial head prosthesis available for immediate implantation. LCL was sutured and a cast with the elbow flexed at 90° was applied (Fig. 1D and E). A functional brace for the elbow was positioned 3 weeks after surgery with a free range of motion (ROM) between 30° and 90° of flexion with free pronosupination.

A week later, the patient returned to the outpatient clinic with dislocated elbow (Fig. 2A and B). Closed reduction was attempted

* Corresponding author.
E-mail address: drtheodorakis@gmail.com (E. Theodorakis).

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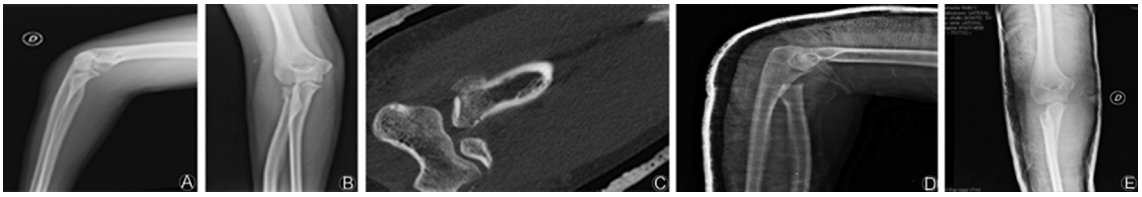

Fig. 1. A, B: Radiographical examination in the AP and lateral planes showing a Mason type III capitellum fracture; C: A CT scan with 3-D reconstruction was performed for a detailed preoperative planning; D, E: A radial head excision was made, lateral collateral ligament was sutured and a cast with the elbow flexed at 90° was applied.

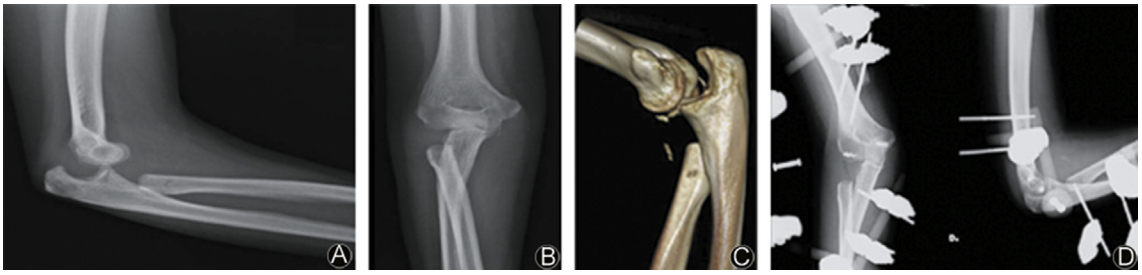

Fig. 2. A, B: Elbow dislocation occurred at four weeks after surgery in the AP and lateral views. C: A new preoperative CT scan was done for planning of the secondary surgery; D: Postoperative X-rays in the standard AP and lateral views after medial collateral ligament and lateral ulnar colateral ligament reconstruction and dynamic external fixation.

without any success. A new CT scan was performed (Fig. 2C) and measurements of the radial head were obtained (using previous CT scan data), in case a prosthesis was needed.

A posterior incision of the elbow was done under pneumo-ischemia. A medial approach was followed, proceeding between the pronator teres muscle and the common flexor tendon and isolating the underlying ulnar nerve to ensure its protection, which was then transpositioned anteriorly. Debridement was carried out with removal of osteocondral fragments. The medial collateral ligament (MCL) was found to be ruptured. We proceeded with reconstruction and reattachment of the ligament by placing sutures anchoring the posterior band of the MCL to the medial epicondyle. A lateral window was then opened through a posterior approach, using suture anchors, to reinforce tension of the lateral ulnar collateral ligament, as the radial collateral ligament was found to be loosened due to previous surgery.

Elbow joint stability was then tested satisfactory under fluoroscopy. A hinged external fixator (Depuy-Synthes, Switzerland) was assembled in order to protect ligament reconstruction with posterior stab incisions for proximal fiche's insertion, with stab posterior to the distal humerus incisions, for proximal fiche's insertion (Fig. 2D). The dynamic external fixator permitted a controlled free ROM of the elbow and was successfully removed 5 weeks later. An intensive physiotherapy program was started performing gravity-aided and assisted flexion/extension - pronation/supination exercises of the elbow joint.

Clinical and radiological evaluation was performed at 1, 2, 3, 4, 6, 12 and 18 months after surgery (Fig. 3). At each follow-up, ROM in flexion/extension and pronation/supination was recorded. At 6 months after surgery, free ROM of the affected elbow was detected between 10° and 125° of flexion/extension with a full pronosupination recovery, when compared with the contralateral side (Fig. 4). No variation was present for free ROM at the 12th and 18th month follow-up. The patient went through progressive clinical recovery with mild occasional pain during sport activity. At 18 months follow-up, there is radiographical evidence of initial arthrosis and mild pounding present during specific movements of the elbow joint.

Discussion

The ideal surgical approach for Mason type III comminuted radial head fractures is currently controversial for some authors. Different surgical approaches have been proposed including prosthetic replacement.[1–3] Careful choice of the implants offers different treatment options in case of intraoperative complications. In our study, after the first intervention, treatment of the ligament lesion did not totally meet our expected standards of surgical care.

Our patient accidentally fell while riding a horse onto her right out-stretched arm, with consequent axial compression, external rotation (supination), and valgus force applied directly to the elbow. The functional anatomy of the elbow instability is best described as a three-stage circle of soft-tissue disruption, initially on the lateral side and extending to the anterior and then the medial part of the joint. This pattern is referred to as the circle of Horii.[4] According to O'Driscoll et al,[5] the nature of our patient's injury is best classified as type III posterolateral instability of the elbow; disruption of the MCL, leading to gross instability of the joint so that it can only be stable at >90° of flexion.

During physical examination performed before the first surgery, elbow instability could not be confirmed using the posterolateral rotatory drawer test, due to the presence of the fractured radial head which acted like a spacer for the elbow joint. Upon radial head excision, instability was detected during intraoperative flexion-extension of the elbow, resulting stability at 90° of flexion and classified as 3c according to Horii. We applied a cast at this degree of flexion in order to achieve the ligamentous complex healing. Three weeks after cast removal, a flexion between 30° and 90° resulted in displacement of the joint. Before revision surgery and during clinical examination the displacement was found to be irreducible, as a result of medial and lateral ligament damage. The presence of irreducibility was a sufficient element in order to classify the lesion as a complex type 3c, without the need for further preoperative MRI investigation.

Adequate implants on the operative table were fully available at the following secondary surgery. We approached the elbow via posterior triceps incision according to the Alonso-Llames

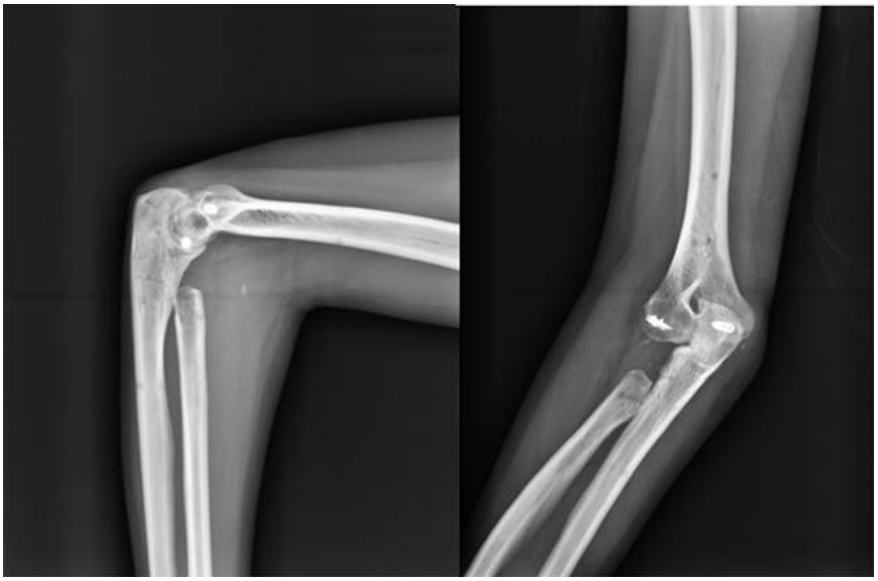

Fig. 3. Radiographical images obtained at 5 weeks after surgery before removal of external fixator.

Fig. 4. At 6 months after surgery, free ROM of the affected elbow was detected between 10° and 125° of flexion/extension with a full pronosupination recovery, when compared with the contralateral side.

technique, which increases the visualisation through medial window and radial "Kocher" window. A posterior approach could be the first choice for complex ligament lesions of the elbow. After reduction of the dislocation, the reconstruction of the MCL and the rupture of the flesso-pronator mass promoted elbow joint stability. Anterior ulnar nerve transposition was performed to prevent ulnar neuropathy in case of valgus deviation of the elbow.

In our case, as laxity of the lateral compartment persisted, the reconstruction of the lateral band of the ulnar collateral ligament contributed to the concentric stability with no posterolateral subluxation, through a flexion-extension arch of movement in neutral, supine or prone rotation of the forearm.[6] We used a hinged external fixator with posterior pin placement on both humerus and ulna for five weeks, while keeping the forearm in neutral position to protect ligament reconstruction of the medial and lateral complex and we encouraged the patient to do constant and active movement of the elbow.

Hinge external fixator provides enough joint stability for rehabilitation to be conducted early after surgery, which usually prevents stiffness and contributes to better functional results.[7] Continuous rehabilitation for six months is important to complete recovery. In our case, functional improvement was already seen after the third month, with total restoration of the extension.[8] Selected ligament repair is reported to be performed with or without hinged external fixator. Some authors also recommend ulno-humeral pin placement for a short period after ligament repair and radial head excision.[9]

We believe that complex lesions are better treated when ligament reconstruction is conducted from medial to lateral sequence, and so, in the opposite direction of the cori cycle, by transforming the lesion from complex to elementary. Different ways of ligament reconstruction are already described in the literature, the aim of which remains to achieve a stable ligament complex.[10,11]

With intact MCL complex, removal of radial head results in no instability; reconstruction of the MCL is therefore a priority and technically less demanding than the one of the LCL, which is often complicated by the usually simultaneous lesion of the annular ligament (after excision of the radial head).[12] Another valid option is radial head replacement, as radial head is one of the primary stabilizers of the elbow, as well as the restoration of radiocapitellar contact. A delay in radial head replacement and treatment of younger patients are common risk factors to perform further surgery for replacement or revision.[13]

Unstable radial head fractures are complex lesions with potential complications. In case of radial excision, it is very common for pain, instability, proximal radius migration and cubitus valgus to occur. Moreover, radial head replacement can also be complicated by infections, heterotopic ossification, impingent, implant failure, painful loosening, capitellar erosion, and radio-ulnar sinostosis.[14]

Concerning our case report, we underestimated the importance of the medial compartment ligamentous damage, which in combination with capitectomy led to an unstable elbow joint after the first surgery. However after medial compartment reconstruction we achieved a stable elbow joint. We believe that the radial head is a constraint secondary to the MCL for both valgus displacement and internal rotation. Isolated repair of the ligament is superior to isolated prosthetic replacement and may be sufficient to restore valgus and internal rotatory stability after excision of the radial head in MCL-deficient elbows.[15] Accurate diagnosis and classification of the lesion of the radial head is mandatory and radiologic exams together with CT analysis are of crucial aid. Fractures involving the anteromedial quadrant have higher dislocation rate of the elbow and are often misdiagnosed, and ligament lesions should be always suspected.[16] Ultrasound exam of the elbow could contribute to preoperative evaluation of soft-tissue lesions of the elbow. Follow-up of young patients after radial head replacement is currently reported to be short; yet we believe that ligament reconstruction without radial head substitution is a safe alternative choice for Mason III radial head fractures accompanied by complex ligament lesions.[12]

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