Prone Positioning for Open Reduction Internal Fixation of Pediatric Medial Epicondyle Fractures

Aristides I. Cruz, Jr., MD
J. Todd R. Lawrence, MD, PhD
Theodore J. Ganley, MD

Department of Orthopaedic Surgery
School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania, USA

Introduction

Medial epicondyle fractures account for up to 20% of fractures about the elbow in children and adolescents.[1] The medial epicondyle serves as the anatomic origin of the flexor-pronator mass, which provides dynamic stability to valgus stress of the elbow.[2] It also serves as the proximal attachment site to the ulnar collateral ligament, which serves as the primary static stabilizer to valgus stress.[3] Operative indications remain unclear as displacement is not always easily established on plain radiographs and even athletes can have good outcomes treated with and without surgery.[4, 5] When operative treatment is required, reduction of the fracture fragment can often be challenging with standard supine positioning because the forces required to expose the medial elbow in this position tend to dislocate the elbow and pull the fracture fragment away from the fracture bed. Here, we present a case of a displaced medial epicondyle fracture in an adolescent athlete and offer an alternative technique utilizing the prone position for operative treatment.

Figure 1. Radiographs showing a displaced medial epicondyle fracture.

Background

The patient is an 11-year old male who fell onto an outstretched left upper extremity during a wrestling match and radiographs revealed a displaced medial epicondyle fracture (Figure 1). Open reduction and internal fixation of the medial epicondyle fracture was recommended based on the degree of displacement and the elbow stability.

Procedure

Positioning and Exposure

The patient is placed prone on the operative table with gel rolls placed at the level of the sternum and ASIS (Figure 2). The abdomen is sufficiently free and a radiolucent hand table is used. The shoulder is fully internally rotated and the dorsal aspect of the wrist placed on the hand table. Occasionally, especially in overhead athletes, the patients lack sufficient shoulder internal rotation to be placed in this position. If this is the case, additional bolsters can be placed under the chest to elevate the shoulder or a sloppy lateral position can be used. The

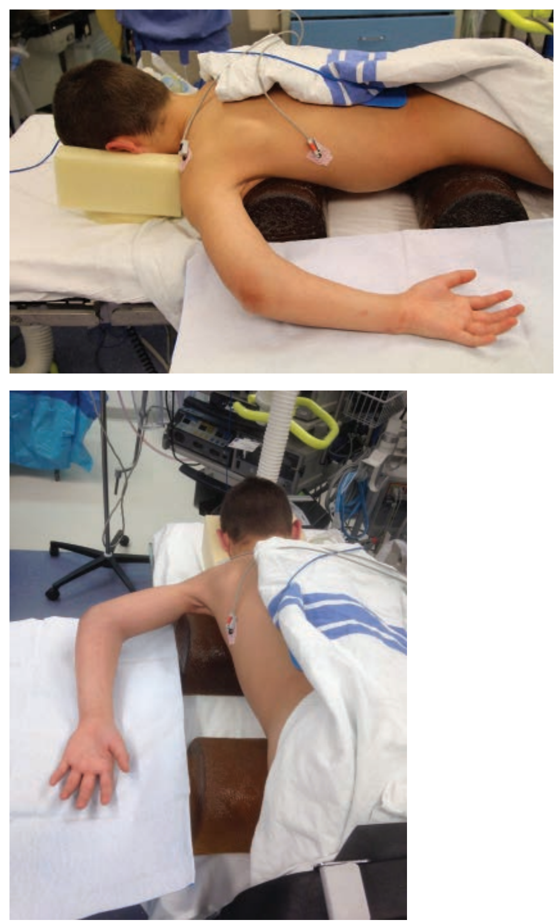

Figure 2. Positioning on the operative table with the patient placed prone and gel rolls placed at the level of the sternum and ASIS.

fluoroscopy unit is positioned, either coming from the head of the bed (if there is no assistant) or from the direction of the hand table (which allows assistant positioning directly opposite to the surgeon). A longitudinal incision is made, centered either over or just anterior to the medial epicondyle. Dissection is carried through the skin and subcutaneous tissue. Care should be taken to identify and protect crossing sensory nerves in this region. In the acute setting, there is usually significant soft tissue and capsular disruption that gentle blunt dissection will often lead directly to the fracture bed. Next, the ulnar nerve is identified posterior to the fracture bed. A formal neurolysis or transposition is not performed unless there are extenuating circumstances such as ulnar nerve subluxation. The nerve is protected during the entire case. The medial epicondyle fracture fragment is then identified. It is often displaced anteriorly and distally, in line with the pull of the attached flexor-pronator mass. The fracture fragment is grasped with a towel clip or pointed reduction clamp taking care not to fragment the piece. A suture can be also placed at the attachment point of the flexor-pronator mass to help facilitate control of the fracture fragment. In older patients, the authors debride any remaining apophyseal cartilage on both the fracture bed and the undersurface of the medial epicondyle. This aids assessment of bony union during subsequent follow-up radiographs and helps guide rehabilitation and return to activity recommendations.

Reduction and Fixation

Varus and internal rotation forces at the elbow facilitate reduction of the elbow joint. Wrist flexion and forearm pronation relax the flexor-pronator mass and facilitate fracture reduction. With the patient in the prone position and the shoulder internally rotated, the upper extremity has a natural tendency to lie with a varus/internal rotation force on the elbow. Pronating the forearm in this position by placing the dorsal wrist on the table causes the wrist to flex (Figure 3). It is the authors' experience that the medial epicondyle fracture fragment is almost always easily reduced in this position because the joint remains stable and reduced and there is little muscular resistance from the attached muscular origins. Once reduced, the medial epicondyle can be held with a pointed reduction clamp, towel clip, K-wires, reduction sutures or a combination thereof. The authors prefer to fix the fracture with a single 4.5 mm partially threaded cannulated screw but a variety of fixation options are appropriate. A washer can be used to enhance compression and reduce the risk of fracture fragmentation and is usually used if there is comminution or if a significant portion of the fracture fragment is cartilaginous. Prior to drilling for the screw, another K-wire can be placed into the fragment (being careful not to worsen any comminution) in order to resist rotation. Because the medial epicondyle lies just posterior to the mid-sagittal plane of the distal humerus, screws placed perpendicular to the fracture line usually have a slightly posterior to anterior trajectory. Prone positioning also facilitates drilling as the surgeon views the medial side of the elbow directly and can drill in a "downhill" trajectory. The screw head often appears prominent on radiographs, however, this is accounted for by the cartilaginous nature of the medial epicondyle as well as the overlying flexor-pronator mass soft tissue. Compression and fragment congruity usually confers rotational stability but this can be reinforced by performing a periosteal repair. Tying the reduction stitch placed in the flexor-pronator mass around the screw can also help with construct stability. Fluoroscopy is used to confirm reduction and fixation and the wound is closed in a routine manner and the patient is placed in a posterior splint (Figure 4).

Figure 3. Placing the patient in the prone position with the shoulder internally rotatedcauses the upper extremity to liewith a varus/internal rotation force on the elbowwhileplacement of the patient's dorsal wrist on the table pronates the forearm and causesthe wrist to flex.

Figure 4. Use of fluoroscopy to confirm reduction and fixation.

Post-operatively, a short period of immobilization is used to protect the surgical wound followed by early elbow, forearm, and wrist range of motion. The patient is progressed through rehabilitation and is allowed to gradually return to play once pain, range of motion, and strength have returned to baseline and bony union is evident on radiographs. This typically ranges from 4-6 months after treatment.

Conclusion

In contrast to supine positioning, where the maneuvers required to visualize the fracture bed tend to place more tension on the fracture fragments and subluxate the elbow joint, prone positioning for open reduction and internal fixation of medial epicondyle fractures facilitates fracture reduction and fixation because it counteracts the deforming forces at the elbow and on the medial epicondyle fracture fragment. While there may be additional time required to position the patient for this procedure, the ease with which fracture exposure, reduction and fixation can be achieved often offsets this additional setup time. The authors propose this surgical technique as an option for treating this injury.

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