Brachial Artery Transection After a Closed Traumatic Isolated Medial Epicondyle Fracture in a Pediatric Patient: A Case Report

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Abstract

Background: Medial epicondyle fractures in pediatric patients might be associated with an occult elbow dislocation and neurovascular damage. **Methods:** A single case of a medial epicondyle fracture presenting with brachial artery transection was reviewed. Presentation, clinical course, and early outcome are reported. **Results:** A 14-year-old patient presenting with an apparently isolated medial epicondyle fracture was found to have examination and diagnostic test findings consistent with brachial artery transection. His injury was explored and repaired acutely, resulting in acute return of perfusion. Final follow-up revealed 0° to 130° of flexion-extension arc of motion and full pronation and supination with normal sensory and motor function of the hand. **Conclusions:** Pediatric medial epicondyle fractures should alert the clinician to the possibility of an occult dislocation of the elbow, and a full neurovascular assessment should be performed. Early recognition and repair of a vascular injury associated with this fracture can lead to a good outcome.

Keywords: medial epicondyle fracture, brachial artery, elbow dislocation, pediatric, neurovascular injury

Introduction

Medial epicondyle fractures of the humerus are the third most common pediatric elbow fracture and account for approximately 12% of all elbow fractures in children.¹⁷ Almost half are associated with concomitant elbow dislocation.²⁰ However, only a handful of reported cases of pediatric closed elbow dislocations resulting in brachial artery transection have been presented in the literature.^{8,11,12} Medial epicondyle fracture fragments can become incarcerated in the joint, and this occurs in approximately 15% to 18% of cases.^{4,13,22} Although injuries to the ulnar nerve have occurred after medial epicondyle humeral fractures, especially in cases of incarceration of the fragment in the joint,^{3,5,7} to our knowledge, no reports have described notable vascular injury associated with isolated medial epicondyle fracture.

We present the case of a 14-year-old boy with a left medial epicondyle humeral fracture. Careful physical examination and imaging studies revealed injury to the brachial artery, and the patient was treated operatively with open reduction and internal fixation of the fracture and saphenous vein grafting.

Case Report

A 14-year-old boy was seen at an outside institution after awkwardly landing on his left elbow during a wrestling match. In the emergency department, the patient was observed to have substantial swelling about his left elbow, and examination of the left hand indicated a delayed capillary refill time of longer than 6 seconds. The extremity remained pink; however, the radial pulse of the left upper extremity was not palpable. A faint arterial signal could be appreciated with use of a Doppler ultrasound machine. During a neurological examination, the patient described global numbness in his left hand but retained full motor function. Radiographs showed an isolated displaced medial epicondyle fracture (Figure 1). The patient was transferred

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Figure 1. Anteroposterior view radiograph showing moderately displaced medial epicondyle fracture of the humerus.

to our pediatric emergency department because of the fracture and concern for vascular injury.

Upon transfer to our institution, a physical examination showed improved capillary refill time in all digits of the left hand. Decreased sensation persisted in all nerve distributions. However, full motor function continued. Based on the improved vascular examination, it was decided to observe the patient overnight while performing serial neurovascular examinations.

The next morning, the capillary refill had improved to shorter than 2 seconds in all digits. However, the swelling around the left elbow had visibly increased, and the patient described decreased sensation specifically in the median and radial nerve distributions. Because of the increase in swelling and concern for impending compartment syndrome, a computed tomographic angiogram was obtained, which showed lack of flow through the brachial artery approximately 4.5 cm proximal to the elbow joint, although there was evidence of collateral blood flow distally (Figure 2). With the development of apparent impending compartment syndrome and brachial artery injury, it was decided that surgical intervention for exploration and repair was warranted.

The patient was taken to the operating room for open reduction and internal fixation of the left humeral medial epicondyle, left forearm fasciotomies, and repair of the brachial artery. The left upper and lower extremities were prepped and draped in the usual sterile fashion in case there was a need for vein graft harvest from the ipsilateral lower limb. A standard serpentine forearm fasciotomy incision was made with proximal medial extension to visualize the

Figure 2. Computed tomographic angiogram showing lack of flow through the brachial artery approximately 4.5 cm proximal to the elbow joint. Collateral flow can be seen distal to the joint.

brachial artery. The forearm fasciotomies were performed of the volar superficial and deep compartments. Upon exposure of the medial epicondyle fragment, a large hematoma was visualized and evacuated. The brachial artery was found to be avulsed with a markedly contused proximal stump (Figure 3). Dissection was continued in a proximal to distal direction from known structures into the traumatized area of the antebrachium. Identification of the median nerve revealed an intact and moderately contused nerve. The brachialis was found to be completely transected, and the common flexor origin had been avulsed with the medial epicondyle and remained attached to the bony fragment. Further dissection was continued in a distal to proximal direction, starting at the level of the intact radial artery, which was traced proximally to the distal component of the brachial artery avulsion. The distal stump of the arterial injury was found approximately 3 to 4 cm proximal to the bifurcation of the radial artery from the ulnar system. The ulnar nerve was then located at the region of the medial epicondyle and was noted to have shifted posteriorly with the epicondyle, nearly becoming incarcerated between the humerus and olecranon.

After irrigation of the elbow, the fragment was reduced and held with a smooth 0.0625 Kirschner wire (K-wire). A second 0.0625 K-wire was placed, and then a 2.7-mm partially threaded screw was inserted proximally into the metaphysis and a second screw was placed more distally in the fragment and aimed toward the olecranon fossa. No washers were used.

The arterial repair was then performed with an 8-cm reverse saphenous vein graft (Figures 4 and 5). Upon release of the vessel clamps, only radial Doppler signals were

Figure 3. Intraoperative photograph showing the proximal stump of the transected brachial artery.

Figure 4. Reverse saphenous vein graft measures approximately 8 cm.

Figure 5. Final repair of the transected brachial artery with a reverse saphenous vein graft.

present. Ulnar artery exploration was performed. The ulnar artery was found to be thrombosed in the distal forearm. A side branch was used for access for a thrombectomy performed with a 2F Fogarty catheter proximally and distally. Improved flow was established by both Doppler signal and palpation. The transverse component of the incision, in the elbow flexion crease, was then closed with interrupted sutures. A medium Hemovac drain was placed, and the elbow was immobilized at 30° of flexion.

The patient experienced an uncomplicated postoperative course. Physical therapy was initiated 5 days postoperatively. Split-thickness skin grafting of an open area of exposed forearm musculature was performed 1 week after the initial procedure, and the patient was discharged from the hospital 10 days after initial injury.

At the initial follow-up examination 1 week after discharge, the patient reported return of sensation to all digits of the left hand. Radiographs showed maintained alignment of the medial epicondyle fracture.

At the final follow-up examination 17 months after discharge, elbow range of motion had markedly improved. Elbow flexion and extension were measured at 134° and 16°, respectively. Pronation and supination were measured at 66° and 72°, respectively. The brachial artery remained patent as evidenced by palpation of a strong radial pulse.

Discussion

The brachial artery is the most commonly injured artery in the upper extremity, representing up to 52% of vascular injuries in patients between the ages of 8 and 84 years.⁹ The majority of these injuries have been reported to occur as a result of penetrating trauma.^{6,9,14,15} To our knowledge, brachial artery injury associated with an isolated medial epicondyle fracture has not previously been reported in the scientific literature. More frequently, damage to the brachial artery has been described as a result of a supracondylar humeral fracture or elbow dislocation.^{1,2,12,16} The reported incidence of brachial artery injury with Gartland type III supracondylar fractures of the humerus in children is between 3% and 12%.²³ Marcheix et al¹² retrospectively reviewed 70 adult cases of elbow dislocations and reported that 4.3% of cases presented as closed posterior dislocation with associated brachial artery transection. The prevalence of injury to the brachial artery in cases of closed posterior elbow dislocations might be underreported, however, because these dislocations might spontaneously reduce before diagnosis.

Despite an initial lack of evidence supporting elbow dislocation in this case, the intraoperative findings of trauma to the soft tissues and neurovascular structures about the elbow were suggestive of an elbow dislocation that had spontaneously reduced. The presentation of this patient with a brachial artery transection associated with an

isolated medial epicondyle fracture is unusual and serves to remind practitioners of the potential diagnosis of occult elbow dislocation in the pediatric population.

Physical examination of patients with brachial artery injuries might reveal a pale, pulseless extremity, although this finding is not universal. In cases of an obviously pale pulseless hand, operative management is clearly indicated. However, the surgical indications are more controversial in the case of a pink pulseless hand after elbow trauma in a child.²³ Hand ischemia is the most feared complication of acute injury to the brachial artery. However, if the cause of ischemia is local arterial spasm, spontaneous resolution can occur. Therefore, nonoperative management of a pink pulseless hand has been recommended to treat transient hand ischemia caused by arterial spasm.²

This patient presented with a pink pulseless left hand that was initially monitored with serial neurovascular checks to rule out spasm of the brachial artery. As the swelling within the patient's forearm progressed, concern for compartment syndrome necessitated the investigation of potential vascular injury, considering that compartment syndrome is a common complication associated with traumatic brachial artery injury and has been reported to occur in 2% to 29% of cases.⁹

Historically, observation has been an acceptable mode of treatment for brachial artery injuries because of the collateral circulation allowing for perfusion of the distal upper extremity. Collateral circulation comprises the radial recurrent artery anastomosis with the radial collateral branch of the profunda brachii and the superior ulnar collateral artery anastomosis with the posterior ulnar recurrent and inferior ulnar collateral arteries.^{10,21} These anastomoses allow for filling of the hand when circulation through the brachial artery is not possible. Sabharwal et al¹⁹ showed that children are able to adequately perfuse the distal extremities via collateral circulation even after brachial artery ligation, whereas Ramesh et al¹⁸ reported that all patients with a pink pulseless hand who were treated conservatively regained radial pulse and had no lasting complications after an average of 36.6 months of follow-up.

In the case reported herein, collateral circulation was shown on a computed tomographic angiogram and a pink perfused hand was maintained. However, the patient reported a substantial neurological deficit in his digits and exhibited increasing forearm edema, representing developing compartment syndrome.

This is the first reported case of brachial artery transection presenting with an apparently isolated medial epicondyle fracture of the humerus in a pediatric patient. However, intraoperative findings of gross medial elbow instability supported the diagnosis of elbow dislocation, which is a common mechanism for sustaining a medial epicondyle fracture. Despite the lack of a palpable radial pulse, the patient had a pink perfused hand and was initially managed

by close observation. Because of concern regarding impending compartment syndrome, the patient was taken to the operating room to undergo forearm fasciotomies and open reduction and internal fixation of the medial epicondyle fracture with repair of the vascular injury to restore perfusion to the distal upper extremity. In conclusion, pediatric patients presenting with apparent isolated medial epicondyle fracture should be evaluated with a high index of suspicion for occult dislocation and associated neurovascular injury.

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Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

Informed consent was obtained from the patient for being included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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