Medial Epicondyle Nonunions in Children: Case Report With Overview and Management

Abstract

Up to 90% of medial epicondyle fractures treated with conservative measures result in nonunion. However, only 21% become symptomatic. The current case review discusses the history and treatment of a symptomatic medial epicondyle nonunion in a 14-year-old over a 2-year period. Initial conservative treatment was insufficient. However, open reduction and internal fixation afforded the patient a full resolution of symptoms with return to all activities at 10 weeks postoperatively. The patient remains asymptomatic more than 2 years after the initial injury. Open reduction and internal fixation achieved excellent outcomes in the treatment of a symptomatic medial epicondyle nonunion.

Case Report

A 14-year-old female patient presented as an outpatient for evaluation of the right elbow pain. The patient initially injured her right elbow 1 year before presentation after running into a wall during her health class. She was seen and treated at an outside hospital. Radiographs at that time demonstrated a medial epicondyle fracture that was displaced 5.5 mm distally (Figure 1), and she was treated conservatively in a long arm cast. At 3 weeks, she was transitioned into physical therapy to work on elbow range of motion. Over the ensuing months, she regained near full symmetric range of motion, and at 5 months, she was released by the outside physician to return to sport. At 10 months after injury, she reinjured her elbow playing field hockey, prompting the outpatient referral. At the initial visit, her history focused around the pain she experienced when flexing her elbow. She also endorsed a “popping” and catching sensation with elbow flexion and extension that was associated with...
paresthesia in the ulnar distribution of her right hand. Her major limitations from this pain were with overhead activities, specifically throwing motions that place increased valgus stress on the elbow. Her DASH score was 19.2. On examination, she was found to have tenderness to palpation over the medial elbow which was made worse with valgus stress and resisted wrist flexion. She also had a positive moving valgus stress test and milking maneuver. She had a full range of motion in both elbows and was neurovascually intact in both upper extremities. Radiographs revealed a nonunion of the medial epicondyle with displacement of the fracture distally and anteriorly (Figure 2).

Initially, the patient was treated using a hinged elbow brace; however, she failed to experience any pain relief after conservative measures, which included limiting aggravating activities of the elbow, rest, and nonsteroidal anti-inflammatories. Because of the failure of conservative measures, we discussed the various treatment options, which included open reduction with bone graft and possible ulnar nerve transposition. After discussing surgical and nonsurgical managements, the decision was made to proceed with open reduction and internal fixation with bone graft and possible ulnar nerve transposition. Ulnar nerve transposition was included in the preoperative planning because of the patient’s preoperative subjective complaints of paresthesias as well as the potential for an extensive intra-operative dissection to facilitate exposure of the fracture bed. Before surgery, the patient underwent electromyography and a magnetic resonance arthrogram of the right upper extremity to further evaluate for ulnar nerve pathology or possible intra-articular derangements, including any osteochondral defects or loose bodies. However, both studies failed to reveal any pathology in the elbow or ulnar nerve.

Procedure

The patient underwent open reduction and internal fixation of the medial epicondyle nonunion with local bone autograft, as well as ulnar nerve transposition. The patient was positioned in the prone position on gel rolls, and a nonsterile tourniquet was applied to the upper extremity. A 5-cm incision was made over the medial aspect of the elbow centered over the medial column. Sharp dissection was carried down to the fascia, and the fragment was encountered almost in the subcutaneous tissue. Visualization of the medial elbow revealed the fibrous nonunion of the medial epicondyle. The fragment was mobile upon palpation and displaced distally and anteriorly. The ulnar nerve was located at the previous fracture bed of the medial epicondyle and was encased in scar.
tissue. The ulnar nerve was carefully evaluated and explored before being transposed subcutaneously, allowing for further dissection and exposure of the fracture bed. The previous fracture site was curetted and prepped. Local bone graft was obtained from the distal humerus. The fragment was reduced with a bone reduction forceps, and two k-wires were used to secure the fragment into place. A fully-threaded screw was placed with a washer through the medial epicondyle in a lag technique fashion using a gliding hole. A full-threaded screw was chosen to maximize the amount of threads into the humerus.2

A local bone autograft was placed, and good compression of the graft was achieved. A #2 fiber wire was used to suture in a Bunnell fashion into the flexor pronator mass and was secured with one suture anchor placed proximally to the bed of the nonunion site. The patient was then placed in a long arm splint postoperatively and later transitioned to a hinged elbow brace set at 10° to 90° 1 week after surgery.

At the 2-week follow-up visit, her range of motion was 0 to 100 with intact sensation in the ulnar nerve distribution. The patients’ range of motion was increased over the ensuing 6 weeks. At 6 months postoperatively, the patient had returned to all activities without issue, and her DASH score was 2.5. Radiographs at 8 months demonstrated a healed medial epicondyle fragment (Figures 3 and 4). Two years since the initial injury, the patient is asymptomatic with a full range of motion, intact sensation in the ulnar nerve distribution, and participation in all activities.

**Discussion**

Medial epicondyle fractures are common in children, accounting for 10% to 20% of pediatric elbow fractures, with a peak age between 11 and 12 years. The mechanism of injury is usually a valgus elbow force produced by a fall on the outstretched hand or by overhead throwing.3,4 The medial epicondyle is typically avulsed distally by the flexor pronator mass and medial collateral ligament. Concomitant elbow dislocation is common (50% to 60% of cases), and approximately 20% of these involve incarceration of the fractured fragment within the elbow joint.5,6 This requires meticulous assessment of the injury radiographs to look for any subtle joint gapping that could indicate an incarcerated fragment.7,8

Treatment of medial epicondyle fracture in children remains controversial. For fragments displaced less than 1 cm on the radiograph, management has traditionally been nonsurgical, consisting of immobilization followed by gradual resumption of activity. However, recent work by Edmonds9 indicates that standard radiographs are neither sufficient nor accurate enough to measure true displacement of medial epicondyle fractures. The absolute indication for surgical treatment is an entrapped intra-articular apophyseal fragment. Otherwise, current literature does not offer a consensus as to the exact indications that warrant surgical intervention versus nonsurgical management, because excellent outcomes have been demonstrated in both, even when the fragment heals with a fibrous union.3,10,11 However, surgery has been recommended in patients who place a high demand on the elbow during athletic activities or those who present with ulnar nerve symptoms.6,8,12 A systematic review by Kamath et al showed a 92.5% rate of bony union in surgical versus 49.2% in nonsurgical treatments at the final follow-up. The odds of bony union were 9.33 times increased with surgical fixation versus nonsurgical treatment, and no notable difference was observed in pain or ulnar nerve symptoms at the final follow-ups ranging from 6 to 216 months.
Up to 90% of medial epicondyle fractures treated with conservative measures result in nonunion. However, only 21% become symptomatic, presenting with pain, weakness, decreased range of motion, joint instability, or ulnar nerve paresthesia. Few reported cases of symptomatic nonunion exist, but they are more common in high-demand individuals such as athletes who are at higher risk of reinjury after initial conservative treatment.

For symptomatic nonunions, both fragment excision and fixation have been advocated. Gilchrist and McKee performed excision of the medial epicondyle with advancement and fixation of the ulnar collateral ligament. All five patients reported increased stability and satisfaction at an average of 10 years after injury. However, a long-term retrospective study by Farsetti and colleagues found that fragment excision to be inferior to open reduction and internal fixation. Others have assessed open reduction and internal fixation, with all patients returning to sport and reporting notable improvements in pain and stability. In this case, late repair after failed conservative measures was likely a contributing factor to the extensive perineural scar tissue encountered during dissection. In most cases, adequate exposure will likely require circumferential mobilization of the ulnar nerve to facilitate exposure. Careful assessment of the nerve stability after fracture fixation should be performed to determine whether a transposition should be performed. In the above case, the authors thought that because of the extensive ulnar nerve dissection required to facilitate exposure, in conjunction with the patients’ preoperative history, she would benefit from an ulnar nerve transposition. Nonabsorbable suture or Kirschner wires may be used to augment a cannulated screw, or in place of it if the fragment is very small or comminuted. Supplementation bone grafting is usually unnecessary but may be considered when there is inadequate cortical contact or bone loss. Ulnar nerve decompression is recommended when patients present preoperatively with ulnar nerve compression symptoms, and subcutaneous transposition should be considered when there is clear ulnar nerve instability after fragment fixation or to avoid impingement by the screw. When a screw is used, a washer helps avoid fragment comminution or screw migration.

In one similar case, a 14-year-old male patient had a history of medial epicondyle fracture that was initially treated conservatively. A radiograph-proven nonunion remained asymptomatic until a second trauma 2 years later. Open reduction and screw fixation was performed along with ulnar nerve transposition, and the patient returned to sport without any report three months later. A retrospective analysis of 14 cases of symptomatic medial epicondylar nonunion treated with open reduction and internal fixation found excellent results. The mean age at presentation was 14.9 years, although it ranged from 6 to 50 years. At a mean of 3 years after surgery, patients reported statistically notable reduction in pain and improved mobility. Radiographic union was achieved in all but one patient.

To conclude, medial epicondyle fracture nonunions are common but rarely become symptomatic. Highly active athletes such as the case presented here are more likely to endure a secondary injury, which precipitates symptoms. In this case, open reduction and internal fixation with one fully-threaded screw accompanied by ulnar nerve transposition achieved an excellent outcome and high patient satisfaction.

References

1. Farsetti P, Potenza V, Caterini R, Ippolito E: Long-term results of treatment of fractures of the medial humeral epicondyle in children. J Bone Joint Surg Am 2001;83-A:1299-1305.
2. Downey MW, Kosmopoulos V, Carpenter BB: Fully threaded versus partially threaded screws: Determining shear in cancellous bone fixation. J Foot Ankle Surg 2015;54:1021-1024.
3. Sawyer JR, Spence DD: Fractures and dislocations in children, fractures and dislocations in children, in Campbell’s Operative Orthopaedics, Cambridge, MA: Elsevier, 2017, pp 1423-1569.e20.
4. Nykya M, Peiser J, Lükic F, Katz T, Liberman N: Avulsion fracture of the medial epicondyle caused by arm wrestling. Am J Sports Med 1992;20:347-350.
5. Tarallo L, Mugnai R, Fiacci F, Adani R, Zambianchi F, Catani F: Pediatric medial epicondyle fractures with intra-articular elbow incarceration. J Orthop Traumatol 2015;16:117-123.
6. Gottschalk HP, Eisner E, Hosalkar HS: Medial epicondyle fractures in the pediatric population. J Am Acad Orthopaedic Surgeons 2012;20:223-232.
7. Syed J, Zamri A, Jamaluddin S, Ruben J, Gopindran M: Intra-articular entrapment of medial epicondyle fracture fragment in elbow joint dislocation causing ulnar neuropraxia: A case report. Malays Orthop J 2017;11:82-4.
8. Lima S, Correia JF, Ribeiro RP, et al: A rare case of elbow dislocation associated with unrecognized fracture of medial epicondyle and delayed ulnar neuropathy in pediatric age. J Shoulder Elbow Surg 2013;22:e9-e11.
9. Edmonds EW: How displaced are “nondisplaced” fractures of the medial humeral epicondyle in children? Results of a three-dimensional computed tomography analysis. J Bone Joint Surg Am 2010;92:2783-2791.
10. Smith JT, McFeely ED, Bae DS, Waters PM, Micheli LJ, Kocher MS: Operative fixation of medial humeral epicondyle fracture nonunion in children. J Pediatr Orthopaedics 2010;30:644-648.
11. Josefsson PO, Danielsson LG: Epicondylar elbow fracture in children. 35-year follow-up of 56 unreduced cases. Acta Orthop Scand 1986;57:313-315.
12. Kamath AF, Baldwin K, Horneff J, Hosalkar HS: Operative versus nonoperative management of pediatric medial epicondyle fractures: A systematic review. J Child Orthop 2009;3:345-357.
13. Erdil M, Bilsel K, Ersen A, Elmadag M, Tuncer N, Sen C Treatment of symptomatic medial epicondyle nonunion: Case report and review of the literature. *Int J Surg Case Rep* 2012;3:467-470.

14. Gilchrist AD, McKee MD: Valgus instability of the elbow due to medial epicondyle nonunion: Treatment by fragment excision and ligament repair—a report of 5 cases. *J Shoulder Elbow Surg* 2002;11:493-497.

15. Kamath AF, Cody SR, Hosalkar HS: Open reduction of medial epicondyle fractures: Operative tips for technical ease. *J Child Orthop* 2009;3:331-336.

16. Pathy R, Dodwell ER: Medial epicondyle fractures in children. *Carr Opin Pediatr* 2015;27:58-66.

17. Patel NM, Ganley TJ: Medial epicondyle fractures of the humerus: How to evaluate and when to operate. *J Pediatr Orthop* 2012;32(suppl 1):S10-S13.

18. Kulkarni VS, Arora N, Gehlot H, Saxena S, Kulkarni SG, Bajwa S: Symptomatic medial humeral epicondylar fracture non-union- rare presentation of a relatively common injury. *Injury* 2017;48(suppl 2):S50-S53.