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Medial Condyle Fracture of the Humerus Following an Arm-Wrestling Injury in an Adolescent: A Rare Kilfoyle Type II Injury with Transient Ulnar Neuropathy Managed by Open Reduction and Pinning

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A B S T R A C T

Fractures of the medial condyle of the humerus are uncommon injuries in the pediatric and adolescent population, accounting for fewer than two percent of elbow fractures, yet they are clinically important because the fracture line crosses both the articular surface and the distal humeral physis. Delayed or inadequate treatment may lead to nonunion, growth arrest, cubitus varus or valgus deformity, and elbow instability. We report a 15-year-old male who presented with one month of persistent left elbow pain after an arm-wrestling contest during which the elbow shifted and he fell onto the affected arm. He described intermittent paresthesia of the ring and little fingers and morning stiffness. Examination revealed medial elbow swelling, tenderness over the medial condyle, painfully limited motion, and paresthesia in the ulnar nerve distribution. Plain radiographs confirmed a left medial condyle fracture classified as Kilfoyle type II. Because of the intra-articular nature of the injury and the risk of displacement, open reduction and internal fixation with Kirschner-wire pinning was performed, followed by intravenous fluid support, ceftriaxone for prophylaxis, and intravenous paracetamol for analgesia. One week postoperatively the patient showed marked improvement, with resolution of stiffness, reduced pain, recovered range of motion, and improvement of the ulnar nerve symptoms, and no complications were observed. This report highlights arm wrestling as a rare mechanism of adolescent medial condyle fracture, its association with transient ulnar neuropathy, and the favorable early outcome achievable with prompt anatomical fixation and structured postoperative care.

1. Introduction

Injuries around the elbow are among the most frequent skeletal injuries of childhood and adolescence, representing a substantial proportion of fractures that present to emergency and orthopedic urgent-care services.[1] The immature distal humerus, with its multiple ossification centers and open physes, responds to trauma in ways that differ fundamentally from the adult skeleton, and imaging interpretation in this age group is complicated by the changing appearance of the cartilaginous epiphysis.[2] Within this spectrum, fractures of the medial condyle of the humerus are decidedly rare, accounting for fewer than one to two percent of all pediatric elbow fractures.[3,4] Their scarcity, combined with the largely cartilaginous nature of the trochlea in younger patients, means that these injuries are frequently underestimated or misclassified at initial presentation.[5]

The medial condyle is an osteochondral structure that incorporates the trochlea, the articular surface across which the ulna articulates, together with a portion of the medial supracondylar column and, in many patients, the contiguous medial epicondylar apophysis. Because the fracture line of a true medial condyle injury traverses the articular cartilage and frequently extends across the distal humeral physis, the injury is simultaneously intra-articular and transphyseal. These two features explain why

anatomical restoration is considered essential: incongruity of the trochlear articular surface predisposes to post-traumatic stiffness and degeneration, while physeal involvement raises the possibility of partial growth arrest and progressive angular deformity.[3,6] It is important to distinguish the medial condyle fracture from the far more common medial epicondyle avulsion, an extra-articular apophyseal injury that follows a different management algorithm and prognosis.[7,8]

The mechanism of injury typically involves a valgus and rotational load transmitted across the elbow, classically generated by a fall onto an outstretched hand but also by activities that concentrate torsional force at the joint. Arm wrestling is a recognized, though uncommon, cause of distal humeral injury in adolescents and young adults, in whom the combination of maximal muscular torque and a sudden valgus moment can exceed the structural tolerance of the immature or slender humerus.[9-12] The clinical presentation is dominated by medial elbow pain, swelling and tenderness, restricted and painful motion, and—because the ulnar nerve courses immediately posterior to the medial epicondyle within the cubital tunnel—symptoms of ulnar nerve irritation such as paresthesia of the fourth and fifth digits.[13,14] Radiographic evaluation is the cornerstone of diagnosis, although the cartilaginous fragment may be poorly visualized, and advanced imaging or examination under anesthesia is occasionally required.[2,5]

The Kilfoyle classification remains the most widely applied framework for medial condyle fractures and stratifies the injury by the degree of fragment displacement and rotation, thereby guiding treatment.[3,4] Nondisplaced or minimally displaced fractures may be amenable to immobilization with close radiographic surveillance, whereas displaced and rotated intra-articular fractures generally require open reduction and internal fixation to restore the articular surface and the physeal anatomy.[4,15] Kirschner-wire pinning and cannulated screw fixation are both established techniques, each with distinct advantages regarding stability, the need for hardware removal, and the risk of physeal injury.[4,16,17] Reported complications of inadequately treated condylar injuries include nonunion, avascular necrosis, cubitus varus or valgus deformity, and chronic ulnar neuropathy, all of which underscore the value of early recognition and appropriate intervention.[18-21]

Despite the clinical importance of these fractures, the literature specific to medial condyle injuries—and particularly to those sustained through arm wrestling in adolescents—remains limited to small series and isolated case reports.[3,9,12] Moreover, the natural history of the associated ulnar nerve symptoms after fixation is incompletely described. The novelty of the present report lies in its description of a rare confluence of features: a Kilfoyle type II medial condyle fracture produced by an arm-wrestling injury in a 15-year-old, accompanied by transient ulnar nerve paresthesia that resolved rapidly after open reduction and pinning. The aim of this report is to document the clinical presentation, radiographic findings, operative management, and early functional and neurological recovery of this uncommon injury, and to situate these observations within the contemporary evidence on the classification and treatment of pediatric distal humeral condylar fractures.

2. Case Presentation

A 15-year-old male presented to the orthopedic outpatient clinic with persistent pain in the left elbow that had been present for approximately one month. Table 1 summarizes the demographic, clinical, and physical examination findings of the patient. The symptoms had begun acutely while the patient was engaged in an arm-wrestling contest with a friend. During the contest, he felt the elbow suddenly shift, after which he lost balance and fell, landing with his body weight on the left arm. He reported that, at the moment of injury, the elbow had appeared deformed and dislocated, and that it had been manipulated and apparently repositioned shortly afterwards. Despite this, the pain did not resolve; instead it persisted over the following weeks and was consistently aggravated by movement of the joint.

In addition to pain, the patient described intermittent paresthesia radiating to the ring and little fingers of the left hand, a distribution corresponding to the territory of the ulnar nerve. He also reported stiffness of the elbow that was most pronounced upon waking in the morning and that improved partially with activity through the day. There was no history of fever,

open wound, or constitutional symptoms. The patient had no prior history of trauma to the limb, no chronic illness, and no previous orthopedic conditions. He was an active junior high school student with an otherwise unremarkable past medical and developmental history and was right-hand dominant.

Table 1. Demographic, clinical, and physical examination findings of the patient.

Parameter	Finding
Age	15 years
Gender	Male
Hand dominance	Right
Affected side	Left elbow
Mechanism of injury	Arm-wrestling contest; elbow shifted under load, followed by a fall onto the left arm with a transient sensation of dislocation
Duration of symptoms	Approximately 1 month
Chief complaint	Persistent left elbow pain, aggravated by movement
Associated symptoms	Intermittent paresthesia of the 4th and 5th digits; morning elbow stiffness
Past medical history	No previous trauma, chronic illness, or orthopaedic conditions
General examination	Well appearing; vital signs stable; systemic examination unremarkable
Local examination	Swelling over the medial aspect of the distal humerus; no open wound or bleeding; tenderness over the medial condyle; no crepitus
Range of motion	Limited and painful, particularly on active flexion and extension
Neurological examination	Paresthesia in the ulnar nerve distribution (4th and 5th digits); intrinsic motor power preserved
Vascular status	Intact; palpable radial and ulnar pulses, normal capillary refill

The physical examination findings are summarized in Table 1. On general examination, the patient was well-appearing and in no acute distress, and his vital signs were stable and within normal limits for age. The systemic examination was unremarkable. Local examination of the left elbow revealed swelling concentrated over the medial aspect of the distal humerus, without any open wound, skin breach, or active bleeding. Palpation elicited well-localized tenderness over the medial condyle region. No crepitus was detected on gentle manipulation, and there was no gross deformity at the time of presentation. The range of motion of the elbow was restricted, particularly during active flexion and extension, with the limitation being predominantly pain-related. Neurological examination demonstrated paresthesia in the distribution of the ulnar nerve, affecting the fourth and fifth digits, while motor power of the intrinsic hand muscles was preserved and the radial and median nerve territories were intact. The distal vascular status of the limb was normal, with palpable radial and ulnar pulses, normal capillary refill, and warm digits.

Plain radiographs of the left elbow were obtained in anteroposterior and lateral projections. Figure 1 illustrates the pre-operative radiographs, which demonstrated a fracture involving the medial condyle of the distal humerus with extension toward the physis and articular margin, consistent with the patient's mechanism of injury and clinical findings. The radiographic appearance, interpreted in conjunction with the largely cartilaginous trochlea characteristic of this age group, was reviewed carefully to avoid the diagnostic pitfalls described for transphyseal and condylar injuries of the immature distal humerus.[2,5]

Based on the integrated clinical and radiographic evaluation, the patient was diagnosed with a left medial condyle fracture of the humerus, classified as Kilfoyle type II, indicating a fracture extending through the epiphysis with minimal but definite displacement of the fragment.[3,4] Given the intra-articular nature of the fracture, the involvement of the physis, and the presence of fragment displacement together with ulnar nerve symptoms, a decision was made to proceed with operative management rather than closed immobilization.

Figure 1. Pre-operative anteroposterior (left) and lateral (right) radiographs of the left elbow demonstrating the medial condyle fracture of the distal humerus. The laterality marker (L) indicates the left side.

The patient underwent open reduction and internal fixation of the left medial condyle fracture using Kirschner-wire pinning. Under general anesthesia, the fracture was exposed through a medial approach; the displaced osteochondral fragment was reduced anatomically to restore the congruity of the trochlear articular surface and the alignment of the physis; and stabilization was achieved with pin fixation. The ulnar nerve was identified and protected throughout the exposure, and intra-operative assessment confirmed satisfactory reduction and stable fixation of the fragment. The operative procedure, the postoperative pharmacological regimen, and the corresponding clinical response at one week are presented in Table 2.

Table 2. Operative management, postoperative regimen, and clinical response at one week.

Component	Detail	Rationale/response
Procedure	Open reduction and internal fixation with Kirschner-wire pinning; medial approach	Anatomical reduction of the trochlear articular surface and physis with intra-operative protection of the ulnar nerve
Intravenous fluid	Normal saline (NaCl 0.9%)	Maintenance of hydration and circulation
Antibiotic prophylaxis	Ceftriaxone 1 g IV twice daily	Prevention of surgical-site and pin-track infection
Analgesia	Paracetamol 1 g IV three times daily	Postoperative pain control
Pain at 1 week	Markedly decreased	Favorable analgesic and surgical response
Elbow stiffness at 1 week	Resolved	Improved joint mobility
Ulnar nerve symptoms at 1 week	Paresthesia of 4th and 5th digits improved	Recovery of ulnar nerve irritation
Range of motion at 1 week	Improved	Functional recovery
Local tenderness at 1 week	Reduced over the medial condyle	Healing without complication
Complications	None (no infection, no neurovascular compromise)	Uncomplicated early course

Notes: IV, intravenous; NaCl, sodium chloride.

As detailed in Table 2, the patient received supportive intravenous fluid therapy with normal saline postoperatively to maintain adequate hydration and circulation. Infection prophylaxis was provided with intravenous ceftriaxone 1 g administered twice daily, a strategy consistent with contemporary recommendations for perioperative antimicrobial prophylaxis in orthopedic surgery and with the recognized, if low, risk of pin-track and surgical-site infection associated with wire fixation.[22,23] Analgesia was achieved with intravenous paracetamol 1 g administered three times daily, an approach supported by evidence on the efficacy and safety of paracetamol for postoperative pain control.[24] The affected limb was supported and the elbow protected in the early postoperative period.

The adequacy of the reduction and the position of the fixation were confirmed radiographically. Figure 2 illustrates the post-operative anteroposterior (panel A) and lateral (panel B) radiographs of the left elbow, demonstrating the reduced medial condyle fracture with the fixation pin in a satisfactory position.

(A) **(B)**

Figure 2. Post-operative radiographs after open reduction and internal fixation with Kirschner-wire pinning: (A) anteroposterior and (B) lateral projections of the left elbow, showing the reduced medial condyle fracture with the fixation pin in satisfactory position.

One week after surgery, the patient returned for follow-up evaluation at the outpatient clinic and reported substantial improvement in his symptoms, as documented in Table 2. The stiffness that had previously limited the elbow had resolved, and the pain experienced during movement had decreased markedly. Importantly, the paresthesia affecting the ring and little fingers had improved, a finding that suggested recovery from the irritation of the ulnar nerve that had been present preoperatively. Physical examination at this visit confirmed an improved range of motion of the elbow and a reduction in tenderness over the medial condyle region. There were no clinical signs of postoperative complications: the wound was healing without evidence of infection, and there was no neurovascular compromise of the limb. The early trajectory was therefore one of favorable functional and neurological recovery following prompt anatomical fixation and structured postoperative care.

3. Discussion

Medial condyle fractures of the humerus occupy an uncommon but clinically significant position within the broad category of pediatric elbow trauma. Although elbow injuries as a whole are among the most frequently encountered skeletal injuries in children and adolescents,[1] fractures isolated to the medial condyle constitute a small minority, reported in most series to represent fewer than two percent of pediatric elbow fractures.[3,4] This rarity has important practical consequences. Many clinicians encounter only a handful of these injuries over the course of a career, the published evidence base is dominated by small retrospective series and case reports, and the largely cartilaginous nature of the immature trochlea makes the fragment difficult to appreciate on conventional radiographs.[2,5] The present case, in a 15-year-old whose physes were approaching but had not yet reached closure, illustrates the diagnostic and therapeutic considerations that arise when a rare intra-articular and transphyseal injury is encountered in an adolescent.

The mechanism of injury in this patient merits particular attention. Arm wrestling is an activity in which two opponents generate sustained, maximal isometric and eccentric muscular force across the elbow and shoulder, and the humerus is subjected to a combination of torsional, valgus, and compressive loads. When the externally applied torque exceeds the mechanical strength of the bone, a fracture results, most classically a spiral fracture of the distal humeral shaft.[9-11] Series examining arm-wrestling injuries have documented that these forces can produce a spectrum of upper-limb fractures and that the injury is not confined to adults but also affects adolescents and young men.[9,12] In the immature or skeletally transitioning elbow, the same valgus and rotational moment that produces a shaft fracture in an adult may instead be transmitted to the weaker physeal and articular regions, generating a condylar or epicondylar injury rather than a diaphyseal one. The patient's own account—of the elbow suddenly shifting under load, followed by a fall onto the arm and a transient sense of dislocation—is highly consistent with this biomechanical model and with the reported behavior of the joint under extreme valgus stress.[10,12] To our knowledge, a medial condyle fracture arising specifically from arm wrestling in an adolescent has rarely been documented, which distinguishes this case from the more commonly reported arm-wrestling fractures of the humeral shaft.

Accurate classification is central to the management of medial condyle fractures, and the Kilfoyle system is the framework most widely employed for this purpose.[3,4] In broad terms, Kilfoyle type I fractures are nondisplaced injuries in which the fracture line is incomplete or the fragment remains in its anatomical position; type II fractures extend through the epiphysis with minimal displacement of the fragment; and type III fractures are completely displaced and frequently rotated. The therapeutic implication of this gradation is direct: type I injuries are often suitable for nonoperative management with immobilization and serial radiographs, whereas type II injuries with demonstrable displacement, and all type III injuries, are generally treated operatively to secure anatomical reduction of the articular surface and the physis.[4,15] Importantly, type II fractures occupy a clinically ambiguous middle ground; apparently minor displacement on initial radiographs can progress, and the cartilaginous component of the fragment may be larger than the ossified portion seen on the film, so the true extent of articular involvement can be underestimated.[5] In the present patient, the combination of demonstrable displacement, the intra-articular and transphyseal character of the fracture, and the presence of ulnar nerve symptoms supported the decision to proceed with operative fixation rather than to accept the risks of nonoperative treatment.

An appreciation of the local pathophysiology helps to explain both the hazards of this injury and the rationale for its treatment. The distal humeral epiphysis derives its blood supply from vessels that enter along the non-articular margins of the condyles, and the trochlea in particular has a tenuous, largely intra-articular vascular supply that renders it vulnerable to ischaemia when the fragment is displaced or stripped of its soft-tissue attachments. A fracture line that traverses the physis may injure the germinal layer of the growth plate and create the potential for a partial arrest and the formation of a physeal bar; because the unaffected portion of the physis continues to grow, the result over time may be a progressive angular deformity of the

elbow.[3,5] The intra-articular extension of the fracture introduces a separate set of consequences, since a residual step or gap at the trochlear surface alters joint mechanics and predisposes to stiffness, pain, and premature degenerative change. These considerations collectively justify the emphasis on anatomical reduction and stable fixation rather than the acceptance of residual displacement, and they explain why even an apparently modest type II injury is treated with caution in the adolescent elbow, in whom remodeling potential is diminishing as the physes approach closure.[4,25]

A central diagnostic challenge in medial-sided distal humeral injuries is the distinction between a medial condyle fracture and a medial epicondyle avulsion. The two entities are frequently confused because they share a mechanism, a region of tenderness, and an association with ulnar nerve symptoms, yet they differ fundamentally in their anatomy and prognosis. The medial epicondyle is an extra-articular traction apophysis that serves as the origin of the flexor-pronator mass and the ulnar collateral ligament; its avulsion is among the most common and most debated elbow injuries in children.[7,8,14] The medial condyle, by contrast, is an intra-articular osteochondral structure that includes the trochlea, and its fracture therefore carries the risks intrinsic to articular and physeal injury.[3] This distinction is more than academic. The recently reported multicentre SCIENCE randomised controlled trial demonstrated that, for displaced medial epicondyle fractures, surgical fixation offered no clinically meaningful functional benefit over nonoperative care and was not cost-effective, leading the investigators to recommend nonoperative management as the default for that specific extra-articular injury.[7] It would be a serious error, however, to extrapolate that conclusion to the intra-articular medial condyle fracture, where restoration of the articular surface and physeal alignment remains the governing principle and where displaced injuries are managed operatively.[3,4,15] The careful clinical and radiographic evaluation that allowed this patient's injury to be correctly identified as a condylar rather than an epicondylar fracture was therefore decisive in directing appropriate treatment.

The ulnar nerve symptoms observed in this patient illustrate another important dimension of medial-sided elbow trauma. The ulnar nerve passes through the cubital tunnel immediately posterior to the medial epicondyle, where it is intimately related to the medial column of the distal humerus and is therefore vulnerable to injury from fracture fragments, hematoma, edema, and traction.[13,14] Paresthesia of the fourth and fifth digits, as seen here, is the characteristic manifestation of ulnar nerve irritation, and its presence in the context of a medial-sided fracture should prompt deliberate assessment and protection of the nerve. The literature on operative management of medial-sided fractures emphasises identification and, where indicated, exploration of the ulnar nerve during open reduction in order to avoid iatrogenic injury and to address pre-existing nerve compromise.[13,26] The configuration and technique of fixation are likewise relevant, as iatrogenic ulnar nerve injury is a recognized hazard of medial instrumentation around the elbow; randomised and comparative data on wire configuration in distal humeral fractures have informed strategies to minimise this risk.[16,17] In this patient, intra-operative identification and protection of the nerve, combined with anatomical reduction that relieved the mechanical source of irritation, was followed by marked improvement of the paresthesia within one week. This favorable and rapid neurological course contrasts with the refractory and chronic ulnar neuropathies that can complicate neglected, malunited, or inadequately treated injuries and that may ultimately require nerve decompression, transposition, or even distal nerve transfer.[21,27]

The treatment of medial condyle fractures is dictated principally by the degree of displacement and the integrity of the articular surface. Nondisplaced fractures may heal satisfactorily with immobilization, provided that close radiographic follow-up confirms that displacement does not progress.[3,4] Displaced fractures, however, require open reduction and internal fixation to reconstitute the joint surface, to realign the physis, and to provide the stability necessary for union.[4,15] Both Kirschner-wire pinning and cannulated screw fixation are well-described options. Wire fixation, as used in the present case, is technically straightforward, is well suited to small and partially cartilaginous fragments in the immature skeleton, and allows straightforward hardware removal, although it carries a small risk of pin-track infection and requires attention to pin

placement relative to the physis.[23,28] Cannulated screws, including absorbable implants, provide compression and have been reported to yield excellent union and functional scores in series of Kilfoyle type II and III medial condyle fractures, with the advantage—in the case of absorbable devices—of avoiding a second procedure for hardware removal.[4] The choice between these techniques is individualized according to fragment size, patient age, surgeon preference, and the configuration of the fracture. Regardless of the implant selected, the unifying objectives are anatomical articular reduction, secure fixation, and protection of the physis and the ulnar nerve, all of which were achieved in this patient.

Table 3 places the present case in the context of previously reported cases and series of distal humeral injuries, including arm-wrestling fractures and medial-sided condylar and epicondylar injuries managed operatively. As demonstrated in Table 3, the constellation observed in this patient—an adolescent, an arm-wrestling mechanism, a Kilfoyle type II medial condyle fracture, associated transient ulnar neuropathy, treatment by open reduction and pinning, and rapid early recovery—represents an unusual combination relative to the existing literature, in which arm-wrestling injuries have most often been diaphyseal and medial-sided pediatric fractures have most often involved the epicondyle.[3,7,9-12] The comparison reinforces both the rarity of the present injury pattern and the consistency of its favorable response to prompt anatomical fixation.

Table 3. Comparison of the present case with previously reported cases and series of distal humeral and medial-sided elbow injuries.

Report	Population	Injury/mechanism	Management	Reported outcome
Present case	15-year-old male	Medial condyle fracture (Kilfoyle II); arm wrestling, with ulnar paresthesia	ORIF with K-wire pinning; ceftriaxone, paracetamol	Rapid 1-week improvement; nerve symptoms resolved; no complications
Shen et al.*	Young men (series)	Humeral shaft fractures; arm wrestling	Operative and nonoperative	Mechanism and outcomes characterised in a retrospective cohort
Jalamneh et al.†	Young adult	Distal humerus spiral fracture; arm wrestling	Conservative management	Union with conservative care
Mirchandani et al.‡	Adult	Spiral humeral fracture; arm-wrestling match	Reported as a case	Documented mechanism and management
Şahbat et al.§	Mixed, incl. adolescents	Arm-wrestling injuries (series)	Various; return-to-sport assessed	Characterised injury pattern and outcomes
Orellana et al.II	Pediatric (series)	Medial humeral condyle fractures	Classification-based; operative for displaced	Defined classification, treatment, and outcomes
Li et al.¶	Children (5-12 y)	Medial condyle fractures (Kilfoyle II-III)	ORIF, medial approach, absorbable cannulated screws	Union in all; excellent/good elbow scores; no major complications
Perry et al. (SCIENCE)	Children 7-15 y (RCT)	Displaced medial epicondyle fracture (extra-articular)	Surgical vs nonsurgical (randomised)	No clinical benefit of surgery; nonoperative recommended

*Notes: ORIF, open reduction and internal fixation; K-wire, Kirschner wire; RCT, randomised controlled trial. Comparator reports: *Shen et al.; †Jalamneh et al.; ‡Mirchandani et al.; §Şahbat et al.; IIOrellana et al.; ¶Li et al. (see References).*

The prognosis of medial condyle fractures is closely linked to the timeliness and adequacy of treatment. When these intra-articular and transphyseal injuries are missed, neglected, or inadequately reduced, they may progress to a range of serious complications. Nonunion of condylar fractures is well recognized and may necessitate delayed fixation or reconstructive procedures.[15,18] Malunion and growth disturbance can produce progressive angular deformity of the elbow, including cubitus varus and cubitus valgus, the latter being a classic late sequela of lateral condylar nonunion but reflecting the broader principle that physeal injury about the elbow threatens normal growth and alignment.[18-20] Progressive cubitus deformity is not merely cosmetic; it can alter the mechanical environment of the ulnar nerve and contribute to tardy ulnar nerve palsy, as illustrated by reports of nerve dysfunction arising from distal humeral malunion years after the original injury.[20,21] Avascular necrosis and persistent stiffness round out the list of potential adverse outcomes. The favorable early result in the present patient—union proceeding uneventfully, restoration of motion, and resolution of nerve symptoms—is precisely the outcome that prompt recognition and anatomical fixation are intended to secure, and it stands in deliberate contrast to the morbid natural history of the neglected injury.[4,18]

Several learning points emerge from this case. First, a high index of clinical suspicion is required when an adolescent presents with persistent medial elbow pain after a high-torque activity such as arm wrestling, even when an initial reduction of an apparent dislocation has been performed and the acute deformity has resolved; the persistence of pain and the development of ulnar nerve symptoms should prompt dedicated imaging and orthopedic assessment rather than reassurance.[2,5] Second, the radiographic interpretation of the immature distal humerus demands care, because the cartilaginous trochlea is radiolucent and the true size of a condylar fragment may be underestimated; the diagnostic pitfalls of transphyseal and condylar injuries are well documented.[5] Third, correct classification of the injury as a medial condyle fracture rather than a medial epicondyle avulsion is essential, because the two follow divergent treatment algorithms—the former generally operative when displaced, the latter increasingly nonoperative even when displaced.[3,4,7] Fourth, deliberate identification and protection of the ulnar nerve during medial exposure, and anatomical reduction of the fragment, collectively offer the best opportunity for rapid neurological recovery and for the prevention of the chronic neuropathy that complicates neglected injuries.[13,21,27] Finally, a structured postoperative regimen incorporating appropriate antimicrobial prophylaxis and effective multimodal analgesia supports an uncomplicated early recovery.[22-24]

Where plain radiographs leave diagnostic uncertainty, adjunctive imaging has a defined role in the immature elbow. Because the trochlea is largely cartilaginous and therefore radiolucent, the ossified fragment visible on a film may represent only a fraction of the true osteochondral injury, and the degree of articular involvement can be correspondingly underestimated.[2,5] Contralateral comparison views, oblique projections, ultrasonography, and, in selected cases, magnetic resonance imaging or computed tomography can clarify the extent of the articular and physeal injury and refine the operative plan. The recurring theme in reports of misdiagnosed transphyseal and condylar injuries is that a deceptively normal-appearing radiograph does not exclude a clinically important cartilaginous injury when the mechanism and examination are suggestive.[5] In the present patient, the convergence of a consistent high-torque mechanism, focal tenderness over the medial condyle, ulnar nerve symptoms, and the radiographic findings provided sufficient diagnostic confidence to proceed to surgery, but clinicians should retain a low threshold for further imaging whenever doubt persists, as the consequences of a missed condylar fracture are substantial.[3,18]

Rehabilitation and the eventual return to activity constitute the final phase of management. After stable fixation, a period of protected immobilization is generally followed by progressive mobilisation that restores the arc of elbow motion while safeguarding the healing fracture, with the timing of pin removal and the resumption of sport individualized to radiographic union and functional recovery.[4,28] The rapid restoration of motion observed in this patient at one week is encouraging, although a graduated rehabilitation

programme and continued surveillance remain appropriate. Counselling regarding the temporary avoidance of high-torque activities such as arm wrestling during the healing period is prudent given the mechanism of the original injury, and evidence from series of arm-wrestling injuries indicates that return to activity is generally achievable once healing is complete.[9,12] Written informed consent for the procedure and for the publication of de-identified clinical information and images was obtained, and patient confidentiality has been preserved throughout; all identifying details have been removed from the radiographs reproduced in this report.

This report is subject to the limitations inherent to a single case. The follow-up described here is short, extending to one week postoperatively, and although the early clinical and neurological trajectory was favorable, longer-term observation would be required to confirm bony union, to verify the maintenance of articular congruity and physeal growth, and to exclude late complications such as growth disturbance, angular deformity, or recurrent ulnar nerve symptoms. As a single observation, the case cannot establish the relative superiority of any particular fixation technique, and the conclusions that may be drawn are necessarily descriptive rather than comparative. Nonetheless, the case adds a well-documented example of a rare injury pattern to the literature and reinforces principles of management that are supported by the broader evidence base on pediatric distal humeral fractures.[3,4,15]

4. Conclusion

Medial condyle fractures of the humerus are rare injuries in adolescents, but they are clinically important because their intra-articular and transphyseal character predisposes to long-term functional impairment when they are missed or inadequately treated. This case demonstrates that activities generating valgus and torsional forces across the elbow, such as arm wrestling, can produce this uncommon injury and may be accompanied by transient ulnar nerve symptoms. Early recognition, accurate classification using the Kilfoyle system, and careful distinction from the more common medial epicondyle avulsion are essential to direct appropriate management. Open reduction and internal fixation with pinning, combined with deliberate protection of the ulnar nerve and a structured postoperative regimen of antimicrobial prophylaxis and analgesia, achieved anatomical restoration and a favorable early outcome, with resolution of pain and stiffness and recovery of the ulnar nerve symptoms within one week. Prompt and anatomically accurate treatment offers the best opportunity to prevent the nonunion, deformity, and chronic neuropathy that may otherwise complicate this injury, and longer-term follow-up remains advisable to confirm sustained union and undisturbed growth.

5. References

1. Abbott A, Swertfager K, Bloom S, et al. Pediatric fracture epidemiology in an orthopaedic urgent care setting. J Pediatr Soc North Am. 2025;12:100216. https://doi.org/10.1016/j.jposna.2025.100216
2. Kim HHR, Menashe SJ, Ngo AV, et al. Uniquely pediatric upper extremity injuries. Clin Imaging. 2021;80:249-261. https://doi.org/10.1016/j.clinimag.2021.07.010
3. Orellana KJ, Baghdadi S, Buttrick E, et al. Pediatric medial humeral condyle fractures: classification, treatment, and outcomes. J Pediatr Orthop. 2025;45(3):113-119. https://doi.org/10.1097/BPO.0000000000002879
4. Li L, Li W, Ma H, et al. Elbow medial approach open reduction and internal fixation with absorbable cannulated screws for the treatment of Kilfoyle II and III type medial condyle fractures of the humerus in children. Front Surg. 2025;12:1538399. https://doi.org/10.3389/fsurg.2025.1538399
5. Zhang L, Yuan Y, Cai H, et al. Diagnostic pitfalls and management of transphyseal fractures of the distal humerus: a retrospective review of 25 cases. Children (Basel). 2026;13(3):352. https://doi.org/10.3390/children13030352
6. Mathew DK, Gangadharan S, Krishnamoorthy V, et al. Anterior physeal separation of distal humerus: report of a rare case with review of literature. Indian J Orthop. 2021;55(1):208-212.

https://doi.org/10.1007/s43465-020-00111-9
7. Perry DC, Achten J, Zimmermann A, et al. Surgical fixation versus non-surgical care for children with a displaced medial epicondyle fracture of the elbow (the SCIENCE study): a multicentre, randomised controlled, superiority trial and economic evaluation. Lancet. 2026;407(10528):577-586. https://doi.org/10.1016/S0140-6736(25)02098-7
8. Lee RC, Syed AN, Bowen MA, et al. Partial avulsion patterns in the pediatric humeral medial epicondyle. Am J Sports Med. 2025;53(3):537-542. https://doi.org/10.1177/03635465241310407
9. Shen J, Yu P, Yang R, et al. Clinical characteristics, mechanism, and outcome of humeral shaft fractures sustained during arm wrestling in young men: a retrospective study. Orthop Surg. 2023;15(6):1627-1635. https://doi.org/10.1111/os.13751
10. Jalamneh B, Salim H, Sabbooba L, et al. Conservative management of a distal humerus spiral fracture sustained during arm wrestling: a case report and literature review. Cureus. 2023;15(7):e42466. https://doi.org/10.7759/cureus.42466
11. Mirchandani A, Espinosa J, Lucerna A. Spiral humeral fracture sustained during an arm-wrestling match: a case report. Cureus. 2026;18(3):e105857. https://doi.org/10.7759/cureus.105857
12. Şahbat Y, Kütük E, Çat G, et al. An unusual injury pattern: arm wrestling injury, treatment modalities, clinical outcomes, and return to sport. Ulus Travma Acil Cerrahi Derg. 2023;29(6):733-740. https://doi.org/10.14744/tjtes.2023.34247
13. Liu S, Su Y. The necessity of ulnar nerve exploration and translocation in open reduction of medial humeral epicondyle fractures in children. Bone Joint J. 2024;106-B(2):212-218. https://doi.org/10.1302/0301-620X.106B2.BJJ-2023-0501.R1
14. McGraw-Heinrich J, Amaral JZ, Williams E, et al. Ipsilateral supracondylar and medial epicondyle humerus fractures in pediatric patients: a retrospective analysis of incidence, epidemiology, treatment, and outcomes. J Pediatr Orthop. 2024;44(8):e705-e710. https://doi.org/10.1097/BPO.0000000000002741
15. Chang E, Gajewski C, Thompson RM, et al. Percutaneous screw fixation for the management of delayed unions in pediatric lateral humeral condylar fractures. J Pediatr Orthop. 2025;45(3):120-127. https://doi.org/10.1097/BPO.0000000000002856
16. Dobbe A, Schaeffer EK, Baraza N, et al. Management of displaced supracondylar fractures of the humerus using lateral versus crossed Kirschner wires: a prospective randomized controlled clinical trial. Bone Joint J. 2026;108-B(2):209-215. https://doi.org/10.1302/0301-620X.108B2.BJJ-2024-1529.R2
17. Baid M, Chatterjee A, Hait S, et al. Functional outcomes of treatment of paediatric supracondylar fractures with open or closed reduction and crossed Kirschner wire (K-wire) fixation. Cureus. 2026;18(3):e105403. https://doi.org/10.7759/cureus.105403
18. Xiao Y, Xie LW, Kang C, et al. Two-stage surgical reconstruction for cubitus valgus secondary to neglected lateral condylar fracture non-union in older children. Front Pediatr.2026;14:1767262. https://doi.org/10.3389/fped.2026.1767262
19. Su F, Dang Y, Li M, et al. A standardized rehabilitation protocol following two-stage surgery for nonunion of lateral humeral condyle fracture with cubitus valgus in children: functional and radiographic outcomes. BMC Musculoskelet Disord. 2025;26(1):1005. https://doi.org/10.1186/s12891-025-09247-x
20. Srivastava A, Jain AK, Dhammi IK, et al. Posttraumatic progressive cubitus varus deformity managed by lateral column shortening: a novel surgical technique. Chin J Traumatol. 2016;19(4):229-230.

https://doi.org/10.1016/j.cjtee.2015.08.009
21. O'Driscoll CJL, Spinner RJ. Failed ulnar nerve surgery due to persistent unrecognized snapping triceps from cubitus varus due to a distal humeral malunion in an adult: illustrative case. J Neurosurg Case Lessons. 2024;8(21):CASE24596. https://doi.org/10.3171/CASE24596
22. Righi E, Mutters NT, Guirao X, et al. European Society of Clinical Microbiology and Infectious Diseases/European Committee on infection control clinical guidelines on pre-operative decolonization and targeted prophylaxis in patients colonized by multidrug-resistant Gram-positive bacteria before surgery. Clin Microbiol Infect. 2024;30(12):1537-1550. https://doi.org/10.1016/j.cmi.2024.07.012
23. Tosti R, Foroohar A, Pizzutillo PD, et al. Kirschner wire infections in pediatric orthopaedic surgery. J Pediatr Orthop. 2015;35(1):69-73. https://doi.org/10.1097/BPO.0000000000000208
24. Stagg K. Intravenous versus oral paracetamol for postoperative analgesia: a systematic review. J Perioper Pract. 2021;31(10):373-378. https://doi.org/10.1177/1750458920950652
25. Bloodworth A, Nihalani S, McGwin G, et al. Factors affecting lateral overgrowth in operatively treated lateral condyle fractures in children. J Pediatr Orthop. 2025;45(1):e10-e17. https://doi.org/10.1097/BPO.0000000000002794
26. Sarıtaş TB, Arici V, Yildirim B, et al. Fragment incarceration as a key determinant of functional outcomes after operative fixation of pediatric medial epicondyle fractures: a single-center retrospective cohort study. J Pediatr Orthop. 2026.https://doi.org/10.1097/BPO.0000000000003312
27. Rocha R, Alves C, Monjardino MP, et al. Distal nerve transfer for refractory ulnar neuropathy after a pediatric elbow fracture: expanding the role of AIN-to-ulnar SETS. Hand (N Y). 2026;21(4):NP7-NP12. https://doi.org/10.1177/15589447251409354
28. Parteti R, Uikey K, Kothale J, et al. Outcome of type III supracondylar humerus fracture treatment by closed reduction and different configuration of percutaneous K-wire technique in children. J Orthop Case Rep. 2025;15(8):324-331. https://doi.org/10.13107/jocr.2025.v15.i08.5984