Case Studies

AAOS Appropriate Use Criteria: Management of Pediatric Supracondylar Humerus Fractures

Upper extremity fractures account for 71% to 90% of pediatric fractures. Among upper extremity fractures, supracondylar humerus fractures are one of the most common pediatric fractures requiring surgery. These injuries may be associated with nerve injury (20%), vascular injury, and/or compartment syndrome, and the treatment may be complicated by angular deformities, such as cubitus varus.

The American Academy of Orthopaedic Surgeons (AAOS) approved appropriate use criteria (AUC) for the treatment of pediatric supracondylar humerus fractures in an effort to assist the clinician in caring for these injuries. Here, we present two clinical scenarios and treatment options to demonstrate how these AUC can be incorporated in the decision-making process. Although these AUC accounted for 220 patient scenarios, it is impossible to include every possible clinical scenario. In addition, the AUC cannot account for individual variations in terms of training, preference in surgical technique, and limitations of institutional resources. These AUC represent the patients that a clinician is most likely to encounter; independent medical judgment and a patient’s clinical circumstances and preferences should always guide patient care and treatment.

Figure 1

Lateral (A) and AP (B) radiographs of the right elbow demonstrating a displaced, type 2 supracondylar fracture with an intact posterior hinge without coronal plane deformity.
Case 1

An 8-year-old boy fell out of bed, landing on his outstretched right arm. Evaluation in the emergency department revealed no signs of neurovascular compromise. Mild to moderate swelling was present around the right elbow. Radiographs of the right elbow showed a displaced, type 2 supracondylar fracture with an intact posterior hinge without coronal plane deformity (Figure 1).

The patient was placed in a long arm cast with the elbow positioned at 90° of flexion. The procedure was performed without sedation, and fluoroscopic imaging studies obtained after the procedure showed adequate reduction (Figure 2).

Radiographs obtained 1 week after the injury showed displacement of the fracture (Figure 3). After appropriate discussion with regards to surgical options, the patient underwent closed reduction and percutaneous skeletal fixation with two lateral Kirschner wires (Figure 4).

Three weeks after the surgery, the patient returned for pin removal. The patient was advised to restrict weight-bearing activities but was allowed to begin range-of-motion exercises. At a 7-week follow-up, the patient had full range of motion comparable to the contralateral elbow. He was released for full activities.

Based on AUC, the injury would have been classified as (1) type 2 extension type with cortical continuity of the posterior cortex, (2) perfused hand with palpable distal pulses, (3) associated nerve injury absent, (4) closed soft-tissue envelope, (5) ipsilateral radius and/or ulnar fracture absent, and (6) typical swelling. These criteria resulted in a strong recommendation for either urgent (score 7) or outpatient
The initial treatment of closed reduction with subsequent casting at 70° to 90° received a marginal score by the AUC panel (score 4). In general, surgical treatment options were favored in this case (Table 1).

Case 2
A 7-year-old boy jumped off a swing and sustained a left elbow injury. Examination in the emergency department revealed absent radial nerve function, palpable radial and ulnar pulses, significant swelling, ecchymoses, and a pucker sign (Figure 5). Radiographs revealed an extension type 3 supracondylar humerus fracture (Figure 6).

Because the patient had absent radial nerve function and significant swelling, treatment consisted of emergent closed reduction, percutaneous pinning, and placement of a long arm splint. Postoperative examination revealed the immediate return of radial nerve function. The patient was admitted for overnight observation. Radiographs revealed acceptable alignment and fixation with two lateral pins and one medial pin (Figure 7). The pins were removed at 4 weeks, and satisfactory range of motion returned by 8 weeks postoperatively.

Based on AUC, the injury would have been classified as (1) type 3 extension type, (2) perfused hand with palpable distal pulses, (3) associated nerve injury present, (4) closed soft-tissue envelope, (5) ipsilateral radius and/or ulnar fracture absent, and (5) severe swelling. These criteria resulted in a strong recommendation for urgent or emergent closed reduction with pinning and immobilization9 (score 7, Table 2). Nonsurgical management received a low score by

Table 1

<table>
<thead>
<tr>
<th>Case 1: Treatment Options and Appropriateness Ratings</th>
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<tr>
<td><strong>Appropriate</strong></td>
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<tr>
<td>Urgent: Closed reduction with pinning and immobilization with lateral pinning (7)</td>
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<tr>
<td>Outpatient: Closed reduction with pinning and immobilization with lateral pinning (8)+</td>
</tr>
<tr>
<td>Urgent: Closed reduction with pinning and immobilization with cross pinning (5)</td>
</tr>
<tr>
<td>Outpatient: Closed reduction with pinning and immobilization with cross pinning (5)</td>
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<tr>
<td>Immobilization with cast or splint without reduction (1)+</td>
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Numbers in parentheses are the median scores of the AAOS Appropriate Use Criteria Management of Pediatric Supracondylar Humerus Fractures. The scores are rated on a scale of 1 to 9: 1 to 3 = Rarely Appropriate, 4 to 6 = May Be Appropriate, 7 to 9 = Appropriate, + = agreement among panel members.
the AUC panel (score 1+). Because of reports of iatrogenic ulnar nerve injury, AAOS Clinical Practice Guidelines recommend lateral pinning versus cross pinning for supracondylar humerus fractures. In this case scenario, however, the AUC panel rated cross pinning and lateral pinning as equally appropriate (score 7). This reflects the finding that when unstable fracture patterns are treated, orthopaedic surgeons view the placement of a medial pin as acceptable treatment when there is a need to obtain sufficient fracture stability.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 4, 9, and 10 are level III studies. References 1-3 and 5-8 are level IV studies.

References printed in bold type are those published within the past 5 years.


