Elbow fractures are among the most frequently seen injuries in the pediatric population. However, a break through the distal humeral physis, most often referred to as a distal humeral epiphyseal separation, is rare, with an incidence of 1:35,000 births.\(^1\)\(^2\) Because this injury typically occurs in very young children before the distal humeral epiphysis is ossified, the diagnosis can be easily missed or misinterpreted as a congenital deformity or an elbow dislocation. Ultrasound has been suggested as a good way to diagnose and treat this injury. However, an illustrative example of the use of an elbow arthrogram to provide visualization for fragment reduction and fixation has not been presented in the literature. The authors show how preoperative ultrasound and an intraoperative arthrogram can greatly aid in the diagnosis and treatment of this rare injury pattern.

**Case Report**

A full-term male newborn was born by spontaneous vaginal delivery complicated by shoulder dystocia. After birth, he was not moving his right arm normally and there was concern for a brachial plexus injury. Radiographs were obtained on day of life 1 showing an elbow injury (Figure 1). The patient was transferred to the authors’ institution for further evaluation and management. On examination, he had spontaneous movement around the elbow. Radiographs and subsequent ultrasound were used to make the diagnosis of distal humeral epiphyseal separation. Given the displaced and acute nature of the fracture, a closed reduction and percutaneous pinning was performed. Intraoperatively, this was greatly facilitated by an elbow arthrogram. Immobilization consisted of a posterior plaster splint and swathe. Postoperative follow-up with clinical and radiographic examination showed abundant bony healing and early restoration of function. Ultrasound is useful to confirm the diagnosis of a distal humeral epiphyseal separation for elbow injuries in very young patients. However, once the diagnosis is confirmed, an intraoperative elbow arthrogram helps highlight the fracture fragments and ensures proper reduction and fixation of the fracture. [Orthopedics. 2016; 39(4):e764-e767.]

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**abstract**

Distal humeral epiphyseal separations are rare and treatment strategies are not well defined. The case of a full-term male newborn with a distal humeral epiphyseal separation as the result of a birth trauma was reviewed. A literature review of this topic was undertaken to better understand its occurrence, diagnosis, and treatment options. The patient sustained a distal humeral epiphyseal separation during a vaginal delivery. Deformity and decreased movement in the elbow were observed. Radiographs and subsequent ultrasound were used to make the diagnosis of distal humeral epiphyseal separation. Given the displaced and acute nature of the fracture, a closed reduction and percutaneous pinning was performed. Intraoperatively, this was greatly facilitated by an elbow arthrogram. Immobilization consisted of a posterior plaster splint and swathe. Postoperative follow-up with clinical and radiographic examination showed abundant bony healing and early restoration of function. Ultrasound is useful to confirm the diagnosis of a distal humeral epiphyseal separation for elbow injuries in very young patients. However, once the diagnosis is confirmed, an intraoperative elbow arthrogram helps highlight the fracture fragments and ensures proper reduction and fixation of the fracture. [Orthopedics. 2016; 39(4):e764-e767.]

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**Distal Humeral Epiphyseal Separation in a Newborn**

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right shoulder and extension and flexion in his wrist and fingers. There was moderate swelling about the right elbow. Ultrasound confirmed the suspected diagnosis of a distal humeral epiphyseal separation (Figure 1).

The patient was taken to the operating room on day of life 2. After general anesthesia was administered, the patient was positioned with the elbow on the image intensifier (C-arm). A gentle closed reduction was performed using standard supracondylar humerus fracture reduction techniques. A 20-gauge needle was used to inject iodinated contrast (iohexol 300 mg/mL), diluted 1:1 with normal saline, into the elbow joint via the posterior olecranon fossa (Figure 2). Only a small amount (< 1 mL) of contrast was required. The arthrogram provided excellent visualization of the unossified structures and highlighted mild persistent medial displacement. This was corrected but unstable. The authors thus stabilized the fracture with two 0.035-in (0.9-mm) K-wires from a lateral starting point (Figure 2). Satisfactory reduction and stable fixation were achieved. A posterior plaster splint was applied in 70° of flexion and swathe was applied with a loosely applied compressive wrap. Satisfactory osseous alignment and exuberant periosteal reaction were noted at 1 week (Figure 3). The pins were removed at this time.
time. At 6 weeks, he was extending and flexing his arms symmetrically (Figure 3). At 1-year follow-up, no clinical deformity was noted; however, long-term follow-up will be required to monitor for growth disturbance.

**DISCUSSION**

Separation of the distal humeral epiphysis in newborns is rare. These injuries are often misinterpreted as an elbow dislocation on radiographs. Because the capitellum does not ossify until approximately 3 to 9 months of age, advanced imaging is usually necessary to make the diagnosis.

Ultrasound can be used to evaluate the unossified epiphysis of infants. It is cost-effective, readily available, and noninvasive. The posterior longitudinal view shows the displacement and angulation at the fracture site as well as the intact radiocapitellar and ulno-trochlear articulations. However, despite being an effective way to make the diagnosis, ultrasound is less useful intraoperatively. The flexed position required for reduction is not ideal for visualizing the fracture fragments. It is also difficult to detect overall angulation.

Magnetic resonance imaging has been proposed by some authors to establish the diagnosis of elbow injuries in newborns. Magnetic resonance imaging provides excellent soft tissue contrast and facilitates the assessment of cartilaginous components. However, it often requires sedation in this age group. Thus, although magnetic resonance imaging provides good anatomic information when the diagnosis is in question, the risk involved with the sedation is often not worth it if the diagnosis can be made with ultrasound.

Direct arthrography offers the ability to highlight unossified cartilaginous structures about the elbow joint. Direct arthrography has been described to help diagnose elbow injuries in infants when the diagnosis is not clear from plain radiographs. Difficulty can be encountered with extravasation or pooling of contrast media with tears in the soft tissues and capsule around the elbow joint. This can be avoided by careful injection of the appropriate amount of contrast. As the current case illustrates, direct arthrography is also a reliable intraoperative tool to evaluate fracture reduction and aid in placement of fixation.

Because of the rare nature of this injury, the optimal treatment is not well established. DeLee et al reported on 3 patients from newborn to 9 months who were treated with closed reduction and immobilization in 90° of flexion with the forearm pronated. All 3 patients developed cubitus varus deformity. In reporting on 12 cases and examining the combined results of other case series, de Jager and Hoffman noted that cubitus varus deformity was common in patients younger than 2 years and speculated that it was likely due to inadequate reduction. Cubitus varus is often considered a cosmetic deformity with little functional significance, but long-term complications have been reported. Displaced acute injuries in healthy infants can likely be safely treated surgically at centers comfortable with anesthesia in infants. However, when the presentation is delayed and reduction may further damage the physis, or when there are comorbidities that might increase the risk of anesthesia, closed reduction and immobilization with plans to address deformity at a later time may be the better option.

**CONCLUSION**

To the authors’ knowledge, this is the first case report to illustrate the use of intraoperative arthrography for this type of injury. Arthrography showed that the initial reduction was not adequate. This was corrected and then the fracture was pinned in anatomic alignment. Arthrography also allowed for dynamic evaluation of the fracture and fixation stability. Although ultrasound was useful in diagnosis of the injury, it was not useful intraoperatively. With the elbow flexed to hold the reduction, the curvature of the skin prevented the probe from contacting the skin enough to obtain the longitudinal view. In addition, it could not be used to visualize the localization of the stabilization pins in the bone fragments.

For the rare distal humeral epiphysseal separation in a newborn, the authors recommend confirming the diagnosis with ultrasound preoperatively but performing a direct elbow arthrogram intraoperatively to confirm anatomic reduction and facilitate stabilization of the injury if needed.

**REFERENCES**


