Detection and treatment of traumatic separation of the distal humeral epiphysis in a neonate: a case report

Yenidoğanda travmatik distal humerus epifiz ayrılmasının tanı ve tedavisi: Olgu sunumu

Yetkin SÖYÜNCÜ,[1] Can ÇEVİKOL,[2] Seçgin SÖYÜNCÜ,[3] Aydın YILDIRIM,[4] Feyyaz AKYILDIZ[1]

Traumatic separation of the distal humeral epiphysis during delivery is an uncommon injury in neonates and usually mimics elbow dislocation. Emergency medicine physicians and orthopedic surgeons must have a high index of suspicion for distal humeral epiphysis separation when evaluating elbow trauma in neonates. Magnetic resonance imaging (MRI) scan is an important diagnostic tool for this purpose. We report a case in which fracture-separation of the distal humeral epiphysis in a newborn was diagnosed with the help of ultrasonography and MRI scan, which provided a clear delineation of the injury.

Key Words: Delivery; distal humeral epiphysis; fracture; neonate.

Doğum travmasına bağlı meydana gelen distal humerus epifiz ayrılması oldukça seyrek görülen bir durumdur ve sıklıkla dirsek ekleminin arkaya çıkığı ile karıştırılır. Acil tıp ve ortopedi doktorları, yenidoğanlardaki dirsek travmalarını değerlendirirken distal humerus epifiz ayrılması konusunda son derece dikkatli davranmalıdırlar. Manyetik rezonans görüntüleme (MRG) ayırıcı tanıda önemli yer tutar. Bu yazıda, yenidoğanda ultrasonografi ve MRG tekniklerinden yararlanarak distal humerus epifiz ayrılmasının tam olarak görüntülenmesi ve orta dönem cerrahi sonucunun verilmesi amaçlandı.

Anahtar Sözcükler: Doğum; distal humerus epifizi; kırık; yenidoğan.

Traumatic separation of the distal epiphysis of the humerus at birth is a rare injury, and the probable reason for the paucity of reports is that the injury is often misdiagnosed clinically and radiologically and is therefore under-reported.[1-8] The fracture occurs in the newborn as a result of traumatic delivery, often secondary to an abnormal presentation. The clinical findings are swelling about the elbow, abnormal motion, and muffled crepitus with manipulation. These symptoms can mimic elbow dislocation to the unwary. Clinical diagnosis based on the constant relationship of the medial and lateral epicondyles with the olecranon has been described; however, this relationship can be difficult to appreciate in the swollen newborn elbow.

Radiological diagnosis of the injury in children, using the alignment of the proximal radius and capitellum, has been described.[9,10] This is not possible in the newborn because of the unossified interval between the humerus, radius and ulna. The ossification center of the capitellum appears only at 3-9 months of age; before this, its alignment with the head of the radius can not be ascertained radiographically.[1,8,9] In the neonate, however, radiographs give a spurious appearance of elbow dislocation. As a result, radiographic examination in neonates cannot distinguish between distal humeral epiphyseal separation and elbow dislocation.[2,3,6-8]

We report a case in which a diagnosis of separation of the distal humeral epiphysis was facilitated by magnetic resonance imaging (MRI). The purpose of the report is to emphasize the utility of MRI as a noninvasive tool for the evaluation of the nonossified epiphysis in the neonatal elbow and to report the mid-term results of the open reduction and percutaneous fixation in this case.

Department of [1]Orthopedics and Traumatology, [2]Radiology and [3]Emergency Medicine, Akdeniz University, Faculty of Medicine; [4]Manavgat State Hospital, Antalya, Turkey.

Akdeniz Üniversitesi Tıp Fakültesi, [1]Ortopedi ve Travmatoloji Anabilim Dalı, [2]Radyoloji Anabilim Dalı, [3]Acil Tıp Anabilim Dalı; [4]Manavgat Devlet Hastanesi, Antalya.

Correspondence *(İletişim):* Yetkin Söyüncü, M.D. Akdeniz Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Anabilim Dalı, Kampüs 07070 Antalya, Turkey.
Tel: +090 - 242 - 249 60 00 / 6151 Fax *(Faks)*: +090 - 242 - 249 61 51 e-mail *(e-posta):* ysoyuncu@hotmail.com

CASE REPORT

A male infant was born with head presentation by spontaneous vaginal delivery after 36 weeks of gestation to a 34-year-old gravida 3 mother. Birth weight was 3250 g. The delivery was thought to be "minimally" traumatic based on the history of the family with the exception of some traction on the right arm that was required during the delivery. On the second day following delivery, a moderate swelling of the right elbow and reduced movement of the right hand were noticed. Examination of the newborn revealed decreased movement of the right arm, with a normally functioning hand. The initial roentgenograms obtained at that time appeared to demonstrate a posterior dislocation of the elbow. An attempt at reduction of the elbow was unsuccessful; hence, the patient was referred to the Emergency Department of our University on the 5th day following delivery for evaluation. During transfer, the right elbow was notably swollen and ecchymotic, but no circulatory compromise was evident. On clinical examination, the newborn was in good health with the exception of swelling of the right elbow, with abnormal motion and associated crepitus present. Movement of the elbow induced vigorous crying. Major peripheral nerve injury was excluded by observation of spontaneous movement at the hand and wrist.

Results of blood investigations such as complete blood count, C-reactive protein, sedimentation rate, alkaline phosphates and lactate dehydrogenase were unremarkable.

Radiographs revealed posteromedial displacement of the proximal radius and ulna with respect to the distal humerus, but normal relationship of the proximal radius and ulna was maintained (Fig. 1a and 1b). No evidence presented of a fracture of the distal metaphyseal region of the humerus or of the proximal radius or ulna. Ultrasonographic examination showed irregularity and the changed relationship between the distal epiphysis and metaphysic of the humerus (Fig. 2). An elbow MRI scan revealed a fracture-separation of the distal humeral physis (Fig. 3). Combining the physical and radiographics findings, a diagnosis of separation of the distal humeral physis was made.

The patient was taken to the operating room where closed reduction under anesthesia was attempted. Reduction was incomplete and unstable; hence, open reduction was performed via posterior incision and splitting triceps muscle. Complete reduction of the fracture was achieved and fixation with two percutaneous K-wires laterally placed was performed (Fig. 4). A posterior splint was applied for four weeks. One of the K-wires was removed on the 12th day because of loosening and the other was removed in the 3rd week. He had full range of motion at the 16th month follow-up examination (Fig. 5).

DISCUSSION

Neonatal separation of the distal epiphysis of the humerus was first reported in 1926 by Camera; there have been very few reports of this rare injury since then.[1-10]

This case illustrates several points with regard to fracture-separation of the distal humeral physis in the newborn.

Fracture-separation of the distal humeral epiphysis in the newborn is difficult to diagnose. The clinical findings such as swelling, instability and limitation of elbow movements with a normal grasp reflex do not always allow a definitive diagnosis.[1,2,8] The three-point relationship between the olecranon process, medial humeral epicondyle and lateral humeral epicondyle may help in differentiating elbow dislocation from fracture-separation of the distal humeral epiphysis. However, as was the case in our patient, elbow swelling makes identification of these points difficult.

The X-ray films typically show medial displacement of the radius and ulna, which is suggestive of fracture-separation.[4,6-8] Plain radiographs of this injury show an abnormal relationship of the radioulnar complex relative to the humeral metaphysis. This is also consistent with true elbow dislocation, and the injury can easily be misdiagnosed as a dislocation of the elbow.[2,3,6-8] Preservation of the normal relationship between the capitellum and the head of the radius, which is disrupted on dislocation, is a valuable clue to the diagnosis of the fracture-separation of the distal humeral epiphysis. Plain radiographs cannot detect fracture-separation until the capitellar ossification center appears or until some new bone is laid down by the elevated periosteum. Thus, radiography is inconclusive in distinguishing between dislocation and fracture-separation.

Ultrasound can be used to differentiate elbow dislocation from fracture-separation of the distal

humeral epiphysis.[1,4,6] However, in the presence of fracture, the ultrasound examination can be uncomfortable and painful. Furthermore, it does not normally provide good images of the bone or the epiphysis, but the periosteum and its elevation can be well visualized.[11]

Elbow arthrography, which delineates the cartilaginous epiphysis, may demonstrate the injury, but the investigation is invasive and there is a risk of infection.[1,8]

We confirmed the diagnosis of fracture-separation of the distal humeral epiphysis using MRI scanning. It has the advantage of providing direct depiction of the cartilage, bone and soft tissue. Furthermore, these can be displayed in sagittal, coronal or oblique long-axis planes. Thus, all components of the injury are directly visualized, allowing more precise definition of the acute injury. It does not use ionizing radiation and the elbow does not have to be manipulated to obtain the images. The potential problem with MRI is getting the baby to lie still in the scanner, which usually means use of anesthesia, though most neonates can be scanned following a feed only or a small dose of oral sedation. Moreover, the procedure is expensive.

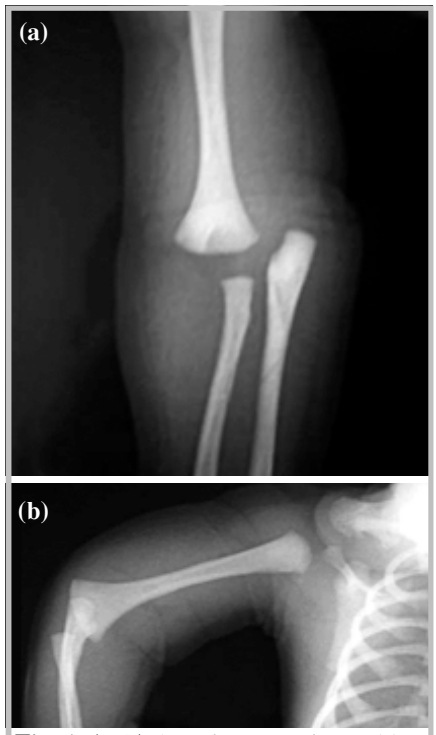

Fig. 1. (a, b) Anterior-posterior and lateral X-ray films of the elbow taken on the 2nd day demonstrate posteromedial displacement of the radius and ulna on the humerus.

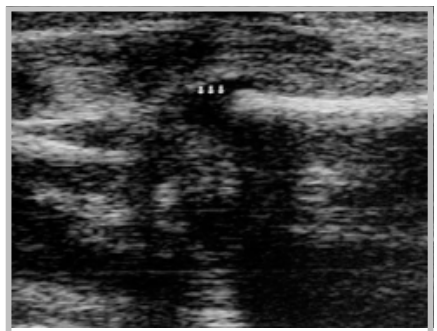

Fig. 2. Lateral coronal ultrasound scan of the affected side. Arrows show the changed relationship between distal epiphysis and metaphysis of the humerus.

Fig. 3. MRI scan of the injured right elbow. The cartilaginous distal humeral epiphysis is visualized (E). It has fractured and displaced posteriorly in relation to the shaft of the humerus. The humero-radial articulation is intact. This confirms the diagnosis as fracture- separation of the distal humeral epiphysis (H: humerus; R: radius).

Fig. 4. X-ray film of the elbow after open reduction and percutaneous fixation.

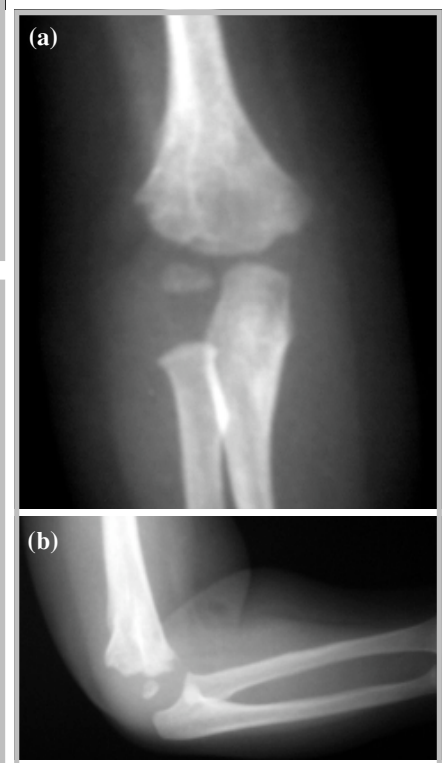

Fig. 5. (a, b) Anteroposterior and lateral X-rays of the elbow 16 months following open reduction and percutaneous fixation.

Closed treatment of these fractures in newborns and infants has been advocated.[2,4-8] The results of nonoperative treatment in the literature in the short-term have been satisfactory. Paige et al. reported one case. Closed manipulation and posterior splinting were performed and long-term follow-up revealed full range of motion.[5] Dias reported a case of neonatal separation of the distal humeral epiphysis in which non-invasive ultrasonic examination provided clear definition of the injury. At follow-up examination, elbow movement was full, with no obvious deformity.[6] However, review of the results from the series of Delee et al. showed a 25% incidence of cubitus varus of 5-10°.[9] The series of Holda et al. revealed a 71% incidence of nonprogressive cubitus varus in the 10-15° range.[10] Ekengren et al. reported five cases and noted only minor loss of extension in one case.[12] Downs reported a case whose elbow lacked 12° of extension at six months. No limitation of flexion or function was evident.[7] Barret et al. reported two cases treated with closed reduction with splint immobilization. In one case, at follow-up 24 months after injury, physical examination revealed a normal carrying angle with full supination and pronation and a 20° lack of full extension when compared with the normal side.[8]

If closed reduction is unstable, percutaneous pin fixation should be used. If the closed reduction is incomplete or unsatisfactory, open reduction with percutaneous pin fixation should be utilized. We treated our patient with open reduction and percutaneous pin fixation for several reasons. Both rotation and angulations were difficult to assess in the infant, especially after a plaster cast was applied. We also believed that it would be difficult to maintain 90° of flexion with use of a cast alone for so small a patient. Pin fixation was also useful in this patient because of the difficulty involved in the visualization of the fracture on plain radiographs after application of a cast with the elbow in 90° of flexion or more. The result of the surgical treatment in the present patient in the short-term is satisfactory, but long-term follow-up is necessary to assess any important malunion or growth disturbance.

In conclusion, epiphyseal separation of the distal epiphysis of the humerus is a rare birth trauma with signs that can be easily missed on physical examination. Its diagnosis is based on sonography or MRI. Since alignment of the fracture fragments is not easily achieved and maintained with closed reduction, open reduction combined with percutaneous pin fixation can be utilized, which is in keeping with our experience.

REFERENCES

1. Davidson RS, Markowitz RI, Dormans J, Drummond DS. Ultrasonographic evaluation of the elbow in infants and young children after suspected trauma. J Bone Joint Surg [Am] 1994;76:1804-13.
2. Raupp P, Haas D, Lovasz G. Epiphyseal separation of the distal humerus. J Perinat Med 2002;30:528-30.
3. Sawant MR, Narayanan S, O'Neill K, Hudson I. Distal humeral epiphysis fracture separation in neonates - diagnosis using MRI scan. Injury 2002;33:179-81.
4. Ziv N, Litwin A, Katz K, Merlob P, Grunebaum M. Definitive diagnosis of fracture-separation of the distal humeral epiphysis in neonates by ultrasonography. Pediatr Radiol 1996;26:493-6.
5. Paige ML, Port RB. Separation of the distal humeral epiphysis in the neonate. A combined clinical and roentgenographic diagnosis. Am J Dis Child 1985;139:1203-5.
6. Dias JJ, Lamont AC, Jones JM. Ultrasonic diagnosis of neonatal separation of the distal humeral epiphysis. J Bone Joint Surg [Br] 1988;70:825-8.
7. Downs DM, Wirth CR. Fracture of the distal humeral chondroepiphysis in the neonate. A case report. Clin Orthop Relat Res 1982;(169):155-8.
8. Barrett WP, Almquist EA, Staheli LT. Fracture separation of the distal humeral physis in the newborn. J Pediatr Orthop 1984;4:617-9.
9. DeLee JC, Wilkins KE, Rogers LF, Rockwood CA. Fracture-separation of the distal humeral epiphysis. J Bone Joint Surg [Am] 1980;62:46-51.
10. Holda ME, Manoli A 2nd, LaMont RI. Epiphyseal separation of the distal end of the humerus with medial displacement. J Bone Joint Surg [Am] 1980;62:52-7.
11. Howard CB, Einhorun MS. Ultrasound in the detection of subperiosteal abscesses. J Bone Joint Surg [Br] 1991;73:175-6.
12. Ekengren K, Bergdahl S, Ekström G. Birth injuries to the epiphyseal cartilage. Acta Radiol Diagn (Stockh) 1978;19(1B):197-204.