CASE REPORT

Epiphyseal Separation of Distal Humerus in Newborn: A Case Report

X Yan, N Zheng, P Song, L Yu, X Duan

ABSTRACT

Complete distal humeral epiphyseal separation which is similar to elbow dislocation is a rare injury in neonates. Whereas ultrasonography and magnetic resonance imaging (MRI) are helpful, plain radiographs are ineffective when diagnosing this disorder. We report a case in which a fracture-separation of the distal humeral epiphysis was diagnosed in a newborn via ultrasonography and MRI. A clear delineation of the injury was provided. The fractured distal humerus was treated by internal fixation with percutaneous Kirschner wires. A follow-up observation revealed a good recovery. Traumatic separation of the distal epiphysis may be missed in maternity wards and not diagnosed until the patient is discharged from hospital. However, a good clinical result can be expected even when no attempt is made to reduce the dislocated epiphysis.

Keywords: Distal humerus, epiphyseal injury, epiphyseal separation humerus, magnetic resonance imaging (MRI), neonate

WIMJ Open 2014; 1 (1): 22

INTRODUCTION

Elbow fracture and dislocation are common in children. However, fewer cases of distal humeral epiphyseal separation have been reported. The secondary ossification centre of the capitellum appears on plain radiographs within three to nine months after birth. As a result, during the neonatal period, a plain radiograph of a distal humeral epiphyseal separation indicates nothing beyond the illusion of elbow dislocation. A correct diagnosis cannot be obtained before the radiological information is carefully analysed or additional arthrography, computed tomography (CT) and magnetic resonance imaging (MRI) scans are performed. We report a case in which a fracture-separation of the distal humeral epiphysis was diagnosed in a newborn *via* ultrasonography and MRI. The study was approved by the Institutional Review Board of the Hospital of the Wuhan Medical and Health Center for Women and Children.

CASE REPORT

One day after his birth, a dystocial baby boy with a weight of 3.0 kg could not move his right arm in the upward direction. A physical examination revealed that the soft tissue of his right elbow joint was swollen and his elbow moved abnormally and in a restricted manner. There were no obvious abnormalities in his shoulder joints, and his finger and wrist joints were also flexible. A plain radiograph of his right elbow joint revealed a nonspecific angulation, indicating subluxation of the right elbow (Fig. 1).

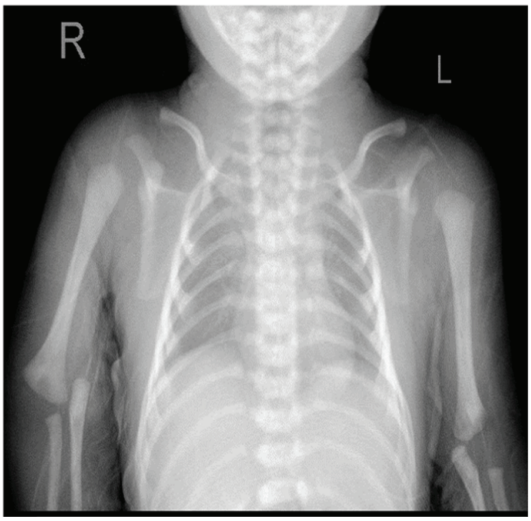

Fig. 1: Radiograph of the injured elbow (right) suggesting an elbow dislocation.

To rule out interference from a distal humeral epiphyseal separation, an ultrasound examination was performed (Fig. 2). This revealed that the right distal humeral epiphysis had shifted dorsally and toward the internal side; additionally, sheets without echo were observed within 1.2 × 0.6 cm in the right elbow joint cavity. The disorder was considered to be an epiphyseal separation of the right distal humerus. Fracture reduction was performed *via* fluoroscopic guidance on the same day; skin traction was later arranged after a small splint fixation. The plain radiograph was re-

From: Wuhan Medical and Health Center for Women and Children, Wuhan, 430016, China.

Correspondence: Dr X Duan, Wuhan Medical and Health Center for Women and Children, Wuhan, 430016, China. E-mail: 15871716704@163.com

 DOI: 10.7727/wimjopen.2014.039

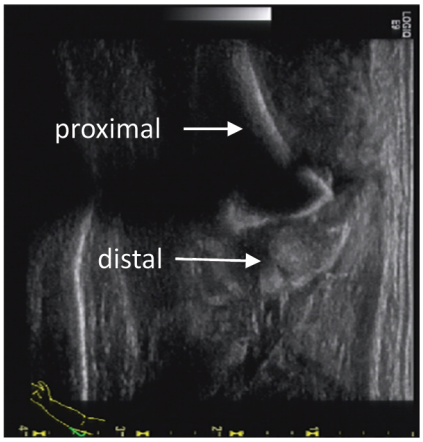

Fig. 2: Ultrasound demonstrates the altered relationship between humeral distal epiphysis and metaphysis.

viewed the next day and it suggested that the relationship between the proximal ulna and distal humerus had improved slightly, but remained abnormal (Fig. 3).

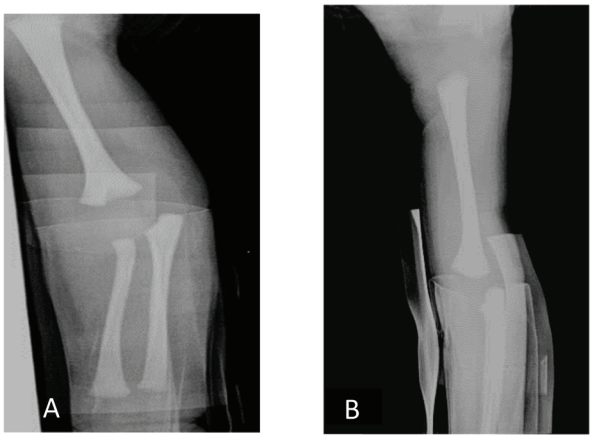

Fig. 3: Two days after plain radiography of the fracture (A – anteroposterior; B – lateral), an abnormal alignment appeared at the elbow joint, with slight improvement from the previous exam.

To further determine the relationship between this fracture and anatomy, an MRI examination was conducted after the fracture reduction failure, thus confirming the result of the ultrasound (Fig. 4); specifically, the distal humeral epiphysis had shifted dorsally and upward. After determining the above-mentioned relationship, we performed a closed reduction, percutaneous Kirschner wire fixation and cast immobilization under general anaesthesia. The plain radiograph (Fig. 5) was reviewed the next day after surgery.

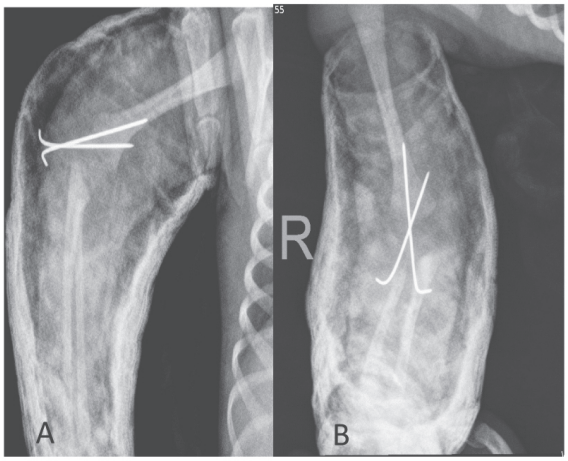

Fig. 5: On the day after surgery, the plain radiograph (A – lateral; B – anteroposterior) demonstrated a normal alignment between the proximal humeral metaphysis and distal epiphysis.

The result revealed that the elbow joint was visible in a normal axial view, along with two cross-fixed Kirschner wires.

A plain radiograph (Fig. 6) taken on the 21st day after surgery revealed the existence of multiple calluses on both sides of the distal humerus and the axial view of the elbow joint was normal. The Kirschner wires and plaster immobilization were removed in the third week after surgery. During follow-up examinations in the next two months, the patient

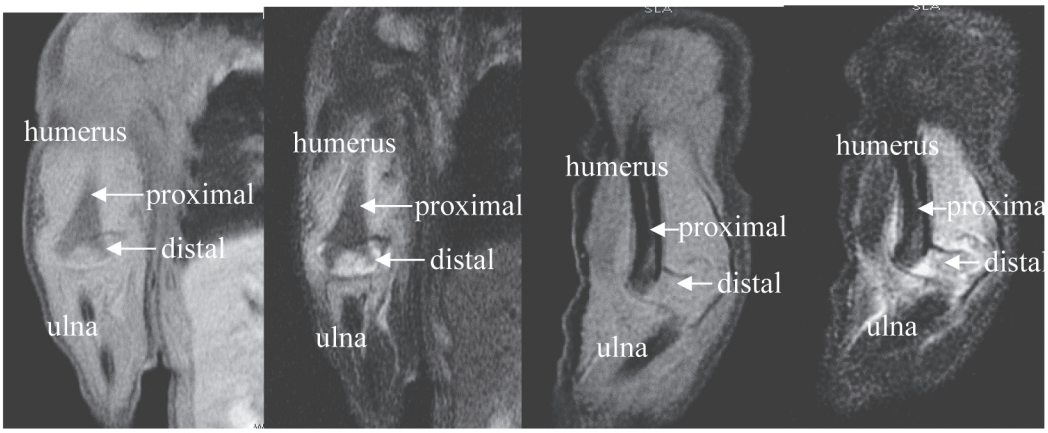

Fig. 4: Four magnetic resonance imaging sections (coronal section, coronal section, sagittal section and sagittal section) of the injured elbow revealed the cartilaginous distal humeral epiphysis. It had fractured and was displaced posteriorly relative to the humeral shaft. The humero-ulnar articulation was intact. The diagnosis was confirmed as a fracture separation of the distal humeral epiphysis, rather than an elbow dislocation.

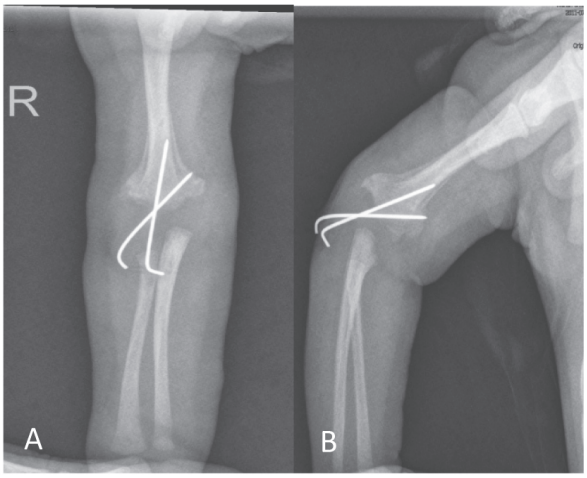

Fig. 6: Three weeks after the fracture, obvious callus formation around the fracture site was visible on a plain radiograph of the elbow (A – anteroposterior; B – lateral).

had a full flexion-extension range and a full supination-pronation arc, and follow-up radiography showed consolidation at the fracture site (Fig. 7).

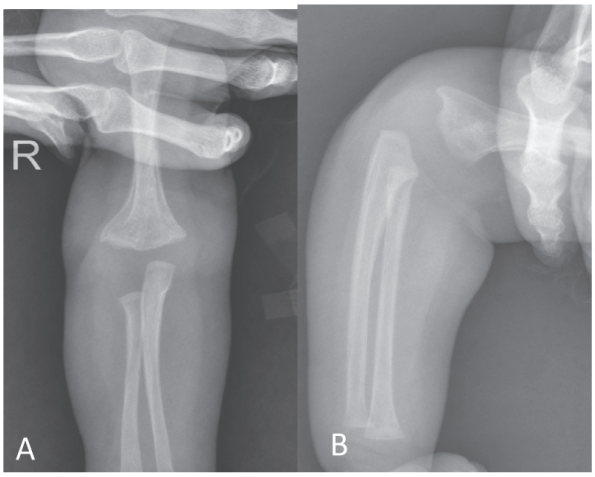

Fig. 7: Two months after the fracture, the patient had a full flexion-extension range and a complete supination-pronation arc. Consolidation at the fracture site was confirmed on the radiograph (A – anteroposterior; B – lateral).

DISCUSSION

Distal humeral epiphyseal separation is rare in neonates. Its clinical manifestations include soft tissue swelling in the elbow joint, skin abrasions and abnormal or restricted elbow joint movement. The above-described symptoms often occur within two or three days after birth. All of these manifestations, which are quite similar to those of elbow dislocation, are nonspecific (1). In neonates, this disorder is mainly caused by the shearing action from back to front when the elbow joint bends, whereas in older children, the disorder can be caused by elbow hyperextension (2).

Given the different appearance times of the distal humeral epiphyseal ossification centre, the vagueness of radiography, non-cooperation from neonates and the incompleteness of clinical examinations, this disorder is often misdiagnosed as an elbow tissue injury, elbow dislocation, supracondylar fracture or an internal and external supracondylar fracture. Clinical diagnosis usually relies on the relationship among the ossification centre for the capitellum, radius end and posterior cubital triangle. However, this relationship is not obvious in neonates (3). In such cases, elbow joint swelling makes it difficult to identify the relationship among these three components. Plain radiography reveals nonspecific angulation, indicating subluxation of the right elbow (Fig. 1). This symptom is often misdiagnosed as elbow dislocation.

Plain radiography can reveal epiphyseal injuries only after the distal epiphysis ossification centre occurs (three to nine months) or bone fragments appear in the proximal end. Therefore, it is difficult to diagnose this disorder in neonates from plain radiographs. Arthrography is a more reliable diagnostic tool, but will cause injury, thus requiring sedation and pain relief. As a result, it will cause children to suffer, and may also increase the risk of infection (4).

Ultrasound can also be used to distinguish elbow dislocation from distal humeral epiphyseal separation (5). However, the physical activity in an ultrasound examination can cause discomfort and pain in children. Moreover, ultrasound cannot provide a good image of the fracture end. In other words, ultrasound cannot show a clear relationship of the anatomical location between the distal and proximal ends; therefore, it cannot make further contributions to clinical care.

Magnetic resonance imaging can clearly show the joint capsule, bone, epiphysis and surrounding soft tissue. Furthermore, it can also present the fracture end in sagittal view, coronal view or on a long axis in any direction. Therefore, all injuries can be directly observed with MRI. Thus, we can evaluate such injuries more accurately and comprehensively. Moreover, the anatomical location at the fracture end can be presented in multiple directions. Magnetic resonance imaging does not apply radioactivity; therefore, there is no need to move the elbow joint to obtain a better image. In this respect, MRI is far superior to plain radiography and ultrasonography. However, MRI also has some disadvantages, for example, neonates must sleep on the scanning plane during the examination and sedatives are often used.

As the secondary ossification centre for the capitellum does not fully emerge during the neonatal period, the epiphysis mainly presents with a cartilaginous nature and a relatively uniform density on both the internal and external sides. At that time, the epiphyseal growth plate is smooth and a Salter-Harris epiphyseal separation usually appears upon injury. Treatments include closed reduction and open reduction. The requirement for needle fixation depends on the

surgeon's experience and the stability after reduction. Neonates possess superior recovery abilities; therefore, tiny dislocations or angulations can be corrected. During follow-up visits, the joint movements of most neonates are unrestricted. However, forearm varus malformations and extension limitations are the most common complications of these injuries. Dias and Menon reported similar injuries and found that the forearm extension was restricted by 12° and 10°, respectively, after closed reduction (6, 7). Downs presented a case in which the elbow extension was restricted by 12° at six months post-surgery but there were no obvious limitations in elbow bending or function (8). Barret *et al* presented a case in which the elbow extension was restricted by 20° at 24 months after closed reduction and external splintage (4). DeLee *et al* declared that the incidence of elbow varus in 5–10° was 25% (2). All of these deformities occurred after closed reduction whereas there were no reports of complications after open reduction and internal needle fixation. Therefore, timely reduction and solid fixation are key to preventing elbow malformation. Crossed Kirschner fixation and open reduction is an alternative treatment.

REFERENCES

1. Tudisco C, Mancini F, De Maio F, Ippolito E. Fracture-separation of the distal humeral epiphysis. Long-term follow-up of five cases. Injury 2006; **37:** 843–8.
2. DeLee JC, Wilkins KE, Rogers LF, Rockwood CA. Fracture-separation of the distal humeral epiphysis. J Bone Joint Surg Am 1980; **62:** 46–51.
3. Sabat D, Maini L, Gautam VK. Neonatal separation of distal humeral epiphysis during Caesarean section: a case report. J Orthop Surg (Hong Kong) 2011; **19:** 376–8.
4. Barrett WP, Almquist EA, Staheli LT. Fracture separation of the distal humeral physis in the newborn. J Pediatr Orthop 1984; **4:** 617–9.
5. Jacobsen S, Hansson G, Nathorst-Westfelt J. Traumatic separation of the distal epiphysis of the humerus sustained at birth. J Bone Joint Surg Br 2009; **91:** 797–802.
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. Menon TJ. Fracture separation of the lower humeral epiphysis due to birth injury: a case report. Injury 1982; **14:** 168–9.
8. Downs DM, Wirth CR. Fracture of the distal humeral chondroepiphysis in the neonate. A case report. Clin Orthop Relat Res 1982; **169:** 155–8.

Submitted 05 Feb 2014
Accepted 24 Feb 2014
Published 07 Apr 2014
Online: http://myspot.mona.uwi.edu/wimjopen/60