Neonatal Physeal Separation of Distal Humerus During Cesarean Section

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Abstract

Diagnosing physeal separation of the distal humerus in a newborn can be challenging. Skeletal immaturity and absence of secondary ossification centers make radiographic diagnosis difficult for inexperienced providers. This fracture is seen in the setting of complicated deliveries with excessive traction and rotation applied to the forearm.

We report a case of physeal separation of the distal humerus in a newborn as a complication of cesarean section and describe the intervention used and the short-term results.

Physeal separation of the distal humerus in a newborn is a rare and severe injury that requires immediate treatment. This fracture was reported as an extremely rare complication of cesarean section.[1] The correct diagnosis can be established by clinical and radiologic findings. However, this injury can be easily overlooked and misdiagnosed. Presentation often involves swelling, tenderness, and agitation with movement of the elbow.

We report a case in which neonatal physeal separation of the distal humerus occurred during cesarean section. The diagnosis was based on clinical and radiologic/arthrographic findings and treated with closed reduction and percutaneous fixation. The patient's guardian provided written informed consent for print and electronic publication of this case report.

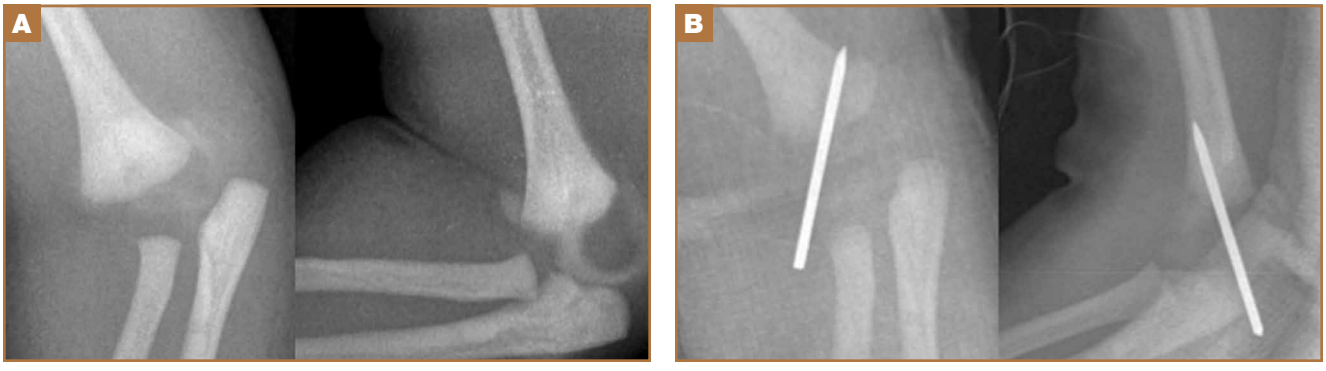
Case Report

A full-term (40-week gestation) male neonate weighing 3690 g was born through cesarean section at the mother's request. Apgar score was 9 at 1 minute and 10 at 5 minutes. The vertex position of the fetus was confirmed with preoperative ultrasonography. This was the mother's first pregnancy and an in vitro fertilization. On his second day of life, the patient was referred to the orthopedic department for evaluation of local swelling and diminished spontaneous motion of the right elbow.

Examination revealed local tenderness and swelling in the anterior and lateral aspects of the elbow. Passive elbow range of motion (ROM) caused agitation, and elbow instability was present. A complete neurovascular examination was performed, and neurovascular injury and compartment syndrome were ruled out. Hematologic workup showed no signs of septic arthritis. Radiographs showed posteromedial displacement of the humeroulnar joint. The patient was placed in a long-arm splint, and no reduction was attempted initially.

The patient was taken to the operating room the same day. With the patient under general anesthesia, an arthrogram of the right elbow was obtained. It showed posteromedial displacement of the distal humeral epiphysis (**Figure 1A**). Closed

Figure 1. Disruption of humeroulnar alignment and medial displacement of forearm. (A) Arthrogram shows posterior displacement of distal humeral epiphysis. (B) Immediate postoperative radiographs.



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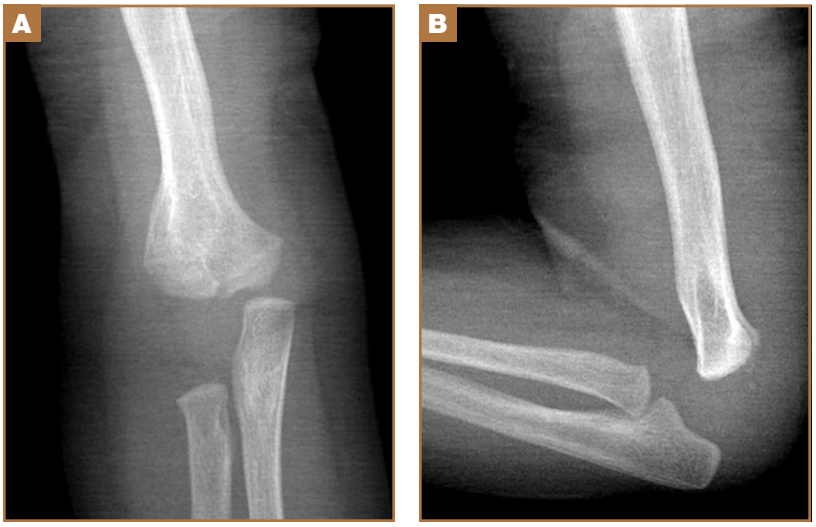

Figure 2. Six months after surgery, (A) anteroposterior and (B) lateral radiographs show union at fracture site.

reduction was performed, and the quality of the reduction was confirmed by intraoperative imaging. Percutaneously, a single 2-mm Kirschner wire (K-wire) was placed in an oblique fashion from the inferolateral aspect of the distal fragment to the contralateral metaphysis of the humerus (**Figure 1B**). The patient was put in a long-arm splint with the elbow flexed at 90° and the forearm in midpronation.

Follow-up visits were scheduled for 1 week, 3 weeks, and 5 weeks after surgery. Three weeks after surgery, callus formation was confirmed, and the K-wire was removed. Five weeks after surgery, the long-arm splint was removed.

At 6-month follow-up, the patient was pain-free and had full elbow ROM, and radiographs (**Figures 2A, 2B**) confirmed anatomical restoration of the fracture.

Discussion

Madsen[2] reported the incidence of birth-related long-bone fractures, including fractures of the humerus, the femur, and the tibia (< 0.1%). According to that review, only 1 of 105,119 patients sustained traumatic physeal separation of the distal humerus.

Different mechanisms have been described for this rare fracture. As the physeal region is the weakest part of the distal humerus, it is prone to injury by rotational shear forces,[3,4] hyperextension of the elbow, or a backward thrust on the forearm with the elbow flexed.[5] Excessive traction applied during cesarean delivery might cause physeal separation, which was the possible cause in the present case. Most patients have a complicated birth history.

This injury should be suspected in an irritable newborn with swelling, tenderness, and reduced mobility of the upper extremity. Osteomyelitis and septic arthritis should be considered in the differential diagnosis. Brachial plexus injury and dislocation of the elbow joint should also be kept in mind. Child abuse and metabolic bone diseases (eg, osteogenesis imperfecta) should also be considered.

Anteroposterior and lateral plain radiographs of the elbow usually establish the diagnosis. Alteration of humeroulnar alignment and displacement of the proximal forearm are the key points leading to the diagnosis.

The cartilaginous part of the distal humerus and humeroulnar alignment can be demonstrated by ultrasonography.[6] Magnetic resonance imaging (MRI) can be helpful in diagnosis but is seldom required,[7] and the sedation or general anesthesia used is a disadvantage. Arthrography is useful not only in diagnosis but in determining the quality of the reduction.[8] An arthrogram may show that open reduction is unnecessary.

Treatment differs widely. In neonates, who have a tremendous healing capability, this fracture almost always heals uneventfully. An effective treatment method is closed reduction and cast immobilization. However, valgus malalignment and limited elbow ROM were noted in 5% of the patients treated with this method.[4]

Jacobsen and colleagues[4] reported on 6 neonates who sustained traumatic separation of the distal epiphysis of the humerus at birth and who were treated with casting with or without closed reduction. The authors described good results. One patient had varus malalignment, which was attributed to fragment internal rotation caused by rotational instability.

As our patient's instability was noted during surgery, we performed percutaneous pinning after arthrography-assisted closed reduction. We considered using 2 lateral pins for fixation, but, after the first pin was placed, fluoroscopic stress testing with the patient under anesthesia demonstrated adequate stability. A second, smaller pin could have been used to control rotation, if needed. Medial pin placement that avoids the ulnar nerve is difficult in the newborn elbow; medial pins should probably be avoided in the newborn, if possible.

Early diagnosis and treatment are essential. Late diagnosis was reported to lead to complications such as varus deformity and restriction of joint ROM.[4]

Our patient healed without any complications and achieved full ROM. Long-term follow-up is needed to diagnose any physeal bar that might lead to secondary deformities.

Conclusion

Cesarean section is reported to reduce birth complications, but it might cause fractures of the femur and humerus.[1] Avoiding application of excessive traction to the forearm can prevent physeal separation of the distal humerus. This entity should be kept in mind as a potential complication of cesarean section. Arthrography is helpful in treatment and may help avoid unnecessary open reduction.

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This paper will be judged for the Resident Writer's Award.