

Distal femoral physeal fractures after neonatal osteomyelitis

A case report

Xing Wu, MD^a, Jingdong Xia, MD^a, Jun Li, MD^a, Jie Sun, MD^b, Xiantao Shen, MD^{a,*}

Abstract

Rationale: The physeal separations and septic osteomyelitis in newborns are unusual, which represents a challenging problem in diagnosis and treatment.

Patient concerns: A 2-day-old mature male suddenly complained by parents about minimal swelling around the left knee, decreased left extremity motion and no fever.

Diagnosis: Preliminary x-rays of the lower extremities demonstrated a displaced distal femoral physeal, Laboratory investigation indicated infection. Magnetic resonance imaging and ultrasound showed displaced distal femoral physeal. A needle aspiration confirmed the diagnosis.

Intervention: Debridement and ultrasound guide reduction with pinning of physeal separations was performed.

Outcome: At 5 years later, his last follow-up showed that there was only 1.6 cm limb-length discrepancy without angular deformity, the child did not report any pain and was perfectly able to perform his daily activities.

Lessons: Distal femoral physeal fractures after neonatal osteomyelitis requires immediate and reliable decision for management. We point out the important role of the application of sonography, which is helpful to make an early diagnosis and guide reduction and percutaneous pinning of distal femoral physeal fractures.

Abbreviations: DFPPFs = distal femoral physeal fractures, MRI = magnetic resonance imaging.

Keywords: neonate, osteomyelitis, physeal fracture, ultrasound

1. Introduction

Distal femoral physeal fractures (DFPPFs) account for less than 1% of fractures in children.^[1] These injuries have a high incidence of physeal arrest, with resultant leg length discrepancy and/or angular or rotational deformity of the extremity. An acute primary osteomyelitis in the newborn is quite rare. DFPPFs is an extremely rare complication of osteomyelitis in neonatal, and

only a few cases have been reported.^[2] Both the diagnostic and treatment of DFPPFs in newborns represent a problem, suggesting the underdiagnosis of condition. Little is known about the consequences of this condition in the newborn child.

We undertook 1 case of pathologic DFPPFs complicating neonatal osteomyelitis in an attempt to review the profile of an awareness of occurrence of this lesion and discuss the dilemmas arising in the proper diagnosis, treatment, and prognosis, and last, to emphasize the importance of ultrasound, rather than performing a simple close reduction, as an aid to reduction and percutaneous pinning.

2. Case presentation

Before the study, we have obtained written informed consent from the patient for publication of the case report and the accompanying images. The Ethics committee of Wuhan children's hospital approved this case study. Research and Inspection No. (2018036).

A mature infant at 40 weeks gestational age, weighing 3400 g and delivered by cesarean section, was admitted to our hospital with a 2-day history of minimal swelling around the left knee, decreased left extremity motion and no fever. There were no other complaints reported. Physical examination revealed mild swelling, tenderness, and local heat over the left knee. The left knee was kept in flexion position.

Preliminary X-rays of the lower extremities demonstrated a displaced DFPPFs (Fig. 1a). The initial peripheral leukocyte count was $24 \times 10^9/L$. Other significant laboratory values were

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^a Department of Pediatric Orthopedic Surgery, ^b Department of Ultrasonics, Wuhan Children's Hospital; Tongji Medical College, Huazhong University of Science & Technology, Wuhan, P. R. China.

* Correspondence: Xiantao Shen, Department of Pediatric Orthopedic Surgery, Wuhan Children's Hospital, Tongji Medical College, Huazhong University of Science & Technology, Xianggan Road 100, Wuhan, 430016, P. R. China (e-mail: xtshenwh@aliyun.com).

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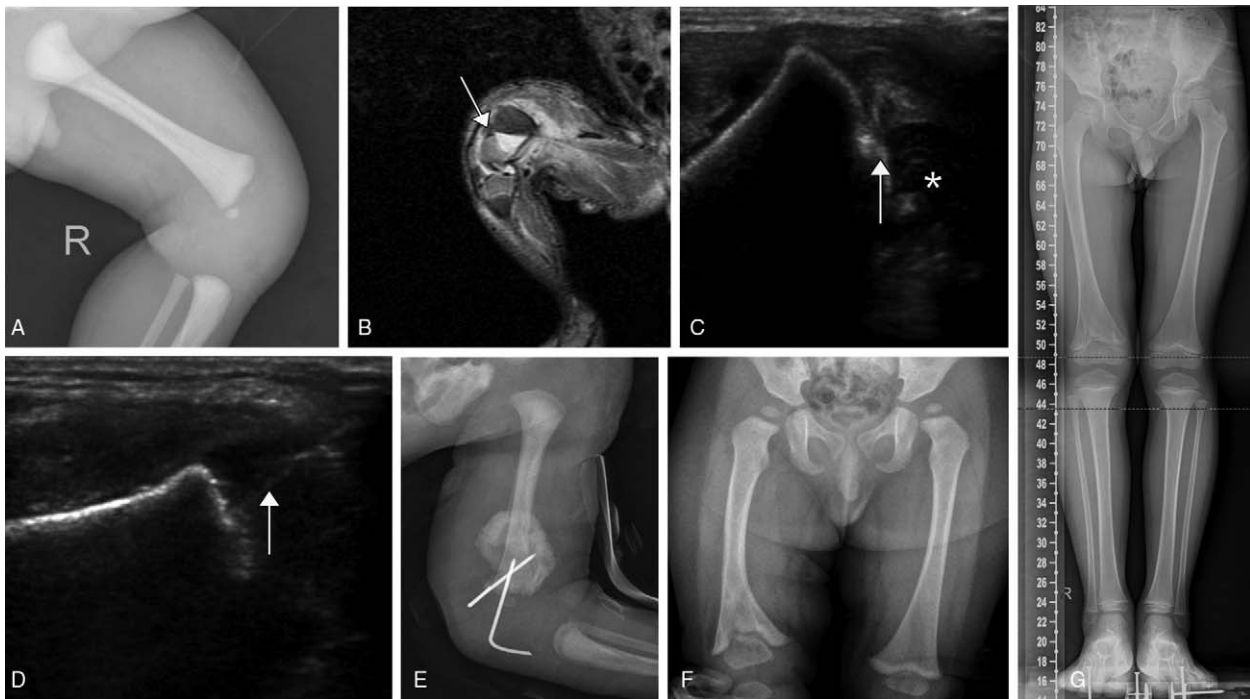


Figure 1. (1a) Radiograph of lower extremities, demonstrating displaced DFFFs on right. (1b) MRI of lower extremities. DFFFs (arrow), epiphyseal of the capitellum (asterisk). (1c) Ultrasound estimation of distal femoral, displacement of fracture (arrow), epiphyseal of the capitellum (asterisk). (1d) Ultrasound guided reduction of DFFFs, Kirschner wires (arrow). (1e) 10days after reduction showing diffuse callus formation around the distal femur. (1f) Radiographs of lower extremities (AP views) at nearly 17 months of age, leg length discrepancy of 2.4 cm was noted and central-arrest phenomenon occurred. (1g) Radiographs of lower extremities (AP views) at nearly 60 months of age, leg length discrepancy of 1.6 cm was noted and central-arrest phenomenon and growth “slowdown” was recovered. DFFFs= distal femoral physeal fractures, MRI= magnetic resonance imaging.

C-reactive protein (CRP) value of 169.00 (range 0 to 3) mg/L, erythrocyte sedimentation rate value of 24 (range 0–20) mm/h, and procalcitonin (PCT) value of 1.73ng/mL. Distal femoral osteomyelitis was suspected. The patient was started on intravenous cefazolin (100 mg/kg per day in divided doses).

Magnetic resonance imaging (MRI) showed a displaced distal femoral physeal with bone marrow edema, adjacent soft tissue abscess, and increased joint effusion at the right knee joint (Fig. 1b).

Ultrasound was performed using a GE Logic E9 ultrasound system (GE Healthcare, Milwaukee, WI) and a 7.0 to 11.0 MHz multiple frequency probe (GE Healthcare). On ultrasonography, there was a posterior displacement of the distal femoral epiphysis (Fig. 1c). This displacement was associated with juxta-osseous hematoma. A small joint effusion was detected.

A needle aspiration of the distal epiphysis of the right femur and knee was performed, a 3 mL of gross pus was obtained in the right distal femur and the fluid was sent for analysis, a 2 mL of gross light yellowish fluid was obtained in the knee.

The patient was taken emergently to the operating room. Once in the operating room, the distal thigh was then incised with a lateral midline incision. After accurate draining and washing of the purulent fluid collection, it was confirmed that there was no pus inside the femur. After copious irrigation, the fracture was gently reduced back to the anatomic position guided by ultrasound, 2 crossed 0.45-mm smooth Kirchner wires were placed percutaneously to stabilize the fragment (Fig. 1 d). The wound was closed over a drainage tube that was left in place for 72 hours. A plaster spica posterior long leg splint was applied. Culture, which was taken at the time of aspiration from the right

distal femur, grew Group B streptococcal septicemia. The Gram’s stain from the knee showed no organisms. After 10 days, postoperative fluoroscopic image was shown in Figure 1e.

At 4th week, the Kirchner wires were removed and follow-up X-rays were taken, which showed a good alignment between the femoral shaft and the epiphyseal nucleus. The fracture appeared to be healed on radiograph. At 17th month, leg length discrepancy of 2.4 cm was noted and central-arrest phenomenon seemed to occur (Fig. 1f), and the infant had no residual functional limitations. At 5 years of age, his last follow-up showed that there was only 1.6 cm limb-length discrepancy without angular deformity (Fig. 1 g), the child did not report any pain and was perfectly able to perform his daily activities.

3. Discussion

DFFFs are described as a unique and rare complication of neonatal osteomyelitis, only 1 case of epiphyseal separation of distal femoral following neonatal osteomyelitis has been reported.^[2] When working up a patient with unilateral decreased lower extremity motion, differential diagnosis between septic joint or osteomyelitis and fracture is difficult. There are a variety of methods of treatment for DFFFs, including closed reduction with immobilization, closed reduction with percutaneous pinning, and open reduction with percutaneous pinning. Consequently, correct early diagnosis and proper early treatment appear to be correlated with good result.

It is difficult to diagnose physeal separation in a newborn, especially differentiating whether it is secondary to trauma or following osteomyelitis. Physical findings may be difficult with

only clinical signs and differential diagnosis is difficult to obtain. Aroojis^[2] reported a case, in which radiographs were misinterpreted, they did not find the distal femoral epiphysis was separated until the operation began. Although in our case, the physal injury was readily visible by the radiographs, usually it was not apparent on plain film. The distal femoral epiphyseal ossific nucleus is always appeared on radiographs after gestation week 36 to 38.^[3] That makes it difficult to visualize the neonatal distal femur ossific nucleus by radiographs.

Literature reports other imaging methods of diagnosis of a physal separation include MRI, ultrasound, and arthrography. MRI has been useful in making the diagnosis of a physal injury, but it needs sedation and greater expenses. Arthrography would be very helpful to evaluate the subsequent position after closed reduction during operation, but it may cause invasive infection. Ultrasound is a useful tool for diagnosing neonatal physal injuries at the distal humerus as well as the proximal femur^[4] and lack of nonionizing radiation. In this case, we used MRI and ultrasound to help diagnosis. Both methods can confirm epiphysis injury and in addition permit direct evaluation of the soft-tissue structures. Compare to MRI, which needs sedation, ultrasound can both help diagnosis and guide a possible aspiration. As ultrasound can get the same image structure as MRI, ultrasound can be used as the first choice.

The choice of treatment for DFPPs is uncertain. Some authors believe that only closed reduction with plaster is sufficient^[5] because of signs of spontaneous healing and remodeling. However, The conservative treatment in plaster is associated with loss of reduction, witnessing that Eid and Hafez^[6] reported 38.3% of patients had re-displacement in the first 2 weeks. The rate of a displaced fracture having growth arrest is 4 times greater than that of a nondisplaced fracture.^[7] As prospectively it is difficult to be certain of the outcome, and Kirschner wire internal fixation has no effect on early epiphyseal closure,^[8] so several authors prefer closed reduction with r percutaneous pinning under arthrography, or even open reduction. In order to obtain anatomical reduction after debridement, we used ultrasound to guide the reduction during operation. We believe that ultrasound is better than arthrography or fluoroscopy-guided reduction with higher accuracy and no radiation exposure.

The distal femoral physis growth accounts for nearly 40% of the overall growth of the lower extremity.^[9] DFPPs in children have a high incidence of growth disturbance up to 52%. Salter-Harris 1 type fractures had approximately 35% incidence of growth rate disturbance. 22% of all distal femoral fractures developed a leg length discrepancy greater than 1.5 cm.^[7] Very little information is available in the literature regarding the prognosis of distal fem DFPPs after neonatal osteomyelitis. Aroojis^[2] reported that a 45-day-old infant with DFPPs after osteomyelitis was treated by 2 crossed Kirschner wires, and after 2-year follow-up, there was no limb length discrepancy or deformity. Growth “slowdown” has been reported,^[10] the central arrest phenomenon maybe little or has no further effect

on femoral length.^[5] In this case, at 1-year follow-up, the growth “slowdown” and central arrest phenomenon were showed. After 5 years, a shortening of only 1.5 cm was found without epiphyseal block and angulation. This phenomenon has rarely been reported in DFPPs. Therefore, the long-term growth disturbances of the femur called for further observation.

In conclusion, this case report not only highlights the rare incidence of these fractures, but also introduces stools needed in the diagnosis and treatment of DFPPs after neonatal osteomyelitis. Moreover, it confirms the applicability of successful treatment with ultrasound-guided reduction/fixation which had not yet been reported in the literature. Additionally, long term follow-up is necessary to ensure that there is no growth disturbance with growth.

Author contributions

Conceptualization: Jun Li, Xiantao Shen.

Data curation: Xing Wu, Dong Jing Xia, Jun Li, Xiantao Shen.

Formal analysis: Xiantao Shen.

Funding acquisition: Xing Wu.

Investigation: Xing Wu, Dong Jing Xia.

Methodology: Jie Sun.

Project administration: Dong Jing Xia, Jie Sun.

Supervision: Xiantao Shen.

Validation: Jun Li.

Writing – original Draft: Xing Wu, Xiantao Shen.

Writing – review & Editing: Xing Wu, Xiantao Shen.

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