



# Application of ultrasound in the early diagnosis of congenital patellar dislocation: a case description

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## Introduction

Congenital dislocation of the patella is a rare condition, the main clinical feature of which is the patella being located in the lateral distal femur that cannot be reduced manually (1). Although patella dislocation is present at birth, its clinical manifestations may not be obvious at birth due to immature knee development. In humans, the patella is a sesamoid bone, and ossification begins at 3–5 years of age (2). Therefore, when a congenital dislocation of the patella is clinically suspected in an infant, it can be easily missed by radiography and thus can only be confirmed with ultrasound. Early diagnosis is critical for completing early surgical correction for avoiding the late consequences, including early degenerative changes of the knee. If congenital dislocation of the patella is not diagnosed in time, the disability can worsen during growth. Here, we used ultrasound to ensure the early detection of a patient with congenital patellar dislocation.

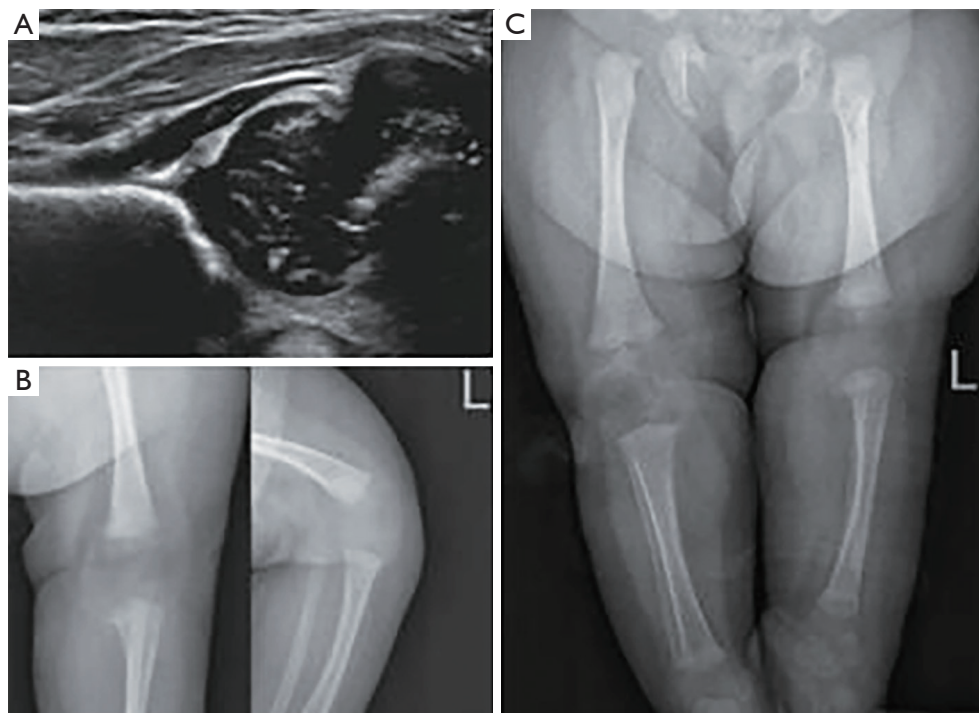
## Case report

The patient was a 6-month-old female infant. The parents reported the detection of a left knee valgus deformity during neonatal screening exam 42 days after birth. It was unilateral, without other malformations, and had no family history of any orthopedic issues. Concurrent ultrasonography of the hip joint showed left hip dysplasia (type II b). No examinations were performed on the left

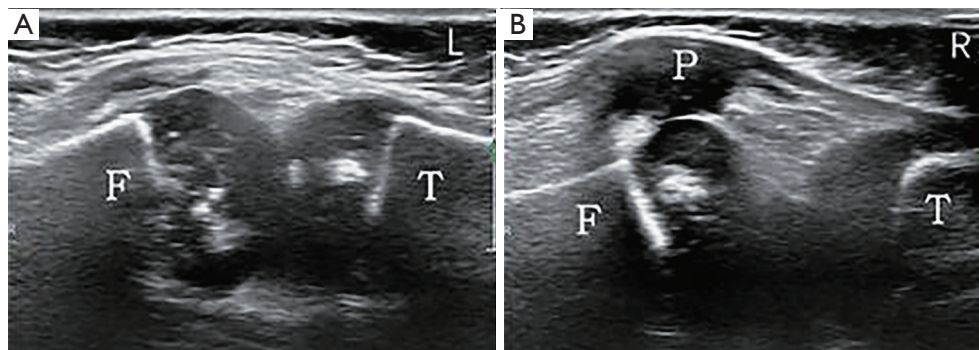
knee at that time. Closed reduction of the hip joint and herring-position plaster tube fixation were performed conservatively in the Department of Orthopedics of Gansu Provincial Maternity and Child-care Hospital. The  $\alpha$  angle of the left hip joint gradually returned to normal (*Figure 1A*). X-ray examination of the knee during the period did not indicate patella dislocation (*Figure 1B*). However, knee valgus deformity did not improve at 3 months after birth. The left lower limb was recently found to be significantly shorter than the right, X-ray examination showed that the left leg was shorter than the right leg, and there was no obvious abnormality in the left knee joint (*Figure 1C*).

Therefore, ultrasound of the knee was performed. It was found that the left patella was located on the lateral side of the knee joint. During dynamic scanning in flexion and extension position, the patella did not return to the normal position, and hence patellar dislocation was diagnosed (*Figure 2A,2B*).

Subsequent computed tomography (CT) examination of the knee confirmed the diagnosis of left patellar dislocation (*Figure 3A-3C*). CT showed multiple fine point-like calcifications in the epiphysis of the distal femur of the left knee joint, the epiphysis of the proximal tibial fibula, and the synovial membrane of the left knee joint. The ossification center of the distal femur and the proximal tibia was smaller than that of the right side (*Figure 3D*). The muscles of the left knee joint had atrophied. The existence of secondary left knee arthritis was considered, which in turn would affect the growth and development of the



**Figure 1** Ultrasound of the left hip and X-ray of the knee joint. (A) The  $\alpha$  angle of the left hip joint returned to normal. (B) X-ray of the left knee joint showed no obvious patella dislocation. (C) X-ray showed that the left lower limb was significantly shorter than the right. L, left.

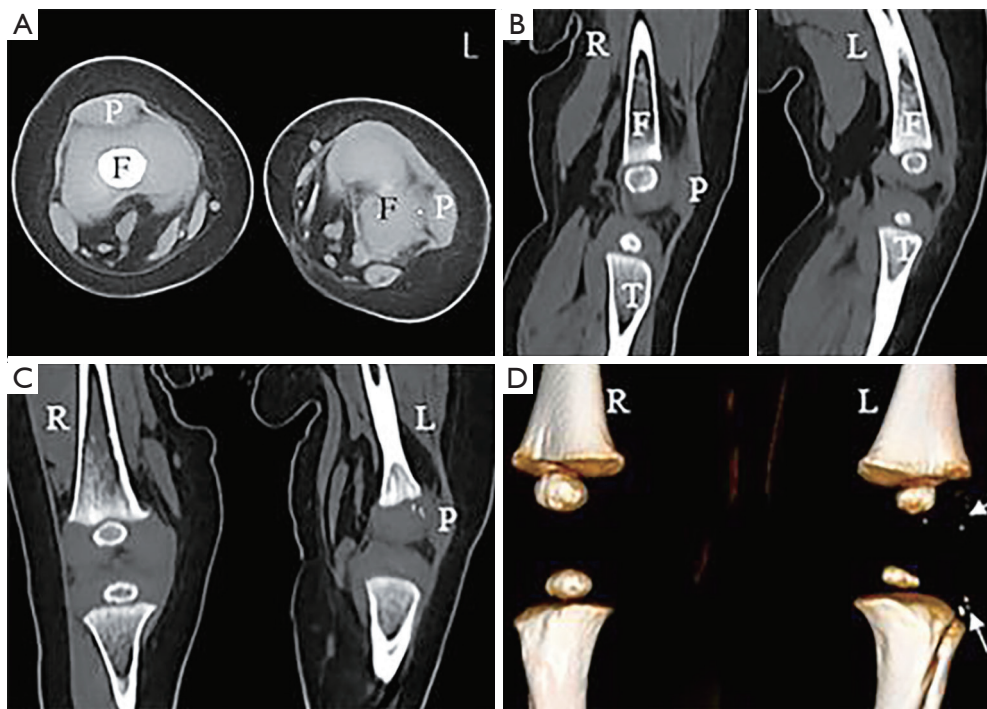


**Figure 2** Ultrasound of the knee. (A) Ultrasound showed dislocation of the left patella. (B) The patellar position was normal in the right knee joint. L, left; F, femur; T, tibia; R, right; P, patella.

left femur. However, a search of the literature yielded no reported cases.

Reconstruction of the medial patellofemoral ligament of the left knee was performed under general anesthesia. An arc-shaped skin incision was made from the lateral end of the distal femur to 2 cm below the anterior tubercle of the tibia at the supine position. The surgical steps were as follows: First, the skin, subcutaneous tissue and fascial tissue

were stripped to expose the patellar retinaculum. Extensive lateral retinal band release was performed. The adhesion was released between the anterolateral quadriceps and the iliotibial band. Second, the patellar tendon adhesion was released and transferred to the medial side, and the midline of the upper segment of the tibia was fixed with osseous suture. Finally, the medial retinaculum and articular capsule were released, and the patella was reduced and secured.



**Figure 3** Computed tomography confirmed dislocation of the left patella. (A) Cross-section of both knee joints. (B) Sagittal plane of both knees. (C) Coronal surface of both knee joints. (D) Three-dimensional reconstruction of both knee joints; the white arrows indicate multiple fine point-like calcifications. L, left; P, patellar; F, femur; R, right; T, tibia.

The patient was protected by braces after surgery, and she recovered gradually. All procedures performed in this study were in accordance with the relevant ethical standards of the institutional and/or national research committee(s) and with the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from the patient's legal guardian for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

## Discussion

Congenital dislocation of the patella is a rare malformation of abnormal growth and development of the knee joint. It is usually bilateral and familial and can be associated with a variety of other system malformations, such as Larsen syndrome (3). The particular case reported here had a unilateral presentation and was complicated with hip dysplasia with no additional positive family history.

Early diagnosis of this condition is crucial, as early treatment will promote easier and faster healing. The early diagnosis of congenital dislocation of the patella can be

easily missed due to nonossification of the patella at birth with resultant invisible patella on X-ray examination, so the treatment may be delayed, which can lead to permanent deformities of the knee joint in children, such as knee valgus, external rotation, contracture flexion, etc. (4).

Ultrasound is an ideal means to assessing the musculoskeletal system in infants because it is noninvasive and does not involve ionizing radiation. Ultrasound examinations are usually much less costly than are other methods and do not require tranquilizers (5). Considering the thinner soft tissue and relatively high percentage of cartilage in infants, high-frequency linear transducers can well describe unossified cartilage, joint anatomy, soft tissue, and blood (6). In this case, however, congenital dislocation of the patella was associated with hip dysplasia, adding further challenges to the clinical diagnosis of this disease (7). The main clinical manifestation of this case was valgus deformity of the knee along with joint contracture, which was misdiagnosed as dislocation of the hip joint and was treated conservatively with plaster fixation with no resultant improvement. Congenital dislocation of the patella is thought to be caused by a failure of the internal rotation of the

muscle sections forming the femur, quadriceps, and extensor muscles. This failure usually occurs between 8 and 10 weeks of embryonic development (8). Congenital dislocation of the patella is mainly distinguished from habitual dislocation and traumatic dislocation of the patella (9). The typical ultrasonographic manifestations of all 3 of the above are hypoechoic patella detached from the trochlea of the femur and located in the lateral femur. Congenital dislocation of the patella is characterized by the patella being unable to return to the femoral trochlea regardless of flexion or extension of the knee joint. Habitual patellar dislocation is characterized by hypoechoic patella flexion on the outside of the knee joint and a return to the trochlear surface in a straight position (10). Traumatic dislocation of the patella is lateral to the femur, but a history of trauma can aid in differential diagnosis. Therefore, when infants have knee flexion spasm, valgus, external tibial torsion, and foot deformity, clinicians should strongly suspect congenital patellar dislocation. As with most orthopedic abnormalities, early diagnosis and intervention are essential, and surgery is the most common form of treatment for congenital dislocation of the patella. Surgical management is the preferred treatment for avoiding late sequelae and preventing early degenerative changes in the knee joint (11).

## Conclusions

Ultrasonography can dynamically observe the patella and its adjacent position in real time, is not limited by body position, can reveal the structure of the peripheral ligament, and can provide more diagnostic information for clinical practice. It is thus an effective method for the early diagnosis of congenital dislocation of the patella.

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## Footnote

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <https://qims.amegroups.com/article/view/10.21037/qims-23-6/coif>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from the patient's legal guardian for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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