



Case Report

Prenatal diagnosis of proximal femoral focal deficiency: A case report and literature review

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Abstract

Objective: To present a rare case of fetal nonfamilial proximal femoral focal deficiency (PFFD) diagnosed as early as 21 weeks' gestation.

Case Report: A 32-year-old woman was referred to our hospital at 21 weeks' gestation. An ultrasound examination revealed isolated unilateral short femur (right femur = 27.3 mm and left femur = 37.9 mm). The measurements of all the remaining long bones were within the normal range. The facial profile was unremarkable. Results of amniocentesis revealed a normal 46,XX female karyotype. A follow-up ultrasound 2 weeks later demonstrated further discrepancy in femoral length. A diagnosis of PFFD was made. The parents were well informed about the treatment options and after counseling they decided to terminate the pregnancy. A *postmortem* X-ray examination confirmed the diagnosis of PFFD.

Conclusion: We have to measure both sides of extremities according to the ultrasound scan guidelines so as not to overlook any possible case of skeletal dysplasia. An advanced three-dimensional (3D) and 4D ultrasound evaluation of the bony structures and carefully observing the range of motion of the affected limbs will provide proper information to formulate a further therapeutic plan.

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Keywords: isolated short femur; proximal femoral focal deficiency; ultrasound; unilateral short femur

Introduction

Measurement of the fetal femur length is necessary for prenatal growth estimation. In most global or lethal skeletal dysplasia cases, multiple limbs are involved. However, detecting subtle discrepancies between normal and abnormal as well as detecting differences between the right and the left side is possible with improving ultrasound technology. Sometimes we only measure the femur proximal to the probe and consider that it is within the normal range. In some rare

situations, however, isolated unilateral short femur in the absence of global findings would be missed. Only a few cases were reported [1–8] and most of them required a highly individualized postnatal intervention based on femur length discrepancy, the degree of subtrochanteric varus, or the severity of superolateral femoral head dislocation [9]. Here, we report a case with isolated unilateral short femur diagnosed as early as 21 weeks' gestation and confirmed the diagnosis of proximal femoral focal deficiency (PFFD).

Case report

A 32-year-old, gravida 1, para 0, woman was referred to our hospital at 21 weeks' gestation for a second opinion on a

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possible intrauterine right femoral fracture in an otherwise normal fetus (Fig. 1A). However, that image was a pitfall for femoral length measurement. A detailed ultrasound examination revealed a markedly shortened right femur, which measured 27.3 mm in length, three standard deviations below the mean for gestational age (Fig. 1B; normal range for 21 weeks: approximately 30.3–39 mm). Morphologically, the right femur was otherwise normal. The length of the left femur was 37.9 mm (Fig. 1C). Because of unilateral femoral shortening, all the remaining long bones measurements were within the normal range for this gestational age. The fetal facial profile was unremarkable. The patient denied any exposure to drugs, environment hazards, or radiation. Results of an amniocentesis revealed a normal 46,XX female karyotype. A follow-up ultrasound at 23 weeks' gestation demonstrated further discrepancy in femoral length: the left femoral length

was 42 mm (reference length at 23 weeks' gestational age: approximately 35.6–44.5 mm), whereas the right femoral length was still at 27 mm, which is approximately four to five standard deviations below the mean for this gestational age. According to the evidence shown earlier, PFFD was suspected. The parents were well informed about the available treatment options and after counseling they decided to terminate the pregnancy. A dead 486-g female fetus was delivered. No bony or facial abnormality was grossly observed. Results of a *postmortem* X-ray examination confirmed the diagnosis of PFFD (Fig. 2).

Discussion

PFFD is a rare skeletal disorder manifested by hypoplasia of the subtrochanteric portion of the femur characterized by shortening of the entire limb with an estimated rate of 0.11–0.2/10000 live births [1,3,10]. The unilateral form is more common, seen in 85–90% of the affected cases [7]. Although the etiology of PFFD is uncertain, the common etiologies of short femur should be excluded, such as aneuploidy (especially, trisomy 21), poor diabetic control, exposure to drugs (thalidomide), viral infections, radiation, focal ischemia between the 4th and 8th week of gestation [5,7]. There are some overlapping clinical manifestations involving developmental defect of focal unilateral or bilateral shortening of the femur, including PFFD, femoral–fibula–ulna syndrome, and femoral–facial syndrome. In our case, we excluded other common etiologies because of the normal length of both bilateral ulna and fibula. The fetal facial profile was also within normal limits. Therefore, we made the

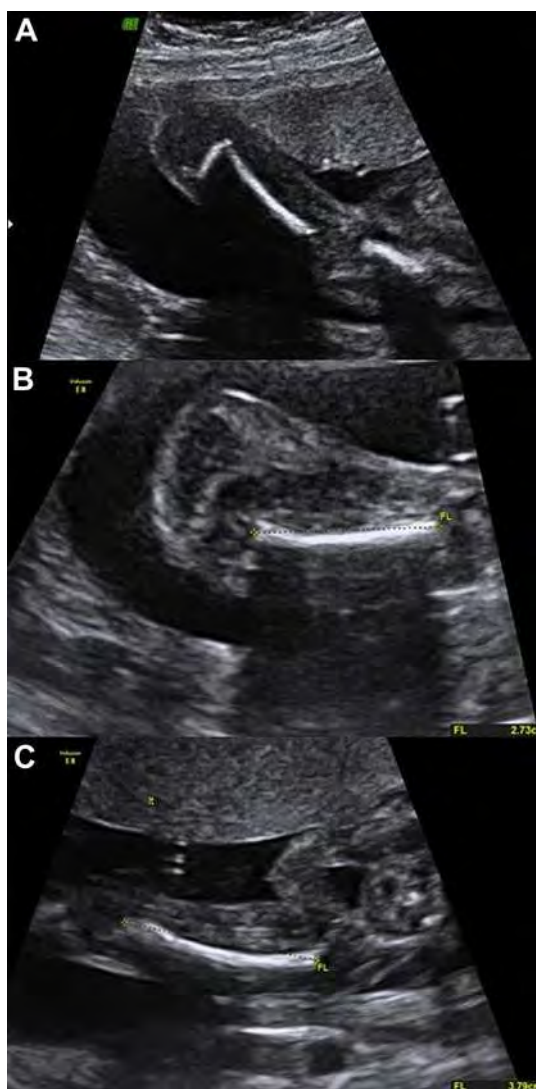


Fig. 1. (A) Oblique view of right femur misleads one to diagnose intrauterine fracture. (B and C) Axial prenatal ultrasound image of the femurs shows that the right femur was markedly shorter than the left. The right femur measured 27.9 mm, three standard deviations below the mean for the gestational age. Both fibulas were identified (data not shown).



Fig. 2. *Postmortem* X-ray examination showed all the extremities within the normal range except the isolated short right femur and a diagnosis of proximal femoral focal deficiency was made.

diagnosis of PFFD. PFFD can be easily discriminated from other skeletal dysplasia, such as thanatophoric dysplasia, osteogenesis imperfecta (OI), and achondroplasia, all of which appear bilaterally and all the other long bones are affected [7].

Usually, PFFD is not associated with other anomalies. Several classifications have been proposed for PFFD and the most widely used one is Amstutz's classification [10]. This classification divides PFFD into four types, namely, Type I, Type II, Type III, and Type V, depending on visualization of the femoral head and its severity by plain radiographs or magnetic resonance imaging. However, the definite diagnosis cannot be made before the 1st year of life, which means that it is impossible to predict the fetal outcome even if the diagnosis is made prenatally. A recent report [1] illustrated that using advanced three-dimensional (3D) and 4D ultrasound with surface-rendering evaluation of the bony structures as well as carefully observing the range of motion of the affected limbs will provide proper information to formulate a therapeutic plan. The ratio of femoral length discrepancy in isolated cases is usually between 0.75 and 0.85 (approximately). In our case, however, the femoral length discrepancy was 0.64. In countries where abortion is legal, the option of termination may be offered because of uncertainty in prognosis.

Femoral–fibula–ulna syndrome, involving not only the femur but also the ulna and the fibula, may decrease the range of motion of the upper extremities, abnormal genitalia, and urogenital system. Patients with femoral shortening, cleft lip/palate, a short nose, or micrognathia are subgrouped under the femoral–facial syndrome. Sometimes the diagnosis is made after delivery because prenatal detection of subtle defect is not guaranteed.

The International Society of Ultrasound in Obstetrics and Gynecology and the American Institute of Ultrasound in Medicine illustrate the guidelines for second trimester obstetric ultrasound practice. Both of them advised us to check the views of all extremities [11,12]. When measuring the femoral length, the cartilaginous ends of the femur should not be included in the measurement. Potential sources of error in measurement of the long bones are stated as follows: First, using different types of transducer (sector, linear, curvilinear) will affect the result. Lessoway et al [13] observed a variation of 2.4–3.4 mm in femoral measurements among different ultrasound units in their department. Second, the angle of inclination also affects the result of measurement. The long bones should be perpendicular to the transducer to control for the effect of angling [11]. A femur measured in the oblique plane (Fig. 1A) is significantly shorter than the one measured in the horizontal plane (Fig. 1B), with a difference up to approximately 4–10 mm by gestational age. Third, measuring the length in oblique plane may also

result in a pitfall and could mislead us to diagnose intrauterine fracture. The intrauterine fractures, caused by trauma or OI, are always from the shaft, and not from the distal part of femur. Finally, the interobserver variation in the measurement of the femur should also be considered.

In summary, prenatal ultrasound has a value for detecting cases of PFFD and for stratifying them according to severity. We have to measure both side of extremities according to the ultrasound scan guidelines to avoid any misses of skeletal dysplasia. Advanced 3D and 4D ultrasound evaluation of the bony structures and carefully observing the range of motion of the affected limbs will provide proper information for a further therapeutic plan.

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