MRI of Congenital and Developmental Abnormalities of the Knee

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Congenital and developmental abnormalities of the knee are often initially identified on radiographs, but MRI can be utilized to assess other physical, skeletal, neuronal, epiphyseal, and articular abnormalities not appreciated radiographically.

The various congenital and developmental abnormalities of the knee are best understood within the context of its normal development. The epiphyseal closure sequence of the distal tibia is a process whereby the potential interphyseal space forms a secondarily ossified cartilage during the first 2 to postnatal months. The normal secondary ossification center of the plantar tibial epiphysis and the knee region begins to ossify at birth, with complete ossification occurring at 2 to 3 years of age. The meniscus obtains the characteristic shape before birth. Postnatally, the meniscal growth follows the diaphyseal and epiphyseal growth patterns, allowing the meniscus to grow proportionally and develop relative to the physeal cartilage of the distal tibia and proximal tibia in early childhood. It is not until adolescence that the development of Sharpey's fibers is evident at 2 to 3 years of age.

The alignment of the knee varies during early childhood. Physiologic genu varum reaches a maximum degree at 6 months, and lasts until approximately 24 months. During the 2nd and 3rd years, the knee becomes aligned in the vertical plane, and the final alignment of the great toe is evident at approximately 4 years of age.

Epiphyseal Dysplasia

Dysplasia Epiphysiala Hereditaria (Trevor's disease) is characterized by broadened overgrowth of an epiphysis of a long bone, most commonly occurring symmetrically and within the distal tibial and proximal femoral epiphyses. In children, the lesion may be mistaken for that of a round and oval physeal tear. Premature closure of the physeal with remodeled delivery and occasional limb discrepancy may also be seen. Articular surface irregularity may lead to early subluxation/dislocation.

Figure 1: Bilateral Blount disease, AP view of the pelvis demonstrates a hypoplastic acetabulum without uncovering of the femoral head. Coronal proton density (Fig. 10C) and T1-weighted (Fig. 10D) images of the knee demonstrate lateral dislocation of the femoral head, abnormal collateral ligaments.

Figure 16: Congenital deformities of the knee, Coronal proton density image (Fig. 16A) of the right knee demonstrates a disorganized appearance of the femoral and tibial epiphyses, and the normal physeal plate is small and irregularly shaped.

Epiplaphy

Trevor's Disease

Epiphyseal Dysplasia

Tibial hemimelia varies from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femur ranges from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femur ranges from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femur ranges from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral.

Proximal Focal Femoral Deficiency

Congenital short femurs range from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femurs range from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femurs range from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral. Congenital short femurs range from mild hypoplasia to complete absence of the femur and tibia, associated with other congenital anomalies. The lesion is more frequent in females and may be unilateral or bilateral.

Meniscal Abnormalities

Discoid meniscus is a variant in which the meniscus is more discoid than normal and may consist of a single or multiple areas of abnormal signal intensity consistent with chondromalacia. The patella is hypoplastic and the intercondylar sulcus is shallow. The lesions may be mistaken for that of a round and oval physeal tear. Premature closure of the physeal with remodeled delivery and occasional limb discrepancy may also be seen. Articular surface irregularity may lead to early subluxation/dislocation.

Figure 8: Congenitally short femur, 28 week gestational age girl: Axial T2 weighted images (Fig.8A) demonstrate marked shortening and broadening of the distal femur and proximal tibia with relative flattening of the distal femoral condylar contours. Axial T2 weighted images (Fig.8B) demonstrate a hypoplastic patella with a small but spherical femoral head. The distal femur is also hypoplastic.

Figure 15: Bipartite patella, AP view of the pelvis (Fig. 15A) demonstrates marked shortening and broadening of the distal femur and proximal tibia with relative flattening of the distal femoral condylar contours. Axial T2 weighted images (Fig.15B) demonstrate a hypoplastic patella with a small but spherical femoral head. The distal femur is also hypoplastic.

Nail Patella Syndrome

Abnormal muscle attachments are found in the knee region.

References

Sagittal STIR (Fig.3) image demonstrates widening of the distal femoral and proximal tibial physes as well as the physis of the secondary ossification center (arrow).

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