Clinical Research on Foot & Ankle

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Identification of Pediatric Foot Disorder using Imaging Techniques

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Abstract

Imaging tests are performed on infants and kids to assess a wide range of inherited and acquired diseases. Imaging procedures must take the patient's comfort, anxiety level, and smaller size into account. Plain radiographs are typically used for the initial imaging study. The Anteroposterior (AP), lateral, and oblique projections are included in the standard radiography examination of the foot. Due to its higher soft tissue contrast and spatial resolution, Magnetic Resonance Imaging (MRI) provides good anatomic detail of cartilage, vascular, and soft tissue, making it useful in many situations. We can perform Computed Tomography (CT), CT imaging, or MRI imaging in accordance with the clinical and objective signs, as shown by the radiograph images. The non-ossified sections of the bones are not clearly defined by CT imaging, which is a drawback given that radiation is used. On the other hand, because of its higher contrast and spatial resolution, MRI imaging is particularly helpful in identifying the cartilaginous components, vascular, and soft tissues. Finally, it's critical to employ the most appropriate diagnostic technique and to frame the diagnostic procedure around the patient's clinical symptoms.

Keywords: Anxiety level; Standard radiography; Magnetic resonance imaging; Perform computed tomography; Cartilaginous components

Introduction

Imaging tests are performed on infants and kids to assess a wide range of congenital and acquired disorders. Conventional radiographs are the first imaging study conducted; occasionally, additional imaging is required and is determined by the results of the plain film and the patient's clinical presentation. Special consideration must be taken while selecting and interpreting an imaging investigation for children because they are typically less cooperative and have smaller feet than adults. Imaging procedures must take the patient's comfort, anxiety level, and smaller size into account. Additionally, as children age, their bones become progressively more ossified, therefore this must be taken into account while choosing and interpreting imaging investigations. The common injuries and uncommon conditions of the child's foot are discussed in this article, along with a discussion of differential diagnosis. These conditions include sesamoiditis, Kohler's disease, Freiberg infraction, Sever's disease, tarsal coalition, osteomyelitis, septic arthritis, and tumors that could imitate a fracture [1].

Imaging techniques

Plain radiographs are typically used for the first imaging study. The AP, lateral, and oblique projections are included in the standard radiography examination of the foot. A Harris view of the calcaneus is frequently performed in cases of suspected taloc-alcaneal coalition in order to assess the subtalar joint. Standing views are necessary when assessing kids with clubfoot deformity because they give the most accurate information about alignment. This method maintains the infant's foot in forced dorsiflexion to enable proper foot positioning by using AP and lateral views and a solid plastic shape. CT scans in the axial and coronal planes are done on kids who have tarsal coalition suspicions. The components of a fracture can be distinguished by CT, as can the nidus in an osteoid osteoma. Infants with congenital foot deformities can have their non-ossified tarsal bones seen with sonography [2, 3].

Due to its superior soft tissue contrast and spatial resolution, magnetic resonance imaging (MRI) is useful in a variety of circumstances, such as identifying the cartilaginous structures in the infant's foot during the evaluation for clubfoot or skew foot, delineating articular cartilage, determining the status of osteochondral fractures, and in the evaluation of avascular necrosis [4].

Congenital deformation

The most prevalent type of this condition, congenital clubfoot, affects about 1 in 1000 live infants. Usually, this abnormality is isolated. Boys are more likely to develop it, and in up to 50% of cases, it may be bilateral. Although the exact origin of congenital clubfoot is unknown, it is believed to be connected to a talus deformity. The clubfoot malformation has several anatomical parts that have been identified. There are numerous soft tissue contractures as well as the lateral rotation of the talus in the ankle joint, medial rotation of the calcaneus, talar and calcaneal equinus, medial subluxation of the navicular, and medial subluxation of the cuboid. The baby clubfoot is clinically evaluated for varying degrees of rigidity, hindfoot varus and equinus, forefoot adduction, minor calf atrophy, and slight hypoplasia of the foot, tibia, and fibula. The preoperative imaging examination of the child with congenital clubfoot can be challenging due to various challenges in situating the foot for plain radiographs and MR imaging or the inability to see the cartilaginous anlage on CT. The conventional method for assessing the foot before repair has been radiographs [5].

Positioning devices must be employed to obtain forced dorsiflexion views of the foot in order to execute AP and lateral projections. As closely as possible to anatomical position must be achieved. The same holds true for MR and CT imaging. With its higher soft tissue contrast, MR imaging has proven to be useful in preoperative assessment. In fact, it can clearly show the intertarsal joints and ossified and cartilaginous sections of the tarsal bones. To identify the degree of clubfoot abnormalities, however, multiplanar reconstruction techniques should be applied because the deformed clubfoot is difficult to evaluate in

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standard orthogonal planes [6].

Slice misregistration was an issue for data collected using two-dimensional sequences, but on three-dimensional T2-weighted images, cartilage could be distinguished from surrounding soft tissue with great clarity. Joint spaces were also well-delineated on T1-weighted images, and with in-version recovery pulses sequences, cartilage from soft tissue could be distinguished and the joint spaces could be defined [7].

Prenatal MR imaging and prenatal ultrasonography can both detect clubfoot deformity. Both approaches are useful for determining the severity of clubfoot deformity as well as any related abnormalities. When the most data are required for prenatal and perinatal care of a pregnancy, both imaging modalities may be used to assess fetuses with complex diagnostic conditions [7].

Adductus of the metatarsus and skew foot

One of the most common foot abnormalities in children is adduction of the forefoot. Forefoot adduction makes up the metatarsus adductus, although midfoot and hindfoot alignment is both proper. Most cases resolve on their own without the need for medical intervention or radiological analysis. Stretching or serial casting, however, might be required in extreme circumstances. Children older than 4 years old or those who are resistant to more conservative treatment may require surgical management. Physical examination makes it difficult to distinguish between kewfoot and metatarsus adductus in the chubby infant foot. The absence of ossification in the tarsals limits the radiographic evaluation, but MR imaging has proven to be extremely helpful in establishing the tarsal positions in newborns whose bones are not ossified. They compared these correlations to radiographs and discovered that the navicular is laterally subluxed on the talus when the base of the first metatarsal is lateral to the midtalar axis. This discovery aids in the differentiation between skewfoot and metatarsus adductus [8].

Flat foot and congenital vertical talus

The phrase "flatfoot" refers to a number of distinct causes of valgus hindfoot and plano-valgus foot. Flatfoot is characterized by valgus rotation of the calcaneus on the talus, which causes the talus to be vertically aligned and the longitudinal arch of the foot to flatten. Flexible or rigid flatfoot are both possible. It is thought that ligamentous laxity allowing aberrant mobility in the hindfoot is what causes flexible flatfoot or pronated feet. It is extremely typical and typically asymptomatic. On AP and lateral radiograph projections, there is a greater talocalcaneal angle. Flatfoot can also occur in disorders like cerebral palsy that cause aberrant muscle tone, and inflexible flatfoot accompanied by peroneal muscular spasm can occur in tarsal coalition. The most severe form of congenital flatfoot is congenital rigid flatfoot, also known as congenital vertical talus. The navicular on the talus is dorsally dislocated, the talus is vertical, and the calcaneus is flexed in the plantar region. The talus and navicular both exhibit an aberrant profile, with the talar head being flattened and the navicular being wedge-shaped.

Osteochondral lesion

A medial or lateral talar fracture may develop from osteochondritis dissecans of the talus, a transchondral fracture brought on by the torsional impaction of the tibia or fibula on the articular surface of the talus. There is frequently, but not always, a history of trauma involving dorsiflexion and inversion in the case of a lateral defect or flexion and plantar flexion in the case of a medial talar fracture. When there is ankle pain, conventional radiography is the most frequently employed imaging modality. On the medial or lateral aspect of the talar dome in the AP or mortise view of the ankle, one can notice a small point of heterogeneous density or a small fracture line in osteochondritis dissecans of the talus. There might be a bone fragment there. Osteochondritis dissecans of the talus has historically been graded using radiography; however, with the increased dissemination of MR imaging, an MRI grading system has been developed [9].

Sesamoiditis

Sesamoiditis, a painful inflammatory disorder, can result from repeated damage to the plantar region of the forefoot. On T1-weighted images, the signal intensity in the marrow of the sesamoid bones is reduced or normal, and on STIR images, it is enhanced, resembling the signal intensity brought on by a stress reaction. Sesamoiditis is a more likely diagnosis than a stress reaction if the signal intensity of the sesamoid bones is aberrant on STIR but normal on T1-weighted imaging.

Osteomyelitis

The most frequent cause of osteomyelitis of the foot is the transcutaneous spread of a soft tissue infection that later affects bone. Low signal intensity on T1-weighted images of the infected bone marrow, increased signal intensity on T2-weighted and STIR images, and contrast enhancement after intravenous gadopentetate dimeglumine injection are MR imaging findings in osteomyelitis [10].

Conclusion

In conclusion, we can primarily employ plain radiographs, CT, and MRI to evaluate congenital and acquired diseases in infants and children. Plain radiographs are frequently used as the first imaging study. After that, we can be orientated to perform CT imaging or MRI imaging according to the clinical and objective indicators, led by the radiograph images. Although CT imaging is useful for observing the bones, it has the drawback of using radiation and is insufficient for defining the nonossified sections of the bones.

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