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BLAUNT'S DISEASE IS A PATHOLOGICAL CONDITION IN CHILDREN THAT REQUIRES EARLY DIAGNOSIS AND TREATMENT MEASURES

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Annotation. Blount's disease - the tibia bends in the upper part, leading to a varus (O-shaped) deformation. In some cases, valgus (X-shaped) deformation is observed. The cause of the development of the disease is the descent of the epiphysis into the cartilage in the area of the head of the tibia. Usually the inner surface suffers, less often the outer. The disease develops at the age of 2-3 years or after 6 years. It is manifested by a visible deformation of the upper third of the foot.

Keywords: bone, tibia, deformity, osteotomy, epiphysis, metaphysis, correction.

Introduction

Blount disease, also known as tibia vara, is an acquired genu varus deformity in children caused by disrupted normal cartilage growth at the proximal medial metaphysis of the tibia. This condition develops due to excessive compressive forces on the medial aspect of the proximal tibial physis, leading to altered enchondral bone formation. Blount disease can be either unilateral or bilateral and manifests in 2 forms—infantile and adolescent—distinguished by variations in age of onset and presentation. The infantile or early-onset form is commonly bilateral, typically manifests in children between the ages of 1 and 5, and tends to exacerbate after the initiation of walking. The adolescent form manifests at a later stage and may present as either unilateral or bilateral.

Blount disease has a multifactorial etiology involving both biological and mechanical factors. Although mechanical overloading of the proximal tibia is a significant contributor, especially in children who are overweight and start walking early, it is not the sole cause of the condition. The infantile form, which also affects normal-weight children, and the higher prevalence among African-American patients indicate a potential hereditary component. In addition to mechanical overload, genetic susceptibility is also implicated in the development of Blount disease.

Genu varum is typically considered a normal finding in children until age 2, after which alignment transitions to valgus, reaching its peak around age 3. In children who are young and overweight, persistent genu varum often serves as the initial indicator for diagnosis. As the growth disorder progresses, knee deformities and associated abnormalities worsen gradually, resulting in a 3-dimensional deformity that combines varus, procurvatum, internal tibial rotation, and limb length discrepancy.

Infantile Blount Disease

Infantile Blount disease is typically diagnosed in children between the ages of 1 and 3. This condition manifests as a bilateral condition characterized by varus deformity of the tibia and internal tibial torsion. Pain is generally rare, and a palpable "beak" may be evident over the medial aspect of the proximal tibial condyle. The identification of lateral thrust, indicating lateral translation of the knee joint during weight-bearing, is a crucial clinical observation. Irreversible asymmetric medial proximal tibial epiphysiodesis usually develops around the ages of 6 to 8, making conservative treatments ineffective.

Adolescent Blount Disease

Adolescent Blount disease typically emerges in children in their late childhood or early adolescence period and is often accompanied by pain in the medial aspect of the knee. The condition is often associated with being overweight or obese. The presentation of the disease is often unilateral and may involve associated abnormalities of the distal

femur.

History, physical examination, and plain radiography constitute sufficient means for diagnosing Blount disease. In the initial stages, clinicians use long-leg anteroposterior radiographs to screen for and measure varus. Accurate measurement requires bilateral projection of the radiograph from the hip to the ankle.

Indicators of Blount Disease

Findings suggestive of Blount disease include medial beaking of the epiphysis, widened and irregular medial physis, irregular ossification, and medial slope of the epiphysis and metaphysis in varus.

Angles For Blount Disease Detection

Healthcare professionals refer to specific angle measurements to detect Blount disease in children. Various angles, such as the Levine-Drennan angle, are used to assess the relationship between the tibia shaft and its upper growth plate. An angle measurement exceeding 11° typically indicates the presence of Blount disease. The angles necessary for Blount disease detection are mentioned below.

Metaphyseal-diaphyseal angle: The metaphyseal-diaphyseal angle (MDA) can predict the progression of Blount disease. The intersection occurs between a line drawn from the most distal point on the medial and lateral beaks of the tibial metaphysis to a line perpendicular to the long axis of the tibial diaphysis.

The disease progression can be predicted as follows:

An angle >16° is associated with a 95% risk of deformity progression.

An angle <10° is likely physiological, with a 95% chance of spontaneous resolution.

An angle between 11° and 16° necessitates close observation for the potential tibia vara progression.

The angular abnormalities include intra- and extra-articular varus malalignment, internal tibial rotation, procurvatum, distal tibial valgus, lateral and medial laxity, and distal femoral deformities.

Tibiofemoral angle: The tibiofemoral angle measures the severity of the varus deformity.

Medial metaphyseal beak angle: The medial metaphyseal beak angle (MMBA) is a potential diagnostic screening tool for individuals at risk of Blount disease. When combined with the MDA, MMBA can confirm the diagnosis, resulting in earlier diagnosis and improved patient outcomes.

Magnetic resonance imaging (MRI) effectively assesses cartilage, menisci, ligaments, and vascularity of the physis. In addition, MRI outperforms radiographs in detecting cartilaginous changes. Thus, gadolinium-enhanced MRI proves beneficial to pediatric patients with neglected or delayed forms of Blount disease observed after age 4 but before the development of radiographic epiphysiodesis.

Treatment and management.

Osteotomy

Realignment osteotomy is typically performed before age 4 in pediatric patients with documented and progressive Blount disease or FDF stage I who demonstrate risk factors. Due to the high recurrence rate in infantile Blount disease, it is expected to overcorrect osteotomies to achieve between 5º and 15° of valgus. The objectives of the osteotomy include lateral translation, 10° to 15° of lateral derotation, and 5° to 10° of valgus. Various osteotomy techniques have been described for Blount disease, including opening and closing wedges, opening wedges, serrations, domes, and inclined osteotomies. The correction can be acute or gradual with external fixation. Gradual correction leads to more precise mechanical axis and leg length discrepancy corrections. A systematic review comparing acute versus gradual correction for Blount disease reveals weak evidence favoring gradual correction, whereas an acute correction results in a higher prevalence of transient peroneal nerve palsy. No difference in the reoperation rate exists between the 2 procedures. With acute correction, there is a risk of peroneal nerve injury and compartment syndrome regardless of the kind of osteotomy and fixation method.

Acute Correction

During acute correction, the varus distal fragment is fixed in translation and external rotation to correct the internal rotation deformity. Other necessary surgical procedures, such as physeal bar resection and medial plateau elevation, are carried out concurrently with the osteotomy. If the bar is more than 50% of the size of the physis, hemiepiphysiodesis is appropriate. The osteotomy level should be positioned below the tibial tuberosity to prevent patella baja, which can lead to extensor insufficiency and knee pain. Children aged 3 or older, regardless of the stage, or patients with stage III Blount disease, irrespective of age, are considered suitable for an osteotomy. Accurate

measurement of limb alignment after acute or gradual correction can be challenging. To visualize mechanical axis alignment, some researchers utilize intraoperative fluoroscopy with the electrocautery cord placed across the skin, overlaying the center of the hip and ankle. The advantage of acute correction is its ability to correct the deformity immediately. However, this approach increases the risk of compartment syndrome and peroneal nerve injury due to acute lengthening.

Gradual Correction

An osteotomy is performed during gradual correction, and a frame is connected to enable progressive correction. Commonly used devices include the Taylor Spatial Frame or Ilizarov Ring External Fixator. Postoperatively, a treatment duration of 12 to 18 weeks is typically required. Gradual correction minimizes the risk of neurovascular compromise and compartment syndrome while also allowing for correction of deformity in all planes. However, a potential drawback is pin site infection, considering the required length of treatment.

Asymmetrical Physeal Distraction

Asymmetrical physeal distraction is a procedure that is not used frequently. This procedure involves inserting 2 half-pins of 6 mm into the proximal tibial epiphysis and 2 pins into the diaphysis. After the pins are inserted, progressive distraction is done at a rate of 1.5 mm/d. A monolateral fixator typically achieves an average of 13° of angular correction. The limited popularity of this procedure may be attributed to the risks of septic arthritis, discomfort during distractions, and the potential for premature closure of the growth plate.

Physeal Bar Resection

Unlike patients who develop physeal bars after trauma, patients with Blount disease patients typically do not have a distinct region of osseous tether that lends itself to surgical excision. Physeal bar resection aims to restore normal growth and prevent further deformity. Children who receive physeal bar resection or epiphysiolysis before age 7, combined with a valgus osteotomy at that time, demonstrate improved outcomes. However, children aged 7 and older are not considered suitable candidates for this surgery, and epiphysiolysis as a standalone operation has minimal use in these patients.

Medial Tibial Plateau Elevation

Blount disease may progress to the extent that the tibia can laterally translate, and the medial femoral condyle enters the posteromedial depression, leading to a varus thrust gait. Children aged 6 and older with severe Blount disease, at Langenskiöld stage V or VI, and exhibiting a substantial posterior depression of the medial tibial plateau are considered suitable candidates for posteromedial tibial plateau elevation. Surgeons recommend conducting an intraepiphyseal or transepiphyseal osteotomy that hinges on the articular cartilage of the intercondylar notch to preserve the medial tibial plateau. The emphasis should be on simultaneously correcting the posterior depression of the medial plateau by incorporating a larger portion of the graft. To prevent the recurrence of a varus thrust gait, healthcare professionals must perform lateral proximal tibial and fibular epiphyseodesis concurrently.

In conclusion, if being overweight caused the Blount disease, it's important for parents to help their child reach and keep a healthy weight. This can reduce stress on the bones and joints and prevent other long-term problems from weight gain (like type 2 diabetes and heart disease). If you need help getting your child to adopt a healthier lifestyle that includes a balanced diet and exercise..

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