Primary Care Orthopedic Issues

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Objectives

1. Discuss the assessment and management of rotational and angular pediatric orthopedic conditions.

2. Identify the physical and radiographic findings for metatarsus adductus, internal tibial torsion (ITT), excessive femoral anteversion, and Blount disease.

Chapter Outline

Rotational Deformities
Metatarsus Adductus
Internal Tibial Torsion
Excessive Femoral Anteversion
Angular Deformities
A woman brings her 15-month-old daughter to your office because she has noticed that the child's toes point inward when she walks and she often falls when she runs. After falling, the child gets up right away and continues on her way. She does not seem to be in pain and is not bothered by these frequent falls. She is otherwise healthy without any medical problems, takes no medications, and has no allergies.

The patient was a full-term infant delivered vaginally after an uncomplicated antenatal course. She weighed 3.8 kg (8.4 lb) at birth and had Apgar scores of 9 and 9 at 1 and 5 minutes. She has achieved developmental milestones on schedule and started walking at 12 months. She eats a diverse diet, including meats, fruits, and vegetables, and drinks whole milk. She shows no preference for either hand and uses both well. There is no family history of cerebral palsy, learning disabilities, brain tumors, progressive neurologic diseases, or spina bifida. Of note, when her father was a toddler, his toes pointed in; he wore corrective shoes connected by a bar, and he currently has a normal gait.

On examination the child is alert and playful and is toddling around the examination room. She is at the 50th percentile for height, weight, and head circumference. Significant physical examination findings include normal neurologic examination results and a normal spine without evidence of a dimple or tuft of hair at the sacrum. Her legs are of equal length. There are no clicks or clunks with Ortolani and Barlow maneuvers, and the hips have a full range of
Primary Care Orthopedic Issues

Clinical Features

The diagnosis of metatarsus adductus is made by looking at the sole of the foot. Normally, the lateral border of the foot is straight. In metatarsus adductus, the lateral aspect of the foot has a C-shaped curve. To assess the flexibility of the defect, the heel is held in neutral alignment and the forefoot is abducted. A flexible deformity can be eliminated, and a fixed or rigid defect cannot.

Grading of metatarsus adductus is based on the degree of flexibility and the relationship of the toes to a line bisecting the heel. With a normal foot, a line bisects the heel between the second and third toes. The line is at the third toe in a mild deformity and between the third and fourth toes in a moderate deformity. The line is between the fourth and fifth toes in a severe deformity.

Management

Mild/flexible and moderate/fixed metatarsus adductus can initially be treated with stretching exercises; however, despite its commonly prescribed use, the effectiveness of stretching exercises is uncertain. If the deformity does not resolve by 2 to 4 months, a referral for casting is recommended. Every 2 to 3 weeks, two or three casts are applied. Treatment with casting

Rotational Deformities

Parents and grandparents are frequently distressed by their child’s intoeing and often seek medical advice. Fortunately, most cases of intoeing are related to age and development and resolve spontaneously as the child grows. Knowledge of the normal musculoskeletal changes that occur through childhood in conjunction with a familiarity of the pathologic causes of intoeing is essential for making the correct diagnosis and appropriate referrals.

Most commonly, the cause of intoeing is related to musculoskeletal development and is considered physiologic. Three physiologic causes of intoeing include metatarsus adductus, ITT, and excessive femoral anteversion.

Metatarsus Adductus

Metatarsus adductus is an intrinsic curving of the foot that results in intoeing. It is thought to result from compression in utero and occurs in approximately 1 in 1,000 live births. In the past it was associated with developmental dysplasia of the hip (DDH), although recent reports have questioned this association. Metatarsus adductus can present in the hospital nursery or can be brought to the attention of a physician at any time during infancy.

CASE SCENARIO 1 CONT.

motion. The lateral aspects of the feet are straight; the feet are easily dorsiflexed above the neutral position (90°), and the heel is midline without varus or valgus deformity. When you have the child sit on the examination table with her legs dangling over the edge, you find the lateral malleolus to be aligned with the medial malleolus. As you finish your physical examination, you have the child walk and then run down the corridor while you observe her from the front and back. For best visualization, you do this part of the examination with the child wearing only a diaper. On observation you note that her feet point inward and her patellae point forward as she ambulates. Otherwise she has a normal gait without evidence of spasticity, ataxia, or pain.

1. What is the diagnosis?
2. What is the treatment?
3. Does the patient need a referral to an orthopedic surgeon?
Internal Tibial Torsion

Usually, ITT presents at walking age with inward pointing of a child’s toes during walking or running. Some parents also comment on frequent falling, especially with running. With ITT, in-toeing is a reflection of the normal rotational changes of the tibia. At birth, the mean tibial torsion is 5°. Over time, the tibia rotates outward to a mature torsion of 15° to 20°.2

Clinical Features

The diagnosis of ITT is made using the bimalleolar axis (Figure 22.1). With the knee bent to a right angle and the tibial tubercle pointing forward, the examiner places his or her hands on the medial and lateral malleoli. In newborns, the lateral malleolus is 2° to 4° posterior to the medial malleolus, by 5 years old it is 9° posterior, and at maturation it is 15° to 22° posterior. If the lateral malleolus is less posterior than this, ITT is present. Tibial rotation is also reflected in the thigh-foot angle (TFA) (Figure 22.2). With the child prone, the foot and the ankle in a neutral position, and the knees flexed to 90°, the TFA is the angle between the axis of the foot and the thigh. An internal TFA is indicative of ITT. Observation of the child’s gait can also aid in the diagnosis. When the child walks or runs, the patellae will face forward while the toes point inward. Encircling the patellae with ink will allow for better visualization of its alignment. Varus at the knee often is associated with ITT. Fortunately, by the time 95% of children with ITT reach 7 to 8 years old, the ITT has resolved and no intervention is required.

Management

In the past, severe ITT was treated with a Denis Browne splint (what our patient’s father had...
Excessive Femoral Anteversion

Excessive femoral anteversion is the most common cause of intoeing and, as with metatarsus adductus and ITT, is related to normal rotational changes with skeletal maturation. Intrauterine positioning results in infants being born with externally rotated hips and feet. During infancy these findings resolve. In addition, the femur is anteverted relative to the axis of the femoral condyles at the knee. Normal degrees of anteversion are reported; however, there is a wide range of normal, with only 80% of patients’ values falling within 10° of the mean. Despite the wide range of values found, all studies document a gradual decrease in anteversion during childhood with an ultimate femoral neck anteversion of 8° to 25° by adulthood. The increased anteversion in newborns can be masked by the external rotation contracture of the soft tissues about the hip. The contracture originates from the externally rotated position of the hips in utero and is perpetuated by the wearing of diapers and positioning of the child postnatally. For this reason, although children with intoeing secondary to excessive femoral anteversion can present as toddlers, they tend to present in early childhood, with maximal average internal rotation in children between 3 and 7 years old.

Clinical Features

As external rotation contracture of the hip resolves, parents might notice a worsening of the child’s intoeing. In addition to intoeing, parents often note that the child sits in the “W” position and is unable to sit cross-legged. Excessive femoral anteversion is often familial, is usually bilateral, and tends to affect girls more frequently than boys. The diagnosis is made by internally and externally rotating the hips while the child lies either prone or supine with the hips extended (Figure 22.3).
In children with excess femoral anteversion, most of the arc of rotation will be inward, with internal rotation as much as 90°. External rotation is only 10° to 30°. On observation of the child’s gait, it can be noted that both the patellae and feet point inward.

**Diagnostic Studies**

Although radiography, computed tomography, magnetic resonance imaging (MRI), and ultrasonography can be used to measure the degree of femoral anteversion, the results from these studies show a poor correlation with clinical examination and are not necessary to make the diagnosis of excessive femoral anteversion.\(^2\) In addition, there might not be a radiographic improvement as the degree of intoeing resolves. The absolute precision of clinical measurement of hip rotation has also been called into question; however, the assessment of hip rotation remains the mainstay of diagnosis in the routine clinical setting. Research to evaluate the long-term complications of excessive femoral anteversion is contradictory. Smaller studies suggest that excessive femoral anteversion predisposes patients to osteoarthritis of the hip, although others contradict this claim.\(^3\)

Further workup should be done if the cause of intoeing is thought to be pathologic. This workup might include radiographs of the pelvis, knees, wrists, and spine to confirm or exclude skeletal dysplasia or metabolic bone disease; ultrasonography, radiography, or MRI of the hip to exclude DDH; MRI to exclude cerebral palsy, spina bifida, and intracranial abnormality; and blood tests to exclude metabolic bone disease.

**Differential Diagnosis**

The differential diagnosis of intoeing is varied; however, the diagnosis can often be made after a thorough history and physical examination, with normal growth and neurologic function excluding many of the causes of intoeing. The physician is able to systematically exclude many of the pathologic causes of intoeing by asking directed questions: a history of hand preference during infancy, spasticity, problems during pregnancy and/or delivery, and unilateral intoeing suggest cerebral palsy; asymmetric leg length with limited external rotation or abduction of the hip suggests DDH; a sacral dimple or hair tuft suggests spina bifida; and a diet devoid of vitamin D suggests rickets.

**Management**

Nonsurgical treatments have included shoe wedges, torque heels, night splints, and twister cables. As with ITT, these interventions have not been shown to be effective. If intoeing persists after 8 to 10 years of age, is cosmetically unac-
ceptable, and causes functional problems with
gait, some recommend derotational osteotomy.
Complications occur in approximately 15% of
patients and include residual intoeing, avascular
collapse of the femoral head, osteomyelitis,
and late-developing valgus deformity. Patients
and families should carefully consider the risks
and benefits of surgery in light of a paucity of
evidence for long-term sequelae. Spontaneous
resolution of intoeing secondary to femoral ante-
version occurs in more than 95% of affected
children.8

KEY POINTS

Management of Metatarsus Adductus,
ITT, and Femoral Anteversion

- Metatarsus adductus
  - Stretching or casting
- ITT
  - Observation or rotational osteotomy
- Femoral anteversion
  - Shoe wedges, torque heels, night splints,
  and twister or derotational osteotomy
- Follow-up in a medical home.
A woman brings her 3-year-old son to your office for evaluation of bowlegs. The boy has had bowlegs since he started walking. The mother was not initially concerned about this because her first son had the same problem and, by 3 years of age, his legs were straight. The child, however, has had progressive worsening and has started to waddle when he walks. He is able to walk and run without difficulty and never complains of pain. He has no history of major trauma to his legs and has never broken a bone. His medical history is remarkable only for the usual childhood viral illnesses. He is taking no medications, has no allergies, and has not received any specific therapy for bowlegs. He was born at term after an uncomplicated antenatal course. He was delivered vaginally and was born headfirst. At birth he weighed 3.9 kg (8.6 lb). He eats a well-balanced diet and tends to snack between meals. He drinks at least 710 mL (24 oz) of whole milk a day. His milestones were achieved on time or early, and although he did not crawl, he walked at 11 months. The mother does not know of anyone else in the family with bowlegs or any other bone problems.

Physical examination reveals a husky boy in no distress. He speaks well and interacts appropriately for his age. His height is at the 50th percentile, and his weight is at the 90th percentile. His head, ears, eyes, nose, throat, lung, cardiovascular, abdominal, and neurologic examination results are normal. When he stands with his back to you, with his medial malleoli touching, you measure the intercondylar distance to be 12 cm. As he walks, his gait is even with lateral thrusting of both knees. Supine, his legs are the same length. You are unable to straighten the bowing with the derotational test. In full extension the knees are stable; however, at 10° to 20° of flexion, the medial femoral condyles sublux posteromedially.

1. What is the next step in the evaluation?
2. Do most children outgrow bowleggedness?
3. Will this patient outgrow his bowleggedness?

Angular Deformities

Bowleggedness or genu varum is a common physical finding in children younger than 2 years. The bowing tends to become more obvious as the child starts to ambulate and in the presence of a rotational abnormality, such as ITT, is exaggerated.

Secondary to intrauterine positioning, infants are born with a contracture of the medial knee capsule, especially of the posterior oblique ligament. This results in external rotation of the entire lower limb and the genu varum posture of the infant’s legs. During the first year of life, this contracture loosens and, depending on the amount that remains, results in children having varying degrees of bowleggedness when they begin to walk. By 18 to 22 months, the contractures stretch and the knees begin to straighten. The varus deformity (bowlegs) becomes a valgus alignment (knock-kneed) during the second and third years of life and then achieves the normal adult alignment of a slight valgus by 7 to 8 years of age. Normal ranges for the tibiofemoral angle during growth are listed in Table 22-1.9

In most cases, bowing is a physiologic abnormality that corrects itself; however, any significant bowing beyond 2 years of age tends not to be physiologic.
**Blount Disease**

Blount disease, as the most common pathologic condition that results in bowleggedness, deserves special mention. Blount disease is characterized by disordered endochondral ossification of the medial proximal tibial physis. Clinically, it appears as an abrupt varus deformity of the proximal tibia associated with an internal torsion of the tibia. There are two major types of Blount disease: infantile and adolescent. The infantile form is more common and usually found in obese, black children younger than 3 years. It is bilateral in up to 75% of cases. This form is more progressive than the adolescent form. Adolescent Blount disease occurs after the age of 6 years and tends to be unilateral. Black children and boys are more commonly affected than white children and girls. Most patients with adolescent Blount disease have a history of childhood bowing that improved but never resolved. When the child has a growth spurt, the varus angle acutely worsens.

The cause of infantile Blount disease is unknown, although it is most likely multifactorial, with contributions from hereditary, developmental, and mechanical factors. Environmental and mechanical factors are postulated to have a role in the adolescent form of the disease.8

The diagnosis of Blount disease is based on historical features, clinical findings, and radiographs. Clinically, the varus deformity is readily apparent, and there is some medial tibial torsion. The beaking of the medial proximal metaphysis is often palpable. Affected children might walk with a waddle (or a limp in unilateral disease) and demonstrate a lateral thrust of the knee dur-

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**TABLE 22-1 Development of the Tibiofemoral Angle During Growth. Note the Normal Physiologic Progression of Bowlegs to Knock-Knees and Then to Normal.**

<table>
<thead>
<tr>
<th>Age</th>
<th>VARUS</th>
<th>VALGUS</th>
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<tbody>
<tr>
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<td></td>
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<tr>
<td>1 yr</td>
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<td>−5°</td>
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<td>2 yrs</td>
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<tr>
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<tr>
<td>6 yrs</td>
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<td>8 yrs</td>
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<td>11 yrs</td>
<td>−50°</td>
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<td>12 yrs</td>
<td>−55°</td>
<td>−35°</td>
</tr>
<tr>
<td>13 yrs</td>
<td>−60°</td>
<td>−40°</td>
</tr>
</tbody>
</table>

Angular Deformities

Signs and Symptoms of Blount Disease
- Intercondylar distance >6 cm
- Short stature
- Weight excessive for height
- Severe deformity
- Palpable metaphyseal beaking
- Knee instability
- Knee pain
- Presence of Siffert-Katz sign

The knee tends to be stable in full extension but at 20° flexion can have posterior subluxation of the femoral condyle into the depressed medial tibial plateau. The subluxation, or Siffert-Katz sign, can be present before there are any changes on radiographs. In the later stages of the disease, clinical features can include pain and instability of the knee with ambulation.

Clinical Features
Adolescent Blount disease is more commonly unilateral, and leg shortening is common. The varus deformity tends to be less than 20°, and medial torsion of the tibia is mild or absent. Locking or popping of the knee and pain are more common than in the infantile form. The patient’s gait can be antalgic and show a mild lateral knee thrust; instability of the knee is uncommon, but at 20° flexion there can be mild laxity of the medial collateral ligament. Varus deformity of the knee is common in children; however, pathologic causes should be excluded. The history of present illness should include onset and progression of symptoms, alleviators and exacerbators, and any prior interventions. A comprehensive medical history, including birth, growth, and developmental histories, dietary habits, and family history, should be elicited. Children with pathologic genu varum frequently have a history of walking at an early age, being overweight, and having pain with ambulation. Physical examination components include the assessment of weight, height, and nutritional status, a comprehensive neurologic examination, skin evaluation for signs of neurofibromatosis, and joint inspection for evidence of inflammatory changes. On examination of the affected extremity, the derotation test and the determination of the intercondylar distance will help differentiate physiologic from pathologic causes of bowing. The derotation test differentiates physiologic bowing secondary to tight knee ligaments from more serious disease. It is done by flexing the knee to 90°, holding the femur steady in one hand, and attempting to externally rotate the knee. Alternatively, it can be done with the child on his or her back by externally rotating the tibia to match the external rotation of the femur. With physiologic bowing, these maneuvers derotate the contracted medial knee capsule and the deformity disappears. The intercondylar distance is determined by measuring the distance between the femoral condyles while the child is standing with medial malleoli touching; distances greater than 6 cm are abnormal. Other concerning findings on physical examination include small size, excessive weight for height, significant asymmetry, severe deformity, palpable metaphyseal beaking, knee pain, and knee instability or lateral thrust with ambulation.

Diagnostic Studies
Children with persistent bowing beyond 2 years old and those patients with concerning findings on history or physical examination should undergo radiography from hip to ankle, with the focus being on the knees. The child should be standing with both kneecaps pointing forward. On plain radiographs, physiologic bowing might show an exaggerated metaphyseal-diaphyseal angle of the proximal tibia, a finding also seen in Blount disease. In physiologic bowing, however, this change also tends to be seen in the distal femur and distal tibia. Radiographic findings in pathologic causes of bowing can include widened physes at all the joints and bowing of the femur and tibia as is seen in rickets or overgrowth of the fibula compared with the tibia and asymmetry in the growth of the proximal tibial metaphysis as is seen in achondroplasia, the most common genetic condition that leads to bowing.
Blood tests in the evaluation of bowlegs are directed by the suspected diagnosis.

**Differential Diagnosis**
In most cases, bowing is a physiologic abnormality that corrects itself. However, any significant bowing beyond 2 years of age tends not to be physiologic and can be due to a number of pathologic conditions.

**Management**
The management of bowleggedness is based on the underlying cause. Most cases are physiologic and resolve spontaneously. They are treated with observational management and can be followed up by the primary care physician. If physiologic genu varum fails to resolve by 7 to 8 years old, orthopedic referral is appropriate. Pathologic conditions should be referred for specialized management. The treatment of Blount disease is determined by patient age, severity of the varus deformity, and Langenskiold stage. Milder cases of infantile Blount disease in children younger than 3 years are initially treated with braces. More severe or progressive angular deformities are treated surgically with a corrective osteo-

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Radiographically, infantile Blount disease is a progressive disease classified according to radiographic findings as defined by Langenskiold’s six stages of Blount disease (Figure 22.4). Radiographic findings include abrupt varus angulation at the metaphysis of the proximal tibia, a widened and irregular physis line medially, a medially sloped and irregularly ossified epiphysis, and prominent beaking of the medial metaphysis with lucent cartilage island within the beak. The Drennan angle, or the metaphyseal-diaphyseal angle, is measured. If it is greater than 11° in children older than 2 years or greater than 16° in children younger than 2 years, it is abnormal. It is important to remember that to diagnose Blount disease there must be other radiographic findings in addition to an excessive Drennan angle. The isolated finding of an increased metaphyseal-diaphyseal angle might represent nothing more than physiologic bowing that will resolve spontaneously. The prognosis for infantile Blount disease is variable, with progression being the norm. Complete regression has been documented in early stages of the disease.

There is not a radiographic classification system for adolescent Blount disease. Radiographic findings include widening of the medial growth plate, a normal or slightly wedge-shaped epiphysis, and a narrow area about midway in the medial physeal line, with sclerosis on the epiphyseal and metaphyseal sides of this area.

In addition to diagnosing disease, radiographs can also be helpful in alerting the physician to those children who need close observation. Levine and Drennan noted that a metaphyseal-diaphyseal angle of the tibia greater than 11° was a marker for increased risk for the development of Blount disease. In their study, 29 of 30 extremities with metaphyseal-diaphyseal angles greater than 11° later developed Blount disease, whereas only 3 of 58 extremities with angles less than 11° had subsequent changes consistent with Blount disease. These high-risk children should not be treated until they show definitive signs of Blount disease because some children with significant varus deformities eventually experience complete spontaneous resolution.

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**Radiographic Signs of Blount Disease**
- Metaphyseal beaking
- Varus angulation of proximal tibia
- Irregularly ossified epiphysis
- Excessive Drennan angle
Angular Deformities

otomy with or without physeal bar resection. Mild, nonprogressive adolescent Blount disease is treated with observation. If the deformity is progressive or causes significant disability, surgical treatment should be considered.

KEY POINTS

Management of Blount Disease
- Observation and follow-up in medical home
- Referral to pediatric orthopedist—evaluate for surgical management

WHAT ELSE?

Differential Diagnosis of Blount Disease

Inflammatory:
- Infection
- Postinfectious
- Rheumatoid arthritis

Tumor:
- Fibrous dysplasia
- Osteochondromata
- Enchondroma
- Neurofibromatosis

Osteochondrodysplasia:
- Focal fibrocartilaginous dysplasia
- Metaphyseal chondrodysplasia
- Multiple epiphyseal dysplasia

Posttraumatic:
- Growth arrest
- Angular overgrowth

Congenital deformities:
- Pseudarthrosis
- Posteromedial bow
- Congenitally short femur
- Fibular hemimelia

Osteogenesis imperfecta

Metabolic:
- Rickets
- Renal osteodystrophy
Check Your Knowledge

1. Which of the following statements are true about intoeing in a 2-year-old child?
   A. Most cases are caused by premature closure of the proximal tibia medial epiphysis.
   B. Corrective braces are frequently needed for long-term correction.
   C. Most cases resolve spontaneously as the child grows.
   D. Most cases are considered pathologic.

2. A 2-month-old infant is noted to have excessive but flexible curvature of her feet causing intoeing. This examination is most compatible with which of the following diagnoses?
   A. Internal tibia torsion
   B. Metatarsus adductus
   C. Excessive femoral anteversion
   D. Blount disease

3. Which of the following statements is true about internal tibia torsion?
   A. In nearly 50% of children with internal tibial torsion, the condition will resolve by the time they are 7 to 8 years old.
   B. The mean tibial torsion in degrees is usually greater in newborns than at maturity.
   C. The lateral malleolus is on average 20° posterior to the medial malleolus at maturity.
   D. Splints with cables are often needed to correct internal tibia torsion.

4. A 10-year-old black boy is diagnosed as having Blount disease after acute worsening of his varus deformity of his right leg. Which of the following signs is not compatible with his diagnosis?
   A. Tall stature
   B. Severe deformity
   C. Weight excessive for height
   D. Palpable metaphyseal beaking

References

A woman brings her 15-month-old daughter to your office because she has noticed that the child’s toes point inward when she walks and she often falls when she runs. After falling, the child gets up right away and continues on her way. She does not seem to be in pain and is not bothered by these frequent falls. She is otherwise healthy without any medical problems, takes no medications, and has no allergies.

The patient was a full-term infant delivered vaginally after an uncomplicated antenatal course. She weighed 3.8 kg (8.4 lb) at birth and had Apgar scores of 9 and 9 at 1 and 5 minutes. She has achieved developmental milestones on schedule and started walking at 12 months. She eats a diverse diet, including meats, fruits, and vegetables, and drinks whole milk. She shows no preference for either hand and uses both well. There is no family history of cerebral palsy, learning disabilities, brain tumors, progressive neurologic diseases, or spina bifida. Of note, when her father was a toddler, his toes pointed in; he wore corrective shoes connected by a bar, and he currently has a normal gait.

On examination the child is alert and playful and is toddling around the examination room. She is at the 50th percentile for height, weight, and head circumference. Significant physical examination findings include a normal neurologic examination results and a normal spine without evidence of a dimple or tuft of hair at the sacrum. Her legs are of equal length. There are no clicks or clunks with Ortolani and Barlow maneuvers, and the hips have a full range of motion. The lateral aspects of the feet are straight; the feet are easily dorsiflexed above the neutral position (90°), and the heel is midline without varus or valgus deformity. When you have the child sit on the examination table with her legs dangling over the edge, you find the lateral malleolus to be aligned with the medial malleolus. As you finish your physical examination, you have the child walk and then run down the corridor while you observe her from the front and back. For best visualization, you do this part of the examination with the child wearing only a diaper. On observation you note that her feet point inward and her patellae point forward as she ambulates. Otherwise she has a normal gait without evidence of spasticity, ataxia, or pain.

1. What is the diagnosis?
2. What is the treatment?
3. Does the patient need a referral to an orthopedic surgeon?

Reassurance is the mainstay of treatment in most cases of rotational deformities. The girl has internal tibial torsion and can be observed for the next several years to ensure that her lower extremity rotational development progresses as expected and her intoeing resolves. If, however, her intoeing persists or worsens as she approaches school age, a referral to an orthopedic surgeon might be indicated. The mother was given a thorough explanation of the abnormality and reassured that this problem should resolve on its own. The other rotational abnormalities can be treated in much the same way with orthopedic referrals made in a timely manner (by 2 to 4 months of age for a flexible metatarsus adductus and sooner for a rigid metatarsus adductus and by 8 to 10 years of age for excessive femoral anteversion) to allow for treatment at the optimal time.
A woman brings her 3-year-old son to your office for evaluation of bowlegs. The boy has had bowlegs since he started walking. The mother was not initially concerned about this because her first son had the same problem and, by 3 years of age, his legs were straight. This child, however, has had progressive worsening and has started to waddle when he walks. He is able to walk and run without difficulty and never complains of pain. He has no history of major trauma to his legs and has never broken a bone. His medical history is remarkable only for the usual childhood viral illnesses. He is taking no medications, has no allergies, and has not received any specific therapy for bowlegs. He was born at term after an uncomplicated antenatal course. He was delivered vaginally and was born headfirst. At birth he weighed 3.9 kg (8.6 lb). He eats a well-balanced diet and tends to snack between meals. He drinks at least 710 mL (24 oz) of whole milk a day. His milestones were achieved on time or early, and although he did not crawl, he walked at 11 months. The mother does not know of anyone else in the family with bowlegs or any other bone problems.

Physical examination reveals a husky boy in no distress. He speaks well and interacts appropriately for his age. His height is at the 50th percentile, and his weight is at the 90th percentile. His head, ears, eyes, nose, throat, lung, cardiovascular, abdominal, and neurologic examination results are normal. When he stands with his back to you, with his medial malleoli touching, you measure the intercondylar distance to be 12 cm. As he walks, his gait is even, with lateral thrusting of both knees. Supine, his legs are the same length. You are unable to straighten the bowing with the derotational test. In full extension the knees are stable; however, at 10° to 20° of flexion, the medial femoral condyles sublux posteromedially.

1. What is the next step in the evaluation?
2. Do most children outgrow bowleggedness?
3. Will this patient outgrow his bowleggedness?

In this case, the boy had multiple red flags in his history and physical examination. He is an obese child whose deformity is worsening. While walking he had lateral thrusting of the knees, a finding that is never seen with physiologic bowing. His intercondylar distance was excessive, and the derotational maneuver was ineffective. Findings on the boy’s radiographs were consistent with stage II infantile Blount disease. He was referred to an orthopedic surgeon, who treated him with braces and will follow his progress closely.

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