Ankle Pain in Children: Diagnostic Evaluation and Clinical Decision Making

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Abstract

Ankle pain in children can be caused by traumatic injuries to bone, ligament, or tendon or by nontraumatic conditions, such as congenital and developmental anomalies, infections and other inflammatory disorders, neural compression, metabolic derangements, and neoplasia. Evaluation of children with this complaint should include a focused history and an anatomically oriented physical examination. Depending on the findings, further diagnostic workup and laboratory evaluation should be done. Appropriate treatment—whether casting, surgery, antibiotic therapy, or a combination thereof—can then be selected on a rational basis.

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A focused, complete history and an anatomically oriented physical examination are the most important steps when evaluating ankle pain in children. The preliminary evaluation will yield a short list of differential diagnoses, which should direct the remainder of the workup, including imaging studies and occasionally laboratory studies. Due to the differences between the growing and the mature skeleton, children's injury patterns are distinct from those of adults. Congenital and developmental anomalies may present with ankle pain. Infections are more common in children and differ from those that occur in adults. Ankle pain in children may also be due to a variety of inflammatory, metabolic, neurologic, and neoplastic disorders.

Diagnostic Evaluation

History

The age of the child determines a likely diagnostic list because the various possibilities carry different likelihoods of causing pain at given ages. Younger children have an especially difficult time describing pain, but parents can be very helpful in reporting the behavior of the child. The onset of the pain should be identified as either insidious, slow, and gradual or sudden and perhaps related to a specific event. It should be remembered that significant pain, especially if progressive, following a relatively minor injury may represent unmasking of a preexisting condition, rather than a true acute injury. The duration, severity, and course of the pain are important as well and help dictate how aggressively the problem should be evaluated. Information about the character of the pain may be difficult to elicit, but it can be helpful to establish whether the pain is aching, burning, stabbing, or just severe and acute.

Variation in the severity of the pain throughout the day and night is also important. Pain in the morning should provoke questions about associated stiffness suggestive of juvenile rheumatoid arthritis or a spondyloarthropathy. Afternoon or evening pain in children is frequently related to activity. If so, the inciting activity should be recorded, as well as whether the pain occurs at the very beginning of participation or if it gradually gets worse with continued activity. Sometimes pain does not start until the inciting activity ceases. Pain that prevents or curtails participation in desired activities is particularly worrisome. The presence of night pain that awakens the patient from sleep must be specifically addressed, as it may be associated with neoplasms and infections.

Specific pain-causing events should be characterized. Sports injuries in adolescents frequently involve the ankle, accounting for 12.1% of all such injuries.[1] Knowledge of the particular sport, the position played, and the maneuver performed may aid in diagnosis.

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The mechanism and direction of forces at the time of injury should be sought, even though that information is frequently unreliable. It is also important to obtain a history of previous and perhaps forgotten injuries. A history of injury or pain in the ankle may be important, as well as prior treatment and its effectiveness. Predisposing sports or hobbies should be identified.

Mechanical symptoms should also be investigated. Although infrequent, locking, catching, or a loose-body sensation suggests the need for a more aggressive evaluation.

The child's overall health should be assessed, starting in the perinatal period and following through major developmental milestones, such as independent walking. Any systemic illnesses or significant past medical history should be noted. Recent changes in the child's usual state of well-being should be sought, such as upper respiratory tract infections, fevers, and weight loss. Current medications, such as nonsteroidal anti-inflammatory drugs and antibiotics, may modify the presentation.

After obtaining a thorough history, a fairly good idea can be developed about the possible nature of the problem, as well as a list of differential diagnoses. While this helps focus the remainder of the examination, the temptation to prematurely narrow the possibilities must be avoided.

Physical Examination

The physical examination must be systematic and thorough. An organized approach will minimize the risk of overlooking important physical findings. Examination of a child can be difficult due to poor cooperation or even outright resistance. In general, the examination should start with the well limb and then proceed to the uninvolved portion of the painful extremity, leaving the most painful area until the end of the examination.

Visual inspection, including station and gait, should be noted in the ambulatory age group, with particular attention to range of motion and restrictions thereof, antalgic gait patterns, and the child's overall motor development. Erythema, ecchymosis, swelling, and skin lesions should, of course, also be sought.

The examination is then directed to the uninvolved limb to establish the baseline. Normal range of motion should be documented, and general muscle tone and bulk should be assessed.

The child will be most cooperative if the examination of the involved limb starts away from the painful ankle. The hip should always be checked for guarding and range of motion. Because knee disorders may radiate pain to the ankle, the area about the knee should be evaluated for tenderness or swelling, stability, and range of motion. The proximal fibula is commonly overlooked and should be palpated for swelling or tenderness. Measurement of quadriceps and calf muscle circumference at a fixed distance above and below the patella and comparison with the contralateral side may reveal atrophy, which is suggestive of a chronic problem.

Attention is then turned to the foot. The navicular deserves particular attention, because disorders in this area may contribute to ankle pain. While the forefoot and midfoot are being manipulated to assess range of motion, the hindfoot is stabilized to prevent painful ankle motion. The assessment of subtalar motion is usually delayed, as it may exacerbate the ankle symptoms.

While some orthopaedists prefer a sequential approach, first examining all osseous structures, then all tendons, and so on,[2] others prefer a circumferential approach, examining all structures in one area before moving to the next area. The important point is that each examiner should develop an organized and systematic approach that includes all anatomic structures.

Palpation of the anterior aspect of the ankle joint starts with the tendons, which are rarely involved. An ankle effusion may be palpable. Tenderness anteriorly over the physis should be differentiated from joint-line or synovial-fold tenderness.[3] Maximum plantar flexion exposes a portion of the talar dome, which can then be evaluated for tenderness or the presence of an abnormality in the usually smooth contour.

Medial ankle tenderness is more common. Careful palpation will distinguish pain at the physis from that at the joint line or below. However, it can be difficult to differentiate pain arising from the subtalar joint from pain caused by conditions affecting the overlying deltoid. If necessary, differential injection may be used to help distinguish which structure is contributory. The posterior tibial tendon and other tendons posterior to the medial malleolus should be assessed for integrity and tenderness.

Posteriorly, the gastrocsoleus complex should be examined sequentially to differentiate disorders of the tendon itself from problems at the insertion or more distally at the calcaneal apophysis. Careful palpation may help identify problems arising from the retrocalcaneal bursa.

Laterally, the peroneal tendons should be assessed for inflammation as well as subluxation, which is sometimes produced by resisted eversion. Fibular physeal tenderness can be differentiated from ligamentous injury, and the specific ligaments, including the anterior tibiofibular ligament, should be identified.[4]

Ankle range of motion should then be documented with the knee flexed, to assess posterior capsular and soleus contractures, as well as with the knee extended, which brings the gastrocnemius into play. Because normal range of motion varies from child to child, comparison with the normal ankle is important.

The subtalar joint should also be evaluated for motion, although this is difficult to quantify. Comparison with the contralateral side can give some indication of whether motion is normal, decreased, or absent.

An examination for stability is also essential. Because the anterior talofibular ligament is horizontal when the ankle is slightly plantarflexed, the anterior drawer test in this position will identify instability of that ligament. The calcaneofibular ligament is directed more inferiorly and posteriorly and is assessed with the tilt test with inversion in dorsiflexion. Laxity of the posterior talofibular ligament is infrequent, but can be revealed by posterior drawer testing. The deltoid ligament is usually protected from laxity due to its breadth and strength relative to the distal tibial physis.

Finally, a vascular and neurologic evaluation should be performed. The spine should also be included, looking for pits, hairy patches, and other dermal defects.

Radiographic Evaluation

Nearly every child with ankle pain merits evaluation with plain radiographs, to assess the integrity of osseous structures and to seek congenital or developmental anomalies. Routine views include the anteroposterior (AP), lateral, and mortise views. The latter is a 15-degree internal oblique view, which best demonstrates the precise relations of the tibia-fibula-talus joint complex.

Radiographic evaluation is complicated by nonossified areas of cartilage in younger patients and by secondary ossification centers in older children. While an os trigonum, a fibular ossicle, or an os subfibulare or os subtibiale may seem to mimic a fracture radiographically,[5] these structures typically have smooth margins. The absence of tenderness over these sites on the physical examination is a good confirmation that these incidental findings are not the cause of symptoms.

Soft tissues should be evaluated for swelling or masses. Tense ankle effusions are characterized by a teardrop appearance of slightly decreased density just anterior to the distal tibia. Lesser effusions merely cause a displacement of the anterior fat stripe. A similar fat stripe is associated with the Achilles tendon and can be used to assess swelling in this area. The joint space of the ankle should be equal on the medial, lateral, and superior joint surfaces on the mortise view. Inequality suggests possible joint disruption.

Algorithm

Once the history has been obtained and the physical and radiographic evaluations have been performed, a diagnostic and treatment algorithm should be followed. The algorithm that we use is shown in Figure 1.

Trauma

No Fracture Seen

If there is a history of trauma but no fracture is seen on the initial radiographs, the differential diagnosis includes contusion, sprain, and occult fracture.

Contusions

In contusions, there is no tenderness over the ligaments and bones. Such injuries typically improve rapidly and are treated with restriction of activity until spontaneous resolution.

Sprains

While sprains are uncommon injuries in younger children, they do occur in adolescents, in whom chronic instability may occasionally develop. A child with an acute sprained ankle will demonstrate ligamentous tenderness, variable degrees of swelling, and possibly instability on physical examination. If swelling is moderate and stability is good, the injury is treated either with rest, ice, compression, and elevation (the so-called RICE regimen) or with immobilization.

If swelling is severe, additional radiographs may be warranted. Specifically, stress views may help further quantify the instability found on physical examination or may help identify occult fractures. After an acute injury, instability may be obscured by guarding. Treatment is typically the RICE regimen, although casting is well tolerated and will be required if a fracture is identified.

Occult Fractures

An occult fracture is suspected if the physical examination shows tenderness, particularly over the distal fibular physis. Suspected minor occult physeal fractures are immobilized in a cast for 3 to 4 weeks, with the expectation that the follow-up radiographs will show evidence of fracture healing. However, if a more significant occult injury is suggested, further evaluation (e.g., additional oblique radiographs or computed tomography [CT]) may be warranted.

Recurrent Sprains

As mentioned previously, ankle instability is uncommon in childhood, but may be seen in adoles-

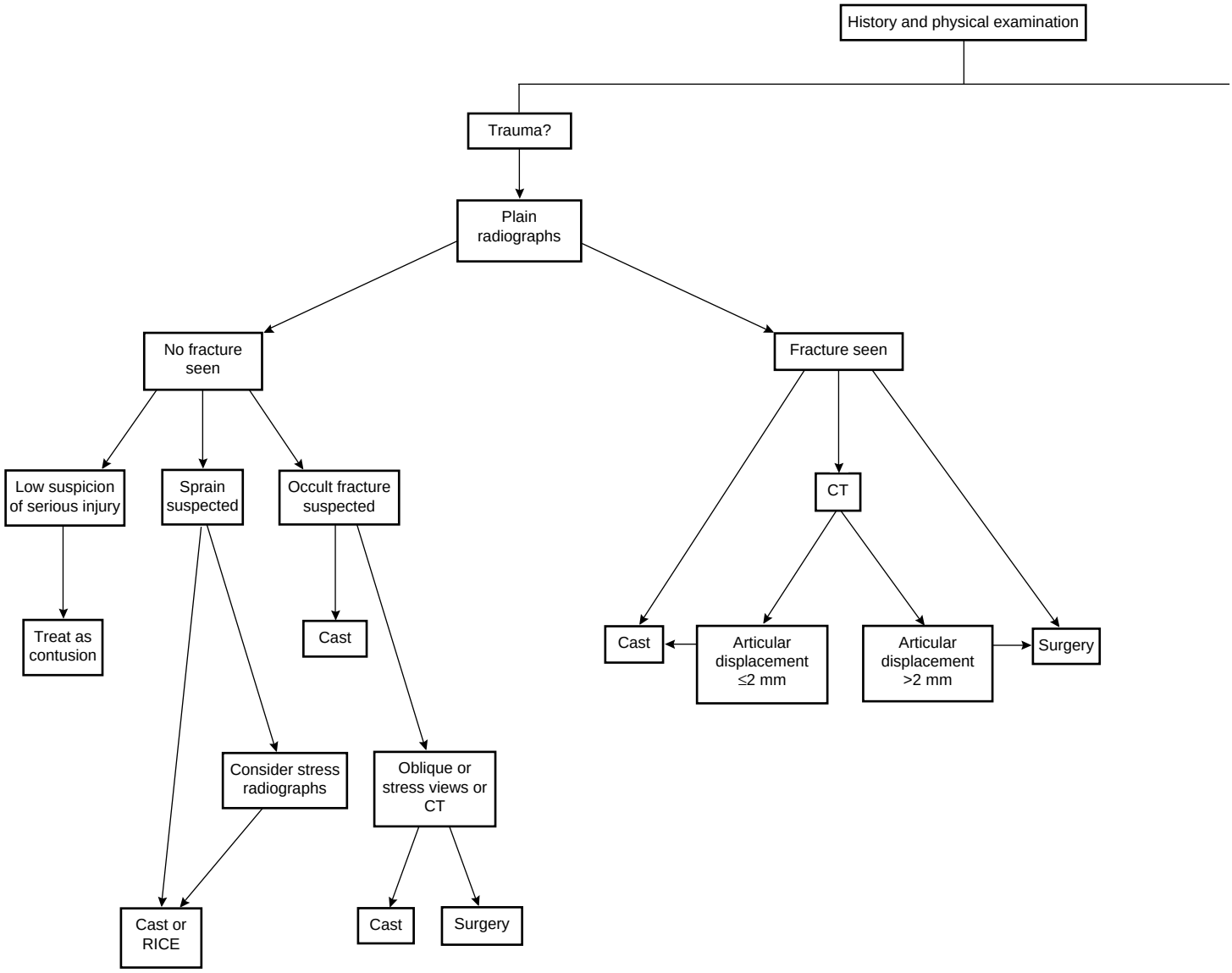
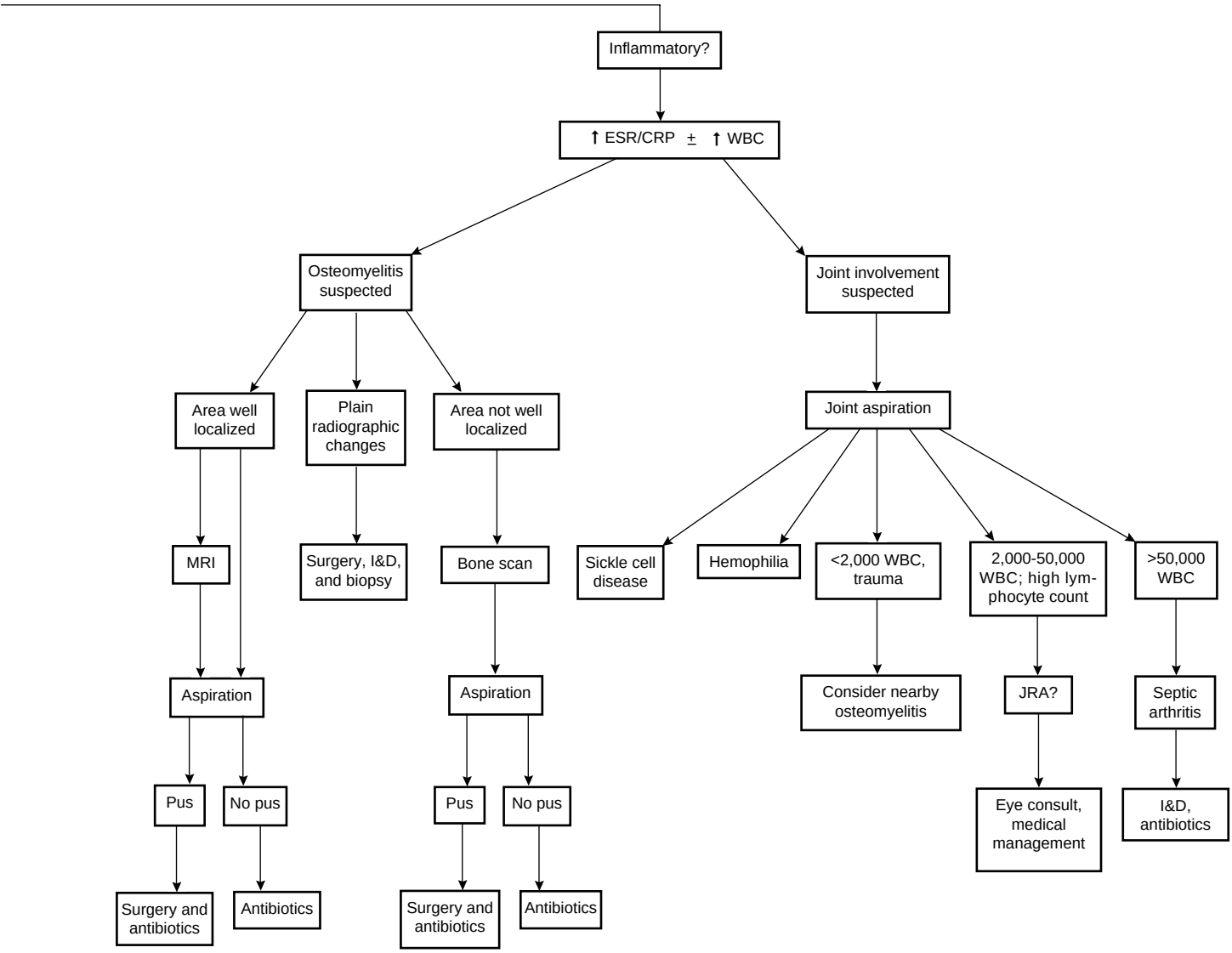


Fig. 1 Diagnostic and treatment algorithm for ankle pain in children. Abbreviations: CRP = C-reactive protein; CT = computed tomography; ESR = erythrocyte sedimentation rate; I & D = irrigation and debridement; JRA = juvenile rheumatoid arthritis; MRI = magnetic resonance imaging; RICE = rest-ice-compression-elevation regimen; WBC = white blood cells.

cents. Stress views can be used to confirm the diagnosis. Ligament reconstruction is needed only if a vigorous rehabilitation program emphasizing strengthening and proprioception fails.

Recurrent ankle sprains may be associated with tarsal coalition resulting from fibrous, cartilaginous, or osseous fusion between the talus, the calcaneus, and/or the navicular (Fig. 2). Although tarsal coalition is usually asymptomatic, ankle pain may develop in late childhood or adolescence due to stresses transferred from the rigid hindfoot. The condition is often bilateral, with one side symptomatic and the other asymptomatic.

Plain radiographs may demonstrate talar beaking or the "anteater nose" sign in the distal calcaneus. The 45-degree oblique (Slomann) view of the foot may clearly show a



calcaneonavicular bar, but CT scanning is required to confirm the location and extent of a talocalcaneal bar. Magnetic resonance (MR) imaging has recently been used to evaluate coalitions with good results.[6]

Conservative treatment aims to return patients to their previous asymptomatic condition. If symptoms persist, excision of a calcaneonavicular bar and interposition of muscle or fat may be necessary. Persistently symptomatic talocalcaneal bars are excised if less than 50% of the joint is involved and no degenerative changes are present; otherwise, subtalar fusion is performed.

A ball-and-socket ankle joint may be caused by tarsal coalition. Plain films demonstrate changes only after ossification, but an MR imaging study can demonstrate the deformity in the cartilage and allow earlier diagnosis.

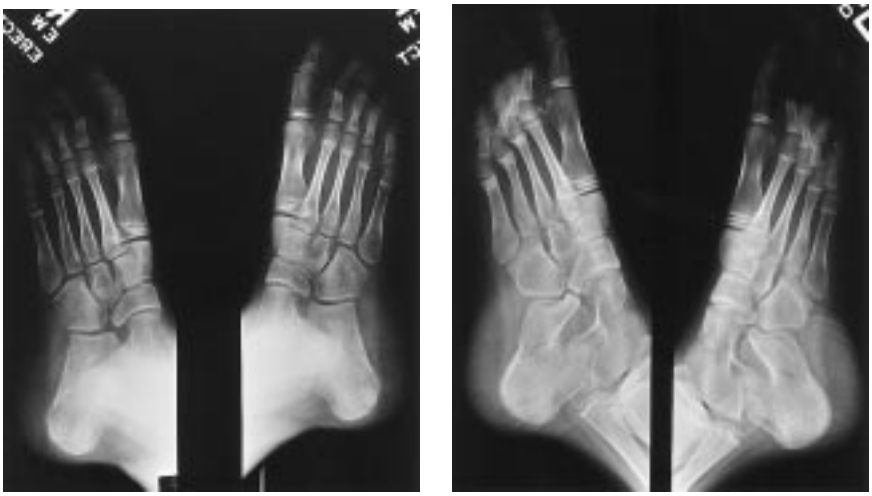


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Fig. 2 Images of a 10-year-old boy with recurrent right ankle injuries. Physical examination showed some restriction of subtalar motion, which was equal bilaterally. **A,** Initial radiographs were interpreted as normal. Conservative treatment yielded short-term relief. **B,** Radiographs obtained 2 years later, after several reinjuries, show mild "anteater nose" sign and ossification of the right calcaneonavicular coalition. A similar condition is suspected in the left foot.

Fracture Seen

The further evaluation and treatment of fractures seen on plain radiographs varies according to the degree of complexity. Simple nondisplaced fractures outside the physis and joint surfaces typically heal with casting for 4 to 6 weeks. Other fractures require more detailed evaluation and intensive management.

Physeal injuries are at the ankle in 10% to 25% of cases. Such injuries are typically described by the Salter-Harris classification, but to accurately differentiate which type of fracture is present, further evaluation may be necessary. For example, failure to notice a small metaphyseal fragment associated with a transepiphyseal fracture can result in misclassification of a fracture as Salter type III rather than type IV, which might lead to management error. A rare isolated Salter type I fracture of the distal tibia may occur in children with neurologic disorders (e.g., myelodysplasia); in the very young, due to an external rotation injury; or in association with child abuse. Any rotational malalignment must be reduced, as it will not remodel.

More complex ankle fracture patterns have been classified by Dias and Tachdjian[7] in a system modified from the Lauge-Hansen classification used in adults, which is based on the mechanism of injury. This classification is most useful when determining the optimal position for immobilization after a closed reduction maneuver.

Juvenile Tillaux and triplane fractures are classified separately. These fractures occur in adolescents when closure of the distal tibial physis starts centrally and then moves from medial to posterior and finally anterolaterally. Triplane fractures occur at a younger age and have two or three fragments. The hallmark is a Salter type III appearance on the AP radiograph and a Salter type II appearance on the lateral view (Fig. 3).

Tillaux fractures involve the anterolateral epiphysis, and appear on the AP radiograph as a Salter type III fracture accompanied by a widened mortise. Diagnostic evaluation of both types necessitates CT scanning, including both sagittal and coronal reconstruction views, for definitive fracture classification and assessment of displacement. Long-term follow-up studies have shown that suboptimal results are associated with residual displacement by 2 mm or more.[8] Therefore, pinning or screw fixation is generally used to maintain reduction. Transphyseal fixation may be used without incurring growth arrest problems, because the physis is already in the process of closing in children with this injury.

Because talar fractures are uncommon in children, they may be overlooked if the talus is not specifically examined radiographically. The talar blood supply is only slightly better in children than in adults. Most neck fractures are angulated plantarward. Some experts accept up to 30 degrees of residual angulation,[9] while others recommend reduction. Avascular necrosis can subsequently develop in adolescents with displaced neck fractures. The finding of Hawkins' sign on the follow-up mortise view is useful in assessing the prognosis. The proper treatment of avascular necrosis continues to be controversial.

A related problem area is the os trigonum. Acute fractures involving this structure may be difficult to recognize, and nonunion can occur even with immobilization. There is also the separate entity "painful os trigonum."[10] Fortunately, conditions affecting the os trigonum nearly always become asymptomatic with restriction of activity, immobilization, or the passage of time.

An osteochondral fracture may be seen on initial radiographs, or it

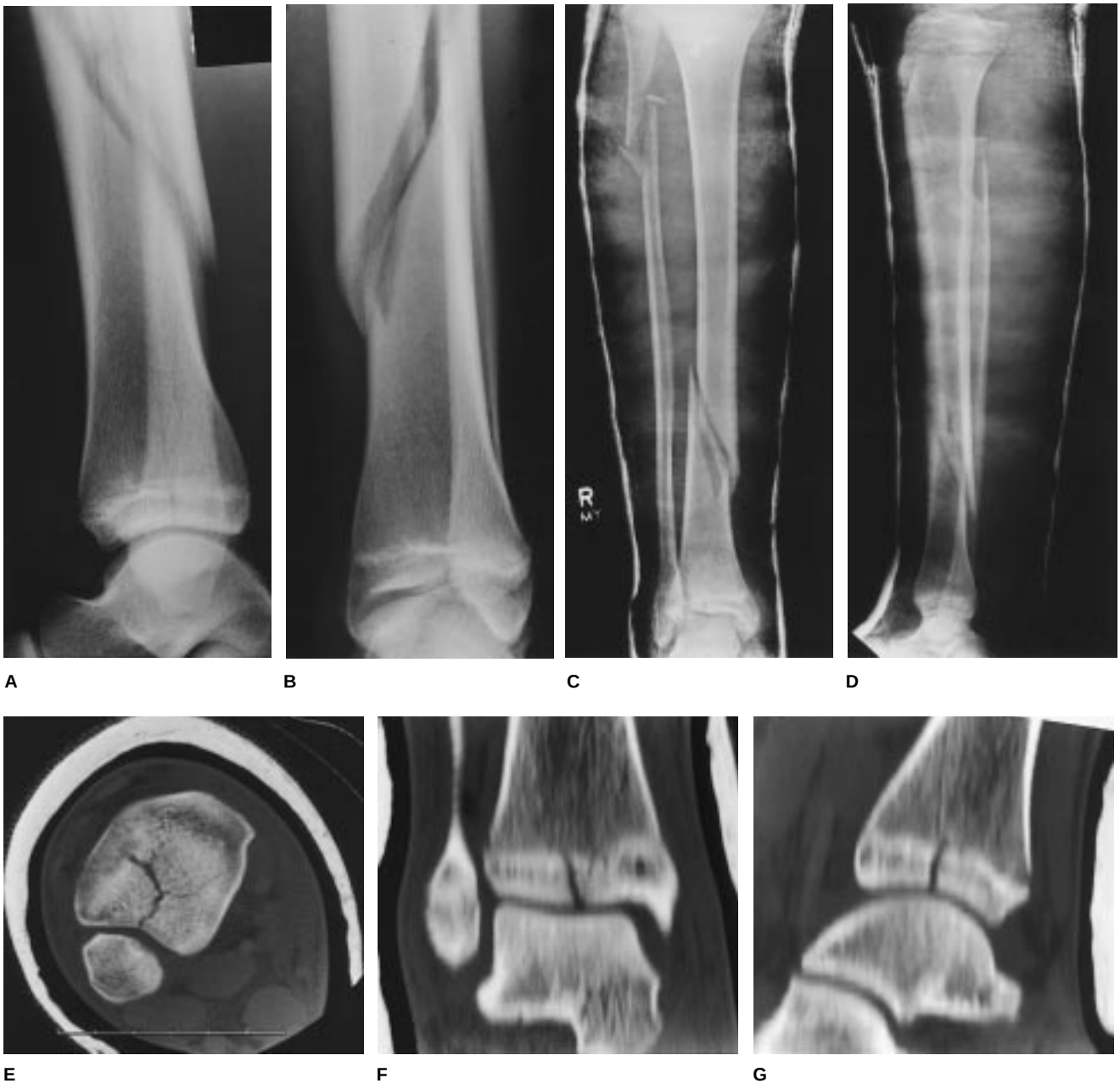

Fig. 3 Triplane ankle fracture associated with a tibial shaft fracture. **A** and **B,** Insufficient examination and subtle findings on inadequate initial radiographs led to an incomplete diagnosis. **C** and **D,** Films obtained after casting better demonstrate the triplane component. The Salter-Harris type III appearance can be appreciated on the AP film **(C);** the Salter-Harris type II appearance can be seen on the lateral film **(D). E-G,** CT study with sagittal reconstructions demonstrates displacement of less than 2 mm.

may be suspected from a history of persistent mechanical symptoms after an injury. Magnetic resonance imaging is particularly useful in establishing this diagnosis[11] because of its ability to delineate the soft tissues. However, it should be emphasized that MR imaging is not the radiologic modality of choice for evaluating most fractures, including those of the ankle. Osteochondral fractures are classified according to the completeness of the fracture, the integrity of the cartilage flap, and the degree of displacement. Both incomplete and nondisplaced fractures may be immobilized. Arthroscopy is usually employed for

drilling and possibly grafting complete fractures and for excising displaced fragments.

Inflammatory Conditions

The history and physical examination may suggest an inflammatory process in the ankle joint or adjacent osseous structures (Fig. 4). However, it may be difficult to diagnose and locate the infection with accuracy. Children frequently cannot localize pain well, and plain radiographs may appear normal for 10 days after the onset of infection. For these reasons, a three-phase bone scan may be required in children with suspected infections. Images taken immediately after injection of the radioisotope tracer essentially provide a nuclear angiogram. Intermediate-time blood-pool images demonstrate areas of increased overall blood flow, which are associated with inflammatory processes. Eventually, the radioisotope is deposited in areas of increased bone turnover ("hot spots") (Fig. 4, B). Fulminant processes, such as infection and tumor, may show lack of uptake (may appear "cold") due to bone necrosis and lack of effective osteoblastic response.

The great strength of the bone scan is its high sensitivity. Any bone process that has been going on for more than 48 hours will usually show changes on the delayed images. Also, the entire skeleton can be imaged, if necessary; localization is excellent; and occult lesions are easily demonstrated. The greatest disadvantage of the bone scan is its lack of specificity; further studies are typically needed to firmly establish the pathologic diagnosis. Furthermore, because the bone scan remains abnormal for a prolonged period, it is difficult to assess for recurrence of infection or a new process in patients with a previous fracture.

Because of the limitations of bone scanning, MR imaging has been used increasingly for the evaluation of musculoskeletal infection in children. Osteomyelitis is evidenced early by marrow changes and subperiosteal fluid (Fig. 4, C and D). The effusions associated with joint sepsis are easily visualized.

Ultrasound has been used to demonstrate abscess formation and subperiosteal fluid collection. However, because imaging beyond the cortical surface is not possible, ultrasound currently has limited utility.

After the imaging studies, needle aspiration of the involved area, including subperiosteal fluid collections and the medullary canal, is performed. If no pus can be obtained, empiric antibiotic treatment targeted at the suspected organism is begun. Evaluation of blood cultures increases the likelihood of positive organism identification. If pus is obtained or if changes are apparent on plain radiographs, we perform surgical debridement. Histologic specimens must be obtained during this procedure, in addition to routine cultures. The optimal duration of antibiotic treatment is controversial.

In addition to imaging studies, serologic evaluation is also usually performed. The erythrocyte sedimentation rate, although nonspecific, typically is elevated in an inflammatory disorder. Determination of the C-reactive protein

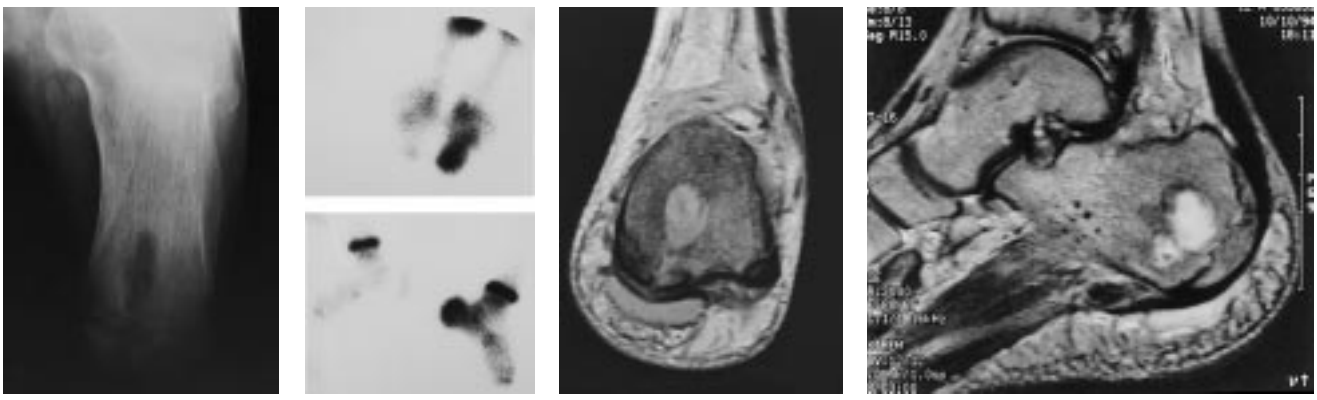

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Fig. 4 Images of a 12-year-old boy with a history of vague, intermittent, poorly localized ankle and hindfoot pain for several years and a recent acute exacerbation. Further questioning disclosed an untreated puncture wound to the heel 4 years previously. **A,** Radiograph demonstrates a lytic defect in the calcaneus. **B,** Anteroposterior **(top)** and lateral **(bottom)** bone scans show markedly increased uptake in the calcaneus. **C** and **D,** MR images show fluid in the calcaneus, with erosion through the cortex, and a medial heel abscess. The patient improved after surgical drainage and long-term intravenous antibiotic therapy.

level is being used increasingly as a more rapidly responsive indicator of inflammation and may be of some use in differentiating simple osteomyelitis from that complicated by septic arthritis.[12] A complete blood cell count with differential white blood cell (WBC) count may be helpful in distinguishing infection from juvenile rheumatoid arthritis (JRA). Rheumatoid factor and antinuclear antibody tests are usually done, although they are poor in both sensitivity and specificity. Although joint problems related to hemophilia and sickle cell disease are less likely (and either condition would usually already have been diagnosed), appropriate studies may be necessary.

Joint aspiration is tremendously helpful in distinguishing septic arthritis from other inflammatory and traumatic effusions. Trauma typically produces bloody fluid with a WBC count below 2,000 / mm^3. Pigmented villonodular synovitis produces a dark reddish-brown aspirate without a large inflammatory component. In JRA, the WBC count is usually in the range of 2,000 to 50,000 / mm^3, with relatively fewer segmented forms and more lymphocytes than in septic arthritis (typical WBC count, 50,000 / mm^3 or more). Gram stain and culture should always be performed, because the arthritic patient is prone to joint sepsis.

Joint Sepsis

If joint sepsis is confirmed, the treatment in children is typically arthrotomy and irrigation, although some surgeons prefer arthroscopic techniques. Although serial needle aspiration has some proponents, its use is no longer widely accepted among orthopaedists. Antibiotics have an important supporting role, but duration and route remain controversial.

Juvenile Rheumatoid Arthritis

The diagnosis of JRA is based primarily on the findings from the history and physical examination, supported by serologic tests. The criteria for diagnosis include the following: (1) chronic synovial inflammation of unknown cause; (2) onset before age 16 years; (3) evidence of arthritis in one or more joints for 6 consecutive weeks; and (4) exclusion of other causes. While the knee is the most frequently involved joint, the ankle is also commonly involved in pauciarticular (three joints or fewer), polyarticular (four joints or more), and systemic-onset JRA. Systemic-onset disease is variably characterized by high fevers, a salmon-pink rash, and acute toxic illness.

Treatment goals in all forms are tempered by a high rate of spontaneous remission with minimal impairment, which occurs in 50% to 90% of affected patients. The inflammatory synovitis can be controlled with various medications. Systemic corticosteroids are avoided in the growing child if possible. Orthopaedic treatment supports and maintains function, initially with exercises and therapy for strength and motion, as well as with bracing to maintain alignment. Surgical realignment of the affected ankle is occasionally necessary, but synovectomy currently has a very limited role.

Seronegative Spondyloarthropathy

The seronegative spondyloarthropathies may also present with ankle pain, typically as enthesitis of the Achilles tendon or less commonly as ankle arthritis. Ankylosing spondylitis is usually seen in boys over 9 years old. Reiter's syndrome is characterized by conjunctivitis, urethritis, and enthesitis. Urinalysis may help confirm this diagnosis. Medical treatment is indicated; surgery is rarely needed, as the prognosis is good.

Hemophilia

Hemophilia is important in the differential diagnosis because the ankle is the most common site of hemarthrosis prior to age 10 years.[13] Arthropathy is a common late finding. Signs are limping, resistance to weight-bearing, and a swollen ankle held in equinus. A gastrocsoleus bleed may present similarly.

The initial treatment is usually replacement of clotting factor, compressive dressings, and splinting, but a major hemarthrosis mandates aspiration. Synovectomy is indicated for recurrent hemarthroses. Long-term treatment is aimed at maintaining a plantigrade foot.

Sickle Cell Disease

Patients with sickle cell disease may present with pain from bone infarction, polyarthritis, or osteomyelitis. Infarction may result in avascular necrosis of the talar dome and collapse or may have a radiographic appearance similar to that of osteochondritis dissecans. A bone scan is expected to be "cold" in avascular areas. Patients with sickle cell disease are at increased risk for osteomyelitis and have a particular susceptibility to Gram-negative organisms, particularly *Salmonella.*

Other Possibilities

Neurologic Conditions

Children with neurologic conditions may complain of ankle pain. In spastic cerebral palsy, the pathophysiologic changes are related to hypertonicity and a tight heel cord, while a supination and / or hindfoot varus deformity transmits increased load to the ankle. Treatment ranges from passive stretching to serial casts and bracing. Heel-cord lengthening is a surgical option for older children.

A spinal disorder may be associated with or cause ankle pain. In a patient with a known pathologic condition affecting the spinal cord in which sensation is preserved (e.g., lipoma), the onset of new ankle pain with a cavovarus foot may be the first sign of cord tethering. Patients with myelomeningocele frequently have a congenital vertical talus. This entity is diagnosed on the basis of a "Persian slipper" appearance on physical examination and the depiction of persistent equinus hindfoot positioning and talonavicular dislocation on dorsiflexion/plantar-flexion lateral radiographs.

Nerve entrapment is uncommon in children. In adolescents, however, tarsal tunnel syndrome, which may be associated with a tarsal coalition, can cause a burning pain in the medial foot and ankle.[14] Examination reveals a Tinel's sign over the tarsal tunnel, usually without sensory or motor changes. Electromyographic findings support the diagnosis. Treatment is retinacular release and neurolysis of the medial and lateral plantar nerves, as well as appropriate excision or fusion of any coalition.

Tumors

Malignant neoplasms are rare in the foot and ankle, accounting for only 2% to 4% of soft-tissue and bone sarcomas. Despite this low frequency, they are an important consideration in evaluating ankle pain in children.

Benign soft-tissue tumorous conditions, such as ganglions and epidermal inclusion cysts, are fairly common. Their treatment is similar to that used elsewhere in the body.

The ankle is a common site for osteochondromas of the metaphysis, particularly in multiple osteochondromatosis. A similar lesion, called dysplasia epiphysialis hemimelica, may present on the distal tibial epiphysis or the talus (Fig. 5). Observation is sufficient unless pain occurs or growth is disturbed.

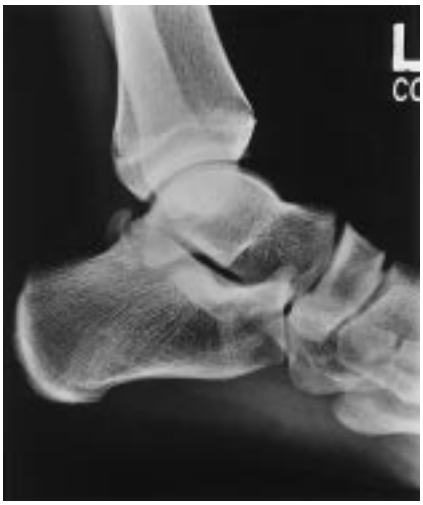
An osteoid osteoma can mimic infection or a Brodie's abscess. Aspirin may relieve pain. A CT study is useful in making the diagnosis and in locating the nidus for excision.

Lytic defects include unicameral bone cysts, aneurysmal bone cysts, and nonossifying fibromas. Presentation may be at the time of a pathologic fracture. Treatment depends on the type and size of the lesion.

Synovial sarcomas are the most common malignant neoplasms in the pediatric foot and ankle. The initial manifestation of leukemia or lymphoma is rarely at the ankle. Fewer than 3% of osteogenic sarcomas arise about the ankle. Ewing's sarcoma is seen more commonly. Workup is complex and must be extensive, usually including biopsy, which should be done by the surgeon who will be doing the definitive procedure.

Summary

While there are many causes of ankle pain in the pediatric patient population, the diagnosis can usu-



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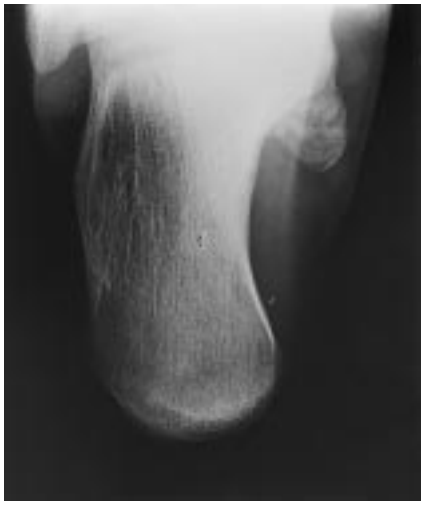

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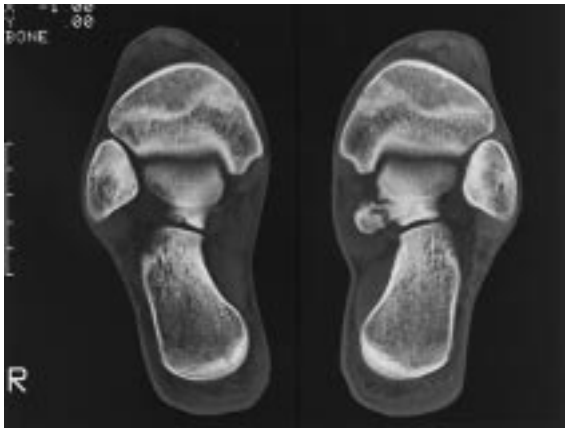

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Fig. 5 Images of a 16-year-old boy with progressive pain and swelling around the medial malleolus. **A** and **B,** Radiographs show bony prominence off the posterior talus. **C,** CT scan depicts the site of origin of the symptoms. Surgical exploration revealed an exostosis impinging on the posterior tibial tendon. Excision resulted in complete relief of symptoms. Pathologic diagnosis was consistent with dysplasia epiphysialis hemimelica.

ally be established with a thorough history and a searching physical examination. Confirmation of the working diagnosis and exclusion of other conditions can be established on the basis of plain radiographs or other imaging studies and laboratory evaluation of blood or joint-fluid specimens. Treatment is generally straightforward, and pediatric patients usually respond favorably.

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