Adolescent Shin Pain
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ABSTRACT

Shin pain is a common complaint in adolescent athletes. The term “shin splints” has historically been applied to these patients. Shin splints, more often than not, refers to a stress reaction of the tibia from overuse. Overuse injuries occur when repetitive microtrauma to the bone exceeds the biologic healing potential. Diagnosis is based on typical history and physical examination findings. Plain radiographs and advanced imaging are rarely necessary but can provide valuable prognostic information. Treatment consists of adequate rest and exercise modification. Time to return to sport depends on injury location and severity. Stress fractures have long-term implications on bone health, so modifiable risk factors should be addressed. It is important for primary care physicians to understand the significance of these injuries. [Pediatr Ann. 2017;46(1):e29-e32.]

Shin pain is a common complaint in adolescent athletes. The term “shin splints” has traditionally been applied to patients complaining of shin pain with activities. However, most patients with shin splints, known clinically as tibial stress syndrome, have an underlying stress reaction of the tibia from overuse. This stress reaction may involve bone, periosteum, and tendon. History and physical examination findings can differentiate tibial stress reactions from other causes of leg pain, such as exercise-induced compartment syndrome and popliteal artery entrapment syndrome. Depending on its location and severity, the stress fracture may require a prolonged period of activity modification or risk progression to complete fracture. Most of these injuries occur in youth, but there are long-term implications on bone health.

EPIDEMIOLOGY

Overuse injuries are common in high school athletes. Stress fractures represent an overuse injury in which repetitive microtrauma to the bone exceeds the biologic healing potential in a period of time. Increasing youth participation in sports, as well as the trend toward specialization in only one sport, have increased the prevalence of this injury. The highest incidence occurs in the sports of cross country running and gymnastics, with girls having nearly twice the risk as boys. Girls with a delayed age of menarche, family history of osteoporosis, or high-impact activity (eg, running, basketball, cheerleading, and gymnastics) have the highest risk.

HISTORY

Patients typically present with an insidious onset of leg pain. The pain is exacerbated by weight-bearing activity and alleviated by rest. There is usually no history of trauma.

The evaluation of an adolescent with shin pain includes key screening questions regarding the duration, severity, and progression of symptoms (Table 1). A history of pain for longer than 1 week, any pain causing a limp, or progression of pain severity is suspicious for stress fracture. Changes in training regimen (eg, surface, intensity, type) or increased hours spent per week participating in sports increases risk. It is important to include questions regarding nutrition (ie, daily dairy or calcium and vitamin D intake), gastrointestinal absorption issues (ie, celiac or Crohn’s disease), and menstrual dysfunction when taking a patient history.

PHYSICAL EXAMINATION

Shin pain causes no or minimal skin changes, no ecchymosis, and no edema. The examiner must palpate the entire length of the tibia and note any areas of bony tenderness. It is important to palpate both the anterior crest and the posteromedial side of the tibia.
to distinguish between compression and tension-sided injuries. Complaints of calf tightness or pain are frequently referred pain from the tibia. Location of injury varies based on type of sport and age of the patient. Injuries to the anterior, middle third of the tibia are more common in jumping athletes. Most long-distance runners have posteromedial pain. The distal third of the tibia is more frequently injured in sprinters or in those who compete in sports with sprinting activity. The proximal third of the tibia is commonly involved in preadolescent athletes.

Physical examination maneuvers include the fulcrum test, tap test, and single leg hop test (Table 2). Positive findings are consistent with stress fracture.

**IMAGING**

Diagnosis is based on typical history and physical examination findings. Plain radiographs have limited diagnostic utility and should be reserved for refractory or high-risk cases. Only a minority of initial radiographs will have positive findings. Follow-up radiographs have increased sensitivity, but one-half of stress fractures will never show abnormal radiographic findings.\(^7,8\) An antero-posterior and lateral view of the tibia should be obtained for suspected anterior tibial stress fractures or for those cases having failed at least 3 weeks of conservative treatment. Radiographs should be scrutinized for a periosteal reaction or “dreaded black line” on the anterior tibia cortex, signifying a high-risk tension side injury (Figure 1).\(^9\)

Advanced imaging is not recommended for most patients but can be considered in select cases where diagnosis confirmation or prognostic information is essential. Magnetic resonance imaging (MRI) has replaced bone scan in the evaluation of stress fractures because it provides more information without the need for radiation exposure and the findings are predictive of recovery time.\(^10,11\) Stress reactions appear as periosteal edema, bone marrow edema, and subtle fracture lines on MRI (Figure 2). The severity of these findings strongly correlates with recovery time.\(^12\)

**PROGNOSIS**

Most patients will have symptoms that persist for longer than 3 weeks, and a significant proportion of patients will have symptoms that persist for longer than 6 months.\(^4,13\) The posteromedial tibia or compression side of the bone is the most common site of injury and carries a low risk for fracture progression. However, the anterior or tension side is considered high risk, as stress fractures here may progress to complete fractures. A delay in presentation, which is common, may increase the risk for a prolonged recovery.\(^14\)

Patients with mild-to-moderate symptoms and no significant findings on a radiograph can expect to return to their sport in 1 to 2 months. If there is periosteal reaction on the radiograph or higher-grade MRI findings, recovery may take 3 to 5 months. A patient with a high-risk anterior mid-tibial stress fracture should expect a prolonged period of waiting, upwards of 5 months.\(^12,15,16\)

**TREATMENT**

Up to 99% of stress fractures are treated nonoperatively.\(^2\) Optimization of vitamin D and calcium intake should be considered in all patients.\(^17\) Management of stress fractures is based on risk of fracture progression and severity of injury at presentation (Table 3). Patients with high-risk stress fractures should bear no weight on their injured leg and use crutches. They should also be referred to an orthopedic surgeon. These fractures are notoriously slow to heal, and surgical intervention may be advantageous for the athlete who requires rapid return to their sport.\(^18,19\)

For all other patients, the treatment consists of adequate rest and exercise.

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**TABLE 1.**

<table>
<thead>
<tr>
<th>Key Screening Questions in the Evaluation of an Adolescent with Shin Pain</th>
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<tbody>
<tr>
<td>• How long have you had shin pain?</td>
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<tr>
<td>• Rate your worst pain during activity (1-10)</td>
</tr>
<tr>
<td>• When do you have shin pain?</td>
</tr>
<tr>
<td>• Do you limp at any time?</td>
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<tr>
<td>• Have you had any changes in training recently?</td>
</tr>
<tr>
<td>• How many hours per week do you spend participating in sports?</td>
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<tr>
<td>• How many servings of dairy do you get in a day?</td>
</tr>
<tr>
<td>• Do you have a prior history of stress fracture?</td>
</tr>
</tbody>
</table>

**TABLE 2.**

**Physical Examination Maneuvers to Determine Shin Pain**

- **Fulcrum test**
  - Using the palm, apply force perpendicular to leg while grasping ankle and moving opposite to applied force. Positive test produces pain
- **Tap test**
  - Using two fingers, percuss the entire length of the tibia. Positive test increases bony pain
- **Single leg hop test**
  - Patient is asked to hop on one leg 10 times. Note any difficulty completing the task, increased landing time, or decreased jump height when compared to unaffected side
modification. Patients with mild-to-moderate symptoms may do non-impact aerobic exercise (eg, aqua jogging, cycling, rowing). Core strengthening should be encouraged as well. Patients with mild symptoms may continue to compete as long as their symptoms do not worsen. If pain is severe, crutches should be provided and the patient should bear no weight on the injured leg. Crutches can be discontinued and activity can progress when pain has subsided and the patient can ambulate without an antalgic gait.

Return to sporting activities is a gradual process based on severity of pain. Premature return risks worsening the injury and delays time to recovery.

**BONE HEALTH**

Risk factors associated with stress fractures and preventive measures should be discussed with these patients. Patient education regarding proper diet, bone mineral density (BMD), and adequate levels of vitamin D should be emphasized. Additional evaluation is important in women who are athletes with menstrual irregularities and eating disorders due to the increased risk of stress fractures.

Lower BMD delays recovery from these injuries and increases the risk of future osteoporotic fractures. Dual-energy X-ray absorptiometry (DEXA) scans should be performed on all adolescents with a history of more than one stress fracture.

**CONCLUSION**

Recognition of athletes at risk for stress fracture aids in prompt diagnosis. Early activity modification is essential to expedite recovery. Patients with high-risk anterior mid-tibial stress fractures need to be provided with crutches and referred to an orthopedic surgeon. Patients with stress fractures should have underlying risk factors addressed. Recurrent stress fracture is an indication for a DEXA scan. Prevention programs should focus on proper training regimens and a healthy diet.
TABLE 3.

Summary of Evaluation and Management of Shin Pain in Adolescents

<table>
<thead>
<tr>
<th>Injury</th>
<th>Risk</th>
<th>Initial Management</th>
<th>Imaging</th>
<th>Follow-Up Interval</th>
<th>Return to Sport</th>
<th>Indications for Referral</th>
<th>Additional Work-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior (medial)</td>
<td>Low risk (compression side)</td>
<td>Crutches for comfort Nonimpact activity</td>
<td>AP and lateral radiographs</td>
<td>2 weeks; may compete as long as symptoms do not worsen</td>
<td>If low grade, 1-2 months If high grade, 3-5 months</td>
<td>Pain with ambulation Pain lasting &gt;3 months</td>
<td>Serum vitamin D [25(OH)D] DEXA scan if history of &gt;1 stress fracture</td>
</tr>
<tr>
<td>Anterior (mid-tibial)</td>
<td>High risk (tension side)</td>
<td>Strict non–weight-bearing with cast or fracture boot and crutches</td>
<td>AP and lateral radiographs</td>
<td>3 weeks; may return to activity gradually when comfortable</td>
<td>&gt;5 months</td>
<td>All Surgery may benefit elite athletes</td>
<td>Serum vitamin D [25(OH)D] DEXA scan if history of &gt;1 stress fracture</td>
</tr>
</tbody>
</table>

Abbreviations: 25(OH)D, 25-hydroxyvitamin D; AP, anteroposterior; DEXA, dual-energy X-ray absorptiometry.

REFERENCES