Medial Tibial Stress Syndrome

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Medial tibial stress syndrome (MTSS), shinsplints, stress fractures, stress reactions, periostitis, fascitis, and deep posterior compartment syndrome are all terms that have been used to describe pain along the medial tibial border. In fact, subcategories of these terms have been proposed in order to create classification systems of medial tibial symptoms.

Shinsplints, the term commonly used by lay persons, is most often seen in populations that engage in activities such as running, jumping, or marching. However, Jones et al. (1989) pointed out that most of the research on stress fractures has been conducted on military populations and that no significant data has been collected on a civilian running sample.

A study by Brynhildsen et al. (1990) found that 22% of the injuries in women's soccer were overuse injuries. Of that 22%, 72% were tibioperiostitis, or shinsplints.

This article presents a case study involving a stress fracture and stress reaction in a female soccer player. Suggested etiologies are reviewed and treatment methods are examined.

Case Report

A 17-year-old female high school soccer player presented with bilateral medial arch pain at the beginning of the 1996 season. She had no previous history of arch pain, and no acute mechanism was suggested. Signs and symptoms were localized in the area of the navicular, and the injury was assessed as a medial arch sprain due to new soccer shoes and an increase in activity. Treatment consisted of arch strengthening exercises, medial arch taping, and icing after practice.

At 2 weeks postinjury the athlete began to complain of bilateral medial shinsplints. Reevaluation demonstrated a bilateral pes planus stance and pain along the distal one-third of the medial tibial border. Reassessment suggested a posterior tibialis ten-dinitis or possibly a mild stress reaction. The athlete was advised to reduce training load, stretch, ice postpractice, and take anti-inflammatorials.

Two weeks following reevaluation, the pain had increased. This was due in part to the athlete's noncompliance with the treatment protocol and to pressure to compete. The athlete was advised to cease training for 1 week but to maintain cardiovascular fitness in a non-weight-bearing activity (e.g., pool workouts). She was also referred to an athletic therapist who specialized in orthotic fabrication.

The athletic therapist concurred with the reevaluation and believed orthotics would relieve the arch pain and help relieve tension on the posterior tibialis tendon. Orthotics were made and the arch pain subsided within 3 days.
but the shin pain continued. The athlete took a 4-day rest and returned to play despite continuous medial tibial pain. For the next 2 weeks she practiced as pain allowed. Her condition did not improve and a doctor referral was advised.

The athlete’s pediatrician ordered a triple-phase bone scan (TPBS) to rule out a stress fracture. The TPBS revealed a “focal intense bony abnormality involving the posteromedial aspect of the right distal tibial shaft... highly consistent with an acute stress fracture,” and “milder focal increases seen in the posterior aspect of the left distal tibial shaft... somewhat more segmental and milder in intensity... suggest either evolving stress fracture or localized stress reactions” (Rutz, 1996, unpublished data from nuclear medical report) (Figure 1).

The pediatrician recommended 4 to 6 weeks rest with minimal weight-bearing activity. The athlete was highly motivated to finish the season, however, as she was a senior and the team had made the state playoffs. She was released by the physician to play to the point of pain in conjunction with strict adherence to an ice/anti-inflammatory therapy.

The athlete and her parents were also counseled on the risk of traumatic tibial failure and accepted liability for further injury. The athlete finished the season with no traumatic tibial failure and rested the prescribed 6 weeks. At 2 months postseason, she was asymptomatic and began conditioning for the softball season.

Many etiologies have been credited as contributing to the pathology of shinsplints. A great deal of literature has been published suggesting that stress fractures and stress reaction are a primary cause of shinsplints. Thus a definition of stress fractures is in order.

Tabor’s Cyclopedic Medical Dictionary (1989) defines a stress fracture as a “fine hairline fracture that occurs without evidence of soft tissue injury... occurring from repetitive microtrauma; as with running, aerobic dance, or marching, with improper shoes, on hard surfaces, or inadequate healing time after stress” (p. 644).

Research by Jones et al. (1989), Detmer (1986), Fredericson et al. (1995), and Hulko and
Orava (1987) have all implicated stress fractures/stress reactions as possible causes of shinsplints. Jones et al. state that rarely is there an actual “fracture line” or “break in bone continuity” that is commonly called a stress fracture. Instead, they suggest that stress reaction would be a more accurate term for describing bone’s response to stressors.

Due to its appearance on bone scan following a complaint of shinsplints/MTSS, periostitis has also been implicated as a possible etiology. As defined by Martire (1994), periostitis is “an overuse injury associated with the tearing of Sharpy’s fibers between the muscle and the bone” (p. 74).

Other etiologies have also been implicated. Sommer and Vallentyne (1995) examined foot posture and its correlation with MTSS. They found that persons with excessive varus hindfoot alignment complained of MTSS more often than those with neutral hindfoot alignment. This anatomical deviation often causes hyperpronation of the midfoot in response, so that the foot remains stable during the stance phase of the gait cycle.

A hyperpronation of the navicular may increase tension on the posterior tibialis tendon, due to its insertion on the navicular, and create a tendinitis condition along the tendon’s route, chiefly the medial border of the tibia. Scheuch (1984) supports this hypothesis as a possible cause of shinsplints.

Beck (1991) refutes this hypothesis by exploring anatomical structures found at the site of the most common points of complaint of MTSS. Her findings suggest that flexor digitorum longus and the soleus muscle as well as overload of the tibia due to stressors are more likely etiologies of MTSS than posterior tibialis tendinitis.

**Classification**

Jones et al. (1989) proposed a grading scale for stress injuries to bone: Grade 0 = normal bone remodeling; Grade 1 = mild stress reaction; Grade 2 = moderate stress reaction; Grade 3 = severe stress reaction; and Grade 4 = stress fracture. Detmer (1986) grades MTSS as Types I, II, and III. Type I MTSS is defined as bone response to stressors and is categorized as 1a—stress fracture, and 1b—stress reaction.

Detmer (1986) classifies periostitis as Type II MTSS. His study hypothesized that ballistic muscular contractions rupture the muscle from its insertion on the bone via tearing of the Sharpy’s fibers at the periosteum. Detmer also speculates that the periosteum actually peels away from the bone and that “subperiostial haemorrhage” causes inflammation between the periosteum and the bone, in turn causing pain at the point of inflammation.

**Diagnosis**

Fredericson et al. (1995) and Martire (1994) examined diagnostic tools that were used to determine stress fractures/stress reactions.

Fredericson et al. performed radiographic, bone scan, and MRI procedures on patients complaining of shinsplints/MTSS. They found a high correlation between the effectiveness of bone scan and MRI to determine stress fracture/stress reaction. They suggested that MRI was superior to bone scan due to its ability to “detect periostial edema, marrow edema, cortical breakdown, and frank fracture line” (p. 480).

Martire (1994) stated that triple-phase bone scan (TPBS) was very capable of differentiating tibial stress fractures from periostitis. He explained that stress fractures appear as round focal points on the bone scan, and that periostitis is “linear and vertical and covers a longer segment of bone” (p. 77).

Martire also stated that periostitis appears only on delayed images of the TPBS. He argued that MRI is much more expensive than TPBS and that TPBS can image a greater area than MRI in the same amount of time.

Murbank et al. (1982) studied posterior compartment pressure in subjects complaining of posterior medial tibial pain. They found no significant increase in the compartment pressure pre-, during, or postexercise. Biopsies of the tissue in these patients showed inflammation and vasculitis in the area of pain.

These findings, along with bone scans showing diffuse uptake of radioisotopes in the area of pain, led researchers to conclude that periostitis was the cause of the tibial pain. Kues’ (1990) review of literature concurred with Murbank et al. (1982). Kues suggested that deep posterior compartment pressure may cause pain along the medial tibial border; however, this has not been supported by the research.
Treatment

All of this literature came to the same conclusion with regard to treatment of shinsplints/MTSS: rest. Hulko and Orava (1987) state that “rest from the aggravating activity may alleviate the symptoms of stress fractures” (p. 225). Also, immobilization and non-weight-bearing is indicated with stress fractures of the fifth metatarsal, talar neck, and navicular to ensure proper healing.

Orava et al. (1991) state that stress fractures to the anterior middle one-third of the tibia would also require immobilization, and possibly bone graft surgery, due to the “hypovascularity of the anterior tibial cortex” and a “predisposition to delayed union” (p. 422).

Rest is also the recommended treatment for MTSS of a non-bone pathology. After signs and symptoms have subsided, a gradual return to activity may be initiated. Muscle strengthening and stretching are then indicated at a gradual level.

Biomechanical analysis of foot posture could also indicate orthotics in order to alleviate hyperpronation. It is suggested that cardiovascular fitness be maintained with non-weight-bearing activities, for example, pool workouts.

If symptoms of non-bone etiology MTSS persist, then deep posterior compartment fasciotomy may be indicated. It is speculated that the release of the fascia from the periosteum decreases traction on the periosteum due to muscular contraction. This allows the periosteum to re-attach to the bone and begin healing. The procedure relieved all symptoms in 78% of the cases Detmer studied.

Conclusions

O’Donoghue (1976) states that “emphasis must be on accurate diagnosis of the actual trouble so that you are not treating ‘shinsplints’, but you are treating the cause of the pain and disability in the patient’s leg” (p. 115).

A thorough history and clinical evaluation are necessary for treating shinsplints/MTSS. Treatment should always focus on the cause of the injury, not just the symptoms. Rest, biomechanical corrections (whether orthotics or reeducation of proper technique), immobilization, and possibly surgical intervention are indicated if clinical findings dictate.

The use of bone scan, X-ray, and MRI are often required to rule out stress fractures/stress reactions. Therefore these are indicated if a bony etiology is suspected.

References


