Podiatry and Biomechanics case history

Bilateral shin pain in a 28 year old female professional Latin dancer and Zumba dance fitness instructor

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Title

A four week history of bilateral shin pain in a 28 year old female professional Latin dancer and Zumba dance fitness instructor.

Presenting Complaint

This Patient presented with bilateral medial shin pain. Located over the mid portion on the front of the shinbone. She describes the pain as an unbearable “extreme ripping/sharp sensation, that was excruciating painful when dancing, particularly jumping movements”. She reported that she was scared to dance to any high energy tracks and cannot put full effort into teaching. As a consequence of this pain she has been unable to teach and initially stopped dancing and rested for two weeks. However, on returning back to activity she still experiences the same pain each time she dances.

History

History of present complaint

Gradual onset of bilateral leg pain when dancing. This started 4 weeks ago and has progressively got worse. No other muscular skeletal complaints of low back pain or reports of paraesthesia, numbness or weakness. No signs of systemic illness. She feels fit and well with no night pain or pain on rest. No change to her weight (BMI of 21). Pain subsided immediately after discontinuation of exercise.

Details of injury and/or risk factors for repetitive use injury

This patient is an experienced Latin and Ballroom dancer and has recently qualified as a dance fitness instructor. She began teaching three months ago. In the past month she has reported a gradual onset of intensive pain, which occurred when performing repetitive jumping in high-energy tracks during a dance fitness class. On a pain scale she initially reported this to be 8/10 and only painful on high-energy tracks and pain subsided when she stopped. She has reported that her condition has progressively got worse, as she now experiences even more intense pain (10/10) from the onset of any dance fitness class, forcing her to discontinue dancing which alleviates pain.

Sports specific aspects

This is the first time she has reported feeling this pain. The change in footwear and dancing styles has exacerbated this pain. Being a professional dancer she is well trained and biomechanically adapted to Latin and Ballroom dancing. Dance fitness is a high-energy dance based aerobic workout and trainers are worn during classes. Latin dance is low impact in comparison and previously she wore a heeled dance shoe when training. Long-term training wearing a heel has resulted in her being more comfortable in a heeled shoe.

Table 1: showing aggravating and easing factors

Aggravating factors	Easing factors
▪ Dancing, especially jumping in high-energy tracks ▪ Wearing trainers, flat shoes	▪ Non-steroidal anti-inflammatory (NSAIDs) ibuprofen ▪ Rest, Ice, Elevation, Compression

Past medical history

Diagnosed with Polycystic ovaries in 2006 no other injuries reported, otherwise feels fit and healthy.

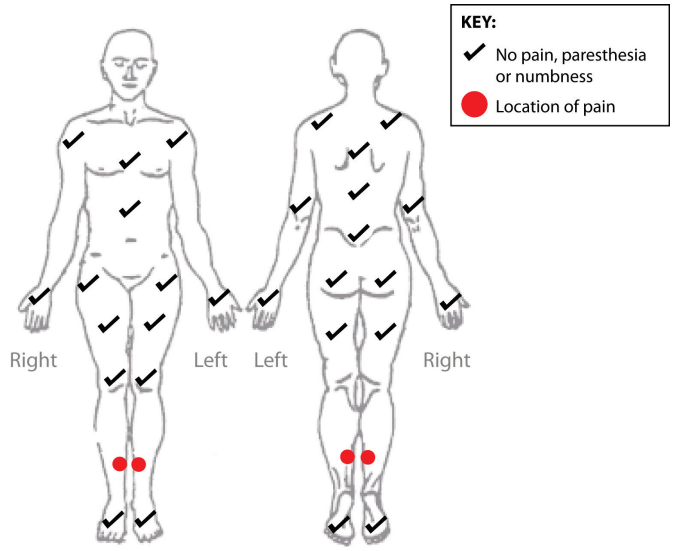
Social history and family history

Recent stress factors include starting a business teaching dance fitness in the community. She has found it very tiring building up her cardio fitness on top of promoting her business. She is very concerned about the impact her recent injury will have on this.

Drug history

400-mg dose of ibuprofen up to 4 times a day, depending on activity levels. No previous history of medication other than combined oral contraceptive pill.

Image 1: a body chart showing symptoms and symptom-free areas



Symptom description

Bilateral leg pain only present when dancing.

Chart 1: showing visual analogue score (VAS) over time since injury

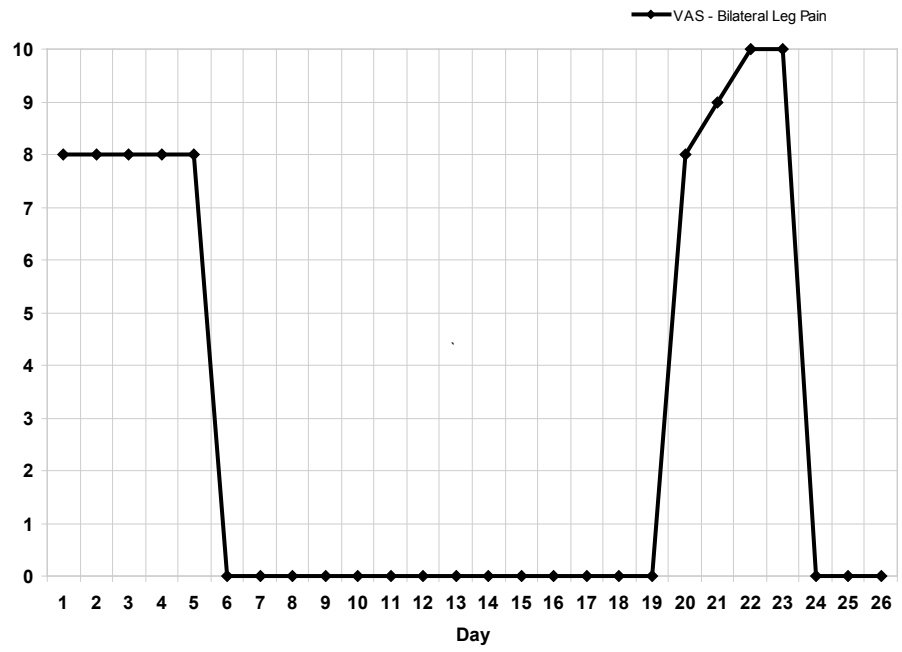
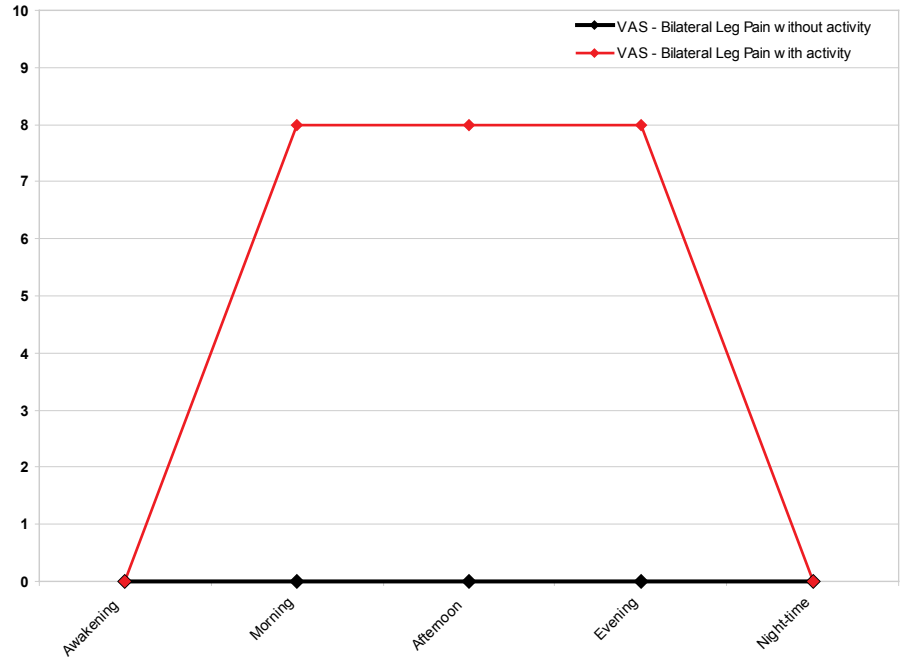


Chart 2: diurnal variation chart to show pain with and without activity



Hypotheses

Medial Tibial Stress Syndrome. 40%

Chronic Compartment Syndrome. 30%

Stress Fracture. 20%

L4 Radiculopathy/Spinal Stenosis. 5%

Muscle Hernia of Tibialis posterior, Gastrocnemius, Soleus or Tibialis anterior. 2.5%

Popliteal Artery Entrapment Syndrome. 2.5%

Examination findings

Observation

- Foot bilateral medial devation of Subtalar more on right.
- Bilateral tibial torsions.
- Bilateral tight muscles of the posterior compartment of the leg.
- Knee alignment slight valgum on right, bilateral recurvatum.

Functional test

- Gait, abductor twist, noted on right.
- Excessive foot pronation.
- Heel rise normal.

Objective measures

- Point tenderness on the medial Tibial aspect worse on the right then left.
- Reduced range of motion of the talocrural joint with the knee flexed and extended.
- Dorsiflexion reduced in and bilateral.
- Mild pain on resisted planterflexion.
- Right functional hallux limitus of the first metatarsophalangeal.
- Leg length equal.
- Less left hip internal rotation then right with a bilateral increase in range of movement at the hip joint.
- Hip abduction strength and control normal and nothing abnormal detected in all muscle power testing.

Results of clinical tests

- The Slump Test and Straight leg raising test were negative.
- Observation of Pulses where present and equal. popliteal and paedal pulses observed with forced plantarflexion or dorsiflexion.
- Tinel sign negative.

Summary

There was bilateral point tenderness on the medial Tibial aspect. She has excessive pronation of the foot with hindfoot varus. The gastrocs and soleus muscles are short and there is reduced dorsiflexion. During gait analysis she demonstrated an abductory twist with bilateral recurvatum.

Hypotheses with Prediction levels

Medial Tibial Stress Syndrome (MTSS) 50%.

Chronic Compartment Syndrome (CECS) 40%.

Stress Fracture 10%.

Hypothesis justification

MTSS is characterized by pain and tenderness over the posteromedial aspect of the distal tibia and is often associated with exertion[1]. It is one of the most common leg injuries affecting athletes including dancers and is more common in women[2 3 4 5].

The exact etiology is unknown[1 2 3 4]. Previous theories included an inflammatory response of the periosteum or periosteal traction reaction. More recent evidence suggests a painful stress reaction of bone[Error! Bookmark not defined.].

Research has shown that there are multiple proposed intrinsic risk factors. Those that correspond with this patient include excessive pronation of the foot[5 6], hindfoot varus, calcaneal stance positions, reduced range of motion of the talocrural joint with the knee extended and an abductory twist during gait[7].

Muscular tightness of the posterior compartment, especially gastrocnemius and soleus, has resulted in a decrease dorsiflexion. This reduction in range of motion can affect biomechanics during dancing and gait, as this restriction results in a forward translation of the leg over the foot. This could explain the findings of genu recurvatum at the knee, as well as early heel lift and an abductory twist in compensation during her gait[8].

An increase in training intensity is an extrinsic factor, which has been shown to correspond with this condition[5 9 10]. She has reported a significant increase in training to meet the new physical demands of teaching a high impact dance fitness class. Research has shown this type of dance requires an increased range of joint motion, joint force and joint moment[11]. Vulnerability to extrinsic overload varies with the intrinsic risk factors of an individual athlete[10], which could explain how she may be more susceptible to injury, as this new style of high impact dance requires a greater range of joint motion, which on physical examination was reduced.

Table 2: highlighting the key findings for and against associated with MTSS

For	Against
▪ Young, active and athletic women. ▪ Pain patterns vary and usually subside during rest, but will return once training begins. ▪ Site of pain is classically lower third of the medial tibia. ▪ Change in intensity and duration of training, surface and footwear ▪ Striking inner tibial border tenderness. ▪ Bilateral ▪ Performing on a harder surface	▪ No residual pain after exercise (only on palpation). ▪ Good hip external rotation strength has shown to contribute to the etiology of lower extremity injuries[12]

CECS is a condition in which increased pressure within a closed anatomic space compromises the circulation and the tissues within that space[13]. The leg is by far the most common site of compartment syndrome in athletes and it occurs bilaterally in 37% to 82% of symptomatic athletes[14]. CECS compared with MTSS has not been shown to be prevalent in dancers. This patient's presentation of leg pain during exercise, which is relieved within minutes of stopping, is commonly experienced with CECS[Error! Bookmark not defined.]. The onset of CECS is usually distinct from MTSS, as the athlete describes pain that does not begin at the initiation of exercise but rather begins at a predictable point after exercise initiation[15]. In her case the onset of pain corresponded with performing high intensity dance tracks, performed after a warm up and other less intensive tracks. The pain therefore normally started about twenty minutes into a dance fitness class. However, the progression of her symptoms has resulted in her now feeling pain in all dance fitness tracks from the onset of dancing the warm up. CECS pain is characterized as "cramping" or "burning" and may or may not subside immediately after exercise[9]. This pain is reported as a focal area of point tenderness. The nature of the pain she experiences doesn't correspond with CECS, which is commonly non-specific in its anatomical location and frequently associated with other symptoms in the lower leg and foot, including, paraesthesia, numbness and weakness[16] [Error! Bookmark not defined.] [14]. The reported presentation of focal pain combined with the precise location classically corresponds with a stress fracture[15].

A stress fracture is a partial or complete bone fracture that results from repeated application of stress lower than the stress required to fracture the bone in a single loading[17].

In athletes the tibia is most common, affecting 49.1 % and prevalent in aerobics and dancers[18] [19]. As with MSST this condition is often caused by an increase in training intensity and is more prevalent in females[15] [Error! Bookmark not defined.].

The onset of pain can be gradual and decrease with rest in early stages. As the stress fracture develops, the pain may persist after exercise even presenting as nocturnal pain (not preventing sleep) and may occur during daily activities[15]. Symptoms of Tibial stress fractures are often indistinguishable from MTSS[15].

Dance floor surfaces; particularly on stage are often poor and have been reported as the causative factor in accidents affecting professional dancers[20]. When teaching dance fitness, she dances on a small stage which

she has reported to be harder compared to the sprung loaded flooring she normally trains and performs on. Harder surfaces have been shown to be a risk factor in this condition[21]. However, stress fractures are rarely bilateral[22] [23] and there is no nocturnal pain or symptoms after exercise during daily activities.

Table 3: highlighting the key findings for and against associated with CECS

For	Against
▪ Gradual Onset ▪ Leg pain during exercise, which is relieved by rest ▪ Bilateral leg pain[15] ▪ Point tenderness less often present ▪ Characterised by pain induced by exercise, swelling, and impaired muscle function[15] ▪ Most prevalent in young active individuals	▪ Point tenderness less often present ▪ Pain often described as "cramping" or "burning" ▪ Onset of pain that does not begin at the initiation of exercise but rather begins at a predictable point after exercise initiation, which is no longer the case in this patient ▪ Frequently associated with other symptoms in the lower leg and foot, including, paraesthesia, numbness and weakness

Table 4: highlighting the key findings for and against associated with a Stress Fracture

For	Against
▪ Increase in training and intensity ▪ Hard surface. ▪ Increased incidence rates in athletes including dancers ▪ Restricted ankle joint dorsiflexion[10] ▪ Point specific tenderness, normally present over the fracture site. ▪ Rarely bilateral ▪ Prevalent in females [15] **Error! Bookmark not defined.**	▪ Disabling and often patients will limp ▪ Nocturnal symptoms with sleep disturbance ▪ Unilateral

Further Investigations

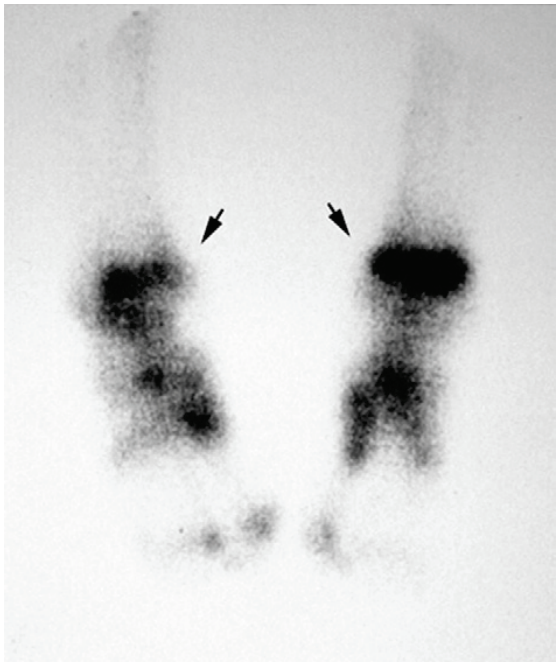
Imaging is usually not necessary for the diagnosis of MTSS[24], which is commonly diagnosed based on physical examination[3].

Additional imaging such as bone, CT and MRI scans have been well studied but demonstrated to be of limited value[3].

However, if the patient fails to improve with conservative management, plain film radiography may be considered. X-rays are usually negative within the first 2-3 weeks after the onset of injury. Long-term radiographic changes of those with chronic MTSS with periosteal involvement may show periosteal exostoses. Those that progress from MTSS to stress fracture may develop a dreaded black line on radiograph[24].

A triple-phase bone scan demonstrates evidence of a stress fracture with an intense uptake of radiotracer in a focal site along the bone[24].

Image 2: showing a bilateral tibial stress fracture[23].



Bone scans are the gold standard of diagnosis technique for stress fracture[24 25].

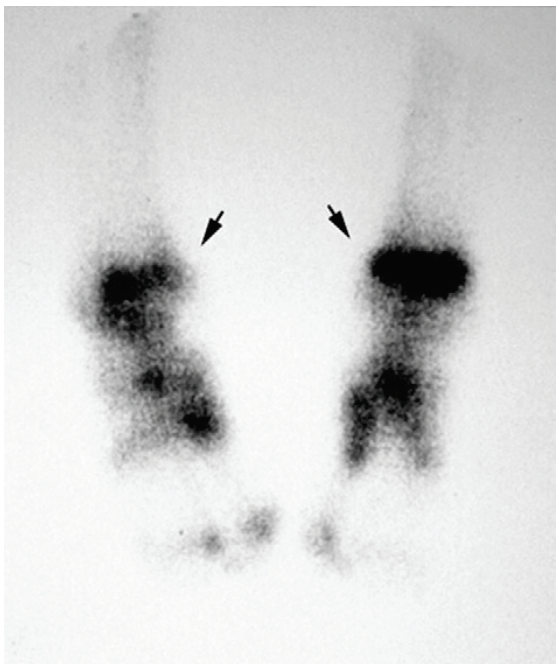
However, they are now often replaced by MRI as this many advantages over a bone scan and plane radiography. MRI is better able to identify other soft tissue injuries as well being able to grade tibial injuries24. MTSS bone marrow and periosteal edema of the tibia on the magnetic resonance imaging (MRI) is frequently reported. A study on 52 athletes with MTSS showed that 43.5% of the symptomatic legs showed bone marrow or periosteal edema and the absence of periosteal and bone marrow edema on MRI was associated with longer recovery. Therefore an MRI may a useful tool in prognosis of recovery time[26].

The use of a standard, graded MR evaluation aides the management of repetitive stress injuries to bone by defining a grade to a stress fracture. This grading system has implications in the management of stress fractures, allowing more individualized treatment for the elite athlete[27].

Table 5: showing the grading system for stress fractures[27].

Grade 1 and 2	Low grade of stress fracture
Grade 3 and 4	High grade of stress fracture

Image 3: showing a bilateral tibial stress fracture[23].



Due to the invasive nature of testing to diagnose CECS it is important firstly evaluate this patients other possible causes of chronic exertional leg pain. If there is nothing abnormal detected on MRI then testing for CECS should be pursued.

The gold standard of diagnosing CECS is the measurement of intracompartmental pressures[28]. Compartment pressures are taken prior to patient exercising and after the patient has exercised. Joint position of the ankle and knee should be standardized during the test because it can affect intracompartment pressures[28]. A patient should perform the offending exercise until severe symptoms occur. Re-measurement has been advised at one minute after exercise as research has shown mean levels at this timing interval only, did not overlap between subjects and controls. Levels above the highest reported value for controls here along with a good history, should be regarded as highly suggestive of CECS[29].

Pre & post exercise MRI, MRI has been shown to be more sensitive post-exercise. An MRI suggestive of CECS will demonstrate an increase in T2-weighted signal intensity within the involved muscle. Increased T2 signal has correlated well with increased intracompartment pressures[28]. However, MRI has been shown to be less compared with ICP and Near infrared spectroscopy (NIRS)[30]. NIRS is a non-invasive, painless alternative to ICP. NIRS has shown to be effective as it can measure tissue oxygen saturation (StO2) noninvasively. StO2 can distinguish healthy from diseased legs.

Table 6: summarising the different methods of Investigations in diagnosis of exercise induced leg pain.

Investigations	MTSS	CECS	Stress Fracture
X-ray	Often not applicable	Not applicable	Good
Bone scan	Good	Not applicable	Good, Isotope bone scans. Gold standard
MRI	Good	Pre & post exercise MRI	Good
ICP study	Not applicable	Good	Not applicable
NIRS	Not applicable	Good	Not applicable

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