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Hyperbaric oxygen therapy: An effective conservative treatment in medial tibial stress syndrome

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Abstract
Medial Tibial stress syndrome (MTSS) is one of the most common leg injuries in athletes and army soldiers, especially who are under training. Medial Tibial Stress Syndrome has been reported to occur frequently in military recruits, long distance runners, dancers, football /soccer players and gymnasts. The incidence of MTSS is reported as being between 6% and 32% in military personnel and athletes respectively. Medial Tibial stress syndrome is the condition that refers to pain on the posteromedial tibial border during exercise, after a long run or march past, with pain on palpation of the tibia over a length of at least 5 cm. Medial Tibial stress syndrome (MTSS) is an overuse injury or repetitive-stress injury of the shin area. Various stress reactions of the tibia and surrounding musculature occur when the body is unable to heal properly in response to repetitive muscle contractions and Tibial strain.
Medial tibial stress syndrome (MTSS) also called as Shin Splints is a common term for shin pain during running. This is because shin pain and 'Shin Splints' can be due to several different conditions. One of the most common conditions which is frequently labeled as 'Shin Splints' is Medial Tibial Stress Syndrome.
Daily Hyperbaric oxygen therapy (HBOT) was given for 50 days to each Army recruit and cadet who complained of shin pain. Overall, 98% of patients who received HBO therapy became pain free and could return to work faster.
We concluded that hyperbaric oxygen therapy is an effective conservative treatment for Medial Tibial Stress Syndrome.

Keywords: Medial tibial stress syndrome, hyperbaric oxygen therapy, shin splints, Indian army soldiers, army recruits

1. Introduction
It is believed that the main cause of Medial Tibial Stress Syndrome (MTSS) involves underlying periostitis of the tibia due to increased strain on the tibia when under a load. However, there is now evidence that indicates that a spectrum of tibial stress injuries is likely to be involved in MTSS, including tendinopathy, periosteal remodeling, and stress reactions of the tibia [1]. Improper functioning of the tibialis muscles, both anterior and posterior and soleus muscles are also commonly implicated [2-3]. These injuries appear to be caused by alterations in tibial loading, as repetitive loading causes abnormal strain and bending of the underlying tibia [1]. Although sometimes of different etiologies, MTSS and tibial stress fractures can be considered as a continuing spectrum of bone–stress reactions [2].

2. Materials and methods
In our study we included 50 young male Indian Army recruits and cadets who were undergoing training at various institutions and Centres, referred to us between Jan 2014 to July 2016 as anterior tibial pain and limp while walking and who were unable to continue military training.
Each selected recruit was clinically examined and found to have tenderness at postero-medial border of tibia for 4-6 cm and mild swelling. Neurovascular symptoms were usually absent. The diagnosis was made based on physical examination, and imaging such as X-ray, bone scan, CT and MRI scans as necessary. Those recruits who had a clear-cut fracture, cellulitis, or pain due to some other reason were excluded from the study.
Out of the 50 recruits, 23 had bilateral Medial tibial stress syndrome and 16 had the Right side and 11 had left sided Medial tibial stress syndrome.

Twelve recruits developed symptoms after repeated march past and nineteen patients developed pain after repeated 5 km run and 09 developed pain after sprints and 10 became symptomatic while engaged in sports (Table 1).

Table 1: Mode of injury

S No	Mode of injury	Number of recruits
1	Repeated march past	12
2	Repeated 5 km run	19
3	After sprints	09
4	During sports	10
	Total	50

Fig 1: All patients were instructed to sit in hyperbaric oxygen chamber.

All patients were exposed to HBOT inside a multiplace hyperbaric chamber (Made in India by DRDO) with either compressed oxygen or compressed air at 2.5 ATA for 90 minutes, comprising a period of 90 minutes when the patient was continuously exposed to 2.4 ATA without interruption. Each patient was provided with a well-sealed breathing mask from which he received 100% oxygen (HBO). Oxygen concentration in the mask was measured every 5 minutes to ensure adequacy of the gas supply and the ability of providing a tight seal around the face. The mask was applied at the beginning of the session and was kept in place throughout the 90-minute treatment session without removal.

The treatment comprised of six daily sessions each week up to a total of 50 sittings. A session involved breathing 100% oxygen at 2 to 2.4 atmospheres absolute in a multiplace pressure chamber for 90 minutes and using a mask breathing system.

In our study no patients were given oral or parenteral NSAIDs

3. Results

All patients were asked to use axillary crutches in order to minimize weight-bearing during the period of treatment as did the comparative, untreated group. Clinical follow-up was at two monthly intervals till 06 months. At the end of 06 months, 43 recruits had become fit enough to join military training again. Seven recruits were still having pain on walking and were treated by second session of HBOT and all became pain free 3 months after second session.

4. Discussion

Medial tibial stress syndrome (MTSS) is one of the most common leg injuries in athletes and army soldiers specially who are undergoing training. Shin Splints is a common term for shin pain during running. It can be a misleading term and most sports medicine professionals try to avoid using it. This is because shin pain and 'Shin Splints' can be due to several different conditions.

One of the most common shin conditions that is frequently labelled 'Shin Splints' is Medial Tibial Stress Syndrome.

Medial tibial stress syndrome has been reported to occur frequently in military recruits, distance runners, dancers, football players and gymnasts. Medial Tibial Stress Syndrome has been classified into two distinct types, which affect specific tissues on the inside of the shin:

Type One: This is characterised by a stress reaction on the inside border of the shin bone. A stress reaction is a preceding stage to a stress fracture.

Type Two: This is characterised by irritation of the outer surface (periosteum) of the tibia at the point where the Soleus and Tibialis Posterior muscles are attached.

Regardless of the type, Medial Tibial Stress Syndrome is largely caused by over-use, with those who run regularly on hard or uneven surfaces being particularly affected. However, there are a number of factors, such as altered foot, knee and hip posture, which can make a person susceptible to the syndrome.

Medial tibial stress syndrome has been reported to be either tibial stress fracture or microfracture, tibial periostitis, or distal deep posterior chronic compartment syndrome.

Three chronic types are described and may coexist: Type I (tibial microfracture, bone stress reaction or cortical fracture); Type II (periostalgia from chronic avulsion of the periosteum at the periosteal-fascial junction); and Type III (chronic compartment syndrome) [10]. Type I disease is treated non-operatively.

The most common complication of MTSS is a stress fracture of the tibia, manifested by local tenderness over the anterior tibia [4]. Acute or chronic exertional compartment syndrome is one of the conditions most likely to be confused with MTSS. It should be considered especially when sensory or motor loss is present in association with exertional lower leg pain. Peripheral vascular disease is another common cause of exertional-leg pain in older and diabetic athletes. The orthopaedician should also be aware of less common causes of lower extremity exertional pain, including muscle tears, fascial defects, occult fracture, infection, neoplasms, venous thrombosis due to undue exertion, per-oneal nerve entrapment, and popliteal artery entrapment syndrome. A thorough history and examination is usually sufficient to exclude other causes. Occasionally, further sophisticated investigations including imaging, compartment pressure measurements, and vascular and nerve conduction studies are required to lead to the correct diagnosis [5].

Table 2: The modalities of conservative treatment include the following

S. No.	Mode of treatment
1	Rest and ice in the acute phase
2	Modify training program: decrease intensity, frequency, and duration
3	Use low-impact and cross-training exercises during rehabilitation period
4	Gradually return to sport with pain-free activity, use shin splints/ braces
5	Perform regular stretching and strengthening exercises
6	Wear proper-fitting shoes with good shock absorption
7	Change footwear if worn out
8	Consider orthotics if indicated
9	Treat key dysfunctions of the entire kinetic chain; use manual therapy
10	Consider other treatment options: ESWT, steroid injections, Laser, SWD, acupuncture
11	Surgery for recalcitrant cases

After the acute phase, the goal of treatment should focus on modifying training regimens and addressing biomechanical abnormalities [6]. Decreasing weekly running distance, frequency and intensity will likely improve symptoms without complete cessation of activity [6]. Runners are encouraged to avoid running on hills and uneven or very firm/hard surfaces [7]. Synthetic tracks provide more shock absorption and cause less strain on the lower extremity [6].

We may need to address certain other factors with female athletes, including nutritional, hormonal, and other medical abnormalities. Adequate calcium intake (ranging from 1000 to 2000 mg daily) and Vitamin D (800 IU daily) are essential for bone strength.

Various injection methods, including cortisone, have successfully been used for decades to treat injuries of the lower extremity [9]. Newer methods, such as dry-needling, autologous blood injection and platelet-rich plasma (PRP), seek to stimulate a local healing response in injured tissues. Some surgeons have proposed injecting the spring and short plantar ligaments to treat laxity and poor mechanics of the foot arch, which common factors are contributing to hyperpronation [9]. However, there are no randomised controlled trials to support these different injection techniques for MTSS.

Most patients with MTSS have significant improvement of their symptoms with conservative management. Surgery for MTSS is usually reserved for recalcitrant cases who do not respond with conservative treatment [10]. A "posterior fasciotomy" is the common procedure performed. This may include cauterization of the posteromedial ridge of the tibia. Surgical results are variable and not likely to cause complete resolution of symptoms but may improve pain and function [11-12].

There are many modalities of conservative treatment mentioned in the literature but role of hyperbaric oxygen therapy has not been studied by many clinicians/surgeons. We found encouraging results with the use of HBOT in treating 50 patients with MTSS.

We thus conclude that hyperbaric oxygen therapy is an effective conservative treatment for Medial Tibial Stress Syndrome in addition to those mentioned in the literature

5. References

1. Anderson M, Ugalde V, Batt M, Gacayan J. Shin splints: MR appearance in a preliminary study. Radiology. 1997; 204:177-180. [PubMed]
2. Detmer D. Chronic shin splints. Classification and management of medial tibial stress syndrome. Sports Med. 1986; 3(6):436-446. doi: 10.2165/00007256-198603060-00005. [PubMed] [Cross Ref]
3. Fredericson M, Bergman G, Hoffman K, Dillingham M. Tibial stress reaction in runners: correlation of clinical symptoms and scintigraphy with a new magnetic resonance imaging grading system. Am J Sports ed. 1995; 23:427-481. doi: 10.1177/036354659502300418. [PubMed] [Cross Ref]
4. Dugan S, Weber K. Stress fracture and rehabilitation. Phys Med Rehabil Clin N Am. 2007; 18(3):401-416. [PubMed]
5. Korkola M, Amendola A. Exercise-induced leg pain. Sifting through a broad differential. Phys Sportsmed. 2001; 29(6):35-50. [PubMed]
6. Beck B. Tibial stress injuries: an aetiological review for the purposes of guiding management. Sports Med.1998; 26(4):265-279. doi: 10.2165/00007256-199826040-00005. [PubMed] [Cross Ref]
7. Wilder R, Seth S. Overuse injuries: tendinopathies, stress fractures, compartment syndrome, and shin splints. Clin Sports Med. 2004; 23:55-81. doi: 10.1016/S0278-5919(03)00085-1. [PubMed] [Cross Ref]
8. Dugan S, Weber K. Stress fracture and rehabilitation. Phys Med Rehabil Clin N Am. 2007; 18(3):401-416. [PubMed]
9. James S, Ali K, Pocock C, Robertson C, Walter J, Bell J. Ultrasound guided dry needling and autologous blood injection for patellar tendinosis. Br J Sports Med. 2007; 41(8):518-522. doi: 10.1136/bjsm.2006.034686. [PMC free article] [PubMed] [Cross Ref]
10. Detmer D. Chronic shin splints. Classification and management of medial tibial stress syndrome. Sports Med. 1986; 3(6):436-446. doi: 10.2165/00007256-198603060-00005. [PubMed] [Cross Ref]
11. Yates B, Allen M, Barnes M. Outcome of surgical treatment of medial tibial stress syndrome. J Bone Joint Surg. 2003; 85:1974-1980. [PubMed]
12. Abramowitz A, Schepsis A, McArthur C. The medial tibial syndrome: the role of surgery. Orthop Rev. 1994; 23(11):875-881. [PubMed]
13. Michael Galbraith R, Mark Lavallee E. Curr Rev Musculoskeletal Med. 2009; 2(3):127-133.