

# Persistent Shin Pain in Competitive Racewalkers

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## Abstract

Due to the unique demands of their event, racewalkers are often subject to intense lower leg pain during training and competition. Although tibial tendinitis, "shin splints" and stress fractures are not uncommon in competitive racewalkers, exertional compartment syndrome (ECS) of the anterior compartment is a far more prevalent malady.

In acute ECS, symptoms arise when relatively sedentary people initiate strenuous exercise programs that require dorsiflexion of the tibialis anterior muscles<sup>5</sup>. Nearly all beginning racewalkers experience some ECS shin pain for the first few weeks of training. In most cases the pain subsides within a few weeks once the tibialis anterior muscles strengthen and the compartmental fascias expand sufficiently to allow for the increased blood flow that comes with exercise.

Chronic ECS, on the other hand, occurs most often in fairly well-trained athletes who are pre-disposed to the condition, or who increase their training loads too rapidly. In racewalking, varying degrees of chronic ECS occurs in up to 90% of elite athletes<sup>13</sup>. In affected athletes, intra-compartmental tissue pressures routinely rise far beyond levels consistent with anterior compartment syndrome diagnosis, with resultant pain and loss of function<sup>13</sup>.

RICE, modification of activity, stretching, and orthotics are often prescribed, but in severe cases, surgical fasciotomy is the only consistently effective cure.

## Etiology

A compartment syndrome can occur whenever tissue pressure within a confined anatomical space rises to the point that circulation and nerve function become reduced. In the anterior compartment, the tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius muscles are contained within the space bounded by the tibia and fibula bones and the anterior compartmental fascia. The deep peroneal nerve and the anterior tibial artery are also contained deep within the anterior compartment, anterior to the interosseous membrane of the tibia. With increased blood flow, skeletal muscles will expand in volume by approximately 20%<sup>1,5</sup>. Compartment syndromes arise in most instances as a result of the fascial compartment being too small and/or too inelastic to allow for the necessary compartmental expansion. Impingement of the deep peroneal nerve and the anterior tibial artery occur with resultant pain and possible paresthesia.

Acute compartment syndromes have various etiologies, but are often brought on by extremity trauma, surgery, snakebites, drug or alcohol abuse, or external pressure<sup>9</sup>. They are relatively rare but have very serious consequences including persistent hypesthesia (decrease in sensation) and dyesthesia (abnormal/unpleasant sensations,) persistent motor weakness, infection, myoglobinuric renal failure, amputation and even death<sup>9</sup>.

Chronic "exertional" compartment syndromes (ECS) are considerably more common, usually affecting athletes and military recruits<sup>9</sup>. Due to the nature of the technique, ECS--particularly anterior compartment syndrome--is remarkably common in racewalkers.

According to the rules of racewalking:

*"Race walking is the progression of steps so taken that the walker makes contact with the ground, so that **no visible** (to the human eye) loss of contact occurs. The advancing leg shall be straightened (i.e., not bent at the knee) from the moment of first contact with the ground until the vertical upright position."*<sup>8</sup>

The constraints of the rules create a situation where technical efficiency is much more closely related to performance in racewalking than in running: Poor technique is not just ugly and apt to result in disqualification, it is also very costly in terms of oxygen consumption<sup>3,7</sup>. To walk legally *and* fast, racewalkers have developed a technique that emphasizes both stride frequency and stride length. (Stride lengths average 125% of stature during racewalking compared to 115% in normal fast walking, while stride frequencies at the elite level approach 240 steps per minute<sup>12</sup>.) Among the modifications to the normal walking gait that allow racewalkers to achieve competition speeds under 6:00 per mile are: significantly greater pelvic rotation, pelvic obliquity ("hip drop"), hip flexion, knee extension and ankle dorsiflexion in racewalkers as compared to conventional walkers<sup>2</sup>.

Extension of the knee and increased dorsiflexion of the ankle of the advancing leg contribute to functional lengthening of the stride (while maintaining ground contact) by moving the calcaneus forward<sup>12</sup>. At heel contact, however, braking forces create leverage about the ankle, forcing plantarflexion--and a sudden, strong eccentric contraction of the tibialis anterior muscle. This eccentric contraction of the tibialis anterior muscles and concomitant increase in blood flow within the anterior compartment (and eventual hypertrophy of the tibialis anterior muscle) is the most likely reason for the high incidence of anterior compartment problems in racewalkers<sup>10</sup>.

## Symptoms

The classic five "Ps" (pulse, pallor, paralysis, paresthesia and pain) have been suggested as clinical signs of a developing compartment syndrome. Pain in the shins is the obvious first sign of a compartment syndrome, but few sufferers of exertional compartment syndrome experience all five "Ps," making assessment difficult. Pulses distal to the compartment, for example, may be present during the development of a compartment syndrome. Absence of the dorsalis pedis pulse indicates a significant lack of flow through the muscle to the point where necrosis could be imminent<sup>15</sup>. The self-limiting nature of ECS prevents most racewalkers from getting to such a point; the pain in the shins is too great for most walkers to continue activity to the point of complete occlusion of blood flow distal to the anterior compartments. Similarly, pallor may not be present with ECS as there is usually enough arterial flow to the distal portion of the extremity. Paresthesia in the leg and top of the foot and paralysis, presenting as a slapping or "drop-foot" on heel contact, are common.

Lower leg pain in racewalkers can be caused by tibial tendinitis, stress fractures or "shin splints." The quality and timing of the pain are most diagnostic for ECS. Anterior compartment syndrome in racewalkers is characterized by a deep, diffuse, aching leg pain during activity, swelling and tightness, muscle weakness, numbness in the legs and feet, sometimes reduced pulse at the front of the ankle, and possibly herniations through the fascia<sup>1</sup>. In acute cases, most commonly seen in beginning racewalkers, onset is within the first few minutes of activity. In chronic cases, seen in more advanced racewalkers, pain develops at a consistent time during a workout or race, usually about 20-30 minutes after the start of activity, or after a certain threshold speed is reached<sup>10</sup>. Perhaps most characteristic is the tendency for symptoms to subside within 10-15 minutes of cessation of activity<sup>1</sup>. While other lower leg injuries will continue to hurt at rest, in ECS

there is almost no pain at rest, except for possible diffuse, dull pain upon deep palpation. Most acute sufferers report complete abatement of symptoms within 2-3 weeks of consistent training, while chronic cases will last years with no reduction in symptoms<sup>4</sup>.

Clinical diagnosis of exertional anterior compartment syndrome relies on evidence of increased tissue pressure, inadequate tissue perfusion and loss of tissue function<sup>9</sup>. Intracompartmental pressure is often measured with a wick or slit-catheter technique immediately after exercise, although it is possible to test during exercise. Elevated resting pressures of 10 to 15 mm Hg, one minute postexercise pressures above 30 mm Hg or five minute postexercise tissue pressure greater than 20 mm Hg are diagnostic of ECS<sup>5</sup>. It is interesting to note that while tissue pressures in excess of 45 mm Hg are seen as diagnostic in cases of acute compartment syndromes<sup>9</sup>, a study of elite Swedish racewalkers found pressures in excess of 140 mm Hg in the anterior compartments of the athletes while they walked on a treadmill at sub-competitive speeds of 12km/h (8:00 per mile)<sup>14</sup>.

## Immediate Considerations

Since symptoms subside so readily with cessation of activity, racewalkers can be relied on to take care of the problem on their own: when the pain gets to be too much, the athlete will stop walking. Preventative measures, including an effective warm-up, calf and shin stretches and self-massage of the tibialis muscles are often effective in reducing the severity of symptoms. Changes in footwear and walking technique are perhaps the most effective prophylactic measures a racewalker can take to prevent or reduce the severity of ECS. Many beginning racewalkers wear stiff running or walking shoes with excessive cushioning in the heel. The high heel and stiffness of the shoe create a long lever arm that causes a forceful eccentric contraction of the tibialis anterior muscles. An excessive anterior stride causes high decelerative forces that put a tremendous strain on the tibialis anterior muscles<sup>11, 16</sup>. Shortening the anterior stride, and changing to a racewalking shoe or a running "racing flat" with a lower heel can do a lot to help reduce the incidence of ECS in racewalkers.

## Conservative Care Plan

If the aforementioned changes in footwear and technique do not alleviate pain in the anterior compartment, orthotics or other shoe inserts may be considered. Anti-inflammatory drugs, or in some cases, diuretics may be prescribed to reduce swelling while walking, but their effectiveness is questionable<sup>1</sup>.

In acute ECS cases, strengthening of the anterior tibialis muscles may be of some benefit. Walking on the heels with the ankles in dorsiflexion, or doing toe-raises by standing with the proximal third of the feet on a step and repeatedly raising and dipping the forefoot are safe and often effective. Care should be taken to not lift heavy weights with forefeet as suggested by some coaches, as this could cause hypertrophy of the tibialis, exacerbating the problem.

After training, RICE can be used to reduce swelling and pain, but it does nothing to prevent recurrence. Light effleurage massage, as well as intermittent sequential pneumatic compression, have also been shown to speed recovery from ECS by enhancing venous return<sup>17</sup>, but again, these don't address the problem *during* training and racing. Certainly, reduction of activity will eliminate the cause of ECS, but many affected racewalkers are unwilling to give up the sport. If the athlete is unwilling to stop training, the only other option is surgical decompression by fasciotomy.

## Alternative/Aggressive Care Plan

If symptoms persist for three months, subcutaneous fasciotomy is recommended for chronic ECS. The operation involves making a 3 to 4 cm incision in the skin 10 cm below the tibial tuberosity and 2 cm lateral

to the anterior tibial edge. The fascia is then cut with a Smillie knife approximately 6 cm proximally and 10 cm distally of the incision. The skin is closed and compression bandages are applied<sup>14</sup>. Passive and active range-of-motion exercises are begun within 24 hours after the fasciotomy to prevent fascial scarring<sup>5</sup>. Walking and jogging can resume after 2 weeks and normal training is resumed after one month. Some 90% of athletes undergoing fasciotomies are able to resume activities that were prohibited before the surgery<sup>9</sup>, including many competitive, elite, and Olympic-level racewalkers<sup>14, 9</sup>.

## Conclusion

Sore shins are prevalent in beginning racewalkers. For the most part, the problem will resolve itself as consistent training causes viscoelastic stretching of the anterior compartmental fascia. Technique and footwear modifications offer the best hope for reduced pain while walking. Strengthening exercises like toe-raises and heel-walking may help as long as hypertrophy isn't caused.

Athletes with chronic anterior compartment syndrome have several options. Some tend to opt for shorter or longer races; races lasting less than 20-30 minutes may be too short to cause crippling pain, while marathon and 50K races are walked at a slow enough pace that intra-compartmental pressure doesn't build up to painful levels. Others try everything short of surgery, but eventually become so frustrated they give up and move on to other activities. Finally, some opt for [surgery](#), which is sometimes viewed as a drastic measure, but the results are nearly always favorable.

Those opting for surgery can be assured of a smooth procedure due to advancements in the [field](#) of medical software. Hospitals are using the latest technology developed by [medical software companies](#) to ensure a patient's medical records are easily accessed.

## REFERENCES

1. Beck, Belinda R: Exercise-induced lower leg pain. *American College of Sports Medicine Current Comment*, March 2002.
2. Cairns, M. A., R. G. Burdett, J. C. Pisciotta, and S. R. Simon: A biomechanical analysis of racewalking gait. *Medicine and Science in Sports and Exercise*, 18(4): 446-53, 1986.
3. Cavagna, G. A.: Mechanics of competition walking. *Journal of Physiology*, 315: 243-251, 1981.
4. Detmer DE, Sharpe K, Sufit RL, et al: Chronic compartment syndrome: diagnosis, management, and outcomes. *Am J Sports Med*, 13 (3): 162-170, 1985.
5. Edwards, P., M. S. Myerson: Exertional Compartment Syndrome of the Leg: Steps for Expedient Return to Activity. *The Physician and Sports Medicine*, 24 (4): 31-46, 1996.
6. Fenton, R. M. Edited by J. Terauds et al: Racewalking ground reaction forces." In *Sports Biomechanics*. Del Mar, CA , Academic Publishers, 1984.
7. Hagberg, J. A., E. F. Coyle: Physiological determinants of endurance performance as studied in competitive racewalkers. *Medicine and Science in Sports and Exercise*, 15 (4): 287-289, 1983.
8. *International Association of Athletics Federations Handbook*. Monaco, IAAF Press, 2002, p 189.
9. Mattsen, F. A. III: *Compartmental Syndromes*. Seattle, WA, University of Washington Press, 2002.
10. McGovern, D: *The Complete Guide to Racewalking Technique and Training*. Mobile, AL, 1998.
11. Morgan D. W., Martin P. E.: Effects of stride length alteration on racewalking economy. *Canadian Journal of Applied Sports Science*, 11(4): 211-7. 1986.
12. Murray, M. P.: Kinematic and electromyographic patterns of Olympic racewalkers. *The American Journal of Sports Medicine*, 11(2): 68-74, 1983.
13. Phillips, S. J., & Jensen, J. L.: Kinematics of race walking, in J. Terauds, K. Barthels, E. Kreighbaum, R. Mann, & J. Crakes (Eds.): *Sports Biomechanics*. Del Mar, CA, Academic Publishers, 1984, pp 71-80.

14. Sanzen, L., A. Forsberg, and N. Westlin: Anterior tibial compartment pressure during race walking. *Am J Sports Med* 14(2): 136-138, 1986.
15. Starkey, C., Jeffrey L. Ryan: *Evaluation of Orthopedic and Athletic Injuries*. Philadelphia, PA, F. A. Davis Company, 1996, pp 118-121.
16. Summers, H.: Placement of the lead foot in racewalking. *Modern Athlete and Coach*, 29 (1): 33-35, 1991.
17. Wiener, A.: Enhancement of Tibialis Anterior recovery by intermittent sequential pneumatic compression of the legs. *Basic Appl Myol* 11 (2): 87-90, 2001.

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