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ATHLETES' LEG PAINS

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ABSTRACT

The frequency and nature of exertion pains of the leg in athletes were studied in 2,750 cases of overuse injuries treated at the Sports Clinic of the Deaconess Institute of Oulu, Finland, during the years 1972-1977. 465 cases of exertion pain (18%) were located in the shin. The medial tibial syndrome was the most common overuse injury among these athletes, comprising 9.5% of all exertion injuries and 60% of the leg exertion pains. Together with stress fracture of the tibia, the second most common exertion pain of the leg, it accounted for 75% of the total leg pains. There are certain difficulties in differentiating between the medial tibial syndrome and stress fracture of the tibia. They both occur at the same site with similar symptoms. Radiological examination and isotope scanning are needed.

The medial tibial syndrome is an overuse injury at the medial tibial border caused by running exercises. The pain is elicited by exertional ischaemia. The pathogenesis is explained by increased pressure in the fascial compartment of the deep flexor muscles due to prolonged exercise. Similar chronic ischaemic pains from exercise are also found in other fascial compartments of the leg, especially in the anterior compartment. The only treatment needed for stress fractures is rest from training. Fascial compartment pains also usually subside. If chronic fascial syndromes prevent training, fasciotomy is recommended as a reliable method to restore the athlete to normal training without pains.

INTRODUCTION

Leg pains are common among athletes, and occur mostly in distance runners. Because most athletic events include running and jumping in one form or another, it is understandable that shin pains may occur in any event. There are several reports concerning athletes' leg pains, but no clear aetiological or curative scheme has been presented (Slocum, 1967, Devas, 1969, Brubacker and James, 1974, Clement, 1974, Andrish et al, 1974). The term "shin splints" has been used generally to describe the overuse pain of the leg due to athletic exertion. The differential diagnosis of these pains has not been described more closely (Encyclopedia, 1971, Juvenal, 1973, AMA Standard Nomenclature . . ., 1976, Williams and Sperryn, 1976). Usually "shin splint" pains are located at the inner border of the tibia. We have called these pains the "medial tibial syndrome" (syndroma tibialis medialis) in cases when stress fracture is excluded (Puranen, 1974). Typically, these pains appear during running, particularly at the toe-off moment, and disappear during rest. A clinically localized, tender and often nodular area is found at the medial border of the tibia. Thus, an inflammation in the insertion site of the muscle, tendon or fascia has been considered the cause of the pain. However, there is apparently a chronic predisposing ischaemia of the fascial compartment caused by the disproportion between the increase of the muscle volume during exertion and the tightness of the fascial walls. This pathogenesis is supported by the immediate curative effect of fasciotomy (Puranen, 1974, Westlin, 1977).

This kind of chronic pain may occur in any one of the four fascial compartments of the leg and sometimes in several compartments at the same time (Fig. 1). After the medial compartment the next most frequent site of chronic compartmental exertion pain is the anterior compartment of the leg (Bradley, 1973, Snook, 1975, Brosjö et al, 1977).

Stress fractures in the shin area occur in both the tibia and fibula. In stress fractures of the tibia the pain is usually located at a site corresponding to that in the medial tibial syndrome, i.e. at the medial border of the tibia in its upper or lower third (Devas, 1975, Orava et al, 1978). Both of these pains can be differentiated by means of X-ray and isotope examinations.

Chronic exertion pain in the shin area may be caused by other factors, too. Sometimes athletes' calf muscles become sore for long periods. Disturbances in innervation or muscle cell mechanics are claimed to cause muscle hardening and cramp-like tender sites in calf

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muscles (Glogowski, 1951, Asmussen, 1956, Komi and Rusko, 1974, Franke, 1977). Exercise induced soreness may be related to disruption of the connective tissue elements in the muscle and/or their attachments (Abraham, 1977).

MATERIAL AND METHODS

The material consisted of overuse injuries seen at the Sports Clinic of the Deaconess Institute of Oulu during the years 1972-1977. During this period 12,500 patients visited the Clinic. About 22% (2750) of the patients came because of overuse injuries. All pains located at the leg area were attributed to exertion injury of the leg, excluding those of the knee and ankle as well as of the achilles tendon. 85% of these patients were active competitive athletes, and the rest of them were involved in regular "keep-fit" sports, mostly jogging. 73% of the patients were between 16 and 29 years of age (Table I). About 10% of the patients were women. This percentage was somewhat smaller than the proportion of women among all the patients suffering from overuse injuries.

TABLE I

Age and sex distribution of athletes with leg pains

	N	%
⩽ 9 YEARS	4	0.8
10–15 YEARS	27	5.5
16–19 YEARS	145	29.3
20–29 YEARS	214	43.3
30–39 YEARS	74	15.0
40–49 YEARS	24	4.8
⩾50 YEARS	7	1.4
TOTAL	495	100%

FEMALES	10.5%
MALES	89.5%

As to the athletic event, middle- and long-distance runners had the greatest number of overuse pains of the shin (44%). In addition, the training of the rest of the patients had included some degree of running and jumping (Table II). Nearly all the leg pains of the cross-country skiers were caused by running during the summer or autumn. The number of soccer players in the series was quite small (1.3%). Overuse pains of the leg also appeared in athletes with moderate training stress to the shin.

In cases of suspected stress fracture radiological examination was performed. The diagnosis of stress fracture is difficult up to about three weeks after the initial symptoms. Repeated plain films, and even tomography, were necessary in many cases. In uncertain cases 99 Tc-pyrophosphate or 85-Strontium scan was used. Due to increased local metabolism, the uptake of the isotope at the fracture site increases before the radiological signs of the fracture can be seen.

TABLE II

Sports events of athletes with leg pains

	N	%
Track and field		
– Middle/long distance running	219	44.2
– Sprinting/hurdling	55	11.1
– Jumping/throwing events and decathlon	8	1.6
– Youth track and field.	4	0.8
Jogging	98	19.8
Skiing	45	9.1
Orienteering	36	7.3
Ball events (football, volley ball, baseball, ice-hockey, bandy, tennis)	15	3.0
Power events (weight lifting, judo, boxing, wrestling)	5	1.0
Gymnastics	3	0.6
Other sports (cycling, skating, ballet dancing, skeet etc)	7	1.4
	495	100%

RESULTS

There were 495 cases of shin overuse injuries in the series, representing 18% of the total number of these injuries. Most common of these was the medial tibial syndrome. Among the ten most common exertion injuries from the series of 1311 cases, there also were included the stress fractures of the tibia (Table III). The medial tibial syndrome and stress fracture of the tibia constituted about 75% of all shin exertion pains (Table IV). Because the pain was located at the inner border of the tibia in both disorders, the majority of shin pains in athletes were found at this area.

TABLE III

Ten most frequent overuse syndromes in a series of 1311 consecutive cases in athletes*.

Medial tibial syndrome	123
Pains of extension mechanism of knee	122
Achilles tendon peritendinitis	91
Iliotibial tract friction syndrome	84
Retrocalcaneal bursitis	42
Metatarsal arch pains	35
Stress fracture of tibia	34
Plantar fascitis	32
Osgood-Sclatter's disease	31
Chronic calf muscle pains	29

**from the Sports Clinic of the Deaconess Institute 1973-1975*

TABLE IV

Distribution of athletes' leg pains according to diagnosis (per cent)

Medial tibial syndrome	58
Stress fracture of tibia	15
Chronic calf muscle pains	11
Anterior tibial syndrome	6
Stress fracture of fibula	4
Simultaneous pain syndrome in two fascial compartments	3
Others (e.g. diffuse muscle pain (myositis?), peroneal compartment pains, fascial hernias . . .)	3
	100%

About 50% of the stress fractures of the tibia were located at the junction of the upper and middle thirds of the tibia (Fig. 2). A somewhat smaller percentage was found at the junction of the middle and lower thirds of the bone. Stress fractures of the mid-diaphysis were uncommon. The pain in fractures of the fibula was located in the lateral aspect of the shin. The majority of these pains were located in the lower part of the fibula, just above the tibio-fibular syndesmosis.

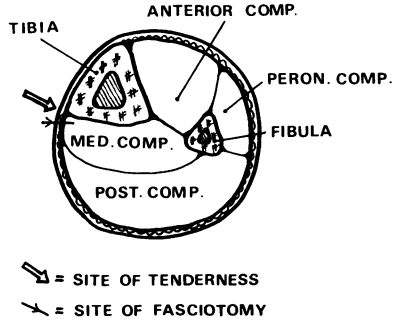

Figure 1. Schematic cross-section of the leg (middle third) with four muscular compartments and the site of maximal tenderness and fibrosis in case of medial tibial syndrome (arrow) and the site of fasciotomy.

Most of the pains of the medial border of the tibia were caused by the medial tibial syndrome. About 2/3 of these pains occurred at the upper part of the lower third of the shin, mostly right next to the tibia (Figs. 1 and 3). In other cases, the tenderness could be elicited in the region of the upper third, sometimes also in the middle third. About 32% of the medial tibial syndromes were bilateral. There were overuse injuries in other muscle compartments of the leg, too, although their number was smaller. In about 3% of the cases two or more compartments were afflicted simultaneously.

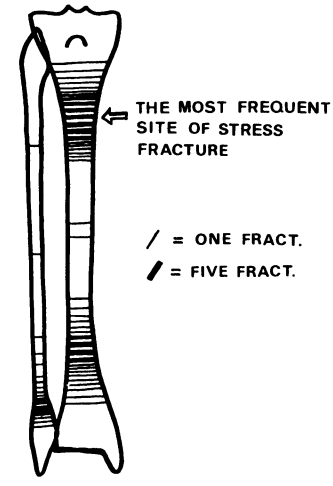

Figure 2. Location of 88 tibial stress fractures and 23 fibular stress fractures in athletes (from the Sports Clinic of Deaconess Institute)

"Permanent cramps", i.e. tender and unusually hard local muscle tissue points, were sometimes found in the calf. These tender spots caused pain with each running step. With heat, massage and other forms of physical treatment as well as with anti-inflammatory medication in some cases, the pains usually disappeared reasonably soon. Some patients had more diffuse muscle pain in legs, possibly as a result of an acute virus infection. In these cases pain was usually located in other muscle groups as well, particularly in the thighs and back.

DISCUSSION

The most common athletes' overuse injury in Finland seems to be exertional ischaemia of the medial fascial compartment of the leg, or "medial tibial syndrome". It composes nearly 10% of all exertion injuries and about 60% of the leg pains (Orava and Puranen, 1978). Stress fracture of the tibia is the second most common shin overuse injury. Together, these two stress injuries constitute about 75% of all pains of the shin region. The frequency of the medial tibial syndrome is indicated by the fact that nearly anyone involved with regular running may sometimes experience its symptoms, often bilaterally. Usually, the symptoms disappear with adaptation and rest.

Chronic ischaemia may also occur in other fascial compartments of the leg. The anterior compartment is the second most common place for this chronic syndrome (Renneman, 1975, Wiklund, 1977). This pain is typically located at the anterolateral side of the leg. In chronic cases the musculature of the compartment may be tender and taut to palpation. The typical pain is usually caused only by running or jumping. It is possible

that two or even more fascial compartments may simultaneously be involved in chronic exertion pain. Medial and anterior compartments form the most frequent combination.

The cause of the chronic fascial compartment syndrome is not known. To some extent, it may be caused by biomechanical disturbances in running style or technique (Juvenal, 1973, James and Brubacker, 1973, Segesser, 1974). It is evident that the size of the muscles is increased by training, and on the other hand, the fascial walls of the compartments may lose their elasticity. At operation, apparent tension and thickening of the fascia has been seen at its site of insertion to the posteromedial edge of the tibia. In some cases, periosteal thickening has been found at the insertion site of the fascia. This observation should not be mistaken for so-called "micro-fractures", which have been considered the reason for "shin splints" (Devas, 1969). Moreover, it is doubtful, whether this kind of fracture really exists. It is further possible that, due to the increasing muscle mass inside the fascial compartment, the pull of the fascia is directed to the insertion area, with resulting irritation (thickening, fibrosis) at the inner edge of the tibia. This would explain the location of the pain at rest. We believe, however, that the real pathogenesis of the pain is chronic ischaemia inside the medial fascial compartment. This may become so severe that muscle necrosis can be seen at operation (Puranen, 1974). In one case, a runner had overuse pains of both legs for several weeks. Gradually, pains became worse, with pain on walking and even at rest. At fasciotomy, necrotic spots were visible in the left flexor digitorum longus muscle, as demonstrated also by histological examination. Postoperative recovery was normal and after a couple of weeks the patient was able to run without pain.

The athletes' most common stress fracture is that of the tibia (Orava et al, 1978). It is evident that running causes unusually heavy loading on the shin (James and Brubacker, 1973). Stress fractures may be seen in both legs simultaneously. The same athlete may have two, even three, stress fractures in series; a new stress fracture may appear in the same bone, but never in the same place (Orava et al, 1978). It was interesting to notice that four athletes in the series had a typical medial tibial syndrome after a previous stress fracture of the tibia. Three were treated effectively by conservative methods, while one patient underwent fasciotomy about one year after the stress fracture. In addition, one runner had these exertion injuries in the opposite order: stress fracture of the tibia appeared three months after the fasciotomy (for medial tibial syndrome) because of progressively increasing training.

Certain difficulties were incurred in differentiating between the medial tibial syndrome and stress fracture of the tibia: both occur with similar symptoms in the same area and in similar patients. Initial pain is felt only during training, later also on walking and then even at rest immediately after training. At first pain is somewhat diffuse, but later it is more closely located at the medial tibial border. For the right treatment it is necessary to make the correct diagnosis. This requires radiological as well as isotope examinations. In some cases of medial tibial syndrome, however, an elevated isotope uptake, compared with the healthy leg, can be seen at the pain site (Puranen, 1974). The real stress fracture usually has an isotope uptake higher than 300 percent over that of the control (healthy) side; this is clearly higher than in the fascial compartment syndromes.

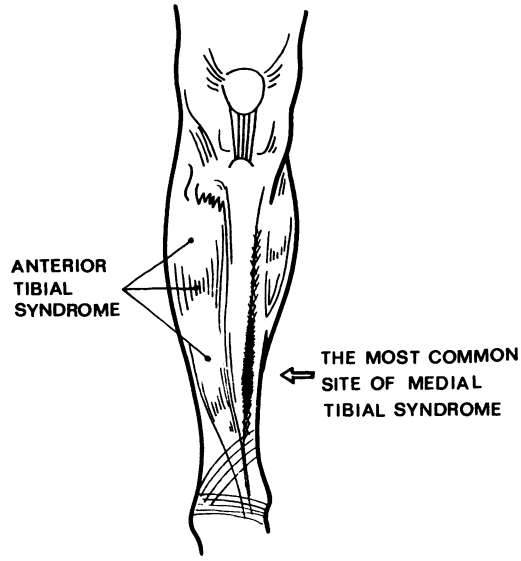

Figure 3. Location of medial and anterior tibial syndromes in the leg. The arrow shows the site of maximal tenderness and most frequent site of the medial tibial syndrome in athletes.

A training pause of 4 to 6 weeks is enough for the treatment of leg stress fractures. Limitations in everyday activities are usually not necessary. Most cases of medial tibial syndrome heal without any specific treatment, with rest and adaptation to training. When the symptoms become chronic in spite of conservative treatment, fasciotomy is effective. Among the patients of this series more than 70 athletes and joggers have undergone this operation, with good success. In performing fasciotomy, it is important to split the fascia in its full length in order to prevent recurrences (Puranen, 1974). In about 35% of the cases, fasciotomy was performed in both legs at the same time since medial tibial syndrome is often bilateral. In 10 cases fasciotomy was performed at the same time in both the medial and anterior fascial

compartments of the same leg. Good results from fasciotomy have also been reported elsewhere (Renneman, 1975, Westlin, 1977).

It is possible that the frequency of athletes' leg pains may be reduced by good maintenance of muscle condition as well as by better planning of training sessions. However, there is a small number of athletes who are prone to chronic leg pains despite all conservative treatment. If the possibility of stress fractures is excluded, there remains a group of patients with chronic exertional ischaemia of the fascial compartments of the leg. In these cases, operative treatment is the fastest and most reliable simple method for relief of symptoms. At present, fasciotomy is used with success by several surgeons in Finland.

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CORRIGENDUM

The diagram below relates to Fig. 2 on Page 73, Vol. 13, No. 2 of the article by T. Reilly, J. Hopkins and N. Howlett. The editor regrets that a second copy of the somatogram of Fig. 1 was included inadvertently instead of this graph.

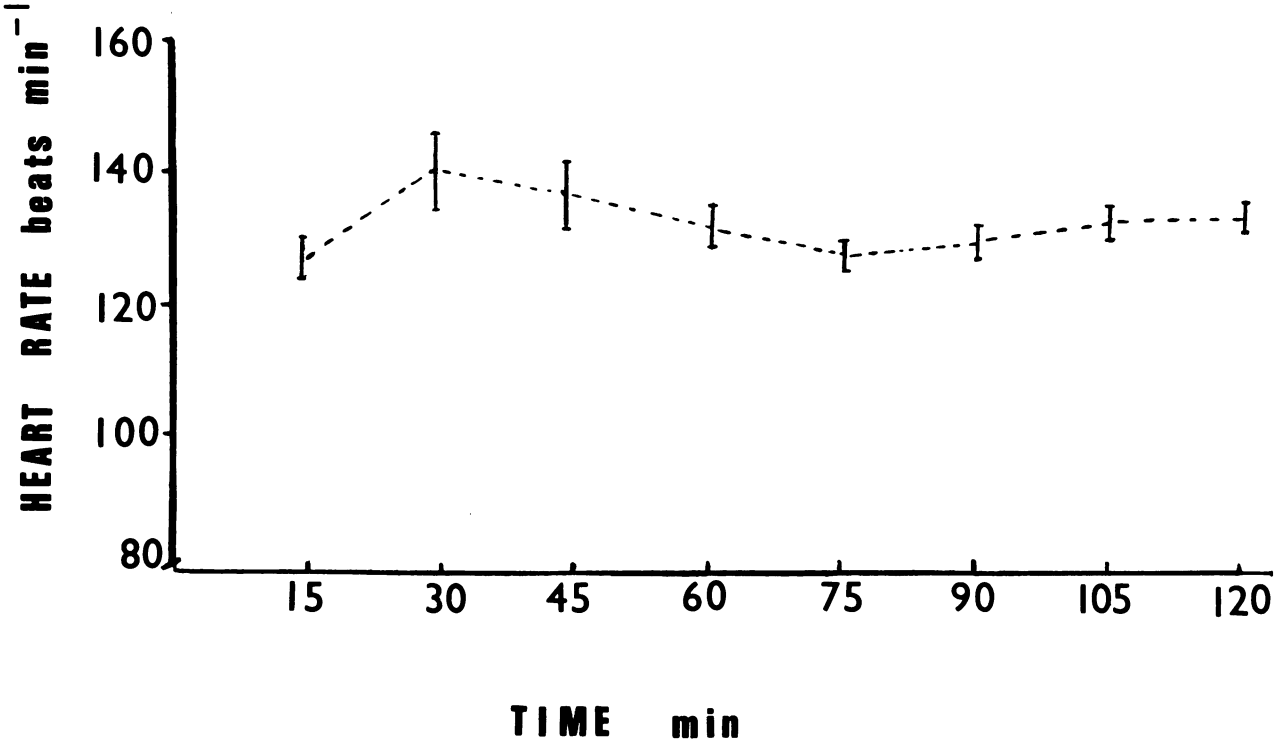

Figure 2: Heart rate ($\bar{x} \pm$ S.D.) for successive 15 min periods of the prolonged training session on road.