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Chronic Leg Pain in Athletes

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ABSTRACT

Chronic leg pain is commonly treated by orthopaedic surgeons who take care of athletes. The sources are varied and include the more commonly encountered medial tibial stress syndrome, chronic exertional compartment syndrome, stress fracture, popliteal artery entrapment syndrome, nerve entrapment, Achilles tightness, deep vein thrombosis, and complex regional pain syndrome. Owing to overlapping physical examination findings, an assortment of imaging and other diagnostic modalities are employed to distinguish among the diagnoses to guide the appropriate management. Although most of these chronic problems are treated nonsurgically, some patients require operative intervention. For each condition listed above, the pathophysiology, diagnosis, management option, and outcomes are discussed in turn.

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BACKGROUND INFORMATION

Chronic leg pain is a common complaint in athletes and is often managed by rehabilitation practitioners and orthopaedic surgeons. Over 80% of athletes are likely to be seen at some point for such an issue, and properly diagnosing and managing these injuries is challenging (1). Many chronic leg conditions present with similar and overlapping symptomatology, resulting in great care being required to arrive at the correct diagnosis.

Differential diagnoses for chronic leg pain can include medial tibial stress syndrome (MTSS), chronic exertional compartment syndrome (CECS), stress fracture, popliteal artery entrapment syndrome (PAES), nerve entrapment, Achilles tightness and tendinopathy, deep vein thrombosis (DVT), and complex regional pain syndrome (CRPS). These represent the more common causes. In this review, the authors provide the background, diagnosis and management of each of these conditions, and, where available, an additional focus on the outcomes of the prescribed treatment regimen.

SUMMARY

Medial Tibial Stress Syndrome (MTSS)

MTSS, or true shin splints, is the most common chronic lower leg injury, accounting for 5% of all athletic injuries (2). MTSS presents as exercise-induced pain along the posterior and medial borders of the tibia, with an estimated incidence of up to 22% in runners and up to 35% in naval recruits (3, 4).

Diagnosis:
The most commonly used diagnostic criteria for MTSS include: "pain along the posteromedial border of the tibia that occurs due to exercise," and pain which is reproduced by "palpation of the posteromedial border of the tibia" (4). The pain is generally present over at least 5 consecutive centimetres of the anterior leg, while posteromedial bony pain is imperative for diagnosis. Imaging studies rarely provide useful diagnostic information, save for MRI or high-resolution CT scans in difficult cases.

Management:
Initial management is non-operative, with a focus on rest, cryotherapy, compression, elevation, stretching, physical therapy and pneumatic leg bracing. Orthotics, alteration of training regimen and shockwave therapy have also been recommended for recalcitrant cases.

Operative treatment is rare and includes posterior fasciotomy in severe cases that remain unresponsive to conservative treatments.

Chronic Exertional Compartment Syndrome

CECS presents as exercise-induced anterior leg pain, the majority of which (95%) involve the anterior and lateral compartments. CECS generally affects young (20-24 years of age), active patients and affects males and females equally.

Diagnosis:
Pain initially presents as predictable pain that begins at the same time/distance/intensity during their workout and subsides with rest. Progression of symptoms may include pain with ambulation and/or rest (5). Swelling and local tenderness may be present, along with the potential for drop foot associated with dermatomal paresthesia (5, 6). Measurement of intracompartmental pressure is considered the gold standard for definitive diagnosis. Imaging rarely contributes to diagnosis and is used more often utilized for differential diagnostic purposes.

Management:
Non-operative management is unfortunately associated with a high failure rate, due largely to the unwillingness of the patient to modify their activities or the oft-delayed diagnosis for this condition. Treatment options include ice, NSAIDs, massage, stretching, ultrasound, shoe/gait modifications, although avoidance of the offending activity is the most effective treatment. The use of botulinum toxin has also been shown to induce transient improvements (7, 8). Surgical release of the involved compartment(s) is a last-resort option for patients unresponsive to conservative care or unwilling to alter their activities.

Stress Fractures

Repetitive stress resulting in microtrauma to bony architecture can lead to stress fractures, which occur most commonly in the tibia. The location of the fracture may vary depending on the type of activity or sport (9, 10).

Diagnosis:
Pain onset is generally insidious, worsened by weight-bearing and lessened by rest. Tenderness on palpation is common, although swelling may not be present. Vibration testing using a tuning fork or ultrasound cannot be used definitively but can be strongly indicative of stress fracture. Although able to be diagnosed by physical exam and history in many cases, plain films are often sought to confirm the diagnosis, with bone scans or MRI used to assist and confirm difficult cases.

Management:
Treatment generally is non-operative and includes rest, pain relief and modification of identifiable risk factors (shoes, running surface, training regimens, etc.). Weight-bearing should be limited for 2-6 weeks following diagnosis. Reintroduction of training should be gradual, progressive and follow the period of non-weight-bearing during a period of 8-16 weeks of full recovery.

Popliteal Artery Entrapment Syndrome

Compression of the popliteal artery as it passes between the gastrocnemius heads can cause intermittent claudication. If untreated, arterial stenosis can result in permanent vascular damage, with aneurysmal dilatation and thrombosis as possible sequelae.

Diagnosis:
The most common initial complaint is pain and leg cramping with strenuous exercise, with mild swelling often present. Diagnosis is often made with the assistance of imaging such as duplex ultrasound, arteriography, CT angiography or MR angiography.

Management:
In cases where surgery is indicated, the posterior or medial approach permits a myotomy of the affected head of the gastrocnemius (11). Saphenous vein grafting of the popliteal artery is reserved for aneurysmal or embolic disease.

Lower Extremity Nerve Entrapment

Initial presentation of lower limb nerve entrapment may be masked by acute injuries and only revealed when the recovery time exceeds the expected timeframe. The saphenous, common fibular (peroneal), superficial fibular (peroneal), and sural nerves are most commonly implicated in lower extremity nerve entrapment syndromes leading to leg pain in athletes (12, 13). The majority of injuries result from athletic activities.

Diagnosis:
The most obvious and consistent symptom is activity-induced leg pain that is exacerbated by continuing the offending exercise (14, 15). Pain is often located at the site of compression and referral generally follows the nerve's distribution. Initial diagnosis is often made based on physical examination, with percussion or compression testing used to confirm. Nerve conduction studies or electromyography can be used to confirm the diagnosis as well. Imaging is rarely used to diagnose nerve pathologies and is helpful only in identifying soft-tissue injury or other differential diagnoses.

Management:
Initial management is non-operative and focuses on modification of offending activities, physiotherapy, stretching or massage (15, 16). Iontophoresis and nerve blocks are advocated by some authors (15). Decompression surgery to relieve the compressed nerve is indicated in patients who do not respond to conservative care.

Achilles Tightness

Achilles tendon tightness is a common but less recognized cause of lower leg injury, which can result in posterior calf pain and tendinopathy. Overuse and lack of flexibility in athletes can lead to microtears and degenerative changes. As the Achilles tendon is required to absorb up to 12.5 times the athlete's body weight during running activities (17), the potential impact of Achilles injuries is significant.

Diagnosis:
A history of activity-induced pain localized to the posterior leg along the Achilles tendon and calf is indicative of tightness, although these symptoms may be vague and difficult to reproduce. The Silfverskiold test, which measures ankle dorsiflexion with the knee in 90 degrees of flexion, then in extension, helps to determine whether symptoms are related to gastrocnemius pain or a combination of gastrocnemius and soleus pain. Radiographs are generally not valuable in assisting with diagnosis.

Management:
Rest, physical therapy and stretching is often successful in mild cases of Achilles tightness. NSAIDs are often prescribed for pain control (18). Shoe modifications are also available for athletes with associated gait/foot abnormalities (19). Surgical lengthening of the gastrocnemius-soleus complex or of the Achilles tendon itself are (albeit, last resort) options for chronic cases non-responsive to conservative care.

Deep Vein Thrombosis

While often viewed as a condition associated with sedentary individuals, DVT should be a consideration for lower leg pain in athletes, especially given its serious sequelae. Pulmonary embolism can occur in up to 50% of DVT patients and 2% of sudden deaths in high school/college football have been linked to DVT (20). While athletic endeavours offer protection against the risk factors for DVT (Virchow's triad: venous stasis, endothelial damage, and hypercoagulability), high altitude training, endothelial damage from previous surgery and genetic mutations which lead to hypercoagulability are present in athletic populations and should not be overlooked.

Diagnosis:
Physical examination findings include unilateral diffuse swelling, local tenderness, extremity warmth and a low-grade fever (21, 22). Homan's sign (calf pain with forceful dorsiflexion) is only 30-72% specific for diagnosis and should not be used to exclude diagnosis (23). Duplex ultrasound is the test of choice and is highly specific (98%) for diagnosis (24).

Management:
Anticoagulant therapy is the first line of treatment for confirmed DVT. Secondary considerations in the athlete must include return-to-play. Anticoagulant therapy should be continued for 3 months and then a risk/benefit analysis should be conducted regarding continued use (22). Athletes should not return to play until anticoagulant therapy is completed and, while no consensus exists regarding restriction of non-contact, historically a period of 7-10 days has been used, although there is a trend towards early mobilization with gradual return to activities (22, 25).

Complex Regional Pain Syndrome

CRPS describes a condition characterized by a disproportionate reaction to injury that results in autonomic and motor symptoms, with significant associated pain. CRPS may (type II) or may not (type I) involve peripheral nerve injury.

Diagnosis:
CRPS is often a diagnosis of exclusion and generally follows a mild to moderate injury. Progression of pain despite a grossly normal appearing extremity, changes to skin colour and temperature and allodynia or hyperalgesia are often present. No gold standard diagnostic test is available, although EMG, thermography, sweat testing and nerve blocks can provide valuable information.

Management:
Non-operative treatment is generally used, with a focus on medications and goal-oriented physical therapy, including TENS, progressive weight-bearing, tactile sensitization and massage (26). No definitive role for chiropractic care has been elucidated to date for CRPS (27).

CLINICAL APPLICATION & CONCLUSIONS

Injuries to the lower leg share multiple commonalities, making diagnosis difficult in many cases. Each condition, however, has differing treatment algorithms and therefore proper diagnosis is paramount to ensuring effective treatment. A thorough examination is recommended, with imaging assistance where appropriate. When managed properly, these conditions have favourable outcomes and athletes' return to play is rarely jeopardized.

STUDY METHODS

This study is a clinical review and is therefore focused primarily on clinical information. The authors provide a broad overview of current diagnostic and treatment approaches, using various sources, ranging from clinical reviews to systematic reviews and meta-analyses. No specific search strategy was employed; instead, clinical information was gathered from available sources and summarized for the clinician.

STUDY STRENGTHS / WEAKNESSES

Strengths

- The discussion of clinical information was comprehensive.
- The presentation of background, diagnosis and treatment is logical and helpful for the clinician.

Limitations

The study's main limitation was the lack of a systematic search and inclusion/exclusion criteria. While the review provides a large amount of information, no specific search strategies or criteria were included.

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