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CASE REPORT

Management of Medial Tibial Stress Syndrome with Glucopuncture. A Clinical Case.

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ABSTRACT

Medial tibial stress syndrome, sometimes referred to as shin splints, is an overuse injury of the lower extremities. It is commonly managed conservatively, but there is lack of consensus on the application of new treatment options such as regional dextrose 5% injections in regional superficial fascia. Over the last decade, regional dextrose 5% injections are popular for the treatment of orthopedic complaints and sports injuries because of easy application, low cost and excellent safety profile. This article describes a 25-year-old runner suffering from pain in both shins for several years. His pain level went from 7/10 to 0/10 after three sessions of dextrose 5% injections in the superficial fascia, and he recovered permanently after five sessions. This case report is an invitation to design more studies to confirm whether this novel approach may become one of the new tools for athletes suffering from shin splints.

Keywords: Medial Tibial Stress Syndrome; Glucopuncture; Tensegrity; Sports Injury; Fascia.

Introduction

Medial tibial stress syndrome (MTSS) is an overuse injury of the lower leg affecting a large percentage of athletes[1]. A common complaint is pain in the shins, usually on the anterior or medial side[2,3,4,5] MTSS injuries often present as a dull ache following exercise, especially running. Some athletes complain about tenderness along the posteromedial border of the tibia, others complain about pain on the anteromedial border of the tibia[6,7]. The pain is often described as being superficial, but it is not always clear if the pain itself is originating from nociceptors in the superficial layer of fascia or rather periost itself. The complaints are typically alleviated by resting. In some cases, MTSS is related to poor footwear, imbalances at the low back and weak calf muscles[8,9,10]. Shin splints are sometimes related to an imbalance in the muscles of hips and lower limb. Myofascial trigger points may become active for a number of reasons including overuse or gait imbalances. The differential diagnosis of MTSS includes, but is not limited to stress fractures, popliteal artery entrapment syndrome, periostitis and peripheral nerve entrapment[11,12,13,14,15]. In several cases, the diagnosis remains unclear. In case of doubt, radiography, computed tomography, ultrasound, bone scintigraphy, and especially magnetic resonance imaging (MRI) are advised[16,17,18,19,20].

Clinical Application of Glucopuncture

Regional injections of dextrose 5% in water (D5W) are used for more than 25 years[21,22]. Glucopuncture (GP) is a medical application which uses regional injections into epidermis, fascia, muscle, ligament and joints with D5W to treat musculoskeletal (MSK) pain and dysfunction[23,24,25,26,27,28]. One can also inject D5W into the epidural space[29,30] or perineurally[31,32]. Both patient-guided as well as screen-guided GP are applied these days (Table 1). Glucopuncture has received increasing popularity over the last years due to low cost and low morbidity associated with the technique[33].

Table 1: Patient-guided versus Screen-guided Glucopuncture

	Diagnosis	Treatment
A: Patient-guided GP	Observation, Palpation	Landmark-guided
B: Screen-guided GP	Fluoroscopy or Ultrasound	X-rays or US-guided

Patient-guided GP (A) is based on questioning and observation of the patient, including detailed palpation of that pain region (PR). For example, the patient points out the PR and then the doctor injects in the fascia or muscles in that particular region. Typically, multiple injections are given in that region. In some cases, the doctor looks for trigger points in fascia, ligaments or muscles *outside* the pain region, and inject these. Patient-guided GP is popular among family physicians and sports doctors who have no access to ultrasound. Patient-guided glucopuncture is mainly used for superficial lesions or easy targets. Recently, especially injections into superficial fascia are becoming more popular[34,35,36,37].

Screen-guided GP (B) is based on imaging techniques such as fluoroscopy or ultrasound[38,39,40,41]. It enhances the efficacy and safety of the injection[42]. Ultrasound-guided GP is becoming very popular and it is mainly used for deeper lying lesions, joint injections, perineural injections, nerve hydrodissection[43,44] and hydrorelease of fascia[45]. It also avoids injecting inadvertently into fragile sites such as important blood vessels and organs. Screen-guided GP has become the standard in modern hospitals worldwide. Especially in the last decade, several clinical studies have confirmed the excellent safety - efficacy ratio of D5W injections[46,47,48,49]. There are many controlled studies for perineural D5W injections for carpal tunnel[50,51,52,53,54,55,56,57,58,59]. Even Harrison's Principles of Internal Medicine textbook recommends D5W injection over steroids for carpal tunnel syndrome[60].

Mechanisms of Action of D5W Injections

The pharmacological effects of D5W injections into the ECM include stabilization effects on neural activity (decrease in neurogenic inflammation) and reduction of neuropathic pain via multifactorial mechanisms[61]. It is not clear yet if exosomes play a role in the effects of glucose on pain modulation and regional tissue repair[62,63]. More specific research in this field is required urgently. Dextrose (d-glucose) has been speculated to indirectly inhibit capsaicin-sensitive receptors such as transient receptor potential vanilloid receptor-1 (TRPV1)[64] and block the secretion of substance P[65] (Table 2), but more research in this field is required.

Table 2. Two Mechanisms of Action of D5W Injections

1/ Inhibition of TRPV1
2/ Blocking of Substance P secretion

A recent investigation illustrated that dextrose or glucose exposure restores function in apoptotic nerves after TNF-α exposure via ROS scavenging, enhancement of MAPK family and Akt pathways[66]. These findings suggest that glucose injection about entrapped peripheral nerves may have several favorable biochemical actions that enhance neuronal cell function. This may explain why D5W injections near peripheral nerves may have such interesting pain modulating effects. This pain modulating effect is typically observed when giving ultrasound-guided perineural injections, but these clinical benefits are also observed when giving multiple injections near tiny peripheral nerve endings and / or nociceptors in or near tendons, joint capsules, fascia, dermis, muscles and ligaments. Especially fascia is very rich in nociceptors[67]. More research is required to check if regional D5W injections are also stimulating vascular endothelial growth factors or even lead to formation of new blood vessels (neo-angiogenesis). It would also be worth investigating whether glucopuncture can modulate neuropathic pain by regulating Tiam1-mediated plasticity[68].

Regional D5W injections for Pain Modulation and Tissue Repair

Clinical experience shows that regional D5W injections have three major effects: improving pain modulation, enhancing fascintegrity[69,70] and supporting local tissue repair[71,72].

Table 3. The three major effects of Glucopuncture

1. Improving Pain Modulation
2. Enhancing Fascintegrity
3. Supporting Tissue Repair

Dextrose 5% injections can be applied for patients with diabetes as the total dose of sugar each session is very low (95% of the injectate is water) and because most of the sugar water is metabolized immediately at the injection site. The latter is exactly the goal of Glucopuncture. It is hypothesized that glucose molecules, after being transported from the extracellular matrix into the cell, support regional cell metabolism. The latter is probably directly related to ATP, leading to a healthier cellular metabolism[73]. This can lead to both enhanced tissue repair and reduction of regional pain[74]. Over the last decade, larger volumes of dextrose 5% (or glucose 5%) are applied. However, we do *not* recommend to inject *hyperosmolar* dextrose solutions such as D15W, because these can create local cell damage[75] and lead to potential scarring and thickening of connective tissue. Scarring and thickening of connective tissue is the exact opposite of what we aim for with glucopuncture. However, thickening of ligaments and joint bands after D15W injections can be beneficial when treating collateral bands of unstable joints[76,77]. In such cases, D15W (as in prolotherapy) is much more efficient than D5W.

Clinical Case

A young athlete (born June 26, 1988) suffers from shin splints for 8 years. He complained about being unable to run for 6 km (4 miles). In December 2015, his family physician diagnosed his condition as bilateral periostitis and prescribed pain medication and NSAIDs, without results. Over the last years, he saw several orthopedic surgeons, sports doctors and physical therapists for his shin splints. He was prescribed a special training program, along with new foot soles and compression socks. MRI confirmed shin splints. On his first visit on Nov 31, 2023, he said he suffered from his shins for about 8 years. He said he could hardly run for more than 6 km (4 miles). His pain level was at 7/10 in rest. The pain regions in both legs were identical in size and location (Fig. 1). Further examination at the first visit revealed superficial pain points in the pain region itself. Touching the skin very lightly in a tangential manner did not make his pain worse, which may mean that there was no need to give *intracutaneous* injections as in patients with regional neuropathic pain[78]. Yet, the pain was elicited with only very mild pressure. In other words, the pain origin must

be very superficial, right under the epidermis, such as the *superficial fascia.* This simple examination made clear that the pain did not come from the periost, because the pain was elicited clearly *without* putting pressure on the periost. He received 10 mL of G5W in both shins, exactly in the pain region he had pointed out (Fig. 2). When using a 5 mL syringe, we use a 27G needle. After thorough disinfection of the area, ten injections were given in the superficial fascia. To reach as much fascial tissue as possible, the needle was introduced at an angle of about 10 degrees[79]. This *tangential approach* avoids injecting inadvertently into periost (injections into periost often give serious post-injection discomfort). He received 5 injections of each 1 mL in both pain regions (10 times 1 mL). On December 8, he said his pain at rest went down from 7/10 to 5/10. He then received his second session with the same protocol. On the third session on December 15, he said his pain went from 5/10 to 2/10 after the second glucopuncture session. He received his third session with the same protocol. He received a fourth session of Glucopuncture in the pain region on December 21 and a fifth session on January 4. Follow-up (end of January) learned us that he had no relapses any more, even after running for more than 10 km. His pain level was at 0/10 in rest. On April 3, the patient stated in an email that he can ran 10 km once a week without any pain or discomfort.

Fig. 1: Patient points both Pain Regions (Snapshot of Video)

Video of Pain Region: Video Shins Glucopuncture.mov

Fig. 2. Injections into Superficial Fascia (5 on each side)

Discussion

The fascial system (FS) represents a sophisticated and intricate network comprising both superficial, myofascial and visceral layers. Especially the superficial layer is a potential source of regional pain where MRI findings are negative. Dysfunctions within the superficial fascia have been implicated in a variety of MSK disorders and pain syndromes. MTSS is an overuse injury of the lower extremities which is prevalent in young athletes. MTSS is commonly managed conservatively, but new treatment options such as D5W injections into regional superficial fascia are becoming more popular because of easy application and interesting safety profile. This article describes a 25-year-old runner suffering from pain in both shins for several years. His pain level went from 7/10 to 0/10 after three sessions of D5W injections in the superficial fascia, and he recovered permanently after five sessions. Glucopuncture has been suggested as a new tool to address such atypical pain patterns by administering multiple injections of D5W into the regional fascia. However, clinical correlation does not always indicate true causation. To further illustrate the significance of this correlation, hard data must be obtained. Therefore, both fundamental and clinical research is urgently warranted to confirm glucopuncture as an appropriate treatment for vague pain patterns.

Conclusion

Medial tibial stress syndrome, usually referred to as "shin splints," is an overuse injury of the shins. Over the last decade, regional dextrose 5% injections have received more attention in the medical profession and the general public for the treatment of orthopedic complaints and sports injuries because of easy

application, low cost and excellent safety profile. This article describes a young runner suffering from bilateral pain at both shins for eight years. He was treated successfully with five glucopuncture sessions. Each session, five injections were given into the superficial fascia in both pain regions. This case report is an invitation to design more research to confirm whether glucopuncture may become one of the new tools for athletes suffering from shin splints.

Conflict of Interest:

None

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