

Treatment of Grade 1 Hamstring Injury with Glucopuncture: A Clinical Case

Kersschot J ^{1,*}, Laverde D ²

¹ Sports Medicine and Pain Management, Private Practice, Aartselaar, Belgium.

² Physical Medicine and Rehabilitation Av 5a Nte. #20N-68, San Vicente, Cali, Colombia.

World Journal of Advanced Research and Reviews, 2023, 19(03), 1084–1089

Publication history: Received on 14 August 2023; revised on 20 September 2023; accepted on 23 September 2023

Article DOI: <https://doi.org/10.30574/wjarr.2023.19.3.1937>

Abstract

Hamstring strain injuries are common among athletes and often require intensive rehabilitation to prepare athletes for a timely return to sport performance. Return to sport is typically achieved within weeks of the hamstring injury. But subsequent athlete performance may be impaired. Both rehabilitation and preventive measures are crucial but not standardized yet. On top of the standard rehabilitation program, it would be interesting to add safe treatment modalities which could speed up recovery from such an injury. In this article we present a young athlete with a large grade 1 hamstring injury which was treated with regional sugar water injections into the muscular lesion. Although they can be biased, both treating physician as well as patient found that injury recovery went smoothly and quickly. The goal of this paper is to share this experience with other sports doctors and to invite the medical community to design randomized trials to confirm the clinical experience with this easy and safe technique. Unfortunately, the injectate is inexpensive and cannot be patented, making the product uninteresting for medical companies.

Keywords: Hamstring Injury; Muscle tear, Soccer; Orthobiologics; Physiotherapy; Sports injury; PRP; Glucopuncture; Prolotherapy; Young athlete

1. Introduction

Hamstring injuries are very common among, for example, football players, rugby players and hockey players. Such lesions can be very detrimental for athletic performance [1, 2, 3, 4, 5, 6]. In particular, injuries to the intramuscular tendon may be present in up to 41% of all HSI and have been described as a 'serious' thigh muscle strain [7]. Re-injury rates as high as 60% have been described in elite track and field athletes, as well as prolonged time to return to play (TTRTP) [8]. Most of these hamstring injuries occur during high-speed movements in sports requiring sudden directional changes [9]. Unfortunately, such muscle injuries have a high recurrence rate and can result in long term loss of ability to participate in training and competition [10]. To exclude lesions which require immediate surgery, early ultrasound or MRI are required. Typically, there are three grades of hamstring muscle injuries (Table 1). In this article, we discuss the treatment of a large grade 1 injury. For practical reasons, the patient had no opportunity to follow the usual physiotherapy protocol.

Table 1 Three Grades of Hamstring Injury

Grade 1: mild muscle pull or strain
Grade 2: partial muscle tear.
Grade 3: complete muscle tear.

* Corresponding author: Kersschot J

2. Treatment of Hamstring Injury

Standard management for low-grade tears includes activity modification, anti-inflammatories, and physical therapy [11]. Platelet-rich plasma (PRP) injections, dry needling, and shock wave therapy may provide benefit as well [12]. PRP is even better than steroids [13]. Target injections with corticosteroid injections are becoming less popular because of potential side effects of steroids [14, 15, 16, 17, 18, 19, 20]. That is why sports doctors apply orthobiologic injections instead of steroid injections.

2.1. 2/ Orthobiologic Injections

The goal of orthobiologic injections is to improve regeneration of musculoskeletal tissues by injecting biomaterials [21]. Orthobiologic injections are given into tissues with intrinsic repair ability such as cartilage, tendons, ligaments and muscle. [24, 25, 26]. Typical orthobiologics (Table 2) are dextrose 5% in water (D5W), hyaluronic acid (HA), platelet-rich plasma (PRP), bone marrow aspirate (BMA) and mesenchymal stem cells (MSCs). The most popular orthobiologic among sports doctors over the last decades is PRP [22, 23].

Table 2 Examples of Orthobiologic Injectates

Dextrose 5% (D5W)
Hyaluronic Acid (HA)
Platelet-rich Plasma (PRP)
Bone marrow aspirate (BMA)
Mesenchymal Stem Cells (MSCs).

Orthoregeneration can be a new solution for orthopedic surgeons, family physicians and sports doctors as an alternative for cortisone and in some rare cases as an alternative of surgery [27, 28]. Their application in sports injuries still requires more clinical studies [29, 30].

2.2. PRP versus D5W

Apart from PRP, injections of dextrose 5% in water (D5W) - or glucose 5% in water (G5W) - are becoming more popular because of their safety and easy application [31]. There have been several cases and studies to confirm the potential of sugar water injections as epidural injections [32, 33] or perineural injections [34, 35, 36]. However, there are no clinical trials yet to confirm their clinical efficacy in treatment of muscle tears in athletes. Clinical experience suggests that D5W injections have similar effects than other orthobiologics such as PRP [37]. D5W solutions are less expensive than PRP, but require to be injected in higher volume, frequency and number of sessions to obtain similar outcome [38]. On the other hand, D5W injections can provide quick pain relief in several clinical situations, even in regional neuropathic pain [39]. The latter is probably related to the direct effect of sugar water on tiny nerve endings. It is postulated that D5W injections can also be used to repair muscle tissue because they stimulate tissue repair through ATP [40]. There are several hypotheses which explain the effect of D5W through substance P [41]. Recent investigations suggest that glucose injection near peripheral nerves can increase levels of CREB, JNK, and p70S6K, pointing to antioxidative and anti-inflammatory actions [42]. These may have several favorable biochemical actions that enhance neuronal cell function. Lab investigations showed that intramuscular dextrose injection can induce phosphorylated extracellular signal-regulated kinase expression in dorsal root ganglion neurons expressing substance P [43].

2.3. D5W versus D15W

It is worth noting, however, that *hypertonic* sugar water injections such as dextrose 15% (D15W), as applied in prolotherapy, are avoided for muscle tears because these hyperosmolar injectates can cause local cell death (osmotic shock) and subsequent tissue damage [44]. In contrast to D5W, local anesthetics need to be added. Prolotherapy has been used for more than five decades in the US and worldwide. These hypertonic sugar water injections can lead to local proliferation of connective tissue, hence the term prolotherapy. These *proliferant* injections can be very effective in thickening and strengthening weak ligaments, tendons and bands [45]. Prolotherapy can be very interesting in well-chosen indications. These injections can also be given into a joint cavity, but then connective tissue proliferation is no longer in play [46], which means that the term prolotherapy is not applicable.

2.4. Clinical Case

The patient is a Belgian 22-year-old professional soccer player. He is playing in London for a few years. On August 2, he had a mild hamstring injury. It was not a sudden injury but rather developed over about a minute. He did not get ultrasound yet because he thought it was not so bad. A few days later, on August 8, he re-injured the same muscle in exactly the same region. Now, it was impossible for him to play soccer because of this injury. He came to Belgium to have ultrasound and glucopuncture treatment on short notice. The ultrasound on August 23 showed no muscle tear in the hamstring muscle. The radiologist concluded that it was a large grade 1 muscle pull without a major muscle tear. He received IM injections with sugar water 5% into the pain region. About 12 mL of G5W were applied in 12 spots in the muscle, using a 27 G needle (Fig.). Depth of injection was between 1 and 3 cm (0.4 – 1.2 "). After the first session, there was immediate improvement regarding pain and stiffness in the area. He received a second session on August 25, before heading back to London. He had to travel to Portugal, so seeing his physiotherapist was not possible. If he would reinjure the same lesion, a third sessions could be considered.



Figure 1 Twelve IM Injections into the Hamstring Lesion

3. Conclusion

Hamstring injury is a common sports injury in the young athlete which requires an individualized treatment to speed up recovery. In this article a soccer player with a fresh grade 1 hamstring injury was treated with regional sugar water injections into the muscular lesion. The goal of this paper is to invite the medical sports community to design randomized trials to confirm our clinical experience with this novel tool.

Compliance with ethical standards

Statement of ethical approval

Ethical approval was not required because the present article is not a research work on humans subjects but only a description of a specific treatment, as requested by the patient himself.

Statement of informed consent

Informed consent was obtained (for detailed case description and one photograph) from the individual participant included in this case study.

References

- [1] Poudel B, Pandey S. Hamstring Injury. 2023 Aug 8. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. PMID: 32644362.

- [2] O'Sullivan L, Preszler J, Tanaka M. Hamstring Injury Rehabilitation and Prevention in the Female Athlete. *Int J Sports Phys Ther.* 2022 Oct 2;17(6):1184-1193
- [3] Chavarro-Nieto C, Beaven M, Gill N, Hébert-Losier K. Hamstrings injury incidence, risk factors, and prevention in Rugby Union players: a systematic review. *Phys Sportsmed.* 2023 Feb; 51(1):1-19.
- [4] Whiteley R, Gregson W, Bahr R, Tabben M, Chamari K, Lolli L, Salvo VD. High-speed running during match-play before and after return from hamstring injury in professional footballers. *Scand J Med Sci Sports.* 2022 Oct;32(10):1502-1509
- [5] Rudisill SS, Varady NH, Kucharik MP, Eberlin CT, Martin SD. Evidence-Based Hamstring Injury Prevention and Risk Factor Management: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Am J Sports Med.* 2023 Jun;51(7):1927-1942
- [6] Al Attar WSA, Husain MA. Effectiveness of Injury Prevention Programs With Core Muscle Strengthening Exercises to Reduce the Incidence of Hamstring Injury Among Soccer Players: A Systematic Review and Meta-Analysis. *Sports Health.* 2023 May 4:19417381231170815
- [7] Kerin F, O'Flanagan S, Coyle J, Farrell G, Curley D, McCarthy Persson U, De Vito G, Delahunt E. Intramuscular Tendon Injuries of the Hamstring Muscles: A More Severe Variant? A Narrative Review. *Sports Med Open.* 2023 Aug 14;9(1):75. doi: 10.1186/s40798-023-00621-4. PMID: 37578668; PMCID: PMC10425319.
- [8] Kerin F, O'Flanagan S, Coyle J, Farrell G, Curley D, McCarthy Persson U, De Vito G, Delahunt E. Intramuscular Tendon Injuries of the Hamstring Muscles: A More Severe Variant? A Narrative Review. *Sports Med Open.* 2023 Aug 14;9(1):75. doi: 10.1186/s40798-023-00621-4. PMID: 37578668; PMCID: PMC10425319.
- [9] Jokela A, Valle X, Kosola J, Rodas G, Til L, Burova M, Pleshkov P, Andersson H, Pasta G, Manetti P, Lupón G, Pruna R, García-Romero-Pérez A, Lempainen L. Mechanisms of Hamstring Injury in Professional Soccer Players: Video Analysis and Magnetic Resonance Imaging Findings. *Clin J Sport Med.* 2023 May 1;33(3):217-224.
- [10] Hotfiel T, Seil R, Bily W, Bloch W, Gokeler A, Kriffter RM, Mayer F, Ueblacker P, Weisskopf L, Engelhardt M. Nonoperative treatment of muscle injuries - recommendations from the GOTS expert meeting. *J Exp Orthop.* 2018 Jun 22;5(1):24
- [11] Marigi EM, Cummings PE, Marigi IM, Burgos W, Gillett J, Camp CL, Krych AJ, Okoroha KR. Hamstring Injuries: Critical Analysis Review of Current Nonoperative Treatments. *JBJS Rev.* 2022 Nov 2;10(11).
- [12] Fletcher AN, Cheah JW, Nho SJ, Mather RC 3rd. Proximal Hamstring Injuries. *Clin Sports Med.* 2021 Apr;40(2):339-361.
- [13] Park PYS, Cai C, Bawa P, Kumaravel M. Platelet-rich plasma vs. steroid injections for hamstring injury-is there really a choice? *Skeletal Radiol.* 2019 Apr;48(4):577-582.
- [14] Sinha A, Mehnert M. Hip Injuries Following Steroid Injection. *Radiology.* 2020 Feb;294(2):482-483
- [15] Stout A, Friedly J, Standaert CJ. Systemic Absorption and Side Effects of Locally Injected Glucocorticoids. *PM R.* 2019 Apr;11(4):409-419. doi: 10.1002/pmrj.12042. Epub 2019 Mar 29
- [16] Malhotra G, Abbasi A, Rhee M. Complications of transforaminal cervical epidural steroid injections. *Spine (Phila Pa 1976).* 2009 Apr 1;34(7):731-9
- [17] Choi EJ, Kim DH, Han WK, Lee HJ, Kang I, Nahm FS, Lee PB. Non-Particulate Steroids (Betamethasone Sodium Phosphate, Dexamethasone Sodium Phosphate, and Dexamethasone Palmitate) Combined with Local Anesthetics (Ropivacaine, Levobupivacaine, Bupivacaine, and Lidocaine): A Potentially Unsafe Mixture. *J Pain Res.* 2021 May 27;14:1495-1504
- [18] Guaraldi F, Gori D, Calderoni P, Castiello E, Pratelli L, Leporati M, Arvat E, Battaglia M. Comparative assessment of hypothalamic-pituitary-adrenal axis suppression secondary to intrabursal injection of different glucocorticoids: a pilot study. *J Endocrinol Invest.* 2019 Sep;42(9):1117-1124
- [19] Charalambous CP, Tryfonidis M, Sadiq S, Hirst P, Paul A. Septic arthritis following intra-articular steroid injection of the knee--a survey of current practice regarding antiseptic technique used during intra-articular steroid injection of the knee. *Clin Rheumatol.* 2003 Dec;22(6):386-90
- [20] McAlindon TE, LaValley MP, Harvey WF, Price LL, Driban JB, Zhang M, Ward RJ. Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis: A Randomized Clinical Trial. *JAMA.* 2017 May 16;317(19):1967-1975

- [21] Lana JFSD, da Fonseca LF, Macedo RDR, Mosaner T, Murrell W, Kumar A, Purita J, de Andrade MAP. Platelet-rich plasma vs bone marrow aspirate concentrate: An overview of mechanisms of action and orthobiologic synergistic effects. *World J Stem Cells*. 2021 Feb 26;13(2):155-167
- [22] Hurley ET, Sherman SL, Stokes DJ, Rodeo SA, Shapiro SA, Mautner K, Buford DA, Dragoo JL, Mandelbaum BR, Zaslav KR, Cole BJ, Frank RM; Members of the Biologics Association; Ahuja M, Anz AW, Chahla J, Chu CR, Cugat R, Espregueira-Mendes J, Farr J, Flanigan DC, Gobbi A, Gomoll AH, Grande DA, Hall MM, Horsch K, Koh JL, Kon E, Lattermann C, McIntyre LF, Murray IR, Muschler GF, Nakamura N, Namdari S, Piuze NS, Saris DBF, Sgaglione NA, Spindler KP, Tokish JM, Yanke AB. Experts Achieve Consensus on a Majority of Statements Regarding Platelet Rich Plasma Treatments for Treatment of Musculoskeletal Pathology. *Arthroscopy*. 2023 Aug 23:S0749-8063(23)00673-4.
- [23] Peng Y, Du L, Yang B, Fan D, Jia S, Zheng C. Efficacy of platelet-rich plasma and platelet-rich fibrin in arthroscopic rotator cuff repair: a systematic review and meta-analysis. *PM R*. 2023 Aug 1. doi: 10.1002/pmrj.13049. Epub ahead of print.
- [24] Moreno-Garcia A, Rodriguez-Merchan EC. Orthobiologics: Current role in Orthopedic Surgery and Traumatology. *Arch Bone Jt Surg*. 2022 Jul;10(7):536-542
- [25] Kersschot J, Intra-articular Glucose Injections for Orthoregeneration of Frozen Shoulder. A Clinical Case. *Medical Research Archives* 2023, 11(8)
- [26] Ferrie J, Kersschot J, Treatment of lateral ankle pain with glucopuncture: A clinical case. *World Journal of Advanced Research and Reviews*, 2023, 19(01), 1012–1016
- [27] Oloff LM, Wilhelm I, Vora NS. Orthobiologic Use in Sports Injuries. *Clin Podiatr Med Surg*. 2023 Jan;40(1):169-179
- [28] Noback PC, Donnelley CA, Yeatts NC, Parisien RL, Fleischli JE, Ahmad CS, Moorman CT, Trofa DP, Saltzman BM. Utilization of Orthobiologics by Sports Medicine Physicians: A Survey-based Study. *J Am Acad Orthop Surg Glob Res Rev*. 2021 Jan 6;5(1):e20.00185
- [29] O'Dowd A. Update on the Use of Platelet-Rich Plasma Injections in the Management of Musculoskeletal Injuries: A Systematic Review of Studies From 2014 to 2021. *Orthop J Sports Med*. 2022 Dec 9;10(12):23259671221140888
- [30] Andia I, Maffulli N. Biological Therapies in Regenerative Sports Medicine. *Sports Med*. 2017 May;47(5):807-828.
- [31] Wu TJ, Lin CY, Tsai CH, Huang YL, Tang CH. Glucose suppresses IL-1 β -induced MMP-1 expression through the FAK, MEK, ERK, and AP-1 signaling pathways. *Environ Toxicol*. 2018 Oct;33(10):1061-1068.
- [32] Maniquis-Smigel L, Dean Reeves K, Jeffrey Rosen H, Lyftogt J, Graham-Coleman C, Cheng AL, Rabago D. Short Term Analgesic Effects of 5% Dextrose Epidural Injections for Chronic Low Back Pain: A Randomized Controlled Trial. *Anesth Pain Med*. 2016; 6 (1): e42550
- [33] Pandey N, Nayak P, Gahnolia V, A Randomized Control Trial on Efficacy of Analgesic Effect of 5% Dextrose Caudal Epidural Injection for Non-specific Low Back Pain. *International Journal of Scientific Research*, 2021, 10 (9), 11-13
- [34] Lam KHS, Hung CY, Chiang YP, Onishi K, Su DCJ, Clark TB, Reeves KD. Ultrasound-Guided Nerve Hydrodissection for Pain Management: Rationale, Methods, Current Literature, and Theoretical Mechanisms. *J Pain Res*. 2020; 4 (13):1957-1968
- [35] Lam KHS, Lai WW, Ngai HY, Wu WKR. Practical Considerations for Ultrasound-Guided Hydrodissection in Pronator Teres Syndrome. *Pain Med*. 2022 Jan 3;23(1):221-223.
- [36] Lam KHS, Lai WW, Ngai HY, Wu WKR, Wu YT. Comment on the safety of the ultrasound-guided hydrodissection technique for carpal tunnel syndrome. *J Ultrasound*. 2022 Feb 16
- [37] Kersschot J, *Glucopuncture: A Clinical Guide to Regional Glucose 5% Injections*, BP International, 2023, pp 33-38
- [38] Lamens T, Kersschot J, Hamstring Injury Rehabilitation in the Female Athlete. A Clinical Case. *J Ortho Physio* 2023, 1(1): 1-4
- [39] Kersschot J, Karavani I. Isotonic Glucose Injections for Postherpetic Neuralgia in the Elderly. *Cureus*. 2022 Sep 29;14(9):e29740. doi: 10.7759/cureus.29740
- [40] Kersschot J, *Glucopuncture: A Clinical Guide to Regional Glucose 5% Injections*, (e-book) BP International, 2023

- [41] Kersschot J, *Glucopuncture: A Clinical Guide to Regional Glucose 5% Injections*, BP International, 2023, p 20
- [42] Cherng J-H, Chang S-J, Tsai H-D, Chun C-F, Fan G-Y, Reeves KD, Lam KHS, Wu Y-T. The Potential of Glucose Treatment to Reduce Reactive Oxygen Species Production and Apoptosis of Inflamed Neural Cells In Vitro. *Biomedicines*. 2023; 11(7):1837.
- [43] Han DS, Lee CH, Shieh YD, Chang CT, Li MH, Chu YC, Wang JL, Chang KV, Lin SH, Chen CC. A role for substance P and acid-sensing ion channel 1a in prolotherapy with dextrose-mediated analgesia in a mouse model of chronic muscle pain. *Pain*. 2022 May 1;163(5):e622-e633
- [44] Chan O, Havard B, Morton S, Pritchard M, Maffulli N, Crisp T, Padhiar N, Perry JD, King J, Morrissey D. Outcomes of prolotherapy for intra-tendinous Achilles tears: a case series. *Muscles Ligaments Tendons J*. 2017 May 10;7(1):78-87
- [45] Hauser RA, Lackner JB, Steilen-Matias D, Harris DK. A Systematic Review of Dextrose Prolotherapy for Chronic Musculoskeletal Pain. *Clin Med Insights Arthritis Musculoskelet Disord*. 2016 Jul 7;9:139-59
- [46] Kersschot J, *Glucopuncture: A Clinical Guide to Regional Glucose 5% Injections*, BP International, 2023, pp 13-14