Cukurova Medical Journal
ÇUKUROVA ÜNİVERSİTESİ TIP FAKÜLTESİ

Cukurova Med J 2018;43(Suppl 1):70-74
DOI: 10.17826/cumj.453280

ARAŞTIRMA / RESEARCH

Effect of hyperosmolar dextrose injections for treatment of Achilles tendinopathy

Aşil tendinopatisi tedavisinde hiperosmolar dekstroz enjeksiyonlarının etkinliği

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Cukurova Medical Journal 2018;43(Suppl 1):70-74

Abstract

Purpose: Achilles tendinopathy is a degenerative, not an inflammatory, condition. It is one of the most frequently injured tendons in the human body despite its strength, due to repetitive strain acting on the tendon. Hyperosmolar dextrose injections also called prolotherapy, is a regenerative injection technique using stimulation of regenerative processes for treatment of chronic musculoskeletal conditions . The aim of study was to investigate the effect of prolotherapy in patients with non-insertional Achilles tendinopathy in terms of pain.

Materials and Methods: This retrospective study is comprised of 18 consecutive patients above 18 years of age, who were diagnosed as Achilles tendinopathy. Visual analogue scale (VAS) was used to assess pain intensity in the last 24 h. Injections were applied to tender points in the subcutaneous tissues adjacent to the affected tendon. All evaluations were done before treatment, at 4weeks and 12 weeks after treatment.

Results: The study sample consisted of 18 adults (12 female and 6 male). Subjects' ages ranged from 18 to 52 years, with a mean age of 34.89 ± SD 12.04 years. A statistically significant improvement in the VAS scale was demonstrated.

Conclusion: Hyperosomolar dextrose injections, irrespective of dextrose concentration is an efficient alternative regenerative treatment modality for achilles tendinopathy. Thus, it should be considered as a treatment option for chronic musculoskeletal conditions, particularly tendinopaties.

Key words: Prolotherapy, achilles, dextrose, tendinopathy.

Öz

Amaç: Aşil tendinopati, inflamatuar değil, dejeneratif bir durumdur. Tendon üzerinde etkili olan tekrarlayan gerginlik nedeniyle, insan vücudundaki en sık hasarlanan tendonlardan biridir. Proloterapi olarak ta adlandırılan hiperozmolar desktroz enkesiyonları, kronik kas iskelet sistemi hastalıklarının tedavisi için rejenerasyon süreçlerini uyararak etkili olan rejeneratif bir enjeksiyon tekniğidir. Çalışmanın amacı insersiyo dışı aşil tendinopatisi olan hastalarda proloterapinin ağrı açısından etkisini araştırmaktır.

Gereç ve Yöntem: Bu retrospektif çalışmada, 18 yaşın üstünde, Aşil tendinopatisi tanısı konan 18 ardışık hasta üzerinde yapılmıştır. Ağrı şiddetini değerlendirmek için görsel analog skala (VAS) kullanıldı. Enfeksiyonlar etkilenen tendonun ciltaltı dokularda tetik noktalarına uygulandı. Tüm değerlendirmeler tedaviden önce 4 hafta ve 12 hafta sonra yapıldı.

Bulgular: Çalışma örneği 18 yetişkin (13 kadın ve 6 erkek) idi. Deneklerin yaşları 10 ila 52 arasında değişmekte olup, yaş ortalaması 34.89±12.04 idi. VAS ölçeğinde istatistiksel olarak anlamlı bir iyileşme görüldü.

Sonuç: Hiperozmolar dekstroz enjeksiyonları, dekstroz konsantrasyonundan bağımsız olarak , Aşil tendinopati tedavisinde etkili bir rejeneratif tedavi modalitesidir. Bu nedenle kronik kas iskelet sistemi rahatsızlıklarında, özellikle tendinopatiler için, bir tedavi seçeneği olarak düşünülmelidir.

Anahtar kelimeler: Proloterapi, aşil, dekstroz, tendinopati.

INTRODUCTION

Achilles tendinopathy (AT) is defined as a clinical syndrome characterized by three elements, pain, swelling and functional impairment, corresponding to the histological pattern of "tendi-nosis", a term that indicates a degenerative non-inflammatory process with a disorganized collagen structure[1]. The

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Geliş tarihi/Received: 21.10.2017 Kabul tarihi/Accepted: 2.1.2018 Published online: 9.9.2018

etiology and pathogenesis as well as the source of pain and the background of the pain mechanisms in AT, have not yet been scientifically clarified[2]. The etiology is considered to be multifactorial[3]. Systemic diseases such as lupus or rheumatoid arthritis, Fluoroquinolone antibiotics have been implicated as causes of tendinopathy of the achilles[4]. Systemic factors, including hypertension and hormone replacement therapy, are causes of tendinopathy in women, whereas obesity is an etiologic factor in both men and women because of diminished local vascularity. Foot pronation has been proposed as a mechanical cause of AT[5,6]. Non-insertional AT is often managed conservatively. Conservative treatment includes immobilization. Heel lifts may also provide some symptomatic relief. Rest, non steroid antiinflamatory drugs (NSAIDs), and ice are also helpful to reduce pain and inflammation. Physical therapy with modalities may also be helpful. Full-length semi rigid orthotics can be used to correct excessive pronation. Autologous blood injection (Platelet-rich plasma) shown some promise in treating AT[7]. Cortisone injections should be avoided because they could lead to a rupture in Achilles tendon.

Prolotherapy is a regenerative injection technique for treatment of a wide range of musculoskeletal pathologies that is becoming popular nowadays[8]. The main point of prolotherapy in chronic musculoskeletal conditions is the stimulation of regenerative processes in the joint that will facilitate the restoration of joint stability by augmenting the tensile strength of joint stabilizing structures[9]. Different prolotherapy agents may be used such as dextrose with altered concentrations, combinations of polidocanol, manganese, zinc, human growth hormone, pumice, ozone, glycerin, phenol, platelet-rich plasma (PRP), bone marrow, or adipose tissue[9].

The aim of this study was to investigate the effect of hyperosmolar dextrose injections, a type of prolotherapy, in patients with non-insertional AT in terms of pain.

MATERIALS AND METHODS

This retrospective study is comprised of 18 consecutive patients above 18 years of age, who were diagnosed as AT in a private orthopedics clinic. This study was performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Patient files of the private clinics has been evaluated for inclusion and exclusion criteria. The inclusion criteria were diagnosis of unilateral or bilateral mid-portion AT. The diagnosis of AT was made clinically on the basis of localized pain at Achilles tendon between 2 and 7 cm proximal to the calcaneal on palpation with a negative Simmonds' test. The criteria for exclusion were presence of medical conditions that may interfere with healing process, neurological disorders, allergy to anesthetic or proliferant solutions and acute tendinitis or symptoms associated with acute trauma. Six patients eligible for initial evaluation were excluded due to exclusion criteria.

Measures

Demographic data of the subjects; age, side of involvement, duration of symptoms, previous treatments were derived from chart review. Visual analogue scale for pain (VAS) has been used to assess pain intensity in the last 24 h routinely in our clinic. The VAS is a unidimensional scale used for measurement of pain intensity. It has been widely used in different adult populations. Scores of VAS which has been recorded before treatment, at 4weeks and 12 weeks after treatment, have been used in assessment of efficacy of prolotherapy or hyperosmolar dextrose injections in this retrospective study.

Injection methods

Injections were applied to tender points in the subcutaneous tissues adjacent to the affected tendon with a solution consisting of 12,5 % glucose/0.1% lidocaine weekly for four weeks, using the technique described by Lyftogt[10]. Topical analgesia was not used.

Statistical analysis

Statistical evaluation was performed using the SPSS 22.0 program. The mean, standard deviation, minimum and maximum values were used to define the data. Kolmogorov Smirnov test was used to determine if the data were close to the normal distribution. The Wilcoxon test was used to compare the VAS values in the group. The $P < 0.05$ level was considered statistically significant.

RESULTS

The study sample consisted of 18 adults (13 female and 5 male). Subjects' ages ranged from 18 to 52 years, with a mean age of 34.89 ± SD 12.04 years. Demographic features of the subjects are given in Table 1. In all of the patients in the study group, multiple previous conservative treatments (>2) had failed.

The treatments included physiotherapy (*n*=14), acupuncture (*n*=5), shockwave therapy (*n*=1), sonography (*n*=2), steroid injections (*n*=4), orthotics (*n*=7), medical treatment (*n*=8) and kinesiotape (*n*=7). Statistically no significant difference was found between the results of male and female patients.

A statistically significant improvement in the VAS scale was demonstrated; initial score 8.83 ± 0.8 (minimum: 7, maximum: 10), 4.94 ± 0.78 after 4 weeks from the last injection (minimum:4, maximum: 6), and 1.1 ± 1.1 after 12 weeks from the last injection (minimum: 0, maximum: 3) (P <0.001). Statistically no significant difference was found between the results of male and female patients. Satisfaction level of the patients after the treatment are in Table 2. No adverse reactions besides prolonged local pain at injection sites have been reported.

Table 1. Demographic features of the subjects

Variable	N =18	mean±SD
Age (years)		34.89 ± 12.04
Gender		
Female	12	
Male	6	
Symptom duration (years)		1.6±2.4
Side of involvement		
Right	14	
Left	4	
Previous treatments		
Physiotherapy	14	
Orthotics	7	
Corticosteroid injection	4	
Medical treatment	8	
Kinesiotape	7	
Shock Wave	1	
Sonography	2	

Table 2. Satisfaction level of the patients after the treatment

Number of Patients	Symptoms				Satisfaction Level (%)
	None	Mild	Moderate	Severe	
12	12				95-100
3	1	2			80-90
1		1			70
2		1	1		50
Total:18			1		

DISCUSSION

Prolotherapy is a nonsurgical regenerative injection technique, formalized by Dr. George Hackett in the 1950s. In clinical practice, it has been used as a practical and efficacious therapeutic strategy to treat ligamentous laxity and related musculoskeletal and arthritic conditions, including osteoarthritis (OA), musculoskeletal pain, joint pain and laxity, chronic low back pain, refractory lateral epicondylithis, painful overuse tendinopathy, refractory, disabling low back pain, and refractory tendinopathies[11,12].

The mechanism of prolotherapy is not completely understood. However, it is hypothesized that this method of intentional small scale "therapeutic trauma" at the injection site producing a controlled

inflammatory response, that initiate a local inflammatory cascade, which triggers the release of growth factors and collagen deposition. This is accomplished when induced cytokines mediate chemomodulation, which leads to proliferation and strengthening of new connective tissue, joint stability, and a reduction in pain and dysfunction [13-15].

Pain reduction is also hypothesized to be related to the elimination of nerve fibers that are associated with neovessels or collagen fibril disruption and subsequent healing response[16]. Dextrose, with different concentrations, is the most common prolotherapy agent used in clinical practice including treatment of AT. Other prolotherapy agents used are combinations of polidocanol, manganese, zinc, human growth hormone, pumice, ozone, glycerin, or phenol. Autologous cellular solutions may also be used, such as platelet-rich plasma (PRP), bone marrow, or adipose tissue[9].

Dextrose is an osmotic agent creating cellular dysfunction and loss of membrane integrity via increases in osmotic pressure from the introduction of the hypertonic solution. Dextrose, also, elicit a proliferant cellular response by inducing inflammation, subsequent growth factor production leading to increased fibroblast proliferation (either locally or systemic), and increased production of extracellular matrix[17]. Dextrose prolotherapy is a safe therapy with few adverse effects reported in the reviewed studies. No serious complications were observed, including nerve damage, pneumothorax, and infection. Dextrose itself is extremely safe, even with intravenous administration[9]. Independent of location, tendinopathies caused by repetitive motion, and overuse injury have similar characteristics[9]. Tendinopathies of Achilles tendon common elbow extensor, and patellar tendon share similar histological, sonographic, and clinical features, representing an underlying noninflammatory painful degenerative pathophysiology[9]. There is a growing consensus, regarding the efficacy of dextrose prolotherapy as an alternative treatment to surgery for patients with chronic tendinopathy.

In a double-blinded study, conducted by Topol, young athletes aged 9–17 years with Osgood–Schlatter disease were randomized to dextrose injection, control injection, or to a non-injection (supervised exercise) group. Dextrose prolotherapy patients had substantially greater pain reduction during sport activity than either group at follow-up, with many pain-free during sport involvement[18]. Scarpone et al, in their randomized controlled trial study on the effect of hyperosmolar dextrose prolotherapy on resting elbow pain in at least 6 months of refractory lateral epichondylitis, revealed improved pain scores that maintained at long-term follow-up, compared with control subjects[19]. Carayannopoulos et al., compared the efficacy of hyperosmolar dextrose prolotherapy versus corticosteroid injection for the treatment of chronic lateral epicondylitis in their randomized controlled trial reporting longer efficacy duration of improvements in the hyperosmolar dextrose prolotherapy then corticosteroid injection[20].

For AT, several studies of hyperosmolar dextrose prolotherapy have been conducted. Maxwell et al. demonstrated a good clinical response in patients with long-standing refractory Achilles tendinosis with significant reduction in tendon pain at rest and during tendon-loading activities treated with hyperosmolar (25%) dextrose under sonographic guidance[21].Ryan et al. reported favorable results with a similar study[17].

Yelland et al. conducted an single-blinded randomised clinical trial in symptoms related to Achilles tendinosis in subjects randomized to hyperosmolar (25%) dextrose prolotherapy, eccentric loading exercises, and a combination group of prolotherapy and eccentric loading exercises. Participants who received combined treatment were found to have better outcomes than either treatment alone[22]. In current study, we used a lower concentration of dextrose (12,5%) and achieved similar results treating patients with Achilles Tendinopathy. This result is consistent with the literature. In their study, Mustafa et al study reported that there is no superiority of any concentration of dextrose over the others in TMJ prolotherapy, and all treatment procedures were efficient in improvement of clinical symptoms related to TMJ hypermobility unless dextrose concentration is hypertonic[23]. Similarly, Hakala and Ledermann stated that that the concentration of dextrose is not critical as long as it is hypertonic and can begin the regenerative process[24]. This study has some limitations are the retrospective design of our study, small sample size and no control group.

In conclusion; hyperosmolar dextrose injections as a type o prolotherapy, irrespective of dextrose concentration, is an efficient alternative regenerative

treatment modality for AT. Thus, it should be considered as a treatment option for chronic musculoskeletal conditions, particularly tendinopaties.

REFERENCES

1. van Dijk CN, van Sterkenburg MN, Wiegerinck JI, Karlsson J, Maffulli N. Terminology for Achilles tendon related disorders. Knee Surg Sports Traumatol Arthrosc. 2011;19:835–41.
2. Magnan B, et al. The pathogenesis of Achilles tendinopathy: A systematic review. Foot Ankle Surg. 2014;20:154-9.
3. Sorosky B, Press J, Plastaras C, Rittenberg J. The practical management of Achilles tendinopathy. ClinJ Sport Med. 2004;14:40-44.
4. Parmar C, Meda KP. Achilles tendon rupture associated with combination therapy of levofloxacin and steroid in four patients and a review of the literature. Foot Ankle Int. 2007;28:1287–9.
5. Holmes GB, Lin J. Etiologic factors associated with symptomatic Achilles tendinopathy. Foot Ankle Int. 2006;27:952–9.
6. Weinfeld SB. Achilles tendon disorders. Med Clin North Am. 2014;98:331-8.
7. Monto RR. Platelet rich plasma treatment for chronic Achilles tendinosis. Foot Ankle Int. 2012;33:379–85.
8. Sanderson LM, Bryant A. Effectiveness and safety of prolotherapy injections for management of lower limb tendinopathy and fasciopathy: a systematic review. J Foot Ankle Res. 2015;8:57.
9. 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;9:139-59.
10. Lyftogt J. Prolotherapy and Achilles tendinopathy: a prospective pilot study of an old treatment. Australas Musculoskel Med. 2005;10:16–19.
11. Kim SR, Stitik TP, Foye PM, Greenwald BD, Campagnolo DI. Critical review of prolotherapy for osteoarthritis, low back pain, and other musculoskeletal conditions: a physiatric perspective. Am J Phys Med Rehabil. 2004;83:379–89.
12. Kesikburun S , Yaşar E , Aras B , Kelle B , Yılmaz B. Rotator manşon tendinopatisine bağlı hemiplejik omuz ağrısında proloterapinin etkinliği: pilot çalışma. Cukurova Medical Journal. 2017;42:13-8.
13. Linetsky FS, Manchikanti L. Regenerative injection therapy for axial pain. Tech Reg Anesth Pain Manage. 2005;9:40–9.
14. Goswami A. Prolotherapy. J Pain Palliat Care Pharmacother. 2012;26:376–8.
15. DeChellis DM, Cortazzo MH. Regenerative medicine in the field of pain medicine: prolotherapy, platelet-rich plasma therapy, and stem cell therapy-theory and evidence. Tech Reg Anesth Pain Manag. 2011;15:74–80.
16. Zeisig E, Ohberg L, Alfredson H. Extensor origin vascularity related to pain in patients with tennis elbow. Knee Surg Sports Traumatol Arthrosc. 2006; 14: 659–63.
17. Ryan M, Wong A, Taunton J. Favorable outcomes after sonographically guided intratendinous injection of hyperosmolar dextrose for chronic insertional and midportion achilles tendinosis. AJR Am J Roentgenol. 2010;194:1047–53.
18. Topol GA, Podesta LA, Reeves KD, Raya MF, Fullerton BD, Yeh HW. Hyperosmolar dextrose injection for recalcitrant Osgood–Schlatter disease. Pediatrics. 2011;128:e1121–8.
19. Scarpone M, Rabago D, Arbogest J, Snell E, Zgierska A. The efficacy of prolotherapy for lateral epicondylosis: a pilot study. Clin J Sports Med. 2008;18:248-54.
20. Carayannopoulos A, Borg-Stein J, Sokolof J, Meleger A, Rosenberg D. Prolotherapy versus corticosteroid ınjections for the treatment of lateral epicondylosis a randomized controlled trial. PM R 2011;3:706-15.
21. Maxwell NJ, Ryan MB, Taunton JE, Gillies JH, Wong AD. Sonographically guided intratendinous injection of hyperosmolar dextrose to treat chronic tendinosis of the Achilles tendon: a pilot study. AJR Am J Roentgenol. 2007;189:w215–20.
22. Yelland MJ, Sweeting KR, Lyftogt JA, Ng SK, Scuffham PA, Evans KA., Prolotherapy injections and eccentric loading exercises for painful Achilles tendinosis: a randomised trial. Br J Sports Med. 2011;45:421-8.
23. Mustafa R, Güngörmüş M, Mollaoğlu N. Evaluation of the efficacy of different concentrations of dextrose prolotherapy in temporomandibular joint hypermobility treatment. J Craniofac Surg. 2018;29:e461-e5.
24. Hakala R, Ledermann KM. The use of prolotherapy for temporomandibular joint dysfunction. J Prolother. 2010;2:439–46.