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AMAÇ VE KAPSAM

Türk Osteoporoz Dergisi, Türkiye Osteoporoz Derneği'nin süreli yayın organı olup, osteoporoz ve metabolik kemik hastalıkları içerikli, yayın dili Türkçe ve İngilizce olan, bağımsız ve önyargısız hakemlik (peer-review) ilkelerine dayanan uluslararası, periyodik bir dergidir. Türk Osteoporoz Dergisi, Nisan, Ağustos ve Aralık aylarında olmak üzere yılda 3 sayı çıkar.

Türk Osteoporoz Degisi'nin hedefi uluslararası düzeyde nitelikli, sürekli ve osteoporoz konusunda özgün bir periyodik olarak klinik ve bilimsel açıdan en üst düzeyde orijinal araştırmaları yayınlamaktır. Bununla birlikte eğitim ile ilgili temel yenilikleri kapsayan derlemeler, editöryel kısa yazılar, olgu sunumları, orijinal görüntüler ve geniş fiziksel tıp, romatoloji, rehabilitasyon ve jinekoloji kesimlerinin konular hakkındaki deneyimlerini ve eleştirilerini içeren mektuplar ve sosyal konulu yazılar yayınlamaktır.

Osteoporoz ve kemik hastalıklarına ilgi duyan birinci basamak tıp hizmeti veren pratisyen hekim, iç hastalıkları, jinekoloji, romatoloji ve fiziksel tıp ve rehabilitasyon uzmanlarının "bilmesi gerekli olanları" iyice saptayarak; bunları Türk Osteoporoz Dergisi'nde bulmaları için gerekli düzenlemeler yapılacaktır.

Türk Osteoporoz Dergisi, Emerging Sources Citation Index (ESCI), DOAJ, EBSCO Database, Gale/Cengage Learning, CINAHL, Index Copernicus, Embase, Scopus, Proquest, J-Gate Academic Keys, TÜBİTAK/ULAKBİM, Hinari, Oare, Ardi, Goali, Türk Medline Ulusal Atıf İndeksi tarafından indekslenmektedir.

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Derginin açık erişim politikası 'Budapest Open Access Initiative(BOAI) kuralları esas alınarak uygulanmaktadır.

Açık Erişim, "[hakem değerlendirmesinden geçmiş bilimsel literatürün], İnternet aracılığıyla; finansal, yasal ve teknik engeller olmaksızın, serbestçe erişilebilir, okunabilir, indirilebilir, kopyalanabilir, dağıtılabilir, basılabilir, taranabilir, tam metinlere bağlantı verilebilir, dizinlenebilir, yazılıma veri olarak aktarılabilir ve her türlü yasal amaç için kullanılabilir olması"dır. Çoğaltma ve dağıtım üzerindeki tek kısıtlama yetkisi ve bu alandaki tek telif hakkı rolü; kendi çalışmalarının bütünlüğü üzerinde kontrol sahibi olabilmeleri, gerektiği gibi tanınmalarının ve alıntılanmalarının sağlanması için, yazarlara verilmelidir.

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Türk Osteoporoz Dergisi, ülkemizde görev yapan fiziksel tıp ve rehabilitasyon uzmanlarına, akademisyenlerine ve osteoporoz'a ilgi duyan diğer tüm tıp branşlarına mensup uzmanlara ücretsiz olarak dağıtılmaktadır. Derginin tüm sayılarına ücretsiz olarak www.turkosteoporozdergisi.org adresinden tam metin ulaşılabilir. Dergiye abone olmak isteyen kişiler Türkiye Osteoporoz Derneği'ne başvurmalıdır.

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AIMS AND SCOPE

Turkish Journal Of Osteoporosis is the regular publishing organ of the Turkish Osteoporosis Society. This periodical journal covers osteoporosis and metabolic bone diseases subjects. It is a periodic international journal, published in Turkish and English languages and is independent, being based on peer-review principles. The journal is published 3 times per year (April, August and December).

The aim of the journal "Turkish Journal Of Osteoporosis" is to continuously publish original research papers of the highest scientific and clinical values specifically on osteoporosis, on an international level. Additionally, reviews on basic developments in education, editorial short notes, case reports, original views, letters from the fields of physical medicine, rheumatology, rehabilitation, gynaecology containing experiences and comments as well as social subjects are published.

Thing that must be known' subjects for general practitioners giving first line medical service who are interested in osteoporosis and metabolic bone diseases, specialists in internal medicine, gynecology, rheumatology and physiotherapy will be determined It will then be possible to make the necessary adjustments to the journal "Turkish Journal Of Osteoporosis" according to their needs.

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Turkish Journal Of Osteoporosis is sent free to physiotherapy specialists, academicians in our country as well as other specialists in all branches of medicine interested in osteoporosis. All published volumes can be reached full text without fee through the web site www.turkosteoporozdergisi.org. Those who wish to subscribe to the journal should apply to the Turkish Osteoporosis Association.

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YAZARLARA BİLGİ

Türk Osteoporoz Dergisi, Türkiye Osteoporoz Derneği'nin resmi yayın organıdır.
Dergi, osteoporoz, metabolik kemik hastalıkları ve rehabilitasyon alanlarını ilgilendiren tüm konulardaki yazıları yayınlar. Dergide orijinal makalelerin dışında derleme yazıları, orijinal olgu sunumları, editöre mektuplar, bilimsel mektuplar, eğitim yazıları, yeni literatür özetleri ve gelecek kongre/toplantı duyuruları da yayınlanır.
Dergide yayınlanacak yazıların seçimine temel teşkil eden hakem heyeti, dergide belirtilen danışmanlar ve gerekirse yurt içi/dışı otörler arasından seçilir.
Yazılarda Türk Dil Kurumu'nun Türkçe Sözlüğü ve Yazım Kılavuzu temel alınmalıdır. İngilizce yazılan yazılar özellikle desteklenmektedir.
Makaleletin formatı 'Uniform requirements for Manuscripts Submitted to Biomedical Journals' (http.//www.icmje.org) kurallarına göre düzenlenmelidir.
Editör tarafından, etik kurul onayı alınması zorunluluğu olan klinik araştırmalarda onay belgesi talep edilecektir. İnsan üzerinde yapılan deneysel araştırmaların bildirildiği yazıların metnin içerisinde, yazarların bu araştırmanın prosedürünün sorumlu olan etik kurulun insan üzerine deney yapılma etik standartlarına (kurumsal ve ulusal) ve 2013 yılında revize edilen1964 Helsinki Deklarasyonuna uyulduğunu ve hastaların onaylarının alındığını belirtilmelidir. Hayvan üzerinde yapılan deneysel araştırmalarda, yazarlar yapılan prosedürlerin hayvanlar haklarına uygun olduğunu belirtilip (Guide for the care and use of laboratory animals. www.nap.edu/catalog/5140html) ayrıca etik kurulu onayı'nı alınmalıdır.
Yazıların içeriğinden ve kaynakların doğruluğundan yazarlar sorumludur.
Yazarlar, gönderdikleri çalışmanın başka bir dergide yayınlanmadığı ve/veya yayınlanmak üzere incelemede olmadığı konusunda garanti vermelidir. Daha önceki bilimsel toplantılarda 200 kelimeyi geçmeyen özet sunumlarının yayınları, durumu belirtilmek koşulu ile kabul edilebilir.
Tüm yazarların çıkar çatışma olmadığını, bilimsel katkı ve sorumluluklarını bildiren toplu imza ile yayına katılmalıdır.
Tüm yazılar, editör ve ilgili editör yardımcıları ile en az üç danışman hakem tarafından incelenir. Yazarlar, yayına kabul edilen yazılarda, metinde temel değişiklik yapmamak kaydı ile editör ve yardımcılarının düzeltme yapmalarını kabul etmiş olmalıdırlar.

Genel Kurallar

Yazılar sadece "online" olarak kabul edilmektedir. Yazarların makale gönderebilmesi için Journal Agent web sayfasına (www.journalagent.com/osteoporoz) kayıt olup şifre almaları gereklidir. Bu sistem on-line yazı gönderilmesine ve değerlendirilmesine olanak tanımaktadır. Makale gönderimi yapılırken sorumlu yazarın ORCID (Open Researcher ve Contributor ID) numarası belirtilmelidir. http://orcid.org adresinden ücretsiz olarak kayıt oluşturabilir.
Bu sistem ile toplanan makaleler ICMJE-www.icmje.org, Index Medicus (Medline/PubMed) ve Ulakbim-Türk Tıp Dizini kurallarına uygun olarak sisteme alınmakta ve arşivlenmektedir. Yayına kabul edilmeyen yazılar, sanatsal resimler hariç geriye yollanmaz.
Yazının tümünün 5000 kelimeden az olması gerekmektedir. İlk sayfa hariç tüm yazıların sağ üst köşelerinde sayfa numaraları bulunmalıdır. Yazıda, konunun anlaşılmasında gerekli olan sayıda ve içerikte tablo ve şekil bulunmalıdır.
Başlık sayfası, kaynaklar, şekiller ve tablolar ile ilgili kurallar bu dergide basılan tüm yayın türleri için geçerlidir.

Orijinal Makaleler

1) Başlık Sayfası (Sayfa 1)
Yazı başlığının, yazar(lar)ın bilgilerinin, anahtar kelimelerin ve kısa başlıkların yer aldığı ilk sayfadır.
Türkçe yazılarda, yazının İngilizce başlığı da mutlaka yer almalıdır; yabancı dildeki yayınlarda ise yazının Türkçe başlığı da bulunmalıdır. Türkçe ve İngilizce anahtar sözcükler ve kısa başlık da başlık sayfasında yer almalıdır.
Yazarların isimleri, hangi kurumda çalıştıkları ve açık adresleri belirtilmelidir. Yazışmaların yapılacağı yazarın adresi de ayrıca açık olarak belirtilmelidir. Yazarlarla iletişimde öncelikle e-posta adresi kullanılacağından, yazışmaların yapılacağı yazara ait e-posta adresi belirtilmelidir. Buna ek olarak telefon ve faks numaraları da bildirilmelidir.
Çalışma herhangi bir bilimsel toplantıda önceden bildirilen koşullarda tebliğ edilmiş ya da özeti yayınlanmış ise bu sayfada konu ile ilgili açıklama yapılmalıdır.
Yine bu sayfada, dergiye gönderilen yazı ile ilgili herhangi bir kuruluşun desteği sağlanmışsa belirtilmelidir.
2) Özet (Sayfa 2)
İkinci sayfada yazının Türkçe ve İngilizce özetleri (her biri için en fazla 200 sözcük) ile anahtar sözcükler belirtilmelidir.
Özet bölümü; Amaç, Gereç ve Yöntem, Bulgular, Sonuç şeklinde alt başlıklarla düzenlenir. Derleme, vaka takdimi ve eğitim yazılarında özet bölümü alt başlıklara ayrılmaz. Bunlarda özet bölümü, 200 kelimeyi geçmeyecek şekilde amaçlar, bulgular ve sonuç cümlelerini içermelidir.
Özet bölümünde kaynaklar gösterilmemelidir. Özet bölümünde kısaltmalardan mümkün olduğunca kaçınılmalıdır. Yapılacak kısaltmalar metindekilerden bağımsız olarak ele alınmalıdır.
3) Metin (Özetin uzunluğuna göre Sayfa 3 veya 4'den başlayarak)
Genel Kurallar bölümüne uyunuz.
Metinde ana başlıklar şunlardır: Giriş, Gereç ve Yöntem, Bulgular, Tartışma.
Giriş bölümü çalışmanın mantığı ve konunun geçmişi ile ilgili bilgiler içermelidir. Çalışmanın sonuçları giriş bölümünde tartışılmamalıdır.
Gereç ve yöntem bölümü çalışmanın tekrar edilebilmesi için yeterli ayrıntılar içermelidir. Kullanılan istatistik yöntemler açık olarak belirtilmelidir.
Bulgular bölümü de çalışmanın tekrar edilebilmesine yetecek ayrıntıları içermelidir.
Tartışma bölümünde, elde edilen bulguların doğru ve ayrıntılı bir yorumu verilmelidir. Bu bölümde kullanılacak literatürün, yazarların bulguları ile direkt ilişkili olmasına dikkat edilmelidir.
Teşekkür mümkün olduğunca kısa tutulmalıdır. Çalışma için bir destek verilmişse bu bölümde söz edilmelidir.
Çalışmanın kısıtlılıkları başlığı altında çalışma sürecinde yapılamayanlar ile sınırları ifade edilmeli ve gelecek çalışmalara ilişkin öneriler sunulmalıdır.
Sonuç başlığı altında çalışmadan elde edilen sonuç vurgulanmalıdır.
Metinde fazla kısaltma kullanmaktan kaçınılmalıdır. Tüm kısaltılacak terimler metinde ilk geçtiği yerde parantez içinde belirtilmelidir. Özette ve metinde yapılan kısaltmalar birbirinden bağımsız olarak ele alınmalıdır. Özet bölümünde kısaltması yapılan kelimeler, metinde ilk geçtiği yerde tekrar uzun şekilleri ile yazılıp kısaltılmalıdırlar.
4) Kaynaklar
Kaynakların gerçekliğinden yazarlar sorumludur.
Kaynaklar metinde geçiş sırasına göre numaralandırılmalıdır. Kullanılan kaynaklar metinde parantez içinde belirtilmelidir.
Kişisel görüşmeler, yayınlanmamış veriler ve henüz yayınlanmamış çalışmalar bu bölümde değil, metin içinde şu şekilde verilmelidir: (isim(ler), yayınlanmamış veri, 19..).
Kaynaklar listesi makale metninin sonunda ayrı bir sayfaya yazılmalıdır. Altıdan fazla yazarın yer aldığı kaynaklarda 6. isimden sonraki yazarlar için "et al" ("ve ark") kısaltması kullanılmalıdır. Dergi isimlerinin kısaltmaları Index Medicus'taki stile uygun olarak yapılır. Tüm referanslar Vancouver sistemine göre aşağıdaki şekilde yazılmalıdır.
a) Standart makale:
Intiso D, Santilli V, Grasso MG, Rossi R, Caruso I. Rehabilitation of walking with electromyographic biofeedback in foot-drop after stroke. Stroke 1994;25:1189-92.
b) Kitap:
Getzen TE. Health economics: fundamentals of funds. New York: John Wiley & Sons; 1997.
c) Kitap Bölümü:
Porter RJ, Meldrum BS. Antiepileptic drugs. In: Katzung BG, editor. Basic and clinical pharmacology. 6th ed. Norwalk, CN: Appleton and Lange; 1995. p. 361-80.
Birden fazla editör varsa: editors.
d) Toplantıda sunulan makale:
Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Reinhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. p. 1561-5.
e) Elektronik formatta makale:
Morse SS. Factors in the emergence of infectious disease. Emerg Infect Dis [serial online] 1995 1(1):[24 screens]. Available from:s URL:http://www/cdc/gov/ncidoc/ EID/eid.htm. Accessed December 25, 1999.
f) Tez:
Kaplan SI. Post-hospital home health care: the elderly access and utilization (thesis). St. Louis (MO): Washington Univ; 1995.
5) Tablolar-grafikler-şekiller-resimler
Tüm tablolar, grafikler veya şekiller ayrı bir kağıda basılmalıdır. Her birine metinde geçiş sırasına göre numara verilmeli ve kısa birer başlık yazılmalıdır. Kullanılan kısaltmalar alt kısımda mutlaka açıklanmalıdır. Özellikle tablolar metni açıklayıcı ve kolay anlaşılır hale getirme amacı ile hazırlanmalı ve metnin tekrarı olmamalıdır. Başka bir yayından alıntı yapılıyorsa yazılı baskı izni birlikte yollanmalıdır. Fotoğraflar parlak kağıda basılmalıdır. Çizimler profesyonellerce yapılmalı ve gri renkler kullanılmamalıdır.

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3) Editöre Mektuplar:
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5) Eğitim Yazıları:
Bu kategoride otörler osteoporoz, metabolik kemik hastalıkları ve rehabilitasyon konularındaki güncel bilgileri özetlerler.

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Türk Osteoporoz Dergisi

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Orijinal Araştırmalar / *Original Investigations*

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Rotator Kaf Tendon Patolojilerinde Ultrasonografi Rehberliğinde Uygulanan Plateletten Zengin Plazma ve Kortizon Enjeksiyonlarının Karşılaştırılması

Comparison of Platelet-rich Plasma and Cortisone Injections Administered Under Ultrasonography Guidance in Rotator Cuff Tendon Pathologies

Volkan Subaşı
Özel Dermancan Tıp Merkezi, Fiziksel Tıp ve Rehabilitasyon Kliniği, Adana, Türkiye

Öz

Amaç: Rotator kaf tendon patolojileri omuz ağrısı yapan nedenler arasında en sık saptanan hastalık grubunu oluşturmaktadır. Rotator kaf sendromu tanısı ile polikliniğimize başvuran hastalara uygulanan plateletten zengin plazma (PRP) ve kortizon tedavilerinin sonuçlarının karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem: Çalışmaya ileri derecede omuz hareket kısıtlılığı olmayan, 3 aydan uzun süreli omuz ağrısı olan toplam 40 hasta dahil edildi. Hastaların ağrı yakınması Visüel Analog Skala (VAS) ve fonksiyonel durumu ise kol, omuz ve el sorunları anketi (Quick-DASH) ile değerlendirildi.

Bulgular: Her iki grubun kendi içindeki değerlendirmelerinde birinci ay ve ikinci ay kontrollerinde (birinci aya ve tedavi öncesine göre) VAS ve Quick-DASH skorlarında istatistiksel olarak anlamlı düzelmeler kaydedildi (p<0,01). Her iki grupta oluşan klinik iyileşmenin kıyaslandığı istatistiksel çalışmada ise sadece VAS skorlarında 2. ay kontrolünde PRP grubunda daha fazla azalma olduğu ve bu farkın istatistiksel olarak anlamlı olduğu saptandı (p=0,007). Quick-DASH skorlarındaki azalmanın ise istatistiksel olarak benzer olduğu saptandı (p=0.007).

Sonuç: Sonuç olarak yaptığımız çalışmada rotator kaf lezyonlarında PRP ve kortizon enjeksiyonları tedavilerinin etkili olduğu sonucuna vardık. Komorbid hastalıkları olan kişilerde, yan etkileri nedeniyle kortizon tedavisi uygulanamayan hastalarda PRP tedavisinin rotator kaf lezyonlarında iyi bir tedavi alternatifi olduğu kanısındayız.

Anahtar kelimeler: Rotator kaf lezyonları, PRP tedavisi, impingement sendromu

Abstract

Objective: Rotator cuff tendon pathologies are the most frequently diagnosed disease group among the causes of shoulder pain. The aim of this study was to compare the results of platelet-rich plasma (PRP) and cortisone treatments applied to patients who admitted to our outpatient clinic with the diagnosis of Rotator cuff syndrome.

Materials and Methods: A total of 40 patients with no shoulder movement restriction and shoulder pain longer than 3 months were included in the study. Pain symptoms of the patients were evaluated with Visual Analogue Scale (VAS) and functional status with the disabilities of the arm, shoulder and hand score (Quick-DASH).

Results: Statistically significant improvements were observed in the VAS and Quick-DASH scores at the first and second month controls (according to the first month and pre-treatment) in the evaluations of the both groups (p<0.01). In the statistical study comparing clinical recovery in both groups, it was found that there was a further decrease in the PRP group at the second month control only in the VAS scores (p=0.007) and this difference was found to be statistically significant, while the decrease in the Quick-DASH scores was found to be statistically similar (p=0.007).

Conclusion: In this study, we concluded that PRP and cortisone injections were effective in rotator cuff lesions. We believe that the PRP therapy is a good alternative to rotator cuff lesions in patients with comorbid diseases or in patients who cannot be treated with cortisone because of the adverse effects.

Keywords: Rotator cuff lesions, PRP treatment, impingement syndrome

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Giriş

Omuz ağrısı kas iskelet sistemi hastalıkları içerisinde oldukça sık görülen ve yaşamı boyunca her üç kişiden birini etkileyen önemli bir semptomdur (1). Rotator kaf tendon patolojileri omuz ağrısı yapan nedenler arasında en sık saptanan hastalık grubunu oluşturmaktadır. Hastalığın gelişimde yaş, cinsiyet, mikro travmalar, aşırı kullanım ve subakromiyal sıkışma sendromları etkin olan faktörlerdir. Ayrıca genetik predispozisyon, diyabet gibi metabolik hastalıklarında rotator kaf tendon patolojilerine zemin hazırladığı düşünülmektedir (2-4).

Rotator kaf tendon patolojilerinin tedavisinde ağrı ve fonksiyonel kısıtlılığa karşı öncelikle konservatif tedavi yöntemlerine başvurulmaktadır. Çeşitli ağrı kesici ilaçlar, sıcak ve soğuk uygulamaları, analjezik elektrik akımları, egzersiz uygulamaları gibi fizik tedavi yöntemlerinin yanında çeşitli enjeksiyon yöntemlerinden de yararlanılmaktadır. Bu enjeksiyon tedavilerinde en sık kullanılan ilaç ise kortizondur. Kortizon özellikle subakromiyal bursadaki enflamasyonu baskılayarak şişliği azaltıp subakromiyal alanda genişleme sağlayabilmektedir (5-7).

Özellikle son yıllarda doku rejenerasyonunu uyarmak amacı ile rejeneratif tedaviler ve plateletten zengin plazma (PRP) tüm dünyada artan bir sıklıkta kullanılmaya başlanmıştır. Dejeneratif eklem hastalıklarının yanında, bağ lezyonlarında ve tendon patolojilerinde de etkili olduğu birçok çalışmada gösterilmiştir (8-11).

Retrospektif olarak yapılan bu çalışmada daha önce rotator kaf sendromu tanısı ile polikliniğimize başvuran hastalara uygulanan PRP ve kortizon tedavilerinin sonuçlarının karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem

Bu çalışma daha önce fizik tedavi ve rehabilitasyon polikliniğine başvuran hastalara uygulanan tedavi sonuçları retrospektif olarak değerlendirildi. Çalışma ile ilgili hastalardan yazılı onam alındı. Çalışma için Adana Şehir Hastanesi Etik Kurulu'ndan onay alınmıştır (protokol no: 2018/191). Araştırma süresince Dünya Sağlık Örgütü Helsinki Bildirgesi ve Dünya Psikiyatri Birliği İyi Klinik Uygulamaları ve İyi Laboratuvar Uygulamaları Kuralları'na uyuldu.

Çalışma Popülasyonu ve Metod

Son 2 yıl içinde Fiziksel Tıp ve Rehabilitasyon polikliniğine omuz ağrısı şikayeti ile başvurup rotator kaf tendon patolojisi tespit edilen hastalara ilk başvurularında kortizon veya PRP uygulandı. PRP enjeksiyonları birinci ayda ve sonraki ikinci kontrolde tekrar edildi. PRP uygulamalarında hastadan alınan venöz kan bu işlem için özel üretilmiş bir kit olan PRPHD (T-biyotekneloji Ltd. Şti.) tüplerine konularak, 830 G'de 8 dakika santrifüje edildi. Yaklaşık 2,5-3 cc hacmindeki PRP ayrıştırılarak ultrason eşliğinde subakromiyal boşluğa enjekte edildi.

Ultrasonografik incelemede Siemens Adara Sonoline cihazı ve 7.5L45S lineer prob kullanıldı. Dik konumda konumlandırılarak aşağıda tuberkulum majusa kadar inceleme yapıldı. İncelenen tendonlarda birbirine dik iki planda hipo ve hiperekojen miks ya da hipoekoik ekojenite değişiklikleri ayrıca subdeltoid, subakromiyal bursal efüzyon olan hastalar çalışmaya dahil edilirken, rotator kafın sonografik olarak görülemediği masif rotator kaf lezyonu olduğu düşünülen hastalar ise çalışmaya dahil edilmedi.

Çalışmaya adeziv kapsüliti olmayan (omuz elevasyonunun 100 dereceden fazla olması, eksternal rotasyonda ise %50'den fazla kısıtlılık bulunmaması), komplet rotator kaf yırtığı olmayan, 3 aydan uzun süreli omuz ağrısı olan tendinit ve kısmi yırtık nedeniyle rotator kaf lezyonu tanısı olan toplam 40 hasta dahil edildi. Yapılan ultrasonografik değerlendirmede; PRP grubundaki 20 hastanın 18'inde tendinit, 2'sinde kalsifik tendinit ayrıca 10 hastada da eşlik eden kısmi yırtık saptandı. Kortizon grubundaki 20 hastanın 18'inde tendinit, 2'sinde kalsifik tendinit ayrıca 8 hastada da eşlik eden kısmi yırtık saptandı. PRP grubundaki hastalara birer ay arayla toplam 2 doz PRP enjeksiyonları, kortizon grubundaki hastalara ise bir doz betametazon dipropiyonat + betametazon sodyum fosfat uygulandı. Hastaların ağrı yakınması, 1/10'luk bölmelerle ayrılmış bir ölçek üzerinde VAS ile derecelendirildi: "0: ağrı yok ve 10: dayanılmaz ağrı" olacak şekilde değerlendirildi. Fonksiyonel durum ise, aktiviteye bağlı ağrıların ciddiyetini, üst ekstremite probleminin sosyal aktiviteler, iş yaşantısı ve uyku üzerine etkisini sorgulayan, 11 sorudan oluşan üst ekstremite problemlerinin sorgulanmasında sıklıkla kullanılan kol, omuz ve el sorunları anketi (Quick-DASH) anketi ile değerlendirildi. Quick-DASH skoru [((n toplam puanı)-1)/n]x25 (n cevaplanmış soru sayısına eşittir) formülüne göre hesaplandı.

İstatistiksel Analiz

İstatistiksel analiz SPSS 24.0 programı kullanılarak yapıldı. Verilerin normal dağılım gösterip göstermediği Shapiro Wilk testi ve histogram grafikleri ile değerlendirildi. Normal dağılıma uygunluk gösteren değişkenlerin parametrik, normal dağılıma uygunluk gösteremeyen değişkenlerin ise parametrik olmayan testlerle istatistiksel karşılaştırması yapılarak uygun tanımlayıcı istatistiksel yöntemler kullanıldı. Kategorik parametrelerin karşılaştırılmasında ki-kare testi kullanıldı. Grupların kendi içerisindeki karşılaştırmalarda Wilcoxon testi ve gruplar arasındaki karşılaştırmalarda Mann-Whitney U kullanıldı. Korelasyon analizi spearman testi kullanılarak gerçekleştirildi. P değeri 0,05'ten küçükse anlamlı kabul edildi.

Bulgular

Çalışmaya alınan hastalar subakromiyal PRP enjeksiyonu uygulanan grup 1 ve kortizon enjeksiyonu uygulananlar grup 2 olmak üzere ayrıldı. Grup 1'in yaş ortalamaları 60,4±11,5 ve grup 2'nin yaş ortalamaları 57,3±9,4 idi. Her iki grupta da 18 kadın ve 2 erkek hasta olmak üzere 20 hasta bulunmaktaydı. Grupların yaş ve cinsiyet dağılımları arasında istatistiksel olarak anlamlı fark saptanmadı (sırasıyla p=0,386 ve p>0,999) (Tablo 1).

Grup 1'de tedavi öncesi VAS skoru ortalaması 6,9±0,6 ve grup 2'de 7,0±0,5, Quick-DASH skoru ortalaması ise grup 1'de 49,1±6,3 ve grup 2 de 49,2±5,2 idi. Tedavi öncesi VAS ve Quick-DASH skorları, gruplar arasında istatistiksel olarak anlamlı fark saptanmadı (sırasıyla VAS p=0,597, Quick-DASH p=0,774) (Tablo 2).

Her iki grubun kendi içindeki değerlendirmelerinde birinci ay ve ikinci ay kontrollerinde (birinci aya ve tedavi öncesine göre) VAS ve Quick-DASH skorlarında istatistiksel olarak anlamlı düzelmeler kaydedildi (p<0,01).

Her iki grupta oluşan klinik iyileşmenin kıyaslandığı istatistiksel çalışmada ise sadece VAS skorlarında ikinci ay kontrolünde PRP grubunda daha fazla azalma olduğu ve bu farkın istatistiksel olarak anlamlı olduğu saptandı (p=0,007) (Şekil 1) (Tablo 3). Quick-DASH skorlarındaki azalmanın ise istatistiksel olarak benzer olduğu saptandı (p=0,385) (Şekil 2) (Tablo-3).

Ayrıca PRP grubu için; VAS-0 değeri ile VAS delta 0-1 değerleri arasında ve Q-DASH-0 değeri ile Q-DASH delta 0-1 değeri arasında pozitif yönde orta düzeyde korelasyon saptandı.

Tablo 1. Demografik veriler

Değişkenler	Grup 1 N=20	Grup 2 N=20	p
Yaş (yıl)	60,4±11,5	57,3±9,4	*0,38
Cinsiyet n, (%) -E -K	 2 (10) 18 (90)	 2 (10) 18 (90)	•>0,99

Veriler ± ortalama olarak ifade edildi,
*Student's t-test,
•chi-square test, E: Erkek, K: Kadın

Tablo 2. Tedavi öncesi gruplarda visüel analog skala ve kol, omuz ve el skoru yetersizliği değerleri

	Grup 1	Grup 2	p*
VAS	6,9±0,6	7,0±0,5	0,59
Quick-DASH	49,1±6,3	49,2±5,2	0,77

VAS: Visüel Analog Skala, Quick-DASH: Kol, omuz ve el sorunları anketi
Veriler ± ortalama olarak ifade edildi
*Mann-Whitney U test

Tablo 3. Tedavi sonrasında gruplarda meydana gelen Visüel Analog Skala ve kol, omuz ve el skoru yetersizliği değişiklikleri

Değişkenler	Grup 1 N=20	Grup 2 N=20	p
VAS Δ 0-1	3,5 ±0,5	3,7±0,4	0,39
VAS Δ 1-2	1,4±0,6	0,6±0,9	0,007
Quick-DASH Δ 0-1	23,6±5,2	26,2±5,9	0,14
Quick-DASH Δ 1-2	11,5±6,1	9,5±6,8	0,38

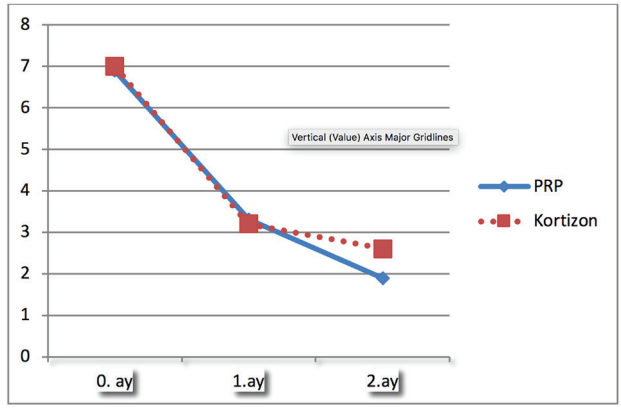
VAS: Visüel Analog Skala, Quick-DASH: Kol, omuz ve el sorunları anketi
Veriler ± ortalama olarak ifade edildi
*Wilcoxon W test

Hastanın ilk başvuru anındaki VAS veya Q-DASH skorlarının ne kadar yüksekse hastanın birinci ay tedavisinden fayda görme oranı o kadar yüksek bulundu. Yine VAS delta 0-1 ile VAS delta 1-2 arasında orta düzeyde anlamlı pozitif yönde bir korelasyon saptandı. İlk ay tedavisinden fayda gören hastaların ikinci ay tedavilerinden de fayda görme olasılığı yüksek bulundu (Tablo 4). Kortizon grubu için: VAS-0 değeri ile VAS delta 0-1 değerleri arasında ve Q-DASH-0 değeri ile QD delta 0-1 değeri arasında pozitif yönde orta düzeyde korelasyon saptandı. Yani hastanın ilk başvuru anındaki VAS veya Q-DASH skorları ne kadar yüksekse hastanın kortizon tedavisinden fayda görme oranı da o kadar yüksek bulundu (Tablo 4).

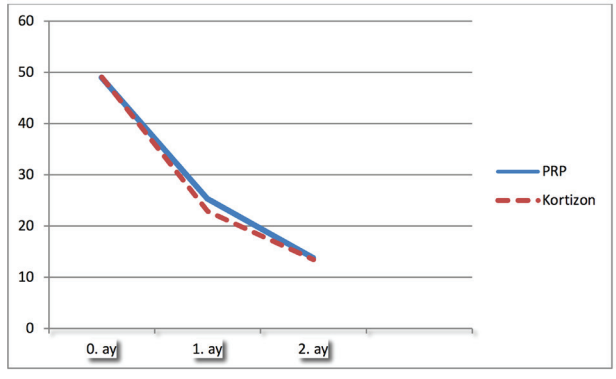
Tartışma

Artroskopik tekniklerdeki gelişmelere rağmen rotator kaf lezyonları çoğunlukla konservatif olarak tedavi edilmekte, cerrahi tedaviler ancak konservatif tedaviden yeterince sonuç alınamayan hastalara uygulanmaktadır (12-14).

Kas iskelet sistemi patolojilerinde son yıllarda gittikçe artan bir sıklıkla rejeneratif tedavilere başvurulmaktadır. Eklem, kas, kıkırdak sorunlarının yanında tendon hasarları da PRP tedavilerinin sıklıkla uygulandığı patolojilerdir (15-21).



Şekil 1. Gruplarda meydana gelen Visüel Analog Skala skoru değişiklikleri
PRP: Plateletten zengin plazma



Şekil 2. Gruplarda meydana gelen kol, omuz ve el sorunları anketi skoru değişiklikleri
PRP: Plateletten zengin plazma

Tablo 4. Plateletten zengin plazma ve kortizon gruplarına ait korelasyon analizleri

			Yas	VAS 0	QD 0	VAS Δ 0-1	VAS Δ 1-2	QD Δ 0-1	QD Δ 1-2
PRP (N=20)	Yas	Korelasyon katsayısı	1,000	-0,180	-0,191	-0,085	-0,220	-0,194	0,151
		Sig. (2-tailed)	.	0,447	0,421	0,723	0,351	0,412	0,526
	VAS-0	Korelasyon katsayısı	-0,180	1,000	0,181	**0,491***	-0,290	0,316	-0,314
		Sig. (2-tailed)	0,447	.	0,446	**0,028**	0,216	0,174	0,178
	QD 0	Korelasyon katsayısı	-0,191	0,181	1,000	-0,197	0,053	**0,573****	0,134
		Sig. (2-tailed)	0,421	0,446	.	0,404	0,824	**0,008**	0,573
	VAS Δ 0-1	Korelasyon katsayısı	-0,085	**0,491***	-0,197	1,000	**-0,597****	-0,185	-0,270
		Sig. (2-tailed)	0,723	**0,028**	0,404	.	**0,005**	0,434	0,249
	VAS Δ 1-2	Korelasyon katsayısı	-0,220	-0,290	0,053	**-0,597****	1,000	0,060	0,361
		Sig. (2-tailed)	0,351	0,216	0,824	**0,005**	.	0,802	0,118
	QD Δ 0-1	Korelasyon katsayısı	-0,194	0,316	**0,573****	-0,185	0,060	1,000	**-0,468***
		Sig. (2-tailed)	0,412	0,174	**0,008**	0,434	0,802	.	**0,038**
	QD Δ 1-2	Korelasyon katsayısı	0,151	-0,314	0,134	-0,270	0,361	**-0,468***	1,000
		Sig. (2-tailed)	0,526	0,178	0,573	0,249	0,118	**0,038**	.
			Yas	**VAS 0**	**QD 0**	**VAS Δ 0-1**	**VAS Δ 1-2**	**QD Δ 0-1**	**QD Δ 1-2**
Kortizon (N=20)	Yas	Korelasyon katsayısı	1,000	0,056	0,189	-0,439	-0,187	-0,050	0,209
		Sig. (2-tailed)	.	0,815	0,425	0,053	0,429	0,835	0,376
	VAS-0	Korelasyon katsayısı	0,056	1,000	0,178	**0,583****	0,213	0,073	-0,067
		Sig. (2-tailed)	0,815	.	0,454	**0,007**	0,367	0,760	0,780
	QD 0	Korelasyon katsayısı	0,189	0,178	1,000	-0,108	-0,264	**0,507***	0,306
		Sig. (2-tailed)	0,425	0,454	.	0,652	0,261	**0,023**	0,190
	VAS Δ 0-1	Korelasyon katsayısı	-0,439	**0,583****	-0,108	1,000	-0,198	-0,223	-0,032
		Sig. (2-tailed)	0,053	**0,007**	0,652	.	0,403	0,345	0,895
	VAS Δ 1-2	Korelasyon katsayısı	-0,187	0,213	-0,264	-0,198	1,000	0,287	-0,325
		Sig. (2-tailed)	0,429	0,367	0,261	0,403	.	0,220	0,163
	QD Δ 0-1	Korelasyon katsayısı	-0,050	0,073	**0,507***	-0,223	0,287	1,000	**-0,461***
		Sig. (2-tailed)	0,835	0,760	**0,023**	0,345	0,220	.	**0,041**

PRP: Platelet-rich plasma, VAS: Visüel Analog Skala, QD: Quick-DASH
• Spearman korelasyon testi kullanıldı

Literatürde rotator kaf tendon patolojilerinde PRP uygulanan olgular irdelendiğinde; Nejati ve ark. (22) çalışmasında Omuz Subakromiyal Sıkışma sendromu olan hastalarda PRP ve egzersiz grupları karşılaştırılmış ve her iki gruptada ağrı ve fonksiyonel durumda düzelmeler olduğu belirtilmiştir. Lädermann ve ark. (23) 25 hastalık retrospektif çalışmasında PRP uygulanan 15

hastada manyetik rezonans (MR) artrogramda rotator kaf yırtığında %50 azalma saptandığı ayrıca ağrı ve fonksiyonel durumda düzelme olduğu belirtilmiştir. Bizim çalışmamızla oldukça benzerlik gösteren bir çalışmada ise rotator kaf tendon patolojisi olan bir gruba PRP bir gruba ise kortizon uygulanmıştır. Erken dönemde PRP grubunda ağrı ve fonksiyonel indekslerde daha fazla düzelme olduğu ancak altıncı ayda aralarında fark olmadığı kaydedilmiştir (24). Bizim çalışmamızda da benzer şekilde VAS skorlarında ikinci ay kontrolünde PRP grubunda daha fazla azalma olduğu ve bu farkın istatistiksel olarak anlamlı olduğu saptanmıştır. Yine benzer şekilde her iki grupta da hem ağrı hemde fonksiyonel indekslerde düzelme olduğu saptanmıştır. Say ve ark. (25) çalışmasında ise PRP ve kortizon grubu karşılaştırılmış altıncı hafta ve altıncı ayda kortizon grubunda düzelmenin daha fazla olduğu belirtilmiştir.

İster cerrahi onarım sonrası olsun ister cerrahi uygulanmayan hasta gruplarında olsun PRP uygulamasının ek bir yarar sağlamadığını ifade eden birçok çalışmaya da rastlanmıştır (26,27). Kesikburun ve ark. (28) çalışmasında rotator kafta parsiyel yırtığı olan hastaların bir grubuna PRP ve diğer grubuna serum fizyolojik enjeksiyonları uygulanmış ve 1 yıllık takipte ağrı ve fonksiyonel skorlarda iki grup arasında fark olmadığını belirtmişlerdir. Yine bir başka çalışmada rotator kaf yırtığı nedeniyle ameliyat edilen hastalara ilave olarak uygulanan PRP tedavisinin tek başına cerrahi tedaviye üstünlüğünün olmadığı sonucuna varılmıştır (29). On bir çalışmayı kapsayan bir meta analiz çalışmasında da rotator kaf lezyonlarında PRP uygulamasının etkinliğine dair bulgu olmadığı belirtilmiştir (30). Genelde çalışmalar incelendiğinde takip sürelerinin 12 ila 24 ay olduğu ve hastaların MR bulgularında yırtık seviyesinin belirtildiği gözlenmiştir (31-33). Bizim çalışmamızın eksik yönleri; MR'de yırtık sınıflaması yapılmaması ve takip süresinin kısalığı olabilir. Ancak genel olarak ilk planda cerrahi tedavi önerilmeyen [belirgin kaf lezyonu olmasına rağmen ileri yaş nedeniyle ilk planda konservatif tedavi önerilen hasta, genç olmasına rağmen masif rotator kaf yırtığı (<3 cm) olmayan hasta] kişilerin tedaviye alındığını belirtmemiz mümkündür.

Sonuç

Sonuç olarak yaptığımız çalışmada rotator kaf lazyonlarında PRP ve kortizon enjeksiyonları tedavilerinin etkili olduğu sonucuna vardık. Komorbid hastalıkları olan kişilerde veya yan etkileri nedeniyle kortizon tedavisi uygulanamayan hastalarda PRP tedavisinin rotator kaf lezyonlarında iyi bir tedavi alternatifi olduğu kanısındayız.

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Is There Any Relationship Between Serum Endocan Levels and Carotid Intima-media Thickness in Patients with Fibromyalgia?

Fibromiyaljili Hastalarda Serum Endokan Düzeyleri ile Karotis İntima-medya Kalınlığı Arasında İlişki Var mı?

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Abstract

Objective: Although the pathophysiology of Fibromyalgia syndrome (FMS) has not yet been completely elucidated, it has been suggested that inflammation and endothelial dysfunction occur in patients with FMS. In recent years, endocan has been reported as an important biomarker for inflammation and endothelial dysfunction. It is important to assess carotid intima-media thickness (CIMT) in the evaluation of early atherosclerotic vascular diseases. In this study, we investigated this mechanism by measuring serum endocan levels and CIMT in patients with FMS and evaluated whether there is a correlation between them.

Materials and Methods: Serum samples collected from 40 female patients diagnosed with FMS (the patient group) for the first time and 40 healthy female participants' (the control group) endocan levels and CIMT ultrasonography were investigated, and the values of the two groups were compared.

Results: Serum endocan levels and CIMT results were significantly higher in the patient group than in the control group ($p<0.001$). In addition, a very weak correlation was found between CIMT and endocan levels in patients with FMS.

Conclusion: Increased subclinical inflammation, endothelial dysfunction, and early atherosclerosis play an important role in the pathophysiology of FMS. Increased endocan levels, CIMT, and the correlation between them will contribute to elucidating this mechanism.

Keywords: Carotid intima-media thickness, fibromyalgia, endocan, correlation

Öz

Amaç: Fibromiyaljinin patofizyolojisi henüz tam olarak aydınlatılmamış olmakla birlikte, fibromiyaljili hastalarda enflamasyon ve endotel disfonksiyonunun ortaya çıktığı ileri sürülmüştür. Son yıllarda, endokan enflamasyon ve endotel disfonksiyonu için önemli bir biyobelirteç olarak bildirilmiştir. Erken aterosklerotik vasküler hastalıkları değerlendirmede karotis intima media-kalınlığının (KİMK) değerlendirilmesi önemlidir. Bu çalışmada, fibromiyalji hastalarında serum endokan düzeylerini ve KİMK'yi ölçerek bu mekanizmayı araştırdık, aralarında bir korelasyon olup olmadığını değerlendirdik.

Gereç ve Yöntem: İlk kez fibromiyalji tanısı alan 40 kadın hastadan toplanan serum örnekleri ve 40 sağlıklı kadın endokan düzeyleri ve KİMK ultrasonografi ile incelendi ve iki grubun değerleri karşılaştırıldı.

Bulgular: Hasta grubunda serum endokan seviyeleri ve KİMK sonuçları kontrol grubuna göre anlamlı olarak yüksek olarak bulunmuştur ($p<0,001$). Ayrıca FMS'li hastalarda KİMK ile endokan seviyesi arasında çok zayıf bir korelasyon görüldü.

Sonuç: Fibromiyaljinin patofizyolojisinde artmış subklinik enflamasyon, endotelyal disfonksiyon ve erken ateroskleroz önemlidir. Artan endokan düzeyi, KİMK ve aralarında korelasyon görülmesi bu mekanizmayı aydınlatmaya katkı sağlar.

Anahtar kelimeler: Karotis intima-media kalınlığı, fibromiyalji, endokan, korelasyon

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Introduction

Fibromyalgia syndrome (FMS) is a chronic Pain syndrome characterized by widespread pain, sensitivity, sleep disturbance, fatigue, cognitive dysfunction, and emotional stress (1). Although the pathophysiology of FMS has not yet been completely elucidated, it has been suggested that inflammation and endothelial dysfunction occur in patients with FMS (2,3). Studies have shown that serum levels of proinflammatory cytokines (TNF-a, IL-6) and chemokines (Tarc, MIG) are higher in patients with FMS than in the healthy population (4-6). Furthermore, carotid intima-media thickness (CIMT) used to evaluate early atherosclerotic vascular diseases has been shown to be increased in FMS patients (2). Some studies have also shown that the level of endocan, which is a novel marker of inflammation and endothelial dysfunction, correlates with CIMT in various inflammatory diseases (7,8). The aim of this study was to evaluate serum endocan levels, which are important in the etiopathogenesis of FMS, and to evaluate the correlation between endocan levels and CIMT.

Materials and Methods

The study included patients admitted to the Physical Medicine and Rehabilitation Polyclinic of Kars Harakani State Hospital, who were diagnosed with FMS based on the 2016 ACR criteria. Exclusion criteria included patients aged <18 years or >70 years, the presence of any acute or chronic inflammatory disease, history of anti-inflammatory drug use, history of chronic illness (such as heart failure, coronary artery disease, liver failure, renal failure, chronic obstructive pulmonary disease, and diabetes mellitus), pregnancy or suspicion of pregnancy, and history of malignancy. The control group was formed of patients with Myofascial Pain syndrome with a trigger point in the upper trapezius muscle and pain durations were recorded.

Written informed consent was obtained from all the study participants. The study were approved by the Kafkas University Faculty of Medicine of Local Ethics Committee (protokol no: 80576354-050-99/131).

The demographic characteristics of patients, including age, weight, height, and body mass index, were recorded. Bilateral CIMT measurements of CIMT were taken using ultrasonography by an experienced radiologist using a linear probe (Figure 1) (7–12 MHz, B-mode, Toshiba Aplio 500, Japan). Serum endocan levels were measured using the commercial Human endothelial cell specific molecule 1 (ESM1) ELISA Kit (catalog no: E-EL-H1557).

Statistical Analysis

Conformity of the data to normal distribution was assessed using the Kolmogorov-Smirnov test. To determine any difference in CIMT and endocan values between the patient and control groups, the Student's t-test or the Mann Whitney U-test was applied. Correlations between endocan levels and CIMT values were assessed using the pearson or spearman correlation test.

Power Analysis: When data were evaluated by assuming that type I error was 0.05 and the power of the study was 80%**, the sample size was calculated as at least 28 patients necessary in each group.

Results

The demographic characteristics of the patient and control groups are shown in Table 1. Age, body mass index, and education level were not different between the groups. The sedimentation, C-reactive protein and lipid profile levels in the patients with FMS were found to be in the normal range and were significantly different from those of the control group.

The level of serum endocan was determined as 394.607±223.132 ng/mL and 235.998±190.812 ng/mL in the patient and control groups, respectively. The CIMT was measured as 0.64±0.13 mm and 0.47±0.15 mm in the patient and control groups, respectively. The serum endocan levels and CIMT were determined to be statistically significantly higher in the patient group than in the control group (p<0.001). In the FMS patients, a very weak correlation was determined between CIMT and endocan levels.

Discussion

The aim of this study was to evaluate serum endocan levels in patients with FMS and to evaluate any correlation between the serum endocan level and CIMT. The results demonstrated that serum endocan levels and CIMT were higher in patients with FMS than in the healthy population. Furthermore, a correlation between CIMT and endocan levels was determined in patients with FMS.

Table 1. Demographic and clinical characteristics of the patients

	Patient group Mean ± SD	Control group Mean ± SD	p
Age (years)	41.9±11.0	38.1±8.8	0.088
BMI (kg/m²)	24.4±3.3	23.5±1.5	0.126
Disease duration (months)	9.2±3.5	6.4±2.2	**<0.001**
CIMT (mm)	0.64±0.13	0.47±0.15	**<0.001**
Endocan (ng/mL)	394.6±223.1	235.9±190.8	**0.001**

BMI: Body mass index, CIMT: Carotid intima-media thickness, SD: Standard deviation

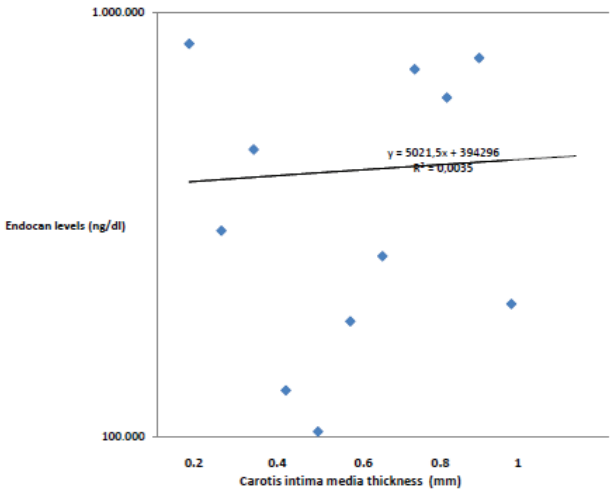

Figure 1. Correlations between serum endocan levels and carotid intima-media thickness values in patients with fibromyalgia

FMS is characterized by chronic musculoskeletal pain, fatigue, sleep disturbance, cognitive dysfunction, and depression (9,10). Stress and pain have been reported to increase the activity of the sympathetic nervous system (SNS) in patients with FMS (11-13). The arterial wall thickening process is significantly affected by SNS activity, leading to alterations in cardiovascular system responses and causing endothelial damage (14). It has also been suggested that a high catecholamine level may have a significant role in FMS pathophysiology (15). With consistent activation of calcium channels, membrane damage, and microvascular spasm may be responsible for catecholamine-induced endothelial dysfunction mechanisms (16).

Topal et al. (17) reported that asymmetric dimethylarginine levels associated with endothelial dysfunction are elevated in patients with FMS. They also determined a positive correlation between 8-iso-prostaglandin F2a (8-iso-PGF2α), which is an important indicator of oxidative stress and lipid peroxidation, and TNF-α, which is a proinflammatory cytokine (17). Another study demonstrated correlations between elevated IL-6 and IL-8 levels in patients with FMS and the severity of disease symptoms (18). Sánchez-Dominguez et al. (19) reported that TNF-α levels measured in skin biopsies were correlated with serum levels patients with FMS, suggesting that an increase in oxidative stress leads to inflammation. In conclusion, a greater risk of endothelial dysfunction and atherosclerosis may be inevitable in FMS patients (20).

Endocan is a novel human endothelial cell specific molecule. Elevated endocan levels may indicate endothelial dysfunction in different pathologies (21,22). CIMT is a strong indicator of early atherosclerosis and cardiovascular disease and is commonly used in rheumatological diseases to assess the risk of cardiovascular disease (23,24). In addition, CIMT values are associated with certain clinical parameters (such as lengthy disease duration, degenerations, high inflammatory parameters, and extra-articular symptoms) in diseases, such as rheumatoid arthritis (25). In the literature, studies have shown the presence of early atherosclerosis with increased CIMT values in ankylosing spondylitis, rheumatoid arthritis and Behçet's disease compared to a healthy population (26,27). In addition, high serum endocan levels and increased CIMT in patients with FMS have been shown in different studies (28,29) .

Previous studies have reported that endocan levels and CIMT are correlated in inflammatory diseases (7,8). Therefore, in the current study, serum endocan levels and CIMT were measured in patients with FMS. Although a correlation was determined between CIMT and endocan levels in the FMS patients, it is difficult to explain the increase in CIMT in this patient group by increased endocan levels alone, although this finding sheds light on a possible mechanism (Figure 1). Due to the complexity of the disease pathogenesis and presence of different risk factors that cannot be controlled, there is a need to investigate possible markers that may be associated with increased CIMT in a larger case series.

Conclusion

In conclusion, the results of this study demonstrated that serum endocan levels and CIMT were higher in patients with FMS than in the healthy population. Furthermore, a correlation was found between CIMT and endocan levels in the FMS patients. These results indicate the presence of increased subclinical inflammation, endothelial dysfunction, and early atherosclerosis in FMS and present a potentially significant mechanism in the pathophysiology of FMS. These patients should be followed up more carefully in terms of atherosclerotic and cardiovascular problems in the long term.

There were some limitations to this study, primarily that only females were included, so the effect of gender on CIMT in patients with FMS was not evaluated. Furthermore, the sample size was relatively small. There is a need for multicenter studies conducted with larger series of patients with FMS.

Ethics

Ethics Committee Approval: The study were approved by the Kafkas University Faculty of Medicine of Local Ethics Committee (protokol no: 80576354-050-99/131).

Informed Consent: Consent form was filled out by all participants.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: F.B., F.H.T., Concept: F.B., F.H.T., Design: F.B., Data Collection or Processing: F.B., F.H.T., Ö.K., Analysis or Interpretation: F.B., F.H.T., Ö.K., Literature Search: F.B., F.H.T., Ö.K., Writing: F.B.

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Investigation of Short-wave Diathermy Genotoxic Effect in Patients with Knee Osteoarthritis

Diz Osteoartriti Olan Hastalarda Kısa Dalga Diaterminin Genotoksik Etkisinin Araştırılması

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Abstract

Objective: Short-wave diathermy (SWD) is a physical therapy agent that is commonly used as a deep heater in physical medicine practices. The aim of this study was to investigate whether there is a chromosomal damage arising from therapeutic SWD by using micronucleus (MN) method.

Materials and Methods: Thirty patients who suffered from knee pain, and diagnosed as gonarthrosis according to American College of Rheumatology criteria were admitted in the present study. Twenty patients were assigned as the treatment group (group 1) and 10 patients were assigned as the control group (group 2). The patients in the treatment group received 10 sessions of SWD therapy, whereas the patients in the control group received 10 sessions of sham SWD therapy. Peripheral venous blood was obtained from both the treatment and the control groups before and after 10 sessions of SWD therapy to evaluate MN scores. The scores of MN assessed before the therapy were compared with the MN scores at the end of 10 sessions of SWD therapy in the treatment and the control groups. Pre-treatment and end of the 10th session MN scores were compared between the treatment and the control groups.

Results: There was not a statistically significant difference in MN scores between pre-treatment and after 10th session SWD therapy in both groups (p>0.05). There was also not a significant difference in the MN scores of the groups between pre-treatment and after 10th session of SWD therapy (p>0.05).

Conclusion: In this study, we observed that the therapeutic SWD did not induce an increase in MN score, which is a sign of cytogenetic damage.

Keywords: Short-wave diathermy, micronucleus assay, gonarthrosis

Öz

Amaç: Kısa dalga diatermi (KDD), fiziksel tıp uygulamalarında genellikle derin ısıtıcı olarak kullanılan bir fizik tedavi ajanıdır. Bu çalışmanın amacı, terapötik KDD'den kaynaklanan bir kromozomal hasar olup olmadığını mikronükleus (MN) yöntemiyle araştırmaktır.

Gereç ve Yöntem: Çalışmaya diz ağrısı olan ve Amerikan Romatoloji Koleji kriterleri ile gonartroz tanısı alan 30 hasta dahil edildi. Yirmi hasta tedavi grubu (grup 1), 10 hasta kontrol grubu (grup 2) olarak tayin edildi. Tedavi grubundaki hastalara 10 seans KDD tedavisi uygulandı, kontrol grubundaki hastalara ise 10 seans sahte KDD tedavisi uygulandı. MN skorlarını değerlendirmek için periferik venöz kan, hem tedavi hem de kontrol grubundan 10 seans KDD tedavisi uygulaması öncesi ve sonrasında alındı. Tedavi öncesi değerlendirilen MN skorları, tedavi grubunda ve kontrol gruplarında 10 seans KDD tedavisi sonu MN skorları ile karşılaştırıldı. Tedavi öncesi ve 10 seans KDD tedavi sonrası MN skorları tedavi ve kontrol grubu arasında karşılaştırıldı.

Bulgular: Her iki grubun KDD tedavisi öncesi ile 10 seans KDD tedavisi sonrasında MN skorları arasında istatistiksel olarak anlamlı bir fark yoktu (p>0,05). Grupların MN skorları karşılaştırıldığında KDD tedavisi öncesi ve 10 seans KDD tedavisi sonrasında MN skorları açısından gruplar arasında anlamlı bir fark yoktu (p>0,05).

Sonuç: Bu çalışmada, terapötik KDD'nin, sitogenetik hasarın bir işareti olan MN skorunda artışa neden olmadığını gözlemledik.

Anahtar kelimeler: Kısa dalga diatermi, mikronükleus deneyi, gonartroz

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Introduction

Short-wave diathermy (SWD) is used by physical therapists to treat symptoms of osteoarthritis and this treatment's one of the oldest forms of electrotherapeutic modalities traditionally (1). SWD is a high frequency current which leads to heat increases into the deep tissues by means of the conversion of electromagnetic energy into thermal energy. In medicine, generally the form of SWD, which has 27.12 MHz frequency and 11 wavelengths, is used (2). Along with microwaves, infrared radiation and laser beams, SWD radio waves are categorized into the non-ionized radiation (NIR) group. Like ionized radiation (X-ray), high density NIR does not affect the molecular structure of the cells. SWD can lead to heat increase in the tissues, alterations in the chemical reactions or to the induction of electrical currents in the cells and the tissues. While SWD poses minimal heat increases in the skin and subcutaneous tissues, it can lead to maximal heat increases in deep tissues like muscles and bones (3-5). SWD is in the NIR group; however, it has been mentioned that their usage in medical treatment in different doses and lengths may lead to potential detrimental effects on the biological tissues (6).

Because radio frequency/microwave radiation leads to increases in DNA strand breaks and the amount of reactive oxygen, the studies on cell cultures, human blood and rats have shown that it increases tendency to brain cancer or neurodegenerative diseases (7,8). In order to detect the chromosomal damage, cytogenetic tests such as micronucleus (MN) assay, chromosomal aberrations are used. MN assay is rapid, simple and sensitive test. Additionally, there is a direct correlation between gene damage and MN frequency (9,10). According to our knowledge, among the studies related to high frequency currents, presently, there is no study conducted to investigate the genotoxic damage of SWD and similar high frequency currents, their side effects related to the extended exposure to these agents and the treatment dose. The aim of the study was to investigate the genotoxic effect of SWD with MN assay.

Materials and Methods

Case Selection

The approval of Human Ethics Committee of our university and informed consent was obtained from all the participants (2008-4/7). The study was conducted in accordance with the principles of the Declaration of Helsinki. During the study period, 30 consecutive patients who clinically meet ACR's knee osteoarthritis diagnosis criteria (11) were identified suitable for the study. Twenty patients were selected as treatment group, ten patients were selected as controls. Exclusion criteria were smoking, use of alcohol, history of viral illness in the last month, and history of medical therapy, chemotherapy, radiotherapy, ultrasonography, X-Ray, magnetic resonance imaging, or short-wave therapy.

Physical Therapy Program

In order to prevent possible effects of surface heaters, electrotherapy, and analgesic and muscle relaxant drugs on MN, only SWD therapy is applied to the study participants as physiotherapy. SWD therapy is applied to same region and the same therapy protocol is applied on all cases in order to prevent differences that may arise from application region, the dose of SWD and duration of SWD. SWD therapy is applied on the patients while they were sitting and sprawling their legs out on their bed. During the application their legs have been supported with rolls beneath and held in 10 degrees slight flexion. Therapy is applied with 12 cm-diameter electrodes that have been located bilaterally and parallel on knees and with enraf nonius curapuls 419 (f=27.12 MHz, p=400 Watt) device in continuous mode and thermal dose as 10 sessions of 30 minutes (2 weeks with 5 days per week and 1 session daily). Therapies are always applied by the same physiotherapist with the same device and in the same hour every day. Sham therapy is applied for 30 minutes on the knees of cases that are in the control group and electromagnetic energy hasn't been given. Peripheral venous blood has been taken from patients in the therapy and control groups before and after 10 session therapy, using 5 mL sterile syringes that contain 0.1-0.2 mL heparin. Blood samples were analyzed in our Genetics Laboratory immediately after being received in order to perform lymphocyte cell culture.

Lymphocyte Culture

Culture has been prepared in sterile medium by adding 1 mL peniciline-streptomycine into 100 Ml Karyotyping Medium-PB and slowly mixing by hand. Prepared medium has been divided into 5 mL-volume screw cap-conic base culture tubes and stored by freezing in -20 °C after waiting in laboratory for 10-15 minutes.

Micronucleus Assay

According to the method of Fenech and Morley, cytochalasin-B (Sigma Chemical Co., St. Louis, MO, USA) was added to cultures to give a final concentration of 3 mcg/mL, at 44 hours of incubation (12). With the method of Balasem AN and Ali AS (13) the cultures were stopped at 72 hours, treated with hypotonic solution (0.1 mol/L KCl) for 3 min and fixed to two changes of methanol-acetic acid (3:1). The fixed cells were spread onto glass slides and colored with 5% Giemsa for 7 min. All the slides were marked and read "blind." Different slides of two parallel cultures of one person were prepared to detect intra-individual differences. Bin binucleated cells were analyzed for each case by the searching (13,14) published citeria for micronuclei determinations. Figure 1 shows normal dual-core micronucleated cells.

Statistical Analysis

All data analyses were carried out using SPSS (version 22.0) software (SPSS Inc., Chicago, IL, USA). Continuous data was expressed as mean ± standard deviation and categorical data was expressed as a percentage (%). The normal distribution

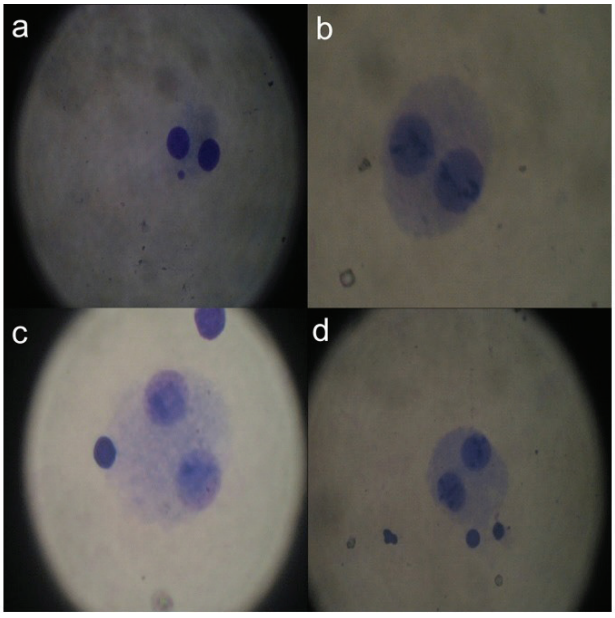

Figure 1. a) Normal dual-core, b) and, c) Dual-core micronucleated cells, d) MN cells containing two dual-core
MN: Micronucleus

of the data was analyzed using Shapiro-Wilk test. Age and gender were compared with t and chi-square tests, respectively. MN frequency was analyzed with paired or unpaired t-test as appropriate. A p value less than 0.05 were considered as significant. The confidence level of the study and the prevalence of the disease was accepted as 95% and 23.9%, respectively (15). Accordingly 20 individuals were included in the patient group under treatment, and the power of the study was calculated as 81.31%. [n=(p.q.t2)/d2]

Results

All the patients and controls were completed the study. The patients and controls were similar with regard to the female ratio (14/20 vs 7/10) and age (44.2±5.2 vs 44.0±5.8 years) (p>0.05).

Figure 2 presents the MN frequency of patients and controls, measured as pretreatment and post treatment. In both patients and controls, there was no significant difference between pretreatment and post treatment MN frequencies (p>0.05). There were no significant differences between the patients and controls with regard to both pretreatment and post treatment MN frequencies (p>0.05).

Discussion

In this study, we assessed the genotoxic effect of SWD before and after treatment in osteoarthritis patients and healthy controls and found that SWD did not cause any meaningful genotoxic effect as demonstrated by MN assay.

MN are extra nuclear units containing damaged chromosome fragments and/or whole chromosomes removed from the

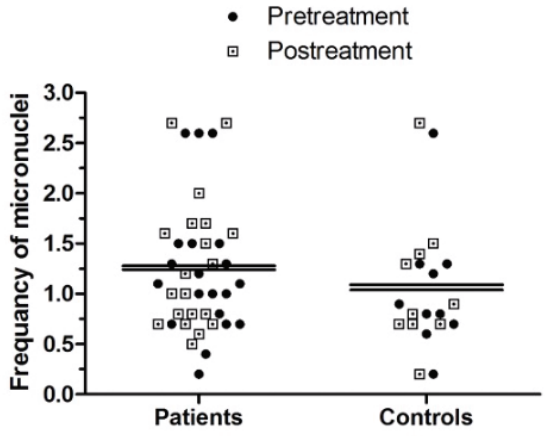

Figure 2. Pretreatment and posttreatment MN frequency of study groups. Dots present the MN frequency of subjects in study groups. Lines present mean MN frequency of study groups, measured as pretreatment ad posttreatment. After paired and unpaired comparisons, there were no significant differences
MN: Micronucleus

nucleus after cell division (16). MN may be the result of abnormal function of cell repair mechanisms and accumulation of DNA damages and chromosomal errors. Several genotoxic agents for their effects on the MN formation leading to cell death, genomic instability, or cancer development were studied (17). The potential of ionizing radiation to damage DNA directly or indirectly is a good example of such genotoxic effect. To alter the DNA structure and influence nuclear integrity different genotoxic agents have many different ways (18). Usually they are divided into two classes according to the mechanism of action: clastogens causing breaks in chromosomes, and aneugens affecting cell division and mitotic spindle apparatus, leading to aneuploidy. MN may be formed as a result of clastogenic or aneugenic exposures, their effects alter the content of the MN as clastogens and aneugens will form MN with acentric fragments and all chromosomes one by one (19). In recent years, there has been an increasing interest and many clinical studies on the effects of electromagnetic field radiating from SWD equipments on the people who are exposed to these fields (20-24). Although there is a general consensus on the fact that RF radiation waves are not directly mutagenic, some studies reveal the mutagenic effects of the RF waves. In these positive findings, mutagenic effects are suggested to be related to the type of the RF waves and their modulation (25).

In the studies investigating the genotoxic effects of SWD, animals were commonly used instead of humans and *in vitro* studies were preferred rather than *in vivo* studies. The studies about the genotoxic effects of SWD on humans generally focus on its negative on the pregnancy results of the women physiotherapists. In these studies, it has been revealed that SWD has potential detrimental effects on the pregnancy results such as low birth weight, congenital malformation and an increase in perinatal death risk (26-29). In a study investigating

the pregnancy in rats, it was found that high RF application is teratogenic in rats during the gestation period. It was thought that the effects observed in the treated rats were related to the hypothermia caused by RF (30).

To the knowledge of the researchers, in the literature, there is no study about SWD and other high frequency currents investigating the emerging side effects of long-term exposure to these agents, the treatment dose and genotoxic effect of SWD applications throughout the treatment.

Nowadays, MN assay provides the most prevalent biomarker of chromosomal defects induced by genotoxic agents due to their rapid formation and easy detection in laboratory practice. MN formation is accepted as related to the initial stage in the development of genomic instability and tumor genesis. Although MN investigations are gaining importance in the literature, there are important knowledge gaps needing new studies as both on most effective ways of MN detection and agents causing MN formation. In clinical practice, several treatment modalities like SWD are used during the management of musculoskeletal disorders.

Study Limitation

The limitation of the present study is the limited number of patients and control group.

Conclusion

In the present study, in a clinical settings of SWD administration as continuous mode and thermal dose as 10 sessions of 30 minutes (2 weeks with 5 days per week and 1 session daily), SWD has no genotoxic effect in patients with osteoarthritis. However, because of the somewhat conflicting results of the *in vitro* and *in vivo* studies conducted on the electromagnetic radiation agents (such as radar, microwave), further studies are needed to expand knowledge related the genotoxic effects of SWD in patients with several musculoskeletal disorders. These studies may increase the safety profile of SWD and their use by physiatrists and physiotherapist.

Ethics

Ethics Committee Approval: The approval of Human Ethics Committee of our university and informed consent was obtained from all the participants (2008-4/7).

Informed Consent: Informed consent was obtained from all the participants.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.Ş., S.H., Concept: Ö.Ş., S.H., Design: Ö.Ş., S.H., Data Collection or Processing: Ö.Ş., A.K., E.H., Analysis or Interpretation: Ö.Ş., A.K., E.H., Literature Search: Ö.Ş., S.H., A.K., E.H., Writing: Ö.Ş., S.H., A.K., E.H.

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The Level of Osteoporosis Knowledge and the Related Factors Among Women Who Attended İskenderun Public Education Center Courses

İskenderun Halk Eğitim Merkezi Kurslarına Katılan Kadınların Osteoporoz Bilgi Düzeyi ve İlişkili Faktörler

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Abstract

Objective: This study aimed to evaluate the levels of osteoporosis knowledge and self-efficacy and the related factors.
Materials and Methods: The study was conducted with 419 women aged between 19 and 60 years who attended the courses provided by Iskenderun Public Education Center. A questionnaire including the osteoporosis knowledge test (OKT) and osteoporosis self-efficacy scale (OSES) scores was applied by face to face interview method, the weight and height measurements were performed in accordance with the techniques.
Results: The women older than 23 years of age had higher total OKT scores than the women younger than 23 years. The total OKT scores of the women with bachelor's degree were 12.9 times higher than those of unschooled literate women. The OSES-exercise scores of self-employed women were 2.4 times higher than those of housewives. A relationship was determined between the OKT and OSES total scores, OKT-nutrition and OSES-calcium, and OKT-exercise and OSES-exercise scores.
Conclusion: Women participating in İskenderun Public Education Center courses have low levels of osteoporosis knowledge and self-efficacy. Age, level of education, and occupation are important demographic factors affecting these levels. Further multicenter studies are needed to evaluate calcium intake and physical activity levels.
Keywords: Osteoporosis, knowledge, self-efficacy, woman

Öz

Amaç: Bu çalışmanın amacı osteoporoz bilgi ve öz-etkililik düzeyleri ile ilişkili faktörlerin değerlendirilmesidir.
Gereç ve Yöntem: Çalışma İskenderun Halk Eğitim Merkezi kurslarına katılan 19-60 yaş grubu 419 kadın ile yürütülmüştür. Osteoporoz bilgi düzeyi ölçeği (OKT) ve Osteoporoz öz-etkililik ölçeğini (OSS) kapsayan anket yüz yüze görüşme yöntemi ile uygulanmış, vücut ağırlığı ve boy uzunluğu ölçümleri tekniklerine uygun olarak yapılmıştır.
Bulgular: Toplam OKT puanları yaşı >23 yıl olanlarda ≤23 yıl olanlara kıyasla daha yüksektir. Lisans mezunlarının toplam OKT puanları okur-yazarlara kıyasla 12,9 kat daha yüksektir. OSS-egzersiz puanları serbest meslek sahibi kadınlarda ev hanımlarına kıyasla 2,4 kat daha yüksektir. OKT ve OSS toplam puanları, OKT-beslenme ve OSS-kalsiyum, OKT-egzersiz ve OSS-egzersiz puanları arasında ilişki saptanmıştır.
Sonuç: İskenderun Halk Eğitim Merkezi kurslarına katılan kadınların osteoporoz bilgi ve öz-etkililik düzeyleri düşüktür. Yaş, eğitim düzeyi ve meslek osteoporoz bilgi ve öz-etkililik düzeylerini etkileyen önemli demografik faktörlerdir. Çok merkezli, kalsiyum alım miktarı ve fiziksel aktivite düzeylerinin değerlendirileceği daha ileri çalışmalara ihtiyaç vardır.
Anahtar kelimeler: Osteoporoz, bilgi, öz-etkililik, kadın

Introduction

Osteoporosis is a skeletal system disease characterized by low bone mass and impaired bone structure, which is associated with a high risk of fracture. Osteoporosis is a silently progressive disease; no clinical symptoms are observed until a fracture occurs (1,2). The World Health Organization defines osteoporosis as "a bone mineral density that lies 2.5 standard deviations (SD) or more below the average value for young healthy women (a t-score of <-2.5 SD)" (3). The risk of osteoporosis is related to genetic and environmental factors. Gender, age, body mass index (BMI), alcohol consumption, smoking, inadequate calcium intake, and insufficient physical activity are associated with an increased risk of osteoporosis and osteoporotic fractures. Formation of the bone mass continues from birth to adulthood

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and reaches the peak at puberty (4). Therefore, information on osteoporosis and self-efficacy should be provided at a young age, and exposure to environmental risk factors should be avoided in order to reduce the risk of osteoporosis (5-7). According to the statistics of the International Osteoporosis Foundation, osteoporosis is expected to affect 200 million women worldwide. Osteoporosis affects both men and women; however, osteoporotic fractures are mostly observed in post-menopausal period among women due to the increased post-menopausal bone loss. Female/male ratio of osteoporotic fractures is 1.6 (8). The results of the FRACTURK study showed that the prevalence of osteoporosis at the femoral neck was 7.5% and 33.3% among men and women in Turkey, respectively. The risk of life-long osteoporotic hip fracture for the individuals older than 50 years of age is 3.5% in men and 14.6% in women (9). Therefore, osteoporosis knowledge and behaviors of young women in the premenopausal period should be evaluated in order to provide appropriate recommendations to prevent osteoporosis, which is an important public health issue around the world. This study aimed to evaluate the knowledge level and self-efficacy regarding osteoporosis among the women who attended the courses in public education center in İskenderun-Hatay, Turkey, and the related factors.

Materials and Methods

Study Sample

This study included 419 women aged between 19 and 60 years of age (mean age, 26.38±7.38 years) who attended the courses provided in the public education center in Iskenderun, a county in Hatay, between April and July 2016.

Data Collection

The study was approved by the Ethical Board of Scientific Research and Publication of Eastern Mediterranean University on 30.05.2016 with number 2016/28-12. All participants were asked to sign an informed consent form as per the Declaration of Helsinki. The data were collected using questionnaires and face-to-face interviews. The questionnaire form included questions regarding general socio-demographic information, osteoporosis knowledge test (OKT), osteoporosis self-efficacy scale (OSS).

OKT: This test was developed by Kim et al. (10) in 1991 and tested by Kılıç and Erci (6) for validity and reliability in Turkish. Subsequently, the OKT was revised by Atalay et al. (11). This revised test consists of 32 items with a mean score ranging from 0 to 32. The two sub-dimensions of this scale include nutrition and exercise, which include 26 and 20 items, respectively, with 14 items in common. An increase in the total score indicates an increase in the level of knowledge.

OSS: Self-efficacy is important for individuals to adopt and implement an attitude, and their individual belief plays a role in overcoming the difficulties they may encounter in the future. The OSS scale was developed by Kim et al. (10) in 1991 in order to evaluate self-efficacy related to osteoporosis, and tested by Kılıç and Erci (6) for validity and reliability in Turkish study. This form assesses individuals' level of confidence in preventing osteoporosis. The scale includes two sub-dimensions evaluating the perception of exercise and calcium self-efficacy. Each sub-dimension is scored between 0 and 600, and the total scale score ranges between 0 and 1200. An increase in the score indicates an increase in the perception of self-efficacy.

Anthropometric Measurements: The weight measurements of the participants were taken as barefoot, with light clothes on digital scale with a sensitivity of 0.1 kg. The height of the participants was measured using a non-streching tape measure with the participants standing with their feet side by side and their head on the Frankfort plane. BMI is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2) According to the classification of the World Health Organization, individuals who have a BMI lower than 18.5 kg/m^2 are considered as "underweight," those with a BMI from 18.5 to 24.9 kg/m^2 are considered as "normal" those with a BMI from 25.00 to 29.9 kg/m^2 are considered as "overweight" and those with a BMI over 30 kg/m^2 are considered as "obese" (12).

Statistical Analysis

The data were analyzed using the descriptive statistics of mean (x), SD, median, minimum and maximum values for quantitative variables and frequency (n), and percentage (%) for qualitative variables. Student's t-test was used for the comparison of two independent groups while one-way analysis of variance (ANOVA) was performed for the comparison of more than two independent groups. In case of a significant difference, Tukey post-hoc test was performed to analyze the pairwise differences between the groups. Pearson correlation analysis was used to examine the associations between numerical variables. The factors that affect OKT and OSS were evaluated using the binary logistic regression analysis. The scales do not have predefined cut-off points; therefore, variables were transformed into binary using sample median values as a threshold for each scale and subscales (being below and above the sample median). All statistical analyses were performed using the SPSS 18.0 software program, and the p values below 0.05 were considered to be statistically significant.

Results

Different age groups obtained different osteoporosis knowledge test-total (OKT-tot) and osteoporosis knowledge test-nutrition (OKT-nutr) scores. The women older than 23 years of age had higher scores than the women younger than 23 years of age ($p<0.05$). Unschooled literate women obtained the lowest OKT and OSS scores, and while university students obtained the highest scores. A statistically significant difference was found between the OKT-tot, osteoporosis knowledge test-exercises (OKT-exc), and OKT-nutr scores of unschooled literate women and university students. In addition, the OKT-tot scores of

unschooled literate women were lower than those of women in high school (p<0.05). The OKT-exc scores of the women in primary-secondary school were lower than those of the women at university (p<0.05). Self-employed women obtained the highest OSS scores, which were found to be statistically different compared to those of the students. No statistically significant difference was observed between the OKT and OSS scores of smokers and alcohol consumers (Table 1). The regression analysis indicated that the OKT-tot, OKT-exc, and OKT-nutr scores of the women in the high school group were 10.4, 5.3, and 4.8 times higher than those of the unschooled literate women, respectively (p<0.05). The OKT-tot scores of the women at university were 12.9 times higher than those of the unschooled literate women (p<0.05). The OKT-tot and OKT-exc scores of the working women were 3.8 and 3.2 times higher than those of the housewives, respectively (p<0.05) (Table 2). The OSS-exc scores of the self-employed women were 2.4 times higher than those of the housewives (p<0.05) (Table 3). A positive weak relationship was observed between the OKT-tot and OSS-tot scores (r=0.192, p<0.001), the OKT-nutr and OSS-calcium scores (r=0.193, p<0.001), and the OKT-exc and OSS-exc scores (r=0.152, p=0.002) (Figure 1).

Discussion

This study showed that the participants had low OKT and OSS scores. The factors such as age, gender, education level, and socio-economic conditions affect osteoporosis knowledge level and self-efficacy. Highly educated women and women with a high income level have more knowledge and awareness about osteoporosis (13). Along with other factors, age has an effect on the osteoporosis knowledge level. The results of this study showed that OKT-tot scores of the women older than 23 years of age were higher than those of the women younger than 23 years of age (p<0.05). In a study conducted with women in Ankara, Turkey it has been found that 18- to 35-year-old women had lower osteoporosis awareness (14). The unschooled literate women had the lowest osteoporosis knowledge level, while the university students had the highest level (p<0.05). The OKT-tot, OKT-exc, and OKT-nutr scores of the women at university were 12.9, 6.3, and 5.1 times higher than those of the unschooled literate women (p<0.05), respectively. This study showed that young women with a high level of education had a high level of knowledge about osteoporosis. The results of this study were consistent with those obtained in a similar study conducted in Turkey in that the osteoporosis knowledge level of women was low and that young age and higher education level were related to an increase in the osteoporosis knowledge level (15). Two separate studies conducted in Poland and Turkey reported similar results to those obtained in the present study (16,17). The results of a study carried out in Vietnam showed that women with a high level of education had high osteoporosis knowledge levels (18). Another study conducted with premenopausal and post-menopausal women in Turkey reported that the women's osteoporosis knowledge level of was generally low, although the women with higher education level had higher knowledge levels (19). In a study conducted with women and men in the United States of America determined that the osteoporosis knowledge level increased with age; however, no relation was observed between the level of education and the osteoporosis knowledge level (20). A study carried out with men and women in Turkey showed that increased in the education level is related to a higher level of osteoporosis awareness (21). The results of another study conducted with women and men in Turkey showed that the men's education level was higher than that of the women, but the osteoporosis knowledge levels of women were higher than those of men (22). No difference was observed between the osteoporosis self-efficacy, age, and education levels among the participants in the present study. A previous study conducted with women in Turkey showed a linear relation between the years of education and osteoporosis self-efficacy level (23). In addition, age was found to be related to the osteoporosis knowledge and osteoporosis self-efficacy of women (24).

The OKT-tot and OKT-exc scores of the working women were 3.8 and 3.2 times higher than those of the housewives, respectively. Self-employed women obtained the highest OSS scores, which were found to be statistically different compared to those of the students. The OSS-exc scores of the self-employed women were 2.4 times higher than those of the housewives (p<0.05). The results of a study conducted in Saudi Arabia showed that the knowledge level and self-efficacy differed by occupation (25). Thus, self-efficacy, which means the belief in oneself about overcoming the difficulties that may arise in the future, can be affected by individuals' occupation and skills. The present study showed no statistical difference between the OKT and OSS scores of smokers and alcohol consumers with respect to their BMI. Alcohol consumption and a high BMI are the factors that increase the risk of osteoporosis, and therefore, appropriate measures should be implemented to raise an awareness on this subject.

Trainings provided to women for prevention of osteoporosis were effective in increasing their knowledge about osteoporosis (26,27). In addition, it was reported that increased level of knowledge did not cause behavioral changes and that the perceptions and beliefs related to osteoporosis were dependent on the individuals' cultural background (28,29). Therefore, strategies should be developed to ensure behavioral changes and increase the individuals' osteoporosis knowledge level (30). In addition, self-efficacy is effective for individuals to develop a behavior. Thus, development of novel strategies to evaluate and improve the self-efficacy is of great importance. A randomized controlled study showed that women were trained about osteoporosis, and their osteoporosis knowledge levels increased after two years, whereas their osteoporosis self-efficacy had not changed (31). Similarly, another study showed that at the end of the training provided to the individuals with or without a history of osteoporosis in their families, no change

Table 1. Osteoporosis knowledge and osteoporosis self-efficacy scores based on the age, education level, occupation and body mass index

	OKT-tot ± SD median (min-max)	OKT-exc ± SD median (min-max)	OKT-nutr ± SD median (min-max)	OSS-tot ± SD median (min-max)	OSS-exc ± SD median (min-max)	OSS-Ca ± SD median (min-max)
Age (years)						
≤23	12.2±5.10 13.0 (0-23)	7.9±3.87 8.0 (0-18.0)	10.1±4.39 11.0 (0-20.0)	737.4±276.68 740.0 (0-1200)	367.4±147.11 360.0 (0-600)	370.0±154.31 360.0 (0-600)
>23	13.0±4.35 13.0 (0-24)	8.1±3.44 8.0 (0-16)	10.8±3.77 11.0 (0-21)	750.7±264.82 745.0 (0-1200)	363.0±147.14 375.0 (0-600)	387.6±155.59 405.0 (0-600)
p	**0.01**	0.12	**0.03**	0.45	0.95	0.80
Smoking						
No	12.6±4.81 13.0 (0-23)	8.0±3.69 8.0 (0-18)	10.5±4.16 11.0 (0-20)	738.0±274.81 740.0 (0-1200)	361.2±149.67 360.0 (0-600)	376.8±155.13 380.0 (0-600)
Yes	12.5±4.61 12.5 (0-24)	7.9±3.60 8.0 (0-16)	10.4±3.99 10.0 (0-21)	765.5±251.21 780.0 (0-1200)	382.4±132.94 415.0 (0-600)	383.1±154.89 405.0 (0-600)
p	0.71	0.89	0.63	0.24	0.07	0.75
Alcohol consumption						
No	12.6±4.78 13.0 (0-24)	8.0±3.68 8.0 (0-18)	10.4±4.14 11.0 (0-21)	745.1±269.80 740.0 (0-1200)	365.9±146.27 370.0 (0-600)	379.2±155.00 380.0 (0-600)
Yes	14.6±3.38 15.5 (9-19)	9.5±2.94 10.0 (4-12)	11.5±2.94 12.0 (7-16)	586.6±312.51 520.0 (180-1000)	300.0±191.10 260.0 (90-550)	286.6±128.16 290.0 (90-450)
p	0.27	0.28	0.21	0.64	0.29	0.32
Education level						
Unschooled literate	8.9±4.76[a,b] 10.5 (0-18)	5.7±3.51[c] 6.0 (0-14)	7.7±4.04[e] 8.5 (0-15.0)	647.1±341.70 625.0 (0-1200)	336.4±194.16 370.0 (0-600)	310.7±191.89 325.0 (0-600)
Primary-secondary School	11.8±4.38 11.5 (0-22.0)	7.0±3.35[d] 7.0 (0-15.0)	9.8±3.85 10.0 (0-19)	763.2±299.48 750.0 (80-1200)	374.8±163.81 405.0 (0-600)	388.4±172.79 410.0 (0-600)
High school	12.6±4.92[a] 13.0 (0-23)	8.1±3.76 8.0 (0-17)	10.4±4.29 10.0 (0-20)	726.0±263.49 710.0 (0-1200)	361.8±136.70 350.0 (0-600)	364.1±152.81 360.0 (0-600)
University	13.3±4.56[b] 14.0 (1-24)	8.6±3.55[c,d] 9.0 (0-18)	11.0±3.92[e] 11.0 (0-21)	767.6±257.89 810.0 (0-1200)	368.6±147.66 380.0 (0-600)	398.9±142.59 410.0 (0-600)
p	**0.03**	**0.02**	**0.01**	0.25	0.80	0.06
Occupation						
Housewife	12.6±4.56 13.0 (0-23)	7.8±3.65 8.0 (0-18)	10.4±3.93 10.0 (0-20)	762.4±267.94 755.0 (0-1200)	372.1±147.60 380.0 (0-600)	390.2±155.4 400.0 (0-600)
Civil servant	13.1±5.29 14.0 (1-20)	8.0±3.83 8.0 (1-14)	11.0±4.83 12.0 (0-17)	544.8±280.54 740.0 (0-1020)	335.0±139.66 340.0 (0-540)	359.3±169.7 400.0 (0-600)
Self employed	13.4±4.57 13.0 (1-24)	8.8±3.56 9.0 (0-16)	10.9±3.91 10.5 (1-21)	862.2±277.04[f] 900.0 (100-1200)	423.3±166.01[g] 460.0 (0-600)	438.8±147.58[h] 475.0 (60-600)
Worker	14.6±3.47 15.5 (8-20)	9.3±2.84 10.0 (4-14)	12.4±3.48 12.0 (6-18)	643.1±232.28 585.0 (290-1010)	304.3±104.68 305.0 (150-490)	338.7±155.00 300.0 (120-580)
Student	12.1±5.12 13.0 (0-22)	8.0±3.78 8.0 (0-17)	10.1±4.40 11.0 (0-20)	703.5±267.08[f] 710.0 (0-1200)	351.1±142.00[g] 340.0 (0-600)	352.3±150.06[h] 350.0 (0-600)
p	0.22	0.37	0.24	**0.00**	**0.02**	**0.01**
BMI (kg/m²)						
18.5	12.7±4.90 14.0 (0-22)	8.4±3.89 9.0 (0-15.0)	10.3±4.35 10.0 (0-19)	724.8±248.10 730.0 (190-1200)	361.2±131.14 370.0 (0-600)	363.6±145.39 360.0(0-600)
18.5-24.9	12.8±4.87 13.0 (0-24)	8.2±3.71 9.0 (0-18)	10.6±4.22 11.0 (0-21)	753.7±273.02 780.0 (0-1200)	366.3±147.59 360.0 (0-600)	387.4±150.14 400.0 (0-600)

Table 1. Continued						
25.0-29.9	12.0±4.82 12.5 (0-23)	7.4±3.74 7.5 (0-16)	10.1±4.11 10.0 (0-20)	732.6±281.94 730.0 (0-1200)	370.0±151.04 390.0 (0-600)	362.6±168.61 360.0 (0-600)
≥30	13.3±2.90 13.5 (7-18)	7.9±2.12 7.5 (4-11)	10.8 11.0 (4-15)	731.9±254.22 680.0 (0-1200)	345.0±157.41 345.0 (0-600)	386.9±158.23 380.0 (0-600)
p	0.46	0.25	0.68	0.85	0.88	0.49
Total	12.6±4.76 13.0 (0-24)	8.0±3.67 8.0 (0-18)	10.4±4.12 11.0 (0-21)	743.7±270.90 740.0 (0-1200)	365.3±146.96 370.0 (0-600)	378.3±154.99 380.0 (0-600)

[a, b, c, d, e, f, g, h]: p<0.05, BMI: Body mass index, Tot: Total, Ca: Calcium, Exc: Exercises, Nutr: Nutrition, OSS: Osteoporosis self-efficacy scale, OKT: Osteoporosis knowledge test

[a]: OKT-tot scores of unschooled literate and high school graduates are statistically different from each other

[b]: OKT-tot scores of unschooled literate and university graduates are statistically different from each other

[c]: OKT-exc scores of unschooled literate and university graduates are statistically different from each other

[d]: OKT-exc scores of unschooled literate and high school graduates are statistically different from each other

[e]: OKT-nutr scores of unschooled literate and university graduates are statistically different from each other

[f]: OSS-tot scores of the self-employed and students are statistically different from each other

[g]: OSS-exc scores of the self-employed and students are statistically different from each other

[h]: OSS-Ca scores of the self-employed and students are statistically different from each other

Table 2. The results of regression analysis of the variables related to the osteoporosis knowledge level

	OKT-tot			OKT-exc			OKT-nutr		
	B (SE)	**p**	**Odds ratio (95% CI)**	**B (SE)**	**p**	**Odds ratio (95% CI)**	**B (SE)**	**p**	**Odds ratio (95% CI)**
Age	0.000 (0.014)	0.975	1.000 (0.973-1.028)	-0.003 (0.014)	0.839	0.997 (0.970-1.025)	0.000 (0.014)	0.981	1.000 (0.973-1.028)
Smoking	-0.318 (0.279)	0.254	0.727 (0.421-1.257)	-0.122 (0.275)	0.657	0.885 (0.517-1.517)	-0.264 (0.278)	0.341	0.768 (0.445-1.323)
Alcohol	0.852 (0.887)	0.337	2.344 (0.412-13.338)	1.697 (1.119)	0.129	5.459 (0.609-48.957)	1.022 (0.887)	0.249	2.778 (0.489-15.794)
Education level									
Primary/ secondary school	1.925 (1.071)	0.072	6.858 (0.840-56.001)	1.025 (0.809)	0.205	2.788 (0.571-13.622)	1.017 (0.810)	0.209	2.766 (0.565-13.539)
High school	2.349 (1.052)	**0.026**	10.470 (1.331-82.375)	1.681 (0.782)	**0.032**	5.372 (1.161-24.863)	1.585 (0.784)	**0.043**	4.877 (1.049-22.673)
University	2.559 (1.057)	**0.015**	12.927 (1.630-102.536)	1.846 (0.787)	**0.019**	6.332 (1.354-29.624)	1.634 (0.790)	**0.039**	5.124 (1.090-24.079)
Occupation									
Civil servant	0.301 (0.536)	0.575	1.351 (0.473-3.861)	-0.347 (0.535)	0.517	0.707 (0.248-2.016)	0.409 (0.535)	0.445	1.505 (0.527-4.298)
Self employed	-0.334 (0.386)	0.387	0.716 (0.336-1.527)	0.155 (0.378)	0.681	1.168 (0.557-2.449)	-0.254 (0.386)	0.511	0.776 (0.364-1.653)
Worker	1.337 (0.603)	**0.027**	3.809 (1.167-13.429)	1.186 (0.603)	**0.049**	3.273 (1.003-10.679)	0.806 (0.545)	0.139	2.239 (0.770-6.512)
Student	-0.111 (0.262)	0.670	3.809 (1.167-12.429)	-0.245 (0.261)	0.348	0.783 (0.470-1.306)	-0.133 (0.262)	0.612	0.876 (0.524-1.463)
BMI (kg/m²)	0.012 (0.026)	0.637	1.012 (0.962-1.066)	-0.013 (0.026)	0.614	0.987 (0.938-1.039)	0.020 (0.026)	0.446	1.020 (0.969-1.074)
Stable	-2.781 (1.272)	0.029	0.062	-1.292 (1.048)	0.218	0.275	-2.197	0.038	0.111

p<0.05, BMI: Body mass index, CI: Confidence interval, Exc: Exercises, Nutr: Nutrition, OKT: Osteoporosis knowledge test, SE: Standard error, Tot: Total
Smoking reference category: do not smoke, alcohol reference category: do not drink, education level reference: unschooled literate, occupation reference category: housewife

was observed in the participants' osteoporosis self-efficacy (32). The present study showed a low positive relationship between OKT-tot and OSS-tot, between OKT-nutr and OSS-Ca, and between OKT-exc and OSS-exc (r=0.192, p<0.001, r=0.193, p<0.001, r=0.152, p=0.002 respectively). Although the correlation coefficients showed a weak association between

Table 3. The results of regression analysis of the variables related to the osteoporosis self-efficacy

	OSS-tot			OSS-exc			OSS-Ca		
	B (SE)	**p**	**Odds ratio (95% CI)**	**B (SE)**	**p**	**Odds ratio (95% CI)**	**B (SE)**	**p**	**Odds ratio (95% CI)**
Age	-0.011 (0.014)	0.432	0.989 (0.963-1.016)	-0.013 (0.014)	0.357	0.987 (0.960-1.015)	0.015 (0.014)	0.275	1.015 (0.988-1.044)
Smoking	0.102 (0.272)	0.707	1.107 (0.650-1.886)	0.503 (0.276)	0.069	1.654 (0.962-2.842)	0,012 (0.273)	0.965	1.012 (0.592-1.729)
Alcohol	-0.961 (0.905)	0.288	0.382 (0.065-2.253)	-0.840 (0.902)	0.352	0.432 (0.074-2.530)	-1.085 (0.901)	0.229	0.338 (0.058-1.977)
Education level									
Primary-secondary school	0.248 (0.601)	0.680	1.281 (0.394-4.161)	0.220 (0.600)	0.714	1.246 (0.385-4.038)	0.659 (0.618)	0.286	1.933 (0.575-6.493)
High school	0.040 (0.569)	0.944	1.041 (0.341-3.175)	-0.280 (0.566)	0.621	0.756 (0.249-2.292)	0.363 (0.589)	0.537	1.438 (0.453-4.563)
University	0.485 (0.577)	0.400	1.624 (0.524-5.030)	0.027 (0.574)	0.962	1.027 (0.334-3.162)	1.009 (0.597)	0.091	2.744 (0.852-8.842)
Occupation									
Civil servant	-0.508 (0.540)	0.348	0.602 (0.209-1.736)	-0.561 (0.553)	0.310	0.571 (0.193-1.686)	0.221 0.550	0.687	1.248 (0.425-3.668)
Self employed	0.673 (0.396)	0.089	1.961 (0.902-4.261)	0.901 (0.406)	0.026	2.461 (1.111-5.453)	0.639 (0.399)	0.109	1.895 (0.867-4.140)
Worker	-0.913 (0.564)	0.106	0.401 (0.133-1.213)	-1.174 (0.604)	0.052	0.309 (0.095-1.010)	-0.707 (0.549)	0.198	0.493 (0.168-1.445)
Student	-0.470 (0.261)	0.072	0.625 (0.375-1.042)	-0.241 (0.261)	0.355	0.786 (0.471-1.309)	-0.394 (0.264)	0.135	0.674 (0.402-1.131)
BMI (kg/m²)	-0.031 (0.026)	0.233	0.969 (0.921-1.020)	-0.020 (0.026)	0.448	0.980 (0.931-1.032)	0.026 (0.026)	0.315	0.974 (0.925-1.025)
Stable	0.903 (0.898)	0.315	2.467	0.826	0.899	0.358	-0.319 (0.919)	0.729	0.727

p<0.05, BMI: Body mass index, Ca: Calcium, CI: Confidence interval, Exc: Exercises, OSS: Osteoporosis self-efficacy scale, SE: Standard error, Tot: Total smoking reference category: does not smoke, alcohol reference category: does not drink, education level reference: unschooled literate, occupation reference category: housewife

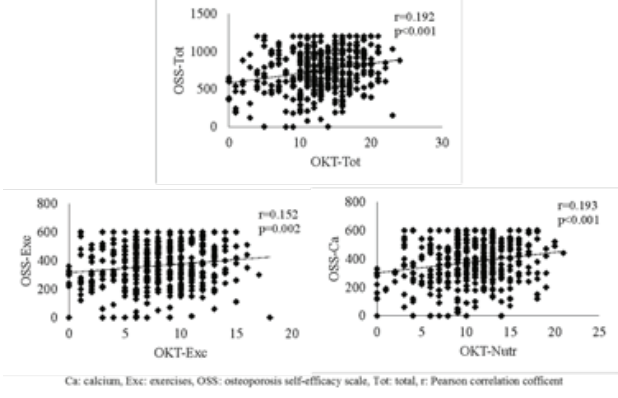

Figure 1. The relationship between osteoporosis knowledge and osteoporosis self-efficacy scores (n=419)

the variables, the considerably large sample size obtained in this study enabled us to show the significance of these correlations. Another study conducted in Turkey showed a similar relationship between the OKT and OSS scores of the women who were admitted to orthopedic clinics (24).

Conclusion

In conclusion, this study showed a low the osteoporosis knowledge level and self-efficacy among the women. Age, level of education, and occupation are important demographic factors which affect osteoporosis knowledge level and self-efficacy. The 80% or 90% of peak bone mass is acquired in late adolescence; therefore, providing theoretical courses in secondary and high schools may increase individuals' osteoporosis knowledge level. In addition, providing information on the physical activities and nutrition that may lead to changes in lifestyles can contribute to reducing the risk of osteoporosis and promoting public health. Limitations of this study include the facts that the study was conducted at only one center, and dietary consumptions and physical activities were not recorded. Thus, there is a need for further multicenter studies which also assess calcium intake and physical activity level.

Ethics

Ethics Committee Approval: The study was approved by the Ethical Board of Scientific Research and Publication of Eastern

Mediterranean University dated 30.05.2016 and numbered 2016/28-12.

Informed Consent: Informed consent was obtained from all participants.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: C.G., Design: C.G., E.O., Data Collection or Processing: E.O., Analysis or Interpretation: C.G., Literature Search: C.G., Writing: C.G., E.O.

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The Impact of Extracorporeal Shock Wave Therapy and Dry Needling Combination on the Pain, Grip Strength and Functionality in Patients Diagnosed with Lateral Epicondylitis

Lateral Epikondilit Tanılı Hastalarda Ekstrakorporeal Şok Dalga Tedavisi ve Kuru İğneleme Tedavisi Kombinasyonunun Ağrı, Kavrama Gücü ve Fonksiyonellik Üzerine Etkisi

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Abstract

Objective: The aim of this study was to investigate the effects of extracorporeal shock wave therapy (ESWT) and dry needling (DN) combination to the trigger points in the forearm extensor muscles on pain, grip strength and functionality in patients diagnosed with lateral epicondylitis.

Materials and Methods: Forty patients who were clinically diagnosed with lateral epicondylitis were included in the study. The patients were divided into two groups as ESWT and ESWT + DN. Patients in the ESWT and exercise group were applied 2.000 pulses, once a week, three sessions; in addition to that three sessions of DN therapy was applied to the other group. Also, stretching and eccentric strengthening exercises were applied to the patients in both groups. The pain severity of the patients which occured with palpation and grip was measured by Visual Analog Scale (VAS), lateral epicondyle sensitivity by an algometer, grip strength by dynamometer and functionality level by the patient-rated tennis elbow evaluation (PRTEE) pre-treatment and at the end of treatment (first month).

Results: In both groups; there were statistically significant improvements in first month VAS scores of the pre- and post-treatment (morning, activity, and rest) ($p<0.001$); in the comparison of the intergroup, the improvement in pain scores, except for night pain, was found to be superior in the ESWT + DN group ($p<0.001$). The evaluation of the most sensitive region of the lateral epicondylitis pre- and post-treatment with algometer were compared, there was a significant improvement in both groups ($p<0.001$), whereas the improvement in ESWT + DN group was observed to be superior ($p<0.001$). While the maximum grip strength values measured in the elbow flexion and extension position increased significantly in both groups after the treatment, the increase in the extension position in the ESWT + DN group was outstanding ($p<0.05$). When the pre- and post-treatment changes seen in the PRTEE scale of the patients were examined; a statistically significant decrease was observed in all groups in favor of improvement post-treatment ($p<0.05$). In ESWT + DN group, pain score and function score change were more effective than ESWT group ($p<0.001$).

Conclusion: These results suggest that ESWT and DN combination therapy in lateral epicondylitis provide better clinical outcomes than ESWT treatment alone.

Keywords: Lateral epicondylitis, dry needling, extracorporeal shock wave therapy

Öz

Amaç: Bu çalışmada, lateral epikondilit tanılı hastalarda, ekstrakorporeal şok dalga tedavisi (ESWT) ile ön kol ekstansör kaslarındaki aktif tetik noktalara kuru iğneleme (DN) tedavisi kombinasyonunun ağrı, kavrama kuvveti ve fonksiyonellik üzerine etkisi araştırıldı.

Gereç ve Yöntemler: Çalışma 40 hasta üzerinde gerçekleştirildi. Hastalar; ESWT ve ESWT + DN olmak üzere iki gruba ayrıldı. ESWT ve egzersiz grubundaki hastalara 2000 atım, haftada bir kere, 3 seans; diğer gruba ise buna ek olarak 3 seans DN tedavisi uygulandı. Her iki gruptaki hastalara germe ve eksentrik kuvvetlendirme egzersizleri verildi. Hastaların palpasyon ve kavrama ile meydana gelen ağrı şiddeti Vizuel Ağrı Skalası (VAS) ile, lateral epikondil hassasiyeti algometre ile, kavrama kuvveti dinamometre ile ve fonksiyonellik düzeyi ise hasta bazlı önkol değerlendirme anketi (PRTEE) ile tedavi öncesinde, tedavi bitiminde (1. ay) değerlendirildi.

Bulgular: Tedavi öncesi ve tedavi sonrası 1. ay sabah, aktivite ve istirahat VAS ağrı skorları karşılaştırıldığında; her iki grupta da bütün VAS değerleri istatistiksel olarak anlamlı iken ($p<0,001$), gruplar arası kıyaslama yapıldığında ESWT + DN grubunda ağrı skorlarında düzelmenin gece

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ağrısı hariç daha üstün olduğu görülmüştür (p<0,001). Tedavi öncesi ve tedavi sonrası lateral epikondilin en hassas bölgesinin algometre ile değerlendirilmesi kıyaslandığında her iki grupta da anlamlı bir düzelme görülürken (p<0,001), ESWT + DN grubunda düzelmenin üstün olduğu gözlemlenmiştir (p<0,001). Dirsek fleksiyon ve ekstansiyon pozisyonunda ölçülen maksimum kavrama kuvveti değerleri tedavi sonrasında her iki grupta da anlamlı artarken ESWT + DN grubunda ekstansiyon pozisyonundaki artış daha üstündü (p<0,05). Hastaların tedavi öncesi ve tedavi sonrası PRTEE skalasında görülen değişimler incelendiğinde; tedavi sonrasında bütün gruplarda tedavi öncesine göre iyileşme lehine istatistiksel olarak anlamlı azalma görüldü (p<0,05). ESWT ile ESWT + DN grupları birbirleriyle karşılaştırıldığında; ESWT + DN grubunda ağrı skoru, fonksiyon skoru değişiminin ESWT grubuna göre daha etkili olduğu görüldü (p<0,001).

Sonuç: Çalışmamız, lateral epikondilit tedavisinde ESWT ve DN kombinasyon tedavisinin sadece ESWT tedavisinden daha iyi klinik sonuçları olduğunu göstermiştir.

Anahtar kelimeler: Lateral epikondilit, kuru iğneleme, ekstrakorporeal şok dalga tedavisi

Introduction

Lateral epicondylitis (LE) is the tendinopathy leading to pain in the musculotendinous junction of lateral epicondyle and wrist extensor muscles (1). It usually occurs between the ages of 35-50 (2). It is caused by overloading and repetitive movements requiring wrist extension. With repeating and overloading, tissue damage occurs by exceeding the strength, flexibility and endurance tolerance of the tissue (3). As repetitive tissue damage continues, pain, strength and functional loss due to degeneration progress. Extensor carpi radialis brevis (ECRB) muscle in particular, extensor carpi radialis longus (ECRL), extensor digitorum communis (EDC) and brachioradialis (BR) muscles tend to be affected. In the treatment of LE; there are conservative, medical or surgical approaches to reduce pain and improve function. Researchers reported that conservative and medical treatments were effective in acute stages and surgery was effective in advanced calcified stages (4). The aim of conservative treatment is; to reduce pain, to control the tendon-bearing loads, to restore flexibility and strength, and to prevent recurrence of symptoms. In conservative approaches, ultrasound, iontophoresis, orthosis, laser, manipulation, mobilization, dry needling (DN) and exercise methods are frequently used. Chard and Hazleman (5) has stated that they used more than 40 treatment methods for LE. However, there is insufficient evidence for the efficacy of treatment modalities due to methodological differences between studies (6). In the literature, the effectiveness of exercise is prominent (7). Although extracorporeal shock wave therapy (ESWT) has been used frequently in recent years, its effect is still controversial (1). ESWT is a treatment modality for the application of high-intensity sound waves to the body. Shock waves are caused by sudden changes in pressure. These changes create strong waves that cause compression and tension (8). The success rate of treatment varies between 65% to 91% (9). DN is a relatively new the treatment for LE and studies have been conducted in the literature (10,11). DN is a minimally invasive method which is known to stimulate myofascial trigger points (MTrPs) in muscle tissue, cause biochemical changes in MTrPs' microenvironment and reduce the spontaneous electrical activity of the trigger points (12,13). Fernandez-Carnero (14) described pain patterns of active MTrPs in the ECRB, ECRL, BR, EDC muscles, which were similar to the pain caused by LE. In our study, we aimed to evaluate the effect of adding DN treatment to ECRB, ECRL, EDC and BR muscles active MTrPs in addition to ESWT treatment to lateral epicondyle.

Materials and Methods

Forty patients ages between 18-70 who were admitted to Kars Harakani State Hospital, Clinic of Physical Medicine and Rehabilitation Outpatient with the complaint of elbow pain between May 2018 and August 2018 were included in the study. All participants were informed about the study and their written informed consent was taken. The approval of the Ethics Committee of the Kars Kafkas University Faculty of Medicine was obtained for our study (18/05/2018, LUT 10/12-13).

The inclusion criteria of our study included patients who had symptoms for at least 6 weeks between the ages of 18-70 and who did not receive any anti-inflammatory treatment during the treatment period and who were diagnosed with LE (15). Along with physical examination, other possible differential diagnoses were excluded by using appropriate laboratory tests and radiological methods. Direct X-rays of the elbow were obtained to rule out radio-humeral joint arthritis, osteochondritis dissecans, or osteonecrosis. Patients with cervical radiculopathy or posterior interosseous nerve entrapment were excluded from the study.

The level of education level (primary school and above) is determined as to be able to understand and complete the treatment, interventions and forms to be used in the evaluation. Malignancy, presence of active infection, history of diffuse inflammatory rheumatic disease, trauma in the elbow area, skin lesion, infection or presence of open wounds, neuropathy, radiculopathy, peripheral circulatory disorder, coagulopathy, use of warfarin, arthropathy, presence of congenital or acquired upper extremity deformity, the presence of fracture sequelae, prosthesis, the presence of internal plate screw fixator, cardiac pacemaker, metal implant in the region of application and the presence of conditions which may be inconvenient in the application of physiotherapy such as pregnancy were not included in the study.

The patients were divided into two equal groups of 20 according to the randomization method.

The Following Parameters Were Used in the Evaluations:

1. Socio-demographic and clinical characteristics of patients
2. Subjective pain intensity
3. Evaluation of pain with algometer
4. Evaluation of grip strength with Jamar Hand dynamometer
5. Evaluation of functionality: Patient rated forearm evaluation questionnaire (PRTEE-T).

Evaluations were performed twice as before and one month after treatment.

Evaluation of Grip Strength: Grip is an indicator of general muscle strength. The wrist extensor muscles provide stabilization during grip and other hand functions. During the grip, the ECRL and ECRB muscles contract more flexibly against the flexor moment created by the wrist and finger flexor muscles (16).

Patients' normal range of motion were evaluated before comparison of grip strength and compared with the intact side. Grip force was evaluated with Jamar Hand Dynamometer. Due to the change in muscle tension in different elbow positions of the ECRB muscle, the elbow was evaluated in two different positions as extension and 90° flexion.

Evaluation of Functionality: The functionality of the patients was evaluated with PRTEE-T before and after treatment. PRTEE-T consists of 15 questions that question the pain experienced by the patients during the week before. The first 5 questions include pain level and the other 10 questions include elbow related functions. In the functionality section; 6 questions include special activities and 4 questions include daily activities. The total score ranges from 0 to 100 and high scores show increased pain and loss of functionality (17).

Physiotherapy and Rehabilitation Program

Group 1: Cold application - home exercise program - ESWT treatment (3 sessions with 1 week intervals).

Group 2: Cold application - home exercise program - ESWT treatment + DN treatment (3 sessions with 1 week intervals)

All evaluations were applied to two groups both before treatment and one month after treatment.

Treatments applied to patients;

1. Cold Application: At the beginning of each treatment, the gel ice packs were wrapped with a damp towel and applied around the elbow joint for 15 minutes.

2. Home Exercise Program: A home exercise program consisting of eccentric strengthening and stretching exercises planned to increase patients' resistance every week. Patients; strength training exercises for wrist extensors and forearm supination were taught and home exercise program was started with 3 sets of 10 repeats per day.

For wrist extensors, wrist flexion was performed with a count to 20 when the wrist was in full extension position and then passively returned to the starting position with the other hand. Starting from the 5th session of the treatment, the eccentric strength training for the wrist extensors was continued with the red-coloured resistant band and the eccentric strength training for the forearm supination was added to the exercise program. Eccentric supination training for the forearm was started weightless. The training program was then continued with a red-coloured resistant band. The patients who participated in the treatment were asked about the presence and/or increase of pain due to exercise before each treatment session. In the event of severe pain during exercise, patients were informed about interrupting the exercise.

In addition to strengthening exercises; stretching exercises for the affected-side wrist extensor muscles were taught. Patients were asked to stretch for 20 seconds with the other hand in the internal rotation, elbow extension, forearm pronation, wrist flexion and ulnar deviation positions. Stretching exercises were recommended to be performed before reinforcement exercise by giving 3 sets a day, 5 to 20 seconds in a set and 45 seconds rest in the first week. From the 2nd week of treatment, 5 sets of 5 to 20 seconds per day before the exercise were asked to be performed 5 to 20 seconds after the exercise (18). The pain increase of the patients was questioned before each treatment.

3. ESWT Application: For the patients randomized into two groups; ESWT was applied once per week with 15 Hz frequency settings in the form of a 2 bar and 2000 pulse. ESWT was applied with equal shares of 2000 pulse to three points that are precisely determined in LE; to the most swollen part of the ECRB muscle with 1 cm above and 1 cm below the posterior epicondyle (19). Painful points of the patients were determined by palpation. After ESWT treatment, cold application was performed for 15 minutes.

4. Dry Needling: Active MTrPs in ECRB, ECRL, EDC, BR muscles were treated with DN. An assessor blind to the participants' condition evaluated the muscles manually for the presence of active or latent trigger points. The compression pain at the trigger points within the muscle was accepted as active MTrP in the form of pain reflected in the lateral epicondyle region. Only the trigger points localized with palpation were evaluated as latent. Dry neeedling was applied according to the localization reference

Table 1. Patients' characteristics in pretreatment visit

	Group 1 (ESWT)	Group 2 (ESWT + DN)	p
Age (year)	428.5±12.98	39.65±14.08	0.459
Height (cm)	164.75±9.45	171.65±10.5	0.161
Weight (kg)	70.05±9.88	75.2±12.73	0.035
BMI (kg/m^2)	29.73±5.34	28.15±6.97	0.418
Disease duration (month)	4.15±2.39	4.95±1.39	0.204

ESWT: Extracorporeal shock wave therapy, DN: Dry needling, BMI: Body mass index
Values average was given as ± standard deviation. Independent samples t-test was used

of MTrPs in ECRB, ECRL, EDC, BR muscles by Simons et al. (20). The practitioner was an expert with 5 years of experience in this field. The patient was placed in supine position during the procedure. The needle was modulated by pulling inside the MTrP, until the local twitch response was obtained. If the patient felt a serious discomfort, the practice was interrupted. Seirin brand 0.6*30 mm acupuncture needles were used during application.

Statistical Analysis

Data analysis was performed by using SPSS for Windows 19.0 software program. Descriptive statistics were given as number, percent, median, mean and standard deviation. The Kolmogorov-Smirnov test was used for data normality. The results were compared within the groups themselves and between the groups. In these comparisons, repeated measures ANOVA and Bonferroni correction for multiple comparisons were used. A level of significance of $p<0.05$ was accepted.

Results

The socio-demographic and clinical features of the patients were summarized in Table 1. Before treatment and 1 month after the treatment; morning, activity and rest Visual Analog Scale (VAS) pain scores were compared; while all VAS values were statistically significant in both groups ($p<0.001$), it was seen that the improvement in pain scores in the ESWT + DN group was superior ($p<0.001$) except night pain (Table 2). When the most sensitive region of LE was compared with the algometer before treatment and after the treatment, a significant improvement was observed in both groups ($p<0.001$), while improvement in ESWT + DN group was superior ($p<0.001$) (Table 2). The maximum grip strength values measured in the elbow flexion and extension position increased significantly in both groups after the treatment, whereas the increase in the extension position in the ESWT + DN group was superior ($p<0.05$) (Table 3).

Table 3 shows the changes in the PRTEE scale within the group before and one month after treatment. When the changes in the PRTEE scale before and after treatment were examined; a statistically significant decrease was observed in favour of improvement in all groups after treatment ($p<0.05$) (Table 3). In ESWT + DN group, pain scores, function scores changes were more effective than the only ESWT group ($p<0.001$) (Table 3).

Discussion

Although many medical and conservative methods are used for LE, there is no consensus on the efficacy of these treatments (21). On the other hand, in recent studies, multimodal approaches are seen in the treatment of LE (22,23). This study showed that ESWT + DN combination therapy in the treatment of LE, grip strength and functionality were effective for early pain reduction. Although the etiology of LE is unknown, overuse and micro traumas affect disease formation (24). ESWT, one of the most common conservative approaches, is thought to stimulate the nerve endings in painful points caused by reflex pain inhibition (hyper-stimulation analgesia). In addition, energy transfer and the local trauma of the ECRB tendon, acute inflammation and repairment process initiated by increased secreted angiogenesis-related growth factors, formation of new vessels and oxygenation are the other mechanisms (25,26). In studies performed with ESWT, a comparison was usually made with the placebo-controlled group. Exercise therapy, which is an effective treatment for LE, has been used in conjunction with ESWT (27).

Simons et al. (20) described pain patterns of active MTrPs in the anterior limb extensor muscles, which may cause pain in

Table 2. Visual Analog Scale and pressure pain threshold scores at pre-posttreatment visit

	Group 1 (ESWT)	Group 2 (ESWT + DN)	p_1
Night VAS-1	5.3±4.23	7.5±2.84	0.061
Night VAS-2	2.6±2.09	2±0.86	0.242
	<0.001	**<0.001**	-
Activity VAS-1	8.75±1.37	8.15±0.81	0.101
Activity VAS-2	3.8±1.11	2.15±0.59	**<0.001**
p_2	**<0.001**	**<0.001**	-
Rest VAS-1	7.8±1.54	8.05±1.15	0.564
Rest VAS-2	3.25±1.16	2.1±0.55	**<0.01**
p_2	**<0.001**	**<0.001**	-
PPT-1	12.45±3.78	11.9±2	0.568
PPT-2	19.7±4.12	25.65±4.97	**<0.001**
p_2	**<0.001**	**<0.001**	-

ESWT: Extracorporeal shock wave therapy, DN: Dry needling, VAS: Visual Analog Scale, PPT: Pressure pain threshold, p_1: Within-subject comparison, p_2: Between-subject comparison
A repeated measure ANOVA was used

lateral epicondyle region. Therefore, we think that MTrPs are important in the treatment of LE. In this study, we investigated the effect of ESWT and DN combination on pain parameters, grip strength and functionality and aimed to contribute to the literature with this combination therapy which has not been performed before.

Shmushkevich et al. (28) suggested that myofascial pain also plays a role in the pathogenesis of the disease. In their study, they evaluated the presence of active or latent trigger points in the ECRB, ECRL, EDC, BR muscles in twenty healthy controls with treatment-resistant twenty patients with LE. They showed significant difference in active MTRPs number in the patient group (28). In an other study by Fernandez-Carnero et al. (29), 25 patients with unilateral chronic LE and active and latent MTRPs in 20 healthy populations, active MTRPs rates in the LE group were 100% in ECRB, 96% in ECRL, 76% in EDC and 32% in BR. Interestingly, a significantly greater number of latent MTrPs were found in the forearm muscles of the unaffected side compared to the control group (29).

Stenhouse et al. (10) compared DN + platelet rich plasma (PRP) combinations with DN treatment in treatment-resistant patients. In a similar study comparing PRP and DN therapies, by Mishra and Pavelko (30) showed that PRP treatment had no superiority to DN treatment. In both of the studies, a thick needle was used in the DN technique, and the needling was directly applied to the painful points in the lateral epicondyle region with the peppering technique (10,30). In another LE study, Uygur et al. (11) compared the combination of DN treatment and medical therapy + brace. In this study; a thinner acupuncture needle was applied to the painful area of lateral epicondyle, DN treatment showed superiority in both pain and PRTEE scores. Uygur et al. (11) treated the most painful area is marked at the lateral epicondyle, DN is performed with DN. In the literature, there are randomized controlled trials in which only MTrPs of ECRB, ECRL, EDC, BR muscles are targeted in the treatment of LE. From these studies Ajimsha et al. (31) examined the effects of myofascial release and sham ultrasound treatment on pain and functionality in patients with chronic LE. In the study of Nourbakhsh and Fearon (32), manual osteopathic technique was used for 23 patients with chronic LE and MTrPs were targeted in one of the groups, while in the other group parts adjacent to MTrPs was treated. It was shown that improvement in pain and functionality scores was superior in the group in which MTrPs were targeted. Therefore, the treatment of active MTrPs of ECRB, ECRL, EDC, BR muscles in the treatment of LE was found to be effective both in reducing pain and increasing the daily activities of the patient (28). In mentioned studies; while treating MTrPs; cold application and/or home exercises programs for tendinitis were not added to the treatment. We think that the treatment combinations for both active MTrPs and tendinitis will be more effective. In our study, this situation was taken into consideration and on the one hand, tendinitis was treated with ESWT, ice application and exercise therapy; on the other hand, active MTRPs in the ECRB, ECRL, EDC, BR muscles of patients were treated with DN. The active MTRPs' DN in the ECRB, ECRL, EDC, BR muscles improved the patient's adaptation to exercise by decreasing the pain felt during stretching exercises and increased the flexibility of the muscles.

Pain is the most important problem in patients with LE. There were statistically significant changes in VAS scores in the ESWT

Table 3. Functional assessment at pre-posttreatment visit

	Group 1 (ESWT)	Group 2 (ESWT + DN)	p_1
FLX-1	16.00±7.53	15.65±4.07	0.856
FLX-2	29±9.04	33.95±6.86	0.058
p_2	**<0.001**	**<0.001**	-
EXT-1	16.9±7.02	15.35±4.23	0.403
EXT-2	28.35±10.12	34.25±7.5	**0.043**
p_2	**<0.001**	**<0.001**	-
PRTEE VAS-1	32.75±5.88	33.95±6.11	0.531
PRTEE VAS-2	20.95±5.32	18.5±5.23	**0.150**
p_2	**<0.001**	**<0.001**	-
PRTEE FUNC-1	60.15±11.68	62.05±11.4	0.606
PRTEE FUNC-2	38.55±5.35	33.75±6.54	**0.015**
p_2	**<0.001**	**<0.001**	-
PRTEE TOTAL-1	93.2±17.02	96.1±17.23	0.595
PRTEE TOTAL-2	60.05±10.61	58.1±10.34	0.560
p_2	**<0.001**	**<0.001**	-

ESWT: Extracorporeal shock wave therapy, DN: Dry needling, FLX: Flexion, EXT: Extension, PRTEE: Patient rated tennis elbow evaluation, VAS: Visual Analog Scale, FUNC: Function, p_1: Within-subject comparison, p_2: Between-subject comparison
Repeated measures ANOVA was used

+ exercise group at the 6th and 12th weeks of treatment in in a study of Yürük et al. (3) comparing the ESWT + exercise combination with placebo ESWT- exercise combination; but ESWT + exercise was not superior to the placebo group. In a randomized, multicentred, double-core, placebo-controlled study, Pettrone and McCall reported 50-61% increase of pain in the ESWT group at 1-year follow-up; and a 29% improvement in the placebo group. They argued that ESWT was a safe and effective treatment for pain (33). Wang and Chen investigated the efficacy of low energy ESWT and placebo ESWT in LE. They found that palpation pain, muscle strength and functionality developed in the treatment group and no side effects were reported. In a randomized controlled trial with ESWT in 62 patients who were resistant to conservative treatments, Spacca et al. (25) reported a decrease in pain, grip strength and function during 6 months.

There is a decrease in pain with ESWT. The treatment of active MTrPs with DN method contributes to pain reduction. Therefore, increase in grip strength and improvement in daily functions are seen. In our study, pain, muscle strength and functionality scores improved in both groups, whereas ESWT-DN combination was superior to ESWT group ($p<0.001$) (Table 2, Table 3).

These results show us while treating tendinitis with ESWT; at the same time DN treatment of active MTrPs in the lateral epicondyl site both reduces the patient's pain and increases the awareness and adaptation of the patients' to the strengthening and stretching exercises which are indispensable for the treatment.

Study Limitations

1. Low number of patients and the absence of long-term results of the ESWT-DN combination.
2. No comparative treatment with a sham control group.
3. DN therapy was applied without ultrasound and/or electrical stimulation.

Conclusion

In this study, we aimed to contribute to the literature by showing the effectiveness of ESWT and DN combination, which was performed for the first time in the treatment of LE. Both treatment methods are cost-effective and easy to apply. We think that additional studies should be done in this direction.

Ethics

Ethics Committee Approval: The approval of the Ethics Committee of the Kars Kafkas University Faculty of Medicine was obtained for our study (18/05/2018, LUT 10/12-13).

Informed Consent: All participants were informed about the study and their written informed consent was taken.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: F.B., Concept: F.B., Design: F.B., N.Y., Data Collection or Processing: F.B., Analysis or Interpretation: F.B., N.Y., Literature Search: F.B., N.Y., Writing: F.B., N.Y.

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Lumbosakral Geçiş Vertebrasının Numaralandırılmasında Paraspinal İşaretleyicilerin Değerlendirilmesi

The Evaluation of Paraspinal Markers in the Numbering of the Lumbosacral Transitional Vertebrae

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Öz

Amaç: Lumbosakral geçiş vertebra (GV) yaygın bir konjenital anomali olup kronik bel ağrısı ile ilişkili olduğu bilinmektedir. Bu çalışmanın amacı bilgisayarlı tomografi (BT) görüntülerde lumbosakral GV'nin doğru numaralandırılmasında çölyak arter (ÇA), süperior mezenterik arter (SMA), sağ renal arter (SRA) orijinleri, abdominal aort bifurkasyonu (AAB) ve iliolumbar ligament (İL) gibi paraspinal belirteçlerin değerini ortaya koymaktır.

Gereç ve Yöntem: Ocak 2015 ile Aralık 2017 tarihleri arasında tüm vücut BT görüntülemesi yapılan 18-65 yaşları arasındaki olgular retrospektif olarak değerlendirildi.

Bulgular: Çalışmaya 380 olgu (yaş, 53,4±10,8 yıl; 164 kadın ve 216 erkek) dahil edildi, 51 olguda (%13,4) GV vardı. Normal spinal segmentasyonlu ve GV'li olgular arasında ÇA, SMA, SRA orijini, AAB ve İL düzeyleri açısından anlamlı farklılık saptandı (p<0,001).

Sonuç: Normal spinal segmentasyonlu ve GV'li bireyler arasında ÇA, SMA, SRA orijinleri, AAB ve İL düzeylerinin lokalizasyonu açısından anlamlı farklar vardır. Dolayısıyla, bu belirteçlerin kullanımı, vertebral numaralandırmanın belirlenmesinde yanlışlıklara neden olabilir.

Anahtar kelimeler: Geçiş vertebra, bilgisayarlı tomografi, paraspinal belirteçler

Abstract

Objective: Lumbosacral transitional vertebrae (TV) are a common congenital anomaly and known to be associated with chronic low back pain. The purpose of this study is to reveal the value of the paraspinal markers such as celiac artery (CA), superior mesenteric artery (SMA), right renal artery (RRA) origins, abdominal aorta bifurcation (AAB), and iliolumbar ligament (IL) in the correct numbering of lumbosacral TV on computed tomography (CT) imaging.

Materials and Methods: The cases with aged from 18-65 years who underwent the whole-body CT imaging between the dates January 2015 and December 2017 were assessed retrospectively.

Results: Of the 380 cases (age 53.4±10.8 years; 164 women and 216 men) included in the study, 51 (13.4%) had TV. A significant difference was determined in terms of the level of CA, SMA, RRA origin, AAB, and IL between the cases with TV and normal spinal segmentation (p<0.001).

Conclusion: There are significant differences in terms of the localization of the CA, SMA, RRA origins, AAB, and IL levels between the subjects with normal spinal segmentation and TV. Therefore, the use of these marks may result in inaccuracy of the vertebral numbering.

Keywords: Transitional vertebrae, computed tomography, paraspinal markers

Giriş

Lumbosakral geçiş vertebra (GV) yaygın bir konjenital anomali olup sıklığı %3 ile %35,6 arasında olduğu bildirilmektedir (1-6). Genellikle lumbosakral GV terimi, vertebranın sakralize bir L5 veya lumbarize bir S1 olup olmadığına karar verilemediği için tercih edilir. Sakralize bir L5 genişlemiş transvers proçesden/proçeslerden tam sakral füzyona kadar değişen morfolojik özellikler gösterir. Lumbarize S1 ise sagital görüntülerde lomber vertebralar gibi kare şeklinde görülebilir ve/veya lomber tip faset eklemlere sahip olabilir (2). Bu nedenle rutin lumbosakral görüntülemede GV'nin doğru olarak numaralandırılması zordur.

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Lumbosakral GV'nin kronik bel ağrısı, sinir kökü semptomları ve sakroiliak disfonksiyon ile ilişkili olduğu bilinmektedir (7-10). Bunun yanında GV'nin belirlenmesi ve numaralandırılması özellikle cerrahi öncesi planlamada yanlış seviyelerin cerrahi girişiminden kaçınmak için çok önemlidir. Rutin lumbosakral görüntülemelerde GV saptanabilir ancak doğru vertebral numaralandırmada tüm vertebrayı içine alan görüntülemeler altın standart olarak kullanılır. Bunun için genellikle tüm omurga radyografisi veya tüm omurgayı içine alan sagital T2 ağırlıklı görüntüler kullanılmıştır (1,2,5,8).

Lumbosakral hastalıkların tanısında manyetik rezonans (MR) görüntüleme yaygın olarak kullanılır. Ancak bilgisayarlı tomografi (BT) incelemeleri daha hızlı ulaşılabilirliği, kemik yapılardan kaynaklı patolojileri daha iyi gösterebilmeleri ve gelişen teknolojiye bağlı olarak daha düşük doz radyasyon maruziyetine rağmen artan görüntü kalitesi nedeni ile son zamanlarda tercih edilebilirliği artmıştır. Bizim bildiğimiz kadarı ile GV'leri BT görüntüleme ile değerlendiren detaylı bir çalışma bulunmamaktadır. Çalışmamızın amacı BT görüntülerde lumbosakral GV'nin tanısında ve doğru numaralandırılmasında çölyak arter (ÇA), süperior mezenterik arter (SMA), sağ renal arter (SRA) orijinleri, abdominal aort bifurkasyonu (AAB) ve iliolumbar ligament (İL) gibi paraspinal anatomik belirteçlerin değerini ortaya koymaktır.

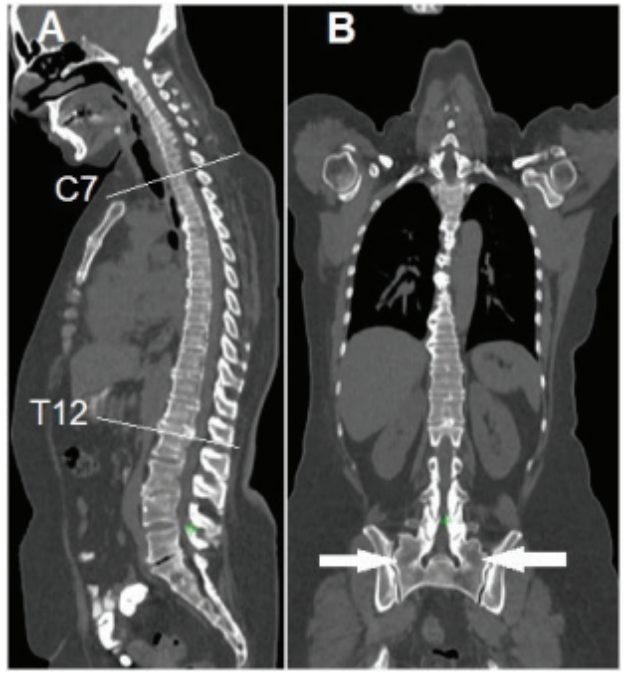
Gereç ve Yöntem

Çalışmanın yapılabilmesi için Kurumsal Etik Kurul Komitesi'nden etik kurul onayı alındı (protokol no:70, karar no: 2018/2, tarih: 12.01.2018). Çalışma Helsinki İlkeler Deklerasyonu'na uygun olarak gerçekleştirildi.

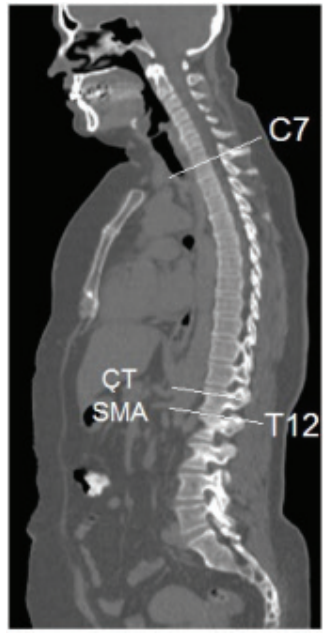
Ocak 2015 ile Aralık 2017 tarihleri arasında herhangi bir nedenle tüm vücut pozitron emisyon tomografisi-BT görüntülemesi yapılan 18-65 yaşları arasında hastaların görüntü arşivleme ve iletişim sisteminde kayıtlı olan BT görüntüleri retrospektif olarak değerlendirildi. Görüntüler Siemens, Biograph mCT S(20)-3R (Siemens Medical Solutions, Knoxville, USA) cihazında elde edildi. Herhangi bir nedenle (vertebra fraktürü, vertebral metastaz gibi) spinal deformitesi olan hastalar, spinal cerrahi geçirmiş hastalar, aort anevrizması ve kıvrımlı seyirli aortu olan hastalar ile birden çok SRA olan hastalar çalışma dışı bırakıldı. BT görüntüler aksiyel, sagital ve koronal olarak üç planda değerlendirildi. Vertebralar, 7 servikal ve 12 torakal vertebra olduğu varsayılarak ikinci servikal vertebradan itibaren kaudale doğru numaralandırıldı. Bu numaralandırmaya göre lumbosakral GV varlığı araştırıldı. Olgular lumbosakral GV olan ve olmayan olmak üzere iki gruba ayrıldı. Lumbosakral GV saptanan olgular Castellvi ve ark. (11) sınıflamasına göre sınıflandırıldı. Her iki grupta bütün olgular değerlendirilerek ÇA, SMA, SRA orjinlerinin ve AAB'lerinin seviyeleri belirlendi. Belirlenen bu seviyelerin denk geldiği intervertebral disk, 1/3 üst, 1/3 orta veya 1/3 alt vertebra korpus düzeyleri kaydedildi. Ayrıca İL değerlendirilerek hangi seviye/seviyelerde olduğu tespit edilerek kaydedildi (Şekil 1-5).

İstatistiksel Analiz

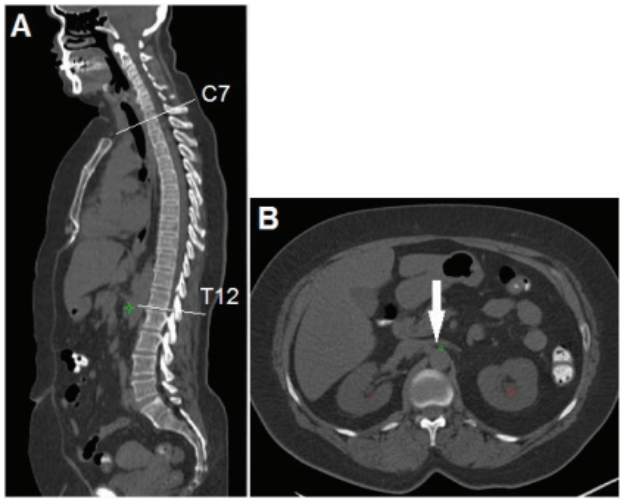
Tüm istatiksel analizler The Statistical Package for the Social Sciences (SPSS), version 18.0, for Windows (SPSS, Chicago, IL, USA) kullanılarak yapıldı. Sürekli değişkenler ortalama ± standart deviasyon, kategorik değişkenler yüzde ve frekans



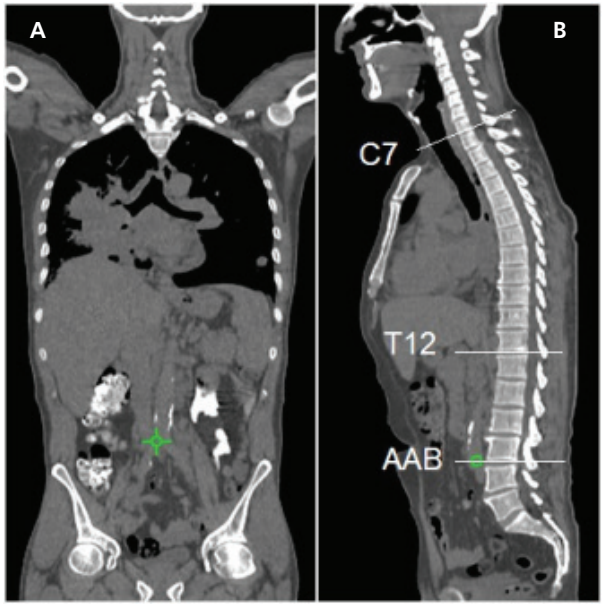
Şekil 1. A) Reforme sagital ve B) koronal bilgisayarlı tomografi görüntülerde L5 vertebranın sakralize olduğu ve her iki L5 transvers proçeslerinin S1 ile füzyone olduğu izleniyor



Şekil 2. Reforme sagital bilgisiyarlı tomografi görüntüde L5 sakralize olguda çölyak trunkus orijini T12 vertebra korpus 1/3 üst düzeyde, süperior mezenterik arter orijini T12-L1 intervertebral disk düzeyinde izlenmektedir



Şekil 3. A) Reforme sagital ve B) aksiyel bilgisayarlı tomografi görüntülerde L5 sakralize olguda sağ renal arterin orijini T12-L1 intervertebral disk düzeyinde izlenmektedir

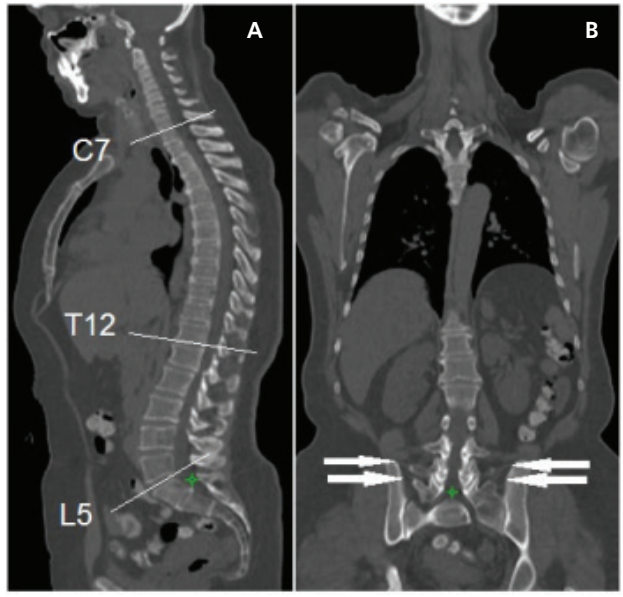


Şekil 4. A) Reforme koronal ve B) sagital bilgisayarlı tomografi görüntülerde S1 lumbarize olguda abdominal aort bifurkasyonu L4-5 intervertebral disk düzeyinde izlenmektedir

dağılımı olarak gösterildi. Gruplar arasında karşılaştırmada ki-kare testi uygulandı. P<0,05 değerler istatiksel olarak anlamlı kabul edildi.

Bulgular

Çalışmaya katılan 380 olgunun ortalama yaşı 53,4±10,8 yıl ve cinsiyet dağılımları kadın/erkek 164 (%43,2)/216 (%56,8) idi. 380 olgunun 51'inde (%13,4) GV tespit edildi. GV saptanan 51 olgunun 42'sinde (%11,1) sakralizasyon, 9'unda (%2,4) lumbarizasyon izlendi. Bir olguda (%2) tip IA, 5 olguda (%9,8) tip IB, 1 olguda (%2) tip IIA, 5 olguda (%9,8) tip IIB, 4 olguda (%7,8) tip IIIA, 34 olguda (%66,7) tip IIIB ve 1 olguda (%2) tip



Şekil 5. Reforme sagital (A) ve koronal (B) bilgisayarlı tomografi görüntülerde S1 lumbarize olgudur. İliolumbar ligamentler (oklar) bilateral L5 ve S1 vertebra transvers proçeslerden iliak kanatlara uzandığı izlenmektedir

IV tespit edildi.

GV'ye sahip olgularda ÇA orijini 2 olguda (%3,9) T11-12 intervertebral disk, 34 olguda (%66,7) T12 vertebra, 1 olguda (%2) T12-L1 intervertebral disk, 14 olguda (%27,5) L1 vertebra seviyesine denk gelmekte idi. Kontrol grubunda ÇA orijini 136 olguda (%41,3) T12 vertebra, 7 olguda (%2,1) T12-L1 intervertebral disk, 186 olguda (%56,5) L1 vertebra düzeyine denk gelmekte idi. İki grup arasında ÇA orijini düzeyleri açısından istatiksel olarak anlamlı farklılık tespit edildi (p<0,001).

GV'ye sahip olgularda SMA orijini 15 olguda (%29,4) T12 vertebra, 3 olguda (%5,9) T12-L1 intervertebral disk, 29 olguda (%56,9) L1 vertebra, 1 olguda (%2) L1-2 intervertebral disk, 3 olguda (%5,9) L2 vertebra düzeyine denk gelmekteydi. Kontrol grubunda ise 40 olguda (%12,2) T12 vertebra, 17 olguda (%5,2) T12-L1 intervertebral disk, 252 olguda (%76,6) L1 vertebra, 11 olguda (%3,3) L1-2 intervertebral disk, 9 olguda (%2,7) L2 vertebra düzeyine denk gelmekteydi. İki grup arasında SMA orijin düzeyleri açısından istatiksel olarak anlamlı farklılık tespit edildi (p=0,009).

GV'ye sahip olgularda SRA orijini 10 olguda (%19,6) T12-L1 intervertebral disk, 28 olguda (%54,9) L1 vetebra, 7 olguda (%13,7) L1-2 intervertebral disk, 5 olguda (%9,8) L2 vertebra, 1 olguda (%2) L2-3 intervertebral disk düzeyine denk gelmekteydi. Kontrol grubunda ise 4 olguda (%1,2) T12-L1 intervertebral disk, 225 olguda (%68,4) L1 vertebra, 63 olguda (%19,1) L1-2 intervertebral disk, 37 hastada (%11,2) L2 vertebra düzeyine denk gelmekteydi. İki grup arasında SRA orijin düzeyleri açısından istatiksel olarak anlamlı farklılık tespit edildi (p<0,001).

GV'ye sahip olgularda AAB 11 olguda (%21,6) L3 vertebra, 9 olguda (%17,6) L3-4 intervertebral disk, 22 olguda (%43,1) L4 vertebra, 2 olguda (%3,9) L4-5 intervertebral disk, 7 olguda

(%13,7) L5 vertebra düzeyine denk gelmekteydi. Kontrol grubunda ise 5 olguda (%1,5) L3 vertebra, 26 olguda (%7,9) L3-4 intervertebral disk, 252 olguda (%76,6) L4 vertebra, 31 olguda (%9,4) L4-5 intervertebral disk, 15 olguda (%4,6) L5 vertebra düzeyine denk gelmekteydi. İki grup arasında AAB düzeyleri açısından istatiksel olarak anlamlı farklılık tespit edildi (p<0,001).

Tablo 1. Geçiş vertebraya sahip olgular ve kontrol grubunun çölyak arter orijin düzeyleri

Çölyak arter orijini	Transizyonel vertebra 51 (n)	Normal 329 (n)
T11-12 intervertebral disk	2 (%3,9)	0 (%0)
T12 vertebra üst 1/3	6 (%11,8)	19 (%5,8)
T12 vertebra orta 1/3	10 (%19,6)	20 (%6,1)
T12 vertebra alt 1/3	18 (%35,3)	97 (%29,5)
T12-L1 intervertebral disk	1 (%2)	7 (%2,1)
L1 vertebra üst 1/3	10 (%19,6)	131 (%39,8)
L1 vertebra orta 1/3	0 (%0)	35 (%10,6)
L1 vertebra alt 1/3	4 (%7,8)	20 (%6,1)
Toplam	51 (%100)	329 (%100)

Tablo 2. Geçiş vertebraya sahip olgular ve kontrol grubunun süperior mezenterik arter orijin düzeyleri

Süperior mezenterik arter	Transisyonel vertebra 51 (n)	Normal 329 (n)
T12 vertebra orta 1/3	4 (%7,8)	4 (%1,2)
T12 vertebra alt 1/3	11 (%21,6)	36 (%10,9)
T12-L1 intervertebral disk	3 (%5,9)	17 (%5,2)
L1 vertebra üst 1/3	18 (%35,3)	85 (%25,8)
L1 vertebra orta 1/3	7 (%13,7)	75 (%22,8)
L1 vertebra alt 1/3	4 (%7,8)	92 (%28)
L1-L2 intervertebral disk	1 (%2)	11 (%3,3)
L2 vertebra üst 1/3	3 (%5,9)	9 (%2,7)
Toplam	51 (100)	329 (%100)

Tablo 3. Geçiş vertebraya sahip olgular ve kontrol grubunun sağ renal arter orijin düzeyleri

Sağ renal arter	Transisyonel vertebra 51 (n)	Normal 329 (n)
T12-L1 intervertebral disk	10 (%19,6)	4 (%1,2)
L1 vertebra üst 1/3	5 (%9,8)	32 (%9,7)
L1 vertebra orta 1/3	20 (%39,2)	99 (%30,1)
L1 vertebra alt 1/3	3 (%5,9)	94 (%28,6)
L1-L2 intervertebral disk	7 (%13,7)	63 (%19,1)
L2 vertebra üst 1/3	4 (%7,8)	34 (%10,3)
L2 vertebra orta 1/3	1 (%2)	3 (%0,9)
L2-L3 intervertebral disk	1 (%2)	0 (%0)
Toplam	51 (100)	329 (%100)

Tablo 4. Geçiş vertebraya sahip olgular ve kontrol grubunun aort bifurkasyonu düzeyleri

Aort bifurkasyonu	Transisyonel vertebra 51 (n)	Normal 329 (n)
L3 vertebra orta 1/3	3 (%5,9)	0 (%0)
L3 vertebra alt 1/3	8 (%15,7)	5 (%1,5)
L3-L4 intervertebral disk	9 (%17,6)	26 (%7,9)
L4 vertebra üst 1/3	5 (%9,8)	57 (%17,3)
L4 vertebra orta 1/3	13 (%25,5)	97 (%29,5)
L4 vertebra alt 1/3	4 (%7,8)	98 (%29,8)
L4-L5 intervertebral disk	2 (%3,9)	31 (%9,4)
L5 vertebra üst 1/3	4 (%7,8)	11 (%3,3)
L5 vertebra orta 1/3	1 (%2)	4 (%1,2)
L5 vertebra alt 1/3	2 (%3,9)	0 (%0)
Toplam	51 (100)	329 (%100)

GV'ye sahip olgularda İL 2 olguda (%3,9) L4 vertebra, 4 olguda (%7,8) L5 vertebra, 24 olguda (%47) L4-L5 vertebralar, 10 olguda (%19,6) L3-L4-L5 vertebralar, 2 olguda (%3,9) L4-L5-S1 vertebralar, 9 olguda (%17,6) L5-S1 vertebralar düzeyinden iliak kemiklere uzanmaktaydı. Kontrol grubunda ise İL 263 olguda (%79,9) L5 vertebra, 54 olguda (%16,4) L4-5 vertebralar, 9 olguda (%2,7) L3-4-L5 vertebralar, 3 olguda (%0,9) L5-S1 vertebralar düzeyinden iliak kemiklere uzanmaktaydı. İL transisyonel vertebraya sahip 51 olgunun sadece 6'sında (%11,7) tek seviyede izlenirken 45 olguda (%88,2) çoklu seviyede izlenmekteydi. Kontrol grubunda ise 263 olguda (%79,9) tek seviyede olup tümü L5 vertebra düzeyindeydi. İki grup arasında İL düzeyleri açısından istatiksel olarak anlamlı farklılık tespit edildi (p<0,001).

ÇA, SMA ve SRA orijinlerinin ve AAB'nin düzeyleri intervertebral disk, vertebra korpusu üst, orta ve alt 1/3 şeklinde daha detaylı seviyelere ayrılarak yapılan karşılaştırmada da GV'ye sahip olgular ile kontrol olgular arasında istatiksel olarak anlamlı farklılık tespit edildi (tümü için p<0,001). ÇA, SMA, SRA ve AAB düzeyleri Tablo 1, 2, 3 ve 4'de gösterilmektedir.

Tartışma

Lumbosakral GV unilateral ya da bilateral olmak üzere genişlemiş transvers proçesden anormal artikülasyona veya tamamen füzyona kadar değişen farklı morfolojik özelliklere sahip, yaygın bir vertebral anomalidir. Castellvi ve ark. (11) bu morfolojik özelliklere göre lumbosakral GV'yi dört sınıfa ayırmışlardır. Tip 1'de tek taraflı (1a) veya iki taraflı (1b) yüksekliği 19 mm'den fazla displastik transvers proçes mevcuttur. Tip 2'de (inkomplet lumbarizasyon ya qda sakralizasyon) transvers proçesin komşu sakrum ile tek taraflı (2a) ya da iki taraflı (2b) psödoartrozu izlenir. Tip 3'te (komplet lumbarizasyon yada sakralizasyon) transvers proçes komşu sakrum ile tek taraflı (3a) ya da iki taraflı (3b) olarak füzyonedir. Tip 4'te (mikst tip) transvers proçeslerde

bir tarafta psödoartroz mevcutken diğer tarafta tam füzyon izlenir (1,12).

GV'nin doğru olarak numaralandırılabilmesi için farklı paraspinal işaretleyiciler kullanılarak birçok çalışma yapılmıştır ve bu çalışmalarda genellikle MR görüntüler kullanılmıştır (1,13,14).

Tokgoz ve ark. (1) GV tanısında spinal ve paraspinal belirteçleri değerlendirdikleri çalışmada SRA proksimali, SMA trunkusu ve AAB'nin normal grupla karşılaştırıldığında sakralizasyon olgularında daha yüksek ve lumbarizasyon olgularında daha düşük düzeylere denk geldiği bildirilmiştir. Bu belirteçlerin lokal dağılımları istatistiksel olarak anlamlı farklılık gösterdiği belirtilmiştir (1).

GV'lerin doğru numaralandırılması için yapılan bir başka çalışmada SRA ve AAB düzeyleri değerlendirilmiştir. Bu çalışmada da SRA ve AAB düzeylerinin normal olgulara göre sakralizasyon grubunda daha yüksek, lumbarizasyon grubunda daha düşük lokalizasyonlu olma eğiliminde olduğu saptanmıştır (15).

Lee ve ark. (16) yapmış oldukları çalışmada AAB'nin en sık görüldüğü yerin L4 vertebra düzeyi (%83) olduğunu belirtmişlerdir. Bu çalışmada SRA'nın proksimal kesimi hastaların %52'sinde L1-L2 intervertebral disk düzeyinde, %39'unda L1 vertebra korpusu düzeyinde izlenmiştir. Ayrıca bu çalışmada S1 lumbarizasyonu olan 11 olgunun 9'unda aortik bifurkasyonun L4 vertebra korpusu düzeyinde, olduğu bildirilmiştir. SRA bu 11 olgunun 6'sında L1-L2 intervertebral disk düzeyinde, 5'inde L2 vertebranın üst yarısı düzeyinde saptanmıştır. L5 sakralizasyonu olan 9 olgunun 7'sinde aortik bifurkasyon L3-L4 intervertebral disk düzeyinde saptanmıştır. Ayrıca L5 sakralizasyonu olan 9 olgunun 7'sinde SRA L1 vertebra korpusu düzeyinde olduğu bildirilmiştir.

Tureli ve ark. (17) 505 olguyu dahil ederek yapmış oldukları çalışmada AAB'nin ortalama ve medyan seviyeleri normal olgularda L4 vertebranın üst yarısında, S1 lumbarize olgularda L4 vertebranın alt yarısında, L5 sakralize olgularda L3-4 intervertebral diskinde izlendiği bildirilmiştir. Ayrıca bu çalışmada SRA normal olgularda L1 vertebranın alt yarısı, S1 lumbarize olgularda L1-2 intervertebral disk, L5 sakralize olgularda L1 vertebranın üst yarısı düzeyinde olduğu belirtilmiştir.

Jagannathan ve ark. (3) 254 normal spinal segmentasyona ve 57 GV'ye sahip olguları dahil ederek yapmış oldukları çalışmada çölyak trunkus, SMA, SRA, AAB ve İL değerlendirilmiştir. Bu çalışmada ÇA orijini T11 vertebra düzeyinden L1-L2 intervertebral disk düzeyine kadar değişen seviyerlerde izlenmiş olup normal olgularda ve sakralizasyonlu olgularda sırası ile %62,6 ve %58,7 oranla en sık T12 vertebra düzeyine, lumbarizasyonlu olgularda %58,3 oranla en sık L1 vertebra düzeyine denk gelmiştir. Bu çalışmada SMA orijini T11-12 intervertebral disk düzeyinden L1-L2 intervertebral disk düzeyine kadar değişen seviyelerde izlenmiştir. SMA orijini normal olguların %78,8'inde T12-L1 intervertebral disk ve L1 vertebra düzeyinde, sakralizasyon olgularının %69,5'inde T12 vertebra ve T12-L1 intervertebral disk düzeyinde ve lumbarizasyon olgularının %66,7'sinde L1 vertebra ve L1-L2 intervertebral disk düzeyinde izlenmiştir. SRA orijini normal olgularda %57,5 L1 vertebra, %24 L1-L2 intervertebral disk düzeyinde, sakralizasyon olgularında %52,2 L1 vertebra, %28,6 T12-L1 intervertebral disk düzeyinde, lumbarizasyon olgularında %41,7 L2 vertebra düzeyinde izlendiği bildirilmiştir. Bu çalışmada AAB normal olgularda %48,8 L4 vertebra, %28,7 L4-L5 intervertebral disk düzeyinde, sakralizasyon olgularında %50 L3-L4 intervertebral disk, %23,9 L4 vertebra düzeyinde, lumbarizasyon olgularında sıklıkla %50 L4 vertebra ve %41,7 L4-L5 intervertebral disk düzeyinde izlenmiştir (3).

İliolomber ligament normal spinal segmentasyona sahip olgularda büyük oranda L5 transvers proçesler düzeyinde izlenir. Ancak transizyonel vertebraya sahip olgularda diğer seviyelerde de izlenebileceği bildirilmiştir (2,13). Farshad-Amacker ve ark. (18) GV'li hastalarda İL olguların %25-38'inde L5 vertebradan kaynaklandığını, %39-59'unda parsiyel olarak L5 vertebradan kaynaklandığını, %15-23'ünde ise L5 vertebradan hiç orijin almadığını göstermiştir. Bizim çalışmamızda iliolomber ligament normal spinal segmentasyonlu 329 olgunun 263'ünde (%79,9) tek seviyede olup L5 vertebra düzeyindeydi. Transisyonel vertebraya sahip 51 olgunun ise sadece 6'sında (%11,7) tek seviyede izlenirken 45 olguda (%88,2) çoklu seviyede izlenmekteydi.

Sonuç

Normal spinal segmentasyonlu olgularda ve GV'ye sahip olgularda ÇA, SMA, SRA orijinleri, AAB ve İL düzeyleri oldukça farklı spinal seviyelerde izlenmektedir. Bu belirteçler kullanılarak vertebral numaralandırma yapılması yanılgılara neden olabilecektir. Bu nedenle herhangi bir girişimsel işlem ya da cerrahi planlanan olgularda hedef bölgeyi vertebral numaralandırma yapmadan lokal referanslar ile tanımlamak doğru bir yaklaşım olacaktır. Eğer vertebral numaralandırma gerekli ise uygun bir görüntüleme yöntemi ile tüm spinal inceleme en doğru yöntem olacaktır.

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