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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 ve CABI 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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Materyal Sorumluluk Reddi

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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 reqiuirements 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

TURKISH JOURNAL OF OSTEOPOROSIS

INSTRUCTIONS TO AUTHORS

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The Journal publishes papers on all aspects of osteoporosis, metabolic bone diseases and its rehabilitation. In addition to original articles, review articles, original case reports, letters to the editor, scientific letters, educational articles, abstracts from new literature and announcements of future congresses and meetings are also published.
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This page should include the Turkish and English titles of the manuscript, affiliation of author(s), key words and running titles.
The English title should take place in the title page. Likely, Turkish title should be mentioned for articles in foreign language. Turkish and English key words and running titles should also be included in the title page.
The names and full postal addresses of authors and the corresponding author should be indicated separately. Especially as e-mail addresses will be used for communication, e-mail address of the corresponding author should be stated. In addition, telephone and fax numbers must be notified.
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In the second page, Turkish and English summaries of the manuscript (maximum 200 words for each), and the key words should take place.
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In this category, authors summarize the present state of knowledge regarding physical medicine, rheumatology and rehabilitation.

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Türk Osteoporoz Dergisi
TURKISH JOURNAL OF OSTEOPOROSIS

Editörden / Editorial

Sevgili Meslektaşlarımız,

Ülkemizi ve dünyayı etkisi altına alan COVID-19 hastalığı nedeniyle tüm sağlık personelinin üstün sorumluluk bilinci ve büyük özveriyle çalıştığı bu zor günlerin sonuna yaklaşmış olmayı gönülden diliyoruz. Pandemi sürecinde meslektaşlarımızın akademik faaliyetlere yönelik çabalarının devam ederek, dergimize basım için yayın akışı sürmesinden büyük mutluluk duyuyoruz.

Bu salgın nedeniyle tüm dünyada yapılması planlanan birçok bilimsel kongre iptal edilmiştir veya yüz yüze yapılan kongrelerin yerini online kongreler almıştır. Osteoporoz, Osteoartrit ve Kas İskelet Sistemi Hastalıkları Dünya Kongresi (WCO-IOF-ESCEO) de 26-29 Ağustos 2021 tarihlerinde online olarak yapılacaktır.

OSTEO 2021 "Osteoporoz, Osteoartrit ve Kas-İskelet Sistemi Ağrıları Kongresi" de 8-10 Ekim 2021 tarihlerinde Türkiye Osteoporoz Derneği ev sahipliğinde ve International Osteoporosis Foundation bilimsel desteği ile dijital platformda gerçekleştirilecektir. Kongrenin içeriğinde gerek akademik çalışma ve araştırmalarda gerekse günlük hekimlik uygulamalarında önemli yer tutan; osteoporoz ve osteoartrit yanında ağrıya, yaşam kalitesinde olumsuz etkilenmelere ve iş gücü kaybına neden olan farklı kas iskelet sistemi sorunlarına da kapsamlı olarak yer verilmiştir. Kongre programı bilimsel ve sosyal açılardan siz değerli meslektaşlarımızın katılım ve katkıları ile zenginleşecektir.

Siz değerli meslektaşlarımıza çalışmalarınızda kolaylıklar diler; akademik faaliyetlerde yüz yüze buluşacağımız günlerin yakın olması arzusuyla, sevgi ve saygılarımı sunarım.

Editör
Prof. Dr. Yeşim Kirazlı

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Lateral Epikondilit Enjeksiyonundan Sonra Geçici Radiyal Sinir Felci: Olgu Bazlı Derleme

Transient Radial Nerve Paralysis After a Lateral Epicondylitis Injection: A Case-based Review

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Öz

Lateral epikondilit, çoğunlukla tekrarlayan kavrama veya el bilek ekstansiyonundan kaynaklanan, el bilek ekstansör kas ve tendonlarının yapışma yeri olan humerus lateral epikondilinin ağrılı tendinozudur. Lateral epikondilit dirsek yan ağrısının erişkinlerde en sık nedenlerinin başında gelmektedir. Hastaların çoğu konservatif tedaviye cevap verirken bazı hastalarda cerrahi tedavi yöntemleri kullanılmaktadır. Bu olgu bazlı derlemede kliniğe dirsek ağrısı ile başvuran 68 yaşındaki bir erkek hasta üzerinden konu irdelenecektir. Çeşitli konservatif tedavilerden fayda görmeyen lateral epikondilit tanılı hastaya tedavi olarak sol dirsek lateral epikondil tendon yapışma bölgesine 0,5 cc prilokain hidroklorür ve 1 cc triamsinolon hekzasetonid enjekte edildi. Enjeksiyondan sonra hastanın 2., 3. ve 4. parmaklarında düşme meydana geldi. Hastada radiyal sinir felci düşünüldü ve eli uygun şekilde atele alındı. Yetmiş iki saat sonra hastanın kas güçlerini tekrar değerlendirmek için yapılan kontrolde hastanın enjeksiyon sonrası oluşan şikayetlerinin düzeldiği gözlendi. Bu derlemede çok yaygın bir enjeksiyon tipinden sonra ortaya çıkan geçici radiyal sinir felçli bir olgu bağlamında lateral epikondilit tedavi yöntemleri ve enjeksiyon sonrası görülen komplikasyonlar vurgulanmıştır.

Anahtar kelimeler: Lateral epikondilit, radiyal sinir, enjeksiyonlar

Abstract

Lateral epicondylitis is a painful tendinosis of the lateral epicondyle of the humerus, which is the attachment site for the wrist extensor muscles and tendons. It is most commonly caused by repetitive gripping or wrist extension. Moreover, lateral epicondylitis is one of the most common causes of elbow flank pain in adults. While most patients respond to conservative treatment, surgical treatment is used in some patients. In this study, we reviewed the case of a 68-year-old man who presented to the clinic with elbow pain. In this patient with lateral epicondylitis, who had not responded to various conservative treatments, 0.5 cc prilocaine hydrochloride and 1 cc triamcinolone hexacetonide were injected in the left elbow lateral epicondyle tendon adhesion area. After the injection, the patient's second, third and fourth fingers dropped. Further, the patient was diagnosed with radial nerve paralysis, and his hand was properly splinted. After 72 hours, in the follow-up to reevaluate the patient's muscle strength, it was observed that the patient's complaints after the injection resolved. This review focuses on the treatment methods of lateral epicondylitis and on complications that occur after a lateral epicondyle injection in the context of a case of transient radial nerve paralysis after a very common type of injection.

Keywords: Lateral epicondylitis, radial nerve, injections

Giriş

Lateral epikondilit, çoğunlukla tekrarlayan kavrama veya el bilek ekstansiyonundan kaynaklanan, el bilek ekstansör kas ve tendonlarının yapışma yeri olan humerus lateral epikondilinin ağrılı tendinozu olarak tanımlanmaktadır (1,2). Lateral dirsek ağrısının sık görülen nedenlerinin başında gelmektedir. Lateral epikondilit tanısı anamnez ve fizik muayene ile konabilmektedir. Dirsek lateralinde ağrı ve günlük işlerin yapılması sırasında güçlük hastaların tipik başvuru yakınmalarıdır (3). Lateral epikondilit karakteristik olarak hastaların yaşamının dördüncü veya beşinci dekatında görülmektedir. Bu hastalıktan erkekler ve kadınlar eşit şekilde etkilenir ve semptomlar daha çok dominant taraftaki kolda görülür (4). Literatürde lateral epikondilit için çok sayıda tedavi metodu önerilmektedir. Klinik uygulamada genel olarak konservatif tedaviler ön planda tercih edilmektedir. Konservatif tedavi olarak alçı-atel ile istirahat, fizik tedavi modaliteleri, vücut dışı şok dalga tedavisi (ESWT), non-steroid anti-enflamatuvar ilaç (NSAİİ) kullanımı ve enjeksiyon tedavisi başlıca tedavi

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seçeneklerindendir (5). Konservatif tedaviden yarar görmeyen hastalarda cerrahi tedavi yöntemleri tercih edilmektedir (6).

Lateral Epikondilitte Konservatif Tedavi Yöntemleri

1. Bekle ve Gör

Yeterince fonksiyon kaybı bulunmayan hastalar için "bekle ve gör" yaklaşımı mantıklı olabilir. Bekle ve gör yöntemi, genelde lateral epikondilite bağlı olan belirtiler hastanın günlük yaşamında kısıtlanmalara neden olmuyorsa ve hasta diğer konservatif tedavileri uygulamak istemiyorsa tercih edilmektedir. Bu yöntemde hastalarda, dirsek tendinopatisi ile ilişkili belirtiler 6 ay ile 2 yıl arasında devam edebilmektedir (6). Genel olarak bekle ve gör yöntemi, mobilizasyon ve egzersize göre daha az etkilidir (7).

2. Aktivite Modifikasyonu

Hastalar ağrılarını şiddetlendiren aktivitelerden kaçınmaya çalışmalıdır. Özellikle lateral epikondil yapışma yerinde sürtünmeye neden olan tekrarlayıcı hareketler konusunda hastalar bilgilendirilmeli ve ona göre aktiviteleri modifiye edilmelidir. Sporcularda hatalı mekaniğin düzeltilmesi, aktivite modifikasyonunun bir parçası olarak uygulanmalıdır. Fiziksel faktörlerin modifiye edilmesi epikondilit riskini azaltabilir ve hastalık prognozunu iyileştirebilir (8).

3. Breys ve Atel Kullanımı

Tendon orijinine aktarılan kuvvetleri azaltan bir breys ya da atel kullanımı hastaların ağrılarını rahatlatabilmektedir. Yapılan bir çalışmada breysleme, kısa vadede (2-12 hafta) ağrı sıklığı ve şiddetinde önemli bir azalma sağlamıştır, ayrıca plasebo breys ile karşılaştırıldığında 26. haftada genel dirsek fonksiyonunda olumlu sonuçları bulunmuştur (9).

4. Egzersiz

Lateral epikondiliti olan birçok hastada başlangıç tedavisi için iyi tasarlanmış fizik tedavi programları uygulanabilmektedir. Etkili egzersiz programları, ihtiyaca göre esneklik eğitimi ve diğer modaliteleri birleştiren ayrıca eksantrik ve izometrik güçlendirmeyi de içeren egzersiz programlarıdır (10,11). Sistematik bir derlemede, kuvvet antrenmanının lateral epikondilitte semptomları azaltabildiği, germe ve kuvvetlendirme egzersizlerinin de etkilenen tendonun daha iyi ve hızlı iyileşmesini sağladığı belirtilmiştir (12).

5. Non-steroid Anti-enflamatuvar İlaç Kullanımı

Bu konuda literatürde kanıtlar az olmasına rağmen, hastalarda kısa vadeli olarak ağrıyı azaltıp fonksiyonel işlevi artırdığı belirtilmektedir (13). Pattanittum ve ark. (14) bir derlemede lateral epikondilit tedavisinde topikal veya oral NSAİİ'lerin yararları veya zararları hakkında kesin sonuçlara varmak için sınırlı kanıt olduğunu bildirmişlerdir. Beş plasebo kontrollü çalışmadan elde edilen veriler, topikal NSAİİ'lerin ağrıyı iyileştirmede faydalı olabileceğini öne sürse de (4 haftaya kadar), verilerin normal olmayan dağılımı ve diğer metodolojik sorunlar nedeniyle kesin sonuçlara varılamadığı belirtilmiştir. Oral NSAİİ'lerin faydalarına ilişkin kanıtlar çelişkili olmakla birlikte, oral NSAİİ kullanımının bazı hastalarda gastrointestinal yan etkilere de neden olabildiği belirtilmiştir.

6. Enjeksiyon Tedavisi

Birçok farklı enjeksiyon yöntemi [kortikosteroid, botulinum toksin, proloterapi, kuru iğneleme, akupunktur, otolog kan, trombositten zengin plazma (PRP) vd.] lateral epikondilit tedavisinde kullanılmaktadır. Kortikosteroid enjeksiyonu lateral epikondilit tedavisinde majör tedavi seçeneğidir (15). Yapılan sistematik bir derlemede, lateral epikondilit tedavisinde kortikosteroid enjeksiyonlarının kısa vadede etkin olmasına rağmen, kortikosteroid dışındaki enjeksiyonların uzun vadede daha faydalı olabildiği belirtilmiştir. Bununla birlikte tendinopati bölgeleri arasındaki etki farklılıkları nedeniyle enjeksiyona yanıtın genelleştirilmemesi gerektiği sonucuna varılmıştır (16). Boden ve ark. (17) PRP enjeksiyonunun lateral ve medial epikondilitte ağrı, fonksiyon ve yaşam kalitesi üzerine istatistiksel olarak anlamlı iyileşmeler sağladığını saptamışlardır. Başka bir çalışmada kronik lateral epikondiliti bulunan hastalarda akupunktur enjeksiyonu ve kortikosteroid enjeksiyon tedavisinin etkili olduğu saptanmış ve uzun vadede akupunktur tedavisinin daha etkili olduğu sonucuna varılmıştır (18).

6.1. Lateral Epikondilit Enjeksiyonuna Bağlı Komplikasyonlar

Lokal kortikosteroid enjeksiyonları eğer tanı doğru konulmuş, kontraendikasyonlara dikkat edilmiş ve steril şartlar sağlanmışsa güvenlidir. Yan etkileri enjeksiyon sonrası ağrı (%2-5), tendon rüptürü (%1'den az), benign deri değişiklikleri (%1) ve enfeksiyondur (%0,1 den az) (19). Bunun dışında enjeksiyon yerine bağlı olarak sinir hasarı da oluşabilmektedir. İlk 48 saate kadar olan ağrıda azalma yerine artma kristal fenomenine bağlanır. Kristal fenomeninde, steroid kristallerinin çökmesi ve kümelenmesi riski nedeniyle, kortikosteroidlerin lidokainlerle karıştırılmasına karşı çıkılır (20). Kırk sekiz saatten sonra ortaya çıkan alevlenme ise genelde bir enfeksiyona işaret eder. Enjeksiyon bölgesinde pigmentasyon azalması veya subkütanöz doku atrofisi fazla dozda veya tekrarlayan dozlarda ortaya çıkmaktadır. Enjeksiyon sonrası enfeksiyon gelişmesi en önemli fakat çok nadir görülen bir komplikasyondur (19). Yapılan bir meta-analizde, PRP enjeksiyonunun ağrıyı iyileştirebileceği ve komplikasyon riskini azaltabileceği, buna karşın otolog kan enjeksiyonunun ağrıyı, sakatlık puanlarını ve basınç ağrı eşiğini iyileştirebileceği, ancak daha yüksek komplikasyon riskine sahip olduğu sonucuna varılmıştır. Ayrıca aynı çalışmada kortikosteroid enjeksiyonu ile karşılaştırıldığında, otolog kan enjeksiyonu, ağrı görsel analog ölçeğinde, kol omuz ve el engelliliklerinde, Hastayla İlgili Tenisçi Dirseği Değerlendirme skorunda ve basınç ağrısında daha büyük iyileşmeler sağlamış ama göreceli yan etki riski daha yüksek bulunmuştur (21). Park ve ark. (22) kortikosteroid enjeksiyonlarının yumuşak doku kalsifikasyonu ile anlamlı ilişkisi olduğunu saptamışlardır ve bu kalsifikasyonun kortikosteroid enjeksiyonunun iyatrojenik bir komplikasyonu olabileceği

sonucuna varmışlardır. Başka bir çalışmada, kuru iğnelemenin düşük komplikasyon oranı nedeniyle güvenli bir yöntem olduğu belirtilmiştir (23). Espandar ve ark. (23) bir çalışmasında, kronik lateral epikondilitli hastalarda botulinum toksin enjeksiyonu ve plasebo enjeksiyonu karşılaştırılmıştır. Bu çalışmada botulinum toksin enjeksiyonu grubunda 4. haftada üçüncü ve dördüncü parmakların ekstansiyonunda, iş yerinde işlevselliği engelleyecek düzeyde güçsüzlük oluşmuş ve bununla birlikte, oluşan bu tablo bir hastada 8. haftada, diğer hastalarda 16. haftada düzelmiştir (24). Aynı çalışmada botulinum enjeksiyonu grubunda bulunan 24 hastanın 10'unda enjeksiyon yerinde ağrı, 5'inde enjeksiyon bölgesinde karıncalanma hissi, 8'inde enjeksiyon bölgesinde subjektif kas spazmı hissi şeklinde yan etkiler gözlenmiştir (24).

Diğer enjeksiyon tiplerinde de komplikasyonlar kullanılan materyale göre değişmekle birlikte benzerdir. Lateral epikondilit enjeksiyonu yaparken çevredeki anatomik yapılar göz önüne alınıp uygun yöntem ve hazırlıkla enjeksiyon yapılması, oluşacak komplikasyonların önlenmesi açısından önemlidir.

7. Vücut Dışı Şok Dalga Tedavisi

ESWT'nin lateral epikondil yapışma yerinde enflamasyon oluşturarak iyileşme kaskadını aktive edip, lateral epikondilit bulunan hastalarda faydalı olabileceği düşünülmektedir. Genel olarak bir miktar fayda sağladığını öne süren çalışmalar olsa da (25), birçok çalışmada etki mekanizması ve kesin etkisi gösterilememiştir (26,27).

Yapılan bir meta-analizde, ESWT tedavisi ile plasebo grupları arasındaki karşılaştırmalarda etkinlik açısından düşük derecede farklar saptanmıştır (28). Yalvaç ve ark. (29) ESWT ve terapötik ultrason (US) tedavisinin lateral epikondilitte etkili olduğu ve etkilerinin birbirine benzer olduğunu saptamışlar ve ESWT'nin alternatif bir tedavi seçeneği olabileceğini bildirmişlerdir.

8. Diğer Fizik Tedavi Modaliteleri

US, iyontoforez, lazer, elektromanyetik tedavi, interferansiyel akımlar ve transkutanöz elektriksel sinir uyarımı (TENS) gibi tedavi uygulamaları lateral epikondilit tedavisinde tercih edilebilen diğer fizik tedavi modaliteleridir (30,31).

Yapılan bir çalışmada, hem ESWT hem de US tedavileri, lateral epikondilit bulunan hastalarda anlamlı derecede etkili bulunmuştur. Bununla birlikte, US tedavisinin, ESWT'ye göre daha az etkili olduğu saptanmıştır (32). Sistematik bir derlemede ise US, lazer, elektroterapi, ESWT, TENS ve darbeli elektromanyetik alan tedavisinin lateral epikondilitte etkinliği araştırılmıştır. Orta dönemdeki takiplerde plaseboya karşı US etkinliğine dair orta düzeyde kanıt bulunmuştur. Diğer tüm modalitelerin etkinliğine ilişkin yalnızca sınırlı/çelişkili veya etkide hiçbir fark olmadığına dair kanıt bulunmuştur (33).

9. Diğer Alternatif Tedavi Yöntemleri

Kinezyo-bantlama, manuel terapi, derin friksiyon masajı ve kas enerji teknikleri gibi bazı yöntemler de lateral epikondilit tedavisinde kullanılabilmektedir.

Yapılan bir çalışmada, kinezyo-bantlama tedavisi lateral epikondilitli hastalarda ağrı şiddetini azaltmada, kavrama kuvvetini geri kazanmada ve işlevselliği iyileştirmede etkili bulunmuştur (34). Giray ve ark. (35) egzersiz tedavisine ek olarak uygulanan kinezyo-bantlama tedavisinin etkili bir tedavi yöntemi olduğunu belirtmişlerdir.

Richer ve ark. (36) manuel miyofasiyal nokta tedavisi ve mobilizasyon tekniklerinin kronik lateral epikondilitte olumlu sonuçlar verdiğini saptamışlardır.

Başka bir çalışmada, derin friksiyon masajının lateral epikondilit için etkili bir tedavi olduğu ve kortikosteroid enjeksiyonu dahil diğer cerrahi dışı tedavi yöntemleri denenen ve başarısız olan hastalarda tercih edilebileceği sonucuna varılmıştır (37).

Küçükşen ve ark. (38) kronik lateral epikondilit tedavisinde hem kas enerji tekniklerinin hem de steroid enjeksiyonunun etkili olduğunu belirtmişler, ayrıca uzun dönemde kas enerji tekniklerinin daha etkili olduğu sonucuna varmışlardır.

Genel olarak bu tedavi yöntemleri ile ilgili daha geniş hasta popülasyonunun dahil edildiği daha kaliteli çalışmalara ihtiyaç olduğu açıktır.

Lateral Epikondilitte Cerrahi Tedavi Yöntemleri

Lateral epikondilitte birincil tedavi olarak öncelikle konservatif tedavi yöntemleri tercih edilmektedir. Tipik olarak kendi kendini sınırlayan bir süreç olmasına rağmen, bazı durumlarda tedaviye rağmen kronik hale gelir ve ağrıya neden olmaya devam eder. Bu durumlarda cerrahi tedavi seçenekleri de tercih edilebilir (39,40). Lateral epikondilit için tanımlanmış 40'tan fazla ameliyat yöntemi bulunmaktadır (41). Cerrahi seçenekler çeşitli olmakla birlikte tedavi sonuçları arasında ciddi farklar yoktur ve evrensel olarak önerilmiş belirli bir yöntem bulunmamaktadır. Bu durumda daha ekonomik ve basit olan tekniğin seçilmesi tercih edilir (41,42).

Yapılan bir çalışmada, lateral epikondiliti olan çoğu hastada konservatif tedavinin başarılı olduğu, tedaviye dirençli olgularda radyolojik değerlendirme yapılması gerektiği ve ekstansör orijinin kısmen veya tamamen kopması durumunda ise cerrahi tedavinin endike olduğu ifade edilmiştir (43). Yapılan sistematik bir incelemede, lateral epikondilit için açık, artroskopik ve perkütan cerrahi tekniklerinin sonuçları karşılaştırılmış ve işe dönüş süresi, komplikasyon oranı ve hasta memnuniyeti açısından gruplar arasında fark saptanmamıştır. Aynı çalışmada açık cerrahi grubundaki ağrısız hastaların oranının artroskopik cerrahi grubunda olan ağrısız hastalara göre daha fazla olduğu saptanmıştır (44).

Olgu Sunumu

Altmış sekiz yaşında erkek hasta sol yan dirsek ağrısı ve eşyaları kavrama sırasında olan ağrı ve güçsüzlük hissi yakınması ile başvurdu. Hastanın ağrısı 6 aydır devam etmekteydi. Hastaya daha önceden lateral epikondilit tanısı ile soğuk uygulama, egzersiz tedavisi, aktivite modifikasyonu ve NSAİİ kullanımı dahil çeşitli tedaviler uygulanmış ama hastanın ağrısında anlamlı azalma gözlenmemişti. Hasta tarafımıza bu şikayetleri

nedeniyle başvurduğunda yapılan fizik muayenede solda lateral epikondil tendon yapışma alanı presyonla duyarlıydı ve solda lateral epikondil provakasyon testi pozitifti. Nörolojik muayenesi normaldi. Tuzak nöropatisine ait bulgusu yoktu. Hastanın laboratuvar tetkikleri orta düzeydeki kreatinin yüksekliği dışında normaldi. Hastaya anamnez ve muayene bulguları ışığında lateral epikondilit tanısı kondu. Daha önce uygulanan konservatif tedavilerden yarar görmediği için enjeksiyon tedavisi uygun görüldü. Hastanın sol dirsek lateral epikondil tendon yapışma bölgesine 0,5 cc prilokain hidroklorür ve 1 cc triamsinolon hekzasetonid kombinasyonu enjekte edildi. Lokal anestezik etkinin hızlı başlanması ve solüsyonun dilüe edilmesi amacıyla tercih edilmiştir. Enjeksiyondan hemen sonra hastanın 2., 3. ve 4. parmaklarında düşme meydana geldi. Motor muayenede 3. ve 4. parmak ekstansiyon kas kuvveti 2/5, 2. parmak ekstansiyon kas kuvveti 3/5 idi. Ayrıca duyusal değerlendirmede radiyal sinir trasesinde hipoestezi mevcuttu. Hastada enjeksiyona bağlı olarak radiyal sinir felci düşünüldü ve hastanın eli uygun şekilde atele alındı. Yirmi dört saat sonra yapılan kontrolde hastadaki motor güçsüzlük tamamen gerilemişti, ancak radiyal sinir trasesi boyunca olan hipoestezisi devam ediyordu. Yetmiş iki saat sonra yapılan ikinci kontrolde hastanın enjeksiyon sonrası oluşan tüm şikayetleri düzelmişti. Ayrıca hastanın lateral epikondil bölgesindeki ağrısı da tamamen geçmişti.

Yazının hazırlanmasından önce hastadan sözlü ve yazılı bilgilendirilmiş onam alınmıştır.

Tartışma

Literatürde lateral epikondilit tedavisinde öncelikle konservatif tedavi yöntemleri önerilmektedir. Konservatif tedaviden yarar görmeyen hasta gruplarında ise cerrahi yöntemler tercih edilebilmektedir (45,46). Bizim olgumuzda da literatürde önerildiği üzere öncelikle konservatif tedavi yöntemleri tercih edilmiştir.

Literatürde iyatrojenik radiyal sinir hasarı ile ilgili birçok çalışma bulunmaktadır. Bu çalışmaların çoğu cerrahiye bağlı yaralanmalar olmakla birlikte, enjeksiyon ve diğer nedenlerle de radiyal sinir hasarı meydana gelebilir. Özellikle lateral epikondil tendon yapışma bölgesi ve radiyal sinir dağılımının birbirine olan yakınlığı nedeniyle bu bölgelere yapılacak enjeksiyonlarda risk artabilmektedir. Enjeksiyon öncesi solüsyon hazırlama aşamasından başlayarak, enjeksiyon yapacağımız bölgenin komşuluğunda bulunan sinir, arter ve ven yapılarını bilmek önemlidir. İyatrojenik radiyal sinir lezyonları genellikle geçicidir ve kendiliğinden geri dönüşümlüdür. Geri dönmesine rağmen hasta ve hekim için endişe verici bir durum olarak kabul edilir (47-49). Radiyal sinir hasarına neden olan müdahaleleri bilmek ve bunlarla ilgili prognozu bilmek; hastayı doğru yönlendirmek ve kalıcı hasar olmadan iyileşmeyi sağlamak açısından önemlidir. Bizim olgumuzda da çok sık gözlenen bir hastalığa bağlı sık tercih edilen bir tedavi yöntemi ile iyatrojenik radiyal sinir hasarı gelişmiştir.

Kessler ve ark. (50) periferik sinir blokları için uygulanan lokal anesteziklerin sinir hasarına neden olabileceğini belirtmişlerdir. Bizim hastamızda, istemeden bir radiyal blok oluşturuldu. Lokal anesteziklere bağlı kalıcı hasar ihtimalini düşünerek biz hastamızın etkilenen elini erken dönemde atele aldık ve izlemlerinde herhangi bir sıkıntı oluşmadan radiyal sinir hasarının geri döndüğünü gözlemledik. Bizim olgumuzda olduğu gibi enjeksiyon yapılırken anatomik yapılara dikkat edilmesi oluşabilecek muhtemel komplikasyonların önlenmesi açısından önemlidir.

Lateral epikondilit dirsek bölgesinin yaygın görülen hastalıklarından biridir (51). Lateral epikondilit tedavisinde hangi yöntemin seçileceği ve uygulanan tedavilerin etkinliğini gösteren az sayıda yüksek kaliteli kanıt bulunmaktadır (52). Lateral epikondilit mevcut veriler ışığında genel olarak kendiliğinden iyileşebilen bir hastalıktır (53). Hastalarda genellikle ilk basamak tedavi konservatif tedavilerdir, ancak bu tedavilere yanıtsız hastalarda cerrahi yöntemler de tercih edilebilir. Lateral epikondilit tedavisi ile ilgili literatür incelendiğinde net bir tedavi seçeneği bildirilmemekte ve bu konuda daha fazla çalışmaya ihtiyaç duyulduğu belirtilmektedir.

Sonuç

Bu olgu bazlı incelemede, sık görülen bu hastalıkta kullanılan tedavi yöntemleri ve özellikle enjeksiyon tedavilerine bağlı gelişen komplikasyonlara kısaca değinilmiştir. Lateral epikondilitte enjeksiyon ve diğer tedavilere bağlı gelişebilecek muhtemel komplikasyonların önceden bilinmesi, hastanın doğru olarak yönlendirilmesi ve gerekiyorsa uygun tedavilerin erken dönemde başlanması, hastanın prognozu açısından önemlidir.

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Kaynaklar

1. Milcan A, Ozge A, Sahin G, Saraçoğlu M, Kuyurtar F. Lateral epikondilit öntanisi konan olgularda posterior interosseöz sinir nöropatisinin elektrofizyolojik testlerle araştirilmasi [The role of electrophysiologic tests in the early diagnosis of posterior interosseous neuropathy in patients thought to have lateral epicondylitis]. Acta Orthop Traumatol Turc 2004;38:326-9.
2. Ma KL, Wang HQ. Management of Lateral Epicondylitis: A Narrative Literature Review. Pain Res Manag 2020;2020:6965381.
3. Çeliktaş M, Köse Ö. Lateral epikondilit tanısında radyografik değerlendirmenin yeri. Anatol J Clin Investig 2009;3:136-7.

4. Calfee RP, Patel A, DaSilva MF, Akelman E. Management of lateral epicondylitis: current concepts. J Am Acad Orthop Surg 2008;16:19-29.
5. Ağır İ, Çaypınar B, Topkar OM, Karahan M. Lateral epikondilit tedavisinde otolog trombositten zengin plazmanın etkisi. Dicle Tıp Derg 2011;38:40-3.
6. Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both-a randomized clinical trial. Am J Sports Med 2004;32:462-9.
7. Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino B. Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial. BMJ 2006;333:939.
8. Shiri R, Viikari-Juntura E. Lateral and medial epicondylitis: role of occupational factors. Best Pract Res Clin Rheumatol 2011;25:43-57.
9. Kroslak M, Pirapakaran K, Murrell GAC. Counterforce bracing of lateral epicondylitis: a prospective, randomized, double-blinded, placebo-controlled clinical trial. J Shoulder Elbow Surg 2019;28:288-95.
10. Park JY, Park HK, Choi JH, Moon ES, Kim BS, Kim WS, et al. Prospective evaluation of the effectiveness of a home-based program of isometric strengthening exercises: 12-month follow-up. Clin Orthop Surg 2010;2:173-8.
11. Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, et al. Effectiveness of physiotherapy for lateral epicondylitis: a systematic review. Ann Med 2003;35:51-62.
12. Hoogvliet P, Randsdorp MS, Dingemanse R, Koes BW, Huisstede BM. Does effectiveness of exercise therapy and mobilisation techniques offer guidance for the treatment of lateral and medial epicondylitis? A systematic review. Br J Sports Med 2013;47:1112-9.
13. Green S, Buchbinder R, Barnsley L, Hall S, White M, Smidt N, et al. Non-steroidal anti-inflammatory drugs (NSAIDs) for treating lateral elbow pain in adults. Cochrane Database Syst Rev 2002;:CD003686.
14. Pattanittum P, Turner T, Green S, Buchbinder R. Non-steroidal anti-inflammatory drugs (NSAIDs) for treating lateral elbow pain in adults. Cochrane Database Syst Rev 2013;2013:CD003686.
15. Macit PM, Sağlam G, Erdal A. Lateral Epikondilitte Fizik Tedavi ve Steroid Enjeksiyonunun Etkinliğinin Karşılaştırılması. Kahramanmaraş Sütçü İmam Üniversitesi Tıp Fakültesi Dergisi 2020;15:54-9.
16. Coombes BK, Bisset L, Vicenzino B. Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomised controlled trials. Lancet 2010;376:1751-67.
17. Boden AL, Scott MT, Dalwadi PP, Mautner K, Mason RA, Gottschalk MB. Platelet-rich plasma versus Tenex in the treatment of medial and lateral epicondylitis. J Shoulder Elbow Surg 2019;28:112-9.
18. Peng Z, Zhang M, Li Y, Feng Z. Treatment of lateral epicondylitis with acupuncture and glucocorticoid: A retrospective cohort study. Medicine (Baltimore) 2020;99:e19227.
19. Çetinoğlu FO. Lateral epikondilit tedavisinde steroid enjeksiyonu ve ultrasonun etkinliklerinin araştırılması (Uzmanlık Tezi). İstanbul: Haydarpaşa Numune Eğitim ve Araştırma Hastanesi; 2009.
20. Gasimov E, Er G, Küçükdurmaz F, Akgülle H, Ağır İ, Zeynelov R, ve ark. Lokal Anestetikler. İçinde: Karahan M, Akgün U, Nuran R, Kocaoğlu B, editörler. Enjeksiyon Teknikleri El Kitabı. Marmara Üniversitesi Spor Bilimleri ve Sporcu Sağlığı Araştırma ve Uygulama Merkezi p. 28. Erişim Linki: https://drzeynalov.az/wp-content/uploads/2013/04/Enjeksiyon-teknikleri-el-kitab%C4%B1.pdf. Erişim Tarihi 9 Mayıs 2021.
21. Arirachakaran A, Sukthuayat A, Sisayanarane T, Laoratanavoraphong S, Kanchanatawan W, Kongtharvonskul J. Platelet-rich plasma versus autologous blood versus steroid injection in lateral epicondylitis: systematic review and network meta-analysis. J Orthop Traumatol 2016;17:101-12.
22. Park HB, Kam M, Gwark JY. Association of steroid injection with soft-tissue calcification in lateral epicondylitis. J Shoulder Elbow Surg 2019;28:304-9.
23. Espandar R, Heidari P, Rasouli MR, Saadat S, Farzan M, Rostami M, et al. Use of anatomic measurement to guide injection of botulinum toxin for the management of chronic lateral epicondylitis: a randomized controlled trial. CMAJ 2010;182:768-73.
24. Uygur E, Aktaş B, Özkut A, Erinç S, Yilmazoglu EG. Dry needling in lateral epicondylitis: a prospective controlled study. Int Orthop 2017;41:2321-5.
25. Spacca G, Necozione S, Cacchio A. Radial shock wave therapy for lateral epicondylitis: a prospective randomised controlled single-blind study. Eura Medicophys 2005;41:17-25.
26. Ho C. Extracorporeal shock wave treatment for chronic rotator cuff tendonitis (shoulder pain). Issues Emerg Health Technol 2007;(96 (part 3)):1-4.
27. Buchbinder R, Green SE, Youd JM, Assendelft WJ, Barnsley L, Smidt N. Systematic review of the efficacy and safety of shock wave therapy for lateral elbow pain. J Rheumatol 2006;33:1351-63.
28. Weber C, Thai V, Neuheuser K, Groover K, Christ O. Efficacy of physical therapy for the treatment of lateral epicondylitis: a meta-analysis. BMC Musculoskelet Disord 2015;16:223.
29. Yalvaç B, Mesci N, Geler Külcü D, Yurdakul OV. Comparison of ultrasound and extracorporeal shock wave therapy in lateral epicondylosis. Acta Orthop Traumatol Turc 2018;52:357-62.
30. Ahmad Z, Siddiqui N, Malik SS, Abdus-Samee M, Tytherleigh-Strong G, Rushton N. Lateral epicondylitis: a review of pathology and management. Bone Joint J 2013;95-B:1158-64.
31. Sims SE, Miller K, Elfar JC, Hammert WC. Non-surgical treatment of lateral epicondylitis: a systematic review of randomized controlled trials. Hand (N Y) 2014;9:419-46.
32. Dedes V, Tzirogiannis K, Polikandrioti M, Dede AM, Mitseas A, Panoutsopoulos GI. Comparison of radial extracorporeal shockwave therapy with ultrasound therapy in patients with lateral epicondylitis. J Med Ultrason (2001) 2020;47:319-25.
33. Dingemanse R, Randsdorp M, Koes BW, Huisstede BM. Evidence for the effectiveness of electrophysical modalities for treatment of medial and lateral epicondylitis: a systematic review. Br J Sports Med 2014;48:957-65.
34. Eraslan L, Yuce D, Erbilici A, Baltaci G. Does Kinesiotaping improve pain and functionality in patients with newly diagnosed lateral epicondylitis? Knee Surg Sports Traumatol Arthrosc 2018;26:938-45.
35. Giray E, Karali-Bingul D, Akyuz G. The Effectiveness of Kinesiotaping, Sham Taping or Exercises Only in Lateral Epicondylitis Treatment: A Randomized Controlled Study. PM R 2019;11:681-93.
36. Richer N, Marchand AA, Descarreaux M. Management of Chronic Lateral Epicondylitis With Manual Therapy and Local Cryostimulation: A Pilot Study. J Chiropr Med 2017;16:279-88.
37. Yi R, Bratchenko WW, Tan V. Deep Friction Massage Versus Steroid Injection in the Treatment of Lateral Epicondylitis. Hand (N Y) 2018;13:56-9.
38. Küçükşen S, Yilmaz H, Sallı A, Uğurlu H. Muscle energy technique versus corticosteroid injection for management of chronic lateral epicondylitis: randomized controlled trial with 1-year follow-up. Arch Phys Med Rehabil 2013;94:2068-74.
39. Brummel J, Baker CL 3rd, Hopkins R, Baker CL Jr. Epicondylitis: lateral. Sports Med Arthrosc Rev 2014;22:e1-6.
40. Vaquero-Picado A, Barco R, Antuña SA. Lateral epicondylitis of the elbow. EFORT Open Rev 2017;1:391-7.
41. Oztuna V, Milcan A, Eskandari MM, Kuyurtar F. Konservatif tedaviye dirençli lateral epikondilitlerin perkütan tenotomi ile tedavisi [Percutaneous extensor tenotomy in patients with lateral epicondylitis resistant to conservative treatment]. Acta Orthop Traumatol Turc 2002;36:336-40.
42. Rocchi L, Fulchignoni C, Donsante S, Fanfani F. Semicircumferential Detachment of the Extensor Enthesis For Surgical Treatment of Chronic Lateral Epicondylitis: A Prospective Study. Tech Hand Up Extrem Surg 2019;23:146-50.
43. Altintas B, Greiner S. Epicondylitis humeri radialis: konservativ - operativ [Lateral epicondylitis: conservative - operative]. Orthopade 2016;45:870-7.

44. Riff AJ, Saltzman BM, Cvetanovich G, Frank JM, Hemu MR, Wysocki RW. Open vs Percutaneous vs Arthroscopic Surgical Treatment of Lateral Epicondylitis: An Updated Systematic Review. Am J Orthop (Belle Mead NJ) 2018;47.
45. Inagaki K. Current concepts of elbow-joint disorders and their treatment. J Orthop Sci 2013;18:1-7.
46. Buchbinder R, Johnston RV, Barnsley L, Assendelft WJ, Bell SN, Smidt N. Surgery for lateral elbow pain. Cochrane Database Syst Rev 2011;2011:CD003525.
47. Wang JP, Shen WJ, Chen WM, Huang CK, Shen YS, Chen TH. Iatrogenic radial nerve palsy after operative management of humeral shaft fractures. J Trauma 2009;66:800-3.
48. O'Driscoll SW. Optimizing stability in distal humeral fracture fixation. J Shoulder Elbow Surg 2005;14(1 Suppl S):186S-194S.
49. Ring D, Chin K, Jupiter JB. Radial nerve palsy associated with high-energy humeral shaft fractures. J Hand Surg Am 2004;29:144-7.
50. Kessler P, Steinfeldt T, Gogarten W, Schwemmer U, Büttner J, Graf BM, et al. Periphere Regionalanästhesie beim Patienten in Allgemeinanästhesie: Risikobewertung bezüglich Parästhesie, Injektionsschmerz und Nervenschäden [Peripheral regional anesthesia in patients under general anesthesia: risk assessment with respect to parasthesia, injection pain and nerve damage]. Anaesthesist 2013;62:483-8.
51. Shiri R, Viikari-Juntura E, Varonen H, Heliövaara M. Prevalence and determinants of lateral and medial epicondylitis: a population study. Am J Epidemiol 2006;164:1065-74.
52. Johnson GW, Cadwallader K, Scheffel SB, Epperly TD. Treatment of lateral epicondylitis. Am Fam Physician 2007;76:843-8.
53. Lenoir H, Mares O, Carlier Y. Management of lateral epicondylitis. Orthop Traumatol Surg Res 2019;105(8S):S241-S6.

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Postural Structure and Mechanic Syndromes Associated with Human Movement Physiology: A Traditional Review of Re-modelling Musculature

Postür Kas İskelet ve Mekanik Sendromlar ile İlgili İnsan Hareket Fizyolojisi: Kas İskelet Remodellemesi Geleneksel Derleme

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Abstract

Postural musculature functioning emphasises the importance of dynamic actions in multiple motion stresses and the mechanical deficiencies of movement modelling. Human posture is a result of the distortion of space in different increments in static and dynamic conditions. Postural dysfunctions are caused by muscle tightness related to myofascicular stiffness. Herein, this traditional review explains the heat- and pain-induced syndromes, general mechanical deficiencies in muscle performance, and hypertrophy. Postural analysis shows the connection of motion system to biomechanics and kinesiology. Mechanical syndromes are caused by complex crossovers in the postural skeleton. Complex postural muscles confirm isometric modelling for limb fixation according to the location of compartment. However, different movement patterns in individualised exercises are inadequate and require further comparisons. Therefore, kinematic data regarding mechanical syndromes are limited. Moreover, this study shows how muscular performance should be involved in postural exercises. Postural muscle strength is the conditioning of the muscles in different working principles. Postural muscle dysfunctions should be analysed to compare atrophic characteristics. Current approaches present that postural analyses should be individualised to examine atrophic shortening and elongation because individuals have varied resistance and motion performance. This study aimed to explain development of mechanical syndromes to evaluate the indexes before postural exercises. These mechanical syndromes are presented in view of the longitudinal body kinesiology involved in comprehensive exercises.

Keywords: Postural musculature, mechanical syndromes, movement modelling

Öz

Postür kas performans modellemede çoklu hareket streslerin mekanik eylemlerine önem vurgular. İnsan duruşu, statik ve dinamik boyutlarda farklı artışlarla uzay konumlandırmalarıdır. Postür fonksiyonların nedeni, miyofasiküler sertliğe bağlı kas-iskelet sistemindeki gerginliktir. Çalışma geleneksel bir derlemedir. Performans ise genel mekanik eksikliklerin hipertrofi olduğu ısı ve ağrı kaynaklı sendromları açıklamaktadır. Postür analizi, biyomekanik ve kinesiyolojik nedenlere bağlı hareket sisteminde gösterilir. Mekanik sendromlar, postüral iskeletteki karmaşık ve geçitler ile ortaya çıkar. Karmaşık postüral kaslar, kompartıman yerleşimlerine göre uzuv fiksasyonu için izometrik modellemeyi doğrular. Bu nedenle kinematik veriler, sendromları göstermede sınırlıdır. Ek olarak, çalışma, kas performansının postüral egzersizlere nasıl dahil edilmesi gerektiğini göstermektedir. Mevcut yaklaşımlar, postüral analizlerin atrofik kısalma ve uzama için bireysel olması gerektiğini söylüyor. Çünkü bireylerin hareket performans faktörlerine karşı direnci değişkendir. Çalışmanın amacı postüral egzersizlerden önce indeksleri değerlendirmek için mekanikte sendromların oluşumunu açıklamaktır. Bu çalışmada, kapsamlı egzersizde yer alan boylamsal vücut kinesiyolojisi temelinde mekanik sendromlar gösterilmiştir.

Anahtar kelimeler: Postüral kas sistemi, mekanik sendromlar, hareket modellemesi

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Introduction

Postural muscle ability sees exercise and movement patterns as the formation of syndromes in limited areas for the changes seen in overactive and lower active muscle groups, together with asymmetries in the kinetic chain sequences of the body involved in static and dynamic movement posture. Loss of muscle function can be strengthened by the atrophic effect (1). Strength training increases the size of the anatomy and physiological muscle mass causing movement deficiencies on the basis of serious medical science (2). The functional ability of the muscle depends on the shape of the muscle mass during movement, the mechanical properties of the tendon tissues. Strength training has increased anatomical muscle strength and neuromuscular locomotive posture for not less than 16 weeks. The increased number of sarcomeres due to the fibril strain, which can be shown by the fascicle length in fibril increase, causes hypertrophy as a force dynamics in series and parallel (3,4). In contrast, physical stresses of the leg limb in the musculoskeletal system in the postural muscles movement access (5). Abnormal injuries other than normal posture showed posture syndrome behaviors in runners, handball, hockey, baseball, and volleyball players as a result of loss of mechanical properties of wrong walking foot pronation (6). Therefore, the beginning of technical exercises, muscle-tendon and joints, which are successful muscular models (7). In the vertical jump movement phase, the volleyball player stepping and using the counter height in accessing the ball or in high pass shots is the technical representation of the walking phases (8). The basic muscle function is therefore the heel against ground reactions in the walking cycle of the lower limb of the lumbopelvic-hip complex in the skeletal system. Medial stress syndrome, which shows foot pronation according to the shock absorption of strokes (9), is important in maintaining postural stabilization of the upper segments in changing reactions and rotations (10). Individual walking is a good examination method in unnatural behaviors. The evaluations should be downward with treadmill and walking in the opposite direction at a distance of 6 meters, especially for individuals with complaints of musculoskeletal pain under 25 years of age, 3-12 months. The loss of energy in the tibialis posterior muscles located at 50-60% increased fasiculations of the central nervous system in strength cause postural muscle disorders (11); electrophysiological nerve stimulation in myotonic muscle tone, especially in muscle activation and relaxation so-called Duch syndrome has shown by podiatrics, sport therapist and physiotherapists (12). In fact, asymmetric complexes on one side of the body have shown the loss of muscular hypertrophy in the leg, strength at extremely small distances, and postural deficiencies that may result in strength and flexibility in physical individuals dealing with weight-bearing sports (13). When complex muscles appear atrophic, especially triple-headed gastrocne. The soleus and deep tendon plantaris in the same location of the minus, pain in the knee joint as a result of pressure on the leverage force is the reason for the lumbopelvic-hip complex syndrome (14,15). The cross muscles that will form the mechanics of the postural musculoskeletal is under the effect of foot pressures, except for the upper-lower part. Knee-tendon disorder separated from the lumbopelvic hip complex is posterior tibial and medial stress syndromes (16), the syndrome seen on the tenderness of upper limb compartment muscles is an upper cross syndrome (17). Conclusion, general populations studies different showing on postural deviation as postural musculature syndrome for example, head and ankle plumbline (Table 1).

Knee Tendon Disorders, Lumbo-Pelvic-Hip Complex Syndrome

Deformities and pains in the knee tendon structure are seen in the iliotibial band in cases of abnormal deviation of pelvic asymmetric and inclination changes, unilateral muscle elongation, and muscle shortness of overloads (16). In athletes, shortening and looseness in the lower extremity joint muscles as shoulder, pelvic, lumbar region in severe potential energy loss it causes the known core region or lumbopelvic-hip complex (17,18). Anterior knee pain patella femoral syndrome volleyball and basketball etc. In sports branches, jumping, running and complex movements such as the squat, deadlift, back squat, etc. As a result of the reduction of the anterior Hoffa swelling of the knee, it has been observed more frequently as a result of the reduction of the swelling of the anterior half of the knee. In this case, the ankle is directly affected by the ground reaction force and the foot pronation rotation in runners brought medial stress syndrome. In addition, fibularis and peroneal muscles pronation-elevation force (10-15°) gastrocnemious vertical power deficiency at an angle (19,20). Exercise models bring along mechanical deficiencies in very different formations as can be seen. The reasons for exercising or not exercising were suggested for the general population in the postural analysis strategy for the evaluation of body weight, body mass index, waist-hip ratio, leg length difference, longitudinal alignment of the medial arch of the foot, and as a result (20), m. quadriceps-hamstring the change in the vascular muscle tone in the fixation of the quadriceps-hamstring flexibility can also cause the neuromuscular repetitive isotonic tendon dynamics changes

Table 1. Leg length of postural body segments cause specific 2-6 m walking

Postural body segments	Limitation causing postural walking
Shoulder (first segment)	One-sided shoulder drop
Humerus	One side arm swing abduction
Pelvic (middle segment)	One side low in swing
Leg	One side rotation
Patella	One-sided hyperextension
Foot (last segment)	Foot turned lateral

in the anterior compartment, causing Hoffa swelling in the knee, and the knee rotation restriction is seen in the chronic complex in microscopic fibril degeneration (19,20). The knee experiences load change with pressure against movement while in hyperextension patella femoral joint syndrome is a serious problem (21).

Lumbo-Pelvic-Hip Complex, Posterior Cross Syndrome

Lumbopelvic hip complex in muscles adhering to the extreme anterior pelvic tilt joint of the pelvic cross syndrome directed to deformity, which is usually shown in phase 1; m. gluteus maximus, medius, iliopsoas, rectus abdominis, posterior tibialis shortenings and the energy of the upper compartment (22). As the muscles show limb location in complex fixation, the longitudinal slope of the femur, hip, pelvic and lumbar spine, known as the core region, also affects the spinal stability and causes advanced lower cross syndrome such as lumbar lordosis (23-25). When postural analysis evaluations determine the factors that cause the treatment, first of all, knee pain should create a perception of pain on the pelvic stability and flexibility of the hip flexor muscles (22,26). In the whole lumbar region where pain threshold does not occur, warm muscle temperature should be created and exercise stability should be applied to touch or spinal cord sensitivity. In this case, for postural control, there are movements such as isometric arm shoulder flexion, prone trunk extension, superman, bird dog movements in which the upper limbs will continue at eye level in a position against gravity, and balance exercises tend towards mechanics in the contraction modes (23,24). It was necessary to provide ligament tension, which is important in mechanical movements, and to balance the force pressures in the spinal discs against gravity in the body weight. Therefore, corrective exercises in postural muscles are suitable methods in athletic physical development for minimal energy expenditure. Posture analysis formation, as can be obtained from previous information, should be evaluated in the evaluation of shoulder, pelvic and spinal inclination deviations in rapid visual asymmetry in neuro-musculoskeletal weaknesses (26). As explained earlier, foot pressure changes in the Olympic athletes, pes planus, leg length changes were obtained in the gait analysis where the evaluation of foot posture did not allow muscle function in terms of degrees of the muscle in the range of motion (27). The change in foot pressures in the lower limb is the cause of the cross-vertical shortening of the anterior-posterior tibialis, soleus and flexor digitorum longus muscles in one example, the basic muscles of pelvic rotation into soleus and sartorious in basketball players. Since the motor activation of the sartorius does not compensate for the mechanical temperature change, the increase in the hip range of motion in the leg lengths and the involvement in negative motion caused the lumbo-pelvic-hip complex to be observed in 1-3 phases (26). Various limitations and syndromes caused by muscles in body segments including general postural gait have been syndromes that can be shown in the head, shoulder, middle pelvic and foot posture indexes in the lower and upper crossover (28).

The limitations of showing postural whole body segments within walking are explained. However, since postural mechanical movements show the occurrence of different syndromes only in general body limbs, syndromes should be seen as problems that occur before and after (28). Observing such muscular limitations in body segments magnetic resonance imaging, ultrasound, and C-tomography are methods that can show eccentric degrees in the extension of motion of joint torque dynamics for dynamic posture (29). The methods have been used in the disruption of the potential loss of strength of muscle groups and geriatric syndromes for soft tissues under dynamic movement conditions of the muscle. Therefore, due to the fact that the center of the postural musculature is in the bone location of the lower and upper limbs, for example; in the example of cycling in the leg area where muscle power is used in fasciculation, the pressure location in dynamic conditions is not shown in the hip-pelvic complex as assessed in the right-left lower limb (30). However, foot, medial, and tibial stresses should be included in exercise patterns that will maintain muscle balance in the lower compartment and upper compartment of the shoulder, head, scapula. In this approach, postural insufficiencies in exercise and sports groups, shortness of the lever muscles that make up the movements, immobilization of the tension, weakness are the reasons for the lack of force against long-term resistance loads (31). Moreover, it is difficult to plan exercise models for syndromes.

Shoulder Cross Syndrome

It causes multiple neck pain, such as axial, due to the increase in degree intervals in the arm and cervical muscles along the acromioclavicular and glenohumeral joints in the upper shoulder compartment (25). The shoulder posture is revealed in isometric muscle modeling of myofascial and tendon tensions in the posterior muscles (32). Loss of function in the shoulder, which causes more shoulder protraction and irregular localization in shoulder stability, with the glenoid fossa tension on the head of the arm and superior anterior shoulder capsule connection, m. supraspinatus from the weakness of the deltoid posterior fibrils (33). Over time, unbalanced muscle shortness, collision syndromes and functional loss of rotator cuff muscles have been caused. In athletes, the shoulder muscles are more effective in the movements of the deep muscles in the cervical region that cause loss of stability function, usually in the shoulder and arm elevation and abduction intervals, at different kinematic movement phases. Since cervical tensions cause the neck muscles to be used under excessive stress, shoulder cross syndrome indicates the posterior junction syndrome that forms the shoulder junction (34,35). Deep cervicals cause advanced head posture and myofascicular separation due to shoulder and upper cervical hyperextension (32,36,37).

The dynamics in the structure of motion of the shoulder posterior cross syndrome joint are shown (Table 2).

Pelvic Crossed Syndrome

Pelvic asymmetry kinematic gluteus medius muscle weakness resulting in anterior pelvic tilt increase in the range of motion, pelvic cross syndrome in the upper group lumbar region (38). Pelvic syndrome causes the weight balance in the central region in the rectus abdomen balance. However, in the anterior compartment muscles, where the hamstring muscle will vary in excessive of motion, especially the sartorius and vastus medial, the excessive pressure changes put an excessive stress load on the upper compartment vertical discs due to the weakening of the pelvic gluteal muscles (39). This situation is mostly in the fasciculation of the L5/S1 spinals, the large compartment in the pelvic region; the gluteus muscles and the iliopsoas cause myofascular weakness (40). This weakness is the result of sacroiliac joint disorders resulting from rotation change, which is seen as lumbopelvic pain when the posterior pelvic muscles are separated from the tensor fascia lata and sartorius hip flexors while the overactive lumbar muscle is flexed (38). As a result of the separation in the lateral compartment since hip flexors cannot show pelvic and hip contraction against isometric movements after a while, the vertical muscle longitudinal anterior superior iliac sacrum causes disruption in resistance exercises (38,40,41). Therefore, pelvic cross-posterior syndrome has revealed low back problems associated with walking and leg changes (39,42,43). Posterior postural examinations should confirm middle-cross syndrome of pelvic muscle groups in different functional tasks.
Postural insufficiency and problems seen as a result of the change in muscle shortness and weakness that cause postural pelvic cross syndrome (Table 3).

Horizontal transition of the pelvic slope over the lumbar spine junction m. quadratus lumborum atrophy is a moderate pelvic cross syndrome in the poas muscle L1-L5 spinal cord accompanied by severe atrophic loss in muscle weakness in the middle region (44). The intensity of flexion in the pelvic lower compartment m. gastrocnemius and m. soleus. In other words, the lateral and posterior fossae affect the length change in these muscles mechanically in gait pressure (44,45). Similarly, patelle is the cause of femoral pain (44,46-48).

Postural Upper Cross and Lower Cross Syndrome

Postural insufficiencies are a serious problem especially in individuals participating in maximal muscle strength and strength training on the upper and lower cross syndrome, which includes acute and chronic syndromes that differ from the middle-compartment lumbo-pelvic-hip complex as the muscular activity of the musculoskeletal structure (18). Most of the postural insufficiencies observed in athlete groups (44). However, overactive movement patterns show strength value in weakening muscles involved in the same movement (46). Thus, the energy in postural muscular activities, which is further evaluation, is eccentric (46). Overactive muscle strength or less active muscle strength, upper cross syndrome, and lower cross syndrome limitation within the whole body structure (47). The limitation is the forward head-rounded shoulder- and cervical kyphosis arising from the lumbo-pelvic-hip complex in which exercise is inhibited (45-47). Postural exercises prevent such syndromes as well as correct them. Separating, complex and comprehensive muscle activation corrective exercises (46). Kinetic muscle imbalance in different sports branches, lower cross syndrome, forward posture in increased pelvic forward

Table 2. Shoulder posterior syndrome postural analysis

Muscle imbalance		**Postural evaluation characteristic**
Shortened muscles	**Weakened muscles**	
Shoulder-upper junction fixators:	Low shoulder junction fixators:	Shoulder elevation
Upper trapezius	Middle trapezius	
Levator scapula	Lower trapezius	
Scalenes	Rhomboid	
Shoulder junction	Serratus anterior	
Protractors:	Shoulder junction retractors:	Shoulder protraction
Pectoralis major	Rhomboid	
Pectoralis minor	Middle trapezius	
	Lower trapezius	
Neck extensors:	Deep neck flexors:	Forward head posture
Short neck extensors	Longus colli	Increased cervical lordosis
Sternocleidomastoid	Longus cervicus	Upper cervical hyperextension
Upper trapezius	Longus capitis	Cervico-thoracic kyphosis
Levator scapula		

inclination, the reason for the forward head posture due to cervical hyperextension in the upper compartment is that the limb strength regulates the trunk changes (48,49). Postural injuries in the limb localization of the lower extremity overactive muscles; gastrocnemious, soleus, hip deep adductors, tensor fascia latea, gluteus medius, superficial latissimus dorsi, and thoracolumbar fascia involved in the minimus complex and muscles weakened by less active extension; anterior, posterior tibialis, gluteus maximus, gluteus medius, transfer abdominis, internal oblique cross syndrome (49,50). Upper cervical spine C4-7, previously known as a proximal cross syndrome by Lee, was the ability to move the scapula in the upper thorax and shoulder girdle (50,51). Later, dynamic force models were seen as a problem of forward head and cervicothoracic kyphosis of the fascicular tendon tension, which causes cervical hyperextension as a result of the extensive pressure of shear force on the cervical muscles (52,53). Therefore, the tension deformity is seen as the central nerve activity in mechanomyographic protein transitions for optimal muscle performance and movement during energy transitions affected the shoulder posture (52,53).

Vladimir Janda (1923-2002) muscle groups shortened in the upper compartment; in deep muscles, the movements of which are elongated and shortened for the muscular function in which the upper trapezius, levator scapula, sternocleidomastoid, scalenes, latissimus dorsi, teres major, subscapularis and pectoral muscules affect scapular dyskinesia; deep cervical flexors-longus colli, cervicis, capitis, serratus anterior, rhomboid, middle trapezius, lower trapezius, teres minor, and infraspinatus motor unit firing rate reductions and shows negative movement function in the cervicothoracic region (32,45,48,49). This appearance causes a lower shoulder in the future, increased kyphosis head posture as well as cervical lordosis deformity (26-28). If the postural muscles are not technically placed even with proper fixation, overloading negatively affects the postural skeleton. The studied view confirms that fitness components in load planning by grading the development of muscle shortness and tensile stress, which are overlooked for the comprehensive muscle rotation balance, <4-12 weeks long (30 seconds rest) and >8-12 weeks (90s rest), exercise programs are postural in single-joint muscules. Maximum voluntary contractions for muscle development at optimal accuracy of 30-50% (set loading 10-12 repetitions), between 70-90% of maximal voluntary contractions if for multiple joint muscle groups, and 80-95% in athletes depending on general movement speed 8-10. It is deemed necessary to create repetitions (51-53).

Thus, the highest quality neuromuscular exercise patterns will be able to test versatile performance, technical accuracy muscular ability, biomechanical and neurological practice. Therefore, periodic advancing therapists recommend extensive exercises in the loss of strength against the compartments in the kinetic chain (53,54). The movement of postural in dynamic actions must achieve tendon dynamics or tendon torque development, which are components of muscular ability and fitness in sports branches in structural micro, meso, and macro planning. Fascicular changes are directed to all body parts in isometric contraction strength (52-54). In the example of the structure of parallel muscle groups in the skeletal muscular system kinetic structure under stress conditions; multiple joint movements in swimmers, integrative isometric contraction occurs for regional muscle strength in the upper compartment (54-56). Therefore, multiple joint movements in physical individuals without exercise injury are integrative, while single and multiple joint levers for regional muscle strength in athletic groups are inclusive in dynamic contraction modes (56-59). Postural neuromuscular increases thus confirm the neuromuscular increases. On the other hand, there is a choice of electrophysiological muscle activation to protect muscle, tendons, ligaments, and joints for fat loss to compliment the body balance on double exercise days (54-56). Electrophysiology, motor unit synchronization of mechanical temperature changes, helps to reduce stress tension by assistants such as foam roll and exercise types can be changes. Therefore, the transition from low intensity to high intensity in athletes after high intensity, 4-6 weeks long program and 2-4 days per week in non-exercising groups (57-59). On this basis, all resistance exercises that allow movement biomechanics are preconditioned for the determination and treatment of postural syndromes can take place.

Table 3. Pelvic posterior crossed syndrome

Postural muscle shortness	Postural muscle weakness	Postural problems
Hip flexors:	Hip extensors:	
-Iliopsoas -Rectus femoris	-Gluteus maximus	Lumbar lordosis ASIS
Lumbar extensors:	Lumbar flexors:	
-Lumbar spin fascia	-Rectus femoris	Protuberant convex abdomen
The dominant hip abductor:	Hip adductors:	
-Tensor fascia lata	-Gluteus medius -Gluteus minimus	Uneffected iliac crest
Pelvic elevator:		
-Quadratus lumborum		Lateral pelvic tilt

ASIS: Anterior superior iliac sacrum

Complementary validations that prevent grading of movement techniques in total coordination and corrective are ability of the bone leverage dynamics in the fixation of multiple joints relative to single joints (56-58). Corrective exercise changes including of body parts, such as dynamic squat and deadlift and back squat movements, such as hip, knee, foot and soles pressure and mechanical tendon development that would allow leverage Dynamics (59,60). Accordingly, it will be more accurate to create total stress power in the mechanics of active and passive muscle groups according to postural segments in sports branches and exercises (53-57). Mechanical syndromes, pediatric physiotherapists and sports therapists are work generally in geriatric anatomy and physiology suggest human structure limitations of dynamic body segments. Syndromes show very complex in postural insufficiencies and should be explain upper and lower compartment syndromes, the importance of mechanical movements should be emphasized, and at the same time, it is appropriate to show the tendency to the optimal degrees of the muscle in the insufficient population that can create stress in practice.

Ethic

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References

1. Kahraman Y. Spor & Postural Bozukluklar Bölüm-17. Sporun Kavramsal Temelleri-5. 2020. p. 317-32.
2. Wilson GJ, Murphy AJ, Walshe A. The specificity of strength training: the effect of posture. Eur J Appl Physiol Occup Physiol 1996;73:346-52.
3. Azizi E, Brainerd EL. Architectural gear ratio and muscle fiber strain homogeneity in segmented musculature. J Exp Zool A Ecol Genet Physiol 2007;307:145-55.
4. Schoenfeld BJ. The mechanisms of muscle hypertrophy and their application to resistance training. J Strength Cond Res 2010;24:2857-72.
5. Holden S, Boreham C, Doherty C, Wang D, Delahunt E. Dynamic postural stability in young adolescent male and female athletes. Pediatr Phys Ther 2014;26:447-52.
6. Martínez-Nova A, Gómez-Blázquez E, Escamilla-Martínez E, Pérez-Soriano P, Gijon-Nogueron G, Fernández-Seguín LM. The foot posture index in men practicing three sports different in their biomechanical gestures. J Am Podiatr Med Assoc 2014;104:154-8.
7. Shelburne KB, Torry MR, Pandy MG. Muscle, ligament, and joint-contact forces at the knee during walking. Med Sci Sports Exerc 2005;37:1948-56.
8. Ozawa Y, Uchiyama S, Ogawara K, Kanosue K, Yamada H. Biomechanical analysis of volleyball overhead pass. Sports Biomech 2019:1-14.
9. Noh B. Running characteristics of plantar flexor forces based on different foot strike patterns in medial tibial stress syndrome. Asian J Kinesiol 2020;22:48-54.
10. Shih YF, Wang YC. Spiking Kinematics in Volleyball Players With Shoulder Pain. J Athl Train 2019;54:90-8.
11. Sponbeck JK, Frandsen CR, Ridge ST, Swanson DA, Swanson DC, Johnson AW. Leg muscle cross-sectional area measured by ultrasound is highly correlated with MRI. J Foot Ankle Res 2021;14:5.
12. Kronlage C, Grimm A, Romano A, Stahl JH, Martin P, Winter N, et al. Muscle Ultrasound Shear Wave Elastography as a Non-Invasive Biomarker in Myotonia. Diagnostics (Basel) 2021;11:163.
13. Reggiani C, Schiaffino S. Muscle hypertrophy and muscle strength: dependent or independent variables? A provocative review. Eur J Transl Myol 2020;30:9311.
14. Ishii T, Kawagishi K, Hayashi S, Yamada S, Yoshioka H, Matsuno Y, et al. A bilateral third head of the gastrocnemius which is morphologically similar to the plantaris. Surg Radiol Anat 2021 Jan 10.
15. Kahraman Y. Corrective isometric strength in lumbopelvic-hip complex for postural structure muscle formation. IJSPR 2021;79:1-7.
16. Becker J, Nakajima M, Wu WFW. Factors Contributing to Medial Tibial Stress Syndrome in Runners: A Prospective Study. Med Sci Sports Exerc 2018;50:2092-100.
17. Mubeen I, Komboh SM, Akhtar W, Gondal J, Iqbal M, Wattoo A, et al. Prevalence of upper cross syndrome among the medıcal students of unıversıty of lahore. Int J Physiother 2016;3:381-4.
18. Martín-San Agustín R, Benítez-Martínez JC, Medina-Mirapeix F, Casaña-Granell J. Sex Differences and Patterns of Muscle Stiffness in the Knee Flexor and Extensor Musculature Through Analysis of Isolated Bellies. J Strength Cond Res 2021;35:1044-9.
19. Rio E, Kidgell D, Purdam C, Gaida J, Moseley GL, Pearce AJ, et al. Isometric exercise induces analgesia and reduces inhibition in patellar tendinopathy. Br J Sports Med 2015;49:1277-83.
20. Kapo S, Rađo I, Smajlović N, Kovač S, Talović M, Doder I, et al. Increasing Postural Deformity Trends and Body Mass Index Analysis in School-age Children. Zdr Varst 2018;57:25-32.
21. Kongsgaard M, Qvortrup K, Larsen J, Aagaard P, Doessing S, Hansen P, et al. Fibril morphology and tendon mechanical properties in patellar tendinopathy: effects of heavy slow resistance training. Am J Sports Med 2010;38:749-56.
22. Wasserberger KW, Downs JL, Barfield JW, Williams TK, Oliver GD. Lumbopelvic-Hip Complex and Scapular Stabilizing Muscle Activations During Full-Body Exercises With and Without Resistance Bands. J Strength Cond Res 2020;34:2840-8.
23. Kelly M, Jacobs D, Wooten ME, Edeer AO. Comparison of electromyographic activities of lumbar iliocostalis and lumbar multifidus muscles during stabilization exercises in prone, quadruped, and sitting positions. J Phys Ther Sci 2016;28:2950-4.
24. Dafkou K, Kellis E, Ellinoudis A, Sahinis C. Lumbar Multifidus Muscle Thickness During Graded Quadruped and Prone Exercises. Int J Exerc Sci 2021;14:101-12.
25. Shah J, Tanwar T, Iram I, Aldabbas M, Veqar Z. Effect of Increased Lumbar Lordosis on Lumbar Multifidus and Longissimus Thoracis Activation During Quadruped Exercise in Patients With Chronic Low Back Pain: An EMG Study. J Appl Biomech 2020:1-8.
26. Ludwig O, Kelm J, Hammes A, Schmitt E, Fröhlich M. Targeted Athletic Training Improves the Neuromuscular Performance in Terms of Body Posture From Adolescence to Adulthood - Long-Term Study Over 6 Years. Front Physiol 2018;9:1620.
27. Gimunová M, Válková H, Kalina T, Vodička T. The relationship between body composition and foot posture index in Special Olympics athletes. Acta Bioeng Biomech 2019;21:47-52.
28. Winter DA. Human balance and posture control during standing and walking. Gait & Posture 1995;3:193-214.
29. Perkisas S, Bastijns S, Baudry S, Bauer J, Beaudart C, Beckwée D, et al. Application of ultrasound for muscle assessment in sarcopenia: 2020 SARCUS update. Eur Geriatr Med 2021;12:45-59.
30. Austin N, Nilwik R, Herzog W. In vivo operational fascicle lengths of vastus lateralis during sub-maximal and maximal cycling. J Biomech 2010;43:2394-9.
31. Maden-Wilkinson TM, Balshaw TG, Massey GJ, Folland JP. What makes long-term resistance-trained individuals so strong? A comparison of skeletal muscle morphology, architecture, and joint mechanics. J Appl Physiol (1985) 2020;128:1000-11.
32. Alenabi T, Whittaker RL, Kim SY, Dickerson CR. Arm posture influences on regional supraspinatus and infraspinatus activation in isometric arm elevation efforts. J Electromyogr Kinesiol 2019;44:108-16.

33. Hawkes DH, Khaiyat OA, Howard AJ, Kemp GJ, Frostick SP. Patterns of muscle coordination during dynamic glenohumeral joint elevation: An EMG study. PLoS One 2019;14:e0211800.
34. Lee HM. Rehabilitation of the proximal crossed syndrome in an elderly blind patient: a case report. J Can Chiropr Assoc 2000;44:223-9.
35. Bordelon NM, Wasserberger KW, Cassidy MM, Oliver GD. The Effects of Load Magnitude and Carry Position on Lumbopelvic-Hip Complex and Scapular Stabilizer Muscle Activation During Unilateral Dumbbell Carries. J Strength Cond Res 2021;35(Suppl 1):S114-S9.
36. Subbarayalu AV, Ameer MA. Relationships among head posture, pain intensity, disability and deep cervical flexor muscle performance in subjects with postural neck pain. J Taibah Univ Med Sci 2017;12:541-7.
37. Sun A, Yeo HG, Kim TU, Hyun JK, Kim JY. Radiologic assessment of forward head posture and its relation to myofascial pain syndrome. Ann Rehabil Med 2014;38:821-6.
38. Laird RA, Keating JL, Kent P. Subgroups of lumbo-pelvic flexion kinematics are present in people with and without persistent low back pain. BMC Musculoskelet Disord 2018;19:309.
39. Kim SH, Kwon OY, Yi CH, Cynn HS, Ha SM, Park KN. Lumbopelvic motion during seated hip flexion in subjects with low-back pain accompanying limited hip flexion. Eur Spine J 2014;23:142-8.
40. Bosch U, Tscherne H. The pelvic compartment syndrome. Arch Orthop Trauma Surg 1992;111:314-7.
41. Flores-León A PT, MSc, Redenz G PT, Valencia OD PT, Guzmán-Venegas R PT, MSc, Araneda OF MD, PhD, Berral de la Rosa F MD, PhD. Coordination of the rotational movement of the pelvis and the hip in men without low back pain, with control impairment of the lumbopelvic region in the sagittal plane. Physiother Theory Pract 2020;36:810-7.
42. Oleksy L, Bylina D, Mika A, Sołtan J, Kielnar R. The relationship between lumbo-pelvic-hip complex and knee joint dysfunctions. J Nov Physiother 2018;8:e149.
43. Cibulka MT, Sinacore DR, Cromer GS, Delitto A. Unilateral hip rotation range of motion asymmetry in patients with sacroiliac joint regional pain. Spine (Phila Pa 1976) 1998;23:1009-15.
44. Key J. The pelvic crossed syndromes: a reflection of imbalanced function in the myofascial envelope; a further exploration of Janda's work. J Bodyw Mov Ther 2010;14:299-301.
45. Bordoni B, Varacallo M. Anatomy, Bony Pelvis and Lower Limb, Gastrocnemius Muscle. StatPearls(internet) February 7, 2021.
46. Hoshikawa K, Yuri T, Giambini H, Kiyoshige Y. Shoulder scaption is dependent on the behavior of the different partitions of the infraspinatus muscle. Surg Radiol Anat 202;43:6153-9.
47. Seidi F, Bayattork M, Minoonejad H, Andersen LL, Page P. Comprehensive corrective exercise program improves alignment, muscle activation and movement pattern of men with upper crossed syndrome: randomized controlled trial. Sci Rep 2020;10:20688.
48. Gillani SN, Ain Q, Rehman SU, Masood T. Effects of eccentric muscle energy technique versus static stretching exercises in the management of cervical dysfunction in upper cross syndrome: a randomized control trial. J Pak Med Assoc 2020;70:394-8.
49. Clifford AM, Dillon S, Hartigan K, O'Leary H, Constantinou M. The effects of McConnell patellofemoral joint and tibial internal rotation limitation taping techniques in people with Patellofemoral pain syndrome. Gait Posture 2020;82:266-72.
50. Chaudhari AMW, VAN Horn MR, Monfort SM, Pan X, OÑate JA, Best TM. Reducing Core Stability Influences Lower Extremity Biomechanics in Novice Runners. Med Sci Sports Exerc 2020;52:1347-53.
51. Bae WS, Lee HO, Shin JW, Lee KC. The effect of middle and lower trapezius strength exercises and levator scapulae and upper trapezius stretching exercises in upper crossed syndrome. J Phys Ther Sci 2016;28:1636-9.
52. Hrysomallis C. Effectiveness of strengthening and stretching exercises for the postural correction of abducted scapulae: a review. J Strength Cond Res 2010;24:567-74.
53. Arshadi R, Ghasemi GA, Samadi H. Effects of an 8-week selective corrective exercises program on electromyography activity of scapular and neck muscles in persons with upper crossed syndrome: Randomized controlled trial. Phys Ther Sport 2019;37:113-9.
54. Bayattork M, Seidi F, Minoonejad H, Andersen LL, Page P. The effectiveness of a comprehensive corrective exercises program and subsequent detraining on alignment, muscle activation, and movement pattern in men with upper crossed syndrome: protocol for a parallel-group randomized controlled trial. Trials 2020;21:255.
55. Altamirano KM, Coburn JW, Brown LE, Judelson DA. Effects of warm-up on peak torque, rate of torque development, and electromyographic and mechanomyographic signals. J Strength Cond Res 2012;26:1296-301.
56. Karimian R, Rahnama N, Ghasemi G, Lenjannejadian S. Photogrammetric Analysis of Upper Cross Syndrome among Teachers and the Effects of National Academy of Sports Medicine Exercises with Ergonomic Intervention on the Syndrome. J Res Health Sci 2019;19:e00450.
57. Frydendal T, Eshøj H, Liaghat B, Edouard P, Søgaard K, Juul-Kristensen B. Sensorimotor control and neuromuscular activity of the shoulder in adolescent competitive swimmers with generalized joint hypermobility. Gait Posture 2018;63:221-7.
58. Mann SJ, Lam JC, Singh P. McKenzie Back Exercises. 2021; In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021.
59. Kim SY, Weon JH, Jung DY, Oh JS. Effect of the scapula-setting exercise on acromio-humeral distance and scapula muscle activity in patients with subacromial impingement syndrome. Phys Ther Sport 2019;37:99-104.
60. Vinstrup J, Sundstrup E, Brandt M, Jakobsen MD, Calatayud J, Andersen LL. Core Muscle Activity, Exercise Preference, and Perceived Exertion during Core Exercise with Elastic Resistance versus Machine. Scientifica (Cairo) 2015;2015:403068.

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Kronik Ağrılı Hastalarda Vitamin D Düzeyi ile Anksiyete ve Depresyon İlişkisinin Değerlendirilmesi

Evaluation of the Relationship Between Vitamin D Levels and Anxiety and Depression in Patients with Chronic Pain

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Öz

Amaç: Kronik ağrılı hastalarda vitamin D düzeyi ile anksiyete ve depresyon arasındaki ilişkiyi belirlemektir.
Gereç ve Yöntem: Çalışmaya 160 hasta (125 kadın, 35 erkek) alındı. Çalışmaya 18 yaş üstü çalışma sorularını cevaplayabilecek düzeyde olan kadın ve erkek hastalar dahil edildi. Hastaların yaş, cinsiyet, boy, kilo, hastalık süresi, tanı, komorbid durumları kaydedildi. Vücut kitle indeksi (VKİ) (kg/m^2) hesaplandı. Vizüel analog skala (VAS) (0-10) ile ağrı değerlendirildi. Hastane anksiyete ve depresyon ölçeği (HAD) hesaplandı. Çalışmaya dahil edilen hastalar vitamin D düzeyine göre iki gruba ayrıldı (grup 1 vitamin D: 0-19, grup 2 vitamin D: 20-60 ng/mL). Ayrıca vitamin D düzeyleri kaydedildi.
Bulgular: Çalışmaya dahil edilen hastaların yaşı 58,72±8,21 yıl olarak hesaplandı. Vitamin D eksikliği %42,8 olarak saptandı. Vitamin D eksikliği kadınlarda %80,7 olarak belirlendi. Kronik ağrılı hastalarda vitamin D düzeyi ile yaş (r=0,185, p=0,026), VKİ (r=0,084, p=0,316), hastalık süresi (r=0,067, p=0,420), VAS (r=0,038, p=0,648), HAD anksiyete (r=0,020, p=0,808) ve HAD depresyon (r=0,048, p=0,569) arasında korelasyon tespit edilmedi. Kronik ağrılı hastalarda VKİ ile vitamin D düzeyi arasında (r=-0,117, p=0,165) ilişki tespit edilmezken, VKİ ile VAS (r=0,305, p=0,000), HAD anksiyete (r=0,185, p=0,001) ve HAD depresyon (r=0,0240, p=0,002) arasında pozitif korelasyon saptanmıştır.
Sonuç: Çalışmamızda kronik ağrılı hastalarda vitamin D düzeyi ile anksiyete ve depresyon arasında ilişki tespit etmedik. Ancak, obezite ile ağrı şiddeti arasında korelasyon saptadık. Ayrıca obezitenin anksiyete ve depresyonla ilişkili olduğunu tespit ettik. Kronik ağrı tedavisinde kilo verilmesi gibi yaşam tarzı değişikliklerinin uygulanması ve vitamin D eksikliğinin replasmanı anksiyete ve depresyon durumunda iyileşme sağlayabilir.
Anahtar kelimeler: Kronik ağrı, vücut kitle indeksi, vitamin D, obezite, depresyon

Abstract

Objective: This study aimed to determine the relationship between vitamin D levels and anxiety and depression in patients with chronic pain.
Materials and Methods: A total of 160 patients, including 125 female and 35 male patients, who were >18 years old and capable of answering study questions were included in this study. Age, gender, height, weight, duration of disease, diagnosis and comorbid status of the patients were recorded. Body mass index (BMI) (kg/m^2) was calculated for each patient. Pain was evaluated using the visual analogue scale (VAS), which ranges from 0 to 10. Hospital anxiety and depression scale (HADS) scores were recorded. The patients were divided into two groups (group 1 vitamin D: 0-19, group 2 vitamin D: 20-60 ng/mL) according to vitamin D levels. Also vitamin D levels were noted.
Results: The mean age of the patients included in this study was 58.72±8.21 years. Vitamin D deficiency was found in 42.8% of the patients, of which 80.7% were female patients.In patients with chronic pain, there was no correlation between vitamin D levels and age (r=0.185, p=0.026); BMI (r=0.084, p=0.316); disease duration (r=0.067, p=0.420); VAS (r=0.038, p=0.648); HADS scores for anxiety (r=0.020, p=0.808) and HADS scores for depression (r=0.048, p=0.569). No relationship was noted between BMI and vitamin D levels (r =-0.117, p=0.165) in patients with chronic pain; however, a positive correlation was noted between BMI and VAS (r=0.305, p=0.000) and HADS scores for anxiety (r=0.185, p=0.001) and HADS scores for depression (r=0.0240, p=0.002).

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Abstract

Conclusion: In the present study, we found no relationship between vitamin D levels and anxiety and depression in patients with chronic pain. However, we found a correlation between obesity and pain severity. Also we report that obesity is associated with anxiety and depression. Implementing lifestyle changes, such as weight loss and reduction of vitamin D deficiency, can improve anxiety and depression in patients with chronic pain.
Keywords: Chronic pain, body mass index, vitamin D, obesity, depression

Giriş

D vitamini D_2 ve D_3'ten oluşan yağda eriyen sekosteroid yapısında bir hormon olarak kabul edilmektedir (1). D vitaminin kalsiyum ve kemik metabolizmasındaki yeri uzun zamandır iyi bilinmektedir. D vitamini düzeyi serumda 25-hydroksivitamin D_3 [25-(OH)D_3] ölçülerek hesaplanmaktadır (2). Düşük D vitamini düzeylerinin kas iskelet sistemi kaynaklı kronik ağrıda önemli bir rolü olduğu iyi bilinmektedir. Bununla birlikte; D vitaminin hücre diferensiasyonu, apopitozu ve profilerasyonu gibi birçok fonksiyonu olduğu tespit edilmiştir (3). Son yıllarda D vitaminin baş ağrısı, yaygın vücut ağrısı gibi kas iskelet sistemi dışında da rolü olduğu öne sürülmektedir (4,5). Ayrıca, diyabet, malignite, kalp damar hastalıkları, otoimmünite ve enfeksiyon durumları ile ilişkili olabileceği bildirilmiştir (6-9). D vitamini 20 ng/mL altında eksiklik, 20-30 ng/mL yetersizlik, 30-60 ng/mL normal, 10 ng/mL altında ise ciddi eksiklik olarak değerlendirilmektedir (2).

İnsanlarda D vitamini, primer olarak deriden ultraviyole B ışınları vasıtasıyla sentezlenir (2). Yaş, kronik hastalık ve dizabilite ile D vitamini sentezi farklılık göstermektedir (2,10). Popülasyon yaşlandıkça ağrı, tutukluk ve fiziksel inaktivite artmakta ve bu durum osteoartrit gelişme riskini artırmaktadır. Ayrıca osteoartrit fiziksel inaktiviteyi tetikleyerek obeziteye yol açabilmektedir (2,11). D vitamini eksikliğinin hem obezite hem de osteoartrit ilişkili semptomlarla ilişkili olabileceği bildirilmiştir (2,11,12). Ayrıca, obez bireylerin daha az vücut alanını güneşe maruz bırakarak D vitamini düzeylerini düşük tutmaya meyilli olduğu öne sürülmüştür (13,14). Yeterli D vitamini düzeyine sahip postmenopoz kadınların 4-5 yıl süre ile takip edildikleri bir çalışmada daha az kilo aldığı yayımlanmıştır (15).

Kronik ağrı ve depresyon toplumun büyük bir kısmını ilgilendiren önemli bir halk sağlığı problemidir. Kronik ağrı ve depresyon arasında yakın bir ilişki vardır. Kronik ağrı depresyona yol açabileceği gibi depresyonun da ağrıya yol açtığını gösteren çalışmalar mevcuttur (16-19). Ayrıca non-spesifik kas iskelet sistem ağrıları ile depresyon arasında ilişki olmadığı bildirilmiştir (20-22). Bununla birlikte kronik ağrıda vitamin D'nin anksiyete ve depresyon ile ilgili sonuçları çelişkilidir (16-26).

Bu çalışmadaki amacımız; kronik ağrılı hastalarda 25-(OH) D_3 düzeyleri ölçülerek anksiyete ve depresyon üzerine etkisini belirlemektir.

Gereç ve Yöntem

Bu çalışmaya 01.02.2017-31.03.2017 tarihleri arasında Ahi Evran Üniversitesi Eğitim ve Araştırma Hastanesi Fiziksel Tıp ve Rehabilitasyon Polikliniği'ne çeşitli ağrı nedenleri ile başvuran en az üç aylık hastalık öyküsü olan 160 hasta (125 kadın, 35 erkek) dahil edildi. Çalışma retrospektif olarak tasarlandı. Çalışmaya 18 yaş üstü soruları cevaplayabilecek düzeyde olan kronik ağrılı kadın ve erkek hastalar dahil edildi. Hastaların yaş, cinsiyet, boy, kilo, meslek, hastalık süresi, tanı, komorbid durumları kaydedildi. Vücut kitle indeksi (VKİ) (kg/m^2) hesaplandı. Vizüel analog skala (VAS) (0-10) ile ağrı değerlendirildi. Çalışmaya dahil edilen hastalar vitamin D düzeyine göre iki gruba ayrıldı. Vitamin D düzeyleri 0-19 ng/mL aralığında ölçüldüğünde eksiklik olarak değerlendirilmektedir (3). Vitamin D düzeyi 0-19 ng/mL arasında yer alan bireyler grup 1, 20-60 ng/mL arasında yer alan bireyler ise grup 2'de yer almaktadır.

Olguların anksiyete ve depresyon düzeyleri; hastane anksiyete ve depresyon ölçeği (HAD) hesaplandı. HAD 0-3 arasında puanlanmakta ve 14 sorudan oluşmaktadır. 1,3,5,7,9,11,13 soruların toplamı anksiyete, 2,4,6,8,10,12 ve 14 soruların toplamı depresyon skorlarını vermektedir. On bir puanın üzeri anksiyete ve depresyon ile uyumlu olarak değerlendirilmektedir (27).

Çalışmaya enfeksiyöz, malignite, nörolojik hastalıklar, dekompanze kalp, karaciğer, pulmoner hastalığı olanlar, 3 aydan kısa süreli D vitamini replasman tedavisi alanlar dahil edilmedi.

Vitamin D ölçümü mevsimsel değişiklikleri engellemek için çalışma Şubat ve Mart ayında yapıldı. Kan örnekleri kübital venden sekiz saatlik açlık sonrası alındı. Vitamin D düzeyi 25-(OH)D_3'nin kemiluminesans immün ölçüm yöntemi ile ölçülmesi ile belirlendi.

Bu çalışma için Ahi Evran Üniversitesi Tıp Fakültesi Klinik Araştırmalar Etik Kurulu'ndan onay alınmıştır (karar no: 2017-15/173, tarih: 10.10.2017). Çalışma Helsinki Deklarasyonu'na uygun olarak organize edilmiştir. Çalışmaya katılan hastaların yazılı ve sözlü onamları alınmıştır.

İstatistiksel Analiz

İstatistiksel analiz SPSS v21.0 (SPSS, Inc, Chicago, IL, USA) programı ile yapılmıştır. Katılımcıların sosyo-demografik özelliklerini test etmek için tanımlayıcı istatistik kullanılarak ortalama ± standart sapma veya yüzde olarak verilmiştir. Verilerin normal dağılıma uygunluğu Shapiro-Wilk testi ve Skewness-Kurtossis yöntemi ile analiz edilmiş ve verilerin normal dağılıma uyduğu görülmüştür. Normal dağılıma uyan verilerin gruplar arası karşılaştırılması bağımsız örneklem t-testi ile yapıldı. Korelasyon analizi için Pearson korelasyon testi kullanılmıştır. Korelasyon katsayıları; r≥0,81-1,0 mükemmel, 0,61-0,80 çok iyi, 0,41-0,60 iyi, 0,21-0,40 makul, 0-0,20 zayıf şeklinde kabul

edilmiştir. Bu çalışmanın istatistiksel anlamlılık düzeyi p<0,05 olarak belirlenmiştir. Depresyon ve anksiyete ile ilişkili olabilecek faktörler lojistik regresyon analizi ile test edilmiştir.

Bulgular

Çalışmaya dahil edilen hastalara ait demografik veriler Tablo 1'de gösterilmektedir. Vitamin D düzeyine göre grupların karakteristik özellikleri Tablo 2'de gösterilmektedir. Vitamin D eksikliği %42,8 olarak saptandı. Vitamin D eksikliği kadınlarda %80,7 olarak belirlendi.

Kronik ağrılı hastalarda vitamin D düzeyi ile yaş (r=0,185, p=0,026), VKİ (r=0,084, p=0,316), hastalık süresi (r=0,067, p=0,420), VAS (r=0,038, p=0,648), HAD anksiyete (r=0,020, p=0,808) ve HAD depresyon (r=0,048, p=0,569) arasında korelasyon tespit edilmedi. Kronik ağrılı hastalarda VKİ ile vitamin D düzeyi arasında (r=-0,117, p=0,165) ilişki tespit edilmezken, VKİ ile VAS (r=0,305, p=0,000), HAD anksiyete (r=0,185, p=0,001) ve HAD depresyon (r=0,0240, p=0,002) arasında pozitif korelasyon saptanmıştır.

Tablo 1. Çalışmaya dahil edilen hastalara ait sosyo-demografik veriler

Değişken	X±SS
Hasta sayısı (n)	160
Kadın n (%)	125 (%78,6)
Erkek n (%)	35 (%21,4)
Yaş (yıl)	58,72±8,21
Beden kitle indeksi (kg/m^2)	30,38±5,61
Hastalık süresi (yıl)	11,76±9,36
VAS	8,27±1,36
HAD anksiyete	10,66±4,01
HAD depresyon	8,09±4,01
Kalsiyum (mg/dL)	9,48±0,38
Magnezyum (mg)	1,93±0,17
Vitamin D (ng/mL)	29,48±16,07
Vitamin D eksikliği	52 (%32,5)
Tanı n (%)	
Fibromiyalji	16 (%8,9)
Miyofasiyal ağrı sendromu	25 (%15,3)
Servikal disk lezyonu	27 (%17,2)
Lomber disk lezyonu	59 (%36,8)
Gonartroz	32 (%21,1)
Yaygın osteoartroz	1 (%0,7)
Meslek n (%)	
Ev hanımı	112 (%70)
Memur	8 (%5)
İşçi	16 (%10)
Emekli	8 (%5)
Çiftçi	16 (%10)

HAD: Hastane anksiyete ve depresyon ölçeği, VAS: Vizüel analog skala, SS: Standart sapma

Kronik ağrılı hastalarda depresyon ve anksiyete ile ilişkili faktörlerin lojistik regresyon analizi Tablo 3 ve Tablo 4'te sunulmuştur. Regresyon analizine göre VKİ anksiyete ile ilişkili bulunmuştur (p=0,021, olasılık oranı: 1,155). Diğer bağımsız değişkenlerin depresyon ve anksiyete ile ilişkisi saptanmamıştır.

Tartışma

Bu çalışmada kronik ağrılı hastalarda vitamin D düzeyi ile ağrı, anksiyete ve depresyon ilişkisi araştırılmıştır. Çalışma sonuçları vitamin D düzeyi ile HAD arasında ilişki olmadığını göstermektedir. Ayrıca, vitamin D eksikliği (0-19 ng/mL) olan grupta da HAD skorlarında farklılık tespit edilmemiştir. Bununla birlikte bu çalışmada obezite ile ağrı, anksiyete ve depresyon skorlarının ilişkili olduğu bulunmuştur.

Vitamin D eksikliği hem Türkiye'de hem de dünyada yaygın bir durumdur (28-31). Vitamin D'nin en önemli kaynağı güneş ışığıdır. Vitamin D eksikliğinin primer nedeni güneş ışığına maruziyetin azalması ve diyetle vitamin D kaynaklarının az alınması ve absorbsiyonunun az olmasıdır. Vitamin D eksikliği klinik olarak non-spesifik kas iskelet ağrısı ile prezente olur. Bu durum yetersiz kalsiyum ve fosfor dengesinin korunması için kemikten periosta doğru mineral göçünden kaynaklandığı öne sürülmektedir (28). Vitamin D eksikliğinin ağrıdaki ve ağrının kronikleşmesindeki rolü henüz netleşmemiştir. Vitamin D seviyesinin duyu nöronların büyümesini negatif yönde etkilediği tespit edilmiştir (2). Ayrıca, vitamin D düzeylerinde azalmanın enflamasyonu tetikleyerek ağrıyı artırdığı öne sürülmektedir (3). Vitamin D eksikliği kemik mineralizasyonunu etkilemekte ve kemik, eklem ile kas ağrılarına yol açabilmektedir. Bu durum klinik olarak fibromiyalji gibi yaygın ağrı sendromlarına eşlik edebildiği gibi dejeneratif eklem hastalığı gibi lokalize ağrı durumları ile prezente olabilmektedir (4). Heidari ve ark. (4) lökomotor sistem yakınması olan kadın hastaların %93'ünde vitamin D eksikliği bildirmişlerdir. Ülkemizde Ege Bölgesi'nde yapılan bir çalışmada vitamin D eksikliği %74,9 olarak raporlanmıştır (29). Ayrıca kadınlarda erkeklere nazaran daha yüksek oranda (%78,7 vs %66,4) görüldüğü bildirilmiştir (30). Ülkemizden yapılmış bir çalışmada ise %33,4 oranında vitamin D eksikliği olduğu yayınlanmıştır (31). Bu çalışmada ise literatürle uyumlu olarak; vitamin D eksikliği %42,8 olarak saptanmış ve bu hastaların %80,7'sinin kadın olduğu sonucuna ulaşılmıştır.

Obezite ve kronik ağrı arasındaki ilişki iyi bilinmektedir (32). Fibromiyalji hastalarında %58'e varan oranda obezite görüldüğü bildirilmiştir (33). Benzer olarak, Neumann ve ark. (34) fibromiyalji hastalarının %28'inin fazla kilolu, %45'inin ise obez olduğu vurgulamışlardır. Loevinger ve ark. (35) bel çevresi ve düşük dansiteli lipoprotein yüksekliğinin metabolik sendromu tetikleyerek kronik ağrı riskini artırdığını yayınlamışlardır. Ayrıca, obezitenin sistemik enflamasyonu artırarak kronik ağrı gelişimine de yol açabildiği öne sürülmüştür (32). Bununla birlikte beynin enerji kullanımını düzenleyen leptin hormonu obez bireylerde yüksek oranda tespit edilmektedir (36). Benzer olarak osteoartritli

Tablo 2. Vitamin D düzeyine göre grupların karakteristik özellikleri			
	Grup 1 (D vitamini 0-19 ng/mL) n=52	**Grup 2 (D vitamini 20-60 ng/mL) n=93**	**p***
HAD anksiyete	10,21±4,14	10,66±4,03	0,520
HAD depresyon	7,82±4,41	8,07±4,36	0,74
Yaş	55,11±17,57	59,69±13,22	0,078
VKİ (kg/m^2)	28,61±5,09	29,96±5,58	0,151
Hastalık süresi (yıl)	11,40±9,76	11,69±8,75	0,852
VAS (0-10)	8,01±1,59	8,24±1,35	0,363
*Independent t-testi, p<0,05 istatistiksel olarak anlamlı kabul edilmiştir. HAD: Hastane anksiyete ve depresyon ölçeği, VAS: Vizüel analog skala, VKİ: Vücut kitle indeksi			

Tablo 3. Depresyon ile ilişkili olabilecek faktörlerin lojistik regresyon analizi				
Bağımsız değişkenler*	**B**	**OR**	**%95 GA**	**p**
Yaş	0,007	1,007	0,955-1,061	0,807
Cinsiyet				
Erkek	0,407	1,502	0,297-7,598	0,623
Kadın	-	1	-	
VKİ	0,021	1,021	0,897-1,163	0,754
Hastalık süresi	-0,016	0,984	0,914-1,059	0,667
Vitamin D	0,011	1,011	0,976-1,047	0,538
Magnezyum	-1,844	0,158	0,006-4,194	0,270
Vitamin B12	0,000	1,000	0,997-1,002	0,661
Hemoglobin	-0,009	0,991	0,636-1,544	0,967
*Hosmer Lemeshow testi p=0,323, Nagelkerke R^2: %6,3 Modelin omnibus testleri p=0,896, VKİ: Vücut kitle indeksi, OR: Olasılık oranı, GA: Güven aralığı				

Tablo 4. Anksiyete ile ilişkili olabilecek faktörlerin lojistik regresyon analizi				
Bağımsız değişkenler*	**B**	**OR**	**%95 GA**	**p**
Yaş	-0,013	0,987	0,944-1,032	0,562
Cinsiyet				
Erkek	0,063	1,065	0,263-4,312	0,930
Kadın	-	1	-	
BKİ	0,144	1,155	1,022-1,306	0,021
Hastalık süresi	0,012	1,012	0,954-1,074	0,695
Vitamin D	-0,005	0,995	0,965-1,027	0,762
Magnezyum	-1,846	0,158	0,008-2,947	0,216
Vitamin B12	0,000	1,000	0,998-1,002	0,784
Hemoglobin	-0,059	0,942	0,642-1,384	0,762
*Hosmer Lemeshow testi p=0,355, Nagelkerke R2: %15,7, Modelin omnibus testleri p=0,218, VKİ: Vücut kitle indeksi, OR: Olasılık oranı, GA: Güven aralığı				

hastalarda sinovyal leptin seviyelerinin yüksek olduğu ve osteoartrit şiddetiyle ilişkili olduğu bulunmuştur (37). Kronik ağrı durumlarından biri olan osteoartrit tedavisinde 5 kg zayıflamanın ağrı şiddetinde %50 azalma ile sonuçlanabileceği gösterilmiştir (38). Ayrıca yetersiz vitamin D düzeylerinin özellikle kadınlarda obezite ile ilişkili olduğu raporlanmıştır (38). Çalışmamızda VKİ ile vitamin D arasında ilişki tespit etmedik. Benzer olarak ağrı ile VKİ arasında ilişki saptadık.

Kronik ağrıdan muzdarip hastalarda uyku, anksiyete ve mizaç bozuklukları gibi komorbid durumlar sıklıkla rastlanmaktadır (39). Bu durum hastaların yaşam kalitesini bozmakta, iş gücü ve sosyal yaşamda kayıplara yol açabilmektedir (39-41). Vitamin D süplementasyonun uyku, ağrı, yaşam kalitesi ve çeşitli indikatörlerde iyileşme kaydettiği bildirilmiştir (39-42).

Vitamin D etkisini VDR (vitamin D reseptörü) vasıtasıyla göstermektedir. Vitamin D maruziyetinin biyoyararlanımı,

transportu, metabolizması ve yağ dokudaki dağılımı VDR'nin genetik poliformizmi ile ilgili olduğu düşünülmektedir (39). Çalışmamızda VDR genetik poliformizmi değerlendirilmedi.

Depresyon iş gücü kaybına yol açan prevalansı yüksek bir halk sağlığı problemidir (43). Majör depresif bozukluklarının kadınlarda %21,3 oranında görüldüğü raporlanmıştır (44). Yaşam boyu depresyon görülme oranı kadınlarda daha yüksektir (45). Bu durumun vitamin D eksikliğinden kaynaklandığı öne süren çalışmalar yayınlanmıştır (23,24). Kaya ve ark. (46) vitamin D ve kalsiyum takviyesi ile altı aylık takip sonucunda hastaların depresyon skorunda anlamlı bir düzelme olduğunu bildirmişlerdir. Bununla birlikte vitamin D ile depresyon arasında ilişki olmadığını gösteren yayınlar da mevcuttur (21,22). Yilmaz ve ark. (47) sağlıklı kadınlar üzerinde yaptıkları bir çalışmada depresyonun %8,3 oranında tespit etmişlerdir. Yılmaz ve ark. (23) premenapozal kadınlarda vitamin D seviyesinin kronik ağrı ile depresyon arasında ilişkili olduğunu yayınlamışlardır. Çalışmamızda vitamin D düzeyi ile anksiyete ve depresyon ilişkisi tespit etmedik.

Çalışma Kısıtlılıkları

Çalışmamızda bazı limitasyonlar mevcuttur. Çalışma retrospektif yapılmış ve vitamin D eksikliği saptanan hastalara replasman yapılarak takip edilmemiştir. Ayrıca hastaların güneşe maruziyet süreleri değerlendirilmemiş ve kronik ağrıdan muzdarip çeşitli tanı alan hastalarda çalışma gerçekleştirilmiştir. Ayrıca VDR polimorfizmi değerlendirilmemiştir.

Sonuç

Vitamin D eksikliği yaygın bir halk sağlığı problemidir. Çalışmamızda kronik ağrılı hastalarda vitamin D düzeyi ile anksiyete ve depresyon arasında ilişki tespit etmedik. Ayrıca, obezite ile ağrı şiddeti, anksiyete ve depresyon arasında korelasyon saptadık. Kronik ağrı tedavisinde kilo verilmesi gibi yaşam tarzı değişikliklerinin uygulanması ve vitamin D eksikliğinin replasmanının anksiyete ve depresyon durumunda iyileşme sağlayabileceği kanaatindeyiz.

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Kaynaklar

1. Cao Y, Jones G, Cicuttini F, Winzenberg T, Wluka A, Sharman J, et al. Vitamin D supplementation in the management of knee osteoarthritis: study protocol for a randomized controlled trial. Trials 2012;13:131.
2. Glover TL, Goodin BR, Horgas AL, Kindler LL, King CD, Sibille KT, et al. Vitamin D, race, and experimental pain sensitivity in older adults with knee osteoarthritis. Arthritis Rheum 2012;64:3926-35.
3. Holick MF. Vitamin D deficiency. N Engl J Med 2007;357:266-81.
4. Heidari B, Shirvani JS, Firouzjahi A, Heidari P, Hajian-Tilaki KO. Association between nonspecific skeletal pain and vitamin D deficiency. Int J Rheum Dis 2010;13:340-6.
5. Pfeifer M, Begerow B, Minne HW. Vitamin D and muscle function. Osteoporos Int 2002;13:187-94.
6. Mitri J, Muraru MD, Pittas AG. Vitamin D and type 2 diabetes: a systematic review. Eur J Clin Nutr 2011;65:1005-15.
7. Cannell JJ, Vieth R, Umhau JC, Holick MF, Grant WB, Madronich S, et al. Epidemic influenza and vitamin D. Epidemiol Infect 2006;134:1129-40.
8. Yap KS, Northcott M, Hoi AB, Morand EF, Nikpour M. Association of low vitamin D with high disease activity in an Australian systemic lupus erythematosus cohort. Lupus Sci Med 2015;2:e000064.
9. Schöttker B, Haug U, Schomburg L, Köhrle J, Perna L, Müller H, et al. Strong associations of 25-hydroxyvitamin D concentrations with all-cause, cardiovascular, cancer, and respiratory disease mortality in a large cohort study. Am J Clin Nutr 2013;97:782-93.
10. Ames BN. Low micronutrient intake may accelerate the degenerative diseases of aging through allocation of scarce micronutrients by triage. Proc Natl Acad Sci U S A 2006;103:17589-94.
11. Tanamas SK, Wluka AE, Davies-Tuck M, Wang Y, Strauss BJ, Proietto J, et al. Association of weight gain with incident knee pain, stiffness, and functional difficulties: a longitudinal study. Arthritis Care Res (Hoboken) 2013;65:34-43.
12. Weiss E. Knee osteoarthritis, body mass index and pain: data from the Osteoarthritis Initiative. Rheumatology (Oxford) 2014;53:2095-9.
13. Lagunova Z, Porojnicu AC, Lindberg F, Hexeberg S, Moan J. The dependency of vitamin D status on body mass index, gender, age and season. Anticancer Res 2009;29:3713-20.
14. Wortsman J, Matsuoka LY, Chen TC, Lu Z, Holick MF. Decreased bioavailability of vitamin D in obesity. Am J Clin Nutr 2000;72:690-3.
15. LeBlanc ES, Rizzo JH, Pedula KL, Ensrud KE, Cauley J, Hochberg M, et al. Associations between 25-hydroxyvitamin D and weight gain in elderly women. J Womens Health (Larchmt) 2012;21:1066-73.
16. Durmuş D, Alaylı G, Canturk F. Effects of biofeedback assisted isometricexercise and electrical stimulation on pain, anxiety anddepression scores in knee osteoarthritis. Turk J Phys Med Rehab 2005;51:142-5.
17. Kara H, Abay E. Kronik ağrıya psikiyatrik yaklaşım. Anadolu Psikiyatri Dergisi 2000;1:89-99.
18. Kerr DC, Zava DT, Piper WT, Saturn SR, Frei B, Gombart AF. Associations between vitamin D levels and depressive symptoms in healthy young adult women. Psychiatry Res 2015;227:46-51.
19. Armstrong DJ, Meenagh GK, Bickle I, Lee AS, Curran ES, Finch MB. Vitamin D deficiency is associated with anxiety and depression in fibromyalgia. Clin Rheumatol 2007;26:551-4.
20. Pan A, Lu L, Franco OH, Yu Z, Li H, Lin X. Association between depressive symptoms and 25-hydroxyvitamin D in middle-aged and elderly Chinese. J Affect Disord 2009;118:240-3.
21. Zhao G, Ford ES, Li C, Balluz LS. No associations between serum concentrations of 25-hydroxyvitamin D and parathyroid hormone and depression among US adults. Br J Nutr 2010;104:1696-702.
22. Binkley N, Ramamurthy R, Krueger D. Low vitamin D status: definition, prevalence, consequences, and correction. Endocrinol Metab Clin North Am 2010;39:287-301.
23. Yılmaz H, Bodur S, Karaca G. The Association between Vitamin D Level and Chronic Pain and Depression in Premenopausal Women. Türk Fiz Tıp Rehab Derg 2014;60:121-5.

24. Jorde R, Sneve M, Figenschau Y, Svartberg J, Waterloo K. Effects of vitamin D supplementation on symptoms of depression in overweight and obese subjects: randomized double blind trial. J Intern Med 2008;264:599-609.
25. Hoang MT, Defina LF, Willis BL, Leonard DS, Weiner MF, Brown ES. Association between low serum 25-hydroxyvitamin D and depression in a large sample of healthy adults: the Cooper Center longitudinal study. Mayo Clin Proc 2011;86:1050-5.
26. Anglin RE, Samaan Z, Walter SD, McDonald SD. Vitamin D deficiency and depression in adults: systematic review and meta-analysis. Br J Psychiatry 2013;202:100-7.
27. Aydemir Ö, Güvenir T, Küey L, Kültür S. Hastane anksiyete ve depresyon olcegi Turkce formunun gecerlilik ve guvenilirligi. Turk Psikiyatri Derg 1997;8:280-7.
28. Özkan B, Döneray H. D vitamininin iskelet sistemi dışı etkileri. Çocuk Sağlığı ve Hastalıkları Dergisi 2011;54:99-119.
29. Alagöl F, Shihadeh Y, Boztepe H, Tanakol R, Yarman S, Azizlerli H, et al. Sunlight exposure and vitamin D deficiency in Turkish women. J Endocrinol Invest 2000;23:173-7.
30. Hekimsoy Z, Dinç G, Kafesçiler S, Onur E, Güvenç Y, Pala T, et al. Vitamin D status among adults in the Aegean region of Turkey. BMC Public Health 2010;10:782.
31. Cigerli O, Parildar H, Unal AD, Tarcin O, Erdal R, Guvener Demirag N. Vitamin D deficiency is a problem for adult out-patients? A university hospital sample in Istanbul, Turkey. Public Health Nutr 2013;16:1306-13.
32. Okifuji A, Hare BD. The association between chronic pain and obesity. J Pain Res 2015;8:399-408.
33. Okifuji A, Donaldson GW, Barck L, Fine PG. Relationship between fibromyalgia and obesity in pain, function, mood, and sleep. J Pain 2010;11:1329-37.
34. Neumann L, Lerner E, Glazer Y, Bolotin A, Shefer A, Buskila D. A cross-sectional study of the relationship between body mass index and clinical characteristics, tenderness measures, quality of life, and physical functioning in fibromyalgia patients. Clin Rheumatol 2008;27:1543-7.
35. Loevinger BL, Muller D, Alonso C, Coe CL. Metabolic syndrome in women with chronic pain. Metabolism 2007;56:87-93.
36. Considine RV. Human leptin: an adipocyte hormone with weight-regulatory and endocrine functions. Semin Vasc Med 2005;5:15-24.
37. Lübbeke A, Finckh A, Puskas GJ, Suva D, Lädermann A, Bas S, et al. Do synovial leptin levels correlate with pain in end stage arthritis? Int Orthop 2013;37:2071-9.
38. Felson DT, Zhang Y, Anthony JM, Naimark A, Anderson JJ. Weight loss reduces the risk for symptomatic knee osteoarthritis in women. The Framingham Study. Ann Intern Med 1992;116:535-9.
39. Shipton EE, Shipton EA. Vitamin D Deficiency and Pain: Clinical Evidence of Low Levels of Vitamin D and Supplementation in Chronic Pain States. Pain Ther 2015;4:67-87.
40. Souberbielle JC, Courbebaisse M, Cormier C, Pierrot-Deseilligny C, Viard JP, Jean G, et al. When should we measure vitamin D concentration in clinical practice? Scand J Clin Lab Invest Suppl 2012;243:129-35.
41. Sanders KM, Stuart AL, Williamson EJ, Simpson JA, Kotowicz MA, Young D, et al. Annual high-dose oral vitamin D and falls and fractures in older women: a randomized controlled trial. JAMA 2010;303:1815-22.
42. Osunkwo I, Ziegler TR, Alvarez J, McCracken C, Cherry K, Osunkwo CE, et al. High dose vitamin D therapy for chronic pain in children and adolescents with sickle cell disease: results of a randomized double blind pilot study. Br J Haematol 2012;159:211-5.
43. Whooley MA, Avins AL, Miranda J, Browner WS. Case-finding instruments for depression. Two questions are as good as many. J Gen Intern Med 1997;12:439-45.
44. Noble RE. Depression in women. Metabolism 2005;54(5 Suppl 1):49-52.
45. Mete HE. Kronik hastalık ve depresyon. Klinik Psikiyatri 2008;11:3-18.
46. Kaya U, Karadağ Saygı E, Akyüz G. The Effects of Vitamin D Treatment on the Pain and the Quality of Life in Elderly Women. Osteoporoz Dünyasından 2010;16:9-12.
47. Yilmaz H, Polat HA, Yilmaz SD, Erkin G, Kucuksen S, Salli A, et al. Evaluation of sexual dysfunction in women with rheumatoid arthritis: a controlled study. J Sex Med 2012;9:2664-70.

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Kinesiophobia and Related Factors in Postmenopausal Women with Osteoporosis and Osteopenia

Postmenopozal Osteoporoz veya Osteopenili Kadınlarda Kinezyofobi ve İlişkili Faktörler

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Abstract

Objective: To investigate level of kinesiophobia and related factors in postmenopausal women with osteoporosis (OP) and osteopenia (OPN).
Materials and Methods: A total of 60 female patients with postmenopausal OP, 60 female patients with postmenopausal OPN and 60 age- and gender-matched controls were enrolled in this study. Demographic data (age, weight, height, body mass index, educational level, employment status, disease duration and menopause duration) of the participants were recorded. In all participants, the level of kinesiophobia, fear of falling, psychological status, health-related quality of life and osteoporosis self-efficacy were evaluated using the Tampa scale of kinesiophobia (TSK), falls efficacy scale-international (FES-I), hospital anxiety and depression scale (HADS), quality of life questionnaire of the European Foundation for Osteoporosis-41 (QUALEFFO-41) and osteoporosis self-efficacy scale (OSES), respectively.
Results: Postmenopausal patients with OP and OPN had higher levels of kinesiophobia than controls ($p<0.05$). However, there was no difference between the levels of kinesophobia in patients with OP and OPN ($p>0.05$). In addition, a positive correlation was found between TSK score and FES-I, HADS, QUALEFFO-41 scores and duration of menopause, and a negative correlation between OSES scores in patients with OP and OPN ($p<0.05$). Patients were divided into two groups according to their kinesiophobia levels: High and low kinesiophobia groups. All clinical parameters were negatively affected in patients in the high kinesophobia group ($p<0.05$).
Conclusion: Both OP and OPN may cause kinesiophobia in postmenopausal women. Increased fear of falling, impaired psychological status, poor quality of life, decreased perception of self-efficacy and prolonged duration of menopause in postmenopausal women with OP and OPN seem to be associated with a higher level of kinesiophobia. As physical activity is essential for bone health, postmenopausal women with OP and OPN should be counselled about the importance of overcoming kinesiophobia.
Keywords: Kinesiophobia, osteoporosis, osteopenia, fear of falling, quality

Öz

Amaç: Osteoporoz (OP) ve osteopenisi (OPN) olan postmenopozal kadınlarda kinezyofobi düzeyini ve ilişkili faktörleri araştırmaktır.
Gereç ve Yöntem: Çalışmaya postmenopozal OP'li 60 kadın hasta, postmenopozal OPN'li 60 kadın hasta, yaş ve cinsiyet uyumlu 60 kontrol dahil edildi. Katılımcıların demografik verileri (yaş, kilo, boy, vücut kitle indeksi, eğitim düzeyi, çalışma durumu, hastalık süresi ve menopoz süresi) kaydedildi. Tüm katılımcılarda kinezyofobi, düşme korkusu, psikolojik durum, sağlıkla ilgili yaşam kalitesi ve OP öz-yeterlik düzeyleri, sırasıyla Tampa kinezyofobi ölçeği (TKÖ), düşme etkinlik ölçeği-uluslararası (UDES), hastane anksiyete ve depresyon ölçeği (HADÖ), Avrupa Osteoporoz Vakfı'nın yaşam kalitesi anketi-41 (QUALEFFO-41) ve osteoporoz öz-yeterlik ölçeği (OEYÖ) kullanılarak değerlendirildi.
Bulgular: OP'li ve OPN'li postmenopozal hastalarda kontrole kıyasla daha yüksek kinezyofobi düzeyleri vardı ($p<0,05$). Ancak OP ve OPN'li hastalarda kinezyofobi düzeyleri arasında fark yoktu ($p>0,05$). OP ve OPN'li hastalarda TKÖ skoru ile UDES, HADÖ, QUALEFFO-41 skorları, menopoz süresi arasında pozitif, OEYÖ skorları arasında negatif korelasyon vardı ($p<0,05$). Hastalar kinezyofobi düzeylerine göre yüksek ve düşük kinezyofobi olarak iki gruba ayrıldı; yüksek kinezyofobisi olan hastalarda tüm klinik parametreler olumsuz etkilenmişti ($p<0,05$).
Sonuç: Hem OP hem de OPN, postmenopozal kadınlarda kinezyofobiye neden olabilir. OP ve OPN'li postmenopozal kadınlarda artmış düşme korkusu, bozulmuş psikolojik durum, düşük yaşam kalitesi ve azalmış öz-yeterlik algısı, uzamış menopoz süresi daha yüksek düzeyde kinezyofobi ile ilişkili görünmektedir. Fiziksel aktivite kemik sağlığı için gerekli olduğundan, OP ve OPN'li postmenopozal kadınlara kinezyofobinin üstesinden gelmenin önemi konusunda danışmanlık verilmelidir.
Anahtar kelimeler: Kinezyofobi, osteoporoz, osteopeni, düşme korkusu, yaşam kalitesi

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Introduction

Kinesiophobia is an irrational fear of movement due to the belief of susceptibility to injury and associated with lower levels of physical activity (1). Recently, researches showed that many chronic musculoskeletal diseases lead to fear of movement due to the belief of increasing pain during activity (2-4). In addition, kinesiophobia was shown to be associated with lower levels of physical activity in subjects with chronic pain (5). As a result, the risk of sedentary life style increases. Sedentary lifestyle and immobilization are important risk factors for bone loss (6).

Osteoporosis (OP) is a systemic skeletal disease characterized by low bone mineral density (BMD) and microarchitectural deterioration of bone tissue resulting in increased risk of fragility fractures (7). Osteopenia (OPN) is a term to define BMD that is not normal but also not as low as OP (8). OP and OPN have a higher incidence in women, especially after menopause, and are increasingly prevalent due to aging populations and increased life expectancy (9). Physically active life style and exercise are essential preventive and therapeutic approaches for OP and OPN (10).

OP is known as a silent disease without pain unless fragility fractures occur (10). However, being diagnosed as OP without an adequate education about the disease may lead to kinesiophobia in patients due to an irrational belief about increasing possibility of falls and related fractures during physical activity (11). In a previous study, researchers reported that subjects with OP have higher levels of kinesiophobia compared to age and gender-matched healthy subjects. They have suggested that a person with OP may have kinesiophobia that might be associated with fear of fracture (11). Although low BMD is not the only factor for fragility, it contributes significantly to the fracture risk (12). Since OP may be perceived by subjects as a more serious and fragile disease than OPN, a higher level of kinesiophobia may be expected in patients with OP than patients with OPN. To date, no study has assessed the association between kinesiophobia and OPN, and no study has compared level of kinesiophobia in subjects with OP and OPN.

The aim of the present study was to investigate the level of kinesiophobia in women with OP and OPN comparing with controls. It was also aimed to evaluate the relation of the level of kinesophobia with demographic features, fear of falling, self-efficacy in OP, quality of life (QoL), and psychological status in these patients.

Materials and Methods

The present study was conducted at the Department of Physical Medicine and Rehabilitation of the Medical Faculty of Ondokuz Mayıs University between May 2018 and June 2019. This cross-sectional observational study includes 60 female patients with postmenopausal OP and 60 female patients with postmenopausal OPN. Age and gender matched 60 subjects with normal BMD were enrolled as control subjects. Diagnosis of OP, OPN and normal BMD was made according to the World Health Organization classification system [lumbar spine or femoral neck T-scores <-2.5 standard deviation (SD) for OP, T-scores -1 to -2.5 SD for OPN, T-scores >-1 SD for normal BMD measured by dual energy X-ray absorptiometry] (13). Patients were included in the study if they were aware of their diagnosis and disease duration was ≥12 months. Participants with history of falls or fractures, any diagnosed musculoskeletal or neurological disease that may affect mobility or any acute or chronic painful condition that may cause kinesiophobia, and participants with a major psychiatric disorder were excluded from the study.

The study protocol was approved by the Medical Research Ethics Committee at Ondokuz Mayıs University (decision no: 2018/154, date: 12.04.2017). All participants provided signed informed consent. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Demographic data of subjects [age, weight, height, body mass index (BMI), educational level and employment status] were recorded. Disease duration and menopause duration of the patients were also reported. The same researcher (S.M.) interviewed with participants face-to-face.

Clinical Assessments

Kinesiophobia

The Tampa scale of kinesiophobia (TSK) was used for the subjective assessment of fear of movement/kinesiophobia. It was developed in 1991 by Miller et al. (14). The TSK includes 17 items associated with fear of movement and reinjury. Each item is scored on a 4-point Likert-type scale, ranging from "strongly disagree" to "strongly agree". Total score ranges between 17 and 68. Higher scores associate with higher levels of kinesiophobia (14). The validity and reliability of the Turkish version of the TSK have been previously performed by Yılmaz et al. (15). Vlaeyen et al. (16) developed a cut-off score and reported patients that scored greater than 37 were high-responders. We used this cut-off score to identify the patients with kinesiophobia.

Fear of Falling

Falls efficacy scale-international (FES-I) was used to evaluate the fear of falling (FOF). The FES-I is a self-report questionnaire, providing information on the level of concern about falls during activities of daily living. The questionnaire contains 16 items scored on a four-point scale (1= not at all concerned to 4= very concerned) providing a total score ranging from 16 (absence of concern) to 64 (extreme concern). The reliability and validity of the Turkish form of FES-I was performed by Ulus et al. (17).

Self-efficacy in Osteoporosis

Osteoporosis self-efficacy scale (OSES) was used to evaluate the self-efficacy in OP. OSES aims to identify the perceived confidence level in relation to calcium intake and weight bearing exercises in order to prevent OP. Turkish adaptation, validity, and reliability of the OSES developed by Kim et al. (18) was performed by Kılıç and Erci (19). The OSES is a twelve item rating scale. The

items are rated by the participants on their confidence about engaging in OP preventive behaviors. The OSES tool consists of two subscales: The OSES-Exercise (6 items) and OSES-Calcium (6 items). Participants then respond on a 100-point Likert-type scale of 0 to 100 (0= not confident at all, 100= very confident). The score of each subscale ranges between 0 and 600 and total score of the scale ranges between 0 and 1200. An increase in the score indicates an increase in the perception of self-efficacy (19).

Psychological Status

The hospital anxiety and depression scale (HADS) was used to evaluate the psychological status. HADS is a frequently used self-rating scale developed to assess psychological distress in non-psychiatric patients. It consists of two subscales, one measuring anxiety (HADS-A) with seven items, and another measuring depression (HADS-D) with seven items, which are calculated separately (20). Each item was answered by the patient on a 4-point (0-3) scale, so the possible scores ranged from 0 to 21 for each of the two subscales. Lower scores of both anxiety and depression subscales indicate better mood status. Aydemir et al. (21) found that Turkish version of HADS is valid and reliable. They proposed a cutoff point of 10 for anxiety and 7 for depression scales. The scores above these cutoff levels, are considered as risk for anxiety and depression (21).

Health Related Quality of Life

The quality of life questionnaire of the European Foundation for Osteoporosis-41 (QUALEFFO-41) was used to assess health related QoL of subjects. This questionnaire covers five dimensions of health: pain, physical functioning, social activities, general health assessment and mental functioning. The total QUALEFFO-41 score is calculated as a sum of all answers to items. Higher scores indicate worse health related QoL. Turkish version of QUALEFFO-41 was reported to be valid and reliable (22).

Statistical Analysis

Statistical analyses were performed with SPSS 22.0 for Windows. Descriptive data were presented as mean ± SD and categorical variables were presented as percentage. The Kolmogorov-Smirnov test was used to analyse normal distribution assumption of the quantitative outcomes. One-Way ANOVA analysis of variance was used to compare the three groups. When a statistically significant difference was noted, Tukey's multiple comparison test was performed in order to demonstrate the difference between the groups. All patients were divided into two groups according to their TSK scores and these groups are compared. To compare two groups Student's t-test was used because all variables were normally distributed. Correlation between kinesiophobia and other parameters' scores in OP and OPN groups was performed by Pearson correlation analysis. The categorical variables (education, occupation, etc.) of the groups were evaluated by chi-square test. P-values less than 0.05 were considered statistically significant.

The sample size was calculated by a statistician with PASS 2011 software. A priori power analysis using data from a previous study (15) assessing kinesiophobia score were applied. In order to have statistical power of 0.82 and $p<0.05$, it was calculated that 60 subjects in each group were required to detect the differences in mean TSK scores between the groups.

Results

Comparison of groups' socio-demographic data are shown in Table 1. The mean age, weight, height, BMI and gender were similar between the three groups. There was no difference between groups regarding education and employment status. The mean duration of disease was 4.85±4.64 years for the OP group and 3.68±4.24 years for the OPN group, and there was no significant difference between the groups regarding this parameter ($p>0.05$).

Comparison of groups' clinical data are shown in Table 2. Patients with OP and OPN had higher level of kinesiophobia than healthy controls ($p<0.05$). But, there was no significant difference in kinesiophobia scores between the patients with OP and OPN. The mean QUALEFFO-41 total, FES-I, HADS-A/D scores were significantly different in the patients with OP and OPN from the healthy control ($p<0.05$). But there was no significant difference between the patients with OP and OPN for QUALEFFO-41 total, FES-I, HADS-A/D scores ($p>0.05$). The mean OSES scores were similar between the three groups ($p>0.05$) (Table 2).

Correlations between the kinesiophobia and demographics, and clinic parameters in the patients with OP and OPN are shown in Table 3. In the OP group, there was a strong correlation between kinesiophobia scores and QUALEFFO-41 total scores. Kinesiophobia scores were moderately correlated with FES-I scores and weakly correlated with duration of menopause, HADS-A/D, and OSES total scores ($p<0.05$). In the OPN group; kinesiophobia scores were strongly correlated with QUALEFFO-41 total scores and moderately correlated with HADS-A/D scores. There were weak correlations between kinesiophobia scores and age, BMI, duration of menopause, FES-I, OSES total scores ($p<0.05$) (Table 3).

Comparison of clinical data according to level of kinesiophobia in the patients with OPN and OP are shown in Table 4. Comparison of high kinesiophobia and low kinesiophobia groups for their mean QUALEFFO-41 total, FES-I, HADS, OSES total scores revealed statistically significant differences ($p<0.05$). But, there was no significant difference between these groups regarding age, BMI, duration of menopause and duration of disease ($p>0.05$) (Table 4).

Discussion

In the current study, kinesiophobia of women with OP, OPN and age-matched healthy controls with normal BMD were compared. The relationship between level of kinesiophobia and demographic features, FOF, self-efficacy in OP, QoL and

psychological status in these patients were evaluated. The results showed that patients with OP and OPN have higher levels of kinesiophobia compared to healthy controls. But, there was no difference between the level of kinesophobia in patients with OP and OPN. Increased FOF, impaired psychological status, poor QOL, and decreased perception of self-efficacy, prolonged duration of menopause seem to be associated with higher level of kinesiophobia in women with OP and OPN.

In the literature, there is only one study evaluating kinesiophobia in the patients with OP (12). Gunendi et al. (11) found that kinesophobia levels of OP patients were higher than healthy individuals with similar age and sex. OP is not associated with

Table 1. Comparison of groups' socio-demographic data

Characteristics	OPN (n=60) Mean ± SD	OP (n=60) Mean ± SD	Healthy control (n=60) Mean ± SD	p
Age (years)	56.98±5.31	56.60±6.37	56.20±4.67	0.73
Height (cm)	157.92±5.65	158.80±6.10	159.15±6.72	0.53
Weight (kg)	73.18±11.40	73.77±8.88	73.68±8.36	0.93
BMI (kg/m^2)	29.41±4.79	29.35±4.23	29.17±3.51	0.95
Duration of menopause (years)[b, c]	10.83±7.16	12.20±6.83	5.88±5.74	<0.01
Duration of disease (years)	3.68±4.24	4.85±4.64	-	0.15
	n (%)	**n (%)**	**n (%)**	
Education				
Primary education	47 (78.4)	39 (65)	45 (75)	0.39
Secondary education	8 (13.3)	14 (23)	11 (18.4)	
College	5 (8.3)	7 (12)	4 (6.6)	
Occupation				
Housewife	38 (63.4)	44 (73.3)	44 (73.3)	0.68
Retired	18 (30)	13 (21.7)	13 (21.7)	
Worker	2 (3.3)	2 (3.3)	2 (3.3)	
Officer	2 (3.3)	1 (1.7)	1 (1.7)	
Level of kinesophobia[b, c]				
TSK score ≤37	11 (%18)	11 (%18)	53 (%88)	<0.01
TSK score ≥38	49 (%82)	49 (%82)	7 (%12)	

P-value is significant when <0.05. [a]Significant difference between OP and OPN group, [b]Significant difference between OPN and control group, [c]Significant difference between OP and control group. SD: Standard deviation, n: Number of patients, %: Percentage of patients, BMI: Body mass index, TSK: Tampa scale of kinesiophobia, OPN: Osteopenia, OP: Osteoporosis

Table 2. Comparison of groups' clinical data

Characteristics	OPN (n=60) Mean ± SD	OP (n=60) Mean ± SD	Healthy Control (n=60) Mean ± SD	p
TSK score (17-68)[b, c]	41.46±4.51	42.76±4.76	32.36±3.78	<0.01
FES-I score (16-64)[b, c]	19.60±1.78	20.01±1.39	18.91±1.12	<0.01
HADS-D score (0-21)[b, c]	5.23±3.29	5.61±3.23	3.70±2.42	<0.01
HADS-A score (0-21)[b, c]	5.86±3.13	6.41±3.40	4.93±2.29	0.02
QUALEFFO-41 total score (0-100)[b, c]	54.76±14.28	55.05±14.74	35.58±9.92	<0.01
OSES-exercise score (0-600)	412.16±123.05	375.83±110.36	390.00±142.91	0.28
OSES-calcium score (0-600)	463.50±130.71	432.66±135.01	424.50±147.14	0.26
OSES-total score (0-1200)	875.66±198.44	808.50±221.33	814.50±231.67	0.17

P-value is significant when <0.05. [a]Significant difference between OP and osteopenia group, [b]Significant difference between osteopenia and control group, [c]Significant difference between OP and control group. OPN: Osteopenia, OP: Osteoporosis, TSK: Tampa scale of kinesiophobia, FES-I: Falls efficacy scale-international, HADS-A: Hospital anxiety and depression scale-anxiety score, HADS-D: Hospital anxiety and depression scale-depression score, QUALEFFO-41: The quality of life questionnaire of the European Foundation for Osteoporosis-41, OSES: Osteoporosis self-efficacy scale, SD: Standard deviation

Table 3. Correlations between the kinesiophobia and demographics, and clinic parameters in the patients with OPN and OP

Characteristics		TSK score	
		OPN patiens (n=60)	OP patients (n=60)
Age	r p	0.345** 0.007	0.214 0.101
BMI	r p	0.352** 0.006	0.068 0.608
Duration of menopause	r p	0.305* 0.018	0.256* 0.048
Duration of disease	r p	-0.009 0.946	0.069 0.601
HADS-A	r p	0.426** 0.001	0.352** 0.006
HADS-D	r p	0.469** 0.001	0.428** 0.001
FES-I	r p	0.340** 0.008	0.495** 0.001
QUALEFFO-41 total	r p	0.830** 0.001	0.715** 0.001
OSES total	r p	-0.315* 0.014	-0.338** 0.008

OPN: Osteopenia, OP: Osteoporosis, TSK: Tampa scale of kinesiophobia, BMI: Body mass index, HADS-A: Hospital anxiety and depression scale-anxiety score, HADS-D: Hospital anxiety and depression scale-depression score, FES-I: Falls efficacy scale-international, QUALEFFO-41: The quality of life questionnaire of the European Foundation for Osteoporosis-41, OSES: Osteoporosis self-efficacy scale, r: Correlation coefficient, *p<0.05, **p<0.01

musculoskeletal pain unless osteoporotic bone fracture occurs. In the study of Gunendi et al. (11), subjects with musculoskeletal disorders that might cause pain were excluded. Thus, they reported that the relationship between OP and kinesiophobia cannot be explained by musculoskletal pain. In addition, they suggested that having a diagnosis of OP without an adequate education about the disease may lead to kinesiophobia and the reason of this behavior might be a belief about increasing possibility of movement related injuries like osteoporotic fracture. Similar to that study we found that there was an association between being diagnosed as OP and kinesiophobia. Furthermore, the level of kinesophobia was similar in postmenopausal OP and OPN patients, and was higher in both patient groups compared to healthy controls. The similarity in kinesiophobia levels of patients with OP and OPN may be due to the inability to distinguish both diseases due to insufficient information. On the other hand, the diagnosis of both diseases may be perceived to be of the same importance. We excluded participants with history of fragility fractures and musculoskeletal painful conditions that could cause kinesophobia. Therefore, we think that having a diagnosis of OP or OPN may cause kinesiophobia in postmenopausal women regardless of painful conditions. In clinical practice, patients with postmenopausal OP or OPN should be evaluated for kinesophobia and strategies should be developed to overcome their wrong beliefs. In this way, patients can be protected from sedentary life and have a positive contribution to bone health.

There are few studies evaluating the relationship between kinesophobia and demographic characteristics in the literature (23-25). In these studies, it was reported that kinesiophobia may be associated with increasing age and obesity. In our

Table 4. Comparison of clinical data according to level of kinesiophobia in the patients with OPN and OP

Characteristics	Subjects with OPN and OP (n=120)		p
	Low kinesiophobia (TSK score ≤37, n=22) Mean ± SD	High kinesiophobia (TSK score ≥38, n=98) Mean ± SD	
Age (years)	55.50±5.55	57.088±5.89	0.25
BMI (kg/m²)	27.71±2.92	29.75±4.71	0.05
Duration of menopause (years)	9.18±5.54	12.04±7.21	0.08
Duration of disease (years)	4.86±5.22	4.13±4.29	0.49
FES-I score (16-64)	18.90±1.19	20.01±1.62	<0.01
HADS-D score (0-21)	3.27±2.45	5.90±3.22	<0.01
HADS-A score (0-21)	4.27±2.71	6.56±3.24	<0.01
QUALEFFO-41 total score (0-100)	36.00±10.28	59.15±11.58	<0.01
OSES-exercise score (0-600)	932.27±214.09	821.83±207.27	0.02
OSES-calcium score (0-600)	488.18±133.29	439.08±132.22	0.11
OSES-total score (0-1200)	932.27±214.09	821.83±207.27	0.02

P-value is significant when <0.05. SD: Standard deviation, TSK: Tampa scale of kinesiophobia, BMI: Body mass index, HADS-A: Hospital anxiety and depression scale-anxiety score, HADS-D: Hospital anxiety and depression scale-depression score, FES-I: Falls efficacy scale-ınternational, QUALEFFO-41: The quality of life questionnaire of the European Foundation for Osteoporosis-41, OSES: Osteoporosis self-efficacy scale

study, there was no statistically significant difference between postmenopausal OP, OPN and control groups in terms of height, weight, BMI, disease duration, education level and occupational status. Therefore, we can say that the results obtained in terms of kinesophobia are independent of these socio demographic characteristics. When we evaluated the relationship between kinesophobia and demographic characteristics, we obtained weak or contradictory data. We observed the relationship between level of kinesophobia and age and BMI only in the patients with OPN. While there was a weak positive correlation between level of kinesiophobia and duration of menopause in the patients with OP and OPN, there was no correlation between level of kinesiophobia and duration of disease. These results may be due to the age range of the participants being 40-65 years. In order to better understand the relationship between the level of kinesophobia and demographic characteristics in these populations, our results should be supported with new studies.

The relationship between OP and fall risk is well known (26). However, there are few studies in the literature evaluating the FOF in patients with OP. In these studies, researchers reported that OP is associated with FOF and restrictions in daily life due to FOF (27,28). In line with previous studies, we found that the FOF was higher in both patient groups than in controls. But the level of FOF was similar in the patients with OP and OPN. In the literature, there are no studies evaluating the relationship between FOF and kinesophobia in any patient population. In the current study, there was a weak-moderate positive correlation between FOF and kinesophobia in the patients with OP and OPN. When the patients were grouped as high and low kinesiophobia, we found that patients with high kinesophobia had more FOF than patients with low kinesophobia. It can be concluded that FOF may increase kinesiophobia or the FOF may be triggered by kinesophobia.

It has been reported that the prevalence of psychological problems such as anxiety and depression in OP patients is higher than the normal population (29,30). Furthermore, increased depression or anxiety levels are correlated with decreased BMD (31,32). Consistent with the literature; anxiety and depression scores in our study were significantly higher in OP and OPN patients compared to controls. But, anxiety and depression scores were similar in the patients with OP and OP. Previously, the relationship between kinesophobia and psychological state was evaluated in other disease populations, and a positive correlation was reported between the level of anxiety and depression and the level of kinesophobia (2,3,33). In our study, we found a weak to moderate positive correlation between kinesophobia scores and anxiety and depression scores of patients with OP and OPN. The weak to moderate level of correlation may be due to the fact that we excluded individuals with major psychiatric disorders who take medication and that the anxiety and depression scores of the study population were low. In addition, when high and low kinesophobia patients were compared in terms of anxiety and depression scores, it was found that high kinesophobia patients had higher anxiety and depression scores. These results suggest that psychological status is associated with kinesiophobia in postmenopausal OP and OPN patients. However, it may be difficult to determine whether this is the cause or consequence of kinesiophobia.

In the literature, there are studies showing that the QoL of OP patients with or without fractures has deteriorated compared to healthy controls (34,35). In a study evaluating the QoL in women with postmenopausal OP without fractures; advanced age, high BMI, low education level, early menopause and low BMD values were stated to adversely affect QoL (36). Our study population consisted of postmenopausal women without fractures. Although the groups were similar in terms of socio-demographic characteristics, QoL was decreased in the patients with OP or OPN compared to controls. In studies conducted in patients with chronic musculoskeletal pain, kinesiophobia has a negative effect on QoL, and a significant relationship between high kinesophobia and low QoL has been reported (2,3,37,38). Similarly, Gunendi et al. (11) reported a significant negative correlation between kinesophobia and QoL in the patients with OP. Consistent with the literature, we found a strong correlation between increased kinesophobia and decreased QoL in both OP and OPN patients. In addition, when we compared the patients with high and low kinesophobia in terms of QoL, we found that patients with high kinesophobia had poor QoL. Overcoming kinesiophobia in the OP and OPN patients may contribute to improved QoL.

Self-efficacy refers to the individual's belief in their ability to successfully complete a specific task (39). OSES utilizes perceived susceptibility and seriousness, perceived barriers and benefits, health motivation, and self-confidence in one's ability to take actions needed to prevent osteoporosis to predict possible occurrence of health behaviors. Janiszewska et al. (40) reported that self-efficacy levels in women over 45 years of age receiving OP treatment were not satisfactory and moreover were decreased with age. Studies have shown that OP knowledge and self-efficacy levels increase with education (41,42). According to our results, there was no difference between the groups (OP, OPN, control) in terms of OSES-total, exercise and calcium intake subgroup scores. On the other hand, in the high kinesiophobia patient group, the OSES-total and subscale scores were lower than the lower kinesiophobia group. There was also a weak negative correlation between total scores of OSES and kinesiophobia scores. Low OP self-efficacy may increase kinesiophobia in the patients with OP and OPN. Strategies to increase OP self-efficacy levels can provide support in overcoming kinesophobia in the patients with OP and OPN.

Study Limitations

The limitations of the present study should be considered. Firstly, a cross-sectional design was used in this study so we cannot establish causal relationship kinesiophobia and OP, and OPN. Secondly, the TSK lacks validity for use in subjects with OP, since it is a measure specifically developed for subjects with

pain complaint. As there is no kinesiophobia scale specifically developed for OP, we used TSK that was previously applied in patients with OP (11,43). Thirdly, our study group has limited number of patients and is composed of only females. Future studies should include a larger population and both sexes. A strong point of our study is that it is the first study in which the relationships between kinesophobia level and demographic, FOF, self-efficacy in OP, QoL and psychological status were assessed together in patients with OP and OPN.

Conclusion

The patients with postmenopausal OP and OPN may have kinesiophobia that might be associated with fear of fracture. Presence of kinesiophobia should be considered in the evaluation of these patients. The kinesiophobia levels of patients with OP and OPN were similar in this study. Therefore, it should be kept in mind that patients with OPN may develop kinesiophobia as well as patients with OP. High level of kinesiophobia may be associated increased FOF, impaired psychological status, poor QoL and decreased self-efficacy in the patients with postmenopausal OP or OPN. This should also be taken into consideration when developing strategies and prevention programs for OP or OPN.

Ethics

Ethics Committee Approval: The study protocol was approved by the Medical Research Ethics Committee at Ondokuz Mayıs University (decision no: 2018/154, date: 12.04.2017).

Informed Consent: All participants provided signed informed consent.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.M., Y.A., Concept: S.M., Y.A., A.B., Data Collection or Processing: S.M., Analysis or Interpretation: Y.A., Y.U., Literature Search: S.M., Y.A., Writing: S.M., Y.A., A.K.C., Y.U.

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References

1. Kori KS, Miller RP, Todd D. Kinesiophobia: a new view of chronic pain behavior. Pain Manag 1990;3:35-43.
2. Oskay D, Tuna Z, Düzgün İ, Elbasan B, Yakut Y, Tufan A. Relationship between kinesiophobia and pain, quality of life, functional status, disease activity, mobility, and depression in patients with ankylosing spondylitis. Turk J Med Sci 2017;47:1340-7.
3. Altuğ F, Ünal A, Kilavuz G, Kavlak E, Çitişli V, Cavlak U. Investigation of the relationship between kinesiophobia, physical activity level and quality of life in patients with chronic low back pain1. J Back Musculoskelet Rehabil 2016;29:527-31.
4. Bäck M, Cider Å, Herlitz J, Lundberg M, Jansson B. The impact on kinesiophobia (fear of movement) by clinical variables for patients with coronary artery disease. Int J Cardiol 2013;167:391-7.
5. Larsson C, Ekvall Hansson E, Sundquist K, Jakobsson U. Impact of pain characteristics and fear-avoidance beliefs on physical activity levels among older adults with chronic pain: a population-based, longitudinal study. BMC Geriatr 2016;16:50.
6. Dontas IA, Yiannakopoulos CK. Risk factors and prevention of osteoporosis-related fractures. J Musculoskelet Neuronal Interact 2007;7:268-72.
7. Osteoporosis prevention, diagnosis, and therapy. NIH Consens Statement 2000;17:1-45.
8. Karaguzel G, Holick MF. Diagnosis and treatment of osteopenia. Rev Endocr Metab Disord 2010;11:237-51.
9. Caires ELP, Bezerra MC, Junqueira AFTA, Fontenele SMA, Andrade SCA, d'Alva CB. Treatment of postmenopausal osteoporosis: a literature-based algorithm for use in the public health care system. Rev Bras Reumatol Engl Ed 2017;57:254-63.
10. Kanis JA, McCloskey EV, Johansson H, Cooper C, Rizzoli R, Reginster JY; Scientific Advisory Board of the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) and the Committee of Scientific Advisors of the International Osteoporosis Foundation (IOF). European guidance for the diagnosis and management of osteoporosis in postmenopausal women. Osteoporos Int 2013;24:23-57.
11. Gunendi Z, Eker D, Tecer D, Karaoglan B, Ozyemisci-Taskiran O. Is the word "osteoporosis" a reason for kinesiophobia? Eur J Phys Rehabil Med 2018;54:671-5.
12. Curtis EM, Moon RJ, Harvey NC, Cooper C. The impact of fragility fracture and approaches to osteoporosis risk assessment worldwide. Bone 2017;104:29-38.
13. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Report of a WHO Study Group. Geneva, World Health Organization, 1994 (WHO Technical Report Series, No. 843).
14. Miller RP, Kori SH, Todd DD. The Tampa Scale. Unpublished Report, Tampa; 1991.
15. Yılmaz OT, Yakut Y, Uygur F, Uluğ N. Turkish version of the Tampa Scale for Kinesiophobia and its test-retest reliability. Fizyoterapi Rehabilitasyon 2011;22:44-9.
16. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. Pain 1995;62:363-72.
17. Ulus Y, Durmus D, Akyol Y, Terzi Y, Bilgici A, Kuru O. Reliability and validity of the Turkish version of the Falls Efficacy Scale International (FES-I) in community-dwelling older persons. Arch Gerontol Geriatr 2012;54:429-33.
18. Kim K, Horan ML, Gendler P. Osteoporosis Knowledge Tests, Osteoporosis Health Belief Scale, and Osteoporosis Self-efficacy scale. Allendale: MI: Grand Valley State University; 1991.
19. Kılıç D, Erci B. Osteoporoz Sağlık İnanç Ölçeği, Osteoporoz Öz-etkililik/yeterlik Ölçeği ve Osteoporoz Bilgi Testi'nin Geçerlilik ve Güvenirliği. Atatürk Üniversitesi Hemşirelik Yüksekokulu Dergisi 2004;7:89-102.
20. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67:361-70.
21. Aydemir O, Güvenir T, Küey L, Kültür S. Validity and reliability of Turkish version of hospital anxiety and depression scale. Turk Psikiyatri Derg 1997;8:280-7.
22. Koçyigit H, Gülseren S, Erol A, Hizli N, Memis A. The reliability and validity of the Turkish version of Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO). Clin Rheumatol 2003;22:18-23.
23. Alaca N. The relationships between pain beliefs and kinesiophobia and clinical parameters in Turkish patients with chronic knee osteoarthritis: a cross-sectional study. J Pak Med Assoc 2019;69:823-7.
24. Vincent HK, Omli MR, Day T, Hodges M, Vincent KR, George SZ. Fear of movement, quality of life, and self-reported disability in obese patients with chronic lumbar pain. Pain Med 2011;12:154-64.
25. Vincent HK, Seay AN, Montero C, Conrad BP, Hurley RW, Vincent KR. Kinesiophobia and fear-avoidance beliefs in overweight

older adults with chronic low-back pain: relationship to walking endurance–part II. Am J Phys Med Rehabil 2013;92:439-45.
26. Olsen CF, Bergland A. The effect of exercise and education on fear of falling in elderly women with osteoporosis and a history of vertebral fracture: results of a randomized controlled trial. Osteoporos Int 2014;25:2017-25.
27. Resnick B, Nahm ES, Zhu S, Brown C, An M, Park B, et al. The impact of osteoporosis, falls, fear of falling, and efficacy expectations on exercise among community-dwelling older adults. Orthop Nurs 2014;33:277-86.
28. Meyer F, König HH, Hajek A. Osteoporosis, Fear of Falling, and Restrictions in Daily Living. Evidence From a Nationally Representative Sample of Community-Dwelling Older Adults. Front Endocrinol (Lausanne) 2019;10:646.
29. Silverman SL, Shen W, Minshall ME, Xie S, Moses KH. Prevalence of depressive symptoms in postmenopausal women with low bone mineral density and/or prevalent vertebral fracture: results from the Multiple Outcomes of Raloxifene Evaluation (MORE) study. J Rheumatol 2007;34:140-4.
30. Holmes JD, House AO. Psychiatric illness in hip fracture. Age Ageing 2000;29:537-46.
31. Catalano A, Martino G, Bellone F, Gaudio A, Lasco C, Langher V, et al. Anxiety levels predict fracture risk in postmenopausal women assessed for osteoporosis. Menopause 2018;25:1110-5.
32. Stubbs B, Brefka S, Dallmeier D, Stubbs J, Vancampfort D, Denkinger MD. Depression and Reduced Bone Mineral Density at the Hip and Lumbar Spine: A Comparative Meta-Analysis of Studies in Adults 60 Years and Older. Psychosom Med 2016;78:492-500.
33. Kocjan J. Impact of anxiety and depression to kinesiophobia (fear of movement) level among patients with cardiovascular diseases. A comparison study. Journal of Education Health and Sport 2016;6:81-90.
34. Ciubean AD, Ungur RA, Irsay L, Ciortea VM, Borda IM, Onac I, et al. Health-related quality of life in Romanian postmenopausal women with osteoporosis and fragility fractures. Clin Interv Aging 2018;13:2465-72.
35. Bianchi ML, Orsini MR, Saraifoger S, Ortolani S, Radaelli G, Betti S. Quality of life in post-menopausal osteoporosis. Health Qual Life Outcomes 2005;3:78.
36. Yılmaz H, Erkin G, Polat HAD, Küçüksen S, Sallı A, Uğurlu H. Osteoporozda Yaşam Kalitesi: Bir Kontrollü Çalışma. Türk Osteoporoz Dergisi 2012;18 47-52.
37. Luque-Suarez A, Martinez-Calderon J, Falla D. Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. Br J Sports Med 2019;53:554-9.
38. Antunes RS, de Macedo BG, Amaral Tda S, Gomes Hde A, Pereira LS, Rocha FL. Pain, kinesiophobia and quality of life in chronic low back pain and depression. Acta Ortop Bras 2013;21:27-9.
39. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. Psychol Rev 1977;84:191-215.
40. Janiszewska M, Kulik T, Żołnierczuk-Kieliszek D, Drop B, Firlej E, Gajewska I. General self-efficacy level and health behaviours in women over the age of 45 years who have undergone osteoporosis treatment. Prz Menopauzalny 2017;16:86-95.
41. Evenson AL, Sanders GF. Educational Intervention Impact on Osteoporosis Knowledge, Health Beliefs, Self-Efficacy, Dietary Calcium, and Vitamin D Intakes in Young Adults. Orthop Nurs 2016;35:30-6.
42. Lv N, Brown JL. Impact of a nutrition education program to increase intake of calcium-rich foods by Chinese-American women. J Am Diet Assoc 2011;111:143-9.
43. Oksuz S, Unal E. The effect of the clinical pilates exercises on kinesiophobia and other symptoms related to osteoporosis: Randomised controlled trial. Complement Ther Clin Pract 2017;26:68-72.

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The Relationship Between Bone Mineral Density Values and Prognostic Nutritional Index As Well As Serum Trace Element Levels in Postmenopausal Women

Postmenapozal Kadınlarda Kemik Mineral Yoğunluğunun Prognostik Nutrisyonel İndeks ve Eser Elementler ile Olan İlişkisi

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Abstract

Objective: The relationship between bone mineral density (BMD) values and nutritional status as well as serum copper (Cu), zinc (Zn), selenium (Se) and manganese (Mn) levels in postmenopausal women has not been fully elucidated. Therefore, this study aimed to investigate whether there is a relationship between BMD values and nutritional status as well as serum Cu, Zn, Se and Mn levels by evaluating the nutritional status of postmenopausal women based on the BMD values using an objective index.

Materials and Methods: The study included 105 postmenopausal women who were divided into the following 3 groups: Controls (control group, n=30, T-score >-1.0), patients with osteopaenia (osteopaenia group, n=30, T-score >-2.5) and patients with osteoporosis (osteoporosis group, n=45, T-score ≤-2.5). Moreover, the nutritional status of the patients was determined using the prognostic nutritional index (PNI), which is calculated based on the serum albumin levels and total lymphocyte count. Further, serum Cu, Zn, Se and Mn levels were also determined. The relationship between BMD and PNI as well as the serum levels of Cu, Zn, Se and Mn was investigated.

Results: The mean age and body mass index (BMI) of the participants were found to be similar in all the groups [control group (age, 63.4±5.2 years; BMI, 33.7±5.6 kg/m^2); osteopaenia group (age, 64.6±5.3 years; BMI, 33.5±5.9 kg/m^2) and osteoporosis group (age, 65.8±5 years; BMI, 30.9±7.2 kg/m^2)]. In the osteoporosis group, the PNI and serum albumin, Cu and Zn levels were significantly lower than those in the control group ($p<0.05$), and a weak positive correlation was observed between lumbar total BMD values and PNI as well as serum albumin and Mn levels ($p<0.05$). Furthermore, a positive moderate correlation between PNI and serum Zn levels was observed in the osteoporosis group ($p=0.045$, $r=0.063$).

Conclusion: Low serum albumin levels and a low PNI, particularly in postmenopausal patients with osteoporosis, may have an adverse effect on the total BMD in the lumbar region. Furthermore, Zn supplementation in patients with osteoporosis having low PNI can be a potential additional treatment strategy. Cu and Mn supplementation may also provide an additional benefit to existing treatments.

Keywords: Postmenopausal osteoporosis, prognostic nutritional index, trace elements

Öz

Amaç: Postmenopozal kadınlarda kemik mineral yoğunluğunun (KMY) nutrisyonel durum ve serum bakır (Cu), çinko (Zn), selenyum (Se) ve manganez (Mn) seviyeleri ile olan ilişkisi tam olarak aydınlatılamamıştır. Bu nedenle postmenopozal kadınların KMY değerlerine göre nutrisyonel durumunu objektif bir indeks ile değerlendirerek Cu, Zn, Se ve Mn ile arasında bir ilişki olup olmadığını incelemeyi amaçladık.

Gereç ve Yöntem: Çalışmada postmenopozal olan 105 kadın üç gruba ayrıldı; kontroller (kontrol grup, n=30, T-skoru >-1,0), osteopenik hastalar (osteopenik grup, n=30, T-skoru >-2,5) ve osteoporotik hastalar (osteoporotik grup, n=45, T-score ≤-2,5). Hastaların nutrisyonel durumlarının belirlenmesinde serum albümin ve total lenfosit sayısını içeren prognostik nutrisyonel indeks (PNI) kullanıldı. Cu, Zn, Se ve Mn eser elementlerinin serum seviyeleri belirlendi. KMY ile PNI ve eser elementlerin serum seviyeleri arasındaki ilişki incelendi.

Bulgular: Katılımcıların ortalama yaş ve vücut kitle indeksi (VKİ) tüm gruplarda benzerdi. [Kontrol grubu (yaş, 63,4±5,2 yıl; VKİ, 33,7±5,6 kg/m^2); osteopeni grubu (yaş, 64,6±5,3 yıl; VKİ, 33,5±5,9 kg/m^2) ve osteoporozis grubu (yaş, 65,8±5 yıl; VKİ, 30,9±7,2 kg/m^2)]. Osteoporoz grubunda; PNI, albümin, serum Cu ve Zn seviyelerinin kontrol grubuna göre anlamlı şekilde daha düşük olduğu ($p<0,05$) ve lomber total KMY değerleri ile PNI, albümin ve serum Mn seviyesi arasında pozitif zayıf bir korelasyon olduğu bulundu ($p<0,05$). Ayrıca osteoporoz grubunda PNI ile serum Zn seviyesi arasında pozitif orta düzeyde bir korelasyon olduğu tespit edildi ($p=0,045$, $r=0,063$).

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Öz

Sonuç: Postmenopozal osteoporoz hastalarında özellikle düşük serum albümin düzeyi ve/veya düşük PNI değeri lomber bölgedeki total KMY'yi olumsuz yönde etkileyebilir. Ayrıca düşük PNI değeri olan osteoporoz hastalarında Zn takviyesinin yapılması potansiyel ek bir tedavi stratejisi olabilir. Bununla birlikte Cu ve Mn bileşiklerinin takviyesi mevcut tedavilere ek olarak fayda sağlayabilir.
Anahtar kelimeler: Postmenopozal osteoporoz, prognostik nutrisyonel indeks, eser elementler

Introduction

Osteoporosis, a silent but progressive disease in which bone mineral density (BMD) and quality is affected, significantly increases the risk of fractures in postmenopausal women. As a result of the increase in the prevalence of osteoporosis with the elderly population worldwide, one in three women is at risk of osteoporotic fracture (1). The increased risk of fractures is a public health problem in postmenopausal women and also an important reason for increased morbidity and mortality. Its pathogenesis is versatile and consists of complex interactions of many physiological processes, including genetic, environmental, hormonal, and nutritional factors, as well as trace element deficiencies (2).

The presence of subclinical chronic inflammation and age-related geriatric problems in postmenopausal osteoporosis may contribute to malnutrition development by causing deterioration of individuals' nutritional status. Therefore, postmenopausal osteoporosis and malnutrition are likely to be seen together and may affect each other negatively (3). In addition, due to both postmenopausal osteoporosis (4) and malnutrition and advanced age (5), the risk of trace element and vitamin deficiencies increases. In previous studies, it has been reported that many trace elements are required in the growth, development, and repair processes of healthy bones (6,7). In some recent studies, the relationship between postmenopausal osteoporosis and trace elements such as copper (Cu), zinc (Zn), selenium (Se), and manganese (Mn) has been investigated (8,9). However, although it is known that the risk of bone resorption may increase in the deficiency of Cu, Zn, Se, and Mn elements, the relationship between these elements and postmenopausal osteoporosis has not been fully elucidated (2,10-12). In addition, there is no study in the literature that examines the nutritional status of postmenopausal women according to their BMD with an objective index and evaluates the relationship between trace elements. Therefore, in our study, the prognostic nutritional index (PNI), which is a reliable method that includes serum albumin and total lymphocyte count (TLC) was used for postmenopausal elderly patients (13).

In this study, we aimed to investigate whether there is a relationship between BMD and PNI and serum levels of Cu, Zn, Se, and Mn trace elements in postmenopausal women.

Materials and Methods

This retrospective study included postmenopausal women who admitted to Atatürk University Medical Faculty Physical Medicine and Rehabilitation Department outpatient clinic between January 2019 and January 2020. The data of the patients included in the study were obtained from hospital records. In addition, consent was obtained from the participants. The study was approved by the Atatürk University Faculty of Medicine Ethics Committee (decision no: 16, date: 07.05.2020). The study was conducted in accordance with the Declaration of Helsinki.

In this retrospective study; 105 postmenopausal women including control (n=30, T-score >-1.0); osteopenic (n=30, -1> T-score >-2.5); and osteoporotic (n=45, T-score ≤-2.5) groups were investigated. Body mass index (BMI) values of women in all three groups were carefully matched.

Inclusion criteria were as follow;

1. Minimum age 45, maximum age 70.
2. Spontaneous menopause for at least 12 months.

Exclusion criteria were as follow;

1. Any disease history that may affect bone metabolism and cause secondary osteoporosis.
2. Having a surgical menopause.
3. Any organ pathology (i.e., gastrointestinal system) and disease that will cause malnutrition.
4. Any drug use history that may lead to corticosteroid or osteoporosis (except non-steroidal anti-inflammatory drugs and paracetamol).
5. Other medical conditions that may affect trace element levels such as kidney disease, diabetes mellitus, or medication use (i.e., diuretic, hormone replacement therapy, laxatives, etc.) may be affected.
6. Bisphosphonates, calcitonin, anabolic steroids, hormone replacement therapy, calcium, or vitamin D use in the last 6 months.

BMD measurements;

Osteoporosis diagnosis was made based on BMD measurements according to World Health Organization criteria (14). Dual-energy X-ray absorptiometry (DEXA) was evaluated by measuring the lumbar spine (L1-L4 total T-score) and femoral total and neck T-scores for axial skeletal BMD values (DEXA, Hologic QDR 2000). Group 1 (normal), group 2 (osteopenia), and group 3 (osteoporosis) were identified as bone mass loss ≤1 standard deviation (SD), 1 SD< bone mass loss <2.5 SD, and bone mass loss ≥2.5 SD, respectively. Results were recorded as g/cm^2 (14).

Determination of nutritional status;

PNI was calculated based on the equation below.

PNI=10 × serum albumin (g/dL) +0.005 × total lymphocyte count (per mm^3)

Serum albumin levels indicate protein reserve and low total lymphocyte count indicate low immune function as a result of

malnutrition. It shows normal malnutrition if PNI value ≥50, mild malnutrition if PNI value is <50, moderate to severe malnutrition if PNI value is <45, and severe malnutrition if PNI value is <40. Lower PNI scores indicate that the nutritional status is worse (13,15).

Measurements of PNI parameters (albumin and TLC) in serum.

Blood samples were taken from the ante-cubital vein following 8-10 hours starving and stored in standard biochemistry tube (yellow capped tubes with gel) and hemogram tubes containing ethylenediaminetetraacetic acid (EDTA). Total lymphocyte count was calculated from hemogram tubes with EDTA. Biochemistry tubes were centrifuged at 3500 rpm for 10 minutes, and serum partition was separated. Serum samples were stored at -80 °C until analysis. Serum samples were taken out of the refrigerator and waited until they reached room temperature. Routine clinical chemistry analyzes were carried out in clinical chemistry devices in the medical biochemistry laboratory of Atatürk University Medical Faculty. Trace element concentration measurements were performed using the Agilent ICP-MS system (Agilent technologies, Courtaboeuf, France). Normal range of serum albumin level and TLC were 3.5-5.2 g/dL and 1.16-3.61×103/mm^3, respectively.

Measurements of Serum Cu, Zn, Se and Mn Levels

The Agilent ICP-MS system consists of a 7700 Series (Agilent Technologies, Courtaboeuf, France), and the system is equipped with a third-generation octopole reaction system (ORS3) using He gas. Samples were injected from sample tubes in a CETAC ASX-500 Series autosampler (CETAC Technologies, Omaha, NE, USA) with a peristaltic pump. The gas outlet, ion lenses, solubility axis, torch position, and background are optimized daily using the adjustment solution (1 mg L-1) to perform the instrument's stability test. Normal ranges of trace elements in serum are Cu; 700-1550 mg/L, Zn; 800-1200 mg/L, Se; 63-160 mg/L and Mn; as 5-15 mg/L.

Statistical Analysis

The data were evaluated in the IBM SPSS statistics 25.0 (IBM Corp, Armonk, New York, USA) statistics program. Descriptive statistics are given as number of units (n), percent (%), mean + SD (x+SD), median (Q1-Q3) values. The normal distribution of data of numerical variables was evaluated by Shapiro-Wilk normality test and Q-Q graphs. Comparisons between groups were made using One-Way ANOVA for variables with normal distribution, and Kruskal-Wallis analysis for variables without normal distribution. As multiple comparison test, Tukey honestly significant difference was used for normally distributed variables, and Dunn-Bonferoni test was used for non-normally distributed variables. In correlations between PNI and trace elements, evaluations were made using Pearson's correlation coefficient (r) for normally distributed variables and Spearman correlation coefficient (r_s) for non-normally distributed variables. Linear regression analysis was performed between age, BMI, PNI, albumin, Cu, Zn and Mn variables and BMD in the groups. P<0.05 was considered statistically significant.

Results

The average BMI, age range, and BMI values of 105 postmenopausal women were determined according to the BMD values as control (n=30, mean age; 63.4±5.2 years, age range; 53-70 years, BMI mean value; 33.7±5.6), osteopenia (n=30, mean age; 64.6±5.3 years, age range; 50-70 years, BMI average value; 33.5±5.9) and osteoporosis (n=45, average age; 65.8±5 years, age range 51-70 years the BMI average value into 30.9±7.2) groups (Table 1).

Age and BMI mean values were statistically similar in the groups. However, mean BMI values decreased gradually in the control, osteopenia, and osteoporosis groups, respectively. When PNI (albumin and TLC), serum Cu and Zn levels of the groups are compared; PNI, serum Cu and Zn levels were found to be gradually decreased in control, osteopenia and

Table 1. Comparison of demographic characteristics, prognostic nutritional index and serum levels of trace elements in groups

Parameters	Control (T-score: 0 to -0.99)	Osteopenic (T-score: -1 to -2.49)	Osteoporotic (T-score: ≤-2.5)	p
n	30	30	45	-
Age (years) (min-max)	63.4 (53-70)	64.6 (50-70)	65.8 (51-75)	0.135
BMI (kg/m^2)	33.7 (25.5±47.6)	33.5 (24.4±46.8)	30.9 (20.1±52.3)	0.109
PNI	53.21+4.95	52.06+4.43	48.01+6.77	0.005**
Albumin	42.12+2.4	37.57+9.6	37.96+4.5	0.006**
TLC	2212+823.6	2296,53+1022,1	2211,11+719.3	0.210
Cu (mg/L)	1021,4+37.4	1007,2+33.5	882.7+31.03	0.017*
Zn (mg/L)	416.1+44.1	366.9+40.8	297.6+41.3	0.026*
Se (mg/L)	262.3+35.08	264.2+33.5	260.1+31.07	0.905
Mn (mg/L)	9.5+2.01	8.5+2.9	7.4+1.9	0.506

*p<0.05, **p<0.01. n: Number of female patients, BMI: Body mass index, PNI: Prognostic nutritional index, Cu: Copper, Zn: Zinc, Se: Selenium, Mn: Manganese, TLC: Total lymphocyte count

osteoporosis groups, respectively. There was a statistically significant difference between control and osteoporosis groups in terms of PNI, albumin, Cu, and Zn levels (p<0.05). However, there was no significant difference between the osteoporosis and the control groups in terms of TLC values. In addition, there was no significant difference between the osteoporosis group and the osteopenia group in terms of PNI, Cu and Zn levels, and between the osteopenia group and the control group. However, there was a significant difference between the osteopenia group and the control group in terms of albumin levels (p<0.05). In control, osteopenia, and osteoporosis groups, it was observed that serum Mn level gradually decreased and serum Se level was lowest in the osteoporosis group, respectively. However, there was no statistically significant difference between serum Mn and Se levels between groups (Table 1).

When the relationship between the lumbar total, femur neck and femur total BMD values and demographic data, PNI and serum levels of trace elements were evaluated; there was a weak negative correlation between age and femoral neck BMD In the control and osteoporosis groups and a moderate positive correlation between BMI and femoral neck and femur total BMD values in the osteopenia group (p<0.05). There was a moderate (p=0.027, r=0.402) and weakly positive correlation (p=0.023, r=0.340) between the lumbar total BMD values and PNI in the control and osteoporosis groups, respectively. In addition, there was a low (p=0.032, r=0.393) and moderate (p=0.001, r=0.556) positive correlation between femur neck and femur total BMD values and albumin in the control group. There was a weak positive correlation between the lumbar total BMD and albumin in the osteoporosis group (p=0.008, r=0.392) (Table 2). There was a moderate positive correlation between femur neck

Table 2. Relationship between bone mineral density and demographic characteristics, prognostic nutritional index and serum levels of trace elements in groups

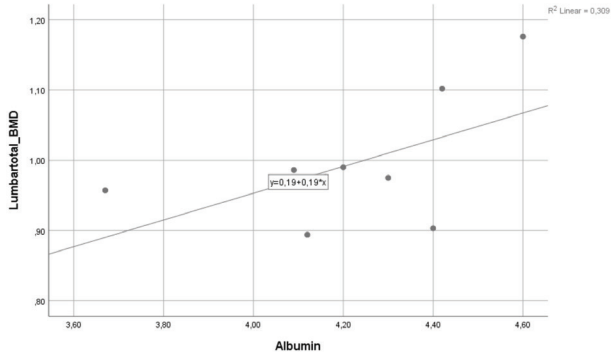
	Control						Osteopeni						Osteoporosis					
	Lomber total BMD		Femur neck BMD		Femur total BMD		Lomber total BMD		Femur neck BMD		Femur total BMD		Lomber total BMD		Femur neck BMD		Femur total BMD	
	(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)		(g/cm²)	
	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r
Age	0.228	0.227	0.049*	-0.363	0.427	-0.151	0.308	-0.193	0.647	-0.087	0.491	-0.131	0.805	-0.38	0.049*	-0.296	0.152	-0.217
BMI	0.518	-0.123	0.110	0.298	0.110	-0.297	0.618	-0.095	0.010*	0.463	0.001**	0.575	0.324	0.150	0.908	-0.18	0.075	0.268
PNI	0.027*	0.402	0.768	0.056	0.268	0.209	0.602	-0.099	0.745	0.062	0.171	0.257	0.023*	0.340	0.310	0.155	0.054	0.290
Alb	0.082	0.323	0.032*	0.393	0.001**	0.556	0.607	0.098	0.588	0.103	0.136	0.278	0.008**	0.392	0.454	0.114	0.075	0.268
TLC	0.116	0.293	0.400	-0.159	0.708	-0.071	0.070	0.335	0.422	-0.152	0.945	0.013	0.334	0.147	0.336	0.147	0.170	0.208
Cu (mg/L)	0.148	-0.271	0.001**	0.626	0.011*	0.458	0.904	-0.23	0.803	0.048	0.871	0.031	0.679	0.063	0.292	-0.160	0.98	0.001
Zn (mg/L)	0.737	-0.064	0.558	0.489	0.623	0.510	0.833	-0.040	0.713	0.070	0.601	-0.100	0.877	-0.24	0.871	-0.025	0.606	0.079
Se (mg/L)	0.068	-0.380	0.899	0.024	0.791	0.050	0.783	-0.052	0.534	0.118	0.437	-0.147	0.609	0.078	0.355	0.141	0.424	0.122
Mn (mg/L)	0.164	-0.261	0.090	0.315	0.226	0.228	0.627	0.093	0.357	0.174	0.429	0.150	0.031*	0.322	0.329	-0.149	0.750	-0.049

*p<0.05, **p<0.01. BMI: Body mass index, PNI: Prognostic nutritional index, Alb: Albumin, Cu: Copper, Zn: Zinc, Se: Selenium, Mn: Manganese, TLC: Total lymphocyte count

and femur total BMD values and serum Cu levels in the control group (respectively; p=0.001, r=0.626 and p=0.011, r=0.455) while a weak positive correlation was observed between lumbar total BMD values and serum Mn (p=0.031, r=0.32) levels in the osteoporosis group (p<0.05). However, there was no correlation between serum Zn and Se values and BMD values (Table 2).

When the relationships between PNI values and demographic data and serum levels of trace elements are evaluated; there was a significant positive moderate correlation between PNI level and serum Zn level (p=0.045, r=0.063) in osteoporosis group, but there was no significant correlation in other data (Table 3).

Age, BMI, PNI, albumin, Cu, Mn and Zn levels were included in the linear regression analysis to reveal the role of the analyzed parameters in the determination of BMD. It was observed that PNI value is not a determiner on lumbar total BMD in postmenopausal osteoporosis patients while the albumin level is a weak determinant [Beta coefficient (β) =0.556, R^2=0.309, p=0.001, standard error =0.054, 95% confidence interval] (Graphic 1). It was observed that BMI was a weak determinant on femur neck and femur total BMD in osteopenia patients while PNI value was found to be a weak determinant on lumbar total BMD in control patients. It was observed that the other parameters evaluated were not a determining factor on BMD.



Graphic 1. Linear regression graph between albumin and lumbar total BMD in postmenopausal osteoporosis group
BMD: Body mineral density

Discussion

In our study, it was found that PNI, serum albumin, Cu, and Zn levels were significantly lower in the osteoporosis group compared to the control group, and there was a weak positive correlation between lumbar total BMD values and PNI, albumin, and serum Mn levels. In addition, there was a moderate positive correlation between PNI and serum Zn levels in the osteoporosis group.

Osteoporosis, one of the most important health problems of postmenopausal women and genetic factors play a major role. However, adequate and balanced nutrition can be an inexpensive and easily applicable therapeutic method as well as an additional contribution to the treatment process compared to other treatment methods. Trace elements other than vitamin D and calcium, which are known as the main components of bone metabolism are essential sub-elements necessary for the success of many stages of bone metabolism (16). For this reason, deficiencies of these basic sub-items can be eliminated with adequate and balanced nutrition or supplements in postmenopausal osteoporosis. Otherwise, in addition to the increased morbidity and mortality seen in osteoporosis, additional morbidity and mortality in malnutrition may pose a serious risk (17).

While advanced age and low BMI values contribute to the formation of osteoporosis in postmenopausal women, subclinical chronic inflammation present in osteoporosis patients may also contribute to the formation of malnutrition (17-20). In our study, there was no significant difference between the groups in terms of age and BMI values. Therefore, it can be suggested that age and BMI values in the groups did not make an additional contribution to the formation of postmenopausal osteoporosis and malnutrition. However, similar to the literature, postmenopausal patients had the lowest BMI level, and this may be an indicator of impaired nutritional status in patients with osteoporosis. Furthermore, it was found that there was a significant relationship between BMI and femur neck and femur total BMD in osteopenia patients. The regression analysis revealed that BMI had a strong effect on femur neck and femur total BMD.

The albumin level evaluated in the PNI is an important indicator of the amount of protein taken by the diet (21). There are several

Table 3. Relationship between prognostic nutritional index values and serum levels of trace elements in groups

Parameters	PNI values with normal control (T-score: 0 to -0.99)		PNI values with osteopenic (T-score: -1 to -2.49)		PNI values with osteoporotic (T-score: ≤-2.5)	
	p	r	p	r	p	r
Age (years)	0.913	-0.21	0.098	-0.308	0.891	-0.21
BMI (kg/m^2)	0.256	0.214	0.394	0.162	0.868	-0.025
Cu (mg/L)	0.052	-0.359	0.946	0.013	0.605	-0.079
Zn (mg/L)	0.671	-0.081	0.181	-0.251	0.045*	0.063
Se (mg/L)	0.104	0.302	0.552	-0.113	0.761	-0.047
Mn (mg/L)	0.909	-0.022	0.717	0.069	0.329	0.149

*p<0.05. PNI: Prognostic nutritional index, BMI: Body mass index, Cu: Copper, Zn: Zinc, Se: Selenium, Mn: Manganese

epidemiological studies reporting that there is a relationship between dietary protein and bone (22,23). These studies show that individuals who consume the most dietary protein have the highest BMD (24,25). However, there are studies reporting that there is no independent relationship between low albumin levels and BMD (26,27). TLC is a useful determinant in the determination of nutritional status, and it is a fast, easily accessible method that can be used in all age groups (13,15,28). In addition, it has been stated that TLC may be a suitable marker in the evaluation of nutritional status and bone health together with albumin in advanced age (senile) patients (29). However, although low TLC is not a specific finding for malnutrition, it has been reported that it may show decreased immune function resulting from malnutrition (13,15,28).

Although the mechanism of the relationship between postmenopausal osteoporosis and hypoalbuminemia is not clear; hypoalbuminemia may be directly related to nuclear factor kappa B, an important protein complex known to suppress osteogenesis and osteoclast activation. Or indirect interaction with acute phase reactants, such as TNF-alpha, IL-1, can also cause a decrease in BMD. Hypoalbuminemia may cause decreased BMD in individuals affected by diseases associated with low albumin levels or through various mechanisms caused by the deficiency of many proteins and trace elements carried by albumin (30). In our study, when the PNI values in the groups were examined, it was seen that the nutritional status was normal in the control and osteopenia groups, but mild malnutrition was observed in the osteoporosis group. PNI and albumin levels were significantly lower in patients with postmenopausal osteoporosis than in control patients. In addition, a positive correlation was found between lumbar total BMD value and PNI and albumin levels in postmenopausal osteoporosis patients. However, the regression analysis revealed that albumin level had a weak effect on lumbar total BMD. Therefore, our study was found to be compatible with previous literature information suggesting a relationship between albumin deficiency and osteoporosis (30). However, it can show us that albumin deficiency may have an important effect on especially trabecular bone density and BMD decrease in lumbar vertebrae where metabolic activities are high, and some precautions should be taken in terms of nutritional status and bone health. In our study, it was found that there was no significant difference between the TLC levels of the groups, and there was no relationship between BMD and TLC levels. This may be due to the very close PNI values in the groups, the limited number of patients, and other factors that may affect the TLC.

The relationship between Cu, Zn, Se, and Mn and osteoporosis is not well defined in the literature. Although there are studies indicating that these trace elements decrease in most patients with postmenopausal osteoporosis, there are studies reporting the opposite (2,8,10-12). Therefore, we determined the serum levels of Cu, Zn, Se, and Mn trace elements and focused on the relationship between BMD and PNI.

Although the Cu deficiency is rarely reported in humans, a low or moderate Cu deficiency may affect the synthesis and stability of bone collagen or cause osteogenesis inhibition leading to osteoporosis (31,32). This indicates that adequate Cu intake with diet is important for the preservation of bone and cartilage (33). However, there are studies reporting that there is no difference between serum Cu levels of patients with and without postmenopausal osteoporosis (2). In our study, serum Cu levels in the groups were within the normal range. However, the lowest Cu level was found in patients with postmenopausal osteoporosis, and there was a significant difference between the control group. Therefore, it suggests that it may be a new supplement candidate in the prevention and treatment of osteoporosis. Although there was no relationship between BMD and serum Cu level in osteoporosis and osteopenia patients, a significant positive relationship was found in the control group. This may have occurred due to other factors that may affect the serum Cu level in the groups. There was no relationship between serum Cu level and PNI in our study. This may be due to the fact that serum Cu is less affected by the albumin level because more than 90% of serum Cu is transported via ceruloplasmin. In addition, since serum Cu level is within the normal range in groups, it can be thought that hematopoiesis and/or TLC are not affected by this condition.

Zn is being the cofactor of enzymes such as alkaline phosphatase, collagenase, and sulfurethylase, which are involved in the synthesis of various bone matrix components and have important roles in normal collagen synthesis and bone mineralization. There are many studies reporting that there is a relationship between Zn deficiency and osteoporosis (2,8,9,11,12).

In our study, serum Zn levels were found to be below normal levels in all groups. In addition, it was determined that the lowest Zn level was in postmenopausal osteoporosis patients, and there was a significant difference between the other groups. In addition, although there was no relationship between BMD and serum Zn level, a positive relationship was found between PNI and Zn level in patients with osteoporosis. The fact that albumin acts as the basic Zn-binding protein in plasma may be the reason for the positive relationship between PNI and Zn in our study. This may show us that in patients with osteoporosis with a low PNI value, Zn supplementation may be appropriate in addition to their current treatment and maybe a new potential additional treatment in the prevention and treatment of osteoporosis.

Although there are many studies evaluating the relationship between Se and BMD in the current literature, the results are insufficient (34). While Se level was positively associated with BMD in healthy aging euthyroid postmenopausal women (35), another study conducted on postmenopausal 50-79-year-old participants suggested that dietary Se intake was not associated with BMD (36). In our study, although there was no difference between serum Se levels in the groups, the lowest Se level was found to be in the osteoporosis group. In addition, no correlation was found between serum Se levels and BMD and PNI. Similar to our study, other studies evaluating the relationship between

Se and BMD in the literature evaluated serum Se levels rather than the amount of Se intake in the diet. This may be a limitation in the context of examining the relationship with Se. Therefore, we think that further studies are needed on the subject.

A large part of the Mn in the body is in the bone, and the Mn density of the bone is an indicator of the serum Mn level and diet Mn, just like Cu and Zn (37). In a study, it was reported that the Mn level in serum was lower in postmenopausal women with osteoporosis compared to non-osteoporotic controls (38). In a study conducted by Strause et al. (39), it was reported that replacement of Mn together with Zn and Cu might help to reduce lumbar region BMD loss in postmenopausal women. In our study, serum Mn levels in the groups were within the normal range. The narrow range of serum Mn level and rareness of deficiency is confirmed by our findings. In our study, the lowest Mn level was found in postmenopausal osteoporosis patients, and there was a weak positive relationship between lumbar total BMD and serum Mn level. While this supports the study of Strause et al. (39), it suggests that Mn compounds may be a new supplement candidate in the prevention and treatment of osteoporosis. However, the lack of relationship between PNI and serum Mn level in our study may be due to the limited number of patients or especially the role beta globulin in addition to albumin in the transport of Mn to bone.

Study Limitations

Limitations of our study can be listed as the limited number of patients, lack of information about how much of the trace elements are taken with the diet, the evaluation of only serum levels of trace elements and the effects of many factors on serum levels of trace elements such as hormone replacement therapy, diuretic and laxative use.

Conclusion

Especially low serum albümin levels and low PNI value in postmenopausal osteoporosis patients may adversely affect total BMD in the lumbar region. Additionally, supplementing Zn in osteoporosis patients with low PNI can be a potential additional treatment strategy. However, supplementation of the Cu and Mn compounds may provide an additional benefit to existing treatments. However, we think that our findings should be supported with more comprehensive future studies investigating the nutritional aspect of osteoporosis and since the question of which supplements should be used is very complex, and the mechanisms are not yet fully understood.

Ethics

Ethics Committee Approval: The study was approved by the Atatürk University Faculty of Medicine Ethics Committee (decision no: 16, date: 07.05.2020).

Informed Consent: In addition, consent was obtained from the participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.K, Z.B, M.Ç., Concept: A.K, Z.B, M.Ç., Design: A.K, Z.B, M.Ç., Data Collection or Processing: A.K, Z.B, M.Ç., Analysis or Interpretation: A.K, Z.B, Literature Search: A.K., Z.B, Writing: A.K., Z.B.

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References

1. Higgs J, Derbyshire E, Styles K. Nutrition and osteoporosis prevention for the orthopaedic surgeon: A wholefoods approach. EFORT Open Rev 2017;2:300-8.
2. Arikan DC, Coskun A, Ozer A, Kilinc M, Atalay F, Arikan T. Plasma selenium, zinc, copper and lipid levels in postmenopausal Turkish women and their relation with osteoporosis. Biol Trace Elem Res 2011;144:407-17.
3. Montalcini T, Romeo S, Ferro Y, Migliaccio V, Gazzaruso C, Pujia A. Osteoporosis in chronic inflammatory disease: the role of malnutrition. Endocrine 2013;43:59-64.
4. Saltman PD, Strause LG. The role of trace minerals in osteoporosis. J Am Coll Nutr 1993;12:384-9.
5. Bonaccorsi G, Lorini C, Bani Assad G, Pepe P, Santomauro F. Serum trace elements and risk of malnutrition in institutionalised elderly. Eur J Clin Nutr 2013;67:155-60.
6. Saltman P, Strause L. Trace elements in bone metabolism and osteoporosis. J Inorg Biochem 1991;43:284.
7. Saltman PD, Strause LG. The role of trace minerals in osteoporosis. J Am Coll Nutr 1993;12:384-9.
8. Odabasi E, Turan M, Aydin A, Akay C, Kutlu M. Magnesium, zinc, copper, manganese, and selenium levels in postmenopausal women with osteoporosis. Can magnesium play a key role in osteoporosis? Ann Acad Med Singap 2008;37:564-7.
9. Liu SZ, Yan H, Xu P, Li JP, Zhuang GH, Zhu BF, et al. Correlation analysis between bone mineral density and serum element contents of postmenopausal women in Xi'an urban area. Biol Trace Elem Res 2009;131:205-14.
10. Wang L, Yu H, Yang G, Zhang Y, Wang W, Su T, et al. Correlation between bone mineral density and serum trace element contents of elderly males in Beijing urban area. Int J Clin Exp Med 2015;8:19250-7.
11. Strain JJ. A reassessment of diet and osteoporosis–possible role for copper. Med Hypotheses 1988;27:333-8.
12. Rodríguez J, Mandalunis PM. A Review of Metal Exposure and Its Effects on Bone Health. J Toxicol 2018;2018:4854152.
13. Sattler ELP, Ishikawa Y, Trivedi-Kapoor R, Zhang D, Quyyumi AA, Dunbar SB. Association between the Prognostic Nutritional Index and Dietary Intake in Community-Dwelling Older Adults with Heart Failure: Findings from NHANES III. Nutrients 2019;11:2608.
14. Miller PD. Guidelines for the diagnosis of osteoporosis: T-scores vs fractures. Rev Endocr Metab Disord 2006;7:75-89.
15. Benjamin EJ, Virani SS, Callaway CW, Chamberlain AM, Chang AR, Cheng S, et al. Heart Disease and Stroke Statistics-2018 Update: A Report From the American Heart Association. Circulation 2018;137:67-492.
16. Coxam V, Wauquier F, Darie C, Spilmont M, Davicco MJ, Wittrant Y. Huile d'olive et santé osseuse. OCL 2014;21:D5111.
17. Lee LC, Tsai AC, Wang JY, Hurng BS, Hsu HC, Tsai HJ. Need-based intervention is an effective strategy for improving the nutritional status of older people living in a nursing home: a randomized controlled trial. Int J Nurs Stud 2013;50:1580-8.
18. Dargent-Molina P, Poitiers F, Bréart G; EPIDOS Group. In elderly women weight is the best predictor of a very low bone mineral density: evidence from the EPIDOS study. Osteoporos Int 2000;11:881-8.

19. Lacativa PG, Farias ML. Osteoporosis and inflammation. Arq Bras Endocrinol Metabol 2010;54:123-32.
20. Montalcini T, Romeo S, Ferro Y, Migliaccio V, Gazzaruso C, Pujia A. Osteoporosis in chronic inflammatory disease: the role of malnutrition. Endocrine 2013;43:59-64.
21. Peters BS, Martini LA. Nutritional aspects of the prevention and treatment of osteoporosis. Arq Bras Endocrinol Metabol 2010;54:179-85.
22. Henriques R, Jásik J, Klein M, Martinoia E, Feller U, Schell J, et al. Knock-out of Arabidopsis metal transporter gene IRT1 results in iron deficiency accompanied by cell differentiation defects. Plant Mol Biol 2002;50:587-97.
23. Ryu MS, Lichten LA, Liuzzi JP, Cousins RJ. Zinc transporters ZnT1 (Slc30a1), Zip8 (Slc39a8), and Zip10 (Slc39a10) in mouse red blood cells are differentially regulated during erythroid development and by dietary zinc deficiency. J Nutr 2008;138:2076-83.
24. Kanno S, Anuradha CD, Hirano S. Localization of zinc after in vitro mineralization in osteoblastic cells. Biol Trace Elem Res 2001;83:39-47.
25. Lopez V, Kelleher SL. Zinc transporter-2 (ZnT2) variants are localized to distinct subcellular compartments and functionally transport zinc. Biochem J 2009;422:43-52.
26. D'Erasmo E, Pisani D, Ragno A, Raejntroph N, Letizia C, Acca M. Relationship between serum albumin and bone mineral density in postmenopausal women and in patients with hypoalbuminemia. Horm Metab Res 1999;31:385-8.
27. Lunde AV, Barrett-Connor E, Morton DJ. Serum albumin and bone mineral density in healthy older men and women: the Rancho Bernardo Study. Osteoporos Int 1998;8:547-51.
28. Nishida T, Sakakibara H. Association between underweight and low lymphocyte count as an indicator of malnutrition in Japanese women. J Womens Health (Larchmt) 2010;19:1377-83.
29. Di Monaco M, Vallero F, Di Monaco R, Mautino F, Cavanna A. Biochemical markers of nutrition and bone mineral density in the elderly. Gerontology 2003;49:50-4.
30. Afshinnia F, Wong KK, Sundaram B, Ackermann RJ, Pennathur S. Hypoalbuminemia and Osteoporosis: Reappraisal of a Controversy. J Clin Endocrinol Metab 2016;101:167-75.
31. Arredondo M, Núñez MT. Iron and copper metabolism. Mol Aspects Med 2005;26:313-27.
32. Rodríguez JP, Ríos S, González M. Modulation of the proliferation and differentiation of human mesenchymal stem cells by copper. J Cell Biochem 2002;85:92-100.
33. Aaseth J, Boivin G, Andersen O. Osteoporosis and trace elements–an overview. J Trace Elem Med Biol 2012;26:149-52.
34. Wang Y, Xie D, Li J, Long H, Wu J, Wu Z, et al. Association between dietary selenium intake and the prevalence of osteoporosis: a cross-sectional study. BMC Musculoskelet Disord 2019;20:585.
35. Beukhof CM, Medici M, van den Beld AW, Hollenbach B, Hoeg A, Visser WE, et al. Selenium Status Is Positively Associated with Bone Mineral Density in Healthy Aging European Men. PLoS One 2016;11:e0152748.
36. Wolf RL, Cauley JA, Pettinger M, Jackson R, Lacroix A, Leboff MS, et al. Lack of a relation between vitamin and mineral antioxidants and bone mineral density: results from the Women's Health Initiative. Am J Clin Nutr 2005;82:581-8.
37. Dermience M, Lognay G, Mathieu F, Goyens P. Effects of thirty elements on bone metabolism. J Trace Elem Med Biol 2015;32:86-106.
38. Reginster JY, Strause L, Deroisy R, Lecart MP, Saltman P, Franchimont P. Preliminary report of decreased serum magnesium in postmenopausal osteoporosis. Magnesium 1989;8:106-9.
39. Strause L, Saltman P, Smith KT, Bracker M, Andon MB. Spinal bone loss in postmenopausal women supplemented with calcium and trace minerals. J Nutr 1994;124:1060-4.

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The Frequency of Spontaneous Vertebral Fracture in Geriatric Patients and the Relationship of Vertebral Fractures with Age: A Retrospective Study

Geriatrik Hastalarda Spontan Vertebral Fraktür Sıklığı ve Vertebral Fraktürün Yaşla İlişkisi: Retrospektif Çalışma

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Abstract

Objective: Vertebral fractures impair the quality of life in the geriatric patients and increase their economic costs. In this study, we aimed to identify spontaneous vertebral fracture rates and associated risk factors in the elderly.

Materials and Methods: Patients over the age of 65 years who were admitted to our physical medicine and rehabilitation outpatient clinic with back pain between January 2018 and June 2018 were examined retrospectively. A total of 136 patients with thoracic and lumbar spine fractures were included in this study. Data regarding osteoporosis treatment, diabetes mellitus, chronic renal failure and thyroid dysfunctions as well as vitamin D levels were recorded for all patients.

Results: The mean age of the patients (female/male: 119/17) was 73.9±6.6 years. Spontaneous vertebral fractures were detected in 74 patients (54.4%). Vertebral fractures were concentrated in the lower thoracic and upper lumbar regions. The patients were divided into the following two groups: Group 1 (65-74 years old) and group 2 (≥75 years old). Moreover, the rate of vertebral fracture was significantly higher in group 2 than in group 1 ($p<0.05$). Regression analysis revealed that age, female gender and the presence of osteoporosis were associated with vertebral fractures.

Conclusion: Vertebral fractures increase dramatically in geriatric patients. Furthermore, advanced age is an independent risk factor for vertebral fractures. Due to the high diagnostic and treatment costs as well as negative impacts of vertebral fractures on the quality of life, its diagnosis and treatment must be performed in a timely manner for the geriatric patients.

Keywords: Geriatrics, age, vertebrae, fracture, osteoporosis

Öz

Amaç: Vertebral kırıklar geriatrik hastalarda yaşam kalitesini bozmakta ve ekonomik maliyeti artırmaktadır. Bu çalışmada, geriatrik hastalarda spontan vertebral fraktür oranlarını ve risk faktörlerini belirlemeyi amaçladık.

Gereç ve Yöntem: 1 Ocak-30 Haziran 2018 tarihleri arasında fiziksel tıp ve rehabilitasyon polikliniğine dorsalji şikayeti ile başvuran 65 yaş üstü hastaların verileri retrospektif olarak incelendi. Torakal ve lomber omurga grafilerinde kırık saptanan 136 hasta çalışmaya alındı. Hastaların vitamin D düzeyi, osteoporoz tedavileri, diabetes mellitus, kronik böbrek yetersizliği ve tiroid disfonksiyonları kaydedildi.

Bulgular: Hastaların (kadın/erkek: 119/17) yaş ortalaması 73,9±6,6 idi. Yetmiş dört kişide (%54,4) spontan vertebra kırığı saptandı. Vertebral kırıklar, alt torasik ve üst lomber bölgede yoğunlaşmaktaydı. Hastalar grup 1; 65-74 yaş arası, grup 2; 75 yaş ve üstü hastalar olarak gruplara ayrıldı. Grup 2'deki spontan vertebra fraktür oranları istatistiksel olarak anlamlı derecede yüksekti ($p<0,05$). Regresyon analizine göre yaş, kadın cinsiyet ve osteoporoz varlığı vertebral fraktür açısından belirgin risk faktörüydü.

Sonuç: Geriatrik hastalarda vertebral kırıklar dramatik şekilde artmaktadır. İleri yaş (>75 yıl) vertebral kırıklar için majör ve bağımsız risk faktörüdür. Maliyetinin yüksek olması ve yaşam kalitesini olumsuz etkilemesi nedeniyle geriatrik hastalarda kemik kalitesine yönelik tanı ve tedavilerin zamanında yapılması gerekmektedir.

Anahtar kelimeler: Geriatri, yaş, vertebra, fraktür, osteoporoz

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Introduction

Osteoporosis is a skeletal system disorder characterized by the deterioration of bone fragility and fracture probability as a result of degradation of low bone mass and bone micro-architecture. The bone matrix consists of mineral, collagen, water and a small amount of non-collagen proteins. Changes within these components or changes in the interaction between any or all of these components contribute to fracture (1).

The genetic predisposition is also important in the relationship between mechanical loading and bone strength concerning fracture. Two mechanical forces that affect the bone is gravity and muscle contraction. The ability of the bone to meet mechanical loading depends on bone mineral density (BMD), muscle mass and quality (2). The changes in muscle fascicule architecture and changes in volume are also very important for muscle strength. In old age, the sarcopenia and the skeletal muscles weaken and shrink (3). It was shown that the elderly experienced different dynamic spinal stiffness and loading compared to young adults for a functional lifting task (4). Osteoporotic vertebra fracture occurs when the forces applied to the vertebral body exceed the strength of the vertebrae. The person's height, weight, muscle strength, movement performance, spinal curvature, intervertebral disc, bone size, density, micro-architecture, collagen changes are factors affecting spine biomechanics (5,6). The most common osteoporotic fractures in old age are a significant health problem as they lead to a decrease in quality of life, increased morbidity and mortality, all of which cause great economic costs (7,8).

Some of the risk factors identified for osteoporotic fractures include advanced age, decreased BMD, chronic inflammatory disease, endocrine system diseases [diabetes mellitus (DM), thyroid], glucocorticoid use, chronic renal and hepatic insufficiency, low vitamin D level, and smoking and alcohol use (9-12). Fractures are most commonly seen in the wrist, hip, humerus, pelvis, rib and the vertebra. The clinical features of non-vertebral fractures are noticeable at the time they occur. Unlike fractures in other skeletal areas, one-third of vertebral fractures are not clinically noticeable unless a spinal visualization is conducted (12,13). When a vertebral fracture occurs, clinical pain, increased kyphosis, a decrease in respiratory capacity, gastroesophageal reflux, decreased physical activity and an increased risk of falling linked to balance disorder may be observed (12).

In this study, we aimed to identify spontaneous vertebral fracture rates and associated risk factors in elderly people.

Materials and Methods

The records of the patients over the age of 65 admitted to our physical therapy and rehabilitation polyclinic between 1 January-30 June 2018 with complaints of back pain were examined retrospectively through our hospital's computer record system. Within these dates, the records of 752 patients were examined. A total of 136 patients with thoracic and lumbar spine radiographs and fractures were included in the study. Vertebral radiographs of patients were evaluated by researcher physicians. Presence of fractures in patients; T4-L5 in lateral spinal radiographs anterior, middle and/or posterior heights in inter-vertebrae 20% reduction in neighbouring vertebrae is defined as fracture evaluated by semicantitive method (6). Presence of fracture; lateral height in at least one vertebra between T4 and L5 in spinal radiographs it was determined by observing the loss (14). The patients' 25-hydroxyvitamin D levels, whether they were taking osteoporosis treatment, DM, chronic renal failure and thyroid dysfunctions were recorded.

The patients were divided into two groups according to the relationship between spontanous vertebral fractures and age. Group 1 was defined as the patients between 65-74 years of age and group 2 was defined as the patients at or above the age of 75.

We excluded patients from the study whose data we could not access and who had a history of rheumatologic disease, malignancy and trauma.

The ethics committee approval for this study was made by Yıldırım Beyazıt University Faculty of Medicine Clinical Research Ethics Committee (decision no: 231, date: 24.10.2018). This study adheres to the ethical rules reported in the 1964 Helsinki Declaration, which were revised in 2013.

Statistical Analysis

Statistical analyses were made with the SPSS 22.0 package program. Following descriptive statistical analyses, Mann-Whitney U and Student t-tests were performed based on the distribution of the data in the cross-group comparison. The categorical data were analyzed with the chi-square or Fisher's Exact Test (when Levene's test was significant). Binary logistic regression analysis was performed with the logistic regression method. The independent variables (gender, age, 25-hydroxyvitamin D_3 level, osteoporosis treatment and comorbidity status) were included in the binary regression analysis. Presence of vertebra fracture was the dependent variable. The statistical significance of the results was evaluated at $p<0.05$. Post-hoc power analyses were performed with using G*Power 3.0.10 program (Heinrich-Heine Universität, Düsseldorf, Düsseldorf, Germany) and power of the study (1-β) was calculated as 0.61 (alpha coefficient was accepted as 0.05, effect size was accepted 0.3).

Results

The mean age of 136 patients (female/male: 119/17) was 73.9±6.6. A spontaneous vertebral fracture was detected in 74 people (54.4%). Vertebral fractures were concentrated in the lower thoracic and upper lumbar region. In terms of the number of vertebral fractures, it was observed that 25.7% had 1, 36.5%-2, 13.5%-3, 13.5%-4 and 10.8% had 5 vertebral fractures. The average level of vitamin D was 22.3±13.4 mg/dL. The demographic and clinical features of the patients are shown in Table 1. When the patients were divided into two groups; 65-75 years of age and over 75, the spontaneous vertebral fracture rates were significantly higher in patients over

the age of 75 than in patients aged 65-75 (p<0.05). Differences were not found between the two groups in terms of gender, vitamin D level, osteoporosis treatment and systemic disease. The comparison of the fracture and clinical features of patients based on age groups is shown in Table 2. In binary logistic regression analysis, age [odds ratio (OR): 1.181, 95% confidence interval (CI): 1.031-1.352, p<0.05], female gender (OR: 6.301, 95% CI: 1.678-23.655, p<0.05), and presence of osteoporosis (OR: 2.554, 95% CI: 1.023-6.375, p<0.05) were associated with vertebra fracture positivity (Table 3).

Table 1. Demographic and clinical features of geriatric patients with back pain

n=136	
Age (mean ± SD)	73.9±6.6
Female/male n (%)	119 (87.5)/17 (12.5)
Those with vertebral fractures n (%)	74 (54.4)
Those having osteoporosis treatment n (%)	91 (66.9)
25-(OH)D_3 level (ng/mL) (mean ± SD)	22.3±13.4
Presence of systemic disease n (%)	
Diabetes mellitus n (%)	44 (32.6)
Thyroid dysfunction n (%)	27 (19.9)
Chronic kidney disease n (%)	32 (23.5)
Spread of vertebral fractures number	
T7	3
T8	12
T9	9
T10	14
T11	31
T12	33
L1	29
L2	25
L3	15
L4	9
L5	3

25-(OH)D_3: 25-hydroxyvitamin D_3, SD: Standard deviation

Discussion

The determination of the previous vertebral fractures provides important information in assessing the risk of fracture in patients. It provides a guide in the prevention of fractures and the shaping of treatment following fracture. The most important conclusion of this study is that the presence of unnoticeable vertebral fractures in individuals over the age of 65 is considerably high and, in particular, independent of other factors dramatically increasing in individuals over the age of 75.

Contrary to fractures in other skeletal regions, it has been demonstrated by some studies that vertebral fractures were not clinically recognized unless a spinal scan was performed (12). In a study of 567 patients with an average age of 72, it was reported that 143 patients (25.2%) had a spontaneous radiographic vertebral fracture (15). Merle et al. (16) in their study on the vertebral fracture awareness of 45 females aged between 60-85 years and 53 male patients between the ages of 50-85 years found that 48.89% of women and 64.15% of men indicated that they were unaware of the vertebral fracture of the body. In the study of Reniu et al. (15) an undiagnosed vertebral fracture was detected in a quarter of patients admitted with non-spinal fractures. In a study by Sanfélix-Genovés et al. (17) which evaluated 824 post-menopausal women in the 50-87 age range, the ratio of vertebral fractures was 21.4% and 46.3% for women over 75 years of age. Only 1.5% of women reported that they were aware of the vertebral fracture. In another study in which 232 post-menopausal women were evaluated in our country (age: 35-89), the vertebral fracture ratio was found to be 12.1% (18). In our study, the vertebral fracture rate was 54.4% in patients over 65 years of age, and the rate of fractures was high in patients over the age of 75, independent of gender. In a study on risk factors in osteoporotic vertebral fractures in our country, it was found that advanced age formed a

Table 2. Comparison of vertebral fracture and clinical features in geriatric patients according to age groups

	Group 1 (n=84) Patients in the 65-75 age range	**Group 2 (n=52) Patients 75 years of age and above**	**p-value**
Gender Female/male n (%)	72/12 (85.7/14.3)	47/5 (90.4/9.6)	0.424
25-(OH)D_3 mg/dL (mean ± SD)	22.0±14.4	22.7±11.8	0.456
Patients receiving osteoporosis treatment n (%)	52 (61.9)	39 (75)	0.115
Presence of vertebral fracture n (%)	35 (41.7)	39 (75)	<0.05
Presence of diabetes mellitus n (%)	26 (30.9)	18 (34.6)	0.657
Presence of thyroid disease n (%)	19 (22.6)	8 (15.4)	0.304
Presence of chronic renal failure n (%)	18 (21.4)	14 (26.9)	0.463

25-(OH)D_3: 25-hydroxyvitamin D_3, SD: Standard deviation

Table 3. Binary logistic regression analysis with precense of vertebra fracture

	OR	95% CI	p
Age	1.181	1.031-1.352	0.017
Gender (female)	6.301	1.678-23.655	0.006
Presense of osteoporosis treatment	2.554	1.023-6.375	0.045
Presense of comorbidity	0.766	0.080-7.348	0.817
25-(OH)D_3	1.303	0.507-3.346	0.582

R^2=0.230 (Cox & Snell), R^2=0.307 (Nagelkerke), -2 Log likelihood =151,968, model $\chi 2$ (2)=35,508, p<0.001, $\chi 2$=5.171, degrees of freedom =8, p=0.739 (Hosmer and Lemeshow test). OR: Odds ratio, CI: Confidence interval, 25-(OH) D_3: 25-hydroxyvitamin D_3

significantly high risk for vertebral fracture (19). A study where 15,570 patients from 19 European countries and 36 centres were radiographically evaluated, found that the vertebral deformity rate was similar in both sexes in all centres (in the range of 6.7%-20.2% in females and in the range 7.5%-19.8% for males) and its prevalence had been reported to increase with age in both sexes (20). Waterloo et al. (21) in a study of 2,887 patients in the age range of 30-87 years found that the proportion of vertebral fractures in women is 13.8% and 11.8% in males; 20.3% in men over the age of 70, 19.2% in women, and indicated that they found a significant increase in vertebral fracture rate with age for both sexes. It was reported in a multi-center study that was conducted in Canada that age is the most significant determinant for vertebral fracture (22). In our study, the vertebral fracture rate in the 65-75 age range was 41.7%, and 75% over the age of 75, and fractures increased with age in both sexes. These findings show a similarity to the data in the literature.

In the present study of ours, it was determined that female gender is a significant risk factor for osteoporosis and vertebral fractures. In the European Prospective Osteoporosis Study, it was reported that the incidence of vertebral fractures was higher in females at all age groups compared to males, and this increase was higher at a significant level over 75 years of age (23). In a study by Wáng et al. (24), future vertebral fractures risk in older females with or without osteoporotic vertebral fractures was found to be much higher compared to older males. In a study conducted in 12 countries to examine age and sex-specific non-traumatic fractures, it was reported that vertebral fracture was much more common in females (25).

Decreased BMD and vitamin D deficiency were defined as risk factors for vertebral fracture in the elderly (12). Waterloo et al. (21) reported that low BMD was a risk factor for vertebral fracture in both sexes. The study of Reniu et al. (15) shows that 49.5% of vertebral fractures have osteoporosis. In another study comparing patients with and without vertebral fractures, it was found that both groups were similar in terms of age, BMD and systemic disease and that the lumbar T-score was significantly lower in those with the fractures (18). In a study that was conducted by Kanis et al. (26), it was determined that vertebral fracture risk was 9-12-fold more in individuals with low BMD. When Demirdal et al. (27) evaluated the rate of vertebral fracture in patients with osteoporosis, they found that the vertebral fracture rate was 18.9% in patients with primary osteoporosis and 18.2% in secondary osteoporosis. Imai et al. (13) which evaluated the fracture incidence of 337 patients over 65 years of age, reported that fracture incidence with patients on osteoporosis treatment is lower (14.5%) and that there is a significant increase in vertebrae and hip fractures in the 70-89 age range. In our study, we found that vertebral fractures were more in individuals who received osteoporosis treatment, i.e. those with osteoporosis, independently from other variables.

Tamaki et al. (28) with their 15-year study where they screened 1,211 women over 50 years of age without early menopause and/or any condition affecting bone metabolism, found that vertebral fracture was significantly higher in patients with a level of vitamin D< 20 ng/dL compared to those with a vitamin D level >20. In another study focusing on the relationship between vertebral fracture and vitamin D, 246 back pain patients of an average age of 69 who had a vertebral fracture had their vitamin D levels compared to 392 non-fracture back pain patients with an average age of 63. The level of vitamin D in those with vertebral fractures was found to be significantly lower (29).

In our study, 66.9% of our patients were under treatment for osteoporosis and the average vitamin D level was 22.29 ng/dL. We were unable to access information on whether our patients obtained vitamin D and BMD level control, before or after the fracture occurred. However, considering the age group, and the fact that the awareness of osteoporosis has increased in our country only over the last 15-20 years, we can conclude that the patients may be late in the initiation of osteoporosis treatment.

Studies of anatomical regions where vertebral fractures are frequently seen have shown that the fractures are frequently reported in the lower thoracic and upper lumbar region (17,29). In our study, fractures were similarly concentrated in the lower thoracic and upper lumbar region. In our study, 74.3% of patients with vertebral fracture had multiple fractures. In many studies, it has been shown that the risk of re-fracture in patients with osteoporotic vertebral fractures is high and that it increases with age (15,30).

It has been shown by various studies that some systemic diseases impact bone metabolism, which is negatively influenced by numerous different mechanisms that increase the risk of osteoporosis and fracture. DM, chronic kidney disease, thyroid diseases are some of these (9-12). Similar to the literature findings, our study found that 32.35% of patients with vertebral fractures suffered from DM, 19.85% from thyroid disease and 23.52% had chronic kidney disease. When we compared our groups of patients with regard to these diseases, we did not detect any statistically significant difference in terms of systemic diseases.

Osteoporotic vertebral fractures that disrupt the quality of life in the elderly and increase mortality also result in large economic costs (12,31). The prevention of osteoporotic fractures is possibly by supporting bone quality, diagnosing and treating secondary causes, providing support for muscle mass to counter increased sarcopenia and posture disorders with ageing, treating balance disorders and reducing the risk of falling.

Study Limitations

The present study has some limitations. Since it was a retrospective study, muscle weakness, diet, agreement with the osteoporosis, medication that cause osteoporosis, and menopause time, which are the risk factors for vertebral fractures and osteoporosis, could not be evaluated. In our country, studies conducted on vertebral fracture rates in geriatric people are very few. In this respect, contributing to the literature is the strength of the present study.

Conclusion

The incidence of vertebral fracture increases rapidly as age progresses. In our study, we found that this increase, independent of other vertebral fracture risk factors, was more prevalent over the age of 75. Presence of osteoporosis and female gender are significant risk factors for vertebral fractures. Due to the high morbidity, cost and negative impact on quality of life, the diagnosis and bone quality treatments in the elderly must be made timely. Together with the non-neglect of posture and balance exercises, precautions must also be taken to reduce the risk of falling.

Ethics

Ethics Committee Approval: The ethics committee approval for this study was made by Yıldırım Beyazıt University Faculty of Medicine Clinical Research Ethics Committee (decision no: 231, date: 24.10.2018). This study adheres to the ethical rules reported in the 1964 Helsinki Declaration, which were revised in 2013.
Informed Consent: Retrospective study.
Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Z.K., B.M.A., Concept: Z.K., B.M.A., Design: Z.K., B.M.A., Data Collection or Processing: Z.K., B.M.A., Analysis or Interpretation: Z.K., B.M.A., Literature Search: Z.K., Writing: Z.K.
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References

1. Burr DB. Changes in bone matrix properties with aging. Bone 2019;120:85-93.
2. Frost HM. Bone's mechanostat: a 2003 update. Anat Rec A Discov Mol Cell Evol Biol 2003;275:1081-101.
3. McGill SM, Hughson RL, Parks K. Changes in lumbar lordosis modify the role of the extensor muscles. Clin Biomech (Bristol, Avon) 2000;15:777-80.
4. Christiansen BA, Bouxsein ML. Biomechanics of vertebral fractures and the vertebral fracture cascade. Curr Osteoporos Rep 2010;8:198-204.
5. Singh DK, Bailey M, Lee RY. Ageing modifies the fibre angle and biomechanical function of the lumbar extensor muscles. Clin Biomech (Bristol, Avon) 2011;26:543-7.
6. Quirk DA, Hubley-Kozey CL. Age-related changes in trunk neuromuscular activation patterns during a controlled functional transfer task include amplitude and temporal synergies. Hum Mov Sci 2014;38:262-80.
7. Ratti C, Vulcano E, La Barbera G, Canton G, Murena L, Cherubino P. The incidence of fragility fractures in Italy. Aging Clin Exp Res 2013;25 Suppl 1:S13-4.
8. Hirsch JA, Beall DP, Chambers MR, Andreshak TG, Brook AL, Bruel BM, et al. Management of vertebral fragility fractures: a clinical care pathway developed by a multispecialty panel using the RAND/UCLA Appropriateness Method. Spine J 2018;18:2152-61.
9. Starup-Linde J, Hygum K, Langdahl BL. Skeletal Fragility in Type 2 Diabetes Mellitus. Endocrinol Metab (Seoul) 2018;33:339-51.
10. Fusaro M, Aghi A, Mereu MC, Giusti A. Fratture da fragilità nella Malattia Renale Cronica (MRC) [Fragility fracture in the Chronic Kidney Disease (CKD)]. G Ital Nefrol 2017;34:2017-vol6.
11. Williams GR, Bassett JHD. Thyroid diseases and bone health. J Endocrinol Invest 2018;41:99-109.
12. Schousboe JT. Epidemiology of Vertebral Fractures. J Clin Densitom 2016;19:8-22.
13. Imai N, Endo N, Shobugawa Y, Oinuma T, Takahashi Y, Suzuki K, et al. Incidence of four major types of osteoporotic fragility fractures among elderly individuals in Sado, Japan, in 2015. J Bone Miner Metab 2019;37:484-90.
14. Genant HK, Wu CY, van Kuijk C, Nevitt MC. Vertebral fracture assessment using a semiquantitative technique. J Bone Miner Res 1993;8:1137-48.
15. Reniu AC, Ong T, Ajmal S, Sahota O. Vertebral fracture assessment in patients presenting with a non-hip non-vertebral fragility fracture: experience of a UK Fracture Liaison Service. Arch Osteoporos 2017;12:23.
16. Merle B, Dupraz C, Haesebaert J, Barraud L, Aussedat M, Motteau C, et al. Osteoporosis prevention: where are the barriers to improvement in a French general population? A qualitative study. Osteoporos Int 2019;30:177-85.
17. Sanfélix-Genovés J, Reig-Molla B, Sanfélix-Gimeno G, Peiró S, Graells-Ferrer M, Vega-Martínez M, et al. The population-based prevalence of osteoporotic vertebral fracture and densitometric osteoporosis in postmenopausal women over 50 in Valencia, Spain (the FRAVO study). Bone 2010;47:610-6.
18. Kilincer C, Kabayel DD, Cagli B, Unlu E, Wicki B, Ozdemir F. Frequency, distribution and severity of prevalent osteoporotic vertebral fractures in postmenopausal women. Turk Neurosurg 2013;23:476-83.
19. Günaydın R, Ölmez N, Kaya T, Vidinli BD, Memiş A. Osteoporotik Vertebra Fraktürlerinde Risk Faktörleri. Turk J Osteoporos 2002;8:105-9.
20. O'Neill TW, Felsenberg D, Varlow J, Cooper C, Kanis JA, Silman AJ. The prevalence of vertebral deformity in european men and women: the European Vertebral Osteoporosis Study. J Bone Miner Res 1996;11:1010-8.
21. Waterloo S, Ahmed LA, Center JR, Eisman JA, Morseth B, Nguyen ND, et al. Prevalence of vertebral fractures in women and men in the population-based Tromsø Study. BMC Musculoskelet Disord 2012;13:3.
22. Prior JC, Langsetmo L, Lentle BC, Berger C, Goltzman D, Kovacs CS, et al. Ten-year incident osteoporosis-related fractures in the population-based Canadian Multicentre Osteoporosis Study - comparing site and age-specific risks in women and men. Bone 2015;71:237-43.

23. European Prospective Osteoporosis Study (EPOS) Group, Felsenberg D, Silman AJ, Lunt M, Armbrecht G, Ismail AA, et al. Incidence of vertebral fracture in europe: results from the European Prospective Osteoporosis Study (EPOS). J Bone Miner Res 2002;17:716-24.
24. Wáng YXJ, Che-Nordin N, Deng M, Griffith JF, Leung JCS, Kwok AWL, et al. Elderly males with or without existing osteoporotic vertebral fracture have much lower future vertebral fracture risk than elderly females: the MrOS (Hong Kong) year-4 follow-up spine radiograph study. Osteoporos Int 2019;30:2505-14.
25. Wade SW, Strader C, Fitzpatrick LA, Anthony MS. Sex- and age-specific incidence of non-traumatic fractures in selected industrialized countries. Arch Osteoporos 2012;7:219-27.
26. Kanis JA, Johnell O, Oden A, Borgstrom F, Zethraeus N, De Laet C, et al. The risk and burden of vertebral fractures in Sweden. Osteoporos Int 2004;15:20-6.
27. Demirdal US, Yigit I, Solak O, Toktaş H, Dundar U, Kavuncu V. The relationship between vertebral fractures and quality of life in patients with osteoporosis. Göztepe Tıp Dergisi 2010;25:20-4.
28. Tamaki J, Iki M, Sato Y, Kajita E, Nishino H, Akiba T, et al. Total 25-hydroxyvitamin D levels predict fracture risk: results from the 15-year follow-up of the Japanese Population-based Osteoporosis (JPOS) Cohort Study. Osteoporos Int 2017;28:1903-13.
29. Maier GS, Seeger JB, Horas K, Roth KE, Kurth AA, Maus U. The prevalence of vitamin D deficiency in patients with vertebral fragility fractures. Bone Joint J 2015;97-B:89-93.
30. Balasubramanian A, Zhang J, Chen L, Wenkert D, Daigle SG, Grauer A, et al. Risk of subsequent fracture after prior fracture among older women. Osteoporos Int 2019;30:79-92.
31. Abimanyi-Ochom J, Watts JJ, Borgström F, Nicholson GC, Shore-Lorenti C, Stuart AL, et al. Changes in quality of life associated with fragility fractures: Australian arm of the International Cost and Utility Related to Osteoporotic Fractures Study (AusICUROS). Osteoporos Int 2015;26:1781-90.

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Correlation of Femoral Cartilage Thickness and Osteoporosis in Female Patients with Knee Osteoarthritis

Diz Osteoartritli Hastalarda Femoral Kıkırdak Kalınlığı ve Osteoporoz İlişkisi

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Abstract

Objective: To evaluate the relationship between ultrasonographic femoral cartilage thickness and presence of concomitant osteoporosis in a group of female patients with knee osteoarthritis (OA).

Materials and Methods: This study included 118 women with knee OA who visited our outpatient clinic. Demographic data were collected, radiologic grading using Kellgren Lawrence (K-L) scale, ultrasonographic femoral cartilage thickness (FCT) evaluation, pain intensity evaluation, disability evaluation using OA index [Western Ontario and McMaster Universities Osteoarthritis index (WOMAC)], quality of life measurement using Short Form-36 (SF-36) and bone density measurement using dual-energy X-ray absorptiometry (DXA) were conducted for each patient.

Results: We found that 58 patients (median age: 64.5 years, range: 50-75) had osteoporosis (group 1) and 60 patients (median age: 62 years, range: 51-75) did not have osteporosis (group 2). Group 2 had higher body mass index (BMI) in addition to lower WOMAC, SF-36 physical function, physical role limitation, pain and social function scores. The severity of osteoporosis and K-L staging were negatively correlated. The DXA femoral neck and total lumbar T-scores were higher in the advanced stages of OA. FCT had no significant correlation with age, WOMAC index and SF-36 scores. Moreover, the left knee FCT was negatively correlated with BMI.

Conclusion: Radiologic staging of OA had a negative correlation with osteoporosis but no significant correlation with the quantitative measurement of FCT using ultrasonography.

Keywords: Femoral cartilage thickness, knee osteoarthritis, osteoporosis, ultrasonography, SF-36, WOMAC

Öz

Amaç: Diz osteoartriti (OA) olan kadın hastalarda ultrasonografik femoral kıkırdak kalınlığı ve eş zamanlı osteoporoz varlığı arasında ilişki olup olmadığının araştırılmasıdır.

Gereç ve Yöntem: Çalışmaya, polikliniğe başvuran ve her iki dizinde OA bulunan 118 kadın hasta dahil edildi. Hastaların demografik verileri, radyolojik Kellgren Lawrence (K-L) evreleme, ultrasonografi ile femoral kıkırdak kalınlığı (FKK) ölçümü yapıldı. Numerik ağrı değerlendirmesi, OA indeksi [Western Ontario ve McMaster Universitesi Osteoartrit indeksi (WOMAC)], genel sağlık ölçütü ve yaşam kalitesi değerlendirmesi Kısa Form-36 (SF-36) ve kemik mineral yoğunluğu için çift enerjili X-ışını absorbsiyometrisi (DXA) yapılarak kaydedildi.

Bulgular: Yaş ortalaması 64,5 (aralık: 50-75) olan 58 hastada osteoporoz mevcut iken (grup 1), yaş ortalaması 62 (aralık: 51-75) olan 60 hastada osteoporoz yoktu (grup 2). Grup 2'de vücut kitle indeksi (VKİ) daha yüksek bulundu. K-L evreleme arttıkça osteoporoz insidansı azalma eğilimindeydi. İleri evre OA'da DXA femur boyun, lomber total T-skor ölçümleri yüksek saptandı. Osteoporoz olmayan grupta istatistiksel olarak WOMAC ağrı, tutukluk, fonksiyon ve total skorları daha yüksek, SF-36 fiziksel fonksiyon, fiziksel rol kısıtlanması, ağrı, sosyal fonksiyon skorları daha düşük saptandı. Osteoporoz varlığı ve K-L evreleme ile FKK ölçümü arasında anlamlı ilişki saptanmadı. Sol diz FKK VKİ ile negatif korelasyon göstermekteydi.

Sonuç: Radyolojik OA ve osteoporoz arasında negatif ilişki saptanmıştır. Ultrasonla FKK ölçümü ve diz OA derecesi arasında anlamlı bir ilişki gözlenmemiştir.

Anahtar kelimeler: Femoral kıkırdak kalınlığı, diz osteoartriti, osteoporoz, ultrasonografi, SF-36, WOMAC

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Introduction

Osteoarthritis (OA) is a major cause of disability and is among the most frequent forms of musculoskeletal disorders. It is characterized pathologically with both focal loss of articular cartilage and marginal and central new bone formation. The knee particularly is assumed to be an important healthcare problem associated with symptoms of pain and functional disability (1).

Osteoporosis is called the "silent thief" because it steals bone without immediate consequence or attention, and it results in low bone mass and the structural deterioration of bone, ultimately leading to fragility fractures. Fractures of the spine and hip are known to be the major determinants affecting quality of life in elderly people. Antiresorptive (bisphosphanates and denosumab) and anabolic (parathormone, growth hormone) medications have been developed to prevent and treat those people at risk (2).

Though relationship between osteoporosis and OA is presumed to be completely controversial with differences in risk factors; bone mineral density (BMD), body mass index (BMI), phenotype, morbidity and mortality, they share some epidemiological profiles and in both diseases bone metabolism plays a crucial role in the pathophysiology. Several recent reviews have summarized the extensive literature on cross-sectional and prospective cohort and population-based studies that discuss the relation between OA and osteoporosis. This relation is complex, in terms of BMI, BMD, bone loss, subchondral bone changes, genetic background, fracture risk and the role of mechanical and systemic factors. Furthermore, in the literature, there is considerable heterogeneity in the way OA is defined. OA is a heterogeneous disease in terms of staging (early versus late), location (weight-bearing versus nonweight-bearing and monoarticular versus polyarticular), definition (clinical and radiographic), classification (according to concomitant inflammation or sequential involvement of cartilage, bone and connective tissue), risk factors (local or systemic) and methods of imaging [radiography, magnetic resonance imaging (MRI), ultrasonography (USG)] (3).

In the Framingham study, it was found that femoral BMD was higher in those with osteophytosis of the knee, and that BMD is not necessarily associated with joint space narrowing among women (4). In the Rotterdam study, radiographic OA was associated with high BMD and also increased rate of bone loss (5). Both of these studies have the largest sample sizes with 1,154 and 2,745 patients respectively. There are some other studies with conflicting results (6-8).

This cross-sectional study observes the relationship between radiologic or ultrasonographic knee OA and osteoporosis of the lumbar and femoral regions. Concurrently, the correlation of ultrasonographic evaluation with demographic factors and disability is also investigated.

Materials and Methods

In this cross-sectional population based study, 118 female patients were included with knee OA according to 1986 ACR criteria who attended to our outpatient clinic (9). Demographic data as age, menopause status, current osteoporosis treatment and BMIs (kg/m^2) were checked. Radiologic staging of knee OA by Kellgren Lawrence (K-L) (10), ultrasonographic femoral cartilage thickness (FCT) by 11-MHz lineer transduser (GE Healthcare, Logiq P5), pain intensity evaluation by numeric pain scale (NPS) (11), disability evaluation by osteoarthritis index [Western Ontario and McMaster Universities Osteoarthritis index (WOMAC)] (12), quality of life measurement by Short Form-36 (SF-36) (13,14) and BMD measurement by dual-energy X-ray absorptiometry (DXA) (15) were done for each patient. The patients were seperated into 2 groups with (G1) or without osteoporosis (G2).

Inclusion criteria were to be female, ages between 50-75 and OA staging of K-L between 1 to 3 for knee OA. Exclusion criteria were; to be K-L staging 4, to have had a surgical procedure, concomittant inflammatory arthritis, plegia or neuropathic disorders and using glucosamine/chondroitin sulfate supplements. Uludağ University Clinical Research Ethics Committee approval was obtained for the study with the number of 2016-7/13 (date: 12.04.2016). All subjects who met the study criteria were informed of the nature of the study and a written consent was obtained.

Ultrasonographic evaluation was done by ultrasound while the patient lied in supine position with her knees in maximum flexion. The ultrasound probe was placed on the suprapateller region in axial plan in order to view the unechoic femoral cartilage between the cortex and the suprapatellar fat. The FCT was measured at medial, intercondylar and lateral regions to calculate the average thickness (Figure 1).

DXA measurements were done by Hologic Horizon Wi S/N 201290 at the university hospital radiology unit. T-scores below -2.5 for lumber total, femur neck (FN) and femur total (FT) BMDs were accepted as osteoporosis referring to World Health Organization classification criteria. The BMD value of the discrete/crushed vertebrae corpus was subtracted from the value of total lumbar BMD for not causing a wrong decision (Figure 2).

NPS is a one-dimensional 11-point numeric scale ranges from '0' representing 'no pain' to '10' representing the pain' as bad as you can imagine'. For construct validity, the NPS was shown to be highly correlated with the visual analogue scale in patients with rheumatic and other chronic pain conditions; correlations range from 0.86 to 0.95.

WOMAC is a disability scale for OA containing 3 parts; pain (5 questions), stiffness (2 questions) and physical function (17 questions) in which Likert scale between 0-4 is used for evaluation. The scores increse as the symptoms get worse. Validity and reliability study for Turkish version of WOMAC was published previously (12).

SF-36 is a measurement tool for quality of life containing totaly 36 questions in 8 divisions; physical functioning, physical role limitation, emotional role limitation, bodily pain, social functioning, mental health, vitality and general health. Scores

are between 0-100 while high scores match with better health status. Validity and reliability study for Turkish version of SF-36 was published previously (13,14).

Statistical Analysis

The statistical analyses were done with SPSS version 21.0. Shapiro-Wilk test was used to test the normality of variables. Descriptive statistics were explained as mean ± standard deviation or median (maximum-minimum) for normal distribution or not respectively. Pearson's chi-squared and Yates corrected chi-squared tests were used for descriptive statistics for cathegorical data of independent groups. One-Way ANOVA was used for double comparison of multivariate data. Kruskal-Wallis test was used for the comparison of multivariate data which were not normally distributed. Correlations between the normally distributed variables were calculated by Pearson correlation test. Spearman correlation test was used for the variables which were not normally distributed. The level of significance for all tests was taken as α=0.05.

Results

Totally 118 patients between the ages of 50-75 were included in the study. Fifty-eight patients with median age of 64.5 (50-75) had osteoporosis (group 1) and 60 patients with the median age of 62 (51-75) did not have (group 2). Thirty-five patients in the osteoporotic group were taking antiresorptive medication (29 of them were taking bisphosphonates and 6 of them were taking denosumab medication). Remaining 23 patients in group 2 were only taking vitamin pills irregularly. Patients in group 2 had higher BMI (p=0.000), worst WOMAC scores (pain, stiffness, function, total) (p=0.003, p=0.019, p=0.000, p=0.001 respectively) and lower SF-36 scores (physical function, physical role limitation, pain, social function) (p=0.008, p=0.017, p=0.006 respectively) baseline. FCT was not statistically different in both of the groups (Table 1).

Right knee K-L OA staging was as follows: 34 knees stage 1, 50 knees stage 2, 34 knees stage 3. Left knee K-L staging was as follows: 38 knees stage 1, 49 knees stage 2 and 31 knees stage 3. K-L staging of

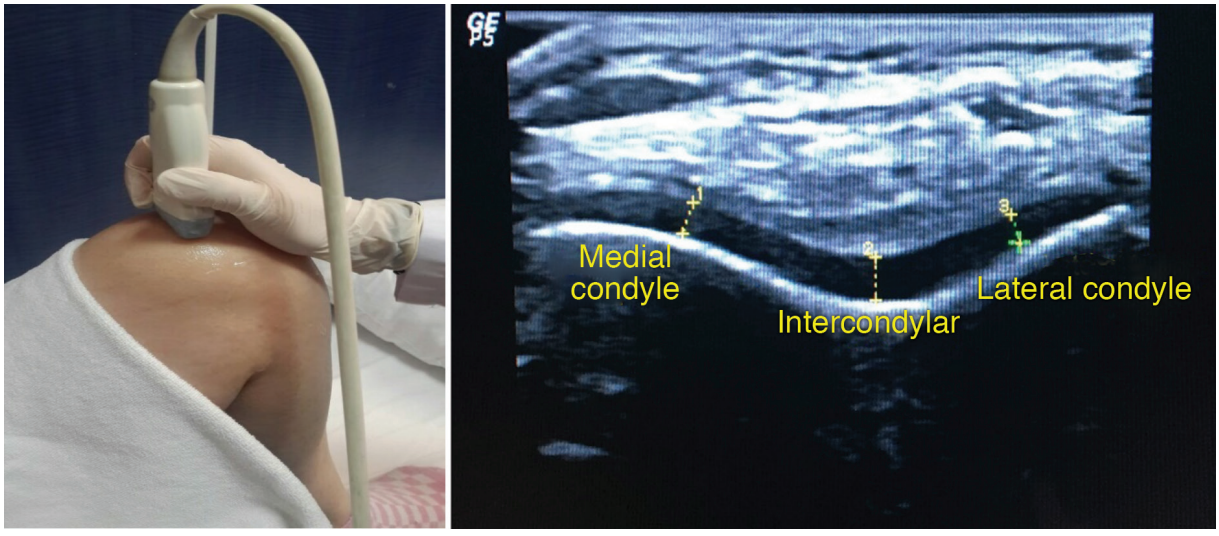

Figure 1. Positioning the ultrasonographic probe in axial plan and imaging the cartilage in 3 points

Figure 2. Bone mineral density and T-score measurement by dual-energy X-ray absorptiometry

the knees were in reverse relationship with osteoporosis according to T-scores. Osteoporosis decreased as the K-L stage increased. Femoral neck and lumbar total T-scores of BMD measurements were higher in the advanced stages of OA at both right and left knees (p=0.015 for FN and p=0.003 for LT T-scores of right knee, p=0.045 and p=0.012 for FN and LT T-scores of left knee). BMI had positive correlation with radiologic K-L grading (p<0.001). (Table 2).

In double comparisons of the variables; the right knees having grade 3 OA had higher FN T-scores when compared to knees with grade 2 OA (p=0.014). Similarly knees with grade 3 OA had better LT T-scores when compared to knees with grade 1 and 2 OA (p=0.05). In the left knees; patients with grade 3 OA had higher FN T-scores when compared to patients with grade 1 OA (p=0.041). Invariably grade 3 OA had higher LT T-scores when compared to grade 1 OA (p=0.003). Other double comparisons were statistically insignificant.

The correlation of FCT with demographic data, disability and general health variables put forth only BMI for consideration which was negatively correlated to FCT at the left knee (p=0.041, r=-0.189) (Table 3).

Discussion

In this cross-sectional observational study we determined that 1) knee OA patients without osteoporosis had worse scores in quality of life and disability when compared to the group of patients with osteoporosis in which higher BMI maybe the key factor, 2) there was a negative relationship between osteoporosis intensity and K-L staging of OA, 3) there was no significant correlation between FCT of the osteoarthritic knees and any other variables except BMI. 4) High BMI was in negative corelation with osteoporosis and FCT of the left knee.

The population-based Chingford study revealed the positive correlation between generalised OA and BMD in 1994 (16). In the Framingham study it was found that femoral BMD was higher in the group of female patients with knee OA with osteophytosis when compared to the group without

Table 1. Demographic variables and basic evaluations of the patients with knee OA according to the existence of concomittant osteoporosis

	Group 1 with OP (n=58) Median (min-max)/mean ± SD	Group 2 without OP (n=60) Median (min-max)/mean ± SD	p
Age	64.5 (50-75)	62 (51-75)	0.516
Menopause age	46.67±5.42	45.53±6.00	0.282
BMI (kg/m^2)	27.51 (20-40)	31.22 (23-42)	0.000
Right knee medial FCT (mm)	1.46±0.50	1.39±0.39	0.421
Right knee intercondylar FCT (mm)	1.60 (0.33-2.99)	1.73 (0.89-3.70)	0.228
Right knee lateral FCT (mm)	1.56 (0.22-2.74)	1.56 (0.80-2.92)	0.454
Right knee average FCT (mm)	1.54±0.44	1.61±0.38	0.370
Left knee medial FCT (mm)	1.44±0.49	1.40±0.35	0.667
Left knee intercondylar FCT (mm)	1.73±0.51	1.73±0.41	0.874
Left knee lateral FCT (mm)	1.39±0.44	1.47±0.42	0.319
Left knee average FCT (mm)	1.52±0.39	1.53±0.30	0.849
WOMAC-pain	2 (0-8)	3.5 (0.5-7.5)	0.003
WOMAC-stiffness	2.5 (0-10)	3.75 (0-10)	0.019
WOMAC-function	2.13 (0-6.91)	3.45 (0.44-6.91)	0.000
WOMAC-total	6.35 (0.5-23.38)	10.49 (0.94-22.37)	0.001
SF-36 physical function	55.0 (10-100)	42.5 (0-95)	0.008
SF-36 physical role limitation	100 (0-100)	0 (0-100)	0.017
SF-36 pain	51.0 (22-100)	41.0 (2-84)	0.006
SF-36 general health	61.0 (15-82)	60 (5-86)	0.326
SF-36 energy	45.0 (0-95)	40.0 (0-90)	0.320
SF-36 social function	87 (25-100)	68.5 (25-100)	0.040
SF-36 emotional role limitation	100 (0-100)	100 (0-100)	0.191
SF-36 mental health	72.0 (20-180)	60.0 (14-100)	0.710

OA: Osteoarthritis, OP: Osteoporosis, BMI: Body mass index, FCT: Femoral cartilage thickness, SF-36: Short Form-36, WOMAC: Western Ontario and McMaster Üniversity Osteoarthritis index, min: Minimum, max: Maximum, SD: Standard deviation

osteophytosis (4). In 2 of the osteoporotic fracture studies it was found that patients with coxarthrosis had higher BMD but fracture risk has remained the same (17,18). This last result was also supported by Rotterdam study in which it was come to a conclusion that vertebral and nonvertebral fracture risk was higher in the patients with knee OA, independent of the BMD variables (5). High BMI, genetic factors, subchondral sclerozis and sitokines like IGF-1 and TGF-B are assumed to be the risk factors for OA, though the relationship with the BMD still remains partly undefined (19). In our study it was found that later stages of OA was positively correlated with higher BMD, supporting the Chingford and Framingham studies (4,16). The hypothesis of negative correlation between OA and osteoporosis was corroborated.

Another study revealed that later stages of knee OA was together with lower proximal femoral BMD scores ipsilaterally because of not using the extremity to avoid pain. The lomber BMD was not influenced by this result (20). There is positive and strong evidence that osteophytosis may be with or cause higher BMD (21). High BMI (obesity) is a very important risk factor for OA while it is a relative protective factor for osteoporosis (22,23). Bone mineral loss slows in the patients with excessive fat tissue producing estrogen which is responsible for the release of IGF-1 and TGF-B from the osteblasts and by mitogenic response to leptin and hyperinsulinemia (24,25). Obesity may cause degenerative processes like OA which may be also related to high adipokine levels and inflammation (26). Because it is also a disability determinant and pain generator by mechanic and metabolic reasons, Osteoarthritis Research Society International recommend to get weight loss by at least 5% in 20 weeks time (27).

In the literature, there is a moderate-strong correlation between reliability of MRI and USG for evaluation of the FCT. Middle

Table 2. K-L staging of the right and left knees and their relation with the BMD T-scores

	FN (T-score) Mean ± SD	LT (T-score) Mean ± SD	FT (T-score) Mean ± SD	BMI (kg/m²) Mean ± SD
Right knee K-L stage 1 (n=34)	-1.40±1.06	-2.04±1.10	-0.87±1.10	27.79±17.41
Right knee K-L stage 2 (n=50)	-1.50±0.94	-2.03±0.94	-1.03±0.95	29.29±18.45
Right knee K-L stage 3 (n=34)	-0.80±1.47	-1.22±1.39	-0.48±1.11	31.92±20.72
p	0.015	0.003	0.066	0.000
Left knee K-L stage 1 (n=38)	-1.47±1.17	-2.5 (-3.8-0.1)	-0.93±1.13	27.75±18.41
Left knee K-L stage 2 (n=49)	-1.43±0.80	-2.1 (-3.1-0.9)	-0.94±0.87	29.28±17.61
Left knee K-L stage 3 (n=31)	-0.84±1.45	-1.3 (-4.5-2.0)	0.54±1.12	31.91±22.30
p	0.045	0.012	0.206	0.001

K-L: Kellgren Lawrence, FN: Femur neck, LT: Lomber total, FT: Femur total, SD: Standard deviation, BMI: Body mass index

Table 3. Correlation of FCT with demographic variables, quality of life and disability scores

	Right knee FCT		Left knee FCT	
	r	p	r	p
Age	-0.096	0.301	-0.052	0.173
BMI	-0.158	0.088	-0.189	0.041
NPS	0.064	0.494	-0.060	0.518
WOMAC-pain	0.100	0.281	0.083	0.374
WOMAC-stiffness	0.001	0.992	0.013	0.893
WOMAC-function	0.058	0.531	0.034	0.716
WOMAC-total	0.060	0.519	0.044	0.637
SF-36 physical function	-0.070	0.453	-0.020	0.828
SF-36 physical role limitation	0.054	0.560	0.022	0.811
SF-36 pain	-0.020	0.832	0.001	0.992
SF-36 general health	-0.014	0.882	0.079	0.393
SF-36 energy	0.052	0.574	0.102	0.272
SF-36 social function	-0.007	0.942	-0.021	0.818
SF-36 emotional role limitation	0.042	0.655	0.063	0.499
SF-36 mental health	0.136	0.141	0.161	0.081

FCT: Femoral cartilage thickness, SF-36: Short Form-36, WOMAC: Western Ontario and McMaster University Osteoarthritis index, BMI: Body mass index, r: Correlation coefficient, NPS: Numeric pain scale

intercondyller notch seems to be the best anatomic place to measure (28,29). In this study USG is preferred for evaluation because of its reliability, repeatibility and cheapness.

Dequeker et al. (24) claimed that excessively high subchondral bone density may cause progressive chondrocyte disfunction in the early stages of cartilage destruction. Increase of the peak mechanical stress at the cartilage of the weight bearing bone with high BMD plays the major role in OA (30). Some other studies have contradictory results in which low BMD means high bone remodelization, with similar accelerating effect on cartilage turnover and inadequate restoration (3,31,32).

These literature knowledge reveals the conflicting and complex relationship between these 2 diseases with several contributing factors in the intersecting etiology such as metabolic, mechanical, genetic or endocrinologic. Low BMI is a risk factor for osteoporosis while high BMI is a risk factor for OA progression as also explained in our study. There was not an association between ultrasonographic FCT and osteoporosis in our study similar to another submitted study by Çarlı et al. (33).

Study Limitations

Limitations of the study were; patients having antiresorptive medication were not excluded, and the sample size is relatively low according to these type of observational studies. Bisphosphonates are antiresorptive agents used for treating osteoporosis and have inhibition effect on osteoklasts. Because it's thought that antiresorptive medication decreases both bone and cartilage turnover, it's reasonable to think that supression of the subchondral bone remodeling may cause a common advantage by delaying the subchondral bone sclerozis and osteophyte formation in OA and may have changed the long term clinic progress (34-39).

Conclusion

Later stages of OA may be positively correlated with high BMD but this is still a question in dispute that if it is a cause or a result? As a conclusion, high BMI may lead to OA progression and disability but has protective effect for osteoporosis. There is also a reason to think that, DXA BMD measurements may be false negative in later stages of OA, because of osteophytosis and subchondral bone sclerozis. There is a need for studies evaluating ultrasonographic FCT with larger sample sizes and may be combined with laboratory detection of cartilage destruction products and its relationship with osteoporosis medication.

Ethics

Ethics Committee Approval: Uludağ University Clinical Research Ethics Committee approval was obtained for the study with the number of 2016-7/13 (date: 12.04.2016).

Informed Consent: All subjects who met the study criteria were informed of the nature of the study and a written consent was obtained.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: G.A.Ö., Concept: A.A., G.A.Ö., Design: A.A., G.A.Ö., Data Collection or Processing: A.A., G.A.Ö., Analysis or Interpretation: A.A., G.A.Ö., Literature Search: A.A., G.A.Ö., Writing: A.A.

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References

1. Man GS, Mologhianu G. Osteoarthritis pathogenesis - a complex process that involves the entire joint. J Med Life 2014;7:37-41.
2. Kanis JA, Glüer CC. An update on the diagnosis and assessment of osteoporosis with densitometry. Committee of Scientific Advisors, International Osteoporosis Foundation. Osteoporos Int 2000;11:192-202.
3. Bellido M, Lugo L, Roman-Blas JA, Castañeda S, Caeiro JR, Dapia S, et al. Subchondral bone microstructural damage by increased remodelling aggravates experimental osteoarthritis preceded by osteoporosis. Arthritis Res Ther 2010;12:R152.
4. Hannan MT, Anderson JJ, Zhang Y, Levy D, Felson DT. Bone mineral density and knee osteoarthritis in elderly men and women. The Framingham Study. Arthritis Rheum 1993;36:1671-80.
5. Burger H, van Daele PL, Odding E, Valkenburg HA, Hofman A, Grobbee DE, et al. Association of radiographically evident osteoarthritis with higher bone mineral density and increased bone loss with age. The Rotterdam Study. Arthritis Rheum 1996;39:81-6.
6. Im GI, Kim MK. The relationship between osteoarthritis and osteoporosis. J Bone Miner Metab 2014;32:101-9.
7. Geusens PP, van den Bergh JP. Osteoporosis and osteoarthritis: shared mechanisms and epidemiology. Curr Opin Rheumatol 2016;28:97-103.
8. Ferrari AG, Cossiolo DC, Silva MKP, da Silva DC. Osteoartritephysiopathology: reviewarticle. MOJ OrthopRheumatol 2018;10:307-9.
9. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. Arthritis Rheum 1986;29:1039-49.
10. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthrosis. Ann Rheum Dis 1957;16:494-502.
11. Ferraz MB, Quaresma MR, Aquino LR, Atra E, Tugwell P, Goldsmith CH. Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis. J Rheumatol 1990;17:1022-4.
12. Tüzün EH, Eker L, Aytar A, Daşkapan A, Bayramoğlu M. Acceptability, reliability, validity and responsiveness of the Turkish version of WOMAC osteoarthritis index. Osteoarthritis Cartilage 2005;13:28-33.
13. Lins L, Carvalho FM. SF-36 total score as a single measure of health-related quality of life: Scoping review. SAGE Open Med 2016;4:2050312116671725.
14. Çelik D, Çoban Ö. Short Form Health Survey version-2.0 Turkish (SF-36v2) is an efficient outcome parameter in musculoskeletal research. Acta Orthop Traumatol Turc 2016;50:558-61.
15. Dasher LG, Newton CD, Lenchik L. Dual X-ray absorptiometry in today's clinical practice. Radiol Clin North Am 2010;48:541-60.
16. Hart DJ, Mootoosamy I, Doyle DV, Spector TD. The relationship between osteoarthritis and osteoporosis in the general population: the Chingford Study. Ann Rheum Dis 1994;53:158-62.
17. Nevitt MC, Lane NE, Scott JC, Hochberg MC, Pressman AR, Genant HK, et al. Radiographic osteoarthritis of the hip and bone mineral

density. The Study of Osteoporotic Fractures Research Group. Arthritis Rheum 1995;38:907-16.
18. Arden NK, Nevitt MC, Lane NE, Gore LR, Hochberg MC, Scott JC, et al. Osteoarthritis and risk of falls, rates of bone loss, and osteoporotic fractures. Study of Osteoporotic Fractures Research Group. Arthritis Rheum 1999;42:1378-85.
19. Deng ZH, Zeng C, Li YS, Yang T, Li H, Wei J, et al. Relation between phalangeal bone mineral density and radiographic knee osteoarthritis: a cross-sectional study. BMC Musculoskelet Disord 2016;17:71.
20. Im GI, Kwon OJ, Kim CH. The relationship between osteoarthritis of the knee and bone mineral density of proximal femur: a cross-sectional study from a Korean population in women. Clin Orthop Surg 2014;6:420-5.
21. Hardcastle SA, Dieppe P, Gregson CL, Arden NK, Spector TD, Hart DJ, et al. Osteophytes, enthesophytes, and high bone mass: a bone-forming triad with potential relevance in osteoarthritis. Arthritis Rheumatol 2014;66:2429-39.
22. Rexhepi S, Bahtiri E, Rexhepi M, Sahatciu-Meka V, Rexhepi B. Association of Body Weight and Body Mass Index with Bone Mineral Density in Women and Men from Kosovo. Mater Sociomed 2015;27:259-62.
23. Tariq S, Tariq S, Lone KP. Relationship of anthropometric measures with bone mineral density in postmenopausal non-osteoporotic, osteopenic and osteoporotic women. J Pak Med Assoc 2017;67:590-4.
24. Dequeker J, Johnell O, Dilsen G, Gennari C, Lopes Vaz AA, Lyritis G, et al. Osteoarthritis protects against femoral neck fracture: The MEDOS study experience. Bone 1993;14(Suppl 1):51-6.
25. Considine RV, Sinha MK, Heiman ML, Kriauciunas A, Stephens TW, Nyce MR, et al. Serum immunoreactive-leptin concentrations in normal-weight and obese humans. N Engl J Med 1996;334:292-5.
26. Poonpet T, Honsawek S. Adipokines: Biomarkers for osteoarthritis? World J Orthop 2014;5:319-27.
27. McAlindon TE, Bannuru RR, Sullivan MC, Arden NK, Berenbaum F, Bierma-Zeinstra SM, et al. OARSI guidelines for the non-surgical management of knee osteoarthritis. Osteoarthritis Cartilage 2014;22:363-88.
28. Schmitz RJ, Wang HM, Polprasert DR, Kraft RA, Pietrosimone BG. Evaluation of knee cartilage thickness: A comparison between ultrasound and magnetic resonance imaging methods. Knee 2017;24:217-23.
29. Pradsgaard DØ, Fiirgaard B, Spannow AH, Heuck C, Herlin T. Cartilage thickness of the knee joint in juvenile idiopathic arthritis: comparative assessment by ultrasonography and magnetic resonance imaging. J Rheumatol 2015;42:534-40.
30. Sambrook P, Naganathan V. What is the relationship between osteoarthritis and osteoporosis? Baillieres Clin Rheumatol 1997;11:695-710.
31. Lo GH, Hunter DJ, Zhang Y, McLennan CE, Lavalley MP, Kiel DP, et al. Bone marrow lesions in the knee are associated with increased local bone density. Arthritis Rheum 2005;52:2814-21.
32. Cao Y, Stannus OP, Aitken D, Cicuttini F, Antony B, Jones G, et al. Cross-sectional and longitudinal associations between systemic, subchondral bone mineral density and knee cartilage thickness in older adults with or without radiographic osteoarthritis. Ann Rheum Dis 2014;73:2003-9.
33. Çarlı AB, Akarsu S, Tekin L, Sağlam M, Kıralp MZ, Özçakar L. Ultrasonographic assessment of the femoral cartilage in osteoarthritis patients with and without osteoporosis. Aging Clin Exp Res 2014;26:411-5.
34. Saag KG. Bisphosphonates for osteoarthritis prevention: "Holy Grail" or not? Ann Rheum Dis 2008;67:1358-9.
35. Carbone LD, Nevitt MC, Wildy K, Barrow KD, Harris F, Felson D, et al. The relationship of antiresorptive drug use to structural findings and symptoms of knee osteoarthritis. Arthritis Rheum 2004;50:3516-25.
36. Lampropoulou-Adamidou K, Dontas I, Stathopoulos IP, Khaldi L, Lelovas P, Vlamis J, et al. Chondroprotective effect of high-dose zoledronic acid: An experimental study in a rabbit model of osteoarthritis. J Orthop Res 2014;32:1646-51.
37. Shirai T, Kobayashi M, Nishitani K, Satake T, Kuroki H, Nakagawa Y, et al. Chondroprotective effect of alendronate in a rabbit model of osteoarthritis. J Orthop Res 2011;29:1572-7.
38. Lehmann HJ, Mouritzen U, Christgau S, Cloos PA, Christiansen C. Effect of bisphosphonates on cartilage turnover assessed with a newly developed assay for collagen type II degradation products. Ann Rheum Dis 2002;61:530-3.
39. Fujita T, Ohue M, Fujii Y, Miyauchi A, Takagi Y. Analgesic and chondroprotective effects of risedronate in osteoarthritis assessed by electroalgometry and measurement of collagen type II fragments in urine. J Int Med Res 2008;36:932-41.

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Neuropathic Pain After Total Knee Arthroplasty: A Cross-sectional Study in Female Patients

Total Diz Artroplasti Sonrası Nöropatik Ağrı: Kadın Hastalarda Kesitsel Bir Çalışma

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Abstract

Objective: This study aimed to investigate the presence of neuropathic pain (NP) in female patients after total knee arthroplasty (TKA) along with NP-associated factors.

Materials and Methods: In total, 85 female patients who underwent TKA due to knee osteoarthritis were included in this study. Socio-demographic factors along with medical and psychological comorbidities were investigated. Pain levels were assessed using the visual analogue scale (VAS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain scales. The functional status was assessed using the WOMAC physical function scales. Importantly, the presence of NP was assessed using the PainDETECT questionnaire. The emotional status of the patients was assessed using the hospital anxiety depression scale.

Results: In total, 9 (10.6%) patients were classified as having likely NP and 14 (16.5%) as having possible NP. The PainDETECT scores were significantly correlated with the preoperative VAS scores (p=0.004), WOMAC pain (p=0.000) and physical function scores (p=0.007) and presence of depression (p=0.021) Furthermore, the PainDETECT scores were significantly negatively correlated with the period after arthroplasty (p=0.033). No correlation was found between NP and socio-demographic factors and medical comorbidities.

Conclusion: Patients with NP had a shorter period after arthroplasty, depression, an increased severity of pain and a decreased physical function. The presence of NP in the patients who underwent TKA should be considered and associated factors should be evaluated.

Keywords: Neuropathic pain, total knee arthroplasty, functional status, depression

Öz

Amaç: Çalışmanın amacı total diz protezinden (TKA) sonra nöropatik ağrı (NP) varlığını ve NP'nin sosyo-demografik faktörler, fiziksel fonksiyon, medikal ve psikolojik komorbiditeler ile ilişkisini araştırmaktır.

Gereç ve Yöntem: Diz osteoartriti nedeni ile TKA olan 85 kadın hasta çalışmaya dahil edildi. Sosyo-demografik faktörler, medikal ve psikolojik komorbiditeler sorgulandı. Ağrı şiddeti görsel analog skala (VAS) ve Western Ontario ve McMaster Üniversiteleri Artrit İndeksi (WOMAC) ağrı skalası ile, fonksiyonel durum WOMAC fiziksel fonksiyon skalası ile, NP varlığı PainDETECT Ağrı anketi ile, hastaların emosyonel durumu hastane anksiyete depresyon skalası ile değerlendirildi.

Bulgular: Dokuz hasta (%10,6) NP pozitif, 14 hasta (%16,5) muhtemel NP olarak sınıflandırıldı. PainDETECT skorları ile operasyon öncesi VAS skorları (p=0,004), WOMAC ağrı (p=0,000) ve fiziksel fonksiyon skorları (p=0,007) ve depresyon varlığı (p=0,021) arasında anlamlı pozitif korelasyon, artroplastiden sonra geçen zaman ile arasında negatif korelasyon (p=0.033) saptandı. NP ve sosyo-demografik faktörler ve medikal komorbiditeler arasında ilişki saptanmadı.

Sonuç: Bu çalışmanın sonuçları TKA sonrası bazı hastalarda NP olduğunu gösterdi. NP'si olan hastaların artroplasti sonrası dönemin daha kısa olduğu ve bu hastaların depresyonu olduğu, ağrı ve disabilitesinin artmış olduğu saptandı. TKA hastalarında NP varlığı düşünülmeli ve ilişkili faktörler değerlendirilmelidir. TKA sonrası ağrı tedavisinde NP için uygun tedavi stratejileri dahil edilmelidir.

Anahtar kelimeler: Nöropatik ağrı, total diz artroplastisi, fonksiyonel durum, depresyon

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Introduction

Total knee arthroplasty (TKA) is usually performed in patients with end-stage osteoarthritis of the knee when conservative treatments are insufficient. Severe pain is one of the most important causes for arthroplasty in patients with end-stage osteoarthritis (1). Some patients continue to complain of pain in the operated joint after TKA (2-5). Although this pain can be inflammatory, nociceptive or neuropathic in nature, the most common diagnosis is neuropathic pain (NP) in patients with chronic pain after knee surgery (6). NP does not usually respond to simple analgesics and specific management strategies are needed (7). Peripheral nerve injury during surgery or impaired pain modulation with central sensitization can cause NP (8-10). Due to the characteristic complaints of NP reported by our patients, we consider that there is a NP component in the pain of knee after arthroplasty. The prevalence of NP after TKA was analyzed in the review of Drosos et al. (11). Mentioned review reported that NP exists in a significant proportion of patients for years after TKA. Although the literature suggests that NP peaks at between six weeks and three-months after TKA (7,12), the presence of NP in the long-term follow-up period after TKA is not underestimated for pain management. Therefore we designed a prospective study involving a cohort of patients underwent TKA at least one year ago.

The risk factors for persistent pain after knee arthroplasty have been identified (1,13) in some studies. To our knowledge, a limited number of studies have evaluated the relationship between risk factors and NP after TKA (14). No firm conclusions were reported about the prevalence of NP and the related factors due to the heterogeneity of the studies in the literature (11). The risk factors of NP due to TKA should be determined to obtain successful results after TKA (14).

Our objectives were to examine first the presence of NP at least one year after TKA and second its association with socio-demographic factors, physical function, medical and psychological comorbidities.

Materials and Methods

A total of 85 female patients with TKA evaluated in the study. Ethical approval was obtained from the Ankara Physical Medicine and Rehabilitation Training and Research Hospital Ethics Committee (decision no: 5995, date: 29.12.2014). A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki. All patients underwent artroplasty due to knee osteoarthritis at least one year ago.

The exclusion criteria were presence of inflammatory diseases, radiculopathies, vitamin B12 deficiency, coxarthrosis, neurological conditions and receiving medical treatment for NP.

Socio-demographic factors including age,job,education, body mass index (BMI), marital status and medical (hearth disease, hypertension, diabetes mellitus, chronic obstructive pulmonary disease, thyroid dysfunction, osteoporosis, hypercholesterolaemia) and psychological (anxiety and depression) comorbidities were questioned. All patients completed the visual analog scale (VAS) for pain at preoperation and postoperation, Western Ontario and McMaster Universities osteoarthritis index (WOMAC) scale, the PainDETECT questionnaire (PDQ) and the hospital anxiety depression scale (HADS).

The VAS was used to assess the preoperative and post-operative pain levels. It consists of a 10 cm line, with the left extreme indicating "no pain or zero" and the right extreme indicating "unbearable pain or 10" (15).

WOMAC scale was used to assess the functional status. It is divided into 3 subgroups that address pain, stiffness and physical functionality. It consists of 24 questions including 5 questions for the pain subgroup, 2 questions for the stiffness subgroup, and 17 questions for the physical functionality subgroup. Each item is recorded using a 5-point Likert form, 0 is none while 4 is extreme pain, with 0 as the best and 96 as the worst. The Turkish reliability and validity studies were conducted (16).

PDQ is a scale to evaluate NP experienced by paints in the preceding four weeks. It contains a body drawing for patients to indicate the sites of pain and any radiation present, assessment of pain quality with a marker of severity from hardly noticed to very strongly, pattern of pain and measures of current, worst and average pain severity. The PainDETECT score ranged from 0 to 38. Score ≥19 indicate likely NP, score ≥13 to ≤18 indicate possible NP, score ≤12 indicate unlikely NP (17). The Turkish version of the PDQ and validation were proven by Alkan et al. (18).

HADS is a scale to assess the emotional status of the patient's. It consists of 2 subscales containing questions about anxiety (7 items) and depression (7 items). Items are recorded using a 4-point Likert form ranging from 0 to 3. Seven point is used as the cut-off score for depression subscale and 10 point for anxiety subscale (19).

Statistical Analysis

SPSS version 20.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analyses. Distributions of continuous variables were evaluated by the Shapiro-Wilk test. Continuous variables were expressed as mean ± standard deviation; discrete variables as median (minimum-maximum), and categorical variables as number (n) and percentage (%). One-Way ANOVA and chi-square tests were used to evaluate demographic and clinical characteristics of patients between the three NP groups (likely, possible and unlikely NP). The linear relationships between PainDETECT scores and other clinical variables were evaluated with Pearson correlation analysis. Multiple regression analysis was used to investigate the clinical and socio-demographical factors affecting PainDETECT scores. A p-value of <0.05 was evaluated as statistically significant.

Results

Eighty five female patients with a mean age of 70.28±7.22 years were included in the study. All patients had knee pain

after arthroplasty, 9 (10.6%) patients were classified as having likely NP, 14 (16.5%) patients were classified as having possible NP and 62 (72.9%) patients were classified as unlikely NP (nociceptive group). Average duration after arthroplasty was 5.48±3.83 years. Socio-demographic characteristics and clinical properties of the patients are shown in Table 1. Demographic and clinical characteristics of patients based on PainDETECT scores are shown in Table 2. When we divided patients into three groups according to the PainDETECT scores, there was no statistically significant difference in demographic features between three groups. There were statistically significant differences in WOMAC pain score ($p<0.001$) and WOMAC physical function score ($p<0.001$) between NP groups (group 2 and 3) and nociceptive group (group 1). In addition, there were statistically significant differences in depression ($p<0.001$) and anxiety scores of HAD ($p=0.004$) between group 1 (nociceptive group) and group 3 (likely NP group).

Table 1. Socio-demographic characteristics and clinical properties of the patients

	Mean ± SD	n (%)
Body mass index (kg/m^2)	33.8±4.7	-
Age (year)	70.2±7.2	-
Work status		
Housewife	-	81 (95.3)
Retired	-	4 (4.7)
Educational status		
Illiterate	-	22 (25.9)
Primary school	-	57 (67.1)
High school-university	-	6 (7.1)
Time frame	5.4±3.8	-
Preop VAS	9.2±0.8	-
Post-op VAS	2.7±2.1	-
HADS	18.6±8.1	-
HADS scores		
Depression	9.0±3.8	-
Anxiety	9.7±5.4	-
WOMAC scores	-	-
Pain	5.3±3.7	-
Physical function	27.2±10.9	-
PainDETECT Q scores	6.8±7.3	-
PDQ groups		
Unlikely neuropathic pain	-	62 (72.9)
Possible neuropathic pain	-	14 (16.5)
Likely neuropathic pain	-	9 (10.6)

SD: Standard deviation, VAS: Visual analog scale, HADS: The hospital anxiety and depression scale, WOMAC: Western Ontario and McMaster Universities osteoarthritis index, PDQ: PainDETECT questionnaire. Likely neuropathic pain (score ≥19), possible neuropathic pain (score ≥13 to ≤18), and unlikely neuropathic pain (score ≤12)

The correlation analysis with PainDETECT scores is shown in Table 3. The PainDETECT scores were significantly correlated with the preoperative VAS scores, WOMAC pain and physical function scores and presence of depression. The PainDETECT scores were significantly negatively correlated with time frame after arthroplasty. There was no correlation between PDQ scores and age or presence of anxiety.

Discussion

Our study results showed that patients with shorter time frame after TKA had NP in their joint pain and that patients who reported NP exhibited increased pain, decreased physical function and presence of depression compared with patients who reported nociceptive pain. We found no relationship between NP and socio-demographic factors or medical comorbidities.

The prevalence of NP after TKA ranges from 6-49% in previous studies (20,21). Wylde et al. (20) found that 6% of patients had NP 3-4 years after TKA. Pinto et al. (21) reported that NP was seen in 49% of patients, according to the Neuropathic Pain Questionnaire 4-6 months after TKA. Using the PDQ score, the rate of NP was determined to be 15.3% of all patients after TKA in the study of Albayrak et al. (14). In our study the prevalence of NP was 10.6% at least one year after TKA (Average duration after arthroplasty was 5.48±3.83 years). Our study confirms the presence of NP after TKA and indicates that NP can exist in the long-term follow-up period after TKA. Differences in assessment tools and post-surgical time frames may explain the discrepancies among these studies. Peripheral nerve injury during surgery or impaired pain modulation with central sensitization can cause NP (8).

The association between preoperative pain and NP after TKA has been reported difference in studies (12,14). In our study, patients with high preoperative VAS scores exhibited NP after TKA. Thus preoperative pain may be considered as a risk factor of NP after TKA. Severe pain before operation may change the somatosensory system, impair pain modulation, and increase the risk of chronic pain even after operation (6).

The effect of socio-demographic factors on pain after TKA has been examined in several studies (7,13,22-28). A better understanding of risk factors for NP is critical to allow patients to have appropriate expectations of TKA. Previous studies reported that gender and age did not predict the development of NP after TKA (22,23). Some studies showed that marital status, educational level and occupation may play roles in pain after TKA (26,27). Another study showed that age and obesity do not have a negative impact on pain after TKA (24). In our study, there was no difference in age, BMI, educational level, marital status and job between groups. We consider that this may be a result of all of our patients were female and most of them being housewives and having a low level of education.

The association between the medical comorbidities and persistent pain after TKA has been investigated in the literatures (13,22). However, it is unknown which comorbidities are associated with NP after TKA. Heart disease, anxiety and depression were

Table 2. Demographic and clinical characteristics of patients based on PainDETECT scores

	Unlikely NP (n=62) Nociceptive group	Possible NP (n=14)	Likely NP (n=9)	p
Age (year)	70.72±6.93	69.21±8.49	68.88±7.65	0.16
Marital status				
Maried	43 (69.4)	7 (50)	5 (55.6)	0.32
Widowed	19 (30.6)	7 (50)	4 (44.4)	
BMI (kg/m^2)	33.37±4.53	35.28±5.96	34.95±3.79	0.30
Educational status				
Illiterate	13 (21)	6 (42.9)	3 (33.3)	0.43
Primary school	44 (71)	7 (50)	6 (66.7)	
High school	5 (8)	1 (7.1)	0	
Work status				
Housewife	58 (93.5)	14 (100)	9 (100)	0.45
Retired	4 (6.5)	-	-	
ROM flexion	102.33±16.78	103.92±12.27	92.77±13.48	0.12
Time after arthroplasty (year)	5.2±3.72	7.21±4.11	4.7±3.88	0.63
Preop VAS	9.16±0.83	9.71±0.61	9.55±1.01	0.28
Post-op VAS	1.9±1.46	4.2±1.58	5.77±1.56	0.63
Comorbidites				
Diabetes mellitus	22 (35.5)	7 (50)	2 (22.2)	0.35
Hypertension	41 (66.1)	10 (71.4)	8 (88.9)	0.40
Thyroid disorders	19 (30.6)	1 (7.1)	2 (22.2)	0.18
Hearth disease	12 (19.4)	0	1 (11.1)	0.14
Chronic obstructive pulmonary disease	7 (11.3)	1 (7.1)	1 (11.1)	1
WOMAC pain	3.83±2.80	9.21±3.49	9±9.44	<0.001[a,b]
WOMAC physical function	23.88±9.6	32.52±8.96	41.88±6.37	<0.001[a,b]
HAD total	16.87±7.24	20.57±8.17	27.66±8.3	<0.001[b]
HAD depression	8.04±3.44	10.42±2.95	13.44±3.84	<0.001[b]
HAD anxiety	8.83±4.92	10.21±6	15.11±5.08	0.004[b]

[a]Significant differences between possible NP group and unlikely NP group, [b]significant differences between likely NP group and unlikely NP group. BMI: Body mass index, ROM: Range of motion, HAD: The hospital anxiety and depression, WOMAC: Western Ontario and McMaster Universities osteoarthritis index, VAS: Visual analog scale, NP: Neuropathic pain

Table 3. The regression analysis with PainDETECT scores

Unstandardized coefficients standard error			95% CI	
	B	p	Lower	Upper
	-21.323	0.013	-38.038	-4.609
Age	-0.022	0.772	-0.173	0.129
Time after arthroplasty	-0.318	0.033	-0.609	-0.027
Preop VAS	2.015	0.004	0.676	3.355
HAD depression	0.438	0.021	0.067	0.810
HAD anxiety	-0.110	0.370	-0.353	0.133
WOMAC pain	0.915	0.000	0.532	1.297
WOMAC physical function	0.182	0.007	0.052	0.311

CI: Confidence interval, HAD: The hospital anxiety and depression, WOMAC: Western Ontario and McMaster Universities osteoarthritis index, VAS: Visual analog scale

reported as risk factors for persistant pain after TKA in the study of Singh and Lewallen (13). Depression has been reported to affect the pain after TKA in several studies (22,23,28,29). But Philips et al. (7) did not find any significant influence of depression on persistant pain in their study. Although there was no association between comorbidities and NP after TKA in the study of Helen Razmjou, they found that the NP group had higher levels of depression in their study (22). Consistent with this study we found that depression was associated with NP after TKA, but we didn't find any correlation between other comorbidities and NP in the TKA patients. According to these findings,we consider that depression may be a risk factor for NP after TKA, can set the scene for chronic pain and should be identified and treated. The effect of other comorbidities on NP after TKA requires further examination. Previous studies showed that patients with NP after TKA reported higher levels of pain and physical dysfunction as measured by domains of the WOMAC (22,23). Our results are consistent with these studies in terms of the relation between NP and increased severity of pain and physical dysfunction after TKA.

Study Limitations

Our study has some limitations. First, all of our patients were female and sample size was small. The results may be different in larger sample size with male patients. Second, TKA were undertaken by different surgeons and the complications after TKA were not controlled. These parameters may effect the evaluation of pain. And another limitation was the lack of control group who do not have any pain after TKA. Further research using a larger sample size with control group is suggested.

Conclusion

Our findings highlight the importance of an assessment of NP after TKA. NP was related to preoperative pain and depression. Patients reporting NP showed increased severity of pain and decreased physical function. Therefore, the presence of NP in the TKA patients should be considered and assosiated factors should be evaluated. Once it is determined, appropriate intervention strategies for NP should be incorporated in the treatment of persistent pain after TKA.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Ankara Physical Medicine and Rehabilitation Training and Research Hospital Ethics Committee (decision no: 5995, date: 29.12.2014).

Informed Consent: A written informed consent was obtained from each patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: C.S.P., Concept: C.S.P., B.F.K., Design: C.S.P., B.F.K., Data Collection or Processing: C.S.P., E.U.A., Analysis or Interpretation: C.S.P., D.S.Ö., Ş.Ş.O., Literature Search: C.S.P., B.F.K., Ş.Ş.O., Writing: C.S.P., D.S.Ö.

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References

1. Lewis GN, Rice DA, McNair PJ, Kluger M. Predictors of persistent pain after total knee arthroplasty: a systematic review and meta-analysis. Br J Anaesth 2015;114:551-61.
2. Pinto PR, McIntyre T, Ferrero R, Almeida A, Araújo-Soares V. Risk factors for moderate and severe persistent pain in patients undergoing total knee and hip arthroplasty: a prospective predictive study. PLoS One 2013;8:e73917.
3. Protzman NM, Gyi J, Malhotra AD, Kooch JE. Examining the feasibility of radiofrequency treatment for chronic knee pain after total knee arthroplasty. PM R 2014;6:373-6.
4. Chughtai M, Elmallah RD, Mistry JB, Bhave A, Cherian JJ, McGinn TL, et al. Nonpharmacologic Pain Management and Muscle Strengthening following Total Knee Arthroplasty. J Knee Surg 2016;29:194-200.
5. Beswick AD, Wylde V, Gooberman-Hill R, Blom A, Dieppe P. What proportion of patients report long-term pain after total hip or knee replacement for osteoarthritis? A systematic review of prospective studies in unselected patients. BMJ Open 2012;2:e000435.
6. Vergne-Salle P. Management of neuropathic pain after knee surgery. Joint Bone Spine 2016;83:657-63.
7. Phillips JR, Hopwood B, Arthur C, Stroud R, Toms AD. The natural history of pain and neuropathic pain after knee replacement: a prospective cohort study of the point prevalence of pain and neuropathic pain to a minimum three-year follow-up. Bone Joint J 2014;96-B:1227-33.
8. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet 2006;367:1618-25.
9. Haroutiunian S, Nikolajsen L, Finnerup NB, Jensen TS. The neuropathic component in persistent postsurgical pain: a systematic literature review. Pain 2013;154:95-102.
10. Wright A, Moss P, Sloan K, Beaver RJ, Pedersen JB, Vehof G, et al. Abnormal quantitative sensory testing is associated with persistent pain one year after TKA. Clin Orthop Relat Res 2015;473:246-54.
11. Drosos GI, Triantafilidou T, Ververidis A, Agelopoulou C, Vogiatzaki T, Kazakos K. Persistent post-surgical pain and neuropathic pain after total knee replacement. World J Orthop 2015;6:528-36.
12. Fuzier R, Rousset J, Bataille B, Salces-y-Nédéo A, Maguès JP. One half of patients reports persistent pain three months after orthopaedic surgery. Anaesth Crit Care Pain Med 2015;34:159-64.
13. Singh JA, Lewallen DG. Medical and psychological comorbidity predicts poor pain outcomes after total knee arthroplasty. Rheumatology (Oxford) 2013;52:916-23.
14. Albayrak I, Apiliogullari S, Erkocak OF, Kavalci H, Ozerbil OM, Levendoglu F. Total Knee Arthroplasty due to Knee Osteoarthritis: Risk Factors for Persistent Postsurgical Pain. J Natl Med Assoc 2016;108:236-43.
15. Tok F, Aydemir K, Peker F, Safaz I, Taşkaynatan MA, Ozgül A. The effects of electrical stimulation combined with continuous passive motion versus isometric exercise on symptoms, functional capacity, quality of life and balance in knee osteoarthritis: randomized clinical trial. Rheumatol Int 2011;31:177-81.
16. Tüzün EH, Eker L, Aytar A, Daşkapan A, Bayramoğlu M. Acceptability, reliability, validity and responsiveness of the Turkish version of WOMAC osteoarthritis index. Osteoarthritis Cartilage 2005;13:28-33.
17. Freynhagen R, Baron R, Gockel U, Tölle TR. painDETECT: a new screening questionnaire to identify neuropathic components in patients with back pain. Curr Med Res Opin 2006;22:1911-20.
18. Alkan H, Ardic F, Erdogan C, Sahin F, Sarsan A, Findikoglu G. Turkish version of the painDETECT questionnaire in the assessment

of neuropathic pain: a validity and reliability study. Pain Med 2013;14:1933-43.
19. Aydemir O, Guvenir T, Kuey L. Hastane anksiyete ve depresyon ölceği turkce formunun geçerlilik ve güvenilirlik çalışması. Turk Psikiyatri Dergisi 1997;8:280-7.
20. Wylde V, Hewlett S, Learmonth ID, Dieppe P. Persistent pain after joint replacement: prevalence, sensory qualities, and postoperative determinants. Pain 2011;152:566-72.
21. Pinto PR, McIntyre T, Ferrero R, Araújo-Soares V, Almeida A. Persistent pain after total knee or hip arthroplasty: differential study of prevalence, nature, and impact. J Pain Res 2013;6:691-703.
22. Razmjou H, Boljanovic D, Wright S, Murnaghan J, Holtby R. Association between Neuropathic Pain and Reported Disability after Total Knee Arthroplasty. Physiother Can 2015;67:311-8.
23. Wylde V, Jeffery A, Dieppe P, Gooberman-Hill R. The assessment of persistent pain after joint replacement. Osteoarthritis Cartilage 2012;20:102-5.
24. Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, et al. Health-related quality of life after knee replacement. J Bone Joint Surg Am 1998;80:163-73.
25. Singh JA, Gabriel SE, Lewallen DG. Higher body mass index is not associated with worse pain outcomes after primary or revision total knee arthroplasty. J Arthroplasty 2011;26:366-374.e1.
26. Lavand'homme PM, Grosu I, France MN, Thienpont E. Pain trajectories identify patients at risk of persistent pain after knee arthroplasty: an observational study. Clin Orthop Relat Res 2014;472:1409-15.
27. Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. J Bone Joint Surg Am 2004;86:963-74.
28. Brander V, Gondek S, Martin E, Stulberg SD. Pain and depression influence outcome 5 years after knee replacement surgery. Clin Orthop Relat Res 2007;464:21-6.
29. Hanusch BC, O'Connor DB, Ions P, Scott A, Gregg PJ. Effects of psychological distress and perceptions of illness on recovery from total knee replacement. Bone Joint J 2014;96-B:210-6.

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Did Wearing Mask and Lockdowns Affect Vitamin D Levels During the Coronavirus Disease-2019 Pandemic?

Koronavirüs Hastalığı-2019 Pandemisinde; Maske ve Sokağa Çıkma Yasağı Vitamin D Seviyelerini Etkiledi Mi?

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Abstract

Objective: To investigate the effects of wearing mask and lockdowns during the coronavirus disease-2019 (COVID-19) pandemic on the vitamin D levels in females.

Materials and Methods: This retrospective study included female adults aged 18-64 years who underwent vitamin D evaluation at our hospital in April and May from 2017 to 2020. Vitamin D levels were categorized as follows: <10 ng/mL (severe deficiency); 10 to <20 ng/mL (deficiency); 20 to 30 ng/mL (insufficiency) and >30 ng/mL (normal).

Results: A total of 835 (90.8%) out of 920 females had vitamin D deficiency, and among them 463 (50.3%) had vitamin D severe deficiency. In April and May of 2020 (during the national lockdown period), 74 (89.2%) out of 83 subjects had vitamin D deficiency. Vitamin D levels were found to be higher in 2017 than the other years ($p<0.001$). There was no significant difference between the lockdown year (2020) and the 2018 and 2019 years regarding vitamin D levels ($p>0.05$).

Conclusion: Our findings indicate that there is a serious and urgent public health problem regarding with vitamin D deficiency (>90%) in our population; and about 50% of them had severe deficiency. This problem was not different during the lockdown period compared with the previous two years.

Keywords: Coronavirus 2019, lockdown, outbreak, mask, vitamin D deficiency

Öz

Amaç: Koronavirüs hastalığı-2019 (COVID-19) pandemisi sırasında maske takmanın ve sokağa çıkma yasağının kadınlarda D vitamini düzeyleri üzerindeki etkilerini araştırmaktır.

Gereç ve Yöntem: Bu retrospektif çalışmaya 2017-2020 yılları arasında Nisan ve Mayıs aylarında hastanemizde D vitamini değerlendirmesi yapılan 18-64 yaş arası erişkin kadınlar dahil edildi. D vitamini düzeyleri şu şekilde kategorize edildi: <10 ng/mL (şiddetli eksiklik); 10 ile <20 ng/mL arası (eksiklik); 20 ile 30 ng/mL arası (yetersizlik) ve >30 ng/mL (normal).

Bulgular: Dokuz yüz yirmi kadından toplam 835'inde (%90,8) D vitamini eksikliği, 463'ünde (%50,3) ciddi D vitamini eksikliği vardı. 2020 yılının Nisan ve Mayıs aylarında (ulusal karantina döneminde), 83 kişiden 74'ünde (%89,2) D vitamini eksikliği vardı. 2017 yılında D vitamini düzeyleri diğer yıllara göre daha yüksek bulundu ($p<0,001$). D vitamini düzeyleri açısından karantina yılı (2020) ile 2018 ve 2019 yılları arasında anlamlı bir fark yoktu ($p>0,05$).

Sonuç: Bulgularımız toplumumuzda D vitamini eksikliği (>%90) ile ilgili ciddi ve acil bir halk sağlığı sorunu olduğunu göstermektedir; ve yaklaşık %50'sinde ciddi eksiklik vardır. Bu sorun, karantina döneminde önceki iki yıla kıyasla farklı değildir.

Anahtar kelimeler: Koronavirüs 2019, karantina, sokağa çıkma yasağı, maske, vitamin D eksikliği

Introduction

Vitamin D is one of the most important hormones in the body, contributing to bone mineralization by affecting the calcium and phosphorus metabolism (1,2). Ultraviolet-B (UV-B) rays constitute the main source of vitamin D. Under normal conditions, 90-95% of vitamin D in human skin is synthesized from 7-dehydrocholesterol following exposure to UV-B radiation from the sun and is then metabolized in the liver and kidney (3-5).

The 25-hydroxyvitamin D [25(OH)D] is the major circulating form of vitamin D with a half-life of 2-3 weeks. It is considered the best indicator of vitamin D supply to the body from nutritional intake

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and endogenous production (3). Although vitamin D reference ranges vary according to the laboratory and study method utilized, vitamin D status is often categorized as <20 ng/mL, deficient; 20-30 ng/mL, insufficient; 30 ng/mL, normal; 150-200 ng/mL and hypervitaminosis (6). Studies conducted in Turkey have indicated significantly low vitamin D levels in subjects. Of note, a study conducted in Ankara province detected vitamin D deficiency in 51.8% and vitamin D insufficiency in 20.7% of the subjects (7). Vitamin D deficiency has been shown to be associated with numerous diseases particularly including bone, cardiovascular and respiratory system, autoimmune, diabetes mellitus, and neurodegenerative diseases, there is insufficient data regarding the control of these diseases with vitamin D replacement (8-14).

Coronavirus disease-2019 (COVID-19) is an infectious disease that was first seen in Wuhan, Hubei Province, China in late 2019. Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) is the strain of coronavirus causing COVID-19, spreading rapidly mostly via droplets and remaining a serious public health problem worldwide. World Health Organization identifies novel coronavirus as global pandemic on March 11, 2020 (15). Self-protection is the most important measure in preventing SARS-CoV-2. Therefore, wearing a facemask has become an official obligation and partial lockdowns have been imposed in Turkey as in the whole world. Due to these restrictions, vitamin D deficiency has become more prevalent mainly because individuals cannot leave home as easily as they did before and even when they leave, they need to cover their faces with a facemask. To our best knowledge, there is no study in the literature investigating this phenomenon (i.e. the effects of lockdowns) following COVID-19 outbreak.

In this study, we aimed to investigate the effect of limited sunshine exposure in COVID-19 pandemic (limited to months) on vitamin D status.

Materials and Methods

The retrospective study included female adults aged 18-64 years who underwent vitamin D measurement in our hospital in April and May of the years from 2017 to 2020. Individuals aged 65 years and over were excluded from the study since they were not allowed to apply to healthcare centers except for emergency conditions throughout the lockdown periods. Serum vitamin D levels were assessed by using a Shimadzu HPLC system with the LC-MS/MS method (16,17).

The study protocol was approved by the local Ethics Committee of Clinical Research of Harran University (decision no: HRU/20.11.14, date: 15.06.2020). The study was conducted in accordance with the principles of the Declaration of Helsinki.

The inclusion criterion was having complete medical records that involved at least one vitamin D measurement within the last one year. Exclusion criteria were as follows; history of vitamin D supplementation, osteoporosis therapy, or surgery within the last six months, liver or kidney failure that could affect the vitamin D synthesis, use, need, or metabolism of vitamin D, pregnancy, breastfeeding, use of glucocorticoid or antiepileptic drugs (including gabapentin and pregabalin), history of thyroid/parathyroid surgery, malabsorption, malignancy, thyroid/parathyroid disease requiring treatment, Paget's disease, genetic diseases that could disrupt bone metabolism and turnover, organ transplantation. Additionally, individuals that had a disability that prevented them from going out and a medical problem that caused them to remain immobile such as hemiplegia, paraplegia, fracture, and diabetic foot were also excluded from the study. In total, 921 patients fulfilled the inclusion criteria and were included in the study. Vitamin D status was categorized as follows; <10 ng/mL (severe deficiency); 10 to <20 ng/mL (deficiency); 20-30 ng/mL (insufficiency); >30 ng/mL (normal).

Statistical Analysis

Data were analyzed using SPSS for Windows version 20.0 (SPSS Inc., Chicago, IL, USA). Numerical variables are shown as median (minimum-maximum), categorical variables as n (%). Normal distribution was tested by Kolmogorov-Smirnov test. Continuous variables were compared using Kruskal-Wallis test as they were not distributed normally. Categorical variables were compared using chi-square test. A p value <0.05 was considered significant.

Results

A total of 920 female adults [37 (18-64) years] were included (Table 1). A total of 835 females (90.8%) had vitamin D deficiency i.e. 463 (50.3%) as severe and 372 (40.4%) as non-severe deficiency. When all participants were classified according to their age ranges, there was no significant difference in vitamin D levels among the age groups (p>0.05).

Serum vitamin D levels of the subjects are given in Table 2. Vitamin D levels were found to be higher in 2017 than the other years-both in April and May (both p<0.001). There was no significant difference among the lockdown year (2020) and 2018 or 2019 regarding vitamin D status (p>0.05). In April and May of 2020 (in the national lockdown period), 74 (89.2%) out of 83 subjects had vitamin D deficiency (Table 3). The frequency of vitamin D deficiency was lowest in 2017-both in April (51.9%) and May (83%) (Both p<0.001). 807 (96.4%) out of 837 female patients had vitamin D deficiency in the last three years.

Discussion

In this study, we found that the prevalence of vitamin D deficiency was more than 90%, and about 50% of them had severe deficiency. Interestingly, this public health problem was not changed within the last three years including the year 2020 (with COVID-19 pandemic). Therefore, our female adults have suffered the pandemic with vitamin D deficiency (>90% of them), and importantly with severe vitamin D deficiency (about 50%).

Vitamin D takes an active role in bone homeostasis by affecting the calcium and phosphorus metabolism along with parathormone

(1,2). However, its effect is not confined to bones and vitamin D has been shown to be associated with cardiovascular, respiratory system, autoimmune, and neurodegenerative diseases and diabetes mellitus (8-14). Vitamin D is severe and insufficient in 50-90% of the individuals worldwide and their vitamin D levels are below 20 ng/mL (18).

Vitamin D deficiency is a prevalent and major global health problem which is mostly associated with the lack of sunlight exposure. Vitamin D deficiency can be considered a pandemic in many parts of the world, especially in Europe (19). Sun is the natural source of UV-B, accounting for 1-10% of UV rays. Sunlight exposure may decrease in a large part of the population due to various reasons such as working indoors, modern and traditional life activities such as indoor time activities, protective sunscreens, and an immobilization due to aging. However, exposing the arms and legs to direct sunlight for 5-30 minutes between 10:00 to 15:00 hours twice a week can produce sufficient vitamin D status (20). Similarly, exposing 24% of the body surface area (face, arms, and legs) to sunlight for 15 minutes or only 6% of the body surface area (face and hands)

Table 1. Age-based comparisons for vitamin D status

Age group (years)	Total	Vitamin D level, ng/mL			p*
		<10	10-20	≥20	
<30	313 (100%)	156 (49.8%)	129 (41.2%)	28 (8.9%)	0.760
30-50	391 (100%)	190 (48.6%)	163 (41.7%)	38 (9.7%)	
>50	216 (100%)	117 (54.2%)	80 (37.0%)	19 (8.8%)	
Total	920 (100%)	463 (50.3%)	372 (40.4%)	85 (9.2%)	

*Chi-square test

Table 2. Comparisons of vitamin D levels by months (ng/mL)

Month (year)	n (%)	Vitamin D level median (min-max)	p&
Total-April	526 (100%)	-	
2017	83 15.7%)	18.2 (3.2-37.2)*	<0.001
2018	205 (38.9%)	8.1 (3.0-28.7)	
2019	199 (37.8%)	9.6 (2.6-33.9)	
2020	39 (7.4%)	10.0 (5.2-41.8)	
Total-May	394 (100%)	-	
2017	88 (22.3%)	14.0 (5.1-31.4)*	<0.001
2018	131 (33.2%)	10.2 (5.0-37.7)	
2019	131 (33.2%)	7.9 (4.2-30.5)	
2020	44 (11.1%)	10.9 (4.2-38.2)	

*Statistical significance is due to this value. &Kruskal-Wallis test, min: Minimum, max: Maximum

Table 3. Comparison of vitamin D status by months

Month (year)	Vitamin D status (ng/mL)			p&
	<10	10-20	≥20	
April				
2017*	10 (12.0%)	33 (39.8%)	40 (48.2%)	<0.001
2018	135 (65.9%)	65 (31.7%)	5 (2.4%)	
2019	106 (53.3%)	86 (43.2%)	7 (3.5%)	
2020	19 (48.7%)	15 (38.5%)	5 (12.8%)	
May				
2017*	23 (26.1%)	50 (56.8%)	15 (17.0%)	<0.001
2018	62 (47.3%)	65 (49.6%)	4 (3.1%)	
2019	89 (67.9%)	37 (28.2%)	5 (3.8%)	
2020	19 (43.2%)	21 (47.7%)	4 (9.1%)	

*The statistical significance is due to this year's percentages. &Kruskal-Wallis test

for 30 minutes can also produce sufficient vitamin D status in the body (21).

Studies have also shown that vitamin D levels change seasonally (22-24). It has also been shown that 25(OH)D levels are lowest in March and highest in September (22). Vitamin D deficiency is highly common in Turkey despite its abundant sunshine. In Adana, vitamin D deficiency was reported in 24.7% of the population (25). Interestingly, we found that 94.9% of the individuals had vitamin D deficiency. A study conducted in İzmir province, 11.3% of the subjects had a normal vitamin D levels while 23.2% of them had deficiency, 46.9% of them had insufficiency, and 18.6% of them had a threshold level of deficiency (26). In our study, our female adults had vitamin D deficiency (>90% of them), and importantly with severe vitamin D deficiency (about 50%). In a previous study, the mean serum vitamin D level of the subjects at the end of the winter season was reported as 16.9±13.1 ng/mL (27). Similarly, we assessed the vitamin D status in April and May as 11.5±6.2 ng/mL. Another study assessed the vitamin D levels of the subjects throughout an entire year and found that the vitamin D level measured in summer months was twice higher than that of winter months (28).

In our literature review, we found that the findings of the studies on clothing style and face covering are contradictory. A study conducted in Adana province compared veiled women, who covered their hands and face, and unveiled women, who did not cover their extremities and head, and found that all the subjects had a normal vitamin D level (29). Similarly, another study evaluated patient groups that had a vitamin D level of lower than 20 ng/mL and found no significant difference between veiled and unveiled patients (30). In the same way, Al-Yatama et al. (31) compared three groups (including a control group who wore Western-style clothing, a group who covered the whole body except for the face and hands, and a group who covered the entire body) and found no significant difference among the groups with regard to vitamin D status. In Turkey, the first COVID-19 case was diagnosed on March 11, 2020 and the first comprehensive nationwide lockdown was initiated in April, 2020. Accordingly, we compared that period with the same months in previous years, considering that the prevalence of vitamin D deficiency could be higher during the lockdown period due to the use of facemasks that cover almost two-thirds of the face. However, we found no difference between the lockdown period and the same months of previous years and it was revealed that 89.2% of 83 subjects had vitamin D deficiency during the lockdown (April-May, 2020) while 96.4% of 837 patients had vitamin D deficiency during the same months of last three years. As the vitamin D deficiency is so high, thus the effect of restrictions might not have affected this level, or, the evaluation of the first two months after the restriction may have misled us. If there had been a longer follow-up, our results would possibly be different.

Study Limitations

Our study was limited in several ways. First, it was a single-center, short term, retrospective study and had a small patient population. Second, the study only included female adults aged less than 65 years and had no information as to whether the participants used any vitamin D supplements that were not available in their medical records.

Conclusion

Our findings indicate that there is a serious and urgent public health problem regarding with vitamin D deficiency (>90%) in our population; and about 50% of them has severely deficient. This problem is not different from the lockdown period. Given its rare adverse effects and relatively broad safety, sunbathing, food fortification and prophylactic vitamin-D supplementation might serve as a very appropriate and invaluable therapy for these worldwide problems (i.e. vitamin D deficiency and COVID-19).

Ethics

Ethics Committee Approval: The study protocol was approved by the local Ethics Committee of Clinical Research of Harran University (decision no: HRU/20.11.14, date: 15.06.2020). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: S.S., A.Y., Design: S.S., A.Y., Data Collection or Processing: S.S., A.Y., Analysis or Interpretation: S.S., A.Y., Writing: S.S.

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References

1. Champe PC, Harvey RA, Ferrier DR. Ulukaya E, çeviri editörü. Lippincott's Illustrated Reviews Serisinden: Biyokimya. 3. baskı Nobel Tıp Kitapevleri; 2007.
2. Bringhurst FR, Demay MB, Krane SM, Kronenberg HM. Boneand Mineral Metabolism in Health and Disease. In: Kasper DL, Braunwald E, Fauci AS, Hauser SL, Longo DL, Jameson JL, editors. Harrison's Principles of Internal Medicine. 16th ed. New York: MC Graw-HillCompanies; 2005;2:238-86.
3. Fidan F, Alkan BM, Tosun A. Çağın pandemisi D vitamin eksikliği ve yetersizliği. Turk J Osteoporos 2014;20:71-4.
4. Pilz S, Zittermann A, Trummer C, Schwetz V, Lerchbaum E, Keppel M, et al. Vitamin D testing and treatment: a narrative review of current evidence. Endocr Connect 2019;8:R27-R43.
5. Türkiye Endokrinoloji ve Metabolizma Derneği. Osteoporoz ve Metabolik Kemik Hastalıkları Tanı ve Tedavi Kılavuzu. 2018.
6. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2011;96:1911-30.

7. Uçar F, Taşlıpınar MY, Soydaş AÖ, Özcan N. Ankara Etlik İhtisas Eğitim Araştırma Hastanesine Başvuran Hastalarda 25-OH Vitamin D Düzeyleri. Eur J Basic Med Sci 2012;2:12-5.
8. Rizzoli R, Boonen S, Brandi ML, Burlet N, Delmas P, Reginster JY. The role of calcium and vitamin D in the management of osteoporosis. Bone 2008;42:246-9.
9. Holick MF. The vitamin D deficiency pandemic: a forgotten hormone important for health. Public Health Rev 2010;32:267-83.
10. Nair R, Maseeh A. Vitamin D: The "sunshine" vitamin. J Pharmacol Pharmacother 2012;3:118-26.
11. Vacek JL, Vanga SR, Good M, Lai SM, Lakkireddy D, Howard PA. Vitamin D deficiency and supplementation and relation to cardiovascular health. Am J Cardiol 2012;109:359-63.
12. Kriegel MA, Manson JE, Costenbader KH. Does vitamin D affect risk of developing autoimmune disease?: a systematic review. Semin Arthritis Rheum 2011;40:512-31.e8.
13. Eyles DW, Burne TH, McGrath JJ. Vitamin D, effects on brain development, adult brain function and the links between low levels of vitamin D and neuropsychiatric disease. Front Neuroendocrinol 2013;34:47-64.
14. Charan J, Goyal JP, Saxena D, Yadav P. Vitamin D for prevention of respiratory tract infections: A systematic review and meta-analysis. J Pharmacol Pharmacother 2012;3:300-3.
15. World Health Organization (2020) Coronavirus disease (COVID-2019) situation reports. Geneva: World Health Organization. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/ (accessed May 2020).
16. Burtiz Ca, Ashwood E.R, Bruns DE. Tietz textbook of clinical chemistry and molecular diagnostics-e-book. Elsevier health sciences 2012.
17. Gonel A, Yetisgin A. False Negative D Vitamin Measurement in LC-MS/MS Method Due to Hyperlipidemia: Case Report. Comb Chem High Throughput Screen 2019;22:428-30.
18. Zittermann A, Gummert JF. Nonclassical vitamin D action. Nutrients 2010;2:408-25.
19. Kara M, Ekiz T, Ricci V, Kara Ö, Chang KV, Özçakar L. 'Scientific Strabismus' or two related pandemics: coronavirus disease and vitamin D deficiency. Br J Nutr 2020;124:736-41.
20. Holick MF. Vitamin D deficiency. N Engl J Med 2007;357:266-81.
21. Bogh MK, Schmedes AV, Philipsen PA, Thieden E, Wulf HC. Interdependence between body surface area and ultraviolet B dose in vitamin D production: a randomized controlled trial. Br J Dermatol 2011;164:163-9.
22. Hansen L, Tjønneland A, Køster B, Brot C, Andersen R, Cohen AS, et al. Vitamin D Status and Seasonal Variation among Danish Children and Adults: A Descriptive Study. Nutrients 2018;10:1801.
23. Niculescu DA, Capatina CAM, Dusceac R, Caragheorgheopol A, Ghemigian A, Poiana C. Seasonal variation of serum vitamin D levels in Romania. Arch Osteoporos 2017;12:113.
24. Eloi M, Horvath DV, Szejnfeld VL, Ortega JC, Rocha DA, Szejnfeld J, et al. Vitamin D deficiency and seasonal variation over the years in São Paulo, Brazil. Osteoporos Int 2016;27:3449-56.
25. Matyar S, Disel NR, Acikalin A, Kutnu M, Inal T. Cukurova Bolgesinde D vitamini düzeyleri. Cukurova Medical Journal 2017;42:320-8.
26. Bozkaya G, Ormen M, Bilgili S, Aksit M. D vitamini için güneşten yeterince faydalanıyor muyuz?. Türk Klinik Biyokimya Derg 2017;15:24-9.
27. Hekimsoy Z, Dinç G, Kafesçiler S, Onur E, Güvenç Y, Pala T, et al. Vitamin D status among adults in the Aegean region of Turkey. BMC Public Health 2010;10:782.
28. Ögüş E, Surer H, Kılınç A, Fidancı V, Yılmaz G, Dindar N, et al. D vitamini düzeylerinin aylara, cinsiyete ve yaşa göre değerlendirilmesi. Ankara Med J 2015;15:1-5.
29. Guzel R, Kozanoglu E, Guler-Uysal F, Soyupak S, Sarpel T. Vitamin D status and bone mineral density of veiled and unveiled Turkish women. J Womens Health Gend Based Med 2001;10:765-70.
30. Taşkıran B, Cansu G. Güneydoğu bölgesinde erişkinlerde D vitamini eksikliği/Vitamin D deficiency in adult residents of Southern Turkey. Osmangazi Tıp Dergisi 2017;39:13-20.
31. Al-Yatama FI, AlOtaibi F, Al-Bader MD, Al-Shoumer KA. The Effect of Clothing on Vitamin D Status, Bone Turnover Markers, and Bone Mineral Density in Young Kuwaiti Females. Int J Endocrinol 2019;2019:6794837.

Olgu Sunumu / Case Report

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Vertebral Sarkoidoz: Nadir Bir Olgu Sunumu

Vertebral Sarcoidosis: A Rare Case Report

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Öz

Sarkoidoz, non-kazeifiye granülomlarla karakterize, başta akciğerler olmak üzere, pek çok doku ve organı etkileyebilen bir hastalıktır. Sarkoidozda, granülomların direkt etkisi, makrofajlardan salınan 1,25-dihidroksivitamin D gibi osteoklast aktive edici faktörler ve glukokortikoidlerin kullanımı ile osteopeni, osteoporoz ve patolojik kemik kırıkları görülebilir. Sarkoidozun kemik tutulumu, el ve ayakta tipik kistik yapılar meydana getirir. Vertebral tutulum ise nadirdir ve litik, sklerotik veya mikst lezyonlara neden olabilir. Metastatik lezyonlar ile ayırıcı tanı yapılmalıdır.
Anahtar kelimeler: Sarkoidoz, osteoporoz, malignite

Abstract

Sarcoidosis is a disease characterized by noncaseating granulomas that can affect many tissues and organs, especially the lungs. In sarcoidosis, osteopenia, osteoporosis and pathological bone fractures can be seen with the direct effect of granulomas, osteoclast activating factors such as 1.25-dihydroxyvitamin D released from macrophages, and the use of glucocorticoids. Bone involvement of sarcoidosis produces typical cystic structures in the hands and feet. Vertebral involvement is rare and may cause lytic, sclerotic or mixed lesions. It should be differentially diagnosed from metastatic lesions.
Keywords: Sarcoidosis, osteoporosis, malignancy

Giriş

Sarkoidoz; sistemik, enflamatuvar, granülomatöz bir hastalıktır. Etiyolojisinde genetik varyasyonlar, mesleksel ve çevresel etkenler düşünülse de, sebebi tam olarak bilinmemektedir. En sık akciğerleri etkiler. Bunun yanı sıra göz, deri ve diğer organlarda tutulabilir (1). Birçok romatizmal hastalığı taklit edebilir veya romatizmal hastalıklarla birlikte görülebilir. Sarkoidoz hastalarında, romatizmal belirtiler %4-38 oranında bildirilmektedir. Artrit, periartrit, artralji, sakroiliit ile eklemleri tutabileceği gibi; miyozit ve miyopati şeklinde kas tutulumu da görülebilir. Kemik yapıda, litik ve sklerotik lezyonlar, osteopeni-osteoporoz ve patolojik kırıklara neden olabilir. Kemik tutulumu nadirdir. Vertebral tutulum ise daha nadir görülür ve metastatik lezyonları taklit edebilir (2,3). Bu yazıda boyun ağrısı ile kliniğimize başvuran sarkoidoz tanılı hasta, literatür eşliğinde sunulmuştur.

Olgu Sunumu

Elli dört yaşında erkek hasta boyun ağrısı ile polikliniğimize başvurdu. Ağrısının 3 haftadır olduğunu, geceleri arttığını ifade etti. Hipertansiyon ve benign prostat hipertrofisi için ilaç kullanımı vardı. Altı sene önce sarkoidoz tanısı almış ve göğüs hastalıkları kliniği tarafından takip ediliyordu. Daha önce azatiopürin ve sistemik steroid kullandığı, son iki yıldır da ilaçsız takip edildiği öğrenildi. Muayenesinde deri lezyonuna rastlanmadı. Boyun hareketleri ağrılı ve kısıtlı idi. Paravertebral spazmı mevcuttu. Nörolojik defisit saptanmadı. Sistemik muayenesi normaldi. Hastanın laboratuvar incelemelerinde lökosit:14.600, sedimentasyon: 22 mm/sa, C-reaktif protein (CRP): 7,96 mg/dL, kreatinin: 1,74 mg/dL, üre: 35 mg/dL bulundu. Diğer biyokimyasal parametreler normaldi.

Posterior-anterior akciğer grafisi ve toraks tomografisi evre 4 sarkoidoz ile uyumlu idi (Şekil 1). Dış merkezde aynı şikayetle gittiğinde istenen servikal manyetik rezonans (MR) raporunda; C6-7'de ödematöz alanlar ve yumuşak dokuda metastaz lehine şüpheli alanlar görüldüğü için; kliniğimizce istenen kontrastlı servikal MR'de: C2 vertebra korpusunu tama yakın dolduran, C6 vertebra seviyesinde 15 mm çapa ulaşan; T2 görüntülerde hafif hipointens T1 görüntülerde hipointens görünümde, belirgin kontrastlanma gösteren lezyonlar izlendi (Şekil 2). Ayrıca C2 seviyesinde spinöz proçestede kontrastlanma ve bu düzeyde

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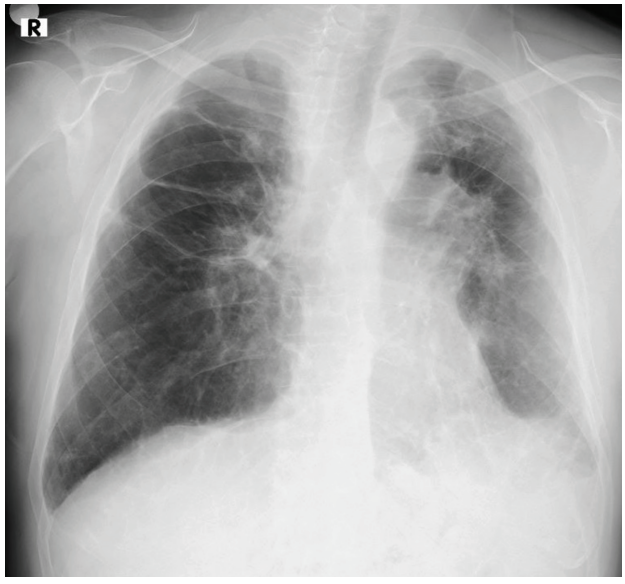
paraspinal kas planları arasında heterojen T2 hiperintens sinyal değişiklikleri, postkontrast serilerde kontrast tutulum alanları gözlendi. İlaveten supraklaviküler bölgede kesit alanına giren düzeylerde lenf nodları görülmesi üzerine hastaya, 3 fazlı kemik sintigrafisi ve pozitron emisyon tomografisi-bilgisayarlı tomografi (PET-BT) yapıldı. Yaygın, multipl hipermetabolik lenf nodları ve kemik lezyonları izlendi. Hasta, lenf nodlarından yapılacak eksizyonel biyopsiyi kabul etmedi. Sağ sternokleidomastoid kası altındaki LAP'ye ince iğne aspirasyon biyopsisi yapıldı. İnce iğne aspirasyon biyopsisi sonucu: Malignite yönünden negatif olarak geldi. Bu arada non-steroidal anti-enflamatuvar ilaç ile boyun ağrısı geçen hasta hematoloji-onkoloji polikliniğine yönlendirildi. Buradaki takibinde, ayırıcı tanı açısından tekrar eksizyonel biyopsi önerildi. Yapılan eksizyonel biyopsi, Hodgkin lenfoma (evre 4 B) (4) ile sonuçlanan hasta hematoloji takibine alındı.

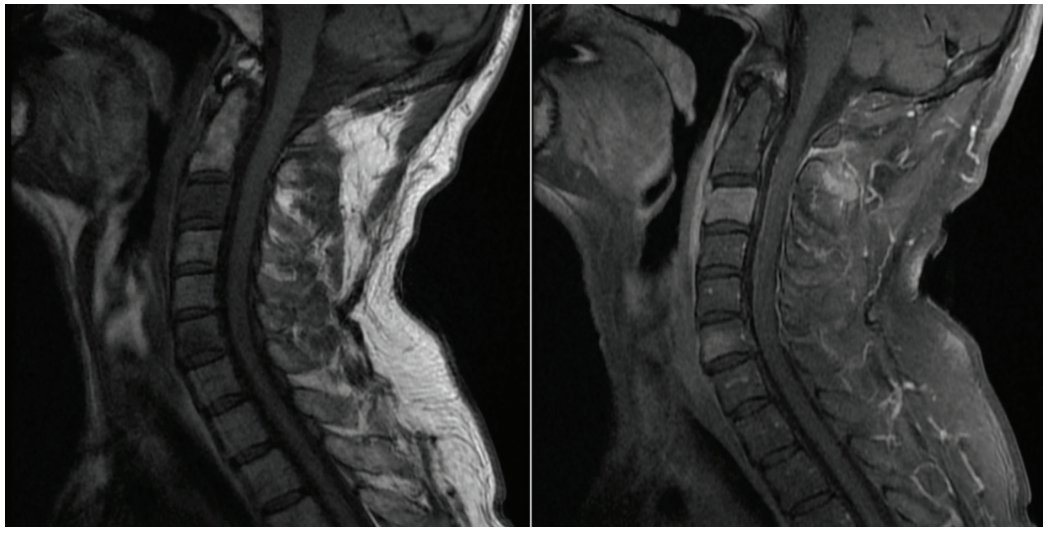


Şekil 1. Hastanın, evre 4 sarkoidoz ile uyumlu posterior-anterior akciğer grafisi

Tartışma

Sarkoidoz tanısı, klinik ve radyolojik bulguları olan hastalarda, histopatolojik olarak non-kazeifiye granülomların görülmesi ile konulur. Her ne kadar Löfgren sendromu (artrit, eritema nodozum ve bilateral hiler lenfadenopati ile karakterize akut sarkoidoz) ve Heerfordt sendromu (ateş, parotis bezinde büyüme, anterior üveit ve fasiyal sinir felci ile karakterize nörosarkoidoz formu) gibi biyopsi gerektirmeyen tipik bulgulara sahip olan formlar bulunsa da diğer formlar için histopatolojik örnekleme yapılması gerekir. Tüberküloz, atipik mikobakteri enfeksiyonları, fungal enfeksiyonlar, yabancı cisim reaksiyonları, silikozis, berilyozis, lepra, poliarteritis nodosa, granülomatöz polianjitis ve romatoid nodüller ile ayırıcı tanının yapılması gerekir. Çünkü, hastalığı doğrulayıcı bir laboratuvar testi bulunmamaktadır (5,6). Sarkoidozda; serum amiloid-A (SAA), CRP, anjiyotensin dönüştürücü enzim (ACE) ve adenozin deaminaz düzeyleri yükselebilir, fakat düşük olmaları hastalığı dışlamaz. Hastalık aktivasyonunda en sık kullanılan testlerden olan ACE'nin duyarlılığı düşük bulunmuştur. Sarkoidozda, monosit- makrofaj aktivasyonu ile TNF-α ve interlökinlerin (IL-1, IL-6) salınımı; CRP, SAA gibi akut faz reaktanlarının üretimini artırır. Akut faz reaktanları sistemik enflamasyonun olduğu hastalıklarda da yükseldiğinden sarkoidozda verdiği bilgiler sınırlıdır (7). Bu yazıda ele alınan olgu daha önce histopatolojik tanı almış evre 4 akciğer sarkoidozu bulunan bir hastadır. Hastanın tanısı kesin olduğu için ACE ve SAA düzeyleri bakılmadı. Hastanın boyun ağrısı ile başvurması sonucu çekilen MR'de belirgin kontrast tutulumu olan lezyonların görülmesi ayırıcı tanı için tekrar biyopsi yapılmasını gerektirmiştir.

Sarkoidozun kemik tutulumu nadiren görülür. Bu tutulumda lezyonlar kistik, litik, ya da sklerotik olabilir. El ve ayak kemiklerinde daha çok kistik lezyonlar görülürken, vertebrada litik, sklerotik veya hem litik hem de sklerotik lezyonlar görülebilir. Kemik mineral yoğunluğu hastalığın erken dönemlerinde genellikle normaldir. İlerleyen dönemlerde osteopeni-osteoporoz ve kemik



Şekil 2. Servikal manyetik rezonans, sagittal T1 sekansta vertebralarda hipointens görünüm ve kontrastlı sagittal T1 sekansta belirgin kontrastlanma gösteren kemik lezyonları

kırıkları görülebilir (2,7-9). Sarkoidoz hastalarında osteoporozun birkaç nedeni olabilir: Bunlardan ilki sarkoidal makrofajlarda paratroid hormonundan bağımsız olarak 1,25-dihidroksivitamin D_3 üretiminin artması ve osteoklastik aktiviteyi stimüle etmesidir (7). İkincisi diffüz iskelet granülomatozu sonucu kemik remodeling (aşırı osteoid, artmış osteoklast ve osteoblast, artmış osteoklastik rezorbe yüzey ve artmış kemik formasyon alanları) artışıdır (8). Son olarak tedavide kullanılan glukokortikoidler osteoporoza neden olabilir. Sarkoidozda D vitamininin aşırı üretimi, artmış hiperkalsemi ve hiperkalsiüri riski nedeni ile osteoporozun önlenmesi ve tedavisi karmaşıktır. Takviye gerektiğinde serum ve idrardaki kalsiyum ve vitamin D konsantrasyonları dikkatle izlenmelidir (10).

Vertebral sarkoidozun görüntülenmesinde MR incelemenin duyarlılığı yüksektir. (a) Kemik biyopsi için uygun bölgeleri yönlendirmede ve lezyonun yapısını tanımlamada değerli bilgiler verir. Farklı boyutlarda, belirsiz veya keskin sınırlı, genellikle düşük sinyal intensiteli lezyonlar görülür. Ancak bazen lezyonların sinyal intensitesi değişkenlik gösterebilir. Santral yağ depolanması gösteren bazı kemik lezyonları oldukça spesifik MR bulguları gösterir. Buna rağmen tüberküloz ve malignite olasılığı tam olarak dışlanamaz. Aynı şekilde PET-BT aktif granülomatöz lezyonu iyi gösteren bir yöntemdir. Ancak hem granülomatöz lezyonlarda, hem de malign lezyonlarda aktivite artışının gözlemlenmesi nedeniyle ayırıcı tanıda net bilgiler verememektedir. Bu nedenle ayırıcı tanıda kesin tanı için, histopatolojik örnekleme yapılması gerekli görülmektedir (6).

Sarkoidozlu hastalarda, malignite riskinin arttığı görülür. Kronik enflamasyon, karsinogenez süreci için önemli bir risk olarak görülmektedir. Bu hastalarda lenfoma riskinin 11 kat arttığı bildirilmiştir (11). Bu birliktelik sarkoidoz-lenfoma sendromu terimi ile ilk kez Brincker (12) tarafından tanımlanmıştır. Sarkoidoz ve lenfoma arasında birçok immünolojik benzerlik tespit edilmiştir. Her ikisinde de kütanöz anerji, dokularda T yardımcı hücrelerin aşırı infiltrasyonu ve periferik lenfadenopatiler görülür. Sarkoidoz ve lenfoma birlikteliği eş zamanlı olarak tespit edilebilir, ancak daha çok sarkoidoz tanısından bir veya iki yıl sonra lenfoma geliştiği gözlemlenmektedir. Bu şekilde olgu serileri mevcuttur. Bu nedenle kemik tutulumunun varlığında malignite mutlaka dışlanmalıdır (13).

Sonuç olarak, sarkoidoz tanısı ile takip edilen bir hastada görülen kemik lezyonlarının ayırıcı tanısı iyi yapılmalıdır. Ayırıcı tanıda MR ve PET-BT kullanılmasına rağmen, kesin ayrımın yapılabilmesi için, lezyonlardan eksizyonel biyopsi yapılması gereklidir. Bu makalede, sarkoidoz-lenfoma ilişkisi bir olgu üzerinden gözden geçirilmiş ve literatürdeki bilgiler derlenmiştir. Ancak, sarkoidoz-lenfoma sendromunun daha iyi anlaşılabilmesi için daha fazla çalışma yapılması gereklidir.

Etik

Hasta Onayı: Hastadan onam alınmıştır.

Hakem Değerlendirmesi: Editörler kurulu dışında olan kişiler tarafından değerlendirilmiştir.

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Kaynaklar

1. Newman LS, Rose CS, Maier LA. Sarcoidosis. N Engl J Med 1997;336:1224-34.
2. Thelier N, Assous N, Job-Deslandre C, Meyer O, Bardin T, Orcel P, et al. Osteoarticular involvement in a series of 100 patients with sarcoidosis referred to rheumatology departments. J Rheumatol 2008;35:1622-8.
3. Sweiss NJ, Lower EE, Korsten P, Niewold TB, Favus MJ, Baughman RP. Bone health issues in sarcoidosis. Curr Rheumatol Rep 2011;13:265-72.
4. Barrington SF, Mikhaeel NG, Kostakoglu L, Meignan M, Hutchings M, Müeller SP, et al. Role of imaging in the staging and response assessment of lymphoma: consensus of the International Conference on Malignant Lymphomas Imaging Working Group. J Clin Oncol 2014;32:3048-58.
5. Wessendorf TE, Bonella F, Costabel U. Diagnosis of Sarcoidosis. Clin Rev Allergy Immunol 2015;49:54-62.
6. Soussan M, Augier A, Brillet PY, Weinmann P, Valeyre D. Functional imaging in extrapulmonary sarcoidosis: FDG-PET/CT and MR features. Clin Nucl Med 2014;39:e146-59.
7. Gungor S, Ozseker F, Yalcinsoy M, Akkaya E, Can G, Eroglu H, et al. Conventional markers in determination of activity of sarcoidosis. Int Immunopharmacol 2015;25:174-9.
8. Fallon MD, Perry HM 3rd, Teitelbaum SL. Skeletal sarcoidosis with osteopenia. Metab Bone Dis Relat Res 1981;3:171-4.
9. Sodhi A, Aldrich T. Vitamin D Supplementation: Not So Simple in Sarcoidosis. Am J Med Sci 2016;352:252-7.
10. Kavathia D, Buckley JD, Rao D, Rybicki B, Burke R. Elevated 1, 25-dihydroxyvitamin D levels are associated with protracted treatment in sarcoidosis. Respir Med 2010;104:564-70.
11. Brincker H, Wilbek E. The incidence of malignant tumours in patients with respiratory sarcoidosis. Br J Cancer 1974;29:247-51.
12. Brincker H. The sarcoidosis-lymphoma syndrome. Br J Cancer 1986;54:467-73.
13. Goswami T, Siddique S, Cohen P, Cheson BD. The sarcoid-lymphoma syndrome. Clin Lymphoma Myeloma Leuk 2010;10:241-7.

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Cystic Fibrosis with Paediatric Femoral Neck Stress Fracture: A Case Report and the Review of Literature

Pediatrik Femur Boyun Stres Kırığı Olan Kistik Fibroz: Bir Olgu Sunumu ve Literatürün Gözden Geçirilmesi

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Abstract

Cystic fibrosis is a common genetic disease of the white population with autosomal recessive inheritance. It may present with sinopulmonary, gastrointestinal, genitourinary, bone and joint findings. Osteoporosis, osteopenia, and fractures are musculoskeletal problems related to the disease. Although vertebral fractures are common, non-vertebral fractures have been reported rarely. In this case report, we present the case of a 9-year-old girl with osteopenia-induced femoral neck stress fracture caused by cystic fibrosis. During hospitalization for sinopulmonary infection, the patient presented to our clinic with left thigh pain without trauma. The left hip joint was examined and found to be clear. Anterior posterior X-ray examination of the patient, who had difficulty in stepping, revealed no displaced fracture. The patient was later diagnosed with type 2 Fullerton & Snowdy fracture, and surgical fixation was ruled out. The patient was successfully treated with non-steroidal anti-inflammatory drugs and immobilization.

Keywords: Cystic fibrosis, stress fracture, paediatric femoral neck fracture

Öz

Kistik fibrozis otozomal resesif geçişli, beyaz ırkın sık görülen bir genetik hastalığıdır. Sinopulmoner, gastrointestinal, genitoüriner, kemik ve eklem bulguları ile karşımıza çıkabilir. Osteoporoz, osteopeni ve kırıklar hastalığa bağlı kas-iskelet sistemi sorunlarıdır. Vertebra kırıkları sık görülmekle birlikte nadiren vertebra dışı kırıklar bildirilmiştir. Biz olgu sunumumuzda kistik fibrozisin yol açtığı osteopeniye bağlı femur boyun stres kırığı olan 9 yaşındaki bir kız hastayı sunmaktayız. Sinopulmoner enfeksiyon nedeni ile yatışı esnasında, travmasız sol uyluk ağrısı ve yük vermede zorluk nedeni ile tarafımıza danışılan hastanın anterior posterior radyografik değerlendirmesinde patolojik bulguya rastlanmayıp, manyetik rezonans görüntüleme sonucunda sol femur boynunda deplase olmayan kırık görüntüsü saptandı. Fullerton & Snowdy tip 2 olarak değerlendirilen hastaya cerrahi fiksasyon düşünülmedi. Non-steroid anti-enflamatuvar ilaç ve immobilizasyon ile başarılı şekilde tedavi edildi.

Anahtar kelimeler: Kistik fibrozis, stres kırığı, çocuk femur boyun kırığı

Introduction

Cystic fibrosis (CF) is an autosomal recessive disease predominantly seen in the Caucasian race. Prevalence is 1/2000-3500 per live birth. Skeletal findings related to CF are only seen in a limited group of patients. Bone manifestations of the disease are osteoporosis, osteopenia, and vertebral fractures. We present a case of a 9-year-old girl diagnosed with CF, having a femoral neck stress fracture.

Case Report

Informed consent was obtained from the mother of the patient because of the patient is under 18 years old. A nine-year-old female patient diagnosed with CF was consulted at our clinic with left hip pain while she was hospitalized because of pulmonary infection. The patient was also receiving treatment for type 1 diabetes mellitus last five years. She had left hip pain, radiating to the anterior thigh without any history of trauma. The range of motion of the left hip joint was full, with moderate pain. There was no other pathological orthopedic finding on physical examination. On pelvic anteroposterior (AP) view X-ray, there was no sign of a fracture or periosteal reaction (Figure 1). Actual laboratory findings were; calcium: 8.9 mg/dL, phosphor: 5.4 mg/dL, magnesium: 1.8 mg/dL, 25-hydroxyvitamin D: 32.12 ug/L, parathormone: 26.54 ng/L, osteocalcin: 5.81 ug/L, C-telopeptide: 0.98 ug/L, C-reactive protein (CRP): 21.8 mg/L. Except for C-telopeptide height

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and CRP height, other tests were monitored in the reference range. Recent dual-energy X-ray absorptiometry result was lumbar (L2-4) bone density 0,495 g/cm^2 (Z-score: 2.4). On magnetic resonance imaging (MRI), left femoral neck stress fracture and surrounding bone edema were visible on the T2 sequence (Figure 2). After radiological evaluation, the fracture was classified as compression type, according to Fullerton & Snowdy classification, and no surgical intervention was planned. The patient was followed with restricted weight bearing, non-steroidal anti-inflammatory drugs, and oral vitamin D replacement therapy. Follow-up was planned and performed as 30 days without, 20 days partial, followed with full weight-bearing. On the 30th day clinic visit, there was callus visible on pelvic AP X-ray (Figure 3). On third month visit, the patient was free of pain with a full range of motion and function.

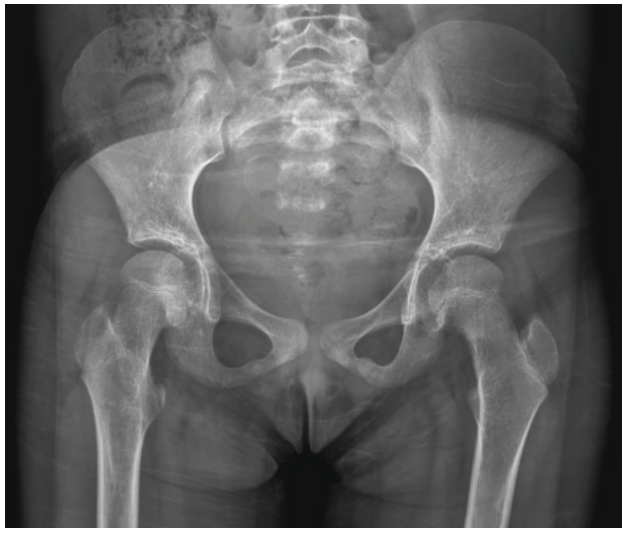

Figure 1. First X-ray: There was no sign of a fracture or periosteal reaction

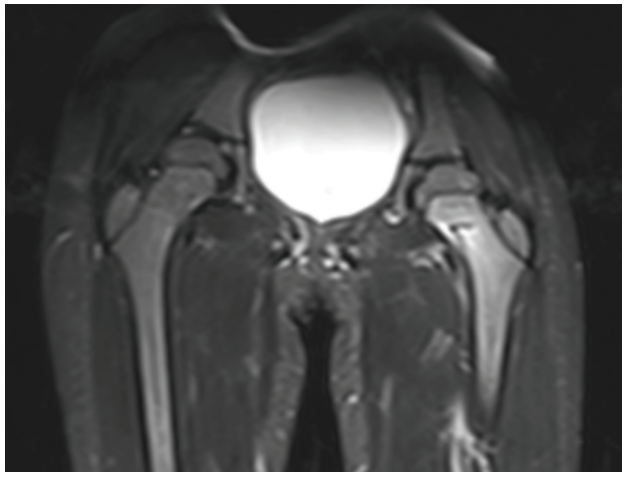

Figure 2. Magnetic resonance imaging: Left femoral neck stress fracture and surrounding bone edema were visible on the T2 sequence

Discussion

CF is a disease caused by a mutation of the transmembrane conductance regulator (CFTR) gene, located on the 7. chromosome. CF; affects respiratory, gastrointestinal, and urinary systems, as well as the musculoskeletal system. Bone involvement includes mostly osteopenia and osteoporosis. Paccou et al. (1) reported in a study on adults with CF, the prevalence of osteoporosis, osteopenia, and non-vertebral pathological fractures; 23%, 38%, and 19%, respectively. The distribution of non-vertebral fractures on CF patients shows heterogeneity, and there are various studies with different results for most frequent fractured bones (2,3).

Femoral neck fractures are uncommon injuries like less than 1% in all pediatric fractures, usually associated with significant trauma (4). Repetitive microtrauma may also cause femoral neck stress fractures (5). Femoral neck stress fractures are 1-7,2% of all stress fractures.

Low bone mineral density (BMD) is one of the possible etiological factors for a stress fracture (6-9). Malnutrition, chronic infection, vitamin D insufficiency, hypogonadism, and low physical activity are primary factors for decreased BMD (10).

BMD of our patient checked 3 years ago was 0.560 g/cm^2 (Z-score: -1.4), declined to 0.495 g/cm^2, (Z-score: -2.4) at the time of fracture. She was seven times hospitalized because of pulmonary infection and malnutrition in the last three years. On every hospitalization, she did not use intravenous corticosteroids but had inhalation corticosteroids for treatment, which is another factor predisposing low BMD (11). Z-score is significantly correlated with respiratory parameter forced expiratory volume in one second (FEV1) (12). FEV1 score 2 months before fracture is 51% (age normal 75-80%). However, even with normal nutrition and mild disease may have low BMD (13). CF patients with F508del homozygous mutation have lower BMD. Our patient does not have this mutation (14).

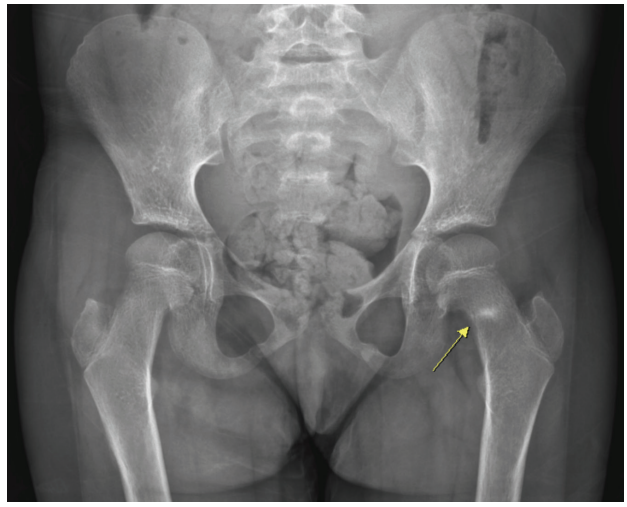

Figure 3. 30th day clinic visit; there was callus visible on pelvic anteroposterior X-ray

A pediatric patient consulted because of hip and groin pain; transient synovitis, Perthes disease, infection, malignancy, and dysplasia should be ina differential diagnosis. The primary symptom for a femoral neck stress fracture is gradually worsening hip, anterior groin, and knee pain. Pain is elevated with weight-bearing and activity, relieves with rest. The patient may have an antalgic gait pattern. Physical examination, patients avoid active hip movement, and passive motion causes pain and fear. The first used imaging modality is AP direct radiography. 15° internal rotation X-ray may also be helpful for evaluation but has limited diagnostic value. MRI is a gold standard for evaluation (6,15-17). Haddad et al. (6) used an MRI to define stress fractures and reported bone edema as the most frequent finding. The most common classification system for femoral neck stress fractures is Fullerton & Snowdy classification, which is based on direct X-rays and bone scans (18). Fractures are classified as compression type, tension type, and displaced fractures according to this classification.

We do not think our patient's stress fracture is caused by repetitive trauma. Risk factors in our patient are Z-score declining from -1.4 to -2.4 /cm^2, prepuberty, female gender, and low FEV1 score, steroid use (10).

Primary aims in the treatment of femoral neck fracture are to prevent avascular necrosis, coxa vara, and premature physeal closure. These complications depend on the amount of displacement (19). Biz et al. (20) successfully treated conservatively 1 of 4 femoral neck stress fractures, and they used dynamic hip screw fixation for other patients. We did not choose surgical intervention because of age, undisplaced fracture, and limited immediate activity expectations of the patient.

There are 2 case reports about femoral neck fractures in CF patients. Lim et al. (21) reported bilateral femoral neck fractures after grand mal epilepsy on a 34-year-old CF patient. The patient reported with prolonged usage of corticosteroids and malnutrition after recurrent pulmonary infection. These two factors decrease BMD and increase the risk of fracture as well as our patient. The patient was treated successfully with bilateral total hip arthroplasty and vitamin D support to increase BMD. Haworth et al. (22) successfully treated a 25-year-old patient with low BMD. The patient was deceased two years after surgery, and on bone biopsy, severe cortical and trabecular osteopenia was observed, which was not specific for osteomalacia or osteoporosis. Their new histomorphological findings suggest that bone disease caused by CF may be much more complicated.

There was no reported femoral neck stress fracture of a CF child.

Low BMD becomes a much more challenging issue because of the longer life expectancy of CF patients. Stress fracture should be in the differential diagnosis of a CF patient with joint and extremity pain without trauma. We suggest early monitorisation of bone quality because of possible early-onset low BMD.

Ethics

Informed Consent: Informed consent was obtained from the mother of the patient because of the patient is under 18 years old.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

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

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Paccou J, Zeboulon N, Combescure C, Gossec L, Cortet B. The prevalence of osteoporosis, osteopenia, and fractures among adults with cystic fibrosis: a systematic literature review with meta-analysis. Calcif Tissue Int 2010;86:1-7.
2. Haworth CS, Selby PL, Webb AK, Dodd ME, Musson H, McL Niven R, et al. Low bone mineral density in adults with cystic fibrosis. Thorax 1999;54:961-7.
3. Elkin SL, Fairney A, Burnett S, Kemp M, Kyd P, Burgess J, et al. Vertebral deformities and low bone mineral density in adults with cystic fibrosis: a cross-sectional study. Osteoporos Int 2001;12:366-72.
4. Beaty JH, Kasser JR. Rockwood and Wilkins. Fractures in Children. Philadelphia: Lippincott, William &Wilkins; 2010. p. 769-96.
5. Palocaren T. Femoral Neck Fractures in Children: A Review. Indian J Orthop 2018;52:501-6.
6. Haddad FS, Bann S, Hill RA, Jones DH. Displaced stress fracture of the femoral neck in an active amenorrhoeic adolescent. Br J Sports Med 1997;31:70-2.
7. Scott MP, Finnoff JT, Davis BA. Femoral neck stress fracture presenting as gluteal pain in a marathon runner: case report. Arch Phys Med Rehabil 1999;80:236-8.
8. Warden SJ, Burr DB, Brukner PD. Stress fractures: pathophysiology, epidemiology, and risk factors. Curr Osteoporos Rep 2006;4:103-9.
9. Umans H, Pavlov H. Stress fractures of the lower extremities. Semin Roentgenol 1994;29:176-93.
10. Conway SP, Morton AM, Oldroyd B, Truscott JG, White H, Smith AH, et al. Osteoporosis and osteopenia in adults and adolescents with cystic fibrosis: prevalence and associated factors. Thorax 2000;55:798-804.
11. Bianchi ML, Romano G, Saraifoger S, Costantini D, Limonta C, Colombo C. BMD and body composition in children and young patients affected by cystic fibrosis. J Bone Miner Res 2006;21:388-96.
12. Sermet-Gaudelus I, Souberbielle JC, Ruiz JC, Vrielynck S, Heuillon B, Azhar I, et al. Low bone mineral density in young children with cystic fibrosis. Am J Respir Crit Care Med 2007;175:951-7.
13. Elkin SL, Vedi S, Bord S, Garrahan NJ, Hodson ME, Compston JE. Histomorphometric analysis of bone biopsies from the iliac crest of adults with cystic fibrosis. Am J Respir Crit Care Med 2002;166:1470-4.
14. King SJ, Topliss DJ, Kotsimbos T, Nyulasi IB, Bailey M, Ebeling PR, et al. Reduced bone density in cystic fibrosis: DeltaF508 mutation is an independent risk factor. Eur Respir J 2005;25:54-61.
15. Werntz JR, Lane JM. The biology of pathologic fracture repair. In: Lane JM, Healey JH, (editors). Diagnosis and management of pathologic fractures. New York: Raven; 1993; p. 1-11.
16. Pouilles JM, Bernard J, Tremollières F, Louvet JP, Ribot C. Femoral bone density in young male adults with stress fractures. Bone 1989;10:105-8.

17. Consensus development conference: prophylaxis and treatment of osteoporosis. Am J Med 1991;90:107-10.
18. Fullerton LR Jr, Snowdy HA. Femoral neck stress fractures. Am J Sports Med 1988;16:365-77.
19. Robertson GA, Wood AM. Femoral Neck Stress Fractures in Sport: A Current Concepts Review. Sports Med Int Open 2017;1:E58-E68.
20. Biz C, Berizzi A, Crimì A, Marcato C, Trovarelli G, Ruggieri P. Management and treatment of femoral neck stress fractures in recreational runners: a report of four cases and review of the literature. Acta Biomed 2017;88:96-106.
21. Lim AY, Isopescu S, Thickett KM, Gumery LB, Darby AJ, Honeybourne D, et al. Bilateral fractured neck of the femur in an adult patient with cystic fibrosis. Eur J Intern Med 2003;14:196-8.
22. Haworth CS, Freemont AJ, Webb AK, Dodd ME, Selby PL, Mawer EB, et al. Hip fracture and bone histomorphometry in a young adult with cystic fibrosis. Eur Respir J 1999;14:478-9.

DOI: 10.4274/tod.galenos.2020.86648
Turk J Osteoporos 2021;27:121-7

Stres Kırıklarına Yaklaşım: Üç Olgu Sunumu ve Literatürün Gözden Geçirilmesi

Approach to Stress Fractures: Report of Three Cases and Review of Literature

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Öz

Stres kırıkları kemiklerin tekrarlayıcı ve mekanik olarak aşırı yüklenmelerine bağlı olarak oluşurlar. Yorgunluk ve yetersizlik kırıkları olmak üzere iki alt tipi vardır. Genellikle etkilenen kemikte ağrı hareketle artar ve istirahatle azalır. Sıklıkla tibia, pelvis kemikleri ve ayak kemiklerinde görülürler. Erken dönemde direkt grafi genellikle normaldir. Dikkatli anamnez, fizik muayene ve ileri görüntüleme yöntemleri ile tanı koyulur. Günlük pratiğimizde sıklıkla gözden kaçabilen, tanı konulması zor olan stres kırıkları klinik şüphe varlığında ayırıcı tanıda mutlaka düşünülmelidir. Bu makalede farklı anatomik bölgelerde stres kırığı olan 3 hasta sunulmuştur.
Anahtar kelimeler: Stres kırıkları, yetersizlik kırığı, yorgunluk kırığı

Abstract

Stress fractures occur following repetitive and mechanical overloading of the bones. Two known subtypes are fatigue fractures and insufficiency fractures. Generally, pain in the affected bone increases with activity and decreases with rest. They are frequently seen in the tibia, pelvis and foot bones. In the early period, results of direct radiography are generally normal. Diagnosis is based on detailed history assessment, physical examination and advanced imaging methods. Stress fractures are often overlooked and difficult to diagnose; thus, it should be considered in the differential diagnosis if there is clinical suspicion. This report presents three cases of stress fractures in different anatomical regions.
Keywords: Stress fractures, insufficiency fracture, fatigue fracture

Giriş

Stres kırıkları kemiklerin uzamış, tekrarlayıcı, normalde tam kırık oluşturacak güçten daha az güçteki mekanik yüklenmelere bağlı oluşan kırıklarıdır. Yetmezlik kırıkları ve yorgunluk kırıkları olmak üzere iki alt tipi bulunur. Yorgunluk kırıkları alışılmadık mekanik yüklenmeye bağlı sağlıklı kemiklerde sıklıkla alt ekstremitelerde görülürler. Genç erişkinlerde çoğunlukla atletlerde, dansçılarda ve askerlerde görülmektedir (1). Yetmezlik kırıkları, anormal kemik yapısına normal ya da travmatik yüklenme sonucunda gelişirler. Çeşitli risk faktörleri bulunmakla birlikte ileri yaştaki, osteoporotik hastalarda daha sıktır. Genellikle pelvis ve çevresinde görülür. Tanıda ilk basamak direkt radyografidir. Belirgin bir kırık gelişmeden önce lineer skleroz ve periost reaksiyonu ortaya çıkarabilir. Ancak fekal materyal, barsak ansları, vasküler kalsifikasyonlar nedeniyle fraktür hattı gölgelenebilir. Klinik şüphe varlığında erken dönemde kemik sintigrafisi, manyetik rezonans görüntüleme (MRG) gibi ileri görüntüleme yöntemleri istenmelidir. MRG ile erken dönemde kemik iliği ödemi, periostal ödem ve intrakortikal sinyal anormallikleri tespit edilebilir (2,3). Tanı konulması zor olan, sıklıkla gözden kaçabilen stres kırıklarının doğru tanı ve tedavisi için klinik şüphe önem taşımaktadır. Bu olgu sunumunda sağ pubik ramus, sakrum ve femur boynunda stres kırığı tespit edilen üç hastanın literatür bilgileri ışığında sunulması planlanmıştır.

Olgu Sunumları

Olgu 1

Altmış beş yaşında kadın hasta 1 ay önce başlayan sağ kasık ağrısı ile polikliniğimize başvurdu. Daha önce sağ inguinal herni nedeniyle opere olan hasta ilk olarak genel cerrahi polikliniğine başvurmuş orada yapılan muayene ve tetkiklerinin normal olması üzerine polikliniğimize yönlendirilmişti. Travma öyküsü olmayan hasta köyde yaşıyordu. Köyde fiziksel olarak aktif çalıştığı

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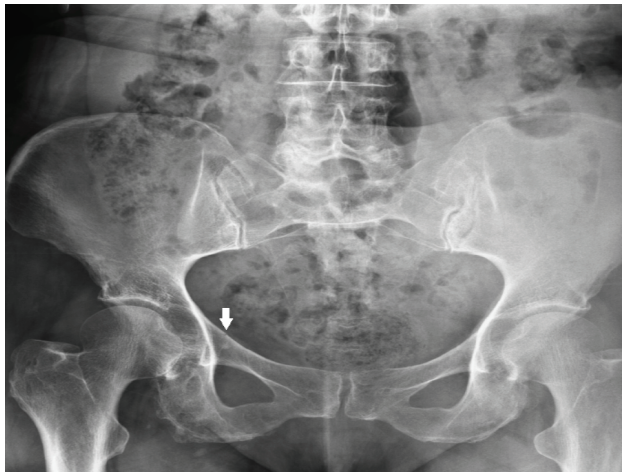
öğrenilen hasta ailesiyle birlikte hayvancılıkla uğraşıyordu. Bilinen herhangi bir sistemik hastalık öyküsü yoktu. Sağ kasık ağrısı 1 aydır özellikle aktivite sonrası ve ağırlık kaldırma sonrası artıyor, istirahat ve non-steroid anti-enflamatuvar ilaç (NSAİİ) alımı ile azalıyordu. Gece ağrısı yoktu. Ara sıra NSAİİ alımı dışında düzenli ilaç kullanım öyküsü yoktu. Hastanın fizik muayenesinde sağ inguinal bölge inferiorunda palpasyon ile hassasiyet mevcuttu. Sağ kalça eklem hareket açıklığı (EHA) tamdı. FABER ve FADIR testleri negatifti. Siyatik germe, sakroiliak germe testleri negatifti. Hastanın diğer kas iskelet sistemi muayenesi normaldi. Mekanik kalça ağrısı olan hastadan istenen pelvis grafisinde sağ superior pubik ramusda non-deplase fraktür hattı ve lineer skleroze alan görüldü (Şekil 1). Biyokimyasal incelemede serumda kalsiyum (Ca): 9,16 (N: 8,4-10,5 mg/dL), fosfor (P): 3,48 (N: 2,3-4,7 mg/dL), 25-hidroksivitamin D_3 [25-(OH)D_3]: 4,53 (N: 20>µg/L), parathormon (PTH): 51,34 (12-72 pg/mL), alkalen fosfataz (ALP): 115 (N: 40-150 u/l), tiroid stimulan hormon (TSH): 1,77 (N: 0,4-4,2 mlU/L), eritrosit sedimentasyon hızı (ESH): 21 mm/saat (N: 0-20 mm/h), C-reaktif protein (CRP): 2,45 mg/L (N: 0-8 mg/L) olarak ölçüldü. Kemik mineral dansitometri (KMD) istenen hastanın L1-L4 T-skoru: -1,2, femur boyun T-skoru: -0,9 olarak tespit edildi. Hastaya Ca ve D vitamini kombinasyonu başlandı (1.200 mg Ca/gün, 880 IU D vitamini/gün). Ortopedi konsültasyonu istenen hastaya 4 hafta aktivite kısıtlaması ve istirahat önerildi. Bir ay sonraki kontrolde hastanın ağrısının belirgin azaldığı görüldü.

Olgu 2

Yirmi sekiz yaşındaki kadın hasta bel ve sağ kalça ağrısı ile polikliniğimize başvurdu. Hasta ağrı nedeniyle yürümekte güçlük çekiyordu bu nedenle polikliniğe tekerlekli sandalye ile getirildi. Öyküsünde 1 hafta önce epidural anestezi altında sezaryen ile doğum yaptığı öğrenilen hastanın gebelik süreci normal geçmişti. Post-operatif komplikasyon gelişmemişti. Hastanın ilk gebeliğiydi ve 3.400 gram ağırlığında sağlıklı bir bebek dünyaya getirmişti. Gebeliği esnasında benzer şekilde bir ağrı olmamıştı. Hastanın kronik hastalık öyküsü, perioperatif travma öyküsü yoktu. Fizik muayenede hastanın bel hareketleri açık ve ağrısızdı. Sağ kalça EHA'larında limitasyon yoktu ancak hasta kalçasını fleksiyon, abdüksiyon ve dış rotasyona zorladığımızda kasıkta ağrı tarifledi. Sakroiliak germe testleri sağda pozitifti. Nörolojik muayenesi normaldi. Rutin kan tahlillerinde akut faz reaktanlarında ılımlı yükseklik olduğu görüldü. İdrar tahlili piyürik gelen hastaya kadın doğum uzmanı antibiyotik tedavisi başlamıştı. Biyokimyasal incelemede serumda Ca: 9,75 (N: 8,4-10,5 mg/dL), P: 3,9 (N: 2,3-4,7 mg/dL), 25-(OH)D_3: 12,5 (N: 20>µg/L), PTH: 70 (12-72 pg/mL), ALP: 55 (N: 40-150 u/L), TSH: 3,46 (N: 0,4-4,2 mlU/L), ESH: 34 mm/saat, CRP: 14 mg/L (N: 0-8 mg/L) olarak ölçüldü. Hastaya mevcut şikayetleri ile çekilen ön-arka pelvis ve lumbosakral iki yönlü grafileri normaldi. Lomber MRG'de anlamlı patolojik bulgu saptanmayan hastaya çekilen sakroiliak eklem MRG'de sağ sakroiliak eklem çevresinde yoğun kemik iliği ödemi ve eklem çevresinde sıvı birikimi görüldü. Mevcut görüntüleme bulguları ile hastada sakroileit, sakral yetmezlik kırığı ayırıcı tanısı yapılamadığı için 10 gün sonra sakroiliak MRG tekrarlandı (Şekil 2). Kontrol MRG'de sağda sakral yetmezlik kırığı tespit edilen hastaya 6 hafta boyunca aktivite kısıtlaması ve ağrılı ekstremite üzerine kısmi yük verme önerildi. D vitamini replasmanı başlandı (880 IU/gün). Ağrı kontrolü için asetaminofen kullanıldı. Sekiz hafta sonraki kontrolde hastanın ağrısı neredeyse tamamen gerilemişti.



Şekil 1. Sağ superior pubik ramusta lineer sklerotik fraktür hattı (beyaz ok)

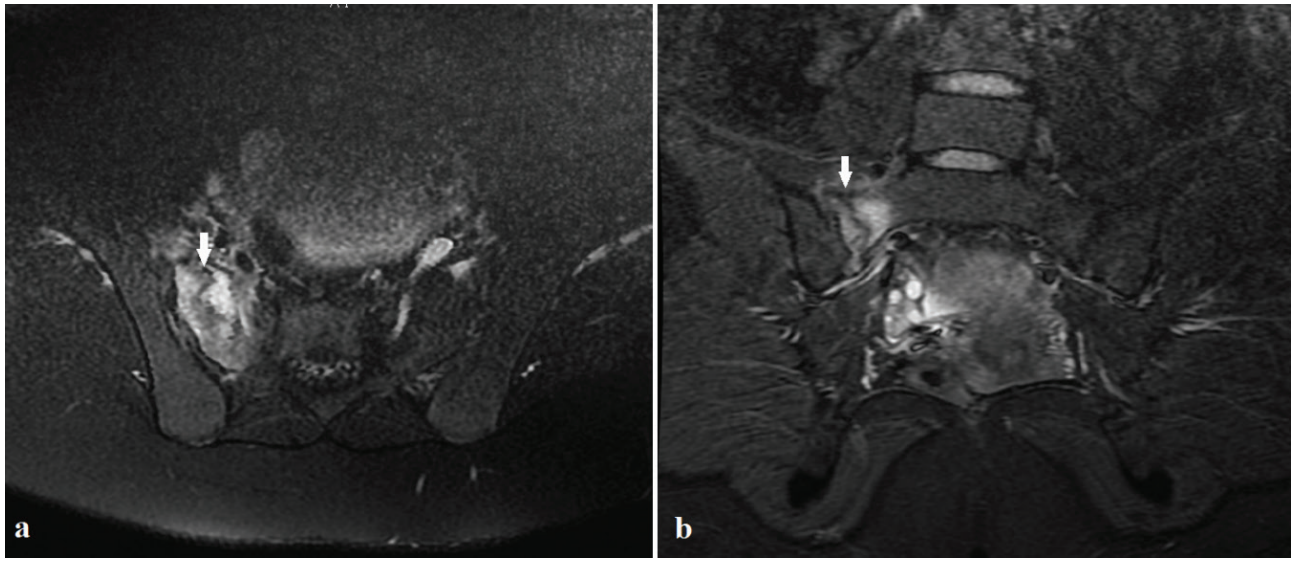
Olgu 3

Altmış bir yaşında erkek hasta sol kasık ağrısı şikayeti ile polikliniğimize başvurdu. Hastanın öyküsünde şikayetinin 10 gün önce başladığı, hareketle ağrısının artıp istirahatte bir miktar rahatladığı, çiftçilikle uğraşan hastanın çalışmakta güçlük çektiği öğrenildi. Otuz yıldır sigara kullanan hastanın bilinen herhangi bir kronik hastalık öyküsü ve yakın zamanda geçirilmiş travma öyküsü yoktu. Fizik muayenede hastanın kalça dış rotasyonunda belirgin olmak üzere sol kalça EHA'ları limitli ve ağrılıydı. FABER ve FADIR testleri solda pozitifti. Hastanın lomber EHA'ları tamdı. Siyatik germe, femoral germe, sakroiliak eklem germe testleri negatifti. Hastanın kasık çevresinde şişlik, renk değişikliği yoktu. Mekanik sol kasık ağrısı olan hastadan öncelikle ön-arka pelvis grafisi istendi. Patolojik görünüm saptanmadı. Sol kalça MRG'de sol kollum femoriste T1-T2 ağırlıklı görüntülerde lineer hipointens görünüm, etrafında kemik iliği ödemi ve kalça eklemi içerisinde sıvı birikimi görüldü (Şekil 3). Mevcut bulgular ile sol kollum femoris yetmezlik kırığı tanısı konan hastaya KMD çekildi. Femur boyun T-skoru: -2,3, L1-L4 T-skoru: -3,9 olarak tespit edildi. Biyokimyasal incelemede serumda Ca: 9,44 (N: 8,4-10,5 mg/dL), P: 3,37 (N: 2,3-4,7 mg/dL), 25-(OH)D_3: 14 (N: 20>µg/L), PTH: 70 (12-72 pg/mL), ALP: 82 (N: 40-150 u/L), TSH: 0,38 (N: 0,35-4,2 mlU/L), ESH: 24 mm/saat (N: 0-20 mm/h), CRP: 12 mg/L (N: 0-8 mg/L) idi. Hastaya osteoporoz tedavisi için intravenöz zoledronik asit yapıldı. Ortopedi konsültasyonu istenen hastaya yüksek patolojik kırık riski nedeniyle operasyon önerildi. Hastaya profilaktik intramedüller fiksasyon yapıldı.

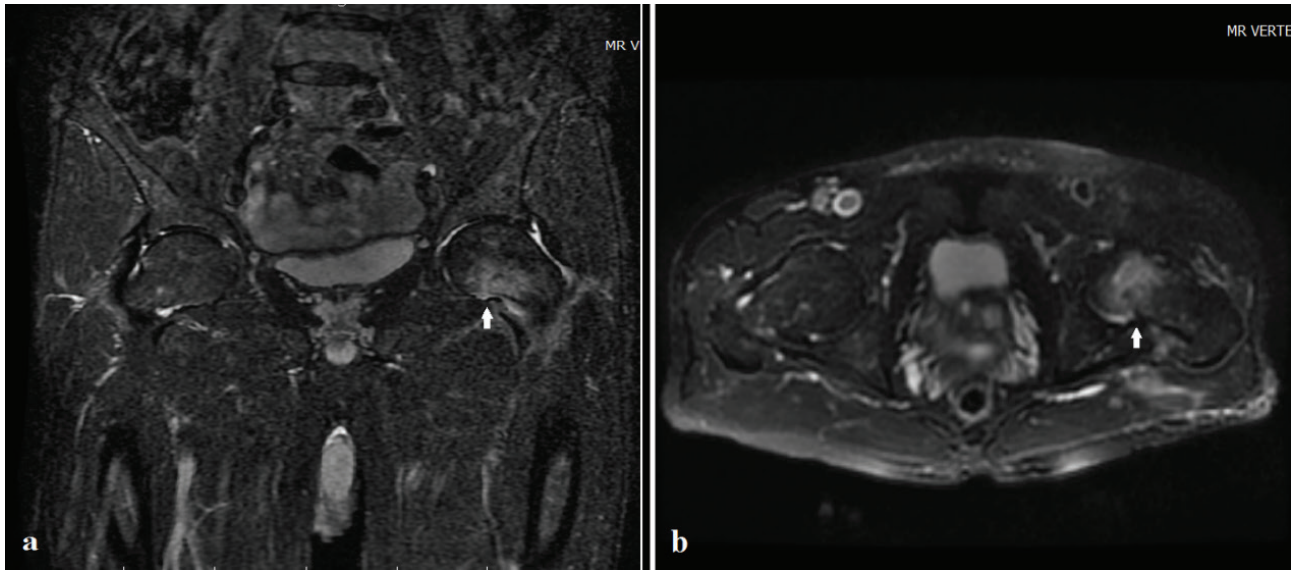
Tartışma

Stres kırıkları ilk olarak 1855 yılında Breithraupt (4) tarafından Prusyalı askerlerde yürümeye bağlı gelişen metatarsal fraktürleri tanımlamak için kullanılmıştır. Bundan yaklaşık bir yüzyıl sonra koşucularda stres kırıkları bildirilmeye başlanmıştır (5). Günümüzde ileri görüntüleme yöntemlerinin yaygınlaşmasıyla birlikte stres kırığı tanısı daha çok koyulmaktadır. Bununla birlikte stres kırıkları bazı iyi ve kötü huylu patolojilerle de karışabileceği için dikkatli bir klinik değerlendirme ve ayırıcı tanı yapılması şarttır. Stres kırıkları kemiğin lokal bir bölgesinde, normal veya anormal kemikte, uzamış veya tekrarlayıcı, normalde tam kırık oluşturacak güçten daha az güçteki mekanik yüklenmelere bağlı oluşan kırıklardır. Stres kırıkları etkilenen kemik matriksin durumuna göre yetmezlik kırıkları (osteopenik kemik) ve yorgunluk kırıkları (normal kemik) olmak üzere iki gruba ayrılır (1,2). Kemik solid bir yapıya sahip olup üzerine mekanik bir stres uygulandığında yük taşıma kapasitesinin sınırları içerinde deforme olup orijinal haline dönebilir. Ancak kemik mekanik yük taşıma kapasitesinin üzerinde gerildiğinde mikrofraktürler gelişmeye başlar. Bu mikrofraktürler kortikal kemik içerisinde düzensizliğe neden olarak stres fraktürlerinin gelişimine neden olur (2,6).

Yorgunluk kırıkları, normal kemik üzerine yüklenen anormal tekrarlayıcı mekanik streslerin sonucu ortaya çıkar. Bu tip stres kırıkları genç aktif bireylerde daha çok yük taşıyan kemiklerde sıktır. Askerlerde, atletlerde ve dansçılarda sık görülür (1). Ekstrinsik ve intrinsik bazı risk faktörleri tanımlanmıştır. Ekstrinsik risk faktörleri içinde antrenman protokolü, ayakkabı, antrenman



Şekil 2. a) T2 aksiyal yağ baskılı sekans b) Koronal STIR sekansta sağ sakral kanatta lineer hipointens fraktür hattı ve etrafında hiperintens kemik iliği ödemi (beyaz ok)



Şekil 3. a) Koronal STIR sekans b) T2 aksiyal yağ baskılı sekansda sol kollum femoriste lineer hipointens fraktür hattı ve etrafında hiperintens kemik iliği ödemi (beyaz ok)

yüzeyi ve spor türü bulunur. Çalışmalar, uzun antrenman mesafesinin, örneğin; haftada 40 milden (yaklaşık 67 km'den fazla) (örneğin; atletlerde) ve 5 saatten fazla günlük çalışma (örneğin; dansçılarda) gibi uzun egzersiz dönemlerinin, stres kırığı riskini artırdığını göstermiştir (7). Bennell ve ark. (8,9) stres kırığı oranlarının oynanan spor türlerinde farklı olduğunu göstermişlerdir. Kısa mesafe koşucularında, engelli koşu yarışçılarında daha çok ayak stres fraktürleri görülürken, uzun mesafe koşucularında pelvis ve uzun kemik fraktürleri daha çok görülür. İntriksik faktörler, cinsiyet, yaş, ırk ve genel kondüsyon seviyesinin yanı sıra iskelet, kas, eklem ve biyomekanik faktörleri içerir (10). Kadınlarda erkeklere göre yorgunluk kırığı insidansının daha yüksek olduğu bildirilmiştir (2). Hipoöstrojenizm ve düşük enerji alımı gibi hormonal ve beslenme ile ilgili faktörler stres kırığı riskini önemli ölçüde artırır. Bu duruma örnek olarak kadın atlet triadı (yeme bozuklukları, amenore, osteoporoz) verilebilir. Pek çok çalışma stres kırıklarının amenoreik ve oligomenoreik kadınlarda daha sık olduğunu göstermiştir (8,9). Yorgunluk kırıklarının tipik görülme yerleri insidansa göre tibia (%33), tarsal kemikler (%20), metatarsal kemikler (%20), femur (%11), fibula (%7) ve pelvis (%7) olarak gösterilmiştir (11). Üst ekstremite yorgunluk kırıkları nadirdir, ancak özellikle jimnastik, halter ve beyzbol veya voleybol gibi fırlatmalı sporlarda ortaya çıkabilir. Üst ekstremite stres kırığı bölgeleri arasında klavikula, skapula, birinci kosta, proksimal humerus şaftı, medial humerus epikondili, olekranon, karpal (skafoid, hamat, triquetrum) ve metakarpal kemikler yer almaktadır (12).

Yetersizlik kırıkları ise elastik direnci azalmış anormal kemiğe normal veya düşük enerjili fizyolojik bir stres uygulandığında oluşur. Başta osteoporoz olmak üzere yetmezlik kırıklarına neden olan çeşitli risk faktörleri bulunmaktadır. Romatoid artrit, metabolik kemik hastalığı, nörolojik bozukluklar, radyoterapi, total kalça protezi, kortikosteroid tedavisi, yüksek doz florür tedavisi ve bisfosfonat tedavisi diğer risk faktörleridir (2). Bu durumlarda kemik elastikiyeti ve mineral içeriğinde bozukluklar görülür. Biyomekanik çalışmalar, %20'lik kortikal porozitenin kemik gücünü azalttığını göstermiştir ve 65 yaş üzeri hastalarda ortalama kortikal porozitenin %46 olduğu görülmüştür (13). Kaslar normalde mekanik stresin bir kısmını absorbe ederek yapışık oldukları kemik üzerine koruyucu bir etki sağlarlar. Yaşlanmayla birlikte gelişen kas atrofisi ile belirgin sarkopenide bu koruyucu etki kaybolur (14). Bu nedenle yaşlı ve postmenopozal osteoporozlu kadınlar yetmezlik kırıkları için en riskli gruptur. Bu kırıklar tipik olarak vertebralar (kompresyon kırıkları), sakrum veya pelvis, lateral femur boynu, femur başı subkondral bölgeleri veya diz medial femoral kondilinde görülür (2). Yetmezlik kırıkları daha çok postmenopozal osteoporotik kadınlarda görülmekle birlikte nadiren genç kadınlarda gebelik döneminde ya da postpartum dönemde de görülebilmektedir. Kemikler hamilelik, doğum ve postpartum dönemde bazı değişikliklere maruz kalır; hem hormonal faktörler hem de mekanik stresler kadın vücudunu etkiler. Artan relaksin seviyeleri, aşırı kilo alımı, hiperlordoz, pelvik bağların zayıflığı, artan prolaktin seviyesinden kaynaklanan osteopeni ve hamilelik osteoporozu pelvik kırıkların gelişimine katkıda bulunabilir. Postpartum dönemde görülen kalça ve bel ağrılarının ayırıcı tanısında mutlaka pelvik yetmezlik kırıkları da düşünülmelidir (15). Pelvik yetersizlik kırıkları en sık pubik ramusta, ardından sakrumda ve daha az sıklıkta asetabulumda görülür (16). Bizim ikinci olgumuzda da postpartum dönemde sakral yetmezlik kırığı tespit edilmiştir. Osteoporoz, Paget, hiperkalsemi, osteogenezis imperfekta, juvenil osteoporoz ve fibröz displazi gibi pek çok hastalığın tedavisinde kullanılan bifosfonatların uzun süreli kullanımına bağlı olarak da yetmezlik fraktürleri görülebilmektedir. Uzun süreli kullanımda bifosfonatlar, kemik matriksin yoğunluğunu artırırken aynı zamanda kırılganlığı artmış ve mikrotravmalara daha dayanıksız bir kemik doku oluşumuna neden olur ki bu da çene osteonekrozu ya da atipik subtrokanterik femur kırıkları ile sonuçlanabilir (17). Üç yıldan fazla bifosfonat tedavisi alan hastalarda atipik femoral subtrokanterik kırık insidansı %2 olarak bildirilmiştir (18). Total diz veya total kalça protezi ameliyatlarında protezlerin kemiğe yerleştirilme aşamasında da stres kırıkları meydana gelebilir. Total diz protez ameliyatından sonra kalçada, total kalça protez ameliyatından sonra pelviste stres kırığı oluşabilir. Protez ameliyatı geçirmiş kişilerde ipsilateral ekstremitede kemik kaynaklı hareketle artan ağrı durumunda stres kırığı ihtimali de düşünülmelidir (19). Bu makalede sunulan üç olguda da farklı anatomik bölgelerde yetmezlik kırığı mevcuttu. Birinci olgunun zorlayıcı günlük aktiviteler dışında risk faktörü yoktu. İkinci olguda gebelik ve laktasyon, üçüncü olguda ise zorlayıcı aktiviteler ve osteoporoz risk faktörü olarak belirlendi.

Hastalar sıklıkla aktivite ile artan istirahatle azalan ağrı şikayeti ile başvururlar. Genellikle ağrının başlangıcında bilinen travma öyküsü olmamakla birlikte tekrarlayıcı fiziksel zorlamalar söz konusu olabilir (19). Pelvisin yetersizlik kırıkları sıklıkla yaşlılarda bel, kalça ve kasık ağrısı olarak belirti verir (20). Fizik muayenede ilgili kemik bölgesinde lokalize hassasiyet bulunur. Kalça eklemini ilgilendiren kırıklarda kalçada hareket kısıtlılığının olması önemli bir muayene bulgusudur (19). Bizim üçüncü olgumuzda da kalça ekleminde artroz bulgusu olmamasına rağmen eklem hareketlerinde ağrı ve hareket kısıtlılığı vardı. Hastada femur boynunda yetmezlik kırığı tespit edildi. Bu makalede sunulan pubik ramus kırığı ve femur boynu kırığı olan iki olgu da köyde yaşıyordu. Biri çiftçilik diğeri hayvancılıkla uğraşıyor ve günlük işleri sırasında sürekli fiziksel zorlayıcı aktiviteler yapıyorlardı.

Konvansiyonel radyografi, kas-iskelet sistemi yaralanmalarında ve stres kırığı şüphesinde birinci basamak görüntüleme yöntemidir. Ancak erken dönemde stres kırıkları için duyarlılığı düşüktür. Özellikle osteopeni ortamında tespit edilmesi zordur. Barsak ansları, fekal materyal, vasküler kalsifikasyonlar kırık hattını gölgeleyebilir. Bununla birlikte, stres kırığı direkt grafide ince lineer skleroz (genellikle büyük trabeküllere vertikal), fokal endosteal veya periosteal reaksiyon ve periost reaksiyonu ile birlikte kortikal fraktür şeklinde kendini gösterebilir (3,20). Bizim birinci olgumuzda da superior pubik ramideki stres kırığı grafide lineer sklerotik hat şeklinde gözükmekteydi. MRG ikinci basamak görüntüleme yöntemi olmasına rağmen stres kırıklarının

tanısında en hassas ve spesifik tanı yöntemidir (duyarlılık %100, özgüllük %85). Yaşlı ve risk faktörü olan hastalarda etiyolojisi açıklanamayan bel, kalça, kasık ve ekstremite ağrılarında mutlaka istenmelidir. T1 ve T2 ağırlıklı görüntülerde lineer hipointens fraktür hattı ve T2 yağ baskılı ve STIR sekanslarında kemiğe komşu kemik iliğinde ödem ile uyumlu hiperintensite tipik görülen bulgulardır (2). Stres kırığının erken belirtisi kemik dokusunun ve bitişiğindeki yumuşak doku alanlarının ödemidir. Bu erken belirtiler MRG ile semptomların başlamasından 1 veya 2 gün sonra tanımlanabilir (7). Bilgisayarlı tomografi (BT), longitudinal kırıkların gösterilmesinde yararlı olabilir. Özellikle, osteoid osteoma ayırıcı tanıda olduğunda, kesitsel BT osteoid osteomanın nidusunu ortaya çıkarırken, yorgunluk kırığı durumunda lineer bir kırık çizgisi görünecektir. Ayrıca, BT vertebraların stres kırıklarının değerlendirilmesinde de yararlıdır. BT'de pars interartikülaris stres kırıklarının (spondilolizis) kırık hattı sıklıkla görülebilir, ancak radyografide ve MRG'de tespit edilmesi zordur (21). Ultrasonografi (USG), stres kırıklarının değerlendirilmesi için kolay ulaşılabilir ve giderek daha yaygın kullanılan bir araç haline gelmektedir. Öncelikle daha yüzeysel kemiklerin değerlendirilmesi ile sınırlı olan USG, kortikal kemiğin hiperekoik yüzeysel kenarlarını değerlendirebilir ve çevresindeki hipoekoik kallusu ortaya çıkarabilir. USG'nin bir dizi olguda metatarsal kemik stres kırıklarının erken tanısında duyarlı ve spesifik bir teknik olduğu gösterilmiştir (22). Kemik sintigrafisi (Teknesyum-99m) artmış kemik remodelling durumlarına duyarlıdır ve stres kırıklarının tanısında semptomların başlamasından 3 ila 5 gün sonra belirti verir (7). Kemik sintigrafisinin, anormal metabolik kemik aktivitesini saptamadaki duyarlılığı mükemmeldir; ancak asemptomatik bölgelerde de %40'lara kadar varabilen tutulum nedeniyle özgüllüğü düşüktür (23).

Stres yaralanmalarının ayırıcı tanısında konvansiyonel radyografilerde fokal kortikal kalınlaşma, besleyici vasküler kanal, osteomiyelit/Brodie apsesi, osteoid osteoma, diğer neoplazmlar (örneğin; yüzeyel osteosarkom veya metastazı), osteitis pubis ve avasküler nekroz düşünülmelidir. MRG'de görülen kemik iliği ödemi spesifik değildir, ancak erken stres yanıtını göstermede oldukça hassastır. Kemik iliği ödemi, neoplazm, enfeksiyon, enflamatuvar spondiloartropatiler, kırık, koşucuların ayaklarında, asemptomatik yetişkinlerde ve çocuklarda tesadüfen tespit edilebilir. Bu nedenle, mevcut olduğunda klinik duruma göre yorumlanmalıdır (2). Sakroileit ve sakral yetmezlik fraktürlerinin MRG bulguları özellikle erken dönemde birbirine benzeyebilir. Bizim ikinci olgumuzda da ilk çekilen MRG'de yoğun kemik iliği ve periartiküler ödem nedeniyle sakroileit ve sakral yetmezlik kırığı ayırımı yapılamamıştır. Hastaya 10 gün sonra çekilen kontrol MRG'de ödemin gerilemesiyle fraktür hattı belirgin hale gelmiş ve tanı netleştirilmiştir. Stres kırıklarının erken başlangıcında ödemin saptanmasıyla ilgili diğer bir durum kalçanın geçici osteoporozudur. Kemik iliği ödemi sendromu olarak da adlandırılan bu tanının, özellikle gebeliğin son üç ayında, iskeletin bir bölgesinde, genellikle kalçada akut ve hızlı kemik kaybının bir sonucu olduğu düşünülmüştür. Femur başı ve boynunun ödemi yaygın bulgudur. Bununla birlikte, daha yüksek görüntüleme yöntemleri ile, kortikal süreksizlik olduğu gözükmektedir; bu nedenle, bu tanı aslında stres kırığının başka bir varyantı olarak da düşünülebilir (7,15). Pubik ramus kırıklarının ayırıcı tanısında inguinal herniler, kasık bölgesinin yumuşak doku zedelenmeleri, adduktör kas strainleri de akılda tutulmalıdır. Bazen klinik ve radyolojik olarak stres kırıklarını tümörlerden ayırmak zordur. Bu nedenle biyopsi yapılmasını önerenler vardır (19). Ancak biyopsi örneği osteoblastik kallus nedeniyle parosteal osteosarkom gibi agresif bir kemik tümörünü taklit edebileceği ve histolojik olarak kafa karıştırıcı olabileceği için alınmasını önermeyenler de vardır. Biyopsi ayrıca kemiği daha da zayıflatarak stres hasarının açık bir kırığa dönüşme olasılığını artırmaktadır (2).

Stres kırığı olan kişilerde laboratuvar bulgularını değerlendiren az sayıda çalışma mevcuttur. Bir çalışmada, teşhis konulduktan sonraki 3 ay içinde, stres kırığı doğrulanmış 53 hastanın 25-(OH)D_3 serum konsantrasyonları ölçülmüştür. 25-(OH)D_3 seviyesi <40 ng/mL (100 nmol/L) olan hastalarda stres fraktürü ile bir ilişki bulunmuştur (24). Daha fazla sayıda hasta ile yapılan prospektif başka bir çalışmada serum 25-(OH)D_3 konsantrasyonu <20 ng/mL (50 nmol/L) olanlarda, >20 ng/mL olanlara göre daha yüksek bir stres kırığı insidansı bildirilmiştir (25). 25-(OH)D_3 düzeyi ile kırık insidansının korele olmadığını gösteren çalışmalarda mevcuttur. Askerlerde yapılan bir prospektif çalışmada stres kırığı olanlarda 25-(OH)D_3 düzeyleri ile diğerleri arasında anlamlı farklılık saptanmamıştır. Bununla birlikte, stres kırıklarının PTH düzeyleri ile anlamlı bir ilişkisi görülmüştür. Bulgular, serum PTH düzeylerinin kırık olanlarda %60 daha yüksek olduğunu göstermektedir (26). Daha yüksek PTH seviyelerinin subklinik D vitamini eksikliği veya direnci ile ilgili olup olmadığı veya sekonder hiperparatiroidizmin diğer nedenlerinin mevcut olup olmadığı bilinmemektedir. Bizim üç olgumuzda da serum 25-(OH)D_3 konsantrasyonları <20 ng/mL idi. PTH seviyeleri ise normal aralıktaydı.

Yorgunluk kırığının tedavisi genellikle konservatiftir. Öneriler arasında istirahat veya kısmi yük verme, soğuk uygulama ve fizik tedavi yer alır. Stres kırığının bulunduğu lokalizasyona göre bazen cerrahi tedavi önerilir. Kırıklar için risk değerlendirmesi, sadece konservatif tedavi ile komplikasyonsuz iyileşme olasılığına ve kırığın lokalizasyonuna göre yapılmaktadır. Düşük riskli bölgeler arasında 2-4. metatarsal şaftlar, fibula/lateral malleol, kalkaneus, küboid, kuneiform ve medial femoral boyun kompresyon kırıkları bulunur. Orta riskli bölgeler arasında pelvis, femoral şaft, posteromedial tibia, medial malleol ve proksimal beşinci metatars bulunur. Yüksek riskli bölgeler arasında lomber omurganın pars interartikularisi, femur başı, lateral femur boynu kompresyon kırıkları, patella (enine kırıklar), tibianın ön korteksi ve ayak içinde talus gövdesi, naviküler kemik, proksimal ikinci metatars, ayak başparmağı veya halluks sesamoidler yer alır. Yüksek riskli bir bölge söz konusu olduğunda ortopedi konsültasyonu alınmalıdır (2,27). Medikal tedavide ağrı kontrolü için analjezikler kullanılabilir. Bifosfonatlar stres kırıklarının önlenmesi ve tedavisi için birkaç çalışmada kullanılmıştır. Beş olguda, intravenöz pamidronatın stres kırığı sonrası eğitime dönmeden önce gereken süreyi azaltmada etkili olduğu bildirilmiştir (28). Ancak askerler üzerinde yapılan

başka bir çalışmada, 12 hafta boyunca uygulanan risedronat tedavisinin stres kırığı insidansını azaltmada, başlama zamanını geciktirmede veya kırıkların şiddetini azaltmada etkili olmadığı gösterilmiştir. Bisfosfonatlar Amerikan Gıda ve İlaç İdaresi tarafından bu endikasyon için onaylanmamıştır (29). Stres kırıklarının tedavisinde sadece yaralanmanın iyileşmesine değil, aynı zamanda yeni olayların önlenmesine de odaklanılmalıdır. Ayakkabı ve antrenman yüzeyleri gibi çeşitli ekstrensek faktörlere yönelik modifikasyonlar yararlı olabilir (7).

Yetersizlik kırıkları meydana geldiğinde, tedavi kırığın lokalizasyonuna, genişliğine, hastanın fonksiyonel durumuna ve eşlik eden hastalıklarına göre düzenlenir. Tedavide belirlenmiş bir konsensüs olmamasına rağmen tercih konservatif olma yönündedir. Ağrı kontrolü için yatak istirahati, asetaminofen, analjezik ilaçlar ve fizik tedavi modaliteleri kullanılabilir ancak NSAİİ'lerin iyileşme yanıtını baskılayabildiği unutulmamalıdır (30). Bununla birlikte, tanı ve tedavideki gecikmeler hastada kırık riskini artırır ve yetmezlik kırığı tam bir kırığa dönüşebilir. Yüksek patolojik kırık riski nedeniyle üçüncü olgumuzda ortopedi konsültasyonu sonrası profilaktik intramedüller fiksasyonla devam etme kararı alınmıştır. Osteopeni hem kırık iyileşmesini hem de tedavisini zorlaştırabilir, zayıf kemik yapı internal fiksasyonu ve vidanın yerleşmesini tehlikeye sokarak kaynamama riskini artırır. Metilmetakrilat çimento kullanımı bazı durumlarda, özellikle omurga, sakrum ve pelviste faydalı olabilir. Kırık iyileşmesini desteklemek için kemik greftleri kullanılabilir. Yetersizlik kırıkları ortaya çıkmadan önce riskli hastaları tanımlamaya ve önleyici tedbirler uygulamaya odaklanan stratejiler uygulanmalıdır. Çift enerjili X-ışını absorbsiyometrisi taraması kullanılarak yapılan KMD testi osteopenik veya osteoporotik hastaları tanımlayabilir. Osteoporozun sekonder nedenleri dışlanmalıdır. Bisfosfonatlar, hormon replasman tedavisi, kalsitonin veya diğer ilaçlarla tıbbi tedavi düşünülebilir. Düşmeyi önlemeye yönelik yürüme eğitimi, davranış modifikasyonu, egzersiz sınıfları veya multidisipliner bir program yardımcı olabilir (31).

Yorgunluk kırıkları en sık görülen aşırı kullanım yaralanmalarındandır. Sporcularda, özellikle koşucularda ve çoğunlukla alt ekstremitelerde görülür. Yetersizlik kırıkları, sıklıkla pelvisi tutan yaşlı osteoporotik popülasyonda yaygındır. Sporcularda hareketle ortaya çıkan ve istirahatle hafifleyen ekstremite ağrılarında, yaşlı ve risk faktörü olan hastalarda etiyolojisi açıklanamayan bel, kalça, kasık ve ekstremite ağrılarında direkt grafi bulguları normal olsa bile stres kırığı ihtimali akılda tutulmalı ve zaman geçirilmeden ileri tetkik yapılmalıdır.

Etik

Hasta Onayı: Çalışmamızda sunulan tüm olgulardan bilgilendirilmiş onam formu alınmıştır.

Hakem Değerlendirmesi: Editörler kurulu tarafından değerlendirilmiştir.

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Kaynaklar

1. PENTECOST RL, MURRAY RA, BRINDLEY HH. FATIGUE, INSUFFICIENCY, AND PATHOLOGIC FRACTURES. JAMA 1964;187:1001-4.
2. Matcuk GR Jr, Mahanty SR, Skalski MR, Patel DB, White EA, Gottsegen CJ. Stress fractures: pathophysiology, clinical presentation, imaging features, and treatment options. Emerg Radiol 2016;23:365-75.
3. Şirvancı M, Ganiyusufoğlu AK, Ulusoy OL, Duran C, Aydıner Ö. Sakral yetersizlik kırıklarının tanısında MRG. Turk J Diagn Intervent Radiol 2002;8:279-83.
4. Breithaupt M. To the pathology of the human foot [in German]. Med Zeitung 1855;24:169.
5. Pepper M, Akuthota V, McCarty EC. The pathophysiology of stress fractures. Clin Sports Med 2006;25:1-16.
6. Chamay A, Tschantz P. Mechanical influences in bone remodeling. Experimental research on Wolff's law. J Biomech 1972;5:173-80.
7. Moreira CA, Bilezikian JP. Stress Fractures: Concepts and Therapeutics. J Clin Endocrinol Metab 2017;102:525-34.
8. Bennell KL, Malcolm SA, Thomas SA, Wark JD, Brukner PD. The incidence and distribution of stress fractures in competitive track and field athletes. A twelve-month prospective study. Am J Sports Med 1996;24:211-7.
9. Bennell KL, Malcolm SA, Thomas SA, Reid SJ, Brukner PD, Ebeling PR, et al. Risk factors for stress fractures in track and field athletes. A twelve-month prospective study. Am J Sports Med 1996;24:810-8.
10. Warden SJ, Burr DB, Brukner PD. Stress fractures: pathophysiology, epidemiology, and risk factors. Curr Osteoporos Rep 2006;4:103-9.
11. Csizy M, Babst R, Fridrich KS. Fehldiagnose "Knochentumor" bei Stressfraktur am medialen Tibiaplateau ["Bone tumor" diagnostic error in stress fracture of the medial tibial plateau]. Unfallchirurg 2000;103:993-5.
12. Anderson MW. Imaging of upper extremity stress fractures in the athlete. Clin Sports Med 2006;25:489-504.
13. Zebaze RM, Ghasem-Zadeh A, Bohte A, Iuliano-Burns S, Mirams M, Price RI, et al. Intracortical remodelling and porosity in the distal radius and post-mortem femurs of women: a cross-sectional study. Lancet 2010;375:1729-36.
14. Iundusi R, Scialdoni A, Arduini M, Battisti D, Piperno A, Gasbarra E, et al. Stress fractures in the elderly: different pathogenetic features compared with young patients. Aging Clin Exp Res 2013;25 Suppl 1:S89-91.
15. Speziali A, Tei MM, Placella G, Chillemi M, Cerulli G. Postpartum Sacral Stress Fracture: An Atypical Case Report. Case Rep Orthop 2015;2015:704393.
16. Peh WCG. Clinics in diagnostic imaging (60). Singapore Med J 2001;42:183-6.
17. Rheinboldt M, Harper D, Stone M. Atypical femoral fractures in association with bisphosphonate therapy: a case series. Emerg Radiol 2014;21:557-62.
18. La Rocca Vieira R, Rosenberg ZS, Allison MB, Im SA, Babb J, Peck V. Frequency of incomplete atypical femoral fractures in asymptomatic patients on long-term bisphosphonate therapy. AJR Am J Roentgenol 2012;198:1144-51.
19. Atalar H, Yanık B, Polat O, Tur BS. Stress Fractures: Evaluation of Three Patients and Review of the Literature. Rheumatism 2007;22:31-5.
20. Daffner RH, Pavlov H. Stress fractures: current concepts. AJR Am J Roentgenol 1992;159:245-52.
21. Sofka CM. Imaging of stress fractures. Clin Sports Med 2006;25:53-62.

22. Banal F, Gandjbakhch F, Foltz V, Goldcher A, Etchepare F, Rozenberg S, et al. Sensitivity and specificity of ultrasonography in early diagnosis of metatarsal bone stress fractures: a pilot study of 37 patients. J Rheumatol 2009;36:1715-9.
23. Bennell K, Matheson G, Meeuwisse W, Brukner P. Risk factors for stress fractures. Sports Med 1999;28:91-122.
24. Miller JR, Dunn KW, Ciliberti LJ Jr, Patel RD, Swanson BA. Association of Vitamin D With Stress Fractures: A Retrospective Cohort Study. J Foot Ankle Surg 2016;55:117-20.
25. Davey T, Lanham-New SA, Shaw AM, Hale B, Cobley R, Berry JL, et al. Low serum 25-hydroxyvitamin D is associated with increased risk of stress fracture during Royal Marine recruit training. Osteoporos Int 2016;27:171-9.
26. Välimäki VV, Alfthan H, Lehmuskallio E, Löyttyniemi E, Sahi T, Suominen H, et al. Risk factors for clinical stress fractures in male military recruits: a prospective cohort study. Bone 2005;37:267-73.
27. Boden BP, Osbahr DC. High-risk stress fractures: evaluation and treatment. J Am Acad Orthop Surg 2000;8:344-53.
28. Stewart GW, Brunet ME, Manning MR, Davis FA. Treatment of stress fractures in athletes with intravenous pamidronate. Clin J Sport Med 2005;15:92-4.
29. Finestone A, Milgrom C. How stress fracture incidence was lowered in the Israeli army: a 25-yr struggle. Med Sci Sports Exerc 2008;40(11 Suppl):S623-9.
30. Yamamoto T, Schneider R, Bullough PG. Insufficiency subchondral fracture of the femoral head. Am J Surg Pathol 2000;24:464-8.
31. Lyders EM, Whitlow CT, Baker MD, Morris PP. Imaging and treatment of sacral insufficiency fractures. AJNR Am J Neuroradiol 2010;31:201-10.