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Ege Tıp Bilimleri Dergisi

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Derginin Yazı Dili

Derginin yazı dili Türkçe ve İngilizcedir. Dili Türkçe olan yazılar, İngilizce özetleri ile yer alır. Yazının hazırlanması sırasında, Türkçe kelimeler için Türk Dil Kurumundan (www.tdk.gov.tr), teknik terimler için Türk Tıp Terminolojisinden (www.tipterimleri.com) yararlanılabilir.

Yazarlık Kriterleri

Makalenin yayımlanması uygun bulunduktan sonra, tüm yazarlardan "Yayın Hakkı Devir Formu" nu imzalamaları istenir: " Biz aşağıda imzaları bulunan yazarlar, sunduğumuz makalenin orijinal olduğunu; başka bir dergiye yayınlanmak üzere verilmediğini; daha önce yayınlanmadığını; eğer, tümüyle ya da bir bölümü yayınlandı ise yukarıda adı geçen dergide yayınlanabilmesi için gerekli her türlü iznin alındığını ve orijinal telif hakkı devri formu ile birlikte Ege Tıp Bilimleri Dergisi Editörlüğü' ne gönderildiğini garanti ederiz."

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Yazar(lar), ticari bağlantı veya çalışma için maddi destek veren kurum varlığında; kullanılan ticari ürün, ilaç, firma vb. ile nasıl bir ilişkisi olduğunu sunum sayfasında Editöre bildirmelidir. Böyle bir durumun yokluğu da yine ayrı bir sayfada belirtilmelidir.

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a) Yazı; iki satır aralıklı olarak, Arial 10 punto ile yazılmalıdır. b) Sayfalar başlık sayfasından başlamak üzere, sağ üst köşesinde numaralandırılmalıdır.

c) Online makale sistemine yüklenen word dosyasının başlık sayfasında (makalenin adını içeren başlık sayfası), yazarlara ait isim ve kurum bilgileri yer almamalıdır.

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Yazının Başlığı

Kısa, kolay anlaşılır ve yazının içeriğini tanımlar özellikte olmalıdır.

Özetler

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Metin

Yazı metni, yazının türüne göre yukarıda tanımlanan bölümlerden oluşmalıdır. Uygulanan istatistiksel yöntem, Gereç ve Yöntem bölümünde belirtilmelidir.

Kaynaklar

Kaynaklar metinde yer aldıkları sırayla, cümle içinde atıfta bulunulan ad veya özelliği belirten kelimenin hemen bittiği yerde ya da cümle bitiminde noktadan önce parantez içinde Arabik rakamlarla numaralandırılmalıdır. Metinde, tablolarda ve şekil alt yazılarında kaynaklar, parantez içinde Arabik numaralarla nitelendirilir. Sadece tablo veya şekil alt yazılarında kullanılan kaynaklar, tablo ya da şeklin metindeki ilk yer aldığı sıraya uygun olarak numaralandırılmalıdır. Dergi başlıkları, Index Medicus'ta kullanılan tarza uygun olarak kısaltılmalıdır. Kısaltılmış yazar ve dergi adlarından sonra nokta olmamalıdır. Yazar sayısı altı veya daha az olan kaynaklarda tüm yazarların adı yazılmalı, yedi veya daha fazla olan kaynaklarda ise üç yazar adından sonra et al veya ve ark. yazılmalıdır. Kaynak gösterilen derginin sayı ve cilt numarası mutlaka yazılmalıdır.

Kaynaklar, yazının alındığı dilde ve aşağıdaki örneklerde görüldüğü şekilde düzenlenmelidir.

Dergilerdeki Yazılar

Kim CH, Cheon JS, Choi WY, Son KM. The efficacy of mobile application use on recall of surgical risks in nasal bone fracture reduction surgery. Arch Craniofac Surg. 2018; 19: 41-47.

Henüz yayınlanmamış online makale

Kurita GP, Højsted J, Sjøgren P. Tapering off long-term opioid therapy in chronic non-cancer pain patients: a randomized clinical trial. Eur J Pain. 2018 May 13. doi: 10.1002/ejp.1241.

Kitap

Bilgehan H. Klinik Mikrobiyoloji. 2. Baskı. İzmir: Bilgehan Basımevi; 1986:137-40.

Kitap Bölümü

McEwen WK, Goodner IK. Secretion of tears and blinking. In: Davson H (ed). The Eye. Vol. 3, 2nd ed. New York: Academic Press; 1969:34-78.

İnternet Makalesi

Abood S. Quality improvement initiative in nursing homes: The ANA acts in an advisory role. Am J Nurs [serial on the Internet] 2002 [cited 12 Aug 2002]. Available from: www.nursingworld.org/AJN/2002/june/wawatch.htm

Web Sitesi

Cancer-pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources [updated 16 May 2002; cited 9 July 2002]. Available from: www.cancer-pain.org

Açıklamalar

Varsa finansal kaynaklar, katkı sağlayan kurum, kuruluş ve kişiler bu bölümde belirtilmelidir.

Tablolar

Tablolar metni tamamlayıcı olmalı, metin içerisinde tekrarlanan bilgiler içermemelidir. Metinde yer alma sıralarına göre Arabik sayılarla numaralandırılıp tablonun üstüne kısa ve açıklayıcı bir başlık yazılmalıdır. Tabloda yer alan kısaltmalar, tablonun hemen altında açıklanmalıdır. Dipnotlarda sırasıyla şu semboller kullanılabilir: *, †, ‡, §, ¶.

Şekiller

Şekil, resim, grafik ve fotoğrafların tümü "Şekil" olarak adlandırılmalı ve ayrı birer .jpg veya .gif dosyası olarak (yaklaşık 500x400 piksel, 8 cm eninde ve en az 300 dpi çözünürlükte) sisteme eklenmelidir. Şekiller metin içinde kullanım sıralarına göre Arabik rakamla numaralandırılmalı ve metinde parantez içinde gösterilmelidir.

Şekil Alt Yazıları

Şekil alt yazıları, her biri ayrı bir sayfadan başlayarak, şekillere karşılık gelen Arabik rakamlarla çift aralıklı olarak yazılmalıdır. Şeklin belirli bölümlerini işaret eden sembol, ok veya harfler kullanıldığında bunlar alt yazıda açıklanmalıdır. Başka yerde yayınlanmış olan şekiller kullanıldığında, yazarın bu konuda izin almış olması ve bunu belgelemesi gerekir.

Ölçümler Ve Kısaltmalar

Tüm ölçümler metrik sisteme (Uluslararası Birimler Sistemi, SI) göre yazılmalıdır. Örnek: mg/kg, µg/kg, mL, mL/kg, mL/kg/h, mL/kg/min, L/min, mmHg, vb. Ölçümler ve istatistiksel veriler, cümle başında olmadıkları sürece rakamla belirtilmelidir. Herhangi bir birimi ifade etmeyen ve dokuzdan küçük sayılar yazı ile yazılmalıdır.

Metin içindeki kısaltmalar, ilk kullanıldıkları yerde parantez içinde açıklanmalıdır. Bazı sık kullanılan kısaltmalar; iv, im, pove sc şeklinde yazılabilir.

İlaçların yazımında jenerik isimleri kullanılmalıdır.

İçindekiler

Orijinal Araştırma / Original Investigation
Aegean J Med Sci 2025;1:1-8

Yüzme Egzersizi Hakkında Yazılmış Lisansüstü Tezlerin Bibliyometrik Analizi

Bibliometric Analysis of Graduate Thesis Written About Swimming Exercise

Yakup Akif Afyon[1], Mehmet Gökay Kılıç[2]

1 Spor Bilimleri Fakültesi, Uşak Üniversitesi, Uşak/Türkiye
2 Spor Bilimleri Fakültesi, Afyon Kocatepe Üniversitesi, Afyon/Türkiye

ÖZ

AMAÇ: Bu çalışmanın amacı, Türkiye'de yüzme egzersizi alanında yazılmış lisansüstü tezleri konu, yöntem ve veri analiz teknikleri açısından incelemek ve değerlendirmektir. Araştırmanın evreni ve örneklemini, 2014-2024 yılları arasında yüzme egzersizi konusunda hazırlanmış yüksek lisans ve doktora tezleri oluşturmaktadır. Veriler, Yükseköğretim Kurulu Ulusal Tez Merkezi'nde arşivlenen lisansüstü tezlerden elde edilmiştir.

GEREÇ ve YÖNTEM: Yapılan taramalar sonucunda 21 doktora ve 18 yüksek lisans tezi olmak üzere toplam 39 tez incelenmiştir. Verilerin analizinde içerik analizi yöntemi kullanılmış ve çalışmalar 10 farklı kritere göre değerlendirilmiştir. İncelenen tezlerde genellikle nicel araştırma yönteminin benimsendiği ve veri toplama aracı olarak en çok ölçüm yöntemlerinden yararlanıldığı görülmektedir. Örneklem büyüklüğü olarak ise çoğunlukla 1-100 kişi arası tercih edilmiştir.

BULGULAR: Yıllara göre tez dağılımı incelendiğinde; yüksek lisans tezlerinin en yoğun olarak 2015 ve 2018 yıllarında, doktora tezlerinin ise en çok 2018 yılında yazıldığı belirlenmiştir. Konuyla ilgili çalışmaların en çok Selçuk Üniversitesi ve Pamukkale Üniversitesi bünyesinde yapıldığı; tezlerin büyük çoğunluğunun Beden Eğitimi ve Spor Anabilim Dalında hazırlandığı tespit edilmiştir. Ayrıca, tezlerde genellikle danışman olarak Prof. Dr. unvanına sahip öğretim üyelerinin görev aldığı görülmüştür.

SONUÇ: Tezlerin tamamının yazım dili Türkçe olup, anahtar kelimeler arasında en sık kullanılan ifadelerin "yüzme", "oksidatif stres", "yüzme egzersizi" ve "egzersiz" olduğu belirlenmiştir.

Anahtar Kelimeler: Yüzme, bibliometrik analiz, lisansüstü tez, yüzme egzersizi

ABSTRACT

OBJECTIVE: The aim of this study is to examine and evaluate postgraduate theses written in the field of swimming exercise in Turkey in terms of subject, method, and data analysis techniques. The population and sample of the research consist of master's and doctoral theses prepared on swimming exercise between the years 2014 and 2024. The data were obtained from postgraduate theses archived in the National Thesis Center of the Council of Higher Education.

MATERIALS AND METHODS: As a result of the review, a total of 39 theses-21 doctoral and 18 master's-were analyzed. Content analysis method was used for data analysis, and the studies were evaluated based on 10 different criteria. It was observed that quantitative research methods were generally adopted in the examined theses, and measurement methods were the most frequently used tools for data collection. In terms of sample size, most studies preferred a range of 1 to 100 participants.

RESULTS: When the distribution of theses by year is examined, it was found that master's theses were most frequently written in 2015 and 2018, while doctoral theses peaked in 2018. It was determined that most of the studies on this subject were conducted at Selçuk University and Pamukkale University, and the majority of theses were prepared within the Department of Physical Education and Sports. Additionally, it was observed that the advisors were predominantly faculty members holding the title of Professor Doctor (Prof. Dr.).

CONCLUSION: All of the theses were written in Turkish, and among the most frequently used keywords were "swimming," "oxidative stress," "swimming exercise," and "exercise."

Keywords: Swimming, bibliometrik analyze, graduate theses, swimming exercise

GİRİŞ

Hareket, insan doğasının en temel işlevi olarak bilinir. İnsanoğlu hareket etme ihtiyacı ile doğar ve ölene kadar da hareket etmeye devam eder. Zorlu doğa koşullarına karşı verdiği mücadelede diğer tüm canlılar gibi insan da en zor şartlar altında bile ihtiyaçlarını karşılayabilecek bir yapıya sahiptir (1). İnsanlar fiziksel olarak aktif olmak üzere tasarlanmıştır. 21. yüzyıl teknolojisi insanları yürüyen,

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merdiven çıkan ve eskisinden daha az hareket eden ekran bağımlısı bir topluma dönüştürmüştür. Spor ideal kilo, sağlık ve yaşam için hayati önem taşımaktadır. Sporu teşvik için uzmanlar bu konuda daha fazla çalışmalıdır. Egzersiz, sağlıklı bir yaşam tarzının anahtarıdır ve erken yaşta başlamalıdır. Yaşlandıkça, egzersiz yapma alışkanlığını geliştirmek daha zor hale gelir. Okulda düzenli egzersiz yapmak, yetişkinlerin de buna alışmasını sağlar. Doğru spor dalında uzmanlaşmak, çocukları yüzme gibi bir sonraki seviyeye taşıyabilir (2). Yüzme, toplumun her kesiminden insanın keyif aldığı ve sağlıklı bir yaşam tarzı için önemli olan uluslararası düzeyde popüler bir fiziksel aktivite ve spordur (3). Sağlıklı insanların güç kazanmak, boş zamanlarını değerlendirmek ve eğlenmek için yaptıkları çok yönlü bir spor olmakla birlikte, yaralanma sonrası iyileşme ve normalleşme sürecinde de kullanılmaktadır. Suyun kaldırma kuvveti sayesinde, yürümek veya merdiven çıkmak gibi doğal ve kolay bir aktivite olarak yapılabilir, bu nedenle yaşlılıkta bile uygulanması çok kolaydır (4,5). Egzersiz, bazal seviyelerin üzerinde enerji gerektiren fiziksel harekettir. Fiziksel kondisyonumuzu geliştirmek için yapılan planlı ve tekrarlı fiziksel aktivite olarak da tanımlanabilir (6). Egzersiz için farklı sporlar kullanılabilir. Yüzme, her yaş için temel, popüler ve etkili bir spordur. Yüzme vücut ağırlığını azaltır, kolay hareket etmeyi sağlar ve tedavi edicidir (7). Suyun direncine karşı yapıldığı için aşındırıcı bir etkisi olmadan vücut direncini artırır. Yüzme, kasları dengeli bir şekilde geliştiren iyi bir fizyoterapi şeklidir (7-9). Avrupa'da yüzmenin geçmişi 17. yüzyıla kadar uzanmaktadır. İlk modern yüzme hareketleri 1837 yılında Londra'da yüzme havuzlarının açılmasıyla başlamıştır. 1844 yılında Kuzey Amerika'dan getirilen bir grup Kızılderili tüm yarışları kazandıkları kayıtlarda yer almaktadır (10-15). 19. yüzyılın ikinci yarısında birçok Avrupa Federasyonu'nun kurulması ve yüzmenin yaygınlaşması uluslararası bir organizasyona ihtiyaç duyulmasına yol açtı. Uluslararası Yüzme Federasyonu 19 Temmuz 1908 tarihinde kurulmuştur (16). Yüzme, birçok motor becerinin yanı sıra koordinasyon, ritim, esneklik, güç ve doğru tekniği içeren bir spordur.

Yüzme neredeyse tüm kas gruplarını harekete geçirir ve bireyin özgüven duygusunu geliştirir (17). Temel olarak 4 yüzme stili vardır. Bunlar serbest stil, sırtüstü, kurbağalama ve kelebektir. Bazı ülkelerde yüzme dersleri kurbağalama, sırtüstü veya kelebek tekniği ile başlar. Türkiye'de ise yüzme dersleri genellikle serbest stil tekniğinin öğretilmesiyle başlar. Serbest stil tekniği yüzme kulaçlarının en hızlısıdır (20-26).

Bu veri tarama çalışmasında Ulusal Tez Merkezi (tez.yok.gov.tr) internet adresinde bulunan yüzme ve yüzme antrenmanları ile ilgili lisansüstü tezlerin içerik analizinin yapılması amaçlanmıştır.

GEREÇ VE YÖNTEM

Çalışmada, yüzme egzersizi konusu üzerine yazılmış olan lisansüstü tezlerin incelenmesi amacıyla yazılmıştır. Çalışmada yöntem olarak içerik analiz yöntemi kullanılmıştır. İçerik analizini; iletişim biçimlerinden ve metinlerden güvenilir, geçerli, sistematik ve tekrarlanabilir çıkarımlar yapma amacıyla kullanılan bir araştırma tekniği olarak ifade edilebilir (27).

Araştırma kapsamında YÖK Ulusal Tez Veri Tabanında arşivlenen erişime açık lisansüstü tezler incelenmiştir. Araştırma konusunda, yüzme egzersizi konusu taranarak 2014 ve 2024 yılları arasında yazılmış olan erişime açık 39 lisansüstü teze ulaşılmıştır. Lisansüstü tezlerin incelenmesinde tez türü, tez yazım dili, tez yayınlanma yılı, hazırlandığı üniversite, tez danışman unvanı, hazırlandığı anabilim dalı, kullanılan araştırma yöntemleri, kullanılan anahtar kelimeler, örneklemin büyüklüğü ve veri toplama teknikleri incelenmiştir. Bilgisayar üzerinden veriler elde edildiğinden Etik Kurul Raporu alınmamıştır. Elde edilen veriler, Excel programı ve SPSS programıyla analizi gerçekleştirilmiş ve yorumlanmıştır.

BULGULAR

Tablo 1'deki veriler incelendiğinde, yüzme egzersizi konusunda yazılmış yüksek lisans tezlerinin sayısının 18, doktora tezlerinin sayısının ise 21 olduğu görülmektedir.

Tablo 1. *Lisansüstü tezlerin türü*

Tür	N	%
Yüksek Lisans	18	46,1
Doktora	21	53,8
Toplam	**39**	**100**

Tablo 2'deki veriler incelendiğinde yüzme egzersizi konusunda yazılmış olan 39 lisansüstü tezin 19 farklı üniversitede hazırlandığı görülmektedir. Konuyla ilgili en fazla yazılan tezin Pamukkale Üniversitesi ve Selçuk Üniversitesi'nde hazırlandığı görülmektedir (6).

Tablo 3 incelendiğinde, yüzme egzersizi konusunda 6 farklı anabilim dalı adı altında lisansüstü tez hazırlandığı görülmektedir. Hazırlanan lisansüstü tezlerin en çok Beden Eğitimi ve Spor Anabilim Dalında (20) yapıldığı tespit edilmiştir (%51,2).

Tablo 4'de yüzme egzersizi konusunda yazılmış toplam 39 tezin tamamının Türkçe dilinde olduğu görülmektedir.

Tablo 5'e göre, yüzme egzersizi konusunda lisansüstü tezlerin hazırlanmasında anket, deney, görüşme ve ölçüm olmak üzere dört farklı veri toplama tekniğinden yararlanıldığı tespit edilmiştir. En çok kullanılan (17) veri toplama tekniği ise ölçüm olmuştur (%43,5).

Tablo 6 incelendiğinde, hazırlanan yüksek lisans ve doktora tezlerinin akademisyen unvanlarına göre dağılımı verilmiştir. Tabloya göre en fazla lisansüstü tezin (23) Prof. Dr. unvanlı danışmanlar tarafından yürütüldüğü tespit edilmiştir (58,9).

Tablo 7 incelendiğinde, çalışmalarda incelenen örneklem büyüklüklerinin 37 tanesinin (%94,8) 1-100 aralığında, 2 tanesinin (%5,1) 101-200 aralığında olduğu tespit edilmiştir.

Tablo 8'e göre, yüzme egzersizi konusunda hazırlanan lisansüstü tezlerde birçok farklı anahtar kelimeler olduğu ve çok sayıda değişkenler incelendiği görülmüştür. Tablo da en çok kullanılan anahtar kelime "Yüzme" kelimesi (12) olmuştur. Ardından sırayla "Yüzme Egzersizi" (10), "Egzersiz" (9), "Oksidatif Stres" (5) anahtar kelimeleri gelmektedir.

Tablo 9'daki veriler incelendiğinde, yüzme egzersizi konusundaki araştırma kriterlerine uyan ilk lisansüstü tezinin 2014 yılında hazırlandığı, en fazla tezin ise 2015 ve 2018 yıllarında hazırlanmış olduğu görülmektedir.

Tablo 10'a göre, yüzme egzersizi konusunda hazırlanan lisansüstü tezlerin araştırma yöntemlerinin 35 tanesinin nicel (%89,7), 3 tanesinin nitel (%7,6), 1 tanesinin ise karma (%2,5) olarak gerçekleştirildiği tespit edilmiştir.

Tablo 2. *Lisansüstü tezlerin hazırlandığı üniversitelere göre dağılımı*

Hazırlandığı Üniversite	N	%
Erciyes Üniversitesi	2	5.1
Dumlupınar Üniversitesi	1	2.5
Pamukkale Üniversitesi	6	15.3
İnönü Üniversitesi	1	2.5
Atatürk Üniversitesi	3	7.6
Gaziantep Üniversitesi	3	7.6
Kırıkkale Üniversitesi	2	5.1
Marmara Üniversitesi	2	5.1
Fırat Üniversitesi	1	2.5
Gazi Üniversitesi	2	5.1
Yüzüncü Yıl Üniversitesi	1	2.5
Hitit Üniversitesi	2	5.1
Onsekiz Mart Üniversitesi	2	5.1
Celal Bayar Üniversitesi	1	2.5
Süleyman Demirel Üniversitesi	1	2.5
Selçuk Üniversitesi	6	15.3
Ondokuz Mayıs Üniversitesi	1	2.5
Acıbadem Mehmet Ali Aydınlar Üniversitesi	1	2.5
Akdeniz Üniversitesi	1	2.5
Toplam	**39**	**100**

Tablo 3. *Lisansüstü tezlerin hazırlandığı anabilim dallarına göre dağılımı*

Anabilim Dalı	N	%
Beden Eğitimi ve Spor	20	51,2
Fizyoloji	10	25,6
Anatomi	3	7,6
Antrenörlük Eğitimi	3	7,6
Biyokimya (Veteriner Programı)	2	5,1
Histoloji ve Embriyoloji	1	2,5
Toplam	**39**	**100**

Tablo 4. *Lisansüstü tezlerin yazım dili*

Yazım Dili	N	%
Türkçe	39	100
Toplam	**39**	**100**

Tablo 5. *Lisansüstü tezlerde kullanılan veri toplama teknikleri*

Veri Toplama Teknikleri	N	%
Anket	4	10,2
Deney	16	41
Görüşme	2	5,1
Ölçüm	17	43,5
Toplam	**39**	100

Tablo 6. *Lisansüstü tezlerin danışman unvanına göre dağılımı*

Danışman Unvanı	N	%
Dr. Öğr. Üy./Yrd. Doç. Dr.	3	7,6
Doç. Dr.	13	33,3
Prof. Dr.	23	58,9
Toplam	**39**	**100**

Tablo 7. *Lisansüstü tezlerdeki örneklem büyüklükleri*

Örneklem Büyüklüğü	N	%
1-100	37	94,8
101-200	2	5,1
Toplam	**39**	**100**

Tablo 8. *Lisansüstü tezlerde kullanılan anahtar kelimeler*

Anahtar Kelime	Sayı
Yüzme	12
Yüzme Egzersizi	10
Egzersiz	9

Oksidatif Stres	5
Solunum, İrisin, Kas Hasarı, Leptin	3
Testosteron, Kemik, Kas Rejenerasyonu, Antrenman, Metabolik Sendrom (MetS), Antioksidan, Adropin, Yaşlılık	2
Anabolik Androjenik Steroid, Ağrı Eşiği, Bağımlılık, Uzamsal Öğrenme, Bellek, Davranış, Fiziksel Performans, Egzersizi Bırakma (Detraining), Hemoreoloji, Dirençli Yüzme Egzersizi, Böbrek Hasarı, Besin Takviyeleri, Kaspaz 3, Dallı Zincirli Amino Asitler, Duchenne, Mdx Fare, Artrit, Matriks Metalloproteinaz, Düşük Dereceli Lazer Tedavisi, Kreatin Kinaz Miyokart Bandı, Malondialdehit, Vasküler Endotel Büyüme Faktörü, Kalp Büyümesi, Kuvvet, Otizm, Akrilamid, Glikoz Homeostazı, Pankreas, Eklem Hareket Açısı, Image J, Ghrelin, Sıçan, Antioksidan Enzim, Üzüm Çekirdeği Ekstresi, Zihinsel Engel, Fiziksel Uygunluk, Epilepsi, Epileptiform, GSE, Anaerobik Güç, Bacak Hacmi, Vasküler Disfonksiyon, Galaktoz, Perivasküler Adipoz Doku, Element Metabolizması, Overektomi, Resveratrol, Serbest Radikaller, Bosu, Dinamik Denge, Statik Denge, Hiyalin Dejenerasyonu, Rat, İskelet Kas Hasarı, Transkritpom, Serebral Palsi, Fiziksel, Fizyolojik, Motorik Özellikler, Spirometri, Metabolik Sendrom, Hipokampus, GLP-1 reseptör, Mutluluk, Postmenopoz, Psikolojik Sağlamlık, Rekreasyon, Umutsuzluk, Apoptoz, Frontal Korteks, Parkinson Hastalığı, Dendritik Çıkıntı, Melatonin, Neurolucida, METRNL, IL-8, IL-7, FSTL1, Reaksiyon Zamanı, Zihinsel Dayanıklılık, Duygusal Zeka, Kinestetik Zeka, Satellit ve Non-satellit Hücreler, Pulmoner Fibrozis, D vitamini, Bleomisin	1

Tablo 9. *Lisansüstü tezlerin yıllara göre dağılımı*

Yıllar	N	%
2014	3	7,6
2015	6	15,3
2016	1	2,5
2017	3	7,6
2018	6	15,3
2019	3	7,6
2020	5	12,8
2021	4	10,2
2022	5	12,8
2024	3	7,6
Toplam	**39**	**100**

Tablo 10. *Lisansüstü tezlerde kullanılan araştırma yöntemleri*

Yöntem	N	%
Nicel	35	89,7
Nitel	3	7,6
Karma	1	2,5
Toplam	**39**	**100**

TARTIŞMA

Bu çalışmanın temek amacı, son 10 yılda yüzme egzersizi hakkında yazılmış lisansüstü tezleri analiz etmek ve açıklamaktır. 2014 ve 2024 yılları "Ulusal Tez Merkezi" veri tabanında "yüzme egzersizi" anahtar kelimesi ile yapılan tarama sonucunda bulunan 39 tez analiz edilmiştir. Çalışma sonucunda elde edilen sonuçlar özetle şöyledir;

Yaptığımız çalışmada il bazlı tez sayıları ele alındığında sadece İstanbul'da yer alan 2 ayrı üniversitede (Marmara Üniversitesi ve Acıbadem Mehmet Ali Aydınlar Üniversitesi) yüzme egzersizi konusunda tez üretilmiştir. En çok çalışma yapılan üniversiteye bakıldığında ise Selçuk Üniversitesi (6) ve Pamukkale Üniversitesi (6) tez çalışması ile en çok yüzme egzersizleri konusunda çalışma yapılan üniversiteler olmuştur (%15,38).

Yüzme egzersizi konulu lisansüstü tezlerde nicel çalışma yöntemi ağırlıklı olarak kullanılmıştır (%89,7). Örneklem grubu olarak ise 1-100 (%94,8) aralığında yoğunlaşıldığı izlenmektedir.

SONUÇ

Bu çalışma, YÖK Ulusal Tez Veri Tabanında arşivlenen yüzme egzersizi kavramı anahtar kelimeler ve başlık taranarak erişime açık olan lisansüstü tezleri incelemek amacıyla gerçekleştirilmiştir. 2014-2024 yılları yazılmış 39 lisansüstü tez yayınlanma yılı, tez türü, tez yazım dili, hazırlandığı üniversite, danışmanın unvanı, hazırlandığı anabilim dalı, kullanılan araştırma yöntemi, kullanılan anahtar kelimeler, veri toplama teknikleri ve örneklem büyüklüğüne göre analiz edilmiştir. Araştırma sonucunda; konuyla ilgili hazırlanan lisansüstü tezlerin çoğunluğunun doktora tezi olduğu tespit edilmiştir. Konu dahilinde hazırlanan lisansüstü tezlerin ilk olarak 2014 yılında yazıldığı görülmüştür. En fazla tezin ise 2018 yılında yazıldığı belirlenmiştir. Bu sonuca göre, 2018 yılında yüzme egzersizi konusunda yazılan tezlerin artması yüzme egzersizi kavramının ön plana çıkması olarak değerlendirilebilir. Hazırlanan tezler, en fazla Prof. Dr. unvanlı akademisyenlerin danışmanlığında hazırlandığı görülmektedir.

Lisansüstü tezlerin tamamının Türkçe olarak yazıldığı görülmüştür. Lisansüstü tezlerin büyük bir kısmı beden eğitimi ve spor anabilim dalı bünyesinde hazırlanmıştır. Konu dahilinde 19 farklı üniversitede lisansüstü tezin hazırlandığı belirlenmiş ve en fazla tezin Selçuk Üniversitesi ve Pamukkale Üniversitesi'nde hazırlandığı görülmüştür. Veri toplama tekniği olarak en çok ölçüm tercih edilmiştir. İncelenen tezlerin ise büyük bir bölümünde nicel araştırma yöntemi kullanılmıştır. Hazırlanan çalışmalar, en çok 1-100 aralığındaki örneklem büyüklüğünde gerçekleştiği tespit

edilmiştir. Hazırlanan çalışmalarda sırasıyla en fazla anahtar kelime "Yüzme" kelimesi (12) olmuştur. Ardından sırayla "Yüzme Egzersizi" (10), "Egzersiz" (9), "Oksidatif Stres" (5) anahtar kelimelerine yer verildiği görülmüştür. Bu çalışmada, sadece YÖK Ulusal Tez Veri Tabanında arşivlenen yüzme egzersizi üzerine yazılan lisansüstü tezler incelenmiştir. Bu çalışmanın gelecekte hazırlanacak olan lisansüstü tez araştırmalarında araştırmacılara yol gösterici olacağı düşünülmektedir.

Etik: Bilgisayar üzerinden veriler elde edildiğinden Etik Kurul Raporu alınmamıştır.

Ethics: Since the data was obtained through computer-based methods, no Ethics Committee Report was obtained.

Yazar katkı durumu; Çalışmanın konsepti; MGK, YAA, dizaynı; MGK, YAA, Literatür taraması; MGK, YAA, verilerin toplanması ve işlenmesi; MGK, YAA, istatistik; MGK, YAA, yazım aşaması; MGK, YAA.

Author contribution status; The concept of the study; MGK, YAA, design; MGK, YAA, literature review; MGK, YAA, collecting and processing data; MGK, YAA, statistics; MGK, YAA, writing phase; MGK, YAA.

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Sarcopenia and Osteoporosis: Two Factors Affecting Hip Fracture Mortality in the Elderly

Sarkopeni ve Osteoporoz: Yaşlılarda Kalça Kırığı Mortalitesini Etkileyen İki Faktör

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ABSTRACT

OBJECTIVE: Sarcopenia and osteoporosis the leading causes of hip fractures in elderly patients. This study aimed to evaluate the effects of sarcopenia related to psoas muscle index and osteoporosis obtained by T score on mortality in hip fracture patients.

MATERIALS AND METHODS: This retrospective cross-sectional study examined 236 patients after a hip fracture. The patients were sarcopenic and nonsarcopenic according to the psoas muscular index; According to the femoral neck T score in Dual Energy X-ray Absorptiometry, patients were grouped as low (<-2.5) and high (≥-2.5) and compared. Statistically significant variables associated with 30 days and one-year mortality were analyzed using logistic regression analysis.

RESULTS: Eighty-four (35.6%) patients were in the sarcopenia group, and 152 (64.4%) were in the non-sarcopenia group. Ninety-two (38.9%) patients were in the low group, and 152 (61.1%) were in the high group. In the sarcopenia and the low T score groups, the frequency of females, ≥65 years, comorbid disease, intensive care unit requirement, and complications rates were significantly higher. The survival rate was significantly lower (p<0.05). Female gender [odss ratio (OR): 2.97, 95% confidence interval (CI): 1.17-7.54], sarcopenia (OR: 3.65, 95% CI: 1.68-7.91), low T score (OR: 2.62, 95% CI: 1.23-5.62), intensive care unit requirement (OR: 2.32, 95% CI: 1.09-4.92) and presence of postoperative complications (OR: 2.89, 95% CI: 1.32-6.36) are significant risk factors for 1-month mortality; female gender (OR: 2.04, 95% CI: 1.06-3.94) and presence of sarcopenia (OR: 2.24, 95% CI: 1.22-4.09) are risk factors for 1-year mortality (p<0.05).

CONCLUSION: Detection of sarcopenia and osteoporosis in elderly patients at the early stage and correction of modifiable factors are of great importance in improving postoperative outcomes and reducing mortality.

Keywords: Hip fractures, sarcopenia, osteoporosis, postoperative outcomes, mortality

ÖZ

AMAÇ: Sarkopeni ve osteoporoz yaşlı hastalarda kalça kırıklarının önde gelen nedenleri arasındadır. Bu çalışmada kalça kırığı hastalarında, psoas kas indeksine bağlı sarkopeni ve T skoru ile elde edilen osteoporozun mortalite üzerine etkisinin değerlendirilmesi amaçlandı.

GEREÇ ve YÖNTEM: Bu retrospektif kesitsel çalışmada kalça kırığı sonrası 236 hasta incelendi. Hastalar psoas kas indeksine göre sarkopenik olan ve sarkopenik olmayan şeklinde; Dual-Energy X-ray Absorptiometry femur boynu T skoruna göre düşük (<-2,5) veya yüksek (≥-2,5) T skoru olarak gruplandırıldı ve karşılaştırıldı. Otuz günlük ve bir yıllık mortalite ile ilişkili istatistiksel olarak anlamlı değişkenler belirlendi ve lojistik regresyon analizi kullanılarak analiz edildi.

BULGULAR: Sarkopeni grubunda 84 (%35,6), sarkopeni olmayan grupta 152 (%64,4) hasta vardı. T skoru düşük grupta 92 (%38,9), yüksek grupta 152 (%61,1) hasta mevcuttu. Sarkopeni ve düşük T skor gruplarında ≥65 yaş, kadın cinsiyet, ek hastalık varlığı, cerrahi sonrası yoğun bakım ünitesi takibi ihtiyacı ve cerrahi sonrası cerrahi komplikasyon oranları anlamlı olarak daha yüksekti. Hem sarkopeni hem de T skoru düşük grupta sağkalım oranı anlamlı olarak daha düşüktü (p<0,05). Kadın cinsiyet [olasılık oranı (OO): 2,97, %95 güven aralığı (GA): 1,17-7,54), sarkopeni (OO: 3,65, %95 GA: 1,68-7,91], düşük T skoru (OR: 2,62, %95 GA: 1,23-5,62) ve cerrahi sonrası komplikasyon varlığı (OO: 2,89, %95 GA: 1,32-6,36) 30 günlük mortalite için bağımsız risk faktörleriyken; 1 yıllık mortalitede sadece kadın cinsiyet (OO: 2,04, %95 GA: 1,06-3,94) ve sarkopeni varlığı (OO: 2,24, %95 GA: 1,22-4,09) bağımsız risk faktörleri (p<0,05) olarak gözlendi.

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SONUÇ: İleri yaş hastalarda sarkopeni ve osteoporozun en erken dönemde saptanması ve değiştirilebilir faktörlerin düzeltilmesinin cerrahi sonrası sonuçların iyileştirilmesi ve mortalitenin azaltılmasında büyük önem taşmaktadır.

Anahtar Kelimeler: Kalça kırığı, sarkopeni, osteoporoz, psoas kas indeks, mortalite

INTRODUCTION

Globally, hip fractures are among the most common musculoskeletal pathologies in the population over 65 (1). Hip fracture is a significant public health problem due to the increase in life expectancy in parallel with the developments in medicine, as well as high morbidity, disability, mortality, and health costs (2). One-year mortality rates reach up to 30% (3). In addition, while approximately half of the survivors lose their functional independence, one-third become entirely dependent (4). While hip fracture rates are decreasing in Western and developed countries, It is increasing in Turkey (5,6).

Most factors associated with functional recovery of elderly hip fractures are specific to the patient's baseline characteristics, including their biological, sociodemographic, or functional capacity (7). Among these factors, various factors affect postoperative recovery. Among the risk factors known as general opinion are advanced age, female gender, osteoporosis, and comorbid diseases (8). However, anemia, cognitive impairment, and Parkinson's disease are among the factors related to discharge (9). In addition, sarcopenia, which has been associated with physical disability and increased functional impairment in recent years and has been shown among the risk factors for falls, is of great importance in patients with hip fractures (10,11).

The term sarcopenia consists of the Greek words sarx (flesh) and penia (loss) (12). In recent years, interest in sarcopenia has increased considerably, and this increased interest is due to its association with adverse outcomes, including decreased ability to function in activities of daily living, mobility impairments, increased risk of falls, poor quality of life, and decreased life expectancy (13). In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) recommended low muscle mass and low muscle function for diagnosing sarcopenia (14). Although there are numerous studies on the relationship between sarcopenia and osteoporosis, there is insufficient data on the association of these two factors with postoperative complications and mortality in elderly patients with hip fractures.

Therefore, this study aims to evaluate the relationship between sarcopenia and osteoporosis in hip fracture in accordance with the clinicopathological data of patients and examine the effects of these two parameters on postoperative results. We hypothesize that the decrease in muscle mass and bone density with age and the sarcopenia that develops accordingly predispose to hip fracture and adversely affect the postoperative results.

MATERIAL & METHODS

Patient Selection

The data of patients operated on for traumatic hip fracture in Çankırı State Hospital, Clinic of Orthopedics and Traumatology between January 2018 and December 2022 were analyzed in a single-center cross-sectional retrospective study design. The study protocol was approved by the Karatekin Univercity Ethical Committee (date: 06.11.2023, no: 9).

Patients who underwent surgery for hip fracture had preoperative abdominopelvic computed tomography, psoas muscle area measurement at lumbar vertebra level for sarcopenia assessment, and bone densitometry measurement in the preoperative period and had complete data included in the study.

Patients who underwent surgery for bone malignancy had a history of malignancy in any part of the body other than bone, did not have preoperative abdominopelvic computed tomography (CT), could not measure psoas area in CT, did not measure femur neck T score in bone densitometry and had missing data were excluded from the study.

Data Collecting

Demographic data of patients (age, gender), anthropometric measurements, preoperative abdominopelvic CT images, preoperative Charlson comorbidity index, American Society of Anesthesiologists score, preoperative femur-neck T score, psoas muscle index (PMI), fracture type, operation timing (emergency, elective), surgical technique, intensive care unit requirement, presence of postoperative complications,

length of hospital stay, and 30-day and one-year survival were recorded.

Study Design

The PMI score of the patients was calculated. According to the PMI cut-off value, the patients were grouped as sarcopenia and non-sarcopenia and compared. According to the femoral neck T score in Dual Energy X-ray Absorptiometry (DEXA), patients were grouped as low (<-2.5) and high (≥-2.5) and compared. Patients were grouped as dead and alive according to their postoperative survival status (30-days and one-year) and compared. Risk factors affecting overall survival were determined.

Anthropometric Measurements

The patient's height (meters) and body weight (kilograms) were measured. Body mass index was calculated with the formula "body weight (kg)/height squared (m^2)". Data were obtained from the patient follow-up file.

Dual Energy X-ray Absorptiometry (DEXA) and Femur Neck T Score

DEXA uses a source that produces X-rays, a detector, and an interface with a computer system to display scanned areas of interest. The relevant, effective radiation doses are small (1-7 μ Sv) (15). DXA is essential compared to other bone density methods because of its high accuracy, simplicity, usability, and relatively low cost and radiation exposure. In addition, unlike most other body composition methods designed to measure a single whole-body component, DEXA allows for quantifying multiple whole-body and regional components. Thanks to these advantages, it is widely used in bone density measurement in all body bones, vertebrae, and femur neck (16).

Psoas Muscular Index and Sarcopenia Detection

PMI was used to detect the presence of sarcopenia. In the preoperative abdominopelvic CT, bilateral psoas muscle area measurement was performed at the level of the L3 vertebra. PMI was calculated with the sum of the psoas area (right psoas area + left psoas area)/height squared (Figure 2). Studies with PMI sarcopenia cut-off values were taken as references. The cut-off value for PMI sarcopenia was ≤5.3 for men and ≤3.6 for women (17).

Statistical Analysis

The mean and standard deviation values were used in the data analysis while making the continuous data statistics. Frequency (n) and percentage (%) values were used to define categorical variables. Student's t-test was used to compare the means of two groups in continuous measurements. The chi-square test was used to evaluate the relationship between categorical variables. In order to evaluate the clinical status effectiveness on overall survival at the end of the postoperative 30-day and one-year, logistic regression analysis was performed with the statistically significant variables using backward and enter methods. The statistical significance level of the data was taken as $p<0.05$. The data evaluation used www.e-picos.com New York software and MedCalc statistical package program.

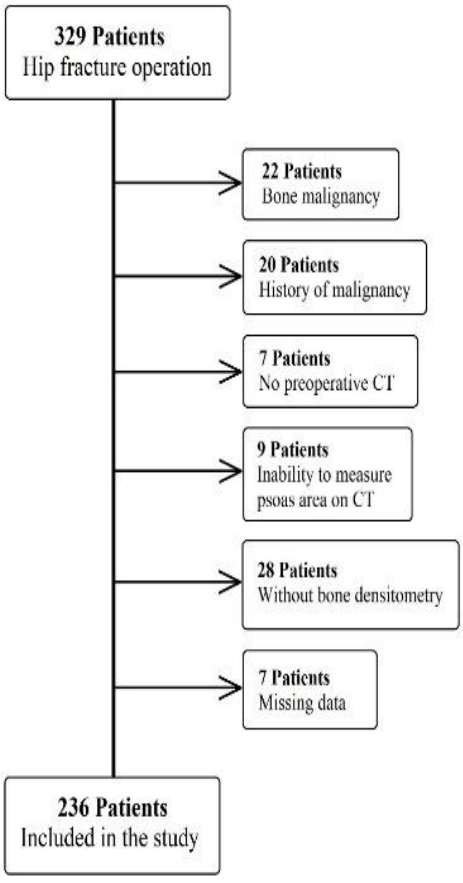

Figure 1. Flowchart-patients included and excluded from the study

CT: Computed tomography

RESULTS

During the study, 329 patients underwent hip joint surgery due to trauma in our clinic. In addition, 22 patients operated on for bone malignancy, 20 patients with a history of malignancy, seven patients without preoperative abdominopelvic CT, nine patients without psoas area measurement on CT, 28 patients without bone densitometry, and seven patients with missing data were excluded from the study (Figure 1).

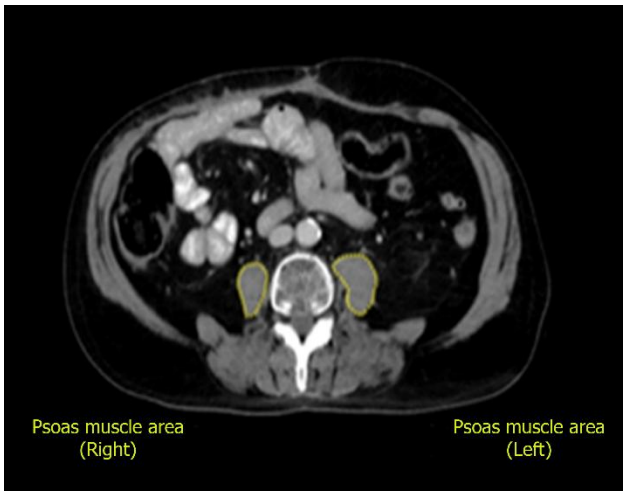

Figure 2. Calculation of psoas muscular index

Two hundred thirty-six patients were included in the study. Of the patients, 147 (62.3%) were female, and 89 (37.7%) were male. The mean age was 70.12±10.24 years. The patients' demographic, preoperative, and postoperative clinical data are summarized in Tables 1, 2.

Postoperative complications were evaluated separately as surgical and medical complications. In some patients, several complications were seen together. Postoperative surgical complications were sciatic nerve injury in two patients, dislocation in seven patients, surgical site infection in eight patients, and loosening in two patients. As postoperative medical complications, cardiovascular disease in 16 patients, thromboembolism in 4 patients, pulmonary infection in 8 patients, extra-pulmonary infections in 11 patients, and different complications in 17 patients.

The patients were divided into two groups sarcopenia and non-sarcopenia. According to the PMI cut-off values, 84 (35.6%) patients were in the sarcopenia group, and 152 (64.4%) were in the non-sarcopenia group. The mean age, CCI, and length of hospital stay were statistically significantly higher in the sarcopenia group than in the non-sarcopenia group, while the mean PMI was lower (p<0.05). In addition, compared to the non-sarcopenia group, the frequency of females ≥65 years, comorbid disease, low T score, ICU requirement, postoperative complications, and surgical complications were significantly higher in the sarcopenia group.

Table 1. *Preoperative demographic and clinical data of the groups according to PMI and T score*

	All Patient (n=236)	**Sarcopenia Group (n=84)**	**Non-Sarcopenia Group (n=152)**	**p value**	**Low T Score Group (n=92)**	**High T Score Group (n=144)**	**p Value**
	x ± SD	**x ± SD**	**x ± SD**		**x ± SD**	**x ± SD**	
Age (year)	70.12±10.24	72.12±9.52	67.49±8.91	**<0.001**	72.49±8.17	69.91±7.89	**0.016**
BMI (kg/m^2)	28.43±5.62	27.89±5.49	28.56±4.41	0.308	28.11±6.01	28.62±4.56	0.461
CCI	10.12±3.42	11.12±3.72	8.47±2.19	**<0.001**	13.01±4.51	9.82±3.37	**<0.001**
PMI							
Female	3.67±0.72	3.11±0.39	4.05±0.61	**<0.001**	3.45±0.61	3.82±0.89	**<0.001**
Male	5.64±1.08	5.07±0.76	5.89±0.84	**<0.001**	5.51±0.99	5.69±1.02	0.152
	n (%)	**n (%)**	**n (%)**		**n (%)**	**n (%)**	

Gender							
Female	147 (62.3)	62 (73.8)	85 (55.9)	**0.007**	69 (75)	78 (54.2)	**<0.001**
Male	89 (37.7)	22 (26.2)	67 (44.1)		23 (25)	66 (45.8)	
Age Group							
<65	45 (19.1)	10 (11.9)	35 (23.1)	**0.037**	11 (11.9)	34 (23.6)	**0.026**
≥65	191 (80.9)	74 (88.1)	117 (76.9)		81 (88.1)	110 (76.4)	
Comorbid Disease							
Yes	201 (85.2)	78 (84.8)	123 (80.9)	**0.013**	78 (84.8)	123 (85.4)	0.894
No	35 (14.8)	6 (15.2)	29 (19.1)		14 (15.2)	21 (14.6)	
ASA							
I	12 (5.1)	2 (2.4)	10 (6.6)	0.125	6 (6.5)	6 (4.2)	0.153
II	37 (15.7)	10 (11.9)	27 (17.8)		8 (8.7)	29 (20.2)	
III	138 (58.5)	50 (59.5)	88 (57.9)		56 (60.9)	82 (56.9)	
IV	40 (16.9)	16 (19.1)	24 (15.8)		17 (18.5)	23 (15.9)	
V	9 (3.8)	6 (7.1)	3 (1.9)		5 (5.4)	4 (2.8)	
Presence of Sarcopenia							
Sarcopenia	84 (35.6)	84 (100)		-	43 (46.7)	41 (28.5)	**0.004**
Non-sarcopenia	152 (64.4)		152 (100)		49 (53.3)	103 (71.5)	
T-score							
Low	92 (38.9)	48 (57.1)	44 (28.9)	**<0.001**	92 (100)	-	
High	144 (61.1)	36 (42.9)	108 (71.1)		-	144 (100)	
Fracture Type							
Femoral Neck	127 (53.8)	40 (47.6)	87 (57.2)	0.156	43 (46.7)	84 (58.3)	0.081
Intertrochanteric	109 (46.2)	44 (52.4)	65 (42.8)		49 (53.3)	60 (41.7)	

ASA: American Society of Anesthesiologists, BMI: body mass index, CCI: Charlson comorbidity index, PMI: psoas muscle index

Table 2. *Postoperative clinical data of the groups according to PMI and T score*

	All Patient (n=236)	**Sarcopeniagroup (n=84)**	**Non-Sarcopenia Group (n=152)**	**p Value**	**Low Group (n=92)**	**High Group (n=144)**	**p Value**
	x ± SD	**x ± SD**	**x ± SD**		**x ± SD**	**x ± SD**	
Length of Hospital Stay (Days)	12.57±5.91	14.56±5.21	11.47±4.88	**<0.001**	13.99±5.51	11.63±5.02	**<0.001**

	n (%)	n (%	n (%)		n (%)	n (%)	
Operation Timing							
Emergent	217 (91.2)	74 (88.1)	143 (94.1)	0.106	84 (91.3)	133 (92.4)	0.771
Elective	19 (8.8)	10 (11.9)	9 (5.9)		8 (8.7)	11 (7.6)	
Operation Technique							
Internal Fixation	112 (47.5)	39 (46.4)	73 (48.0)	0.511	46 (50.0)	66 (45.8)	0.216
Hemiarthroplasty	86 (36.4)	34 (40.5)	52 (34.2)		36 (39.1)	50 (34.7)	
Total Hip Replacement	38 (16.1)	11 (13.1)	27 (17.8)		10 (10.9)	28 (19.5)	
ICU Requirement							
Yes	84 (35.6)	39 (46.4)	45 (29.6)	**0.010**	35 (38.1)	49 (34.0)	0.530
No	152 (64.4)	45 (53.6)	107 (70.4)		57 (61.9)	95 (66.0)	
Postoperative Complication							
Yes	52 (22.1)	25 (29.8)	27 (17.8)	**0.033**	28 (19.4)	24 (16.7)	**0.013**
No	184 (77.9)	59 (70.2)	125 (82.2)		64 (80.6)	120 (83.3)	
Postoperative Surgical Complication							
Yes	10 (4.2)	7 (8.3)	3 (1.9)	**0.020**	7 (7.6)	3 (2.1)	**0.040**
No	226 (95.8)	77 (91.7)	149 (98.1)		85 (92.4)	141 (97.9)	
Postoperative Medical Complication							
Yes	50 (21.2)	18 (21.4)	32 (21.1)	0.946	19 (20.7)	31 (21.5)	0.872
No	186 (78.8)	66 (78.6)	120 (78.9)		73 (79.3)	113 (78.5)	
30-day Mortality	32 (13.5)	18 (21.4)	14 (9.2)	**0.009**	16 (17.4)	16 (11.1)	0.149
1-year Mortality	58 (24.6)	29 (34.5)	29 (19.1)	**0.008**	25 (27.2)	33 (22.9)	**0.022**

PMI: psoas muscle index, ICU: intensive care unit

The frequency of survival (30 days and one year) was significantly lower (p<0.05). There was no significant difference between the sarcopenia and non-sarcopenia groups in terms of other parameters (p>0.05) (Table 1, 2). According to the femoral neck T score, the patients were divided into low and high groups. Ninety-two (38.9%) patients were in the Low group, and 152 (61.1%) were in the high group. The mean age, CCI, and length of hospital stay were statistically significantly higher in the low group than in the high group, while the mean PMI was lower (p<0.05).

In the low group, compared to the high group, the frequency of females ≥65 years, sarcopenia, postoperative complications, and surgical complications was significantly higher. In addition, the postoperative 30-day survival rate was significantly lower (p<0.05). There was no significant difference between the low and high groups in terms of other parameters (p>0.05) (Tables 1, 2).

Patients were divided into two groups, alive and dead, according to their postoperative 30-day and one-year survival. In the postoperative 30-day mortality evaluation, 204 (86.5%) patients were alive, and 32 (13.5%) were dead. Women, sarcopenia, low T score, ICU requirement, and postoperative complications were significantly higher in the dead than in the alive group (p<0.05). However, there was no significant difference between the groups in terms of 30-day survival in terms of other parameters (p>0.05) (Table 3).

In the postoperative 1-year mortality evaluation, 178 (75.4%) patients were alive, and 58 (24.6%) were dead. The frequency of women and sarcopenia was significantly higher in the dead group than in the alive group (p=0.032, p=0.008, respectively). There was no significant difference between the groups in terms of one-year survival in terms of other parameters (p>0.05) (Table 3).

For postoperative one-month mortality, female gender [odds ratio (OR): 2.97, 95% confidence interval (CI): 1.17-7.54] and sarcopenia (OR: 3.65, 95% CI: 1.68-7.91), low T score (OR: 2.62, 95% CI: 1.23-5.62), ICU requirement (OR: 2.32, 95% CI: 1.09-4.92) and presence of postoperative complications (OR: 2.89%) 95 CI: 1.32-6.36) were significant risk factors (p<0.05). For postoperative one-year mortality, female gender (OR: 2.04, 95% CI: 1.06-3.94) and presence of sarcopenia (OR: 2.24, 95% CI: 1.22-4.09) was a significant risk factor (p<0.05) (Table 4).

DISCUSSION

In the current study, patients who were operated on for hip fractures were examined, and 1-month and 30-day mortality and postoperative complications were compared between the groups according to sarcopenia due to PMI and osteoporosis status obtained according to the T score of the patients.

While 1-year mortality was seen in 58 (24.6%) patients, 1-month mortality was observed in 32 (13.56%) patients. In multivariate analysis, the sarcopenic group and female gender due to PMI were necessary for 1-year and 30-day mortality; low T score, ICU requirement, and postoperative complications are among the factors affecting 30-day mortality.

Table 3. *Comparison of groups according to postoperative survival (30-day and one-year)*

	All Patient (n=236)	**30-day Mortality (n=32)**	**p Value**	**One-year Mortality (n=58)**	**p Value**
	n (%)	**n (%)**		**n (%)**	
Gender					
Female	147 (62.3)	26 (81.3)	**0.020**	43 (74.1)	**0.032**
Male	89 (37.7)	6 (18.7)		15 (25.9)	
Age Group					
<65	45 (19.1)	6 (18.7)	0.664	45 (77.6)	0.717
≥65	191 (80.9)	26 (81.3)		13 (22.4)	
Comorbid Disease					
Yes	201 (85.2)	27 (84.4)	0.892	52 (89.7)	0.268
No	35 (14.8)	5 (15.6)		6 (10.3)	
PMI					
Sarcopenia	84 (35.6)	20 (62.5)	**0.001**	29 (50)	**0.008**
Non-Sarcopenia	152 (64.4)	12 (37.5)		29 (50)	
T score					
Low	92 (38.9)	19 (59.4)	**0.011**	25 (43.1)	0.459
High	144 (61.1)	13 (40.5)		33 (56.9)	

Table 4. *Multivariant analysis of the effect of clinical data on postoperative 30-day and one-year mortality status*

	Odds Ratio	95% Confidence Interval	p Value
For 30-Day Mortality			
Gender (Female)	2.97	1.17-7.54	**<0.05**
PMI (Sarcopenia)	3.65	1.68-7.91	**<0.05**
T score (Low)	2.62	1.23-5.62	**<0.05**
ICU (Yes)	2.32	1.09-4.92	**<0.05**
Postoperative Complication (Yes)	2.89	1.32-6.36	**<0.05**
For One-Year Mortality			
Gender (Female)	2.04	1.06-3.94	<0.05
PMI (Sarcopenia)	2.24	1.22-4.09	<0.05

PMI: Psoas muscle index, ICU: Intensive care unit, odds ratio, $p<0.05$

The term sarcopenia was first described by Rosenberg et al. (18) in 1989 as a degenerative loss in skeletal muscle mass and strength. After understanding the pathophysiology of sarcopenia in line with the studies conducted in recent years, its importance is increasing day by day due to its effect on the aging society and its close relationship with the clinical results of the disease. It is known that a sarcopenic state is associated with impaired cardiopulmonary performance, weakened cognitive functions, greater risk of falling, and thus fracture risk, physical disability, and death (19,20). In addition, the hospital cost of patients with sarcopenia in hospitalized patients is 5-fold higher than those without sarcopenia (21).

In the current study, sarcopenia was detected in 84 (35.59%) of 236 patients who were operated for hip fracture. In patients with sarcopenia, 30-day, and 1-year mortality rates were observed in 18 (21.4%) and 29 (34.5%) patients, respectively. In addition, while 30-day mortality increased 3.65 times in the sarcopenic group, it was found that 1-year mortality increased 2.24 times. A recent study involving 913 people aged 63-67, similar to ours, showed that low muscle mass increased the risk of fracture 2-fold for three years (22). Similarly, another study reported that the EWGSOP definition of sarcopenia fracture risk was higher than the patient group without sarcopenia (heart rate: 0.94, 95% CI: 0.54-1.64) (23).

In this study, most patients with hip fractures were female. In addition, female patients have a higher prevalence of sarcopenia than male patients. However, contrary to the current study, it has been shown in various studies that the male gender is a risk factor for increased hip fracture mortality. Low grip strength and muscle mass are more common in male patients with hip fractures than in females (24,25). However, in a study of 322 male and 435 female patients, the effect of sarcopenia on fractures in various parts of the body differed between men and women. In this study, sarcopenia was seen more in women with vertebral and hip fractures; sarcopenia is more common in men with ankle and hip fractures (26).

In the current study, 92 (38.9%) patients were in the low group according to the femoral neck T score. In the low group, the incidence of females ≥65 years of age, sarcopenia, postoperative complications, and surgical complications was significant. Similarly, a study involving 2,261 patients showed that lower T scores were directly related to a 1-year risk of hip fractures (27).

Studies show that both conditions are seen in similar populations when we evaluate the relationship between sarcopenia and osteoporosis in advanced age. A mechanical relationship exists between muscle and bone in sarcopenic individuals (28). The relationship between muscles and bones has been revealed more clearly with DEXA and cross-sectional imaging methods (29). While DEXA studies show positive relationships between muscle condition and bone mass and density, cross-sectional imaging methods have additionally shown that bone size and strength are associated with muscle size and, to a lesser extent, muscle strength (30). This study also has several limitations. First, the study was designed as a single center and retrospective.

Sarcopenin was performed only according to radiological measurements according to PMI, and functional parameters such as EWGSOP or ISarcoPRM criteria were not used. In addition, sarcopenia cut-off values were determined in accordance with the current literature data. Despite these limitations, the study also has strengths. Our study is the only study evaluating the effects of sarcopenia and osteoporosis on postoperative outcomes in hip fracture patients in the Turkish population.

CONCLUSION

In conclusion, sarcopenia and osteoporosis are age-related decreases in the amount of muscle and bone, respectively. Both are among the factors that cause disability, falls, and hip fractures in the elderly and directly affect the postoperative results. The incidence of sarcopenia and low T score is high in female patients over 65 and in patients with adverse postoperative outcomes. Therefore, especially in geriatric patients, the detection of these two conditions in the earliest period to be detected and the correction of the factors that can be corrected are crucial both in increasing the quality of life of the patients and in dealing with the development of adverse traumatic events and the resulting situations with less damage.

Ethic: The study protocol was approved by the Karatekin Univercity Ethical Committee (date: 06.11.2023, no: 9).

Etik: Çalışma protokolü Karatekin Üniversitesi Etik Kurulu tarafından onaylandı (tarih: 06.11.2023, sayı: 9).

Yazar katkı durumu; Çalışmanın konsepti; MBU, OA, dizaynı; MBU, Literatür taraması; YE, MBU, verilerin toplanması ve işlenmesi; UD, OA, istatistik; OA, YUY, yazım aşaması; MBU, YUY, YP

Author contribution status; The concept of the study; MBU, OA, design; MBU, literature review; YE, MBU, collecting and processing data; UD, OA, statistics; OA, YUY, writing phase; MBU,YUY, YP

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The Effect of Physical Therapy on Pain and Quality of Life in Patients with Chronic Neck Pain: A Prospective Randomized Controlled Study

Kronik Boyun Ağrılı Hastalarda Fizik Tedavinin Klinik Durum ve Yaşam Kalitesi Üzerine Etkisi: Prospektif Randomize Kontrollü Bir Çalışma

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ABSTRACT

OBJECTIVE: This study aimed to evaluate the effectiveness of physical therapy (PT) on pain, functional status, depressive symptoms, and quality of life in patients with chronic neck pain (CNP).

MATERIAL AND METHODS: The study was designed as a randomized controlled trial involving outpatient clinic patients at a tertiary care hospital and included 80 patients with CNP. The patients were randomly assigned to two groups. The treatment group (TG) received ten sessions of conventional PT (hot pack, ultrasound, and Transcutaneous Electrical Nerve Stimulation) and home-based exercises. The control group (CG) was only given a home-based exercise program. Both groups were informed about correct posture and daily life activities. Patients were assessed pre-treatment, at the end of treatment (2 weeks), and 12 weeks after the treatment using the Visual Analogue Scale (VAS pain), cervical range of motion (ROM), Beck Depression Index (BDI), and short form-36 (SF-36).

RESULTS: Both groups showed significant improvements in VAS pain scores, ROM, SF-36, and BDI scores post-treatment ($p<0.01$ for all). At the three-month follow-up, the improvements in the TG continued, while the CG showed a regression compared to the levels observed two weeks after the treatment. The degree of improvement in VAS pain and BDI scores in the TG was significantly greater than in the CG ($p<0.01$).

CONCLUSION: In the treatment of CNP, adding PT modalities to the home exercise resulted in greater reductions in pain, disability, and depressive symptoms, as well as improvements in quality of life compared to home exercise alone. It's appropriate to recommend PT modalities as a beneficial treatment for CNP.

Keywords: Chronic neck pain, quality of life, exercise, physical therapy modalities

ÖZ

AMAÇ: Bu çalışmanın amacı, kronik boyun ağrısı (KBA) olan hastalarda fizik tedavinin (FT) ağrı, fonksiyonel durum, depresif semptomlar ve yaşam kalitesi üzerindeki etkinliğini değerlendirmektir.

GEREÇ ve YÖNTEM: Çalışma, 3. basamak hastane tabanlı, randomize kontrollü olarak tasarlanmıştır. KBA olan 80 hasta iki gruba randomize edilmiştir. Tedavi grubuna (TG), on seans konvansiyonel FT (sıcak paket, ultrason ve Transkutanöz Elektriksel Sinir Stimülasyonu) ve ev egzersiz programı verilmiştir. Kontrol grubuna (KG) ise yalnızca ev egzersiz programı verilmiştir. Her iki gruba da doğru duruş, günlük yaşam eğitimi verilmiştir. Hastalar, tedavi öncesi, tedavi sonunda (2 hafta) ve tedaviden 12 hafta sonra Vizüel Analog Skoru (VAS ağrı), servikal eklem hareket açıklığı (EHA), Beck Depresyon Ölçeği (BDÖ) ve yaşam kalitesi kısa form-36 (SF-36) kullanılarak değerlendirilmiştir.

BULGULAR: Her iki grup da tedavi sonrası VAS ağrı skorları, servikal EHA, SF-36 ve BDÖ skorlarında anlamlı iyileşmeler göstermiştir (tüm parametrelerde, $p<0,01$). Üç aylık takipte, TG'deki iyileşmeler devam ederken; KG'de tedavi sonrası ikinci haftada gözlemlenen düzeylerde gerileme izlenmiştir. TG'deki VAS ağrı ve BDÖ skorlarındaki iyileşme derecesi, KG'ye göre anlamlı derecede daha fazladır (her biri için, $p<0,01$).

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SONUÇ: Kronik boyun ağrısı tedavisinde, ev egzersiz programına FT modalitelerinin eklenmesi, yalnızca ev egzersiz programına göre ağrı, engellilik ve depresif semptomlarda daha büyük azalmalar ile yaşam kalitesinde daha fazla iyileşmeler sağlamıştır. Kronik boyun ağrısında FT modalitelerinin faydalı bir tedavi olarak önerilmesi uygun gözükmektedir.

Anahtar Kelimeler: Kronik boyun ağrısı, yaşam kalitesi, egzersiz, fizik tedavi modaliteleri

INTRODUCTION

Chronic neck pain (CNP) is a prevalent and debilitating musculoskeletal condition that affects 15-20% of the adult population and it is more commonly observed in women than in men (1,2). It is characterized by persistent pain and discomfort in the posterior and lateral aspect of the neck region, often resulting in functional limitations and decreased quality of life. CNP can have various etiologies, including mechanical, degenerative, and postural factors, and it is associated with significant healthcare costs and socioeconomic burdens (3). The management of CNP typically involves a multidisciplinary approach, aiming to alleviate pain, improve function, and enhance patients' overall well-being. Common conservative treatment options include patient education, medical interventions (paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), opioids, muscle relaxants, etc), exercise therapy, injections, and physical therapy (PT) modalities (3-5). While patient education and medical interventions, such as analgesics and muscle relaxants, have been extensively studied and are widely implemented, the efficacy of PT modalities in CNP management remains an area of ongoing research.

Physical therapy modalities encompass a range of therapeutic interventions, including manual therapy techniques, therapeutic exercises, electrotherapy modalities, and heat/cold applications (4-6). Superficial heat agents, such as hotpack (HP), and deep-heating agents, such as therapeutic ultrasound (US), are commonly used conservative treatment methods for CNP (7,8). US and HP contribute to pain reduction through various mechanisms. They can increase endorphin levels, raise the pain threshold, alter the viscoelastic properties of tissues, reduce pressure and tension in nerve endings, and facilitate the removal of harmful metabolic waste from the affected area through vasodilation, among others (9). Additionally, therapeutic US can effectively reduce pain through its micro-massage effect (10). Transcutaneous nerve stimulation (TENS) is another electrotherapy method commonly used in the conservative treatment of chronic musculoskeletal pain due to its analgesic effect, although its effectiveness is not strongly supported by robust evidence (11). Similar to other agents, TENS positively contributes to pain modulation through the gate control theory and by triggering the release of natural opioids (beta-endorphins and enkephalins) in the body (9,12).

These interventions address the underlying musculoskeletal dysfunctions, promote tissue healing, reduce pain, and improve physical function. There is no clear evidence on the effectiveness of PT modalities for CNP, as studies report inconsistent results and lack comprehensive data, with some showing positive effects on pain reduction and functional improvement. In contrast, others find minimal or no significant benefits (4,6,13,14). The heterogeneity in study designs, treatment protocols, outcome measures, and patient populations contributes to the variability in the reported results.

There is a lack of Level 1a evidence regarding the effectiveness of PT modalities in managing CNP. Therefore, well-designed prospective randomized controlled trials (RCTs) are needed to provide high-quality evidence. This study aims to address this gap and evaluate the effectiveness of PT modalities (electrophysical therapy), widely used in conservative CNP management, including in Türkiye.

MATERIAL & METHODS

Study Design

The research was designed as a hospital-based, single-center, randomized controlled study. The study protocol was approved by the Ethics Committee of Konya University, Meram Medicine Faculty (approval number: 2012/083). This study was conducted according to the Declaration of Helsinki, and written informed consent for participation in the study was obtained from all patients.

Participants

Patients who applied to the University of Konya, Medicine Faculty, Physical Medicine and Rehabilitation Clinics, and

were diagnosed with non-specific CNP clinically between June 2012 and July 2014 were assessed for the study. The diagnosis of CNP is defined, in line with the literature, as non-specific, mechanical, degenerative, discogenic musculoskeletal pain occurring in the neck region, based on anamnesis, detailed physical examination, and necessary imaging (X-ray and/or magnetic resonance imaging) (3-5).

The inclusion criteria were subjects between the ages of 18 and 65 years old with a pain severity of ≥3 according to the Visual Analog Scale (VAS pain) and previous neck pain of at least 12 weeks. The exclusion criteria included the presence of acute protruded or extruded cervical disc herniation (CDH), CDH or cervical stenosis leading to a neurological deficit, the presence of red flags, including cancer, infection, fracture, and rheumatological diseases (e.g., ankylosing spondylitis or rheumatoid arthritis), chronic widespread pain, including fibromyalgia, individuals with significant headaches, patients with a history of major depression or those who had started antidepressant medication within the last 3 months, thoracic outlet syndrome, history of cervical region surgery, individuals with cardiac pacemakers, those who are pregnant, or those with decompensated systemic diseases (respiratory failure, heart failure, liver cirrhosis, etc.).

Interventions

All patients were initially provided with education, including the resting position of the neck and points to consider in daily life activities. Additionally, all patients were given a home exercise program for three months, including range of motion (ROM) exercises and isometric strengthening exercises. These strengthening exercises were applied to the cervical flexor, extensor, and rotator muscles due to their ease of use and practicality in daily practice (6). The program consisted of two sets of 10 repetitions, performed twice a day. The same physician demonstrated the exercises to the patients multiple times and provided written materials with visual representations of the exercises to all participants. Patients whose exercise compliance, assessed based on self-reported adherence, was below 70% at the follow-up assessment were excluded from the study. The patients were not prescribed any analgesics for regular use. However, they were advised that they could take 500 mg of paracetamol or an NSAID if necessary, provided that they did not use it within 24 hours before the follow-up appointments.

In the active treatment group (TG), in addition to the treatments received by the control group (CG), conventional PT modalities, including HP, therapeutic US (ITO US-100®), and TENS (Intelect®), were applied for two weeks. The patients received a total of 10 sessions of conventional PT, with one session per day for five days a week, for two weeks, in alignment with the routine practice of our hospital. The treatment included the application of an HP to the neck area for 20 minutes, continuous US at a dose of 1.5 watts/cm^2 for 10 minutes, and conventional TENS for 30 minutes. The TENS parameters were set with a pulse duration of 100 microseconds, a frequency of 100 Hz, and an amplitude adjusted to a level where the patient felt paresthesia.

The patients were randomly allocated into two groups using simple randomization using the coin flip method by an independent hospital staff member. The evaluation of patients' parameters and questionnaires was conducted by the same physician.

Evaluation Parameters

Patient evaluations were performed by the same physician at baseline, 2 weeks post-treatment, and 3 months post-treatment. The VAS pain, ranging from 0 to 100 mm, was used to measure pain intensity. The active ROM of the cervical spine in all directions (flexion, extension, right and left lateral flexion, and rotation) was assessed. In this study, the active cervical ROM levels were evaluated using a grading method based on the percentage of limitation. Based on this classification, the degrees of limitation are as follows: no limitation (0%), 1st-degree limitation (0-25%), 2nd-degree limitation (25-50%), 3rd-degree limitation (50-75%), and 4th-degree limitation (75-100%).

The SF-36 Health Survey, which is the most commonly used generic measure of quality of life, was utilized to assess the quality of life. The SF-36 quality of life scores have been validated and tested for reliability in Turkis (15). It consists of eight subscales, including physical functioning, physical role limitations, emotional role limitations, pain, general health, vitality (energy or fatigue), social functioning, and mental health. Scores on each subscale range from 0 to 100, with higher scores indicating better health status.

The Beck Depression Inventory (BDI) is used to assess depressive symptoms. It has been validated and tested for reliability in Turkish (16). The inventory consists of 21 items, and each item utilizes a four-point self-rating scale ranging from 0 to 3 to evaluate specific behaviors associated with depression. The total maximum score on the inventory is 63, with a score of 17 or higher indicating the presence of a depressive mood.

Statistical Analysis

The statistical analysis of the data was conducted using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. software in a computerized environment. The chi-square test was used for categorical variables to determine whether there were differences in demographic variables between groups. Independent t-tests were applied to assess differences for continuous variables. The changes in VAS, SF-36, and BDI scores of patients at baseline, post-treatment, and 3-month follow-up were evaluated for time effects, group effects, and group-time interactions using repeated measures analysis of variance (ANOVA). The assumption of sphericity was assessed using the Mauchly test statistic. Multiple comparisons were adjusted using the Sidak method based on corrected p-values. Furthermore, the analysis of ordinal values of cervical ROM limitations in patients at baseline, post-treatment, and 3-month follow-up was performed using the nparLD package in the R program. Multiple comparisons were adjusted using the Bonferroni method based on corrected p-values. A significance level of $p<0.05$ was considered statistically significant.

The G Power 3.1.9.4 program was used for the study sample size. Considering the VAS-pain value, which is the main outcome of this study, it was calculated that (ANOVA: Repeated measures, between factors) at least 40 patients per group should be taken in when the effect size (medium) is 0.3, the alpha value is 0.05, and the power value is 0.90.

RESULTS

A total of 85 patients were randomized at baseline, of whom 80 completed the study, resulting in a total of 40 participants in both groups. No treatment-related side effects (wound development, blood pressure fluctuations, discomfort, allergies, etc.) were reported by the participants or observed on medical follow-ups. Figure 1 shows the study's flow chart.

Both groups consisted of 38 females and 2 males. The mean duration of symptoms in the TG and CG were 4.1±4.2 and 2.7±2.4 years respectively (p=0.06). The demographic characteristics of the patients are presented in Table 1, and there were no statistically significant differences between the groups in terms of age, gender, BMI, marital status, education level, smoking status, and occupation (p>0.05).

The change in VAS pain scores between the TG and the CG during the treatment period is shown in Figure 2 and Table 2. According to these results, a significant reduction in pain was observed in both groups. In the CG, the decreased pain level observed 2 weeks after treatment increased at the 12-week follow-up. However, in the TG, the reduction in pain continued throughout the follow-up period. Significant improvement in cervical ROM was observed in both groups after treatment, but the ROM gains at 12 weeks decreased in the CG while they continued in the TG, and the improvement in the TG was found to be superior to the CG ($p<0.01$). Similarly, the changes in BDI and SF-36 quality of life scores are summarized in Tables 2 and 3 below.

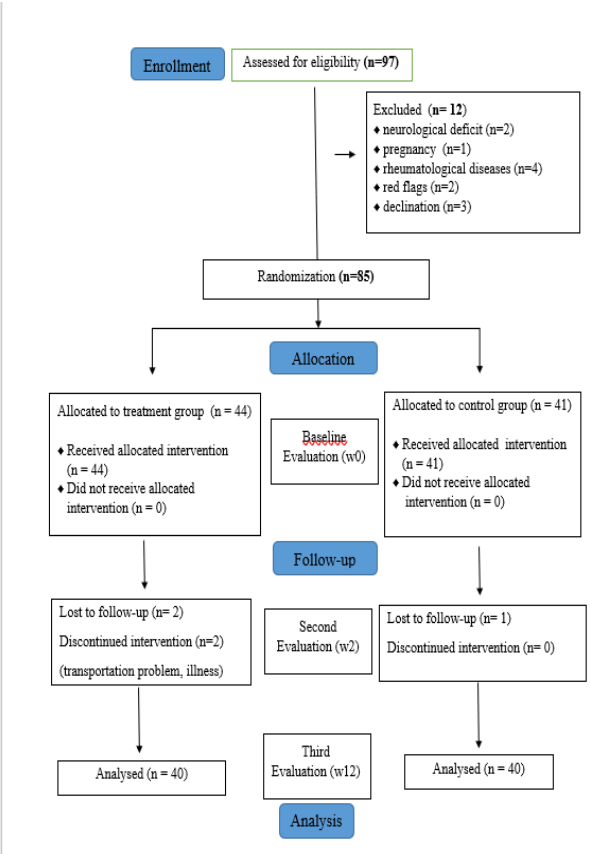

Figure 1. Flowchart of the enrollment process of the study

Table 1. Demographic characteristics of study participants

		Treatment Group (n=40)	Control Group (n=40)	p
		Mean ± SD	**Mean ± SD**	
Age (Years ± SD)		49.9±9.9	48.8±9.1	0.609[a]
BMI (kg/m² ± SD)		31.5±6.2	31.0±4.7	0.698[a]
Symptom Duration (Years)		4.1±4.2	2.7±2.4	0.06[c]
		n (%)	**n (%)**	
Sex	Female	38 (95)	38 (95)	1.00[b]
	Male	2 (5)	2 (5)	
Marriage	Single	4 (10)	0 (0)	0.116[b]
	Married	36 (90)	40 (100)	
Education	Illiterate	5 (12,5)	5 (12,5)	0.334[b]
	Primary School	26 (65)	31 (77,5)	
	High School or College	9 (22,5)	4 (10)	
Smoking	Non-smoker	35 (87,5)	36 (90)	0.950[b]
	Smoker	5 (12,5)	4 (10)	
Employment	Employed	35 (87,5)	38 (95)	0.55[b]
	Housewife	4 (10)	2 (5)	
	Student	1 (2,5)	0 (0)	

BMI: Body mass index, SD: Standard deviation, [a]Independent Samples t-test, [b]Pearson chi-square test, [c]Mann-Whitney U test

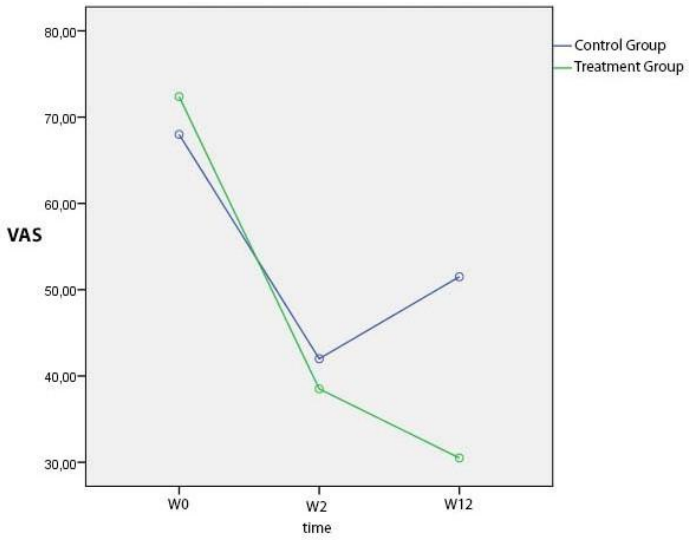

Figure 2. The change in VAS pain scores over time was examined in the treatment and control groups

VAS: Visual Analogue Scale

Table 2. Evaluation of patients' VAS-pain and Beck Depression Inventory scores

		TG Group	Control Group	p
		Mean ± SD	**Mean ± SD**	
VAS (mm)	W0	72.37±9.47	68.00±11.59	0.068[a]
	W2	38.50±12.51	42.00±13.99	0.242[a]
	W12	30.50±11.75	51.50±12.51	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	0.006[c]
	W0-W12 (p[b])	<0.001	<0.001	
	W2-W12 (p[b])	<0.001	<0.001	
BDI	W0	16.62±7.85	14.35±6.55	0.164[a]
	W2	5.70±4.26	6.25±4.14	0.560[a]
	W12	4.45±4.51	8.97±4.21	< 0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	0.387[c]
	W0-W12 (p[b])	<0.001	<0.001	
	W2-W12 (p[b])	0.056	<0.001	

VAS: Visual Analog Scale, BDI: Beck Depression Inventory, W0: Before treatment, W2: 2 weeks after treatment, W12: 12 weeks after treatment, [a] Independent Samples t-test, [b]paired t-test, [c]Two-Way Repeated Measures Analysis of Variance (ANOVA)

Table 3. Evaluation of patients' SF-36 Quality of Life scores

		TG Group	**Control Group**	**p**
		Mean ± SD	**Mean ± SD**	
Physical Functioning	W0	67.8±16.1	62.7±16.1	0.016[a]
	W2	36.7±15.4	33.6±15.2	0.365[a]
	W12	33.1±19.6	44.2±15.1	<0.001[a]
	W0-W2 (p[b])	<0.001	< 0.001	0.765[c]
	W0-W12 (p[b])	<0.001	< 0.001	
	W2-W12 (p[b])	0.189	< 0.001	
Social Functioning	W0	33.7±22.3	39.6±19.7	0.212[a]
	W2	72.5±16.7	74.0±16.5	0.677[a]
	W12	70.6±20.9	57.5±17.6	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	0.592
	W0-W12 (p[b])	<0.001	<0.001	
	W2-W12 (p[b])	0.884	<0.001	
Physical Role Limitations	W0	3.7±12.0	3.7±14.4	1.000[a]
	W2	54.3±34.8	50.0±30.4	0.552[a]
	W12	63.1±33.0	30.6±26.8	<0.001[a]

	W12	63.1±33.0	30.6±26.8	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	
	W0-W12 (p[b])	<0.001	<0.001	0.011[c]
	W2-W12 (p[b])	0.188	<0.001	
	W0	7.5±17.6	6.6±18.7	0.839[a]
Emotional Role Limitations	W2	67.5±28.7	67.5±32.4	1.000[a]
	W12	69.1±31.4	43.3±33.0	< 0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	0.055[c]
	W0-W12 (p[b])	<0.001	<0.001	
	W2-W12 (p[b])	0.983	<0.001	
	W0	29.5±11.1	34.6±11.0	0.043[a]
Pain	W2	65.0±11.9	66.5±15.4	0.629[a]
	W12	68.1±15.4	52.7±12.4	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	
	W0-W12 (p[b])	<0.001	<0.001	0.203[c]
	W2-W12 (p[b])	0.389	< 0.001	
	W0	21.5±13.6	23.6±14.3	0.500[a]
Vitality (Energy)	W2	58.0±16.3	58.2±17.1	0.954[a]
	W12	61.1±19.0	42.1±16.3	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	
	W0-W12 (p[b])	<0.001	<0.001	0.068[c]
	W2-W12 (p[b])	0.535	<0.001	
	W0	31.0±14.0	35.5±12.4	0.133
Mental Health	W2	68.8±12.9	67.5±16.9	0.701
	W12	71.3±16.7	54.1±14.0	< 0.001
	W0-W2 (p[b])	<0.001	<0.001	0.082[c]
	W0-W12 (p[b])	<0.001	<0.001	
	W2-W12 (p[b])	0.678	<0.001	
	W0	33.5±15.7	38.7±16.8	0.154[a]
General Health	W2	57.6±14.0	57.7±14.1	0.968[a]
	W12	60.6±16.2	47.3±15.3	<0.001[a]
	W0-W2 (p[b])	<0.001	<0.001	
	W0-W12 (p[b])	<0.001	<0.001	0.387[c]

	W2-W12 (p^b)	0.212	<0.001

SD: Standard deviation, W0: Before treatment, W2: 2 weeks after treatment, W12: 12 weeks after treatment, [a] Independent Samples t-test, [b]Paired t-test, [c]Two-Way Repeated Measures Analysis of Variance (ANOVA)

DISCUSSION

In the present study, aimed at investigating the effectiveness of PT modalities, which are among the conservative treatment methods for CNP, on clinical findings and quality of life, a significant improvement compared to baseline was observed in both groups during the follow-up period after treatment. While the improvement in the CG decreased at the 3-month follow-up after the treatment received at CG, a continuation of improvement was observed in the TG.

In an RCT, it has been reported that a combination of US and TENS is as effective as high-intensity laser therapy (HILT) in treating neck pain associated with cervical disc herniation (17). In an RCT conducted by Venosa et al. (18) the effects of HILT and a combination of US treatment and TENS on pain, ROM, and functional activity in patients with cervical spondylosis were evaluated. After 12 treatment sessions, improvement was observed in cervical ROM, VAS pain scores, and neck disability index (NDI) in both groups, but the HILT group was found to be superior. However, studies are available that demonstrate these treatments' ineffectiveness (19,20). There are numerous studies in the literature regarding the efficacy of US and TENS in the treatment of CNP, and it is evident that there are promising results (21). In our study, physical therapy modalities were compared to a CG that received a highly potent treatment including exercises (22,23), contrary to some previous studies. It was found that 10 sessions of US, TENS, and HP therapy were effective. We believe that the results we obtained will contribute to the conflicting findings in the literature.

In a systematic review (24), which included 83 studies, to demonstrate the effectiveness of physical therapy modalities in the treatment of acute or CNP, acupuncture, laser therapy, and intermittent traction were reported to have moderate levels of evidence in short-term follow-up. For acute whiplash syndrome, subacute, or CNP, pulse US therapy, infrared light therapy, and continuous traction were reported to have no significant effect on pain reduction with moderate evidence. Furthermore, it was stated that the addition of superficial HP therapy to mobilization, manipulation, or electrical stimulation did not provide additional benefits in the 6-month follow-up. The authors emphasized the need for determining standard treatment doses and conducting well-designed studies in this regard.

A meta-analysis published in 2018 revealed insufficient evidence regarding the use of TENS for cervical spine pain (25). Only one RCT related to neck pain and six RCTs related to lower back pain were included in this meta-analysis. It was reported that TENS had very short-term effectiveness and did not show significant efficacy after 1-3 months of treatment. In our study, patients were assessed 3 months after the treatment, and it was observed that the clinical effectiveness in the TG continued without diminishing. Therefore, our study, being an RCT with a moderate follow-up period, can contribute to the need for strong-quality studies in this area.

In the present study, the combined application of physical therapy modalities prevented us from isolating the effectiveness of each modality individually. Therefore, this study would be insufficient in contributing to the clarification emphasized in systematic reviews and meta-analyses, which state that US therapy may be effective for neck pain but that the extent of its additional benefit when combined with other treatments is not clear (26). However, considering that in many physical therapy and rehabilitation clinics these treatments are commonly combined and are cost-effective and safe, the results we obtained are valuable from a clinical practice perspective.

Exercise therapy is believed to reduce inflammation, decrease muscle activity and spasms, improve muscle coordination, and support tissue regeneration, thereby restoring musculoskeletal pain and disability (27). Indeed, many exercise programs are designed to correct muscle coordination, relax tense muscles, increase ROM, and enhance muscle strength. There is limited research evaluating the effectiveness of exercise programs specifically for CNPs. Lluch et al. (28) found that low-load training involving deep cervical flexor muscle exercises for

six weeks resulted in reduced pain and disability in patients but did not observe changes in pressure pain sensitivity in the regional neck muscles. Schomacher et al. observed structural changes such as increased fat concentration and type 2 fibril proliferation in the deep cervical extensor muscle group in patients with neck pain (29). They recommended exercises targeting the deep cervical extensor muscles. Studies on the effectiveness of exercise in the treatment of CNP have generally focused on specific muscle groups and demonstrated the efficacy of these targeted exercises (23,30).

In studies investigating the effectiveness of medical treatments or PT modalities, the comparison is often made with a CG receiving either a placebo effect or exercise interventions (4,6,8,13,14). In a recent study, Haklıgil et al. (8) compared Pilates alone to Pilates combined with conventional physiotherapy in CNP. Similar to our study, this RCT included physiotherapy modalities such as hot packs, TENS, and US, and reported that the addition of physiotherapy modalities was beneficial. Moreover, as in our study, sham physiotherapy modalities were not used in this RCT. In our study, both groups were engaged in home exercise therapy from the beginning of the study until the 3-month follow-up, in addition to patient education and points to consider in daily life activities. Therefore, it would not be appropriate to make definitive conclusions solely regarding the effectiveness of the exercise program due to the methodology of the present study. However, the observed improvements in both groups support the potential positive effects of exercise when combined with other treatments on clinical symptoms and quality of life. The addition of PT modalities, especially HP and TENS, to exercise in a patient experiencing pain will likely decrease pain in the short term and increase patient compliance with exercises.[30] In our study, in the group receiving physical therapy in addition to exercise and medical treatment, the continued decrease in pain and improvement in physical functions for up to 3 months may also be attributed to the indirect impact of exercise on adherence to daily life activities.

In the evaluation of the quality of life and satisfaction in patients with neck pain, more rational tools such as the NDI or the Neck Pain and Disability Index are commonly used, rather than the SF-36 test (31). Due to the majority of our study participants having low educational levels, not driving cars, and leading sedentary lifestyles, the SF-36 scale, which primarily assesses general activities, was utilized to measure their quality of life. CNP often coexists with mood disorders such as depression and anxiety (21,32). Considering this association, we used the BDI as a general screening test for assessing the emotional status of the patients. The results obtained in our study are consistent with the literature, as we observed a reduction in BDI scores and an improvement in quality of life parallel to the decrease in pain following treatment.

Study Limitations

The main limitations of the present study were the unequal treatment of the groups and the lack of single-blinding. The intervention group received more intensive treatment, while the CG did not receive the same dose of sham therapy. As a result, this may significantly impact the findings. However, these treatments are inherent practices in PT, and patients undergoing these therapies would naturally receive more treatment compared to those not receiving PT. Hence, this aspect does not invalidate the main objective of our study, and the obtained results remain meaningful. Although a true sham application for HP could not be conducted, sham applications could have been performed for TENS and US; however, this was not the primary aim of our study. Other important limitations include the single-center nature of the study, the lack of a long-term follow-up period, and the absence of structured psychiatric evaluations for assessing mood levels. Additionally, cervical ROM was assessed using a subjective classification method rather than goniometry or digital measurement techniques, which could have provided more reliable data. Despite these limitations, we believe that the strengths of our study, such as being an RCT and the thorough evaluation of patients at two different time points, are noteworthy. In a field where strong evidence is lacking, we hope that our study will contribute significantly to the literature.

CONCLUSION

In the treatment of CNP, adding PT modalities (HP, US, and TENS) to the home-based exercise program resulted in greater reductions in pain, disability, and depressive symptoms, as well as improvements in quality of life compared to home-based exercise alone in the short and

medium term. Considering that PT modalities are safe, easy to apply, relatively inexpensive, and effective treatment options, they may be considered an important component of conservative treatment for CNP.

Ethic: This study was approved by the Ethical Committee of the Konya University Medicine Faculty (approval number: 2012/083). Its procedure complied with the Declaration of Helsinki guidelines.
Etik: Bu çalışma Konya Üniversitesi Tıp Fakültesi Etik Kurulu tarafından onaylandı (onay numarası: 2012/083). Prosedürü Helsinki Bildirgesi Yönerge'lerine uygundur.
Author contribution status; The concept of the study; MŞ, NŞ, RY, design; MŞ, NŞ, RY, literature review; MŞ, NŞ, RY, collecting and processing data; MŞ, NŞ, RY, statistics; MŞ, NŞ, RY, writing phase; MŞ, NŞ, RY
Yazar katkı durumu; Çalışmanın konsepti; MŞ, NŞ, RY, dizaynı; MŞ, NŞ, RY, Literatür taraması; MŞ, NŞ, RY, verilerin toplanması ve işlenmesi; MŞ, NŞ, RY, istatistik; MŞ, NŞ, RY, yazım aşaması; MŞ, NŞ, RY
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Original Investigation / Orijinal Araştırma
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Frequency of Metabolic Syndrome in Individuals Diagnosed with Rheumatoid Arthritis and Its Relationship with Inflammatory Parameters

Romatoid Artrit Tanılı Bireylerde Metabolik Sendrom Sıklığı ve İnflamatuvar Parametrelerle İlişkisi

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ABSTRACT

OBJECTIVE: The aim of this study is to investigate the relationship between rheumatoid arthritis (RA) and metabolic syndrome (MetS), to evaluate the prevalence of MetS in patients with RA and its association with biomarkers [C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), lipid profile, vitamin D], and to explore the effects of antirheumatic therapies on metabolic parameters. It is known that MetS increases cardiovascular risk in RA patients; thus, clarifying this relationship is critically important for patient management.

MATERIALS AND METHODS: This study was designed as a cross-sectional cohort analysis, including 270 RA patients followed in a single center. Demographic, clinical, and laboratory data of patients were collected retrospectively. MetS diagnosis was established according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria. Disease activity markers for RA (CRP, ESR), lipid profiles, vitamin D levels, and treatment details were recorded. Student's t-test, Mann-Whitney U test, and chi-square test were used for statistical comparisons between groups.

RESULTS: The prevalence of MetS among RA patients was found to be 31.7%. Patients with MetS had significantly higher metabolic risk factors, such as body mass index (32.7 kg/m^2), hypertension (95%), and hypertriglyceridemia (86%). No significant differences were observed in CRP and ESR levels between patients with and without MetS. Although vitamin D deficiency was common, it was not significantly associated with MetS. Furthermore, no significant relationship was identified between RA treatments (methotrexate, biological agents) and MetS.

CONCLUSION: The prevalence of MetS in patients with RA is higher compared to the general population, leading to increased cardiovascular risk. In RA patients whose disease activity is well-controlled, the inflammation-metabolic risk relationship may diminish. A "treat-to-target" approach in RA management should encompass both joint-related and cardiometabolic outcomes. Early diagnosis and management of MetS can improve quality of life and prognosis in RA patients.

Keywords: Rheumatoid arthritis, metabolic syndrome, cardiovascular risk, inflammation, antirheumatic treatment, vitamin D

ÖZ

AMAÇ: Bu çalışmanın amacı, romatoid artrit (RA) ve metabolik sendrom (MetS) arasındaki ilişkiyi incelemek, RA hastalarında MetS prevalansını ve biyobelirteçlerle [C-reaktif protein (CRP, eritrosit sedimantasyon hızı (ESH), lipid profili, D vitamini] ilişkisini değerlendirmek, ayrıca anti-romatizmal tedavilerin metabolik parametreler üzerindeki etkilerini araştırmaktır. RA'lı hastalarda MetS'nin kardiyovasküler riski artırdığı bilinmekte olup, bu ilişkinin aydınlatılması hasta yönetimi açısından kritik öneme sahiptir.

GEREÇ ve YÖNTEM: Kesitsel bir kohort analizi olarak tasarlanan bu çalışmada, tek merkezde takipli 270 RA hastası incelendi. Hastaların demografik, klinik ve laboratuvar verileri retrospektif olarak toplandı. MetS tanısı Ulusal Kolesterol Eğitim Programı (NCEP ATP III) kriterlerine göre konuldu. RA hastalık aktivitesi (CRP, ESH), lipid profili, D vitamini düzeyleri ve tedavi detayları kaydedildi. İstatistiksel analizlerde gruplar arası karşılaştırmalar için Student t-testi, Mann-Whitney U testi ve ki-kare testi kullanıldı.

BULGULAR: RA hastalarında MetS prevalansı %31,7 olarak bulundu. MetS'li hastalarda vücut kitle indeksi (32,7 kg/m^2) ve hipertansiyon (%95), hipertrigliseridemi (%86) gibi metabolik risk faktörleri belirgin şekilde daha yüksekti. CRP ve ESH düzeyleri MetS'li ve MetS'siz gruplar arasında farklılık göstermedi. D vitamini eksikliği yaygın olmakla birlikte, MetS ile anlamlı bir ilişki saptanmadı. RA tedavileri (metotreksat, biyolojik ajanlar) ile MetS arasında belirgin bir ilişki gözlenmedi.

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SONUÇ: RA hastalarında MetS prevalansı genel popülasyona göre daha yüksektir ve kardiyovasküler riski artırmaktadır. İyi kontrol altındaki RA hastalarında enflamasyon-metabolik risk ilişkisi hafifleyebilir. RA tedavisinde "tüm hedefler için tedavi" yaklaşımı hem eklem hem de kardiyometabolik sonuçlar için benimsenmelidir. MetS'nin erken tanı ve yönetimi, RA hastalarının yaşam kalitesini ve prognozunu iyileştirebilir.

Anahtar Kelimeler: Romatoid artrit, metabolik sendrom, kardiyovasküler risk, enflamasyon, antiromatizmal tedavi, D vitamini

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic autoimmune joint disease characterized by systemic inflammation. Patients with RA have a significantly increased long-term risk of cardiovascular disease; systemic inflammation in these patients can reduce life expectancy by approximately 5 years (1,2). Metabolic syndrome (MetS), a cluster of metabolic disorders including obesity, insulin resistance, dyslipidemia, and hypertension, substantially elevates cardiovascular risk (1,3). While the prevalence of MetS in the general population is around 20-25%, higher rates have been reported among RA patients due to systemic inflammation and insulin resistance (1,3). Additionally, a recent meta-analysis indicated a MetS prevalence of approximately 30% in RA patients, highlighting a significantly greater risk compared to healthy individuals (3). Correspondingly, RA patients commonly exhibit atherogenic lipid profile changes [such as low high-density lipoprotein (HDL) and high triglycerides] and adipokine imbalances (1).

The relationship between RA and MetS appears bidirectional. Chronic inflammation associated with RA can promote the development of MetS components, while the presence of MetS may increase the risk of developing RA. For instance, obesity and abdominal adiposity are known risk factors for RA; individuals with MetS have a higher likelihood of developing RA in the future (a 12-year cohort study reported a ~22% increased RA incidence among individuals with MetS) (4). Inflammatory cytokines, particularly tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), can disrupt insulin receptor signaling, leading to insulin resistance and adversely affecting lipid metabolism in RA (5). Consequently, RA patients are more likely to exhibit MetS components such as visceral obesity, hyperglycemia, and dyslipidemia. Conversely, the presence of MetS has been associated with increased RA disease activity; studies indicate higher Disease Activity Scores (DAS28) and acute-phase reactant levels among RA patients with MetS (6). Therefore, a vicious cycle may exist between chronic inflammation and metabolic disturbances. Clarifying the link between RA and MetS is critical both for understanding disease pathogenesis and improving long-term cardiometabolic outcomes in RA patients.

In light of existing literature, the present study aims to investigate the relationship between RA and MetS, examine associations between MetS and biomarkers [e.g., C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), lipid profiles, 25(OH) vitamin D levels] in RA patients, and explore the impact of antirheumatic treatments on metabolic parameters.

MATERIALS & METHODS

Study Design and Patient Selection

This study was designed as a cross-sectional cohort analysis involving RA patients followed in a single center. Data from patients were meticulously collected and evaluated according to national ethical guidelines for research involving human subjects. Ethical approval for this study was obtained from the Ethics Committee of Balıkesir University Faculty of Medicine (decision no: 2025/70). Patients included in the study were adults aged over 18 years, diagnosed with RA according to the American College of Rheumatology classification criteria. Patient data were collected retrospectively from medical records and electronic health information systems.

For each patient, demographic data (age, sex), anthropometric measurements [height, weight; body mass index (BMI) calculated], duration of RA and treatment details, comorbidities, and laboratory results were recorded. Disease activity indicators such as CRP (mg/L) and ESR (mm/h), as well as rheumatoid factor (RF) and anti-cyclic citrullinated peptide (anti-CCP) antibody positivity, were collected. Metabolic profile assessments included fasting blood glucose or presence of diabetes, lipid parameters [triglycerides, total cholesterol, low-density lipoprotein (LDL), HDL], arterial blood pressure values, and serum 25(OH) vitamin D levels.

Definition of Metabolic Syndrome

The diagnosis of MetS in patients was established according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria. According to this definition, the presence of at least three of the following five criteria was considered diagnostic of MetS (3):

- Abdominal obesity: Waist circumference ≥102 cm in men, ≥88 cm in women (since waist circumference measurements were unavailable, patients with BMI ≥30 kg/m² were considered as having abdominal obesity).
- Hyperglycemia: Fasting plasma glucose ≥100 mg/dL or previously diagnosed diabetes mellitus.
- Hypertension: Blood pressure ≥130/85 mmHg or current antihypertensive therapy.
- Hypertriglyceridemia: Triglyceride levels ≥150 mg/dL or current treatment for elevated triglycerides.
- Low HDL cholesterol: HDL <40 mg/dL in men or <50 mg/dL in women, or current treatment aimed at increasing HDL cholesterol.
- Patients meeting at least three of these criteria were classified as having MetS.

Therapeutic Management

RA treatments were categorized into conventional synthetic disease-modifying antirheumatic drugs (csDMARDs, e.g., methotrexate, sulfasalazine, hydroxychloroquine), biological agents (bDMARDs, e.g., TNF inhibitors, IL-6 receptor inhibitors), and targeted synthetic DMARDs (tsDMARDs). Additionally, glucocorticoid use was recorded. Comorbidities such as hypertension, diabetes, coronary artery disease, and demographic data including age, sex, BMI, smoking history, and disease duration were documented.

Statistical Analysis

The prevalence of MetS within the RA cohort was calculated using descriptive statistics. Clinical and laboratory characteristics of RA patients with and without MetS were compared. Comparisons of continuous variables between groups were performed using Student's t-test or Mann-Whitney U test, depending on normality. Chi-square tests were used for categorical variables. A p-value of less than 0.05 was considered statistically significant. Results were interpreted in conjunction with relevant literature findings for comprehensive evaluation.

RESULTS

Patient Characteristics

A total of 270 patients with RA were evaluated (mean age ~59.3 years). The majority were female (approximately 75%). Hypertension was observed in 50.2%, type 2 diabetes in 26%, and dyslipidemia in 19% of the cohort. RF and/or anti-CCP antibody positivity (RA seropositivity) was present in 80% of patients. The RA seropositivity rate (RF and/or anti-CCP positivity) was determined to be 80%. A significant proportion of patients were treated with DMARDs: 57% were on at least one csDMARD (most commonly methotrexate, 45%), 19% were on a bDMARD, and 5% were on a tsDMARD. The proportion of patients currently receiving glucocorticoid treatment was 26%, usually at the low-dose prednisone level (≤5 mg/day).

Prevalence of Metabolic Syndrome

The prevalence of MetS among RA patients was similar to expected rates, with sufficient data available for diagnostic criteria in 104 patients. MetS prevalence was identified in 31.7% of patients. When comparing RA patients with and without MetS, demographic characteristics such as age (~60 years in both groups) and sex distribution (86% female in MetS[+], 81% female in MetS[-]) were comparable (p>0.05). Patients with MetS exhibited a significantly higher BMI (32.7 kg/m² vs. MetS[-]), with abdominal obesity noted in approximately 64% (14/22) of these patients based on BMI values.

Prevalence of MetS Components

In the cohort of 22 patients diagnosed with RA and MetS, the most prevalent metabolic risk components were high blood pressure and hypertriglyceridemia. A significant proportion of these patients met criteria for arterial hypertension (95%, 21/22) and high triglycerides (86%, 19/22). Additionally, LDL cholesterol levels were observed in 59% (13/22) of the MetS patients. Hyperglycemia or diabetes criteria were present in 73% (16/22) of patients, and 55% of the group with MetS were known diabetics. In comparison, the prevalence of hypertension was 35%, diabetes 18%, and hypertriglyceridemia 8% in RA patients without MetS (all p<0.001). The group without MetS exhibited significantly higher mean HDL cholesterol levels (62 mg/dL vs. 49 mg/dL, p<0.01). Interestingly, mean LDL cholesterol levels were slightly lower in patients with MetS (119 mg/dL vs. 134 mg/dL, p=0.08), which may be related to

the use of statins among some of these patients. The lipid profile of the RA cohort exhibited a negative correlation between CRP and HDL, with a r value of approximately -0.16, suggesting a "lipid paradox" in the context of active inflammation (6).

Inflammatory Markers and Disease Activity

No significant differences in RA-specific inflammatory markers (CRP, ESR) were identified between patients with and without MetS. Although MetS-positive patients tended to have slightly lower mean CRP (5.6 vs. 9.4 mg/L) and ESR values (27 vs. 30 mm/h), these differences were not statistically significant (CRP: p=0.94, ESR: p=0.67). Disease activity measured by inflammatory markers did not appear significantly different between groups, suggesting inflammation may have been effectively controlled in both cohorts.

Vitamin D Levels

Vitamin D deficiency was widespread among RA patients. In the 261 patients assessed, mean 25(OH) vitamin D levels were 25.6±14.1 ng/mL. Vitamin D deficiency was highly prevalent, observed in 67% of patients overall. However, no significant difference was noted in vitamin D levels between RA patients with and without MetS (23.4 ng/mL vs. 24.9 ng/mL, respectively, p=0.58), indicating that vitamin D status was not closely associated with MetS in this RA cohort.

RA Treatments and Metabolic Syndrome

The distribution of primary treatment groups (csDMARD, bDMARD, tsDMARD) utilized in patients with RA did not exhibit a discrepancy according to the presence of MetS. The distribution of patients with MetS who utilized csDMARD, bDMARD, or tsDMARD was 55%, 32%, and 14%, respectively, while the corresponding figures for the non-MetS group were 55%, 31%, and 8%, respectively (p>0.05 for all). The two groups exhibited significant similarity, particularly with regard to methotrexate use: The use of methotrexate was 8% (36%) in the MetS group and 23% (p=0.22) in the non-MetS group. TNF inhibitor biologic drug use was 32% in patients with MetS and 31% in those without MetS (p=0.89). The prevalence of glucocorticoid use was comparable between the two groups (30% vs. 25%, p=0.60). However, it has been observed that long-term, high-dose steroid use may contribute to the development of obesity and diabetes in some patients. These analyses, which were performed on the basis of treatment subgroups, did not demonstrate a clear effect of any particular RA treatment agent on the MetS in the current data.

DISCUSSION

In this study, we investigated the relationship between RA and MetS from multiple perspectives, including prevalence, risk factors, biomarkers, and therapeutic influences. The prevalence of MetS observed in our RA cohort (~31.7%) aligns closely with the rates (~30%) reported by recent meta-analyses and other international cohort studies (1,3). For example, previous meta-analyses have consistently reported MetS prevalence rates of approximately 30% in RA populations across diverse geographical settings (1,3). Although the observed prevalence in our cohort aligns with these findings, methodological differences, particularly the lack of direct waist circumference measurements, might have led to underestimation. Since we used BMI as an indirect measure for abdominal obesity, some patients meeting waist circumference criteria might have been overlooked. Indeed, abdominal obesity, a key MetS component, was indirectly inferred from BMI in approximately 34% of our MetS-positive patients. Given that waist circumference measurement directly reflects abdominal adiposity -a critical determinant of MetS- its absence likely affected accurate prevalence estimation.

The most common components of MetS observed in our RA cohort were hypertension (95%) and hypertriglyceridemia (86%). These findings are consistent with the literature, confirming hypertension and dyslipidemia as dominant cardiovascular risk factors in RA patients with MetS (1,4). The prevalence of hyperglycemia (73%) and low HDL cholesterol (59%) in our MetS-positive patients further highlights the metabolic complexity associated with RA. Notably, HDL cholesterol was significantly lower in patients with MetS compared to those without, aligning with previous reports indicating an inverse relationship between systemic inflammation and HDL cholesterol levels in RA patients (6). Interestingly, LDL cholesterol levels were slightly lower in MetS-positive individuals, potentially reflecting statin use among these patients.

The relationship between MetS and inflammatory markers (CRP, ESR) in RA patients remains controversial in the literature. While some studies report significantly higher inflammatory activity (DAS28, CRP, ESR) in RA patients with

MetS (1,3,4,6,7), others fail to identify such associations (8,9). In our cohort, no significant differences in CRP and ESR levels were identified between RA patients with and without MetS, suggesting well-controlled inflammatory activity overall. Indeed, our cohort showed relatively low inflammatory markers, reflecting effective disease control through treatment. This might partially explain why we did not observe a significant association between disease activity and MetS, aligning with studies suggesting inflammation-metabolic risk relationships become less prominent when RA is effectively managed (8-10).

Vitamin D deficiency was highly prevalent in our cohort (67% had 25(OH)D <30 ng/mL), but we found no significant difference between patients with and without MetS. Although some studies have reported a clear association between low vitamin D levels and increased MetS risk (11), our results did not confirm such a relationship. This discrepancy may be related to the widespread vitamin D deficiency across the entire study population, potentially reducing statistical power. Nonetheless, evidence from other studies indicates that vitamin D deficiency is associated with elevated cardiometabolic risk in RA patients, underscoring the importance of addressing vitamin D status as part of comprehensive RA care (11,12).

Regarding RA therapies, our study found no significant relationship between the use of conventional synthetic DMARDs (csDMARDs), biologics, targeted synthetic DMARDs, or glucocorticoids and the presence of MetS. The proportions of patients receiving these treatments were comparable across groups. Although methotrexate is known to reduce metabolic risk through its anti-inflammatory and insulin-sensitizing effects, we did not observe significant differences in MetS prevalence between methotrexate users and non-users. This might be attributed to the relatively small patient number, no follow-up or effective control of inflammation obscuring subtle metabolic effects (6,10,13). Similarly, TNF inhibitors did not significantly alter metabolic parameters, aligning with previous smaller studies that found minimal metabolic changes during short-term follow-up periods (10). While glucocorticoids are well-known to negatively influence metabolic parameters (weight gain, hyperglycemia, hypertension), the moderate usage (≤5 mg/day prednisone) in our cohort likely limited these adverse effects.

A study was conducted to assess the disease knowledge levels of RA patients, revealing a general dearth of knowledge. While no significant correlation was identified between knowledge level and disease activity (DAS-28) or functional status (SDA), it was observed that education level and disease duration positively influenced knowledge level (14). This finding underscores the necessity for enhanced educational resources and information for RA patients, particularly regarding disease management and comorbidities such as metabolic syndrome. In light of these findings, MetS screening and management should be a critical component in the follow-up of RA patients. International guidelines, such as the EULAR recommendations, advocate for regular screening and aggressive management of cardiovascular risk factors in RA patients (1,15). In patients diagnosed with RA, it is necessary to not only control joint inflammation but also closely monitor metabolic parameters such as blood pressure, blood sugar, and lipid profile. While the prevalence of MetS in our study population was approximately 12%, this low rate does not imply an absence of underlying risk, but rather underscores the need for further investigation to ascertain its true magnitude. Notably, the presence of insulin resistance in RA patients, even at the time of diagnosis, has been documented at rates as high as 50-70% (1).

Strengths of our study include a comprehensive, multidimensional evaluation of RA and MetS, emphasizing prevalence, biomarkers, and treatment outcomes. However, several limitations should be acknowledged. First, the cross-sectional design prevents establishing causality; prospective studies are needed to clearly demonstrate how RA treatments and disease activity affect metabolic outcomes over time. Second, the absence of direct waist circumference measurement, a key diagnostic criterion for MetS, likely resulted in underestimated MetS prevalence. Third, our patients predominantly had low disease activity, reducing the observable inflammatory burden and potentially masking the inflammation-metabolic relationship that might be more evident in active or untreated RA populations. Lastly, regional variability may affect findings, as the prevalence and relationship between RA and MetS may differ across populations due to genetic, environmental, and lifestyle factors (13).

Considering the existing literature, our findings reinforce the importance of evaluating and managing metabolic risk factors early in RA patients. Studies have shown that components of MetS significantly increase the risk of developing RA, and addressing these risk factors through lifestyle interventions (e.g., weight loss, dietary changes, and exercise) and pharmacological approaches (e.g., statins, antihypertensives) may mitigate RA incidence and cardiometabolic complications (4). Education and lifestyle modification strategies could thus be crucial preventive tools.

In conclusion, a multidisciplinary approach that encompasses both inflammation control and management of metabolic risk factors is essential for optimal RA patient care. Regular monitoring of metabolic syndrome, effective treatment of RA activity, lifestyle modifications, and targeted interventions such as vitamin D supplementation could significantly improve long-term cardiometabolic outcomes and reduce cardiovascular morbidity and mortality among patients with RA.

CONCLUSION

The relationship between RA and MetS is strongly supported by evidence at both epidemiological and pathophysiological levels. MetS is notably prevalent among RA patients, significantly increasing cardiovascular risk. Chronic inflammation in RA facilitates the development of MetS components such as obesity, insulin resistance, and dyslipidemia, while MetS itself can negatively affect disease activity and prognosis. DMARDs and biologic agents, commonly used in RA treatment, generally have beneficial metabolic effects by suppressing inflammation. Our findings suggest that, in patients with well-controlled RA, the inflammation-driven metabolic risk may be less pronounced. These observations underscore the necessity of adopting a comprehensive "treat-to-target" approach in RA management, not only focusing on joint-related outcomes but also considering cardiometabolic health. Early identification and active management of MetS in RA patients, including lifestyle modifications and targeted interventions, are crucial for improving long-term prognosis, disease activity, and overall quality of life.

Ethic: Data from patients were meticulously collected and evaluated according to national ethical guidelines for research involving human subjects. Ethical approval for this study was obtained from the Ethics Committee of Balıkesir University Faculty of Medicine (decision no: 2025/70).

Etik: Hasta verileri, insan katılımcıların yer aldığı araştırmalara ilişkin ulusal etik kurallara uygun olarak titizlikle toplanmış ve değerlendirilmiştir. Bu çalışma için etik onay, Balıkesir Üniversitesi Tıp Fakültesi Etik Kurulu'ndan alınmıştır (karar no: 2025/70).

Author contribution status; The concept of the study; NŞ, design; NŞ, literature review; NŞ, ASA ESK, FZL, FU, HZA, SK, YTD collecting and processing data; ASA ESK, FZL, FU, HZA, SK, YTD statistics; NŞ, writing phase; NŞ, ASA ESK, FZL, FU, HZA, SK, YTD

Yazar katkı durumu; Çalışmanın konsepti; NŞ, dizaynı; NŞ, Literatür taraması; NŞ, ASA ESK, FZL, FU, HZA, SK, YTD verilerin toplanması ve işlenmesi; ASA ESK, FZL, FU, HZA, SK, YT istatistik; NŞ, yazım aşaması; NŞ, ASA ESK, FZL, FU, HZA, SK, YTD

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Olgu Sunumu / Case Report
Aegean J Med Sci 2025;37-40

Nadir Bir Olgu: İntratorasik İntraparankimal Ekstramedülller Hematopoez

A Rare Case : Intrathoracic Intraparenchymal Extramedullary Haematopoiesis

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ÖZ

Ekstramedüller hematopoez (EMH), kemik iliği dışında kan hücrelerinin üretilmesidir. EMH sıklıkla karaciğer ve dalak gibi organlarda görülür. İntratorasik EMH, tipik paravertebral radyolojik yerleşim ve eşlik eden hematolojik hastalıkla ilişki ile histopatolojik doğrulama olmadan teşhis edilebilir. Bu olguda atipik bir prezentasyon gösteren intratorasik intraparankimal yerleşime sahip nodülü olan bir hasta sunulacaktır. Hastada yapılan tüm incelemeler malignite açısından şüphe taşımasına rağmen asıl tanı ancak wedge rezeksiyon ile konulabildi. İntratorasik EMH çok nadir görülen bir durumdur. EMH'ler akciğer parankiminde yer aldığında, radyolojik incelemelerle ayırt edilemezler. Bu durumda, maligniteleri taklit edebilirler ve klinisyeni, EMH'ler için katastrofik sonuçlar doğurabilecek olan iğne veya doku biyopsilerine yönlendirebilir. Bu hastalarda VATS ile komplet wedge rezeksiyon tanı için güvenli bir yöntemdir.
Anahtar kelimeler: Ekstramedüller hematopoez, intraparankimal akciğer nodülü, hematolojik bozukluk

ABSTRACT

Extramedullary haematopoiesis (EMH) is the production of blood cells outside the bone marrow. EMH is frequently seen in organs such as liver and spleen. Intrathoracic EMH can be diagnosed without histopathological confirmation by typical paravertebral radiological location and association with accompanying haematological disease. We report a patient who had atypical presentation of an intrathoracic intraparenchymal nodule. All investigations performed in the patient supported a prediagnosis of malignancy and the diagnosis was only confirmed by lung wedge biopsy. Intrathoracic EMH is a very rare condition. When EMHs are located in the lung parenchyma, they cannot be distinguished by radiological examinations. In this case, they may mimic malignancies and lead the clinician to needle or tissue biopsies with catastrophic results for EMHs. In these patients, complete wedge resection by VATS is a very safe method for diagnosis.

Keywords: Extramedullary haematopoiesis, intraparenchymal lung nodüle, haematological disorder

GİRİŞ

Ekstramedüller hematopoez (EMH); temel olarak kanın kemik iliği dışında üretilmesi olarak tanımlanır (1). Fetal dönemde hematopoez ilk trimesterde yolk kesesinde, ikinci trimesterde karaciğerde ve dalakta görülür. Üçüncü trimesterden itibaren primer olarak kemik iliği sorumludur (2). EMH genellikle talasemi, orak hücreli anemi, miyelofibrozis, herediter sferositoz gibi çeşitli hematolojik hastalıkların kompansatuvar bir mekanizması olarak karşımıza çıkmaktadır (3). EMH en sık karaciğer ve dalakta görülse de; plevra, lenf nodları, mediasten, meme, testis gibi organlarda da yerleşimi bildirilmiştir (4). EMH'nin toraks içindeki tipik yerleşim yeri paravertebral bölge olup izole intratorasik intrapulmoner EMH çok nadir görülen bir durumdur (5).

Bu yazıda akciğer kanserini taklit eden intratorasik intraparankimal EMH tanılı hasta sunulmuştur.

OLGU SUNUMU

Bilinen hastalığı olmayan 58 yaş kadın hasta öksürük şikayeti ile çekilen toraks bilgisayarlı tomografisinde (BT) bilateral nodüller nedeniyle tarafımıza yönlendirildi. Hastanın fizik muayenesinde patolojik bulgu saptanmadı. Laboratuvar parametrelerinde hemoglobin: 14,3 g/dL, hematokrit: %43,6, ortalama eritrosit hacmi: 88,8 fl, platelet: 263.000, laktat dehidrogenaz: 173 ıu/L idi. Sağ akciğer orta lobdaki nodül 1,5 yıl önce çekilen toraks BT ile karşılaştırıldığında progrese izlendi (Şekil 1A). Primer malignite?/intraparankimal metastaz? ön tanıları ile çekilen

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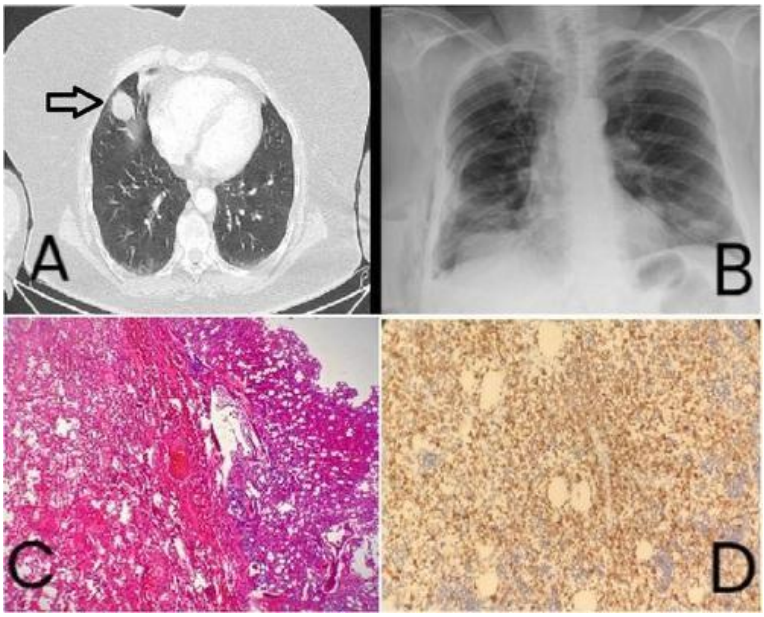
pozitron emisyon tomografisinde sağ akciğer orta lobda 2,8 cm boyutlu SUV_{maks} 2,8, sol akciğer lingulada 2,7 cm boyutlu SUV_{maks} 2,2 olan nodüller görüldü. Akciğer parankimindeki diğer nodüllerde ve başka bir odakta anlamlı floro-deoksi-glukoz tutulumu yoktu.

Hastada ilk etapta malignite ön görüldüğünden tarama amaçlı beyin manyetik rezonans görüntüleme (MRG) çekildi. Çekilen beyin MRG'de metastaz ya da primer malignite lehine lezyon saptanmadı.

Sağ orta lobdaki progrese lezyonunda malignite düşünülmesi nedeniyle transtorasik iğne biyopsisi için konsülte edildi. Girişimsel radyoloji ile görüşüldü ancak lezyonun kalbe yakınlığından dolayı işlemin gerçekleştirilemeyeceğine karar verildi. Bunun üzerine hastaya operasyon önerildi. Ameliyat öncesi hazırlıkları tamamlanan hastanın sağ akciğer orta lobdaki nodülüne sağ VATS ile 8x4,5x1,3 cm ebatlarında wedge rezeksiyon uygulandı. Lezyon çevre akciğer dokusu ile eksize edildi. İşlem sırasında lezyondan kanama izlenmedi. Postoperatif hasta extübe olarak yoğun bakım ünitesine alındı. Hastanın takipleri stabil olup 16 saat sonra servise çıkarıldı. Kontrol grafileri de expanse seyreden ve drenajı olmayan hasta postoperatif 3. günde göğüs tüpü sonlandırılarak taburcu edildi (Şekil 1B).

Hastanın nihai patoloji sonucu EMH olarak raporlandı (Şekil 1C, D). Özgeçmişinde herhangi bir hematolojik tanı ya da semptom görülmeyen hasta hematoloji kliniğine konsülte edildi. Herhangi bir hematolojik rahatsızlık tespit edilemedi. Hasta hematoloji kliniği tarafından takibe alındı.



Şekil 1. A) İntratorasik intraparankimal EMH toraks BT görüntüsü, B) Post-operatif 2. gün akciğer grafisi, C) 4X büyütme, hematoksilin & eosilin boyama, sol taraf akciğer parankimi sağ taraf EMH odağı, D) 20X büyütme, miyeloperoksidaz (Mpo) pozitif myeleoid hücre serileri

EMH: Ekstramedüller hematopoez, BT: Bilgisayarlı tomografi

TARTIŞMA

EMH; genellikle kronik anemi yaratan durumlarda fizyolojik olarak oluşur (4,6). Talasemi, kalıtsal sferositoz, kronik myeloid lösemi, polisitemi vera gibi hastalıklarda beraberliği sıktır (5). Ancak nadiren, bu hastada olduğu gibi, belli bir sebebe bağlı olmadan da ortaya çıkabilir.EMH çoğunlukla mikroskobiktir; ancak kitle benzeri lezyon şeklinde vücudun çeşitli yerlerinde görülebilir. Toraks EMH'nin görüldüğü nadir yerlerdendir (3). İntratorasik EMH'ler soliter ya da multiple, unilateral veya bilateral olarak görülebilirler (4). Hastalar çoğunlukla asemptomatik olup başka bir nedenle tetkik edilirken lezyonlar fark edilir. Diffüz tutulumlarda ya da pulmoner hipertansiyon geliştiği durumlarda dispneye, respiratuvar yetmezliğe ya da alveolar hemoraji geliştiği durumlarda hemoptiziye neden olabilir. İntratorasik EMH

plevrada görüldüğü olgularda spontan hemotoraksa neden olabilir (7). Bu olgudaki hastanın lezyonları da öksürük nedeniyle çekilen toraks BT'de insidental olarak saptanmış ve hasta takibe alınmıştır. Takibinde öksürük şikayeti gerileyen hastanın kliniğimize başvurduğunda aktif yakınması yoktu.

İntratorasik EMH, en sık radyografik olarak bilateral paravertebral yumuşak doku yoğunluğu olarak görülür. Paravertebral radyolojik görünüm sıklıkla eşlik eden hematolojik hastalığı olan bu hastalarda patognomoniktir (7). Ancak, ek hematolojik hastalığı olmayan hastamız gibi intraparankimal lezyonu bulunan ve atipik yerleşimi olan hastalarda EMH tanısı koymak zorlayıcı olabilir. Malignite öyküsü olan hastalarda metastaz düşünülebilir (5).

EMH lezyonları kanamaya meyilli oldukları için iğne biyopsisi güvenilir bir tanı yöntemi değildir (8). Tanısal yöntem olarak iğne biyopsisi yerine VATS önerilmektedir (1,9,10). Hastamızdaki sağ orta lobdaki lezyon kanama olmadan güvenli bir şekilde çıkarıldı; ancak preoperatif dönemde malignite şüphesi, bilinen bir hematolojik hastalığının olmaması ve atipik prezentasyon nedeniyle transtorasik iğne biyopsisi istendi. Bu işlem benzer hastalarda katastrofik sonuçlara yol açabilir. Bu nedenle hematolojik hastalıkların eşlik ettiği, tipik radyolojik görünüme sahip lezyonlarda tru-cut ya da iğne biyopsilerinden kaçınılmalıdır. Aynı şekilde operasyon sırasında da lezyonun komplet olarak çıkarılması uygun olacaktır.

EMH nadir görülen bir hastalık olduğundan dolayı standart bir tedavi rejimi yoktur. Tedavi semptomlara, lezyonun boyutuna ve eşlik eden hastalığa göre değişmektedir. Tedavide hipertransfüzyon, hidroksiüre veya radyoterapi kullanılabilir (6). Asemptomatik EMH'leri olan hastaların tedavi endikasyonu yoktur. Ancak semptomatik lezyonlarda ya da spontan kanama riski olan kitlelerde cerrahi tedavi önerilebilir (4). EMH lezyonlarının radyosensitif yapısından dolayı düşük doz radyoterapi verilebilir (8). EMH tedavisinde semptomatik olan hastalarda cerrahi de düşünülmelidir (10). Bu olgudaki hastanın aktif semptomu olmadığından hematoloji kliniğince takibe alındı.

SONUÇ

EMH'ler ek hematolojik hastalıklarla birlikte ortaya çıkmadıklarında ve radyolojik olarak atipik prezentasyon gösterdiğinde kolaylıkla maligniteleri taklit edebilir. Bu durum klinisyenleri iğne ya da tru-cut biyopsilere yönlendirebilir. Ancak EMH'lerin kanamaya yatkın olduklarından dolayı iğne ve parça biyopsilerin kötü sonuçlanabileceği akılda tutulmalıdır. VATS wedge rezeksiyon intratorasik intraparankimal EMH'ler için güvenilir bir tanı yöntemidir.

Etik: Çalışmanın geriye dönük olması dolayısıyla hastaların dosyaları taranmasında kurum izni alınmış olup, hastalardan ayrıca izin alınmamıştır. Çalışmaya dahil edilen tüm hastalarda çalışma öncesinde yapılmış olan cerrahi işlem için bilgilendirilmiş onam formu alınmış olup hastane arşivindeki dosyalarında mevcuttur.

Ethics: Since the study was conducted retrospectively, institutional permission was obtained for scanning patient files, and additional consent from the patients was not required. All patients included in the study had previously provided informed consent for the surgical procedure performed before the study, and this is available in their hospital archive records.

Yazar katkı durumu; Çalışmanın konsepti; İÖB, ÖFD, dizaynı; İÖB, MŞ, Literatür taraması; ÇG, MŞ, verilerin toplanması ve işlenmesi; GŞÖ, İÖB, yazım aşaması; GŞÖ, ÇG, denetleme/danışmanlık; ÖFD, AY

Author contribution status; The concept of the study design; İÖB, ÖFD, MŞ, literature review; ÇG, MŞ, collecting and processing data; GŞÖ, İÖB, writing phase; GŞÖ, ÇG, prevention/counseling; ÖFD, AY

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