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Amaç ve Kapsam

Journal of Academic Research in Medicine-JAREM, yayın dili Türkçe-İngilizce olan, açık erişimli, bağımsız ve önyargısız çift-kör hakemlik prosedürlerine bağlı olarak yayın yapan uluslararası bir dergidir. Dergide deneysel ve klinik tıp alanlarında yapılan araştırmalar, güncel konularla ilgili derlemeler, editöre mektuplar ve tıp eğitimiyle ilgili yazılar yayınlanır. Dergi, Nisan, Ağustos ve Aralık aylarında olmak üzere yılda 3 sayı yayınlanmaktadır. Derginin finansmanı Sağlık Bilimleri Üniversitesi Gaziosmanpaşa Eğitim ve Araştırma Hastanesi tarafından sağlanmaktadır.

JAREM'in hedefi, uluslararası düzeyde ve güncel konulu araştırmaları yayınlamaktır. Ayrıca derlemeler, editöryel yorumlar ve görüntüler de dergide basılır. Okuyucu ve yazar hedef kitlesi eğitimciler, akademisyenler, araştırmacılar, uzmanlar ve pratisyenler olan derginin tüm yayın süreçleri ve prosedürleri ICMJE, WAME ve COPE standartları çerçevesinde yürütülmektedir. JAREM, Web of Science-Emerging Sources Citation Index, TÜBİTAK ULAKBİM TR Dizin, EBSCO, Gale, CINAHL, J Gate, Türk Medline ve CAB International (CABI) tarafından dizinlenmektedir.

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The aim of JAREM is to publish research on recent topics at an international level. Moreover, reviews, editor's note and images are also published in the journal. The target audience of readers and authors is composed of educators, academics, researchers, specialists and general practitioners, and all publication process and procedures comply with the standards of ICMJE, WAME and COPE. JAREM is indexed in Web of Science-Emerging Sources Citation Index, TUBITAK ULAKBIM TR Index, EBSCO, Gale, CINAHL, J Gate, Türk Medline and CAB International (CABI).

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Yazarlara Bilgi

Journal of Academic Research in Medicine-JAREM, çift-kör hakemli, açık erişimli bir dergi olarak, tıp alanında yapılan deneysel, temel, özgün klinik çalışmaları; mezuniyet sonrası eğitim, tıp tarihi, yayın ve araştırma etiğiyle ilgili yazıları yayınlar. Editörlerin yazı seçiminde temel unsur olarak dikkate alacağı hakemler, yurt içi ve yurtdılında konusunda uzman olan dış bağımsız kişilerden seçilir. Dergi, Nisan, Ağustos ve Aralık aylarında olmak üzere yılda 3 sayı yayınlanmaktadır.

Deneysel, klinik ve ilaç araştırmaları için ilgili uluslararası anlaşmalara uygun etik komisyon raporu gerekmektedir. (Helsinki Declaration of 1975, revised 2008-http://www.wma.net/en/30publications/10policies/b3/index.html, "Guide for the care and use of laboratory animals - www.nap.edu/catalog/5140.html)

Tüm yazarlar bilimsel katkı ve oranlarını ve ilgili sorumluluklarını; ayrıca çıkar çatışması olmadığını bildiren toplu imzaları ile yayına katılmalıdırlar. Araştırmalara kısmi de olsa yapılan nakdi ya da ayni yardımların hangi kurum, kuruluş, ilaç-gereç firmalarınca yapıldığı dip not olarak bildirilmelidir. (ICMJE Potansiyel Çıkar Çatışmaları Bildirim Formu)

Makalelerin formatı ICMJE-Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (updated in December 2018 - http://www.icmje.org/icmje-recommendations.pdf) kurallarına göre düzenlenmelidir.

Orijinal Araştırmalar ve Derlemeler'in sunumu çalışma bildirimi kılavuzlarına göre düzenlenmelidir: randomize çalışmalar için CONSORT, gözlemsel çalışmalar için STROBE, tanısal değerli çalışmalar için STARD, sistematik derleme ve meta-analizler için PRISMA, hayvan deneyli çalışmalar için ARRIVE, randomize olmayan davranış ve halk sağlığına müdahale çalışmaları için TREND.

Orijinal Araştırma için genel etik kurallar çerçevesinde yayının yapıldığı kurumun yetkililerinin hazırladığı etik kurul onayı ya da eşdeğeri bir kabul yazısının sunulması şarttır. Yazılardaki düşünce ve öneriler tümüyle yazarların sorumluluğunda olup, Editör ve yardımcıların kanaatlerini yansıtmaz.

Dergide basılması amacıyla gönderilen yazılar başka yerde yayınlanmamış olmalıdır. Daha önce bilimsel toplantılarda sunulan 200 kelimeyi geçmeyen özet yayınları, durumu açıklanmak koşulu ile kabul edilebilir.

İşlemleri yürütülüp karar aşamasına yaklaşmış olan yazıların, makul bir neden olmadan geri çekilme talebi "ret" kapsamına girmektedir. Yayına kabul edilen yazılar için birinci yazar, Türkçe ve İngilizce açısından olduğu gibi, metinde temel değişiklik yapmamak kaydı ile düzeltmelerin Editörlerce yapılmasını kabul etmiş sayılır.

Yazıların dergide yayınlanmak üzere kabul edilmesi için; atıf alabilme olasılığı, orijinal ve bilimsel akademik üst düzeyde olması ön koşuldur.

Genel Kurallar

Yazılar sadece derginin çevrimiçi makale kabul sistemi www.jarem.org üzerinden gönderilebilir. Yayına kabul edilmeyen yazılar, sanatsal resimler dışında geriye gönderilmez. Tüm yazılar, Editör başta olmak üzere, Editör danışmanı ve yardımcıları, istatistik danışmanları ve en az iki hakem tarafından incelenir. Yazı konusunun en önde gelen otörü olan, fakat çalışmanın dışında olup yazarlarla ve kurumları ile ilişkisi-bilgisi olmayan üç kişinin ilk yazar tarafından hakem olarak önerilmesi dergi için çok önemlidir.

Editör, hakemlere yazıyı göndermeden önce aşağıda bildirilen biçimsel kurallara uygunluğunu araştırır. Düzeltmeler orijinal metinde değil, düzeltilmesi istenen bölümlerle kısıtlı olmalıdır. Yazılar gönderilmeden önce yazım ve çizim hatalarından tam olarak arındırılmalıdır.

Yazım Kurallarına uygun hazırlanmayan makaleler değerlendirmeye alınmayacaktır.

Araştırma Yazıları

1. Özgün Araştırmalar: Yazının tamamı 5000 kelimeyi geçmemeli ve yalnızca içeriği anlamak için gerekli olan sayı ve içerikte tablo ve grafik desteği olmalıdır. Kaynakların 50'den az olması inandırıcılık için genelde yeterlidir. Özgün Araştırma yazılarının yazar sayısı 5 ile sınırlandırılmıştır. İstisnai durumlarda bu sayı artırılabilir ancak sorumlu yazar tarafından gerekçesi dergiye gönderilmelidir.

1.1 Kapak sayfası: Birinci sayfadır ve ayrı MS Word dosyası olarak düzenlenir. Yazarların tam ve açık isimleri, son aldıkları akademik unvanlar ile 50 karakteri geçmeyecek şekilde yazının başlığı yazılır. Yazarların ilgili oldukları kurum, bölüm ve şehir sıra ile bildirilmelidir. Birden fazla yerde yapılan çalışmalar sembollerle açıklanır. Bu sayfanın altına yazışmaya yetkili ve düzeltmeleri yapacak yazarın açık adı, posta ve e-posta adresi, telefon ve faks numaraları yazılır. Ayrıca çalışma bilimsel toplantıda önceden bildirilen koşullarda tebliğ edildi ya da özeti yayınlandı ise açıklaması yapılır.

1.2 Orijinal araştırma makalesi için bölümlü özet: Özetler 250 kelimeyi aşmayacak şekilde çalışmanın amacını, tipini, çalışmadaki ana bulguları ve kısaca çalışmanın sonucunu içermelidir.

Özetler; Amaç, Yöntemler, Bulgular, Sonuç şeklinde alt başlıklarla düzenlenmelidir.

NLM MESH terimleri ile uyumlu en az , en fazla 6 tane anahtar kelime bölümlü özetin altında verilmelidir (http://www.nlm.nih.gov./mesh/MBrowser.html).

1.3 Metin: Makale Başlığı, Giriş, Yöntemler (alt başlıklı), Bulgular, Tartışma, Çalışma kısıtlamaları ile Sonuçlar ve Kaynaklar kısımlarını içermelidir. Metnin özellikle yöntemler, bulgular ve tartışma kısmının alt başlıklara bölünmesi yararlı olabilir. Metin toplam 5000 kelimeyi geçmemeli ve Times New Roman yazım sitili ile 12 puntoda yazılmalıdır. En son bölüme teşekkür yazılacak ise, ciddi bilimsel katkı dışında araştırmanın yürütülmesine önemli katkıda bulunanlarla, yazının son şeklinin verilmesine yardım edenler yazılır. Bu bilginin e-posta ile gönderilmesi gerekir veya ayrı MS Word dosyasında "Teşekkür Notu" olarak sisteme yüklenir.

1.4 İstatistiksel Analiz: Tıbbi dergilerdeki istatistik verilerini bildirme kurallarına göre yapılmalıdır (Altman DG, Gore SM, Gardner MJ, Pocock SJ. Statistical guidelines for contributors to medical journals. Br Med J 1983: 7; 1489-93). İstatistiksel analiz için kullanılan yazılım tanımlanmalıdır. Sürekli değişkenlerin karşılaştırılmasında parametrik testler kullanıldığı zaman verilerin ortalama±standart sapma olarak bildirilmesi gerekir. Parametrik olmayan testler için de Medyan (Minimum-Maksimum) veya Medyan (25'inci ve 75'inci persantiller) değerleri olarak bildirilmesi gerekir. İleri ve karmaşık istatistiksel analizlerde, göreceli risk (RR, relative risk), olasılık (OR, odds ratio) ve tehlike (HR, hazard ratio) oranları güven aralıkları (confidence intervals) ve p değerleri ile desteklenmelidir.

1.5 Kaynaklar: Metin içinde geçiş sırasına göre numaralandırılır ve ayrı sayfada yazılır. Kişisel bilgi, yayınlanmamış veriler, "baskıda gibi" ulaşılamayan kaynaklar burada değil, metin içinde parantez ile sunulur. İki yıldan eski özetler kaynakçaya alınmaz; alınanlar parantezde (abstr.) şeklinde verilir. Kaynakların gerçekliğinden yazarlar sorumludur. Atıf yapılırken en son ve en güncel yayınlar tercih edilmelidir. Yazarlar 10 yıldan eski yayınlara atıf yapmamaya özen göstermelidir. Dergimizde eski kaynakların kullanımı %15 ile sınırlı tutulmaktadır.

Dergiler

Dergi isimlerinin kısaltmaları Index Medicus/Medline/PubMed listesine göre yapılır (dergilerin kısaltmaları için NLM tarafından her yıl yayınlanan MEDLINE dergilerin listesine http://www.nlm.nih.gov/tsd/serials/lji.html adresinden ulaşılabilir). Altı ve daha yazarlı makalelerde tüm isimler yazılır. Yedi ve fazla yazarlı olanlarda ilk altı isim yazılır ve "et al." ilave edilir. Yazar isimlerinden sonra, o yazının tam başlığı, yıl, cilt ve sahifeler sıralanır.

Örnek: Müller C, Büttner HJ, Petersen J, Roskomun H. A randomized comparison of clopidogrel and aspirin versus ticlopidine and aspirin after the placement of coronary-artery stents. Circulation 2000; 101: 590-3.

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Yazarlara Bilgi

Kitaplar

Kitap içinde bölüm: Sherry S. Detection of thrombi. In: Strauss HE, Pitt B, James AE, editors. Cardiovascular Medicine. 2nd ed. St Louis: Mosby; 1974. p.273-85.

Tek yazarlı kitap: Cohn PF. Silent myocardial ischemia and infarction. 3rd ed. New York: Marcel Dekker; 1993.

Yazar olarak Editör (ler): Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

Toplantıda sunulan makale: Bengisson S. Sothemin BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sept 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. P. 1561-5.

Bilimsel veya teknik rapor: Smith P. Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX) Dept. of Health and Human Services (US). Office of Evaluation and Inspections: 1994 Oct. Report No: HHSIGOE 169200860.

Tez: Kaplan SI. Post-hospital home health care: the elderly access and utilization (dissertation). St. Louis (MO): Washington Univ. 1995.

Elektronik formatta makale

Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis (serial online) l995 Jan-Mar (cited 1996 June 5): 1(1): (24 screens). Available from: URL: http:/ www.cdc.gov/ncidodlEID/cid.htm.

1.6 Şekiller, Tablolar ve Resimler: Şekil ve resimler, hasta, doktor ve kurum isimleri gözükmeyecek şekilde hazırlanmalıdır. Metinden ayrı olarak, metin içinde geçiş sırasına göre numaralandırılarak verilir. Başlık ve altyazılar ayrı bir sayfada sunulur. Grafiklerde yeteri kalınlıkta çizgi kullanılır. Böylece gerekli küçültmelerde kayıplar en aza iner. Genişlikler en fazla 9 ya da 18 cm. olmalıdır. Çizimlerin profesyonellerce yapılması faydalı olacaktır. Gri renkler kullanılmamalıdır. Kullanılan kısaltmalar alt kısımda alfabetik sıra ile mutlaka açıklanmalıdır. Tablo ve Şekil başlıklarında ve tablonun yazı içinde anılmasında Roma rakamları kullanılmamalıdır. Metin, Tablo ve Şekillerde kullanılan ondalık sayılar Türkçe metinlerde virgül İngilizce metinlerde ise nokta ile ayrılmalıdır. Özellikle tablolar metni açıklayıcı ve kolay anlaşılır hale getirmek amacı ile hazırlanmalı ve metnin tekrarı olmamalıdır.

Video Görüntüler

Özgün Görüntüler'de yer alan resimlere ek olarak video/hareketli görüntüler ve ekstra imaj/statik görüntüler aşağıdaki teknik özelliklerde gönderildiği takdirde web sayfamızda yayınlanacaktır.

1. İmaj/statik görüntü formatında sunumlar: JPG, GIF, TIFF, BMP

2. Video/hareketli görüntü formatında sunumlar: MPEG, VMF.

3. Dosya boyutu maksimum 2 MB olmalıdır.

4. Resimlerde ve özellikle video görüntülerinde doktor, kurum, şehir ve hasta tanımlamaları tümü ile silinerek gönderilmelidir.

Makalenizde yer alan tablolar, şekiller ve resimler için orijinal oldukları ayrıca bildirilmelidir. Orijinali dışında ve başka kaynaktan alındıklarında mutlaka alınan kaynağa atıfta bulunmalı ve alınan kaynağın "hardcopy" veya elektronik formatta versiyonları Telif Hakkı sahibinden (yayınevi, dergi veya yazar) alınan izinler ile birlikte Baş Editör ofisine sunulmalıdır. Kaynaklar, şekiller ve tablolar ile ilgili kurallar tüm makale türleri için geçerlidir.

Özel Bölümler

2. Davetli Derlemeler: Editör ofisinin kararıyla davetli yazarlar tarafından hazırlanabilir. Bir bilgi ya da konunun klinikte kullanılması için son vardığı düzeyi anlatan, tartışan, değerlendiren ve ileride yapılacak çalışmalara yön belirleyen düzeyde olmalıdır. Yazarının konusunda otör olması ve atıfta bulunulmuş yazılarının olması gerekir.

Bölümsüz özet: Araştırma makalelerindeki kelime sayıları burada da geçerlidir, sadece bölümlü olmayacaktır. NLM MESH terimleri (http://www.nlm.nih.gov./mesh/MBrowser. html adresinde bulunabilir) ile uyumlu en az , en fazla 6 tane anahtar kelime bölümlü özetin altında verilmelidir. Kelime sayısı 5000, kaynak sayısı 50 ile sınırlıdır.

3. Editöryel Yorum: Dergide çıkan bir araştırmanın o konunun otörü veya iyi değerlendirme yapan hakem tarafından kısaca değerlendirilmesi amacı güder. Sonunda; klinik anlam ve kısa özet bulunur.

4. Bilimsel Mektup: Yeni bilimsel buluş ve verileri duyurmayı amaçlayan, klinik açıdan önemli ancak ön bildiri niteliğinde olan yazılar bilimsel mektup olarak yayına kabul edilir. Bilimsel mektuplar içerik olarak alt başlıksız olup toplam 900 kelimeyi aşmamalıdırlar. Kaynak sayısı 10, tablo ve resim sayısı ise 2 ile sınırlı olmalıdır.

4. Editöre Mektuplar: Derginin temel yayın amaçlarından birini oluşturmaktadır. Yayınlanan bir yazının önemini, gözden kaçan bir yapısını ya da noksanını tartışır. Yazarlar, yayınlanan makaleler hakkında yorum içeren mektuplar dışında da okurlarımızın ilgi alanlarına giren konular veya özellikle eğitici vakalar hakkında da Editöre Mektup formatında yorumlarını sunabilirler. Kaynak sayısı 5, metin ise 500 kelimeyi geçmemelidir, alt başlıkları bulunmaz.

6. Eğitim: Son yıllarda araştırma sonuçları ile kesinleşen, akademik düzeydeki eğitimde yerini alan ve klinik uygulamada yer bulan bilgiler ayrıntıları ile sunulur.

Bölümsüz özet: Araştırma makalelerindeki kelime sayıları burada da geçerlidir, sadece bölümlü olmayacaktır. NLM MESH terimleri (http://www.nlm.nih.gov./mesh/MBrowser. html adresinde bulunabilir) ile uyumlu en az , en fazla 6 tane anahtar kelime bölümlü özetin altında verilmelidir. Kelime sayısı 5000, kaynak sayısı 50 ile sınırlıdır.

7. Özgün Görüntü: Klinik bilime dayalı önemli bulguları yansıtan, hastalıkların temel mekanizmalarına ışık tutan, anormallikleri vurgulayan veya yeni tedavi yöntemlerini aydınlatan çarpıcı ve nadir görüntüler yayına kabul edilir. Video görüntüsü olanların basılma şansı yüksektir. Başlığı ile beraber tanımlayıcı metin ve resim alt yazıları (kaynaksız) toplam 250 kelimeyi geçmemelidir.

8. Tarihten Notlar: Türkiye için özellikle tıp tarihindeki önemli olayları açıklayan, hastalıkların tanı ve tedavisinin tarihi ile ilgili yeni bilgileri ortaya çıkaran makalelerdir. Yeni tarihsel bulgular konu ile ilgili uygun araştırma çalışmalarının sonucu olmalıdır. Tarihten notların içeriği altbaşlıksız olmalıdır ve metin 900 kelime kaynak sayısı ise 10 ile sınırlıdır.

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Journal names must be abbreviated according to the list of Index Medicus/Medline/PubMed (the list of MEDLINE journals and their abbreviations published annually by NLM can be accessed at http://www.nlm.nih.gov/tsd/serials/lji.html). All author names are listed for articles having less than 6 authors. If the article contains 7 or more authors, names of the first 6 authors are written and followed by "et al.". Names of the authors are followed by the title of the manuscript, year, volume and page numbers.

Example: Müller C, Büttner HJ, Petersen J, Roskomun H. A randomized comparison of clopidogrel and aspirin versus ticlopidine and aspirin after the placement of coronary-artery stents. Circulation 2000; 101: 590-3.

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Section in a book: Sherry S. Detection of thrombi. In: Strauss HE, Pitt B, James AE, editors. Cardiovascular Medicine. 2nd ed. St Louis: Mosby; 1974. p.273-85.

Book with single author: Cohn PF. Silent myocardial ischemia and infarction. 3rd ed. New York: Marcel Dekker; 1993.

Editor(s) as author: Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

Article presented at a meeting: Bengisson S. Sothemin BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sept 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. P. 1561-5.

Scientific or technical report: Smith P. Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX) Dept. of Health and Human Services (US). Office of Evaluation and Inspections: 1994 Oct. Report No: HHSIGOE 169200860.

Thesis: Kaplan SI. Post-hospital home health care: the elderly access and utilization (dissertation). St. Louis (MO): Washington Univ. 1995.

Manuscript in electronic format

Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis (serial online) l995 Jan-Mar (cited 1996 June 5): 1(1): (24 screens). Available from: URL: http:/ www.cdc.gov/ncidodlEID/cid.htm.

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J Acad Res Med 2023;13(3):118-22

Correlation Between the Voice Handicap Index and the Multidimensional Voice Program

Ses Handikap Endeksi ve Çok Boyutlu Ses Analiz Programı Korelasyonu

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ABSTRACT

Objective: Voice disorders have an adverse effect on the psychological, social, and physical lives of patients, and they diminish their quality of life. A subjective self-assessment tool, the voice handicap index (VHI-10) and an objective diagnostic tool, the multi-dimensional voice program (MDVP), are frequently used in the evaluation of voice disorders. The aim of this study is to determine how these tools correlate with each other and whether they can be used independently.

Methods: A total of 27 patients were enrolled in this study. VHI-10 and MDVP were prepared to perform voice analysis. The strength of the linear relationship was measured using Pearson's and Spearman's correlation.

Results: The study included 14 (51.8%) males and 13 (49.2%) females with a mean age of 46.07±14.78 years. The total score of the VHI-10 was 23.4±9.9. According to the MDVP scores, the mean fundamental frequency (mF0) was 188.064±53.6 Hz (88.946-260.153), jitter (percentage jitter) was 1.85 (1.115-7.27), shimmer (absolute shimmer) was 0.475 (0.394-0.829), and noise harmonic ratio (NHR) was 1.715±4.7. There was no correlation between VHI scores and MDVP parameters, including mean fundamental frequency, jitter, shimmer, and NHR (r=0.086; -0.018; 0.002; and 0.083) (p>0.05).

Conclusion: VHI-10 scores and parameters of the MDVP were not significantly related to each other, and these tools cannot be used interchangeably.

Keywords: Voice analysis, voice handicap index, multi-dimensional voice program

ÖZ

Amaç: Ses bozukluklarının değerlendirilmesinde sübjektif bir değerlendirme aracı olan ses handikap endeksi (SHE-10) ve objektif bir tanı aracı olan çok boyutlu ses programı (MDVP) oldukça sık tercih edilmektedirler. Bu çalışmanın amacı, bu araçların birbirleriyle nasıl ilişkili olduğunu ve birbirlerinden bağımsız olarak kullanılıp kullanılamayacağını belirlemektir.

Yöntemler: Çalışmaya toplam 27 hasta dahil edildi. Ses analizi amacıyla SHE-10 ve MDVP gerçekleştirildi. Doğrusal ilişkinin gücü Pearson ve Spearman korelasyonu kullanılarak ölçüldü.

Bulgular: Hastaların yaş ortalaması 46,07±14,78 yıl iken, 14'ü (%51,8) erkek ve 13'ü (%49,2) kadın idi. SHE-10'un toplam puanı 23,4±9,9 idi. MDVP puanlarına göre ortalama temel frekans (mF0) 188,064±53,6 Hz, jitter (yüzde) 1,85 (1,115-7,27), shimmer (mutlak) 0,475 (0,394-0,829), gürültü harmonik oranı (GHO) 1,715±4,7 idi. Ortalama temel frekans, jitter, shimmer ve GHO içeren MDVP parametreleri ile SHE skorları arasında korelasyon izlenmedi (r=0,086; -0,018; 0,002; ve 0,083) (p>0,05).

Sonuç: SHE-10 skorları ile MDVP parametreleri arasında korelasyon izlenmemiştir ve bu araçların birbirleri yerine kullanılamayacağı sonucuna varılmıştır.

Anahtar kelimeler: Ses analizi, ses handikap endeksi, çok boyutlu ses programı

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INTRODUCTION

Voice, the basic tool of human communication, plays a crucial role in personal and social life. Approximately 25% of working people need an ideal voice quality (1). Voice disorders have an adverse effect on the psychological, social, and physical life of patients and diminish their quality of life (1,2). Voice disorders are commonly seen in the general population (0.65-15%). 30% of people experience voice problems at least once in their lifetime (3). Subjective and objective diagnostic tools are used in the evaluation of these disorders.

Self-assessment tools were developed to subjectively demonstrate how voice disorders affect the quality of a patient's life. These tools play a critical role in determining the degree of voice disorder, treatment planning, and post-treatment follow-up and evaluation of patients. The voice handicap index (VHI-10), developed by Jacobson et al. (4) in 1998 and simplified by Rosen et al. (5), is the most widely used and accepted tool in the subjective evaluation of patients with voice disorders. In addition, Kiliç et al. (6) evaluated the reliability and validity of VHI in Turkish and demonstrated that it can easily be used in the Turkish population. The preferred objective methods for evaluating voice quality are acoustic analysis devices, which perform multi-dimensional analysis of the voice. The multi-dimensional voice program (MDVP) (Kay Pentax, Lincoln Park, USA), is a commercial software developed for this purpose, which is considered the gold standard, especially for the evaluation of voice (7). With the MDVP program, the mean fundamental frequency, amplitude, and frequency perturbations of the voice, ratios, and harmonic and subharmonic values can be evaluated (8).

The aim of this study was to determine how one of the most commonly used subjective self-assessment tools, VHI-10, and the objective diagnostic tool, MDVP, correlate with each other in the evaluation of patients with voice disorders and whether they can be used independently of each other.

METHODS

The study was conducted according to the tenets of the Declaration of Helsinki. The Clinical Research Local Kütahya Health Sciences University Non-invasive Clinical Research Ethics Committee with the registration number E-41997688-050.99-17208 approved our study (decision no: 2021/12-12, date: 08.07.2021). An informed consent form was obtained from each subject. The data of 27 patients who applied to our clinic with a complaint of dysphonia between 2015 and 2016 were retrospectively evaluated. The laryngeal examination of each patient was performed by an otolaryngologist experienced in laryngology with the help of flexible fiberoptic laryngoscopy and videolaryngostroboscopy.

Subjective Voice Analysis

VHI-10 was prepared to perform subjective voice analysis. The self-reported VHI-10 consists of 10 items in three sub-groups of functional, emotional, and physical sections (5). Items 4, 5 and 7 refer to functional aspects, items 3, 8, and 9 to physical aspects, and items 1, 2, 6, and 10 to emotional aspects. Each item is scored with a Likert-type response between 0 and 4, with higher scores indicating a greater voice problem (4).

Objective Voice Analysis

Computerized voice analysis was performed using the MDVP to perform objective voice analysis. According to the MDVP (Model 5105, Version 2.3 Kay Elemetrics Corporation), the patient was sitting in a comfortable position in a quiet environment, with the microphone at approximately 10 cm away from the mouth and a mouth-microphone angle of approximately 45°, and a sampling rate of 44,100 Hz was performed during the phonation of approximately 5 s. The mean fundamental frequency (mF0), jitter (%), shimmer (%), harmonic noise ratio, frequency perturbation rate [period perturbation quotient (PPQ)], amplitude perturbation rate [amplitude perturbation quotient (APQ)], and soft phonation index (SPI) values were recorded and analyzed during phonation. These parameters show the mean fundamental frequency, amplitude, and frequency perturbations of the voice, their proportions, and harmonic and subharmonic values (8).

Inclusion/Exclusion Criteria

Only adult patients with complaints of dysphonia were recruited in this study. The exclusion criteria were being below the of age 18 years, the presence of a malignant tumor, trauma, previous laryngeal surgery, inflammatory or infectious diseases that may alter the anatomy of the larynx, a history of head and neck radiotherapy pregnancy, and illiteracy.

Statistical Analysis

Data obtained in the study were statistically analyzed using the Statistical Package for Social Sciences software (SPSS 17.0 for Windows; IBM, Armonk, NY, USA). The results are stated as mean ± standard deviation values or number (n) and percentage (%). Kolmogorov-Smirnov test was used for assessing normality. The strength of the linear relationship between the results of the subjective self-assessment tools (VHI-10) and objective (MDVP) diagnostic tools was measured using Pearson and Spearman correlation coefficients, and a value of $p<0.05$ was considered statistically significant. Pearson's correlation coefficient was used for normally distributed variables and Spearman's correlation for non-normally distributed variables.

RESULTS

Evaluation was made of 14 (51.8%) males and 13 (49.2%) females with a mean age of 46.07±14.78 years (range, 20-70 years). In the evaluation of laryngeal pathologies, 8 (29.6%) patients had unilateral vocal cord nodules, 5 (18.5%) had unilateral vocal cord polyps, 4 (14.8%) had unilateral vocal cord paralysis, 2 (7.4%) had bilateral vocal cord paralysis, 2 (7.4%) had bilateral sulcus vocalis, 2 (7.4%) had unilateral intracordal cyst, 1 (3.7%) had mutational falsetto, 1 (3.7%) had bilateral Reinke's edema, 1 (3.7%) had unilateral keratosis, and 1 (3.7%) had unilateral pseudocyst (Table 1).

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In the evaluation of the VHI-10 scores, the physical part was 8±2.61, the functional part was 6.7±3.62, the emotional part was 8.7±4.62, and the total score was 23.4±9.9. According to the MDVP scores, maximum phonation time (MFT) was 12.4 s (10.9-13.2); mean fundamental frequency (mF0) was 188.064±53.6 Hz, jitter (percentage jitter) was 1.85 (1.115-7.27); shimmer (absolute shimmer) was 0.475 (0.394-0.829); noise harmonic ratio (NHR) was 1.715±4.7, APQ was 3.848 (3.354-6.674); PPQ was 0.857 (0.672-2.301), and SPI was 5.107±1.963 (Table 2).

According to the Kolmogorov-Smirnov test, VHI-10 scores and MDVP parameters, including mF0, NHR, and SPI, were normally distributed, but MFT, jitter, shimmer, APQ, and PPQ scores were not.

In the evaluation of the VHI-10 scores and MDVP parameters using the Pearson correlation test, a strong correlation was found between the total VHI scores and functional, physical, and emotional subgroups (r=0.916; 0.843; and 0.947) (p<0.05). There was no correlation between VHI scores, parameters of mean fundamental frequency, and NHR (r=0.086; 0.083) (p>0.05) (Table 3). According to Spearman's correlation test, there was no correlation between VHI scores and parameters of jitter and shimmer (r_s:-0.018; 0.002;) (p>0.05) (Table 3).

DISCUSSION

Voice disorders adversely affect the psychological, social, and physical lives of patients and diminish their quality of life. Subjective self-assessment tools and objective diagnostic tools are available for the assessment of voice disorders and help in the evaluation of disease severity, treatment planning, and post-treatment follow-up. According to the results of this study, a poor correlation between VHI-10 and MDVP parameters was observed. However, there was a strong or strong correlation between the VHI subgroups in the assessment of the severity of voice disorder.

These results can be explained in several ways. First, the high correlation between the VHI-10 subgroups reveals that the functional, physical, and emotional contents of this method are highly compatible with each other; therefore, VHI-10 can be used easily and reliably for the subjective evaluation of laryngeal disorders. However, the weak correlation between the two diagnostic tools can be explained by the disadvantages of both the VHI-10 and MDVP methods. The VHI-10 test, which is a subjective self-assessment tool, may vary according to the age, personality, social status, educational level, occupational status,

Table 1. Demographic features and laryngeal pathologies of the patients

	n (%)
Number of patients	27 (100%)
Age (range), years (mean ± SD)	46.07±14.78 years (18-60)
Gender	
Male	14 (51.8%)
Female	13 (49.2%)
Laryngeal pathologies	
Unilateral vocal cord nodules	8 (29.6%)
Unilateral vocal cord polyps	5 (18.5%)
Unilateral vocal cord paralysis	4 (14.8%)
Bilateral vocal cord paralysis	2 (7.4%)
Bilateral sulcus vocalis	2 (7.4%)
Unilateral intracordal cyst	2 (7.4%)
Mutational falsetto	1 (3.7%)
Bilateral Reinke edema	1 (3.7%)
Unilateral keratosis	1 (3.7%)
Unilateral pseudocyst	1 (3.7%)

SD: standard deviation

Table 2. Voice handicap index scores and multi-dimensional voice program parameters of the patients

	Scores and parameters (mean ± SD) [median (25p-75p)]
VHI-10	
Physical part	8±2.61
Functional part	6.7±3.62
Emotional part	8.7±4.62
MDVP	
Maximum phonation time	12.4 (10.9-13.2)
Mean fundamental frequency (mF0)	188.064±53.6 Hz
Jitter (percentage jitter)	1.85 (1.115-7.27)
Shimmer (absolute VHImmer)	0.475 (0.394-0.829)
Noise harmonic ratio	1.715±4.7
Amplitude perturbation quotient	3.848 (3.354-6.674)
Period perturbation quotient	0.857 (0.672-2.301)
Soft phonation index	5.107±1.963

SD: standard deviation, p: percentage, VHI-10: voice handicap index, MDVP: multi-dimensional voice program

Table 3. The Pearson and Spearman correlation scores between VHI-10 scores and MDVP parameters

		r	p-value
VHI-10	**VHI-10**		
	Functional	0.916	p<0.05
	Physical	0.843	
	Emotional	0.947	
	MDVP		
	Mean fundamental frequency (mF0)	0.086	p>0.05
	Jitter	-0.018	
	VHImmer	0.002	
	Noise harmonic ratio	0.083	

VHI-10: voice handicap index, MDVP: multi-dimensional voice program

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family status, test compliance, and vital characteristics of the patients (9,10). In addition, although VHI has been successfully adapted for Turkish society (6), differences between the language features of nations in describing the severity of the disease may explain the discrepancy between the two methods. Ziwei et al. (11) evaluated the VHI and objective voice parameters in a similar study in 50 patients and reported that there may be no correlation between the VHI subgroups and the objective parameters and therefore concluded that subjective parameters may show different results in different countries. Hunter and Kebede (12) and Hall (13) stated that different phonetic structures in languages of various nationalities may lead to different voice characteristics, which may affect subjective measurement results. Acoustic analysis can also be affected by microphone type, ambient noise levels, data evaluation system features, and program features used for sampling and analysis, which can be considered responsible for the discrepancy between the two methods (14). Although MDVP is accepted as an objective diagnostic tool, patient intolerance can be an important handicap for this diagnostic tool because it could occur in all other computer-assisted analysis devices. The variability of subglottic pressure and glottic closure in patients with compliance problems during the evaluation may have a negative effect on the measurement of voice parameters and may explain the weak correlation between the two methods. Psychosocial changes in patients and gender, in particular, may lead to changes in the assessment of voice with objective diagnostic tools (2,8,9,15). In the studies of Baken and Orlikoff (16), it is stated that the relationship between VHI and MDVP and shimmer measurements and gender was uncertain.

Similar to the present study, some previous studies in the literature have indicated that acoustic measurements were poorly correlated with VHI, that they might not be related to each other, and that they should be evaluated independently (9,17-19). In those studies, the assessment of different voice disorders, non-homogeneity of patient groups, insufficient time in objective diagnostic tests, longer time for subjective tests compared with objective tests, and the effects of patient emotions and perceptions were thought to be responsible for the discrepancy between them. In the present study, no correlation was found between the two methods. In addition to the handicaps of the diagnostic tests, non-homogenous study groups could be held responsible for this phenomenon just like in other studies.

Voice is a multidimensional and complex phenomenon (11). At the same time, pathological changes affecting voice quality can be caused by different factors (11). Interchanging frequently used diagnostic tools for any reason may produce false or incomplete diagnostic results. Therefore, to achieve the most accurate diagnosis in the evaluation of voice disorders, multiple parameters should be independently evaluated using different diagnostic tools (20).

Study Limitations

Further studies involving a greater number of homogeneous patients, evaluating gender differences and evaluating pre-/post-treatment results, excluding social phonetic differences, and using different objective and subjective diagnostic tools will contribute to the literature.

CONCLUSION

The results of this study demonstrated that the scores of the VHI-10 and the parameters of the MDVP were not significantly related to each other and that these tools cannot be used interchangeably. In the future, there is a need for diagnostic tools that can successfully evaluate voice disorders both objectively and subjectively and that are at the same time correlated with each other.

Ethics Committee Approval: The Clinical Research Kütahya Health Sciences University Non-invasive Clinical Research Ethics Committee with the registration number E-41997688-050.99-17208 approved our study (decision no: 2021/12-12, date: 08.07.2021).

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Usefulness of DECAF Score as a Predictor of 30-day Mortality in Patients with Dyspnea Aged 60 Years

60 Yaş ve Üzeri Dispne Hastalarında 30 Günlük Mortalite Öngörüsünde DECAF Skorunun Etkinliği

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ABSTRACT

Objective: In this study, we aimed to investigate the prognostic values of dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation (DECAF), BAP-65, and CURB-65 scores in predicting hospitalization and 30-day mortality in elderly patients who received at least one of the diagnoses of chronic obstructive pulmonary disease (COPD), asthma, community-acquired pneumonia (CAP), and congestive heart failure (CHF).

Methods: Data from patients hospitalized for acute exacerbations of COPD, asthma, CAP, and CHF within 6 months from November 15, 2018 were obtained from hospital medical records. Clinical and laboratory parameters were examined, and discharge or hospitalization, intensive care unit (ICU) admission, and 30-day mortality were recorded. DECAF, CURB-65, and BAP-65 scores were calculated.

Results: This retrospective study included 369 patients aged 60 years. The DECAF score was found to be significant in predicting hospitalization according to BAP-65 and CURB-65 (odds ratio: 2.054, 1.263, 1.404, respectively). When we divided the patients into two groups, those who died within 30 days and those who did not, the DECAF scores were significantly higher in the group with mortality ($p<0.001$), whereas there was no significant difference between the two groups in terms of CURB-65 ($p=0.329$) and BAP-65 scores ($p=0.678$).

Conclusion: Our study demonstrated that the DECAF score was an effective predictor of hospitalization, need for ICU, and 30-day mortality in patients aged 60 years who presented with dyspnea and received at least one of the following diagnoses: COPD, asthma, CAP and CHF.

Keywords: Ageing, BAP-65, CURB-65, dyspnea, DECAF, geriatric medicine

ÖZ

Amaç: Bu çalışmada amacımız, kronik obstrüktif akciğer hastalığı (KOAH), astım, toplum kökenli pnömoni (TKP) ve konjestif kalp yetmezliği (KKY) tanılarından en az birini alan yaşlı hastalarda, dispne, eozinopeni, konsolidasyon, asidemi ve atriyal fibrilasyon (DECAF), BAP-65 ve CURB-65 skorlarının hastaneye yatış ve 30 günlük mortaliteyi öngörmedeki prognostik değerlerini araştırmaktır.

Yöntemler: 15 Kasım 2018 tarihinden itibaren 6 ay içinde KOAH, astım, TKP ve KKY'nin akut alevlenmeleri nedeniyle hastaneye yatırılan hastaların verileri, hastane tıbbi kayıtlarından elde edildi. Klinik ve laboratuvar parametreleri incelenerek yoğun bakım ünitesi (YBÜ) yatış, servis yatış, taburculuk ve 30 günlük mortalite kayıt altına alındı. DECAF, CURB-65 ve BAP-65 puanları hesaplandı.

Bulgular: Bu retrospektif çalışmaya 60 yaş ve üstü 369 hasta dahil edildi. DECAF skoru hastaneye yatışı öngörmede, BAP-65 ve CURB-65'e göre anlamlı bulundu (olasılık oranı: sırasıyla 2,054, 1,263, 1,404). Hastalar 30 gün içinde ölenler ve ölmeyenler olarak iki gruba ayrıldı. Mortalitesi olan grupta DECAF skoru anlamlı olarak yüksek bulunurken ($p<0,001$), CURB-65 ($p=0,329$) ve BAP-65 skorlarında ($p=0,678$) iki grup arasında mortalite açısından anlamlı fark saptanmadı.

Sonuç: Çalışmamızda, nefes darlığı nedeniyle başvuran ve KOAH, astım, TKP ve KKY tanılarından en az birini alan 60 yaş ve üstü hastalarda DECAF skorunun hastaneye yatış, YBÜ ihtiyacı ve 30 günlük mortalite için etkili bir belirteç olduğu gösterilmiştir.

Anahtar kelimeler: Yaşlanma, BAP-65, CURB-65, dispne, DECAF, geriatrik tıp

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INTRODUCTION

Dyspnea is one of the most common reasons for the admission of elderly patients to the emergency department (ED). Patients may describe dyspnea in various ways: breathlessness, air hunger, painful breathing, or shortness of breath (1). In elderly patients, shortness of breath should not be considered a natural consequence of aging due to decreased functional capacity; however, the underlying possible pathology should be clarified. Although there is no direct algorithm to facilitate the management of dyspnea in the ED, cardiopulmonary disease should be excluded in the differential diagnosis of dyspnea (2).

Chronic obstructive pulmonary disease (COPD), asthma, community-acquired pneumonia (CAP), and congestive heart failure (CHF) are common causes of dyspnea in EDs. Although COPD is a common, preventable, and treatable disease presenting with persistent respiratory symptoms and airway obstruction, it is still a leading cause of mortality and morbidity (3). Asthma affects approximately 6.3% of patients aged 65 years (1,4,5). In asthma patients, the interval between symptoms and asymptomatic periods tends to shorten with increasing age, and the need for systemic steroids increases (4). A common cause of mortality and morbidity in the geriatric population is CAP, which has a prevalence of 34/1000, particularly in the elderly population over the age of 75 (6). Another cause of dyspnea that increases with advanced age is heart failure.

The CURB-65 score is a scoring system that has been used for many years to determine the severity and management of pneumonia. The dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation (DECAF) score is a scoring system that predicts in-hospital mortality in acute COPD exacerbation (AECOPD) based on the severity of DECAF. Dyspnea severity was determined using the Extended Medical Research Council Dyspnea scale (eMRCD), with eMRCD 1-4 0 points, eMRCD 5a 1 point, and eMRCD 5b 2 points. The BAP-65 score is used to predict MV and in-hospital mortality in patients with AECOPD. Although disease-specific scoring systems have been developed for estimating mortality due to acute dyspnea caused by these diseases, there is no scoring system containing objective parameters proven to predict hospitalization or 30-day mortality among patients admitted to the ED due to dyspnea.

In our study, we aimed to investigate the usefulness of the DECAF, CURB-65, and BAP-65 scores in determining hospitalization and predicting mortality in patients admitted to the ED for acute dyspnea who received at least one of the diagnoses of AECOPD, asthma attack, pneumonia, or decompensated CHF, as well as their efficacy in predicting hospitalization and 30-day mortality by comparing these three scores.

METHODS

In this study, we retrospectively analyzed patients aged 60 years who presented with dyspnea and were diagnosed with COPD, asthma, CAP, or CHF within 6 months from November 15, 2018. Data were obtained from hospital medical records. Approval was obtained from the Clinical Researches Ethics Committee of the University of Health Sciences Turkey, Haydarpaşa Numune Training and Research Hospital [HNEAH-KAEK 2018/49 (HNEAH-KAEK 2018/KK/49), date: 22.10.2018]. This study was conducted in compliance with the principles of the Declaration of Helsinki. The hospital ethics committee waived written informed consent because the study was retrospective and evaluated only the clinical data of the patients and did not involve any potential risk. The epicrises of patients admitted to the ED because of dyspnea were reviewed by two independent emergency medical physicians. Patients' final diagnoses explaining dyspnea were categorized as CAP, AECOPD, acute heart failure, asthma, and others. Patients presenting with shortness of breath were diagnosed with pneumonia if their symptoms included dry or phlegmatic cough, fever, chest and back pain, and radiological findings suggestive of pneumonia. The diagnosis of AECOPD was confirmed by worsening respiratory symptoms in patients with AECOPD compared with normal pulmonary function. The diagnosis of acute heart failure was confirmed by transthoracic echocardiography findings and B-type natriuretic peptide levels. Patients who had been hospitalized in the past month, patients receiving intravenous drug therapy, hemodialysis patients, patients with trauma in the past month, patients diagnosed with acute coronary syndrome, patients with pulmonary embolism, pleural effusion due to another cause, pneumothorax, cancer diagnosis, and epicrisis were excluded from the study. The epicrisis of the patients was examined, and age, sex, degree of dyspnea, AF, eosinophils, altered mental status, respiratory rate (RR), systolic blood pressure (SBP), heart rate, pH, blood urea nitrogen (BUN), partial oxygen pressure, presence of consolidation on radiography, discharge or hospitalization, intensive care unit (ICU) admission, and 1-month mortality were recorded. DECAF, CURB-65, and BAP-65 scores were calculated.

Statistical Analysis

The Shapiro-Wilk test was used to analyze the normality of the data. Continuous variables were summarized with mean ± standard deviation for normally distributed data and median [interquartile range (IQR): 25-75th percentile] for non-normally distributed data. Categorical variables were given with frequencies (n) and percentages (%). Pearson's chi-square test, Yates' chi-square test, and Fisher's Exact test were used for the analysis of categorical variables. The Mann-Whitney U test was performed for non-parametric comparisons of continuous data, whereas the independent t-test was used for parametric comparisons. Post-hoc analysis was performed using the Bonferroni correction. The optimal cutoff values of BAP-65, DECAF, and CURB-65 for differentiating 30-day mortality, need for mechanical ventilation (MV), and ICU stay were assessed using receiver operating characteristic (ROC) curve analysis. The area under the curve (AUC), sensitivity, specificity, and negative and positive predictive values were calculated and reported with 95% confidence intervals (CIs). The method of DeLong et al. (7) was used to compare AUCs.

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Multivariate logistic regression analyses were used to identify independent factors associated with 30-day mortality, ICU stay, service admission, and hospital admission. The results of the model were reported with odds ratios (ORs) and corresponding 95% CIs. Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY). The results were considered significant at p<0.05.

RESULTS

The mean age of the 369 patients included in the study was 74.57±9.92 years, and 52.3% of the patients were female. A total of 16.8% of the patients had AF, 49.3% had eosinopenia, 52.6% had consolidation, and 11.4% had acidemia. A total of 5.4% of the patients required non-invasive mechanical ventilation (NIMV) and 10.3% required MV. A total of 216 patients (58.5%) had pneumonia, 165 patients (44.7%) had AECOPD, 51 patients (13.8%) had CHF, and 69 patients (18.7%) had AECOPD + pneumonia. Forty-two patients (11.4%) presented to the ED with a complaint of acute change of consciousness. The eMRCD score was 0 in 250 patients (67.8%), 1 in 99 patients (26.8%), and 2 in 20 patients (5.4%). The median DECAF score was 2 (IQR: 1-2), the CURB-65 score was 4 (IQR: 4-5), and the BAP-65 score was 4 (IQR: 3-4). According to BAP-65, 11.9% of the patients were classified as class 1, 30.9% as class 2, 42.3% as class 3, 11.7% as class 4, and 3.3% as class 5.

The mean age of the patients who died in the first 30 days after admission to the ED was higher than that of the patients who did not die (p<0.001), and the sex distribution of the groups was statistically similar (p=0.549). The median eMRCD score was higher in the mortality group (p=0.022), patients with an eMRCD score of 2 were found to be higher in the mortality group (14.9% and 4%), and those with a score of 0 were found to be higher in the surviving group (69.6% and 55.3%) (p=0.006). AF (p=0.019), consolidation (p<0.001), and acidaemia (p=0.002) were observed more frequently in the mortality group. NIMV (p=0.007) and MV requirements (p<0.001) were higher in the mortality group. In the mortality group, the rates of pneumonia (p=0.004) and asthma in the surviving patients (p=0.035) were higher. While the DECAF scores of patients in the mortality group were significantly higher (p<0.001), no significant difference was found between the two groups in terms of CURB-65 (p=0.329). According to BAP-65, the rate of patients classified as class 1 (13.7% and 0%) and class 2 (32.9% and 17%) was higher in surviving patients, and the rate of patients classified as class 4 was higher in the mortality group (31.9% and 8.7%) (p<0.001). In the mortality group, patients with altered mental status (p<0.001), BUN >19 (p<0.001), BUN >25 (p<0.001), RR >30 (p=0.007) and SBP <90 mmHg (p<0.001) was at a higher rate (Table 1).

The mean age of the patients admitted to the ward was higher and according to ICU admission the mean age was was similar (p<0.001 vs. p=0.604). While the mean age value was significantly higher in the patients admitted to the ward, no significant difference was found according to age in the patients admitted to the ICU (p<0.001 vs. p=0.604). According to the mean age values of the patients who were hospitalized and discharged; the mean age of hospitalized patients was higher than those discharged, and the difference was significant between the two groups (p<0.001). The median eMRCD score was higher in patients with ICU admission (p<0.001), and patients with eMRCD scores of 1 (39.6% and 24.9%) and 2 (14.6% and 4%) were in the group with ICU admission and patients with a score of 0 were found to have a higher rate (71% and 45.8%) in the group without ICU admission (p<0.001). When the characteristics of hospitalized and discharged patients were examined, it was found that patients with an eMRCD score of 1 (31.4% and 20.1%) and 2 (8.2% and 1.3%) were higher in the hospitalized group, and those with a score of 0 were higher in the non-hospitalized group (78.5% and 60.5%) (p<0.001). In patients treated in the ward, eosinopenia (p=0.002) and consolidation (p<0.001) were at a higher rate, and acidemia (p=0.001) was at a lower rate. The incidence of eosinopenia, consolidation and acidemia was higher in ICU and hospitalized patients (p<0.05). The incidence of AF was found to be higher in hospitalized patients (p=0.023). NIMV (p=0.026) and MV (p<0.001) were lower in patients admitted to the ward. The need for NIMV and MV was observed more frequently in ICU patients (p<0.001). In ward patients, asthma rate was lower (p=0.003), pneumonia (p<0.001), CHF (p=0.003) and COPD + pneumonia rate (p=0.002) were higher. Pneumonia (p=0.008), altered mental status (p<0.001), BUN >19 (p<0.001), BUN >25 (p<0.001), RR >30 (p<0.001), SBP <90 (p<0.001) and heart rate ≥109 (p=0.003) were higher in ICU patients. The rate of patients with a heart rate ≥109 was lower in ward patients (p=0.019). The DECAF (p<0.001) and CURB-65 scores (p=0.018) of the hospitalized patients were higher. There was no significant difference in the BAP-65 scores of the patients according to hospitalization (p=0.661). DECAF scores of ward patients were found to be significantly higher (p<0.001). No significant correlation was observed between hospitalization and CURB-65 (p=0.883) and BAP scores (p=0.730). DECAF and CURB-65 scores of ICU patients were found to be significantly higher (p<0.001). According to BAP-65, the proportion of patients classified as class 1 (13.4% and 2.1%), class 2 (33.3% and 14.6%), and class 3 (44.5% and 27.1%) were in patients without ICU admission, whereas the proportion of patients classified as class 4 (31.3% and 8.7%) and class 5 (25% and 0%) was higher in ICU patients (p<0.001). The rate of patients classified as class 5 according to BAP-65 was found to be higher in unadmitted to the service group (6.1% vs. 0%; p=0.005) and the rate of patients classified as class 1 was higher in the without hospitalization group (18.8% and 7.3%), class 4 (16.4% and 4.7%), and class 5 (5.5% and 0%) (p<0.001) (Table 2).

In the multivariate analysis of parameters effective in predicting 30-day mortality, age (OR: 1.065; 95% CI: 1.027-1.105; p=0.001), need for MV (OR: 7.816; 95% CI: 2.055-29.724; p=0.003), SBP <90 mmHg (OR: 2.321; 95% CI: 1.03-5.23; p=0.042), and DECAF score (OR: 1.505; 95% CI: 1.05-2.156; p=0.026) increased the risk of 30-day mortality (Table 3).

ROC analysis findings for BAP-65, DECAF, and CURB-65 scores in discriminating 1-month mortality are presented in Table 4. BAP-65 [AUC =0.704 (95% CI: 0.655-0.750); p<0.001] and DECAF [AUC

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Table 1. Patient characteristics according to 1-month mortality

Variables	Patients (n=369) n (%)	30-day mortality (no) (n=322) n (%)	30-day mortality (yes) (n=47) n (%)	p-value
Age (years)	74.57±9.92	73.68±9.71	80.6±9.36	<0.001
Female	193 (52.3)	166 (51.6)	27 (57.4)	0.549
eMRCD	0 (0-1)	0 (0-1)	0 (0-1)	0.022
0	250 (67.8)	224 (69.6)[a]	26 (55.3)[b]	0.006
1	99 (26.8)	85 (26.4)[a]	14 (29.8)[a]	
2	20 (5.4)	13 (4)[a]	7 (14.9)[b]	
Atrial fibrillation	62 (16.8)	48 (14.9)	14 (29.8)	0.019
Eosinopenia	182 (49.3)	153 (47.5)	29 (61.7)	0.097
Consolidation	194 (52.6)	155 (48.1)	39 (83)	<0.001
Acidemia	42 (11.4)	30 (9.3)	12 (25.5)	0.002
NIMV	20 (5.4)	13 (4)	7 (14.9)	0.007
MV	38 (10.3)	20 (6.2)	18 (38.3)	<0.001
CAP	216 (58.5)	179 (55.6)	37 (78.7)	0.004
AECOPD	165 (44.7)	149 (46.3)	16 (34)	0.156
CHF	51 (13.8)	44 (13.7)	7 (14.9)	0.999
Asthma	28 (7.6)	28 (8.7)	0 (0)	0.035
AECOPD + CAP	69 (18.7)	58 (18)	11 (23.4)	0.493
Altered mental status	42 (11.4)	26 (8.1)	16 (34)	<0.001
BUN >19	210 (56.9)	171 (53.1)	39 (83)	<0.001
BUN >25	150 (40.7)	118 (36.6)	32 (68.1)	<0.001
RR >30/min	60 (16.3)	46 (14.3)	14 (29.8)	0.013
SBP <90 mmHg	59 (16)	43 (13.4)	16 (34)	0.001
Heart rate ≥109/min	87 (23.6)	77 (23.9)	10 (21.3)	0.831
DECAF score	2 (1-2)	2 (1-2)	2 (2-4)	<0.001
CURB-65 score	4 (4-5)	4 (4-5)	4 (4-5)	0.329
BAP-65 score				
Class I	44 (11.9)	44 (13.7)[a]	0 (0)[b]	<0.001
Class II	114 (30.9)	106 (32.9)[a]	8 (17)[b]	
Class III	156 (42.3)	134 (41.6)[a]	22 (46.8)[a]	
Class IV	43 (11.7)	28 (8.7)[a]	15 (31.9)[b]	
Class V	12 (3.3)	10 (3.1)[a]	2 (4.3)[a]	

Values are expressed as means ± standard deviation, median (IQR) or n (%). Independent t-test, Mann-Whitney U test, Yates chi-square test, Pearson chi-square test, Fisher's Exact test. Same letters in a row denote the lack of statistically significant difference
AECOPD: acute exacerbations of chronic obstructive pulmonary disease, BUN: blood urea nitrogen, CAP: community-acquired pneumonia, CHF: congestive heart failure, eMRCD: extended Medical Research Council Dyspnea scale, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, IQR: interquartile range, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

=0.745 (95% CI: 0.698-0.789); p<0.001] scores were found to be able to differentiate patients who died. The differential power of the CURB-65 score for 1-month mortality was found to be lower than that of the BAP-65 and DECAF scores (p=0.308, p<0.001, and p<0.001, respectively; Figure 1). The optimal cut-off point for BAP-65 with the Youden index was calculated as more than 2 (sensitivity: 82.98% and specificity: 46.58%), >1 (sensitivity: 87.23% and specificity: 49.38%) for lactate, and more than 3 (sensitivity: 91.49% and specificity: 14.91%) for CURB-65 (Figure 1). The performances of BAP-65 and DECAF scores in distinguishing 1-month mortality were statistically similar (p=0.336).

The results of ROC analysis for BAP-65, DECAF, and CURB-65 scores in predicting ICU admission are shown in Table 5. BAP-65 [AUC =0.781 (95% CI: 0.735-0.822); p<0.001], DECAF [AUC =0.820; (95% CI: 0.777-0.857); p<0.001] and CURB-65 [AUC =0.653; (95% CI: 0.602-0.701); p<0.001] scores were found to be distinctive factors in predicting intensive care. Sensitivity and specificity were 56.25% and 91.28% for BAP-65 >3 cut-off values determined by

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Table 2. Patient characteristics by admission to ward, admission to ICU, and hospitalization or discharge

	Ward n (%)			ICU n (%)			Hospitalization n (%)		
Variables	**No (n=197)**	**Yes (n=172)**	**p-value**	**No (n=321)**	**Yes (n=48)**	**p-value**	**No (n=149)**	**Yes (n=220)**	**p-value**
Age	72.45±9.50	76.99±9.87	<0.001	74.40±9.9	75.71±10	0.604	71.37±9.0	76.71±9.9	<0.001
eMRCD	0 (0-1)	0 (0-1)	0.203	0 (0-1)	1 (0-1)	<0.001	0 (0-0)	0 (0-1)	<0.001
0	139 (70.6)	111 (64.5)	0.436	228 (71)[a]	22 (45.8)[b]	<0.001	117 (78.5)[a]	133 (60.5)[b]	<0.001
1	49 (24.9)	50 (29.1)		80 (24.9)[a]	19 (39.6)[b]		30 (20.1)[a]	69 (31.4)[b]	
2	9 (4.6)	11 (6.4)		13 (4)[a]	7 (14.6)[b]		2 (1.3)[a]	18 (8.2)[b]	
Atrial fibrillation	28 (14.2)	34 (19.8)	0.155	51 (15.9)	11 (22.9)	0.314	17 (11.4)	45 (20.5)	0.023
Eosinopenia	86 (43.7)	96 (55.8)	0.020	148 (46.1)	34 (70.8)	0.002	52 (34.9)	130 (59.1)	<0.001
Consolidation	75 (38.1)	119 (69.2)	<0.001	159 (49.5)	35 (72.9)	0.004	40 (26.8)	154 (70)	<0.001
Acidemia	33 (16.8)	9 (5.2)	0.001	17(5.3)	25 (52.1)	<0.001	8 (5.4)	34 (15.5)	0.005
NIMV	16 (8.1)	4 (2.3)	0.026	4 (1.2)	16 (33.3)	<0.001	0 (0)	20 (9.1)	<0.001
MV	33 (16.8)	5 (2.9)	<0.001	5 (1.6)	33 (68.8)	<0.001	0 (0)	38 (17.3)	<0.001
CAP	91 (46.2)	125 (72.7)	<0.001	179 (55.8)	37 (77.1)	0.008	54 (36.2)	162 (73.6)	<0.001
AECOPD	96 (48.7)	69 (40.1)	0.097	145 (45.2)	20 (41.7)	0.764	76 (51)	89 (40.5)	0.045
CHF	17 (8.6)	34 (19.8)	0.003	46 (14.3)	5 (10.4)	0.611	12 (8.1)	39 (17.7)	0.013
Asthma	23 (11.7)	5 (2.9)	0.003	25 (7.8)	3 (6.3)	0.999	20 (13.4)	8 (3.6)	0.001
AECOPD + CAP	25 (12.7)	44 (25.6)	0.002	57 (17.8)	12 (25)	0.316	13 (8.7)	56 (25.5)	<0.001
Altered mental status	27 (13.7)	15 (8.7)	0.180	15 (4.7)	27 (56.3)	<0.001	0 (0)	42 (19.1)	<0.001
BUN >19	104 (52.8)	106 (61.6)	0.087	171 (53.3)	39 (81.3)	<0.001	65 (43.6)	145 (65.9)	<0.001
BUN >25	73 (37.1)	77 (44.8)	0.132	118 (36.8)	32 (66.7)	<0.001	41 (27.5)	109 (49.5)	<0.001
RR >30/min	35 (17.8)	25 (14.5)	0.401	33 (10.3)	27 (56.3)	<0.001	8 (5.4)	52 (23.6)	<0.001
SBP <90 mmHg	34 (17.3)	25 (14.5)	0.476	40 (12.5)	19 (39.6)	<0.001	15 (10.1)	44 (20)	0.016
Heart rate ≥109/min	56 (28.4)	31 (18)	0.019	67 (20.9)	20 (41.7)	0.003	36 (24.2)	51 (23.2)	0.828
DECAF score	1 (0-2)	2 (1-3)	<0.001	1 (1-2)	3 (2-3)	<0.001	1 (0-2)	2 (1-3)	<0.001
CURB-65 score	4 (4-5)	4 (4-5)	0.883	4 (4-5)	5 (4-5)	<0.001	4 (4-5)	4 (4-5)	0.018
BAP-65 score									
Class I	29 (14.7)[a]	15 (8.7)[a]	0.005	43 (13.4)[a]	1 (2.1)[b]	<0.001	28 (18.8)[a]	16 (7.3)[b]	<0.001
Class II	58 (29.4)[a]	56 (32.6)[a]		107 (33.3)[a]	7 (14.6)[b]		51 (34.2)[a]	63 (28.6)[a]	
Class III	76 (38.6)[a]	80 (46.5)[a]		143 (44.5)[a]	13 (27.1)[b]		63 (42.3)[a]	93 (42.3)[a]	
Class IV	22 (11.2)[a]	21 (12.2)[a]		28 (8.7)[a]	15 (31.3)[b]		7 (4.7)[a]	36 (16.4)[b]	
Class V	12 (6.1)[a]	0 (0)[b]		0 (0)[a]	12 (25)[b]		0 (0)[a]	12 (5.5)[b]	

Values are expressed as means ± standard deviation, median (IQR) or n (%). Independent t-test, Mann-Whitney U test, Yates chi-square test, Pearson chi-square test, Fisher's Exact test. Same letters in a row denote the lack of statistically significant difference
AECOPD: acute exacerbations of chronic obstructive pulmonary disease, BUN: Blood urea nitrogen, CAP: community-acquired pneumonia, CHF: congestive heart failure, eMRCD: extended Medical Research Council Dyspnea scale, ICU: intensive care unit, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

the Youden index, 68.75% and 81.93% for DECAF >2, 64.58% and 63.55%, respectively, for CURB-65 >4. No significant difference was observed in terms of distinguishing performances of BAP-65 and DECAF scores for ICU admission (p=0.379).

DISCUSSION

In our study, the DECAF score was found to be significant in predicting hospitalization and 30-day mortality in patients aged 60 years who applied to the ED with shortness of breath and received at least one of the diagnoses of COPD attack, asthma attack, pneumonia, or decompensated CHF. When DECAF, BAP-65, and CURB-65 were compared with one another by multivariate analysis, DECAF was found to be superior (OR: 1.505) to the others in predicting 30-day mortality. For DECAF cut-off >1, AUC: 0.74, sensitivity 87.23%, specificity 49.38, and negative predictive value (NPV) 96.4% were found.

A decrease in cardiopulmonary capacity with aging, systemic circulation, and stiffening of the pulmonary circulation are expected changes (8). The prevalence of heart failure increases to 10% between the ages of 60 and 79 years, whereas this rate is 12-

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Table 3. Multivariate logistic regression analysis of parameters effective in predicting 30-day mortality

Variables	OR (95% CI)	p-value
Age	1.065 (1.027-1.105)	0.001
CAP	1.194 (0.482-2.962)	0.701
NIMV	0.629 (0.136-2.905)	0.553
MV	7.816 (2.055-29.724)	0.003
RR >30/min	0.726 (0.279-1.888)	0.512
SBP<90 mmHg	2.321 (1.03-5.23)	0.042
DECAF score	1.505 (1.05-2.156)	0.026
BAP-65 score	1.312 (0.847-2.031)	0.224

CAP: community-acquired pneumonia, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, OR: odds ratio, CI: confidence interval, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

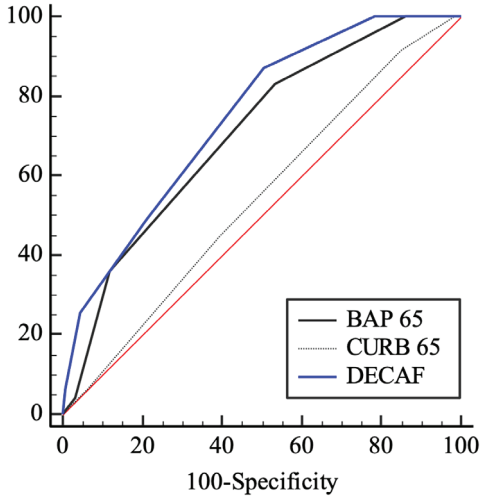

Figure 1. Comparison of BAP-65, DECAF and CURB-65 scores in distinguishing 30-day mortality
DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

14% over the age of 80 (9). While the rate of hypertension between the ages of 60 and 69 is above 50%, the rate of hypertension above the age of 70 increases to 75% (10). The prevalence of COPD is 9.2% in the 40-59 age group and 22.6% in the 60-79 age group (11). CAP is 4 times more common in the elderly population than in the young population, and hospitalization and cap-related deaths are also more common in the elderly population (12). Asthma, on the other hand, causes lower airway inflammation and can occur at any age, with an incidence of 5.4/1000 between the ages of 50 and 70 (13). Today, the elderly population rate is gradually increasing, and aging leads to a decrease in organ function and an increase in chronic diseases and polypharmacy (6,10,14). Considering the additional medical history of elderly patients, it is possible that they will be diagnosed more than once at the time of admission. Thus, the evaluation of geriatric patients may require a more complex and multidisciplinary approach than that of younger individuals.

Dyspnea may be an important symptom of underlying cardiopulmonary diseases in elderly patients. It may be difficult to differentiate acute cardiac from pulmonary causes of dyspnea, particularly in the elderly population (15). The Borg scale and modified Borg scale were developed for evaluating shortness of breath, and the use of these scores in patients with COPD and asthma has been confirmed (15,16). However, the fact that these scoring systems contain subjective parameters may limit their applicability. Gondos et al. (15) developed a scoring system to accelerate the triage of patients with dyspnea in the ED by using more objective parameters in the evaluation of dyspnea. Using bedside scoring systems, clinicians can quickly assess the patient, predict their mortality, and decide if they should be hospitalized. In fact, some researchers have argued that clinicians can evaluate the risk of early mortality and plan treatment using this scoring system by improving the geriatric pneumonia index in the evaluation of patients diagnosed with geriatric pneumonia (6). The effectiveness of the DECAF score in predicting mortality in patients with

Table 4. Discriminative performance of BAP-65, DECAF and CURB-65 scores in predicting 30-day mortality in dyspnea patients

Variables	AUC (95% CI)	p-value	Cut-off value	Sensitivity (%)	Specificity (%)	NPV (%)
BAP-65	0.704 (0.655-0.750)	<0.001	>2	82.98	46.58	94.9
DECAF	0.745 (0.698-0.789)	<0.001	>1	87.23	49.38	96.4
CURB-65	0.541 (0.489-0.593)	0.308	>3	91.49	14.91	92.3

AUC: area under curve, CI: confidence interval, NPV: negative predictive value, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

Table 5. Discriminative performance of BAP-65, DECAF and CURB-65 scores in predicting ICU admission in patients

Variables	AUC (95% CI)	p-value	Cut-off value	Sensitivity (%)	Specificity (%)	NPV (%)
BAP-65	0.781 (0.735-0.822)	**<0.001**	>3	56.25	91.28	93.3
DECAF	0.820 (0.777-0.857)	**<0.001**	>2	68.75	81.93	94.6
CURB-65	0.653 (0.602-0.701)	**<0.001**	>4	64.58	63.55	92.3

AUC: area under curve, CI: confidence interval, NPV: negative predictive value, AUC: area under curve, CI: confidence interval, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation, ICU: intensive care unit

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AECOPD has been demonstrated in different studies (17,18). In the study by Bansal and Gaude (19) with 228 patients, it was shown that mortality increased as the score increased, and the DECAF score was successful in predicting in-hospital mortality in AECOPDs. In a study conducted with 118 low-risk AECOPD patients, it was shown that the DECAF score could distinguish patients who could be treated quickly and safely at home (20). In another study, it was found that the DECAF score was more successful in predicting 1-month mortality in patients with AECOPD than the CURB-65 and BAP-65 scores (21). However, to the best of our knowledge, this scoring system consisting of more objective parameters has not been studied in terms of its effectiveness in predicting mortality in older individuals suffering from at least one of the following diagnoses: AECOPD, asthma, pneumonia, and acute heart failure. When we examined patients who had dyspnea and at least one of the diagnoses of AECOPD, asthma, pneumonia, and CHF, we found that the DECAF score was significantly predictive of hospitalization when compared with the BAP-65 and CURB-65 scores (OR: 2.054, 1.263, 1.404, respectively). While BAP-65 was not found to be significant in predicting hospitalization, the sensitivity for cut-off >2 was 82.98%, the specificity was 46.58%, and the NPV was 94.9% in predicting 30-day mortality. In predicting 30-day mortality, the CURB-65 score had the lowest AUC (AUC: 0.745, sensitivity 91.49%, specificity 14.91%, NPV 92.3%) for a cut-off >3. Specifically, when we examined the literature, we find that an AUC value of >0.8 was found to be reliable in predicting mortality in patients with AECOPD (18,22). In our study, the AUC value was 0.820 (95% CI 0.777-0.857), sensitivity was 68.75%, and specificity was 81.93% for the DECAF >2 cut-off value in predicting ICU admission.

Study Limitations

One of the most important limitations of our study is that it is a single-center study, and therefore, a relatively small number of patients participated in the study. Due to the rapid increase in the geriatric population today, it is also becoming increasingly likely that patients in EDs will include geriatric patients. Multicenter studies in this field are likely to assist clinicians in managing geriatric patients by predicting mortality and will have a significant impact on reducing health expenditures by preventing unnecessary hospitalizations in geriatric patients.

CONCLUSION

In conclusion, our study demonstrated that the DECAF score is an effective indicator of mortality in patients aged 60 years presenting with dyspnea and receiving at least one of the diagnoses of AECOPD, asthma, pneumonia, or acute CHF. The DECAF score can be used to determine patient hospitalization and mortality risk in the crowded environment of EDs.

Ethics Committee Approval: Approval was obtained from the Clinical Researches Ethics Committee of the University of Health Sciences Turkey, Haydarpaşa Numune Training and Research Hospital [HNEAH-KAEK 2018/49 (HNEAH-KAEK 2018/KK/49), date: 22.10.2018].

Informed Consent: The hospital ethics committee waived written informed consent because the study was retrospective and evaluated only the clinical data of the patients and did not involve any potential risk.

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Hasta Onamı: Hastane etik kurulu, çalışmanın retrospektif olması, yalnızca hastaların klinik verilerinin değerlendirilmesi ve herhangi bir potansiyel risk içermemesi nedeniyle yazılı bilgilendirilmiş onamdan feragat etti.

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Relationship Between Shock Index, sPESI Score, and Right Ventricular Dysfunction in CTPA with Mortality in Patients Diagnosed with Acute PTE in the Emergency Department

Acil Serviste Akut PTE Tanısı Alan Hastalarda Şok İndeksi, sPESI Skoru ve Sağ Ventrikül Disfonksiyonun Mortalite ile İlişkisi

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ABSTRACT

Objective: Pulmonary thromboembolism (PTE) is a cardiovascular disease that occurs as a result of occlusion of the main pulmonary artery and/or its branches due to thrombus or another reason, requiring urgent diagnosis and treatment. Several scoring systems are used to predict mortality due to PTE. In our study, we aimed to show the superiority of the right ventricular/left ventricular (RV/LV) ratio in predicting 30-day mortality using simplified pulmonary embolism severity index (sPESI), shock index (SI), and computed tomography pulmonary angiography (CTPA).

Methods: This was a retrospective, cross-sectional study. The study was conducted on patients diagnosed with acute PTE who were admitted to the Emergency Department of University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital between January 01, 2017 and November 17, 2021. Demographic characteristics, clinical features, and vital parameters of the patients were recorded. SI, sPESI score, and RV/LV ratio were calculated. SI ≥1.0, sPESI ≥1.0, and RV/LV ≥1.0 were considered high risk.

Results: A total of 205 patients, of which 55.6% were female, were included in the study. The mean age of the patients in our study was 67.1±16.6 (minimum-maximum =20.0-105.0). We found statistically significant differences in sPESI, SI, and RV/LV ratio between the mortality and survival groups ($p<0.05$). In our study, we accepted PESI [area under the curve (AUC) =0.776] as the gold standard and performed receiver operating characteristic curve analysis to determine mortality in sPESI (AUC =0.697), SI (AUC =0.654), and RV/LV ratio (AUC =0.605). We found that the sPESI, SI, and RV/LV ratios were moderately predictive and statistically significant, respectively ($p<0.001$, $p<0.001$, $p=0.001$, $p=0.0028$).

Conclusion: We believe that CTPA can be used as a single procedure for diagnosis and risk stratification in patients with acute PTE. SI, sPESI, and RV/LV ratios were found to be significant in predicting 30-day mortality.

Keywords: Computed tomography pulmonary angiography, mortality, PESI, pulmonary thromboembolism, RV/LV ratio, SI, sPESI

ÖZ

Amaç: Pulmoner tromboemboli (PTE), acil tanı ve tedavi gerektiren ana pulmoner arter ve/veya dallarının trombüs veya başka bir nedenle tıkanması sonucu ortaya çıkan kardiyovasküler bir hastalıktır. PTE'nin mortalitesini öngörmek amacıyla bazı skorlama sistemleri kullanılmaktadır. Çalışmamızda basitleştirilmiş pulmoner emboli şiddet indeksi (sPESI), şok indeksi (SI) ve bilgisayarlı tomografi pulmoner anjiyografide (BTPA) sağ ventriküler/sol ventriküler (RV/LV) oranının 30 günlük mortaliteyi öngörmede üstünlüklerini göstermeyi amaçladık.

Yöntemler: Çalışmamız Sağlık Bilimleri Üniversitesi, Şişli Hamidiye Etfal Eğitim ve Araştırma Hastanesi Acil Servisi'ne 01 Ocak 2017-17 Kasım 2021 tarihleri arasında başvuran akut PTE tanısı almış hastaların incelendiği retrospektif ve kesitsel bir araştırmadır. Hastaların demografik ve klinik özellikleri, vital parametreleri kaydedildi. SI, sPESI skoru ve RV/LV oranı hesaplandı. SI ≥1,0, sPESI ≥1,0 ve RV/LV ≥1,0 yüksek risk olarak kabul edildi.

Bulgular: Çalışmaya alınan toplam hasta sayısı 205 olup, %55,6'sını kadın, %44,4'ünü erkek cinsiyet oluşturmaktaydı. Çalışmamızdaki hastaların yaş ortalaması 67,1±16,6 (minimum-maximum =20,0-105,0) olarak saptandı. sPESI, SI, RV/LV oranını mortalite görülen grupta istatistiksel olarak anlamlı saptadık ($p<0,05$). Çalışmamızda PESI'yi [eğri altında kalan alan (AUC) =0,776] altın standart kabul ederek, sPESI (AUC =0,697), SI (AUC =0,654) ve RV/LV oranının (AUC =0,605) mortaliteyi saptamak açısından alıcı işletim karakteristik eğrisi analizini yaptık, sırasıyla sPESI, SI ve RV/LV oranının orta düzeyde prediktif ve istatistiksel olarak anlamlı olduğunu saptadık ($p<0,001$, $p<0,001$, $p=0,001$, $p=0,0028$).

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Sonuç: Akut PTE'li hastalarda, tanı ve risk sınıflandırması için BTPA'nın tek bir prosedür olarak kullanılabileceğini düşünüyoruz. SI, sPESI ve RV/LV oranlarının 30 günlük mortaliteyi öngörmede anlamlı olduğu saptandı.

Anahtar kelimeler: Bilgisayarlı tomografi pulmoner anjiyografi, mortalite, PESI, pulmoner tromboemboli, RV/LV oranı, SI, sPESI

INTRODUCTION

Pulmonary thromboembolism (PTE) is the occlusion of the pulmonary artery and/or its branches by a thrombus carried through the systemic veins. This occlusion may also occur due to non-thrombotic reasons (1,2). PTE is a cardiovascular disease that requires urgent diagnosis and treatment, which has an increased frequency of diagnosis in emergency services in parallel with the developments in imaging methods; however, it still has a high mortality rate (3,4). Pulmonary angiography is the gold standard in the diagnosis of PTE, but it is not easy to perform. Computed tomography pulmonary angiography (CTPA) has come to the forefront because it is non-invasive and easily accessible (5,6). The ratio of the right ventricle to the left ventricle, which can be an indicator of right ventricular dysfunction, can be easily measured in CTPA. Although many methods such as shock index (SI) and pulmonary embolism severity index (PESI) have been developed to predict mortality at the next stage of diagnosis and treatment of PTE, there are some difficulties in its use (7,8). Therefore, several other scoring systems have been developed that are easier to use than PESI, such as simplified PESI (sPESI), SI, and ratio of ventricular diameters [right ventricular/left ventricular (RV/LV)] showing RV dysfunction in CTPA. sPESI, which is calculated using the combination of patients' demographic characteristics, vital parameters, clinical findings, and additional comorbidities, is useful in predicting mortality together with pulse/systolic blood pressure (SI) and RV/LV ratio in CTPA (9,10).

Therefore, in this study, we aimed to compare SI, sPESI score, and RV/LV ratio in terms of mortality in acute PTE in the emergency department (ED).

METHODS

In this retrospective study, the files of acute PTE patients admitted to the ED of the University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital were obtained from the hospital data processing system. This study was approved by the University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital Health Application and Research Center Clinical Research Ethics Committee (decision no: 1937, date: 23.11.2021).

Patients and Study Design

This study included patients who were admitted to the ED of our hospital between January 01, 2017 and November 17, 2021, diagnosed with acute PTE confirmed by CTPA, and whose diagnosis and treatment protocols were complete in the electronic health record system. Patients who were under the age of 18 years, pregnant, had missing data on the system, and whose mortality information was not available in the system were excluded from the study.

Data Collection

The University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital Information Management System (HIMS) was used to collect data.

Information regarding the demographic characteristics of the patients such as age and gender, complaints such as dyspnea, chest pain, hemoptysis, syncope, dizziness, leg pain/swelling, and confusion, vital parameters (systolic and diastolic blood pressure, respiratory rate, pulse and oxygen saturation) and history of previous or known disease were obtained from HIMS. Radiology images were also obtained from HIMS to determine SI, RV/LV on CTPA, and sPESI score. SI ≥1.0, sPESI ≥1.0, and RV/LV ≥1.0 were considered high risk (8,11).

CTPA findings were accessed through HIMS. The diameter ratio of the ventricles (RV/LV) was measured in the valvular plane of the two-dimensional axial transverse plane. Patients with an RV/LV ratio ≥1.0 in CTPA were considered to be at high risk for 30-day mortality (12). CTPA recordings were made using 128-Slice Siemens SOMATOM Definition Edge (Siemens, Erlangen, Germany). Imaging interpretations were performed by radiologists, and RV/LV ratios were calculated by the researchers. In CTPA, the RV short axis in the axial orientation was measured at the level of the tricuspid valve in the basal third of the ventricle. Measurements were made from the inner wall to the inner wall at the widest point. It was considered that the short axes of RV and LV could be found at different axes of CT levels in the same patient. The images in Figure 1a and b were accessed using HIMS.

We obtained the 30-day mortality information of the patients through the Ministry of Health Death Notification System.

Statistical Analysis

In the descriptive statistics of the data, the mean, median, minimum-maximum (min-max), standard deviation, frequency, and ratio values were used. The distribution of variables was analyzed using the Kolmogorov-Smirnov test. The chi-square test was used in the analysis of qualitative independent data, and the Fisher

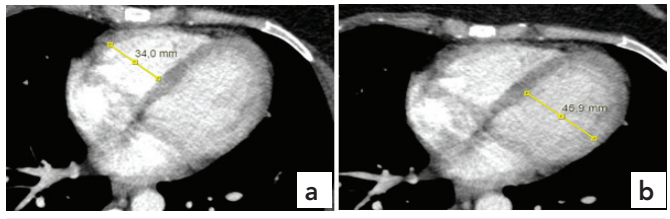

Figure 1. a) Measurement of the right ventricle at the widest point in the short axis from the inner wall to the inner wall, b) Inner wall to inner wall measurement of the left ventricle at its widest point in the short axis

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Exact test was used when the chi-square test conditions were not met. Independent sample t-test and Mann-Whitney U test were used in the analysis of quantitative independent data. Receiver operating characteristic (ROC) curve analysis was performed to determine the cut-off values of the RV/LV ratio in predicting mortality in sPESI, SI, and CTPA. SPSS 28.0 (IBM) program was used in the analysis. The Medcalc statistic program was used for ROC curve comparison.

RESULTS

Two hundred five patients were included in the study. The number of women (114) was higher than that of men (91). The mean age of the patients in our study was 67.1±16.6 years (min-max =20.0-105.0 years), and the median age was 69 years.

The mean age of the patients in the mortality group was higher than that in the survival group (p<0.001). Gender distribution in the mortality and survival groups was similar (p>0.05). The frequency of dyspnea, chest pain, hemoptysis, syncope, dizziness, and leg pain/swelling was similar in the mortality and survival groups (p>0.05). The frequency of confusion was higher in the mortality group than in the non-mortality group (p<0.001; Table 1).

In the mortality group, systolic and diastolic blood pressures were lower than those in the survival group. The heart rate did not significantly differ between groups (p>0.05). The respiratory rate in the mortality group was higher than that in the survival group. The O_2 saturation value in the mortality group was lower than that in the survival group (Table 2).

The mean values of neutrophil lymphocyte ratio (NLR), urea, and lactate levels were higher in the mortality group than in the survival group (p=0.001). Hemoglobin, creatinine and Na+, pH, PO_2, PCO_2, D-dimer levels and troponin levels were similar in both groups (p>0.05; Table 3).

PESI and sPESI scores were higher in the mortality group. The SI and RV/LV ratio on CTPA were higher in the mortality group (Table 4).

We performed ROC curve analysis to determine the highest specificity and sensitivity point of our study with the new cut-off value.

ROC curve analysis was performed to determine the predictive value of PESI for mortality. The area under the curve (AUC) value shown in Figure 2 was found to be 0.776 with moderate-to-high significance [p<0.001, 95% confidence interval (CI) 0.702-0.851, Table 5].

ROC curve analysis was performed to determine the predictive value of SI for mortality. The AUC value shown in Figure 2 was found to be 0.654, with moderate (p=0.001, 95% CI 0.563-0.746, Table 5).

ROC curve analysis was performed to determine the predictive value of the RV/LV ratio for mortality in patients with CTPA. The AUC value shown in Figure 2 was found to be 0.605, with moderate (p=0.028, 95% CI 0.520-0.689, Table 5).

Table 1. Comparison of demographic characteristics and complaints on admission to the ED in mortality and survival groups

		Mortality (-)			Mortality (+)			p-value
		Median ± SD		25-75 per	Median ± SD		25-75 per	
Age		67.0±16.7		54-77	78.5±12.8		67.5-84	**<0.001[m]**
		n	%		n	%		
Gender	Female	92	58.6%	-	22	45.8%	-	0.119[X²]
	Male	65	41.4%	-	26	54.2%	-	
Dyspnea	(-)	27	17.2%	-	3	6.3%	-	0.060[X²]
	(+)	130	82.8%	-	45	93.8%	-	
Chest pain	(-)	95	60.5%	-	33	68.8%	-	0.302[X²]
	(+)	62	39.5%	-	15	31.3%	-	
Hemoptysis	(-)	154	98.1%	-	44	91.7%	-	0.054[X²]
	(+)	3	1.9%	-	4	8.3%	-	
Syncope	(-)	140	89.2%	-	40	83.3%	-	0.279[X²]
	(+)	17	10.8%	-	8	16.7%	-	
Dizziness	(-)	147	93.6%	-	47	97.9%	-	0.249[X²]
	(+)	10	6.4%	-	1	2.1%	-	
Leg pain/swelling	(-)	121	77.1%	-	42	87.5%	-	0.117[X²]
	(+)	36	22.9%	-	6	12.5%	-	
Confusion	(-)	155	98.7%	-	41	85.4%	-	**<0.001[X²]**
	(+)	2	1.3%	-	7	14.6%	-	

[m]Mann-Whitney U test, [X²]chi-square test (Fisher test), SD: standard deviation, ED: emergency department, per: percentile

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Table 2. Comparison of vital findings at the time of admission to the ED between mortality and survival groups

	Mortality (-)		Mortality (+)		p-value
	Median ± SD	25-75 per	Median ± SD	25-75 per	
Systolic BP (mmHg)	120.0±21.2	110-130	110.0±21.6	96-120	**0.001**[m]
Diastolic BP (mmHg)	71.0±12.4	64-71	70.0±13.1	60-80	**0.009**[m]
Pulse/min (heart rate)	100.0±19.8	89-100	110.0±21.3	96-120	0.052[m]
Respiratory rate	20.0±3.7	18-20	20.0±6.5	20-29.5	**<0.001**[m]
O_2 saturation	92.0±9.5	78-92	88.5±7.8	80-91	**0.006**[m]

[m]Mann-Whitney U test, SD: standard deviation, ED: emergency department, BP: blood pressure, per: percentile

Table 3. Comparison of hematological parameters in terms of mortality

	Mortality (-)		Mortality (+)		p-value
	Median ± SD	25-75 per	Median ± SD	25-75 per	
Hg	12.6±1.8	11.3-13	12.5±1.9	10-13.6	0.437[m]
NLR	4.2±7.4	2.7-6.3	7.0±5.7	3.6-10.3	**0.001**[m]
Urea	40.0±21.3	28-53	50.5±37.1	39-73	**0.001**[m]
Cre	0.9±0.4	0.76-1.0	1.0±0.5	0.7-1.4	0.264[m]
Na^+	137.0±5.2	135-139	138.0±5.9	133-140	0.736[m]
K^+	4.2±0.5	3.8-4.6	4.5±0.6	4.0-4.8	**0.003**[m]
pH	7.4±0.1	7.38-7.45	7.4±0.1	7.33-7.46	0.255[m]
PO_2	66.0±25.0	46-89	60.0±23.6	47-82	0.356[m]
PCO_2	35.0±9.4	32-43	35.5±7.2	32-42	0.538[m]
Lactate	2.0±1.1	1.4-2.5	2.8±2.0	1.4-3.9	**0.005**[m]
D-dimer ($x10^3$)	2.5±9.8	2100-7600	2.5±17.0	2150-36600	0.313[m]
Troponin	0.1±2.9	0.01-0.09	0.1±1.5	0.4-0.89	0.084[m]

[m]Mann-Whitney U test, Cre: creatinine, Hg: hemoglobin, NLR: neutrophil lymphocyte ratio, SD: standard deviation, per: percentile

Table 4. Comparison of clinical scores in terms of mortality

	Mortality (-)		Mortality (+)		p-value
	Median ± SD	25-75 per	Median ± SD	25-75 per	
PESI score	106.0±34.8	82.5-130	144±42.2	117-172	**<0.001**[m]
sPESI score	1.0±1.24	0.5-2.0	2.5±1.25	1.25-3.0	**<0.001**[m]
Shock index	0.85±0.23	0.7-1.0	0.98±0.34	0.8-1.33	**0.001**[m]
RV/LV	1.11±0.8	0.97-1.33	1.2±0.8	1.06-1.36	**0.028**[m]

[m]Mann-Whitney U test, SD: standard deviation, PESI: pulmonary embolism severity index, sPESI: simplified pulmonary embolism severity index, RV/LV: right ventricular/left ventricular

We compared the independent variables for which we analyzed the ROC curve for mortality. We found that the PESI score differed from the others (Table 6).

DISCUSSION

Two hundred five patients with acute PTE were included. In this study, we compared the sPESI, SI, and RV/LV ratio for mortality in patients with acute PTE, and found that sPESI had the highest sensitivity and reliability.

The mean age of our patients was advanced (67.1±16.6). In a study by Gök and Kurtul (12), the mean age was found to be 64±16 years and 63±15 years in the study by Secemsky et al. (13). In our study, the mean age was found to be higher than that in other studies. It was thought that the mean age was high because our hospital is an advanced tertiary center and serves elderly patients with high comorbidities.

We divided the patients into groups with and without mortality. In the group with mortality, we found that the mean age was significantly higher than that in the group with no mortality. In the study statistics of Erarslan et al. (14), advanced age was found to be statistically significant. Advanced age is the independent variable for mortality and is the most important risk factor for mortality in many diseases such as PTE.

Among the patient groups, only blurred consciousness was significantly more pronounced in the mortality group than in the

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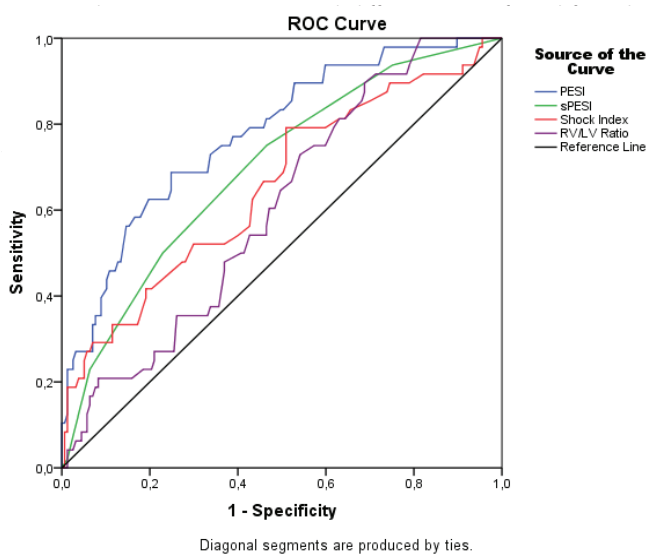

Figure 2. ROC curve analysis for mortality of all variables
ROC: receiver operating characteristic, PESI: pulmonary embolism severity index, sPESI: simplified pulmonary embolism severity index, RV/LV: right ventricular/left ventricular

with PTE, as well as those that occur in tissue perfusion disorders, for the prognosis.

PESI and sPESI are scoring systems developed to predict 30-day morality based on clinical parameters (17). When we compared the groups in terms of RV/LV ratio in PESI, sPESI, SI, and CTPA, which are the parameters we investigated in our study, we found that all of them were higher and statistically significant in the mortality group.

In our study, we accepted PESI (AUC =0.776) as the gold standard and performed ROC curve analysis to determine mortality in sPESI (AUC =0.697), SI (AUC =0.654), and RV/LV ratio (AUC =0.605) in CTPA. We found that the RV/LV ratio was moderately predictive and statistically significant for sPESI, SI, and CTPA, respectively ($p<0.05$).

Among these independent variables, sPESI (93.8%) had the highest sensitivity, followed by RV/LV ratio (91.7%) and SI (72.6%). Among these variables, sPESI has the highest negative predictive value (94.3%).

In Venetz et al. (18), PESI and sPESI scores were compared and the estimated 30-day mortality within each risk group was analyzed. The total 30-day mortality was 9.3%. In the study, PESI classified a significantly greater proportion of patients as low risk than sPESI. PESI and sPESI had similar sensitivities (90% vs. 89%), negative predictive values (98% vs. 97%), and negative odds ratios (0.23 vs. 0.28) for predicting mortality. The original PESI was found to have a significantly higher discrimination power than the sPESI (18). In our study, the sensitivities of PESI and sPESI were similar to those in the literature and had high values.

The SI has been investigated in many disease groups in the ED. Some of these are diseases that carry a risk of shock, such as acute PTE and myocardial infarction, sepsis, trauma, bleeding, and ruptured ectopic pregnancy. SI >1.0 was found to be commonly associated with increased mortality, emphasizing the need for an aggressive treatment approach in these patients (19). In PTE, the heart rate increases to send the decreased amount of blood returning to the left ventricle to the systemic circulation at a sufficient level due to the clot load caused by PTE. The SI value increases with increasing heart rate and decreasing systolic pressure. In our study, parameters such as systolic blood pressure, heart rate, syncope due to hypotension, blurred consciousness, and elevated lactate levels resulting from perfusion disorder came to the forefront with regard to mortality in patients with high SI compared with patients with low SI. In our study, SI was determined to be an independent risk factor for mortality in the univariate model. Among the other parameters, SI had the highest specificity in predicting mortality (72.6%).

One study concluded that SI is an important predictor of in-hospital death, myocardial necrosis, and RV dysfunction. The efficacy of SI in predicting in-hospital death was found to be high for the distinction between PTE patients with a lower and higher risk of in-hospital death after acute PTE (20). A study by Kucher et al. (21) concluded that time-consuming imaging tests can be avoided to reduce the risk of sudden death and not delay reperfusion therapy in patients with PTE and high SI.

In a large meta-analysis, an abnormally increased ratio of right and LV diameters (>2.5-fold) measured in cross-sections was associated with a 5-fold risk of pulmonary embolism-related death (22). In the study of Robert et al. (23), AUC for RV/LV ratio was found to be 0.77 (95% CI: 0.62-0.99) for the estimation of all-cause 30-day mortality. In our study, we found that the variable with the lowest predictive value for mortality was the RV/LV ratio (AUC =0.605) in CTPA, but its sensitivity was 91.7%. In a study investigating whether RV dilatation can be used to evaluate the risk of acute pulmonary embolism in CTPA, RV dilatation detected by CT was associated

Table 5. ROC analysis of PESI, sPESI, shock index, RV/LV to predict 30-day mortality in PTE

	AUC	Sensitivity	Specificity	Cut-off	95% CI	p-value
PESI	0.776	68.8%	75.2%	128	0.702-0.851	**<0.001**
sPESI	0.697	75.0%	53.5%	1.5	0.613-0.780	**<0.001**
SI	0.654	79.2%	49.0%	0.825	0.563-0.746	**0.001**
CT RV/LV	0.605	89.6%	31.2%	1	0.520-0.689	**0.028**

ROC: receiver operating characteristic, PESI: pulmonary embolism severity index, sPESI: simplified pulmonary embolism severity index, CT: computed tomography, RV/LV: right ventricular/left ventricular, CI: confidence interval, AUC: area under the curve, SI: shock index, PTE: pulmonary thromboembolism

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Table 6. Comprasion of ROC curves

		sPESI	SI	RV/LV
PESI	p	**0.001**	**0.001**	**0.001**
sPESI	p	-	0.349	0.11
SI	p	-	-	0.43

ROC: receiver operating characteristic, PESI: pulmonary embolism severity index, sPESI: simplified pulmonary embolism severity index, SI: shock index, RV/LV: right ventricular/left ventricular

with an increased 30-day mortality in all hemodynamically stable patients presenting with pulmonary embolism (24). In our study, we found a high sensitivity of RV/LV ≥1 (91.7%) to exclude mortality in acute PTE. Based on our statistical analyses, we believe that multislice CTPA can be used as a single procedure for diagnosis and risk stratification in patients with acute PTE.

Study Limitations

Our study was retrospective, single-center, and the number of patients was limited. In addition, some hematological data were not evaluated because biomarkers showing myocardial damage, such as heart-type fatty acid binding protein, and RV dysfunction, such as B-type natriuretic peptide (BNP) and N-terminus-proBNP, were not studied in our hospital. The compatibility and correlation of these parameters, which have been found to be associated with mortality, with the scores and indexes subject to our study in terms of mortality could not be evaluated.

CONCLUSION

Scoring systems such as sPESI, SI, and RV/LV ratio were found to be significant and moderately predictive in predicting 30-day mortality in patients with PTE. It has been observed that PESI is the most valuable scoring method because of its inclusiveness. When we compared sPESI, SI, and RV/LV ratios, sPESI had the highest specificity and reliability. SI was the scoring method with the highest specificity. RV/LV on CT was the most sensitive in terms of mortality. In multivariate regression analysis, age and respiratory rate were shown to be effective in predicting mortality. Because these parameters are simple to measure in the emergency room, they can be used to determine prognosis. We believe that CTPA can be used as a reliable method in predicting mortality and as a diagnostic tool.

Ethics Committee Approval: This study was approved by the University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital Health Application and Research Center Clinical Research Ethics Committee (decision no: 1937, date: 23.11.2021).

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

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Frontal Sling and Levator Resection Surgery for Ptosis Due to Third Cranial Nerve Paralysis

Üçüncü Kraniyal Sinir Paralizisine Bağlı Ptozis Cerrahisinde Frontal Askı ve Levator Rezeksiyonu

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ABSTRACT

Objective: To evaluate the effectiveness of levator resection and frontal sling surgery in patients with ptosis due to third cranial nerve (3rd CN) paralysis.

Methods: A total of 16 patients who underwent frontal sling surgery (n=9, group 1) and levator resection (n=7, group 2) during follow-up due to ptosis due to 3rd CN paralysis in the oculoplastic surgery unit of our clinic were included in the study. The surgical procedure, preoperative levator muscle function test, marginal reflex distance 1 (MRD1) and palpebral fissure height (PFH) were recorded during follow-up. The MRD1 and PFH values of the patients in both groups were recorded in the postoperative 1st month and 12th month examinations, and during the last examination. All data were statistically compared between the two groups.

Results: Seven (43.8%) patients were female and 9 (56.3%) were male. Preoperative mean MRD1 values in group 1 and group 2 were -1.78±1.56 mm (-4-0) and -1.29±0.76 mm (-2-0), respectively. In groups 1 and 2, both MRD1 and PFH showed a statistically significant increase compared with preoperative measurements (p=0.277). While postoperative success was 88.8% in the 1st month in group 1, it was 55.5% in the 12th month. In group 2, postoperative success rates were 85.7% in the 1st month and 71.4% in the 12th month examinations. In the comparison between the groups, MRD1 and PFH did not differ statistically (p=0.216).

Conclusion: Although patients with ptosis due to 3rd CN are difficult to treat, they can be effectively and safely treated with frontal sling surgery or levator resection.

Keywords: Frontal sling, levator muscle, levator resection, palsy, ptosis, third cranial nerve

ÖZ

Amaç: Üçüncü kraniyal sinir paralizisine bağlı pitozis nedeniyle cerrahi tedavi uygulanan hastalarda levator rezeksiyonu ve frontal askı cerrahisinin etkinliğini değerlendirmektir.

Yöntemler: Kliniğimizde okülоplastik cerrahi biriminde, okülomotor sinir paralizisine bağlı pitozis nedeniyle takiplerinde frontal askı cerrahisi (n=9, grup 1) ve levator rezekiyonu (n=7, grup 2) yapılan, toplam 16 hasta çalışmaya dahil edildi. Hastalara uygulanan cerrahi prosedür, ameliyat öncesi, ameliyat sonrası 1. ay, 12. ay ve 18. ay muayenesindeki marjinal refleks mesafesi 1 (MRD1) ve palpebral fissür yüksekliği (PFH) değerleri kayıt edildi. Tüm veriler iki grup arasında istatistiksel olarak karşılaştırıldı.

Bulgular: Hastaların 7'si (%43,8) kadın, 9'u (%56,3) erkek idi. Hastaların yaş ortalaması 35,7±24,0 yıl (2-70 yaş) ve takip süresi ortalama 16,9±4,2 (8-24) ay idi. Grup 1 ve grup 2'de ameliyat öncesi ortalama MRD1 değeri sırasıyla -1,78±1,6 (-4-0) ve -1,29±0,8 (-2-0) idi. Grup 1 ve grup 2'de son muayenede ortalama MRD1 değeri sırasıyla 2,28±0,8 mm (1-3) ve 2,29±1,1 mm'ye (1-4) yükseldi. Grup 1 ve grup 2'de son kontrolde hem MRD1 hem de PFH, ameliyat öncesi ölçümlere göre istatistiksel olarak anlamlı artış göstermiştir (p=0,277). Postoperatif başarı grup 1'de 1. ayda %88,8 iken 12. ayda %55,5 olarak kaydedildi. Grup 2'de postoperatif başarı, 1. ayda %85,7 iken 12. ayda %71,42 olarak devam etti. Gruplar arasındaki karşılaştırmada ise MRD1 ve PFH istatistiksel olarak farklılık göstermemiştir (p=0,216).

Sonuç: Üçüncü kraniyal sinir paralizisine bağlı pitozisli hastaların yönetimi zor olsa da frontal askı cerrahisi veya levator rezeksiyonu ile etkili ve güvenli bir şekilde tedavi edilebilir.

Anahtar kelimeler: Frontal askı, levator kası, levator rezeksiyonu, paralizi, pitozis, üçüncü kraniyal sinir

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INTRODUCTION

Ptosis can occur due to damage to the third cranial nerve (3rd CN, oculomotor nerve) for various reasons. In the adult population, the most common cause of 3rd CN paralysis is ischemia (1). Other important causes include trauma, giant cell arteritis, and less frequent tumors and aneurysms (2-4). Congenital causes and trauma are the most common etiologic causes in children (5). The treatment of 3rd CN palsy is primarily based on etiology.

Surgery should be planned for ocular findings that do not improve by themselves after the etiologic cause has been eliminated or treated. The management and repair of paralytic ptosis, unlike other ptosis, can be complicated by corneal exposure after surgery due to the weak Bell phenomenon resulting from the dysfunction of the levator muscle (5).

In this case, the success of surgical intervention depends on patient selection, surgical expectations, and appropriate management of complications.

In our study, we aimed to evaluate the efficacy and safety of levator resection and frontal sling surgery in patients who underwent surgical treatment for 3rd CN palsy in the oculoplastic surgery unit of our clinic.

METHODS

The study was conducted by taking the principles of the Declaration of Helsinki into consideration. An approval statement was obtained from the Clinical Research Ethics Committee of University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (decision no: 348, date: 26.10.2022). We retrospectively reviewed the records of patients who were treated and who were followed up for ptosis caused by 3rd CN paralysis in the oculoplastic surgery unit of our clinic between February 2020 and January 2023. All patients included in the study had previously undergone strabismus surgery and did not have double vision in the primary position. Preoperative levator muscle function test (LFT) measurements, marginal reflex distance 1 (MRD1), palpebral fissure height (PFH), and Bell's phenomenon were noted in the oculoplastic surgery unit follow-ups of the patients included in the study. The mean MRD1 and PFH at the 1st and 12th, and last examinations were recorded in the postoperative controls. The frontal sling technique with silicone sling material (tarsal fixation) (group 1) was performed for ptosis surgery in patients with a preoperative LFT value of ≤4 mm, and levator resection surgery (group 2) was performed by the same surgeon (F.S.) in patients with LFT >4 mm. Revision surgery was applied to patients with MRD1 <1 mm in the follow-ups. Considering the general condition of the patients, both surgical techniques were performed under general or local anesthesia. Patients with partial 3rd CN palsy and those with less than 1 year follow-up were excluded from the study.

Surgical Technique

Frontal Sling Surgery

Markings were made on the lid using the modified Fox pentagon technique with an open approach. Then, 20 mg/mL lidocaine and 0.0125 mg/mL adrenaline were applied locally to the marking areas. A skin incision was made in the lid fold using a 15/0 scalpel. The tarsal surface was dissected by blunt and sharp dissection. Bleeding control was achieved after eyebrow incisions were made. The silicone suspension material was sutured to the upper 1/3 of the tarsal with a 5/0 dacron. The silicone suspension material was then passed over the orbital septum and removed from the incisions on the eyebrow. After the lid heights were adjusted to the upper limbus level, the sling material was placed in the pocket prepared in the upper incision. In the lid incision, the lid fold was created with three 6/0 vicryl sutures, and all skin incisions were sutured with a 6/0 prolene. The operation was terminated by covering the eye with plenty of ointment to prevent corneal exposure.

Levator Resection

Marking was done from the cover fold. Then, 20 mg/mL lidocaine and 0.0125 mg/mL adrenaline were applied locally to the marking area. A skin incision was made in the lid fold using a 15/0 scalpel. The tarsal surface was dissected by blunt and sharp dissection. The orbital septum was opened, and the levator aponeurosis and muscle were dissected up to the upper orbital margin. The aponeurosis was carefully dissected from the underlying Müller muscle. The levator horns were cut, preserving the Whitnall ligament, and muscle attachments were dissected. A central double-arm 6-0 vicryl suture was placed three mm below the superior tarsal border. The suture was removed from under the Whitnall ligament and adjusted to bring the eyelid to the upper limbus level. If deemed necessary, medial, and lateral sutures were placed to obtain a satisfactory valve contour. Excess tissue was clamped and excised. After creating the lid fold with three 6/0 vicryl incisions, the skin incision was sutured with 6/0 prolene. The operation was terminated by covering the eye with plenty of ointment to prevent corneal exposure.

Success was defined as ≥2 mm MRD1 postoperatively. In the follow-up of the patient, MRD1 <1 mm was accepted as recurrence.

Statistical Analysis

The mean, standard deviation, median, minimum, maximum value frequency, and percentage were used for descriptive statistics. The distribution of variables was checked using the Kolmogorov-Smirnov test. Independent samples t-test and Mann-Whitney U test were used for the comparison of quantitative data. The Wilcoxon test was used for the repeated measurement analysis. The chi-square test was used for the comparison of qualitative data. SPSS 28.0 was used for statistical analyses.

RESULTS

A total of 16 patients, 9 patients in the group 1 (3 females, 6 males) and 7 patients in the group 2 (4 females, 3 males) were included in the study. The mean ages of the patients in the group 1 and group 2 were 28.6±23.3 (2-58 years) and 44.9±23.4 (10-70 years), respectively. In the preoperative examination, the mean LFT measured in the patients was 1.9±1.6 mm (0-4) in the group

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1 and 6.4±1.6 mm (5-9) in the group 2. When the group 1 and the group 2 were compared statistically, no significant difference was observed between patients' age, gender distribution, mean LFT, and mean follow-up time (p=0.187, p=0.615, p=0.775, p=0.146, respectively) (Table 1).

The MRD1 and PFH values recorded during the follow-up of the patients in the groups 1 and 2, and the comparison results between the groups are given in Table 2. Preoperative mean MRD1 values were similar between the groups 1 and 2 (p=0.515). In the group 1, the mean MRD1 value during the postoperative 1st month, 12th month, and last examination showed a significant increase compared with the preoperative period (p=0.008). In the group 2, the mean MRD1 value during the postoperative 1st month, 12th month, and last examination showed a significant increase compared with the preoperative period (p=0.018, p=0.17, p=0.17, respectively). The mean MRD1 change during the postoperative 1st month, 12th month, and the last examination did not differ significantly between the group 1 and the group 2 (p=0.669, p=0.306, p=0.455, respectively) (Figure 1).

Preoperative mean PFH values were similar between the groups 1 and 2 (p=0.277). In the group 1 and group 2, the mean PFH values during the postoperative 1st month, 12th month, and the last examination showed a significant increase compared with the preoperative period (p<0.05) (Table 2). The mean PFH change at the postoperative 1st month, 12th month, and last examination points did not differ significantly between the group 1 and the group 2 (p=0.483, p=0.914, p=0.556) (Figure 2). Although postoperative success was 88.8% at 1 month interval in group 1, it was 55.5% at 12 month's examination point. In the group 2, the postoperative success rate was 85.7% at the first month and 71.4% at the 12th month points. During the last examination, there was a clear visual axis in all cases (Figure 3, 4). During the follow-up period, revision was performed once in 2 (22.2%) patients in the group 1 and twice in 1 (11.1%) patient, in total 3 patients (33.3%). There was no need for revision in the group 2. There was no statistically significant difference in revision requirement between the two groups (p=0.213) (Table 1).

In all patients, corneal epithelial defects due to exposure to various degrees occurred in the first postoperative week and were successfully treated with topical treatments in the early period. No serious ocular complications were observed in any patient.

DISCUSSION

3rd CN palsy is a clinical and difficult-to-manage condition presenting itself with diplopia and ptosis. The ptotic eyelid may cause amblyopia in visually immature children as well as functional and cosmetic problems in adults by closing the pupil. The presence of amblyopia, involvement of other cranial nerves, and alteration of paretic and spastic function in cyclic oculomotor palsy affect patient selection and treatment outcomes (6). The presence of ptosis temporarily masks existing diplopia in adult patients.

For this reason, strabismus surgery should be given priority to prevent diplopia that may occur after ptosis surgery. Permanent diplopia may contraindicate ptosis surgery in acquired oculomotor nerve palsy (6). In our study, ptosis surgery was not performed on any patient with diplopia in the primary position. Because of the neurological characteristics of oculomotor nerve palsy, not all affected patients may benefit equally from surgery; therefore, the appropriate selection of suitable candidates whose functional and cosmetic disabilities can be corrected by surgical intervention is essential.

Frontal sling operation is usually required in patients with ptosis who have no or poor levator function (7). Among the many sling materials used for frontal sling operations, silicone allows easy adjustment in eye blinking and revision surgery because of its flexibility (7-10). Apart from silicone, autologous fascia lata has been used for many years in frontalis sling surgery (11-13). However, it is very difficult to obtain autologous fascia lata in children.

Table 1. Statistical results of the demographic data, revision rates, and mean follow-up times of groups 1 and 2

		Group 1			Group 2			p-value
		Mean ± SD/n-%	Median	Min-max	Mean ± SD/n-%	Median	Min-max	
Age (years)		28.6±23.3	25.0	2-58	44.9±23.4	50.0	10-70	0.187[t]
Gender	Female	3 (33.3%)	-	-	4 (57.1%)	-	-	0.615[X²]
	Male	6 (66.7%)	-	-	3 (42.9%)	-	-	
Lateralization	Right	2 (22.2%)	-	-	3 (42.9%)	-	-	0.596[X²]
	Left	7 (77.8%)	-	-	4 (57.1%)	-	-	
LFT		1.9±1.6	2.0	0-4	6.4±1.6	6.0	5-9	0.775[m]
Revision	(-)	6 (66.7%)	-	-	7 (100.0%)	-	-	0.213[X²]
	I	2 (22.2%)	-	-	0 (0.0%)	-	-	
	II	1 (11.1%)	-	-	0 (0.0%)	-	-	
Follow-up time		18.7±5.6	18.0	12-24	14.6±4.2	12.0	8-24	0.146[m]

[t]: t-test, [m]: Mann-Whitney U test, [X²]: chi-square test (Fisher test), [w]: Wilcoxon test, group 1: frontal sling surgery, group 2: levator resection, SD: standard deviation, min-max: minimum-maximum, LFT: levator muscle function test

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Table 2. Mean MRD1 and PFH values and statistical results of group 1 and group 2 in preoperative, postoperative 1st month, 12th month, and last control examinations

	Group 1			Group 2			p-value
	Mean ± SD	Median	Min-max	Mean ± SD	Median	Min-max	
MRD1							
Pre-op	-1.78±1.56	-2.00	-4-0	-1.29±0.76	-1.00	-2- 0	0.515[m]
1st month post-op	2.56±0.77	2.50	1.5-4	2.43±1.17	2.00	1.5-5	0.405[m]
12th month post-op	1.39±0.93	1.00	0- 3	2.29±1.07	2.00	1- 4	0.112[m]
Last visit	2.28±0.83	2.50	1- 3	2.29±1.07	2.00	1- 4	0.871[m]
Difference with preoperative							
1st month post-op	4.33±2.02	4.50	2- 8	3.71±1.15	3.50	2.5-6	0.669[m]
Intra-group Difference p	**0.008[w]**			**0.018[w]**			
12th month post-op	3.17±1.90	3.00	1- 7	3.57±0.73	3.50	3- 5	0.306[m]
Intra-group Difference p	**0.008[w]**			**0.017[w]**			
Last visit	4.06±2.04	4.00	1- 7	3.57±0.73	3.50	3- 5	0.455[m]
Intra-group Difference p	**0.008[w]**			**0.017[w]**			
PFH							
Pre-op	3.67±1.58	3.00	2- 6	4.57±0.79	4.00	4- 6	0.277[m]
1st month post-op	8.22±1.48	8.00	7- 11	8.71±1.70	8.00	7- 12	0.439[m]
12th month post-op PFH	7.11±1.69	7.00	5- 10	8.43±1.90	8.00	6- 11	0.162[m]
Last visit	7.89±1.36	8.00	6- 10	8.29±1.98	8.00	6- 11	0.871[m]
Difference with preoperative							
1st month post-op	4.56±1.94	5.00	2- 8	4.14±1.77	4.00	3- 8	0.483[m]
Intra-group Difference p	**0.007[w]**			**0.016[w]**			
12th month post-op	3.44±2.07	4.00	0- 7	3.86±1.68	3.00	2- 7	0.914[m]
Intra-group Difference p	**0.011[w]**			**0.017[w]**			
Last visit	4.22±1.99	4.00	1- 7	3.71±1.80	3.00	2- 7	0.556[m]
Intra-group Difference p	**0.008[w]**			**0.018[w]**			

[m]: Mann–Whitney U test, [w]: Wilcoxon test, group 1: frontal sling surgery, Group 2: levator resection, SD: standard deviation, min-max: minimum-maximum, PFH: palpebral fissure height, MRD1: marginal reflex distance 1

Although various synthetic materials have been tried before for temporary suspension, their recurrence rates are quite high (14). In our study, we also used silicone sling material in patients with poor LFT for whom we planned frontal sling surgery because of its easy accessibility and good flexibility. Choi and Kim (15) reported that anterior suspension surgeries using silicone suspenders safely and effectively corrected ptosis without serious corneal complications in 18 patients with 3rd CN paralysis. We did not observe any serious ocular complications due to exposure during the first postoperative days in our patients to whom we applied the silicone sling.

Malone and Nerad (6) determined the effectiveness of surgery in ptosis due to 3rd CN paralysis. They performed levator surgery in 16 patients and frontal sling surgery in 4 patients. Functional and cosmetic improvements in these patients they evaluated; reported that functional improvement was 83%, cosmetic improvement was 100%, and no patients who underwent levator surgery required repeat surgery. In this study, the most common complication of ptosis surgery was under correction, more so in the frontalis sling group. Researchers have associated frontal sling procedures and super maximum levator muscle resections producing a relatively atonic eyelid with a greater risk of lagophthalmos for a given postoperative fissure size than levator muscle aponeurosis advancement surgery in patients with good levator muscle function. Therefore, they argued that in patients with oculomotor nerve palsy and poor levator muscle function, discontinuing eyelid elevation entirely to cosmetic levels would be a measured course of action to reduce the risks of corneal complications by minimizing postoperative lagophthalmos. We preferred suboptimal surgical correction to prevent serious postoperative ocular complications in our patients who underwent both surgeries. In our study, the mean MRD1 and PFH values measured at 12 months point in the group 2 patients who underwent levator surgery were 2.29 and 8.43, respectively. In our study, we achieved acceptable results in patients who underwent levator resection (postoperative success was 85.7% at 1 month, 71.42% at 12 months) and we did not require revision. Therefore, we believe that levator resection surgery may be more appropriate in selected cases in which ptosis develops secondary to 3rd CN paralysis.

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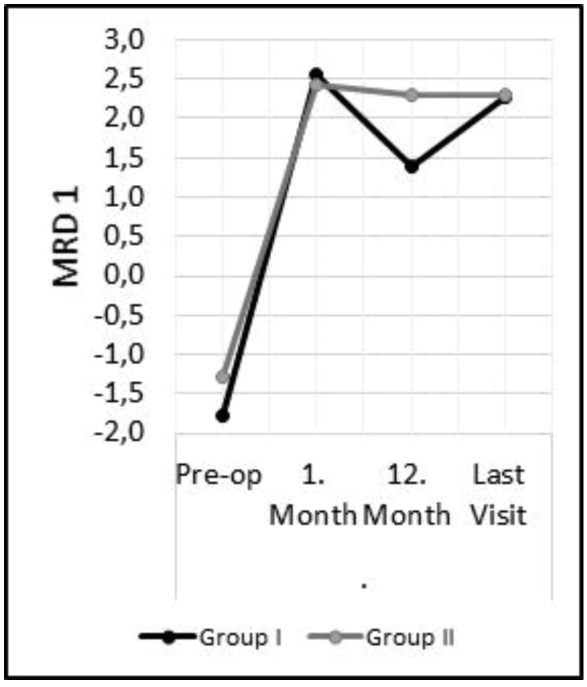

Figure 1. Graph of change in mean MRD1 value of group 1 and group 2 in preoperative, postoperative 1st month, 12th month and last control examinations
MRD1: marginal reflex distance 1

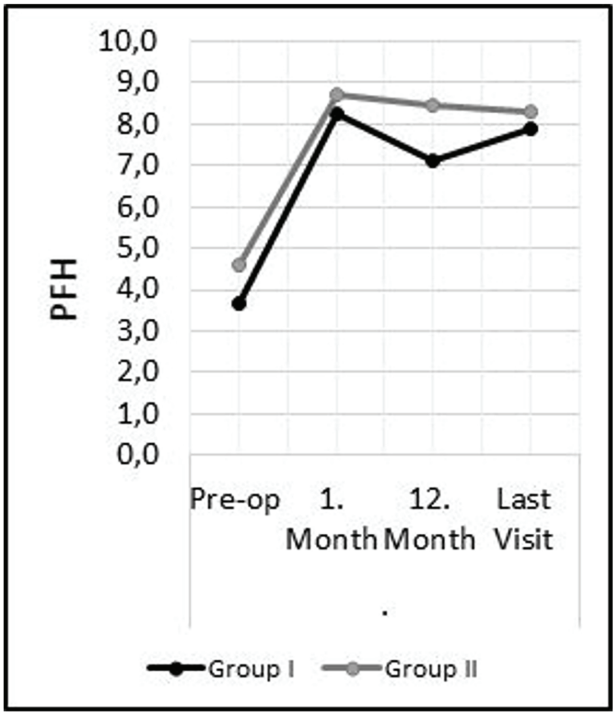

Figure 2. Graph of change in mean PFH value of group 1 and group 2 in preoperative, postoperative 1st month, 12th month and last control examinations
PFH: palpebral fissure height

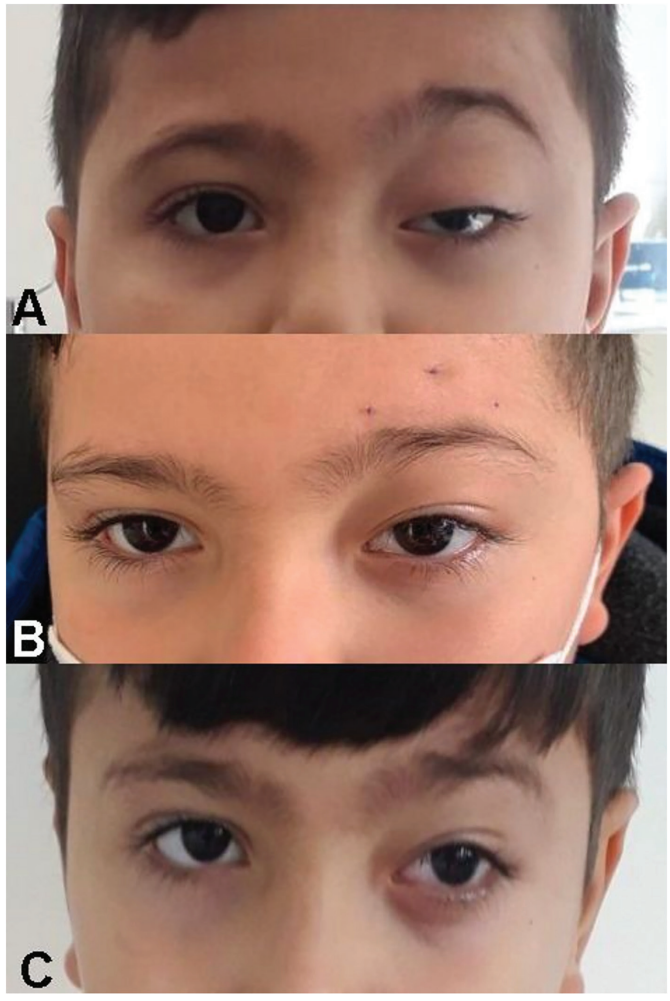

Figure 3. View of the patient who underwent frontal sling surgery due to ptosis secondary to left 3rd CN paralysis, (A) preoperative left ptosis, (B) postoperative 1st week view, (C) postoperative 6th month view
3rd CN: third cranial nerve

Bagheri et al. (16) reported the results of patients who underwent levator resection (n=5, 27.7%) and frontal sling surgery (n=13, 72.3%) due to ptosis and due to the 3rd CN paralysis. The study reported that acceptable results in patients who underwent levator resection were achieved, but the results of the first surgery were poor at a rate of 61.5% in patients who applied for frontal sling. They thought that this was due to the occurance of more severe paralysis in this group. They used silicone sling, supramide, and fascia lata as frontal sling materials in their patients. However, they did not report a comparison between suspension materials. Inadequate correction and the need for reoperation are frequent complications of sling procedures using various materials. Various studies have reported a variable recurrence rate (8-53%) in patients treated with fascia lata and various synthetic materials for the frontalis sling (14,17-20).

In our study, the success of the surgical procedure performed in group 1 patients who underwent frontal sling was 88.8% during

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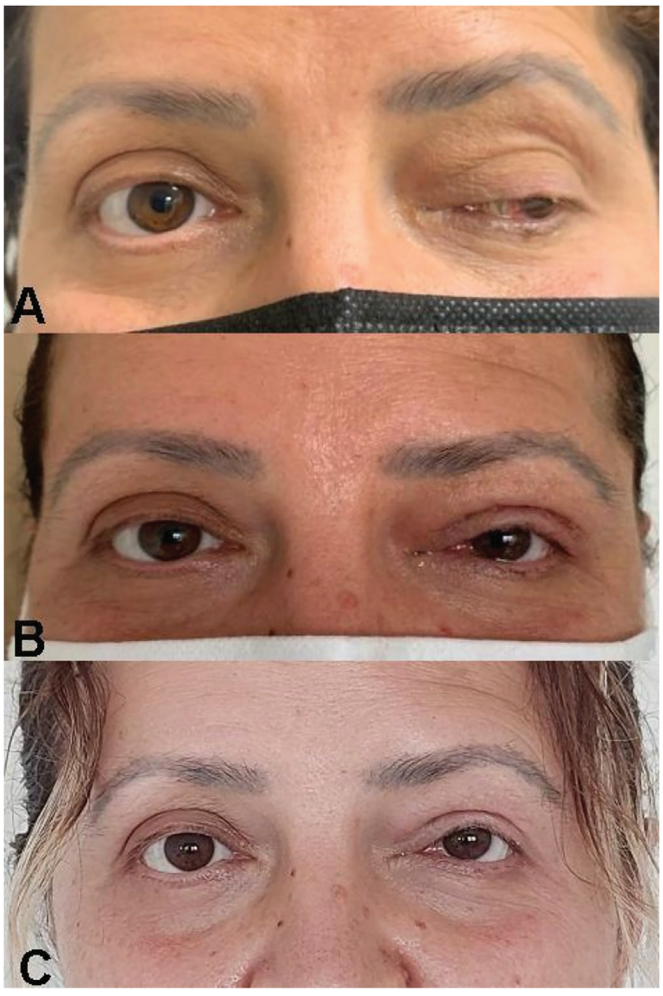

Figure 4. View of the patient who underwent levator resection for ptosis secondary to left 3rd CN paralysis, (A) preoperative left ptosis, (B) postoperative 1st week view, (C) postoperative 6th month view
3rd CN: third cranial nerve

the 1st month examination, whereas it decreased to 55.5% during the 12th month examination, similar to the results of studies in the literature. We believe that the decrease in the success rate in group 1 over time may be due to the lower initial levator muscle function and the silicone material used in the patients in this group. During the follow-up period, revision was performed once in 2 (22.2%) patients and twice in 1 (11.1%) patient in group 1, resulting in a total of 3 patients (33.3%). Because of the surgeries performed, all our patients had an open visual axis during the last examination.

Study Limitations

3rd CN paralysis and related ptosis is a disease that is very rare and difficult to manage. Therefore, our study was designed retrospectively because designing a prospective study involves various difficulties. Another limitation of our study is the small number of cases included. To overcome this limitation, multicenter studies should be designed in which data from ptosis cases due to 3rd CN paralysis can be optimized.

CONCLUSION

In light of all the information, although the surgical management of functional and cosmetic problems experienced by patients with ptosis due to 3rd CN paralysis is difficult and complex to treat, a safe and effective treatment along with the appropriate surgical technique can be provided to the suitable patient.

Ethics Committee Approval: An approval statement was obtained from the Clinical Research Ethics Committee of University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (decision no: 348, date: 26.10.2022).

Informed Consent: Signed informed consent was obtained from all participants, including the parents or guardians of the children, for the research and publication of the images.

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An Assessment of the Tracheobronchial Branching Anomalies in 1000 Adult Patients: A Computed Tomography-based Population Study

Trakeobronşiyal Dallanma Anomalilerinin 1000 Yetişkin Hastada Değerlendirilmesi: Bilgisayarlı Tomografi Tabanlı Bir Popülasyon Çalışması

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ABSTRACT

Objective: The tracheobronchial tree has several anatomical variants, many of which are asymptomatic and are not identified until adulthood. This study demonstrated tracheobronchial branching anomalies in adult patients using chest computed tomography (CT).

Methods: Thorax CT examinations of 1000 adult patients were retrospectively evaluated. Frequencies, localizations, and types of the tracheal diverticulum, tracheal bronchus, accessory cardiac bronchus, upper lobes, and right middle lobe branching anomalies, sub superior and supra superior bronchus, right and left isomerism, and situs inversus and bridging bronchus were evaluated.

Results: Tracheobronchial branching anomalies were detected in 102 of 1000 patients (491 females, 509 males). An isolated anomaly was observed in 92 patients, whereas five patients had two separate anomalies. Preeparterial bronchi in 8 patients, left prehyparterial bronchi in 2 patients, right suprasuperior bronchi in 9 patients, right subsuperior bronchi in 33 patients, left subsuperior bronchi in 38 patients, and accessory cardiac bronchi in 7 patients were observed. A single right tracheal bronchus, posteparterial bronchus, right tracheal diverticulum, upwardly displaced middle lobe bronchus, and situs inverse were observed. Of the detected congenital tracheal bronchial anomalies, 11 were displaced and 82 were supernumerary.

Conclusion: Radiological assessment of branching anomalies is crucial because of their potential clinical consequences. CT is a successful imaging method in the evaluation of tracheobronchial branching anomalies. Using lobe-based classification will facilitate the detection and classification of these anomalies.

Keywords: Tracheobronchial branching, tracheobronchial tree, branching anomalies, chest CT

ÖZ

Amaç: Trakeobronşiyal ağaç, birçoğu asemptomatik olan ve yetişkinliğe kadar tanımlanamayan çeşitli anatomik varyantlara sahiptir. Bu çalışmanın amacı erişkin hastalarda trakeobronşiyal dallanma anomalilerini toraks bilgisayarlı tomografisi (BT) kullanarak göstermektir.

Yöntemler: Erişkin 1000 hastanın toraks BT incelemeleri retrospektif olarak değerlendirildi. Trakeal divertikül, trakeal bronş, aksesuar kardiyak bronş, üst loblar ve sağ orta lob dallanma anomalileri, subsuperior ve suprasuperior bronş, sağ ve sol izomerizm, situs inversus ve köprü bronşların sıklıkları, lokalizasyonları ve tipleri değerlendirildi.

Bulgular: Trakeobronşiyal dallanma anomalileri 1000 hastanın 102'sinde (491 kadın, 509 erkek) saptandı. Hastaların 92'sinde izole bir anomali gözlenirken, 5 hastada iki ayrı anomali vardı. Preeparteriyel bronşlar 8 hastada, sol prehiparteriyel bronşlar 2 hastada, sağ suprasuperior bronşlar 9 hastada, sağ subsuperior bronşlar 33 hastada, sol subsuperior bronşlar 38 hastada ve aksesuar kardiyak bronşlar 7 hastada gözlendi. Tek bir sağ trakeal bronş, posteparteriyel bronş, sağ trakeal divertikül, yukarı doğru yer değiştirmiş orta lob bronşu ve situs inversus saptandı. Tespit edilen konjenital trakeal bronş anomalilerinin 11'i yer değiştirmiş ve 82'si süpernümererdi.

Sonuç: Dallanma anomalilerinin radyolojik değerlendirmesi potansiyel klinik sonuçları nedeniyle çok önemlidir. BT, trakeobronşiyal dallanma anomalilerinin değerlendirilmesinde başarılı bir görüntüleme yöntemidir. Lob bazlı sınıflamanın kullanılması bu anomalilerin saptanmasını ve sınıflandırılmasını kolaylaştıracaktır.

Anahtar kelimeler: Trakeobronşiyal dallanma, trakeobronşiyal ağaç, dallanma anomalileri, toraks BT

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INTRODUCTION

Several congenital variations in the number, length, diameter, and placement of the bronchi have been reported previously. Data regarding tracheobronchial branching anomalies are mostly based on bronchoscopy, bronchography, and cadaver studies. A limited number of studies have been conducted to identify tracheobronchial branching abnormalities assessed by chest computed tomography (CT). The prevalence of tracheobronchial anomalies in the general adult population is reported to be 0.1-12% (1,2). The majority of these abnormalities were discussed without CT guidance (1), and further anomalies have subsequently been identified (3,4).

The preferred screening technique for examining congenital tracheobronchial tree anomalies is CT. It often enables a thorough and accurate assessment of abnormal tracheobronchial structures and any accompanying abnormalities. Routine chest CT may detect all congenital branching defects affecting the trachea, major bronchi, and intermediate bronchus; however, they are usually overlooked in typical CT scans. Adequate knowledge of the CT features of the primary congenital bronchial abnormalities and comprehensive visibility of the tracheobronchial tree can help detect further incidental anomalies. Thus, the increasing use of CT for the analysis of congenital anomalies of tracheobronchial branching patterns has improved the determination of these anomalies (5,6).

The bronchial tree, with its intricate network of airways, plays a pivotal role in maintaining respiratory homeostasis. Any structural abnormalities can significantly impact respiratory physiology, leading to complications that vary in severity in affected individuals. Understanding the mechanisms underlying these complications is crucial for optimizing patient management and improving outcomes. There are some risks associated with the tracheal bronchus. These risks include respiratory failure resulting from inadvertent intubation of the tracheal bronchus and lobar or segmental atelectasis caused by luminal tube occlusion. Accidental intubation into the tracheal bronchus is far more dangerous than occlusion of the lumen of the tracheal bronchus, as this can lead to inadequate ventilation of most of the respiratory system (7,8). Knowledge of the distance between the tracheal bronchus and the carina, the diameter of the tracheal bronchus, and the angle between the tracheal bronchus and the trachea are important factors for anesthesiologists to avoid complications of intubation (2). Additionally, the tracheal bronchus may be the cause of stridor, atelectasis, recurrent infections, and bronchiectasis due to the stenosis and retained secretions (9). Although the accessory cardiac bronchus (ACB) rarely causes symptoms, this blind-ending airway could act as a potential reservoir for pathogenic materials. Clinical symptoms in these cases are believed to be related to retained secretions causing inflammation, hypervascularity, and hemoptysis (10). Several hospitals routinely perform video-assisted thoracoscopic surgery (VATS) for lung cancer patients. However, the left eparterial bronchus may make VATS procedures challenging, and lower lobectomy may cause damage to the bronchovascular system. Consequently, the risk of harm to the left eparterial bronchus increases if its presence is unknown during surgery (11). In addition to the risk of injury mentioned above, obstructive emphysema has been reported in one patient with left eparterial bronchus because of close contact between the left pulmonary artery and eparterial bronchus (12).

Given that routine chest CT is not specifically examined for branching patterns, this study aimed to determine the frequency and types of tracheobronchial branching anomalies in Turkish adult patients who underwent thoracic CT for any clinical indication.

METHODS

Adult patients who underwent chest CT examinations from July 2020 to November 2020 were included in this retrospective study. Patients whose tracheobronchial branching pattern could not be evaluated because of consolidation, atelectasis, endobronchial pathologies, motion, respiratory artifacts, or surgical procedures were excluded. This study was approved by the local ethics committee.

Chest CT examinations were performed on multislice CT scanners (Aquilion, Toshiba Medical Systems Europe, Zoetermeer, The Netherlands and GE Revolution EVO, GE Medical Systems, Milwaukee, WI, USA). All examinations were performed in the supine position during deep inspiration covering the area from the thoracic inlet to the diaphragm. CT scanning parameters were as follows: rotation time, 0.5-0.6 s; 120 kV; 50-500 mA; slice thickness, 1.25 mm; section interval, 1.25 mm; pitch, 1.375-1.388.

All images were evaluated on a workstation (GE Advantage Workstation, General Electric Medical Systems, Milwaukee, Wisconsin) by two radiologists (with 3 and 8 years of experience respectively) who were in consensus. The tracheobronchial branching pattern was evaluated on axial, coronal, and sagittal images at the lung parenchyma window (window width 1500 HU, level -600 HU), minimum intensity projection (MinIP), three-dimensional, and curved multiplanar reconstruction images. Boyden's nomenclature and a lobe-based classification scheme proposed by Chassagnon et al. (3) were used to describe segmental bronchial anatomy and tracheobronchial branching anomalies. Branching anomalies were classified as displaced or supernumerary (1,3). The term displaced bronchus was used to describe a bronchus with an abnormal origin when the normal bronchus was absent. The term supernumerary describes an abnormal bronchus that coexists with the normal corresponding bronchus (2).

The following anomalies were evaluated:

1. Tracheal diverticulum and tracheal bronchus,

2. ACB and its subtypes (blind ending, ventilated lobulus, soft tissue mass, cystic degeneration),

3. Branching anomalies of the bilateral upper and right middle lobes,

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4. Subsuperior and suprasuperior bronchi in the lower lobes,

5. Right isomerism, left isomerism, and situs inversus,

6. Bridging bronchus.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. Approval was granted by the Scientific Research Ethics Committee of Karadeniz Technical University Faculty of Medicine (no: 24237859-44, date: 11.01.2021).

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.0 (Inc. Chicago, USA). Frequencies and percentages were used for categorical variables. Mean ± standard deviation and minimum and maximum values were used for continuous variables. Frequencies of anomalies in male and female subjects were compared using the chi-square test. A p-value of 0.05 was considered statistically significant.

RESULTS

One thousand adult patients were retrospectively evaluated in this study. Of these patients, 509 were male and 491 were female. The mean age of the patients was 55±17.5 years (range 18-99 years). A total of 102 tracheobronchial branching anomalies were found in 97 patients (Table 1). Five patients had two anomalies: a right tracheal bronchus and a left subsuperior bronchus in one patient, bilateral subsuperior bronchi in one patient, a prearterial bronchus and a right subsuperior bronchus in one patient, and a right suprasuperior bronchus and a left subsuperior bronchus in two patients. Forty-four female and 53 male patients had tracheobronchial branching anomalies. There was no statistically significant difference between male and female patients in terms of the frequency of tracheobronchial branching anomalies (p=0.223).

One male patient had a right tracheal bronchus, which was a supernumerary apical bronchus (Figure 1). One female patient had a tracheal diverticulum localized on the right posterolateral side of the proximal trachea.

Preeparterial bronchus was found in 8 patients (4 females and 4 males). They ventilated the apical segment partially or totally. In 7 patients, the apical bronchi were displaced (Figure 2), whereas a supernumerary apical segment bronchus was found in one patient. A posteparterial bronchus was detected in one male patient. It was displaced anterior (B2) segment bronchus stemming from the middle lobe bronchus (MLB) (Figure 3). The left prehyparterial bronchus was observed in 2 male patients (Figure 4). One of them was a supernumerary B1+3 bronchus and the other was a displaced B1+3 bronchus. Both ventilated the apicoposterior segments.

The right supernumerary suprasuperior bronchus was observed in 9 patients (5 females and 4 males) (Figure 5). The most common

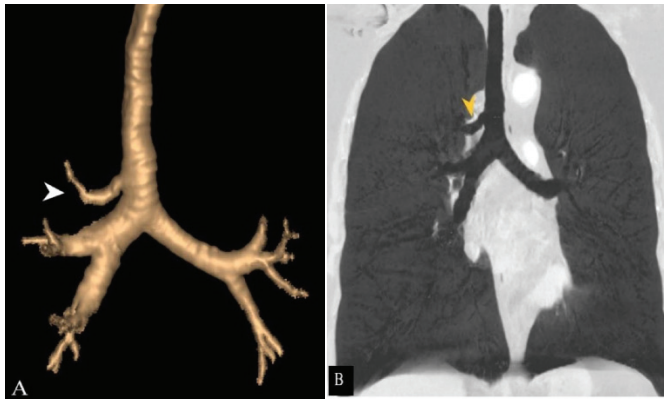

Figure 1. A 65-year-old male patient, A) 3D reformatted and B) coronal MinIP images show the right tracheal bronchus (arrowhead), which is the supernumerary apical bronchus

Table 1. The distribution of the congenital tracheobronchial anomalies

	All patients		Female patients		Male patients	
Tracheobronchial anomaly	**Number**	**%**	**Number**	**%**	**Number**	**%**
Right tracheal bronchus	1	0.1	-	-	1	0.2
Preeparterial bronchus	8	0.8	4	0.8	4	0.8
Posteparterial bronchus	1	0.1	-	-	1	0.2
Left prehyparterial bronchus	2	0.2	-	-	2	0.4
Right suprasuperior bronchus	9	0.9	5	1	4	0.8
Right subsuperior bronchus	33	3.3	16	3.2	17	3.3
Left subsuperior bronchus	38	3.8	14	2.8	24	4.7
Accessory cardiac bronchus	7	0.7	3	0.6	4	0.8
Right tracheal diverticulum	1	0.1	1	0.2	-	-
Gross upward displacement of the MLB	1	0.1	-	-	1	0.2
Situs inversus anomaly	1	0.1	1	0.2	-	-
Total	**102**	**10.2**	**44**	**8.9**	**58**	**11.4**

MLB: middle lobe bronchus

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tracheobronchial branching anomaly detected in this study was the subsuperior bronchus. The right subsuperior bronchus was found in 33 patients (16 females and 17 males). One was displaced bronchus, and the others were identified as supernumerary bronchi (Figure 6). The left subsuperior bronchus was detected in 38 patients (14 females and 24 males), and all were supernumerary bronchi.

ACB was found in 7 patients (3 females and 4 males). Five of them originated from the bronchus intermedius (Figure 7) and two from the left main bronchus. All anomalies were blind-ending subtypes and were not associated with ventilated or rudimentary lung tissue. Situs versus was detected in one female patient. The right MLB was displaced from its normal location to the superior in one male patient. The MLB originated just inferior to the right upper lobe bronchus (RULB) orifice (Figure 8).

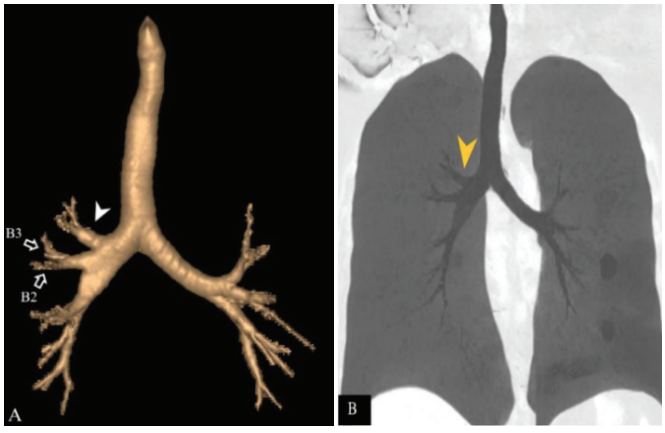

Figure 2. A 51-year-old female patient, A) 3D reformatted and B) coronal MinIP images show the preeparterial bronchus (arrowhead). The anterior (B2) and posterior (B3) segment bronchi originate from the right upper lobe bronchus, while the apical segment bronchus (arrowhead) arises from the right main bronchus separately

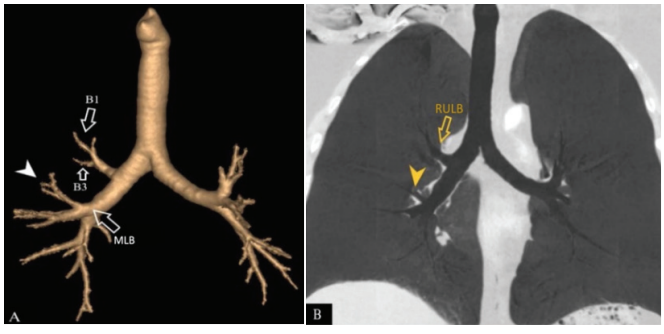

Figure 3. A 46-year-old male patient, A) 3D reformatted and B) coronal MinIP images show a posteparterial bronchus (arrowhead). The apical (B1) and posterior (B3) segment bronchus originates from the RULB, while the displaced anterior (B2) segment bronchus originates from the MLB as a posteparterial bronchus

MLB: middle lobe bronchus, RULB: right upper lobe bronchus

In total, 11 branching anomalies were displaced, and 82 were supernumerary. The segments most frequently ventilated by the abnormal bronchi completely or partially were the superior segments of the lower lobes (Table 2).

DISCUSSION

The prevalence of tracheobronchial branching anomaly was found to be 10.2% in our study, which is similar to others in the literature. Most of these anomalies are asymptomatic and are detected incidentally. Although anomalies such as situs versus and tracheal bronchus can be easily recognized on thoracic CT, other tracheobronchial branching anomalies are often overlooked (5,6,13).

Kurt et al. (14) reported a prevalence of tracheal diverticulum of 2.38%. They found that 97.1% of the diverticula were right posterolateral (14). Similar retrospective CT studies stated the prevalence of paratracheal air cysts as 3.7-6.5%. According to their

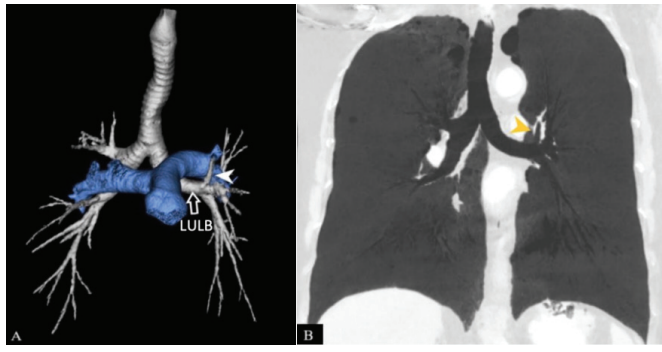

Figure 4. A 76-year-old male patient, A) 3D reformatted and B) coronal MinIP images show a left prehyparterial bronchus (arrowhead). It arises between the LULB and the level where the left pulmonary artery crosses the left main bronchus

LULB: left upper lobe bronchus

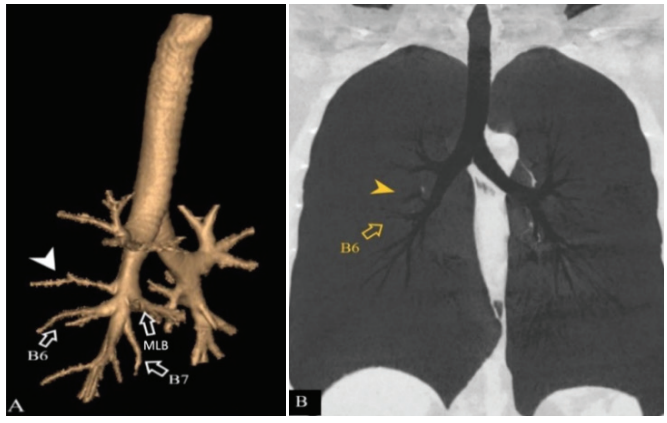

Figure 5. A 30-year-old female patient, A) 3D reformatted and B) coronal MinIP images show a supernumerary right suprasuperior bronchus (arrowhead). The normal superior bronchus (B6) originates from the lower lobar bronchus at the level of the MLB origin

MLB: middle lobe bronchus

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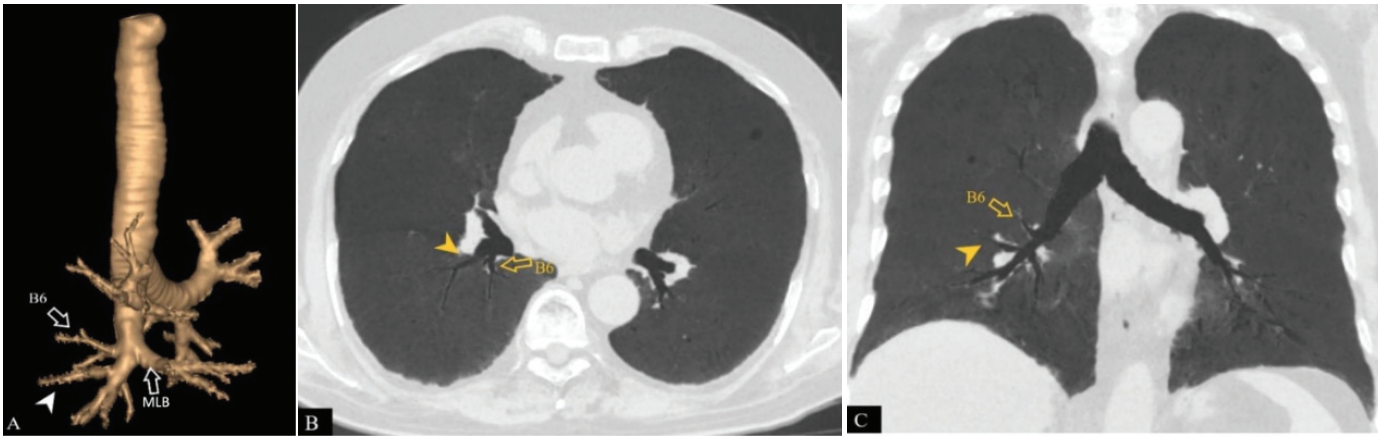

Figure 6. A 71-year-old female patient, A) 3D reformatted, B) axial MinIP and C) coronal MinIP images show a supernumerary right subsuperior bronchus (arrowhead). The right superior bronchus (B6) originates from the lower lober bronchus at the level of MLB origin
MLB: middle lobe bronchus

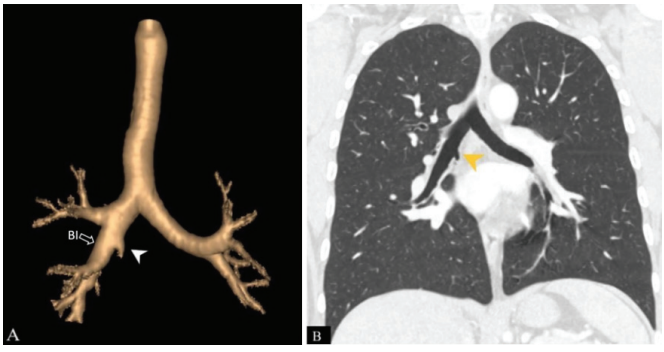

Figure 7. A 35-year-old male patient, A) 3D reformatted, B) coronal reformatted images show a blind-ending type ACB (arrowhead) originating from the bronchus intermedius (BI)
ACB: accessory cardiac bronchus

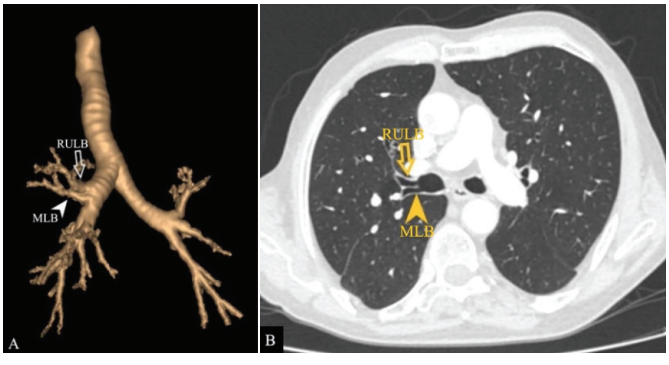

Figure 8. 74-year-old male patient, A) 3D reformatted B) axial thorax CT images shows MLB originating just inferior of the RULB
MLB: middle lobe bronchus, RULB: right upper lobe bronchus, CT: computed tomography

results, the tracheal diverticulum was detected more frequently in women and almost all of these anomalies were located on the right (15,16). However, no congenital acquired distinction was made for tracheal diverticulum, and most of the cases considered as tracheal diverticula were acquired in these studies. In our study, we did not include acquired paratracheal air cysts as tracheobronchial branching anomalies. Therefore, the prevalence of congenital tracheal diverticulum (0.1%) was lower than that in previous studies.

Table 2. The distribution of the segments ventilated by the abnormal bronchi

Ventilated segments	Number of patients	Percentage (%)
Right upper lobe apical segment	9	0.9
Right upper lobe anterior segment	1	0.1
Right middle lobe medial segment	1	0.1
Right lower lobe superior segment	42	4.2
Left upper lobe apicoposterior segment	2	02
Left lower lobe superior segment	38	3.8
Total	**93**	**9.3**

The prevalence of the tracheal bronchus has been reported as 0.1-2% in several studies (2,17-20). McLaughlin et al. (17) evaluated children who underwent bronchoscopy for respiratory symptoms, and the prevalence of the tracheal bronchus was stated as 2%. The retrospective study of Akoglu et al. (20) found the prevalence of tracheal bronchus to be 0.2% in the bronchoscopy assessment of 6732 cases. Fifteen of 16 cases were on the right side (20). Ruchonnet-Metrailler et al. (19) examined bronchoscopy data of 5970 children with respiratory symptoms and found 57 cases of tracheal bronchus (0.9%). The bronchoscopy data of 1000 children evaluated by Doolittle and Mair (2) showed that the prevalence was 0.5%. Displaced B1 tracheal bronchus was detected in 1 (0.42%) of 238 patients who underwent CT by Wang et al. (18). The prevalence of tracheal bronchus was 0.1% in our study. This was similar to the study of Akoglu et al. (20), but lower than the other studies. Studies by Ruchonnet-Metrailler et al. (19) and Doolittle

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and Mair (2) are based on data from symptomatic pediatric patients. This may be the reason for the higher prevalence of tracheal bronchus in these studies. Because Doolittle and Mair (2) specified tracheal diverticulum as a subtype of tracheal bronchus, this can be considered another reason for the high prevalence (18,19).

Previously, the tracheal bronchus is mostly associated with the apical segment, which is more common on the right side and in males. The tracheal bronchus detected in our study was located on the right side of the distal trachea and was associated with the apical segment in one male patient. Our results were in accordance with the findings in previous studies in terms of its side and location. However, it was supernumerary bronchus, not a displaced one, which is more common in the literature (6,21).

Our study revealed preeparterial bronchus associated with apical segments in 8 patients (0.8%), and seven of them had displaced bronchi, in line with previous data. The prevalences of preeparterial and tracheal bronchus were found to be 0.9% and 0.4%, respectively, by Atwell (5) in 1200 bronchograms. Ulusoy et al. (22) detected a displaced type of pre-eparterial bronchus in two (0.5%) of 400 patients who underwent CT. In another study by Ghaye et al. (23), 25 preeparterial bronchi were reported, 20 displaced, and 5 supernumerary bronchi.

Studies investigating the posteparterial bronchus anomaly are limited. The right posteparterial bronchus originating from the bronchus intermedius was found in one case (0.04%) of 2773 bronchoscopy reports (24). Ghaye et al. (23) reported displaced posteparterial bronchus in two cases (0.01%). One arose from the bronchus intermedius and the other from the right lower lobe bronchus (23). We detected posteparterial bronchus in one patient (0.1%). It was displaced B2 bronchus originating from the MLB.

Despite the relatively high prevalence in anatomical and bronchographic studies, the number of cases of left eparterial bronchus detected by CT is low. This may suggest that this anomaly is overlooked in CT. The left eparterial and prehyparterial bronchus were grouped under the title of displaced left ULB by Oshiro et al. (11). They found accessory fissures in seven of the ten cases. In this study, 8 of 10 displaced left superior bronchus cases diagnosed during surgery were seen in retrospective CT evaluation (9,22).

Ghaye et al. (23) reported 5 cases of eparterial bronchus and 3 cases of prehyparterial bronchus. All of the eparterial bronchi were displaced, whereas the prehyparterial bronchus was supernumerary. An accessory fissure was observed in two of the three prehyparterial bronchus cases in their study (23). In our study, two patients had prehyparterial bronchus. One was a supernumerary subtype, and the other was a displaced subtype. Both were associated with the apicoposterior segment. The prevalence of left eparterial bronchus has been reported to be 1% in anatomical studies and 0.3-0.5% in bronchographic studies (11,23,25). However, we did not detect any left eparterial bronchi.

Upward-displaced MLB is a very rare anomaly. The appearance may be confused with left isomerism, but the RULB is eparterial in this anomaly. Chassagnon et al. (3) found upward displaced MLB in two cases of congenital heart disease. We observed an upward displacement of MLB in one male patient. Its origin was inferior to the ULB.

Anomalies involving the lower lobes are the suprasuperior and subsuperior bronchi, which are associated with the superior segment. Boyden reported 6 cases of displaced suprasuperior bronchus (1). Sabri et al. (26) reported a suprasuperior bronchus in 3 (6%) of 50 patients who underwent thoracic CT for various reasons. We found 9 right suprasuperior bronchi (0.9%). All of them were supernumerary. Two of the cases had both the right suprasuperior and left subsuperior bronchus. No suprasuperior bronchus was detected on the left side.

Ghaye et al. (23) observed subsuperior bronchus at a rate of 56% on the right and 26% on the left. The rate of subsuperior bronchus was found to be 19.4% in 67 cases by Martín-Ruiz et al. (27) 16.4% of them were on the right side. Nagashima et al. (28) reported the prevalence of subsuperior bronchus as 20.4% by assessing 270 CT examinations. We found the right subsuperior bronchus in 33 cases and the left subsuperior bronchus in 38 cases. According to our results, the prevalence of subsuperior bronchus (7.1%) was lower than that in the above-mentioned studies. This conflicting result may be explained by the identification differences in the subsuperior bronchi. In our study, we only defined the bronchi that ventilate the superior segments of the lower lobes as subsuperior bronchi. However, the bronchi originating from the inferior of the superior bronchus origin and ventilating basal segments were also accepted as subsuperior bronchi in other studies.

The ACB is the only bronchus originating from the medial wall of the main bronchus or bronchus intermedius. Ghaye et al. (23) reported the prevalence of ACB as 0.08%. The accessory bronchus was blind-ended in ten cases and the parenchyma was ventilated in four cases (23). Akoglu et al. (20) retrospectively evaluated 6732 bronchoscopy cases and found ACB in 4 cases. The prevalence of ACB was found to be 0.2% in CT examinations of 5790 patients by Unlu et al. (29). The anomalies were detected in seven male and five female patients, all of whom originated from the bronchus intermedius. Blind-ending diverticulum was detected in six patients, whereas fusiform ACB and multi cystic appearance of rudimentary lung tissue were observed in three patients. Lobules ventilated by ACB were detected in three cases (29). ACB was found in two of 400 CT examinations by Ulusoy et al. (22) and those that ended blindly. The prevalence of ACB was 0.7% in our study. This was similar to the prevalence reported by Ulusoy et al. (22) and higher than that reported in other studies. Five of the ACBs originated from the bronchus intermedius, which is consistent with the literature, and two of them originated from the left main bronchus. All of them ended blindly. Cases missed during bronchoscopy and diagnosed with CT were also reported (30). This may explain the lower incidence of anomalies observed in bronchoscopic studies.

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Situs inverse is a rare anomaly and is seen in 0.0005-0.01% of the general population (31). Situs inversus was found in one patient in our study. There was no accompanying congenital heart disease. Bronchiectasis was observed in the lower lobes, consistent with primary ciliary dyskinesia.

Situs ambiguous (or heterotaxy) and bridging bronchus are both rare anomalies and have been frequently reported as case reports in the literature. Situs ambiguous includes abnormalities in the arrangement of the cardiac atria, lungs, liver, stomach, and spleen that cannot be categorized as situs solitus or situs inversus. The most reliable CT marker of the bronchial situs is the relationship of the ULB with the ipsilateral pulmonary artery (32). Bridging bronchus is the most common tracheobronchial malformation (78%) in patients with pulmonary artery sling (33). We did not detect bridging bronchus or ambiguous situs in our study.

Study Limitations

Our study has some limitations. First, the study design was retrospective. Two radiologists evaluated the CT images by reaching a consensus. Inter-reader agreement was not analyzed. A larger sample may be required to detect extremely rare anomalies such as bridging bronchus. Finally, the detected anomalies were not confirmed by bronchoscopy or histopathology. Strengths of our study include the following: radiologists experienced in chest CT and CT bronchography performed the assessments, a larger sample size than previous CT-based Turkish population studies, a wide spectrum of tracheobronchial branching anomalies was screened, and a uniform nomenclature was used as a guideline to identify anomalies.

Our results indicate that subsuperior and suprasuperior bronchi constitute the majority of the bronchial tree developmental anomalies. Detection of such tracheobronchial branching anomalies by a radiologist is important because it may have clinical consequences if overlooked. Knowing these tracheobronchial anomalies facilitates the procedure and prevents complications before intubation, bronchoscopy, bronchoalveolar lavage, endobronchial treatment, lung transplantation, or resection.

CONCLUSION

Congenital tracheobronchial branching defects affecting the trachea, main bronchi, and intermediate bronchus may be categorized thoroughly using a lobe-based categorization method. The assessment of clinicians performing bronchoscopy and radiologists evaluating CT scans depends on their understanding of bronchial anatomy and abnormalities. CT screening is a practical, reliable, and accessible method to further assess the tracheobronchial tree, determine the type of bronchial anomaly, and rule out intraluminal diseases.

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Efficiency of a Titanium-platelet Rich Fibrin Membrane in Primary Pterygium Surgery

Primer Pterjiyum Cerrahisinde Titanyum-plateletten Zengin Fibrin Membranın Etkinliği

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ABSTRACT

Objective: This study aimed to evaluate the efficacy and safety of titanium-platelet rich fibrin (T-PRF) membranes in primary pterygium surgery.

Methods: Twenty-three patients diagnosed with primary pterygium were included in our retrospective study. Patients underwent pterygium excision between January 2017 and October 2017 after T-PRF membrane autograft to close the scleral bed. Blood samples from the patients were centrifuged in titanium tubes and mechanically compressed to prepare T-PRF membranes. In this study, preoperative patient characteristics, spread of pterygium, T-PRF resorption time in postoperative controls, and pterygium recurrence and complications were evaluated.

Results: The mean follow-up period was noted as 8.9±3.1 months (4-14 months). The mean extension of the pterygium was 2.5±1.0 mm. Eleven patients had pterygium recurrence (42.3%). The mean time to recurrence was 3.9±1.8 months. No complications were observed during surgery. The T-PRF resorption time was noted as <7 days in seven patients. Postoperative follow-up revealed suture reaction in 7 (26.9%) patients, loss of graft in 1 (3.8%), conjunctival granuloma formation in 1 (3.8%), and Tenon's cyst formation in 1 (3.8%) patient.

Conclusion: The T-PRF membrane is easily available, cost-effective, can be prepared with the desired size and thickness, and thus can be an alternative method for patients who are not eligible to receive conjunctival autograft for pterygium surgery. The surgical technique could be improved to be accepted as a standard method.

Keywords: Autograft, titanium tubes, conjunctival granuloma, ptergium surgery, suture reaction

ÖZ

Amaç: Bu çalışma, primer pterjiyum cerrahisinde titanyum-trombositten zengin fibrin (T-PRF) membranların etkinliğini ve güvenliğini değerlendirmeyi amaçlamıştır.

Yöntemler: Primer pterjium tanısı konulan 23 hasta retrospektif çalışmamıza dahil edilmiştir. Skleral yatağı kapatmak için hastalar T-PRF membranı otogrefti sonrası 2017 Ocak ve 2017 Ekim arası pterjiyum eksizyonu operasyonu geçirmiştir. Hastaların kan örnekleri titanyum tüplerde santrifüjlenmiş ve mekanik olarak sıkıştırılarak T-PRF membranları hazırlanmıştır. Çalışmada ameliyat öncesi hasta özellikleri, pterjiyumun yayılımı ve ameliyat sonrası kontrollerde T-PRF rezorpsiyon süresi, pterjiyumun tekrarlaması ve komplikasyonları değerlendirilmiştir.

Bulgular: Ortalama takip süresi 8,9±3,1 ay (4-14 ay) olarak kaydedilmiştir. Pterjiyumun ortalama uzantısı 2,5±1,0 mm olarak ölçülmüştür. On bir hastada (%42,3) pterjiyum rekürrensi görülmüştür. Nükse kadar geçen ortalama süre 3,9±1,8 aydır. Ameliyat sırasında herhangi bir komplikasyon görülmemiştir. Yedi hastada T-PRF rezorpsiyon süresi <7 gün olarak kaydedilmiştir. Postoperatif takipte 7 (%26,9) hastada sütür reaksiyonu, 1 (%3,8) hastada greft kaybı, 1 (%3,8) hastada konjonktival granülom oluşumu ve 1 (%3,8) hastada Tenon kisti oluşumu görülmüştür.

Sonuç: T-PRF membran kolay bulunabilir, uygun maliyetli, istenilen ebat ve kalınlıkta hazırlanabilir ve bu nedenle pterjiyum cerrahisi için konjonktival otogrefte uygun olmayan hastalar için alternatif bir yöntem olabilir. Standart bir yöntem olarak kabul edilebilmesi için cerrahi teknikler geliştirilebilir.

Anahtar kelimeler: Otogreft, titanyum tüpler, konjonktival granülom, pterjium ameliyatı, sütür reaksiyonu

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INTRODUCTION

Pterygium is a degenerative and proliferative ocular surface disease characterized by fibrovascular extension of the conjunctiva over the cornea. The disease is treated surgically to relieve symptoms, including stinging, burning, redness, and blurred vision, and for a better cosmetic appearance (1). The major problem encountered after pterygium surgery is recurrence. Lower recurrence rates have been observed in methods where tissue grafts are applied to the scleral bed following pterygium excision. The conjunctival (CA) and CA-limbal, amniotic membrane, and platelet rich fibrin (PRF) membrane have been used as tissue grafts in pterygium surgery (2-4). At present, CA and limbal conjunctival autograft (LCA) techniques are the most commonly used techniques in pterygium surgery because of their lower recurrence rates. The CA technique has significant disadvantages, including a long surgical time, the creation of a second CA defect, and being technically challenging. In addition, the use of upper CA tissue is not considered eligible in patients who are candidates for glaucoma surgery. Although the recurrence rates are low, CA and LCA techniques are not applicable in every patient because of their disadvantages (3).

The PRF membrane is a second-generation thrombocyte concentrate. This membrane is widely used for treating various diseases. The PRF membrane can be used as a graft to accelerate tissue regeneration. Platelets and leukocytes found in the structure of PRF play an essential role in wound healing. The PRF membrane has several advantages, including being a completely autogenous material, easy accessibility, short preparation time, low cost, and preparation in any desired size and thickness (5,6). Glass and titanium tubes can be used in the centrifuge stage in the preparation of the PRF membrane. According to several studies conducted, the PRF membrane obtained using a titanium tube [titanium-platelet rich fibrin (T-PRF)] resorbs relatively late, and fibrin consistency was found to be tighter and better organized (7,8).

Our study aimed to investigate the efficacy and safety of the T-PRF membrane in primary pterygium treatment. For this purpose, data from patients who underwent surgery for primary pterygium using T-PRF membrane between January 2017 and October 2017 and had sufficient follow-up time were retrospectively evaluated.

METHODS

Ethical Approvement

The data from patients who used the T-PRF membrane in the surgical treatment of primary pterygium were retrospectively evaluated under the approval of the Bezmialem Vakıf University Non-invasive Clinical Research Ethics Committee dated 16th May 2017, decision number 10/86. The study was conducted at the department of ophthalmology in accordance with the Helsinki Declaration and Good Clinical Practices Guide. The patients included in the study signed the pre-operative informed consent and the written consent for the data evaluation.

Patients

Twenty-six eyes from patients (n=23) with a minimum follow-up period of 6 months were included in the study. Male patients included in the study (n=12) were higher than female patients (n=11). The inclusion criteria involved patients who were older than 20 years and underwent surgery by a surgeon using T-PRF fibrin membrane for primary pterygium diagnosis. Patients who had recurrent pterygium diagnosis and systemic diseases affecting wound healing, coagulopathy, corneal or conjunctival surgery in the same eye, or received permanent topical therapy for ocular diseases such as glaucoma or allergic conjunctivitis were excluded from the study.

Preoperative examination findings, including pterygium characteristics, best-corrected visual acuity, intraocular pressure, detailed anterior segment and fundus examination findings, age, gender, and systemic disease history, were enlisted. The pterygium extension size was defined as the distance in millimeters from the limbus to the apex of the lesion measured using a slit lamp. In this study, recurrent situation was defined as fibrovascular growth up to the surgical limbus and over the cornea. The presence of recurrence, the condition of the graft applied, and the presence of complications were evaluated at the postoperative 1st day, 1st week, 1st month, 3rd month, and 6th month control visits.

Preparation of the T-PRF

Right before surgery, 20 mL of venous blood was taken from the antecubital vein using a 20-22 G catheter. The blood samples were drained into two sterilized grade IV titanium tubes (being in 10 mL in each tube), without any anticoagulant contents. Immediately after, the titanium tubes were placed in a centrifuge device (IntraspinTM, USA) and centrifuged at 2700 rpm for 12 min. After centrifugation, the fibrin clot (Figure 1) formed in the middle layer of the tube was moved to the PRF kit (XpressionTM, USA). The erythrocyte-containing layer at the bottom of the fibrin clot was removed. On the PRF kit, the serum in the fibrin clot was discharged by mechanical compression, and thus, the fibrin membrane was obtained (Figure 1).

Surgical Technique

The operations were performed under local anesthesia using a surgical microscope. Topical 5% proparacaine HCl and subconjunctival 10 mg/mL lidocaine with 0.0125 mg/mL epinephrine were used for local anesthesia. During the pre-operative preparation stage, the periorbital region and eyelids were disinfected with 10% povidone-iodine solution. The eyes of the patients were covered with an ophthalmic drape, and lid retractors were placed. The 5% povidone-iodine solution was dropped onto the ocular surface and was waited for 3 min. Pterygium tissue borders are marked under a surgical microscope. Pterygium tissue was excised using Wescott scissors and a crescent blade. Fibrotic tissue on the cornea was polished using a motorized diamond ball burr (Bien-Air OsseodocTM, Switzerland). Tenon's tissue following pterygium excision was removed from the scleral surface, and hemostasis was performed using a thin-

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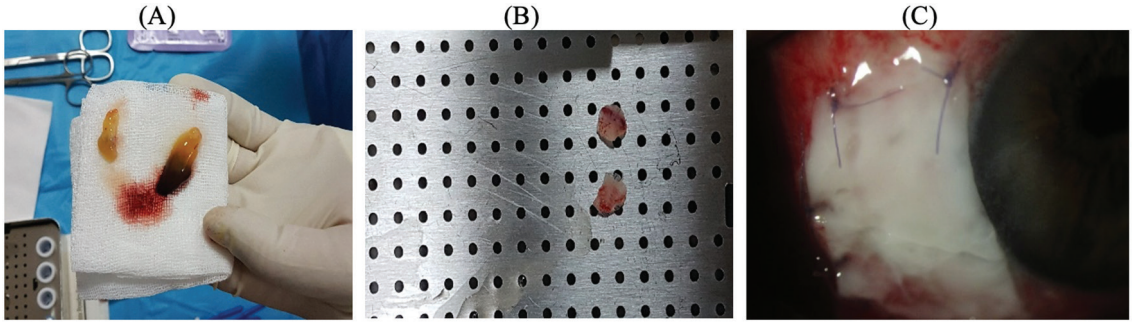

Figure 1. Obtaining the T-PRF membrane with the blood sample taken from the patient before the surgery. 10 mL blood samples in titanium tubes were centrifuged in a centrifuge (IntraspinTM, USA). After centrifugation, the fibrin clot that formed in the middle layer of the tube was transferred to the PRF kit (XpressionTM, USA). In the PRF kit, the serum in the fibrin clot was discharged by mechanical compression to obtain a fibrin membrane. (A) Fibrin clot; (B) T-PRF membrane; (C) Postoperative 1st day T-PRF membrane graft
T-PRF: titanium-platelet rich fibrin

tip single-use cautery pen (Accu-Temp®). The prepared T-PRF membrane was cut fittingly to the open edges of the wound bed and sutured to the wound edges of the conjunctiva with 5-7 8/0 polyglactin absorbable sutures (Polysorb TM). After the surgical operation, the eye was closed with an eye bandage following the application of antibiotic pomade (tobramycin 0.3% pomade).

Topical antibiotic drops 4 times a day (0.3% tobramycin), oral analgesic 3 times a day (500 mg paracetamol), topical lubricant drop 4 times a day (0.150 g hyaluronic acid sodium salt in 100 mL), and topical lubricant gel once a day (2 mg/g polyacrylic acid) were prescribed for 2 weeks postoperatively. Topical steroid drops 4 times a day (10 mg/mL prednisolone sodium phosphate) were prescribed for 2 months.

Statistical Analysis

To evaluate the distribution of categorical variables, chi-square or Fisher test results, as well as descriptive statistics of variables including frequency, percentage, median, and other parameters, were presented. All statistical analyses were performed using the computer software IBM SPSS Statistics package program. The $p<0.05$ was considered statistically significant.

RESULTS

Our study evaluated 26 eyes of patients (n=23) retrospectively. The T-PRF membrane was applied to all patients following pterygium excision under local anesthesia. In our study, 13 right (50%) and 13 left (50%) eyes of male and female patients were examined. The age of the patients ranged from 26 to 74 years, with a mean age of 50.7±13.5 years (Table 1).

Bilateral primary pterygium was detected in 10 patients (43.5%). Three of these patients had surgery for both eyes, and the remaining seven patients had one eye operation. In the pre-operative examinations of the patients, the extension of the pterygium varied between 1.2 and 5 mm, and the mean was noted to be 2.5±1.0 mm.

The extension of the pterygium was noted ≤2 mm in 11 eyes, between 2 and 4 mm in 11 eyes, and ≥4 mm in four eyes. On the postoperative 7th day examination, the T-PRF membrane was completely resorbed in six eyes (23.1%). The follow-up period of the patients ranged from 6 to 14 months, and the mean follow-up period was calculated as 8.9±3.1 months (Table 1).

Table 1. Demographic and clinical characteristics of the cases (23 patients, 26 eyes)

Characteristics	Values
Age	**Years**
Mean ± standard deviation	50.7±13.5
Gender	n (%)
Male	12 (52.2%)
Female	11 (47.8%)
Pterygium extension	**mm**
Mean ± standard deviation	2.5±1.0
Range	1.2-5
Follow-up period	**Months**
Mean ± standard deviation	8.9±3.1
Range	6-14
T-PRF resorption time	**n (%)**
<7 days	6 (23.1%)
≥7 days	20 (76.9%)

T-PRF: titanium-platelet rich fibrin

Recurrence was observed in 11 (42.3%) of 26 eyes. Recurrent situations were detected in 41.7% of patients under 50 years of age and in 42.9% of patients over 50 years of age. The recurrence rate was 38.5% in male patients and 46.2% in female patients. No statistically significant difference was found between recurrence rates in terms of age and gender $p>0.05$ (Figure 2).

The recurrence prevalence was 27.3% in eyes with pterygium ≤2 mm, 54.5% in eyes with 2-4 mm, and 50.0% in eyes with ≥4 mm. The recurrence rate was 66.7% in eyes where T-PRF membrane resorption was <7 days and 35% in eyes ≥7 days. Less recurrence was detected in eyes with pterygium size ≤2 mm and autograft resorption time ≥7 days. No statistically significant difference was found between pterygium size and T-PRF membrane resorption time and recurrence rates $p>0.05$ (Table 2).

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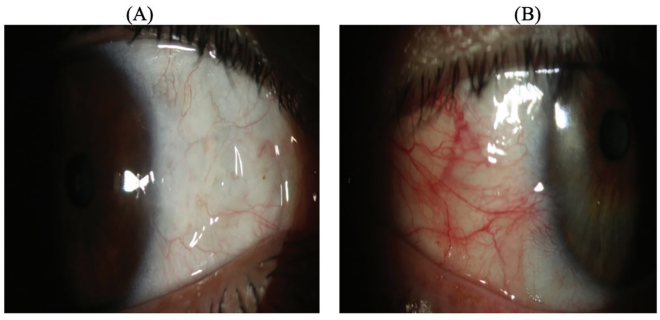

Figure 2. Observation of postoperative recurrence in time. Recurrence was detected in 11 of 26 eyes. This recurrence rate was directly proportional to time. (A) No recurrence was observed at sixth month postoperatively; (B) Pterygium recurrence was detected in the first postoperative year

Table 2. Recurrence rates according to demographic and clinical characteristics of the cases (23 patients, 26 eyes)

Characteristics	Total number	Recurrence (%)	p-value
Cases	26	11 (42.3)	
Age, years			
<50	12	5 (41.7%)	0.95
≥50	14	6 (42.9%)	
Gender			
Male	13	5 (38.5%)	0.69
Female	13	6 (46.2%)	
Pterygium extension, mm			
≤2	11	3 (27.3%)	0.24
2-4	11	6 (54.5%)	
≥4	4	2 (50.0%)	
Suture reaction			
Positive	7	5 (71.4%)	0.095
Negative	19	6 (31.6%)	
T-PRF resorption time			
<7 days	6	4 (66.7%)	0.35
≥7 days	20	7 (35.0%)	

T-PRF: titanium-platelet rich fibrin

No pre-operative complications were encountered. In postoperative follow-up, one patient (3.8%) had graft loss on the 1st day, one patient (3.8%) had conjunctival granuloma in the 1st month, one patient (3.8%) had Tenon's cyst in the 1st month, and seven patients (26.9%) had suture reaction in the 1st week (Figure 3).

Sutures are removed in patients who develop suture reactions. Recurrence was detected in five (71.4%) of the seven patients who developed a suture reaction. No statistically significant difference noted in a comparison of eyes with and without suture reaction in terms of recurrence p>0.05 (Figure 2). According to the evaluation of recurrence times, one patient had in the 1st month, six patients had in the 3rd month, and four patients had in the 6th month. The mean recurrence time was found to be 3.9±1.8 months in patients with recurrence (Table 3).

DISCUSSION

Pterygium is an ocular surface disease characterized by fibrovascular proliferation. Although the underlying ethology and pathogenesis are not completely understood, UV-B radiation exposure remains a predisposing factor. Today, surgery is still the main treatment modality for pterygium. Among surgical approaches, techniques including the bare sclera technique and primary conjunctival closure are known (9). The major problem encountered in the surgical treatment of pterygium is high recurrence rates. In terms of recurrence of pterygium, the characteristics of pterygium (type, grade, and dimension), age of patient, environmental factors, and applied method of surgical intervention were stated to be risk factors (9). At the same time, surgical trauma, postoperative inflammation, fibroblast proliferation, and accumulation of extracellular matrix proteins have been associated with recurrence (10). Various surgical techniques and adjuvant treatment methods have been applied to reduce recurrence rates. Recurrence rates of 38-88% have been reported in patients who are operated with the bare sclera technique alone. In patients who are operated with the primary conjunctival closure technique, recurrence rates ranging between 45-70% have been reported. Both of these techniques have been discontinued because of unacceptably high recurrence rates, and tissue graft applications have become widespread after pterygium excision (11).

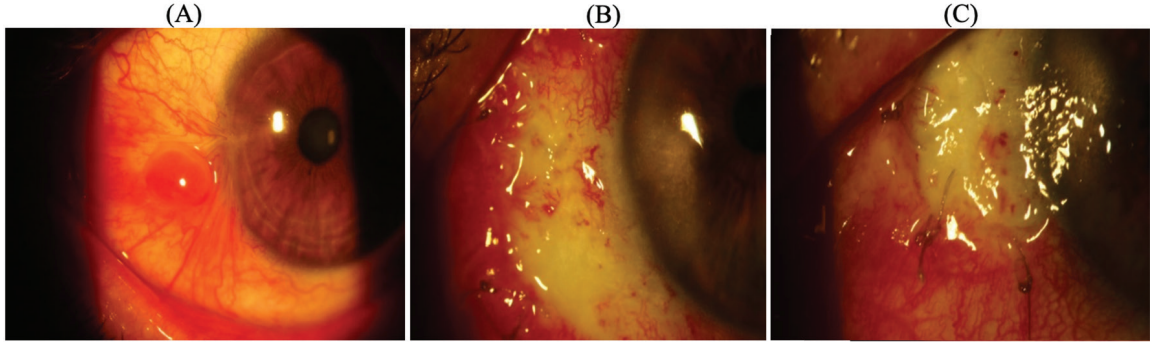

Figure 3. Follow-up of patients after surgery. Complications were observed in the postoperative follow-up. In postoperative follow-up, one patient had Tenon's cyst in the 1st month (A), and seven patients had suture reaction in the 1st week (B), one patient had graft loss on the 1st day (C)

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Table 3. Postoperative complications and their prevalence

Complication	Number (%)
Recurrence	11 (42.3%)
Suture reaction	7 (26.9%)
Graft loss	1 (3.8%)
Conjunctival granuloma	1 (3.8%)
Tenon's cyst	1 (3.8%)

Kenyon et al. (12) revealed that the CA technique suturing the autograft (which is taken from the superior temporal bulbar conjunctiva) over the bare sclera following pterygium excision had a recurrence rate of 5.3% in complicated and recurrent pterygium cases. Coroneo (13) and Dushku and Reid (14) reported that deterioration in the limbal corneal-conjunctival epithelial barrier is the main cause of fibrovascular tissue invasion over the cornea and progressive corneal conjunctivalization. Based on the significance of the limbal barrier, limbal conjunctival tissue was used as a graft in later conducted studies. As per the mentioned studies, LCA showed better anatomical and functional results than CA. 0-15% recurrence has been reported in cases where LCA was applied in primary pterygium treatment (15). Al Fayez (16) compared CA and LCA techniques in primary and recurrent pterygium cases and reported a recurrence rate of 8.3% in primary pterygium and 33.3% in recurrent pterygium with CA. In the study, no recurrence was observed in the LCA group (16).

The CA and LCA techniques are not suitable for all patients due to the disadvantage of being candidates for upcoming glaucoma surgery. In addition, they have disadvantages including prolonged operative duration and complexity, low postoperative patient comfort, and secondary injury at the donor site (3).

The basal lamina and stromal structure of the amniotic membrane are similar to those of the conjunctiva. The amniotic membrane contains pro-inflammatory cytokines, including IL-6 and IL-8, and anti-inflammatory cytokines, including IL-10 and IL-1 receptor antagonist. The amniotic membrane contributes to the proliferation of conjunctival and corneal epithelial cells and to the structural restructuring of limbal tissue in pterygium. In addition, the amniotic membrane reduces postoperative pain by covering the free nerve endings (17). Recurrence rates of 6-40% have been reported when amniotics are used in patients with pterygium.

In a previous study, Liang et al. (18) reported a recurrence rate of 7.4% in 81 eyes using the CA technique and 19.2% recurrence rate in 52 eyes using the amniotic membrane transplant (AMT) technique. Tananuvat et al. (19) reported a recurrence rate of 4.76% with the CA technique in 42 eyes and a recurrence rate of 40.9% with the AMT technique in 44 eyes. Although higher recurrence rates have been reported with the AMT technique compared with the CA technique, studies have shown that this technique can be used in patients, especially those with large tissue defects where CA cannot be used (15). The application of amniotic membrane has several disadvantages, including being an allogenous material, risk of contamination, complex preparation procedure, and low availability. Several reasons for different recurrence rates in pterygium cases using the AMT technique have been reported, including different donor characteristics, different amniotic membrane contents, and postoperative sunlight exposure (20).

The PRF membrane consists of fibrin matrix, which contains a large amount of platelets, leukocytes, stem cells, growth factors, and cytokines released from them. The PRF contains pro-inflammatory and anti-inflammatory cytokines from platelets and leukocytes. Growth factors and cytokines inside the PRF support cell proliferation and migration by controlled release and have a chemotactic effect on extracellular matrix synthesis. They also serve as structural support for the migration of conjunctival and endothelial cells. Compression of PRF into membrane form provides suturing of PRF. Despite similar characteristics of both amniotic and PRF membranes, the PRF membrane has an advantage owing to its autogenous origin over the allogenic origin of the amniotic membrane, thus reducing the risk of contamination (5).

Cakmak et al. (4) first reported the application of a PRF membrane prepared in glass tubes in the surgical treatment of pterygium. In this study, 20 patients who underwent CA technique and 15 patients who underwent PRF membrane technique were compared in terms of recurrence rates, operation time, and complications, with follow-up periods ranging from 6 to 24 months. No recurrence was observed in the CA group, but a recurrence was detected in one patient (6.6%) in the PRF membrane group. The average operation time was found to be approximately 10 min shorter in the PRF membrane group. In the CA group, graft loss was detected in two patients (10%) and suture reaction in 3 patients (15%). In one patient (6.6%) in the PRF membrane group, graft loss was observed, but no suture reaction was detected. Postoperative inflammation was significantly lower in the PRF membrane group. This study stated that PRF membrane can be used in ocular surface reconstruction after pterygium excision due to its several advantages, including easy preparation and shorter operation time, and providing similar results as CA in terms of recurrence and complications (4).

Titanium shows better biocompatibility with living tissues, owing to its resistance to corrosion, compared with other corrosion-resistant metals. Therefore, titanium can be safely used in the structure of dental implants, joint prosthetics, and artificial heart valves. The new product, T-PRF, has a tighter and better organized fibrin matrix structure than conventional PRF. The release of growth factors and cytokines is slower; therefore, the resorption time of the T-PRF membrane is longer (8).

In our study, we aimed to delay fibrin membrane resorption using T-PRF. Due to the delay in the resorption time, it reduces the risk of a bare scleral surface and prolongs the release of growth factors and cytokines. In addition, recurrence was observed in 11 (42.3%) of 26 eyes with a follow-up period of at least 6 months and a mean of 8.9±3.1 in our study. In an evaluation of the clinical features and follow-up examinations of the patients, a higher rate of recurrence was observed in cases with a pterygium size of >2 mm, suture

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reaction, and resorption time of <7 days. In our data, recurrence was detected in eight (53.3%) of 15 patients with a pterygium size of >2 mm. As the size of the pterygium increases, the possibility of residual tissue remaining after surgery increases. We assume that with the effect of growth factors such as platelet-derived growth factor, fibroblast growth factor, and vascular endothelial growth factor in the structure of PRF, the proliferation of the residual pterygium tissue and stimulation of angiogenesis causes the fibrovascular tissue to extend over the cornea and thus result in recurrence. In our study, recurrence was detected in five (71.4%) of seven patients who developed a suture reaction. An end-to-end suturing technique with polyglactin suture material to the conjunctiva was used for stabilization of the T-PRF membrane.

In a similar study in the literature, Kim et al. (21) compared the use of 8-0 polyglactin and 10-0 nylon suture material in primary pterygium cases where they applied a conjunctival rotation flap. Absorbable polyglactin sutures were removed at the end of 1 month postoperatively if they were still present, and non-absorbable nylon sutures were removed 1 week postoperatively. A 7.31% recurrence rate was observed in 8-0 polyglactin group but a 0% recurrence rate was observed in the 10-0 nylon group (21). This study stated that polyglactin suture material could increase the recurrence rate by increasing conjunctival inflammation and irritation in the early postoperative period.

In the CA technique, several studies have been conducted on the use of fibrin glue instead of sutures to shorten the duration of the surgery and increase patient comfort. In these studies, the use of fibrin glue appeared to be more advantageous in terms of surgical time and patient comfort, although different results were reported in terms of recurrence rates. Koranyi et al. (22) reported a recurrence rate of 5.3% with fibrin glue application and 13.5% with suture application. Bahar et al. (23) reported a recurrence rate of 11.9% with the fibrin glue application technique and 7.7% with suture application. Some researchers used autologous blood for fixation of CA because of the high cost of fibrin glue and the presence of contamination risk. Kurian et al. (24) compared the autologous blood technique with the fibrin glue technique, reporting similar recurrence rates of 6.25% and 8.16% with graft loss of 3.13% and 2.04%, respectively. In the CA technique, de Wit et al. (25) let the small hemorrhage on the bare sclera coagulate spontaneously after pterygium removal, and when hemostasis occurred, they used the clot for autograft fixation. In this study of 15 cases, which were followed up for 6-14 months, no recurrence or complication was observed. de Wit et al. (25) targeted to avoid the foreign body reactions that may occur due to sutures and fibrin glue in this study. In the literature, Yang et al. (26) compared the use of PRF graft and LCA after pterygium excision and found 3.6% recurrence in the PRF graft group, but no recurrence in the LCA group. No suture reaction was observed because of the 10-0 nylon suture used for PRF graft stabilization. In addition, statistically significant postoperative inflammation (12.5%) was observed in the PRF graft group (26). In a similar study, Idoipe et al. (27) compared the use of CA, PRF membrane, and AMT after pterygium excision and found that the recurrence rates were 0%, 7.7%, and 20%, respectively. In this study, fibrin glue was used for graft stabilization. In addition, significant improvement in ocular surface symptoms was observed in patients using PRF membranes. The mean resorption time of the PRF membrane was 12.67 days (27).

We assume that the beneficial effect of the PRF membrane on wound healing decreased because of the inflammation that developed in response to the suture material in the early postoperative period. Nylon sutures or fibrin glue can be preferred instead of polyglactin sutures in pterygium cases with a high risk of recurrence and significant inflammation.

In our study, recurrence was detected in 4 (66.7%) of 6 patients whose T-PRF membrane resorption time was less than 7 days. Because the conjunctival epithelization is not fully finished, the scleral surface remains bare due to early resorption of the PRF membrane. We assume that methods that increase the PRF membrane resorption time will decrease the recurrence rates. We suppose that by modifying this technique, using a double-layer T-PRF membrane instead of a single-layer PRF membrane, we can extend the resorption time and thus avoid the early exposure of the scleral surface. We presume that early resorption increases the recurrence rate.

Mitomycin C (MMC) is applied intraoperatively on the wound bed, and MMC suppresses subconjunctival tissue proliferation and fibroblast activity. These adjuvant procedures are intended to suppress the fibroblastic activation of the remaining adjacent tissue after surgery. Ha et al. (28) compared the CA and AMT methods and simultaneously applied intraoperative MMC as an adjuvant in some patients. This study stated that the most important parameter in the development of recurrent pterygium is inflammation that arises in the early postoperative period (28). Koranyi et al. (29) emphasized that the CA method together with intraoperative use of 0.02% MMC is more effective than the CA method alone in primary pterygium. These studies have shown that recurrence rates decrease with the application of adjuvant MMC in pterygium treatment. We estimate that better results can be achieved with the use of intraoperative MMC with the T-PRF membrane method in terms of low recurrence rates.

Study Limitations

Our study has significant limitations. Because T-PRF membrane application is a new approach in primary pterygium cases, a limited number of patients were included in the study. Therefore, it was not possible to perform significant statistical analyses. Studies with longer follow-up periods are required for comparison with alternative treatment methods. This new approach should be used as an experimental group in randomized controlled studies with other surgical approaches as control groups in primary pterygium treatment.

CONCLUSION

In conclusion, our study revealed that the T-PRF membrane can be used as an alternative approach for patients who are not eligible

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to receive conjunctival autografts for pterygium surgery. Because the T-PRF membrane is easily available, cost-effective, and can be prepared in the desired size and thickness, the use of T-PRF membranes can be integrated into the treatment of pterygium. To be approved as a standard procedure, the surgical technique could be improved.

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Ethics Committee Approval: The data from patients who used the T-PRF membrane in the surgical treatment of primary pterygium were retrospectively evaluated under the approval of the Bezmialem Vakıf University Non-invasive Clinical Research Ethics Committee dated 16th May 2017, decision number 10/86.

Informed Consent: The patients included in the study signed the pre-operative informed consent and the written consent for the data evaluation.

Peer-review: Externally peer-reviewed.

Author Contributions: Surgical and Medical Practices - F.N., R.B.; Concept - U.S.; Design - F.N., H.Ö.; Data Collection and/or Processing - U.S., F.N., R.B., H.Ö.; Analysis and/or Interpretation - U.S.; Literature Search - U.S., R.B., H.Ö.; Writing - U.S., F.N., R.B., H.Ö.

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Etik Komite Onayı: Primer pterjiyumun cerrahi tedavisinde T-PRF membranı kullanan hastaların verileri, Bezmialem Vakıf Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'nun 16 Mayıs 2017 tarih ve 10/86 sayılı kararıyla retrospektif olarak değerlendirildi.

Hasta Onamı: Çalışmaya dahil edilen hastalardan ameliyat öncesi bilgilendirilmiş onam ve veri değerlendirmesi için yazılı onam alındı.

Hakem Değerlendirmesi: Editörler kurulu dışında olan kişiler tarafından değerlendirilmiştir.

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Seasonal Variation in Acute Dacriocystitis

Akut Daksiyosistitin Mevsimsel Değişikliği

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ABSTRACT

Objective: We aimed to investigate whether there is a seasonal relationship between the emergence of acute dacryocystitis.

Methods: The files of patients who applied to the ophthalmology outpatient clinic with complaints of tearing and discharge for five years and were diagnosed with acute dacryocystitis were retrospectively analyzed. Age, gender, date of occurrence of the complaints, and date of diagnosis of acute dacryocystitis were recorded. To determine the seasonal relationship, the data regarding the number of cases who applied every month of the year were analyzed statistically by Rayleigh test.

Results: The mean age of 60 patients (45 females, 15 males) included in the study was 54.70±16.80 years. It was found that all patients were not equally likely to be admitted to the hospital and the onset of their complaints throughout the months of the year ($p<0.05$). The frequency of applications was higher between May and August.

Conclusion: There appears to be a seasonal relationship with the timing of acute dacryocystitis. In our series, more acute dacryocystitis cases were encountered during the first spring-summer months. The reason for the increase in acute dacryocystitis cases in the hot seasons of the year may be the increase in infectious agents in these seasons.

Keywords: Acute dacryocystitis, seasons, gender

ÖZ

Amaç: Akut dakriosistitin ortaya çıkışı ile mevsimsel bir ilişkinin olup olmadığını araştırmayı amaçladık.

Yöntemler: Göz hastalıkları polikliniğine beş yıldır göz yaşarması ve akıntı şikayeti ile başvuran ve akut dakriyosistit tanısı alan hastaların dosyaları geriye dönük olarak incelendi. Yaş, cinsiyet, şikayetlerin ortaya çıkış tarihi ve akut dakriyosistit tanı tarihi kaydedildi. Mevsimsel ilişkinin belirlenmesi amacıyla yılın her ayında başvuran olgu sayılarına ilişkin veriler Rayleigh testi ile istatistiksel olarak analiz edilmiştir.

Bulgular: Çalışmaya dahil edilen 60 hastanın (45 kadın, 15 erkek) yaş ortalaması 54,70±16,80 yıldı. Tüm hastaların hastaneye başvurma ve şikayetlerinin yılın ayları boyunca başlama olasılığının eşit olmadığı belirlendi ($p<0,05$). Mayıs-Ağustos ayları arasında başvuru sıklığının daha yüksek olduğu görüldü.

Sonuç: Akut dakriyosistitin zamanlaması ile mevsimsel bir ilişki var gibi görünmektedir. Serimizde ilkbahar-yaz aylarında daha çok akut dakriyosistit olgularına rastlandı. Akut dakriyosistit olgularının yılın sıcak mevsimlerinde artmasının nedeni, bu mevsimlerde enfeksiyon etkenlerinin artmasına bağlı olabilir.

Anahtar kelimeler: Akut dakriyosistit, mevsimler, cinsiyet

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INTRODUCTION

Dacryocystitis is an acute suppurative inflammation of the lacrimal sac. Generally, the clinical picture develops because of infection in the lacrimal sac secondary to obstruction of the nasolacrimal duct. Pain, edema, and erythema are observed together with lacrimal sac distension (1,2). Dacryocystitis can be congenital or acquired. Acquired dacryocystitis is frequently seen at the age of 40 years. The cause of the nasolacrimal duct obstruction is not fully known. It has been suggested that various factors such as the anatomical structure of the nasolacrimal canal (unilateral nasolacrimal obstruction with facial asymmetry or nasal septal deviation), endocrine changes, climatic factors, infections, and smoking may play a role in the development of obstruction (1-3). In acute dacryocystitis, the agent is usually Gram (+) bacteria. These are usually *Streptococcal pneumococci* and *Staphylococci* (4).

Some medical diseases can be seen more in certain seasons of the year. It has been wondered whether there is a seasonal effect in the occurrence time of some diseases. Seasonal changes in the clinical symptoms of a disease indicate environmental effects. Observing the seasonal effect also gives an idea of the pathogenesis. This information may also gain importance in the development of preventive health services. Seasonal changes have been reported in various infectious and surgical diseases (5-7). In this retrospective data review study, we aimed to examine the seasonal variation in acute dacryocystitis among patients admitted to our hospital.

METHODS

The Afyonkarahisar Health Sciences University Clinical Research Ethics Committee approved the study (committee code: 2011-KAEK-2, meeting no: 2021/4, date: 02.04.2021). In this study, the files of the patients were retrospectively reviewed after the approval of the ethics committee was obtained in accordance with the tenets of the Declaration of Helsinki. The files of patients who applied to the eye outpatient clinic of the private hospital with complaints of tear and discharge and were diagnosed with acute dacryocystitis were retrospectively analyzed. Best corrected visual acuity, intraocular pressure measurement, and full slit-lamp examination were performed on all patients, and the results were recorded. All patients were treated with topical and systemic antibiotics. Age, gender, date of occurrence of the complaints, and date of diagnosis of acute dacryocystitis were recorded. In particular, the time of onset of the patients' acute complaints was questioned and the month in which they occurred was recorded. Further analysis of the case series was excluded because it was beyond the scope of this study. Seasons -summer, winter, fall, and spring- were defined according to internationally recognized astronomical seasons based on solstices and equinoxes and taking leap years into consideration. In our country, December, January, February are winter, March, April, May are spring, June, July, August are summer, and September, October, and November are fall.

Statistical Analysis

Descriptive statistics used in the study are expressed as mean ± standard deviation, number (n), and percentage (%). A Statistical Package for the Social Sciences (SPSS Inc., version 22.0, Chicago, IL, USA) was used for data analysis. A value of $p<0.05$ was taken as the statistical significance criterion. Data were analyzed using the Rayleigh test.

RESULTS

The mean age of 60 patients (45 females, 15 males) included in the study was 54.70±16.80. The mean age of the male patients was 43.67±17.17. The mean age of the female patients was 58.38±15.14. The ratio of female/male patients was 3/1. Rayleigh test analysis showed that patients' admission times to the hospital was unevenly distributed over months. The number of patients with symptoms and signs of acute dacryocystitis seen in each month of the year was significantly different ($p<0.05$). The frequency of applications was particularly high between May and August. The distributions are shown in Figure 1. The distribution of hospital admissions and the onset of complaints by months of the year was analyzed in terms of gender. It was determined that female patients' admission to the hospital and the onset of their complaints were not equally distributed over the months of the year. The difference in the number of female cases with acute dacryocystitis between months was statistically significant ($p<0.05$). The frequency of admission was higher between May and August. It was observed that male patients' admission to the hospital and the onset of their complaints were equally distributed over the months of the year, and there was no statistical difference among the months ($p>0.05$). The distribution of hospital admissions and the onset of complaints of female and male patients by months of the year are shown separately in Figure 2 and 3, respectively.

DISCUSSION

In our study, when we analyzed the monthly distribution of patients admitted to our hospital with acute dacryocystitis symptoms for five years, we obtained data indicating that the development of acute dacryocystitis may have a seasonal relationship. In our series, the average age was younger than that in western countries. Patients

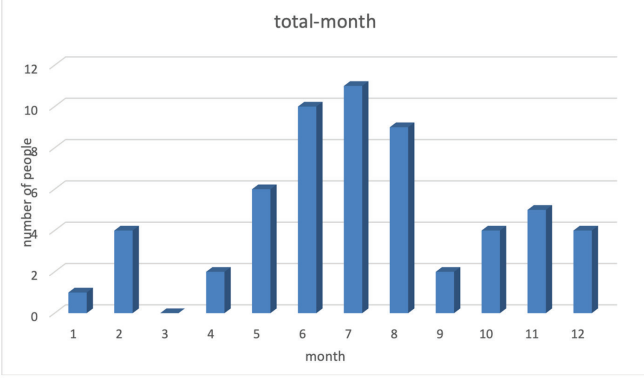

Figure 1. The frequency of applications, total

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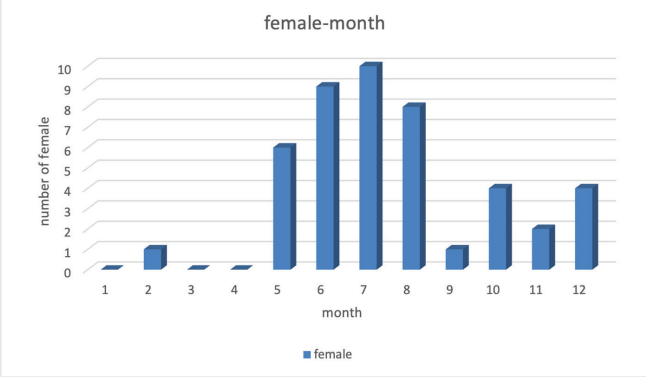

Figure 2. The frequency of applications, female

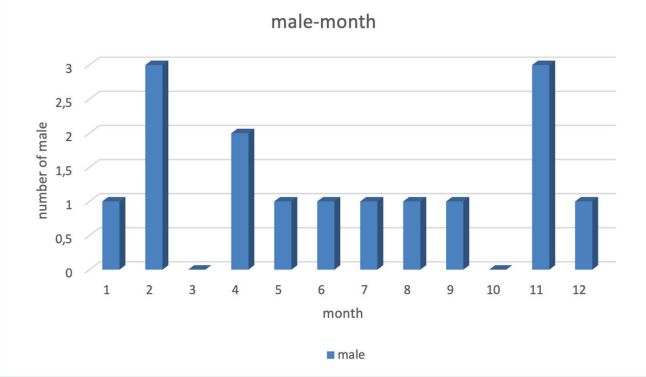

Figure 3. The frequency of applications, male

who have dacryocystitis are diagnosed generally at the age of 40 and over. However, acquired nasolacrimal duct obstruction has been diagnosed in the advanced age group (mean between 55.0 and 66.3 years) in developed countries (8). In our study, the mean age of the patients was 54.70±16.80 years.

In the study by Chung et al. (9), the age of the patients was found to be 55.4 years, similar to our study. The number of female patients was higher than that of men. In this study, *Staphylococcus aureus* was found to be the most frequently isolated microbiological agent in the culture results (9). When dacryocystitis cases are examined in terms of gender, while the distribution between genders is equal in congenital dacryocystitis cases, dacryocystitis seen in adulthood is more common in women. This ratio is observed to be 80% women and 20% men. Various studies have reported that hormonal irregularities in women may cause narrowing of the nasolacrimal canal, causing dacryocystitis to be observed more frequently. In addition, the lower lacrimal passage is more irregular in women (10,11). In our study, the rate of female patients in a series of 60 patients included in the study was 75%. Studies conducted in our country have reported the rate of women being between 71.2% and 89.3% (12,13).

Despite the differences in various economic and environmental factors, the fact that nasolacrimal obstruction occurs more frequently in women and in the postmenopausal period suggests that anatomical and hormonal factors play an important role (14,15). When nasolacrimal duct obstruction develops, patients usually develop low-grade chronic dacryocystitis, which is exacerbated from time to time. Patients usually live with these symptoms of chronic dacryocystitis until they undergo surgery for nasolacrimal duct obstruction. The patients have symptoms of permanent epiphora and purulent discharge due to recurrent conjunctivitis from time to time. These cases develop acute dacryocystitis due to acute inflammation of the lacrimal sac at a certain time of the year. When acute dacryocystitis develops, a very disturbing clinical picture with subacute onset of pain, tense swelling at the medial chantus, and mild to intense preseptal cellulitis develops in these patients, and systemic antibiotic treatment is often required. Some patients are persuaded to undergo surgery after experiencing acute dacryocystitis. It is very difficult to predict when acute dacryocystitis will develop in these patients. A seasonal relationship with the time of onset of acute dacryocystitis may indicate the influence of other environmental factors. Whether there is a seasonal relationship with acute dacryocystitis has rarely been investigated.

In an epidemiological study on acute dacryocystitis, the seasonal variation analysis of acute dacryocystitis cases showed that dacryocystitis was relatively more common during warm periods, but the difference was not statistically significant. Seasonal distribution analysis was not performed between genders (16).

In our study, it was observed that there was an increase in the frequency of acute dacryocystitis during the hot season among all patients. This difference was statistically significant among women ($p<0.05$). No significant difference was found between male patients in terms of seasonal distribution by months of the year ($p>0.05$).

Badhu et al. (17) showed that dacryocystitis was observed at a higher rate in patients with nasolacrimal duct obstruction living in the plains than in those living in the mountainous region from their sociodemographic data. These geographic data may show that temperature is a risk factor and are consistent with the results of our study. In a retrospective study on the sociodemographic data by Nemet and Vinker (18), it was found that 36.3% of the patients with nasolacrimal obstruction had a low socioeconomic level, but this rate was not found to be significantly different from the control group. In our study, no evaluation could be made regarding socioeconomic level or geographical location.

Study Limitations

Our study has some limitations. The small number of patients is one of them. The second limitation may be the lack of microbiological culture data to analyze the microbiological factors causing dacryocystitis according to seasons. Third, anatomical variations in the patients were not examined by endoscopic examination. In our study, it was not attempted to reach these data accurately retrospectively, but rather we exerted the afford to find data about when the patients developed symptoms. More detailed results can be obtained by examining these features in a larger case series.

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The seasonal relationship between the time of occurrence of acute dacryocystitis cases and the fact that there is an increase in the warm seasons, especially in female patients, but the absence of seasonal relationship in male patients suggests that different factors may play a role in the etiology of acute dacryocystitis. Our study should be investigated with further studies, especially considering the small sample size of male patients. If this relationship is validated by further studies, patients with chronic epiphora or chronic dacryocystitis can be informed and warned about the seasonal risk factors of this very disturbing clinical picture, and thus disease management can be performed more accurately.

CONCLUSION

In conclusion, we considered that the increase in the frequency of acute dacryocystitis cases in summer may be due to the change in lacrimal sac flora or increase in infectious agents in these seasons. Further studies are warranted to demonstrate the seasonal relationship of the development of acute dacryocystitis.

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Ethics Committee Approval: The Afyonkarahisar Health Sciences University Clinical Research Ethics Committee approved the study (committee code: 2011-KAEK-2, meeting no: 2021/4, date: 02.04.2021).

Informed Consent: Retrospective study.

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