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A technical review is performed to confirm that all of the required documentation has been submitted and to conduct a preliminary evaluation of the manuscript and supplementary files to assess suitability for the Journal. The manuscript will be returned to the Author in the event of any deficiency.

Pediatric Practice and Research Journal operates a blind review process. Contributions deemed suitable are then typically sent to a minimum of two independent expert reviewers in the field of study to assess the scientific quality of the paper.

The Editor/Editors are responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. If necessary, author(s) may be invited to submit a revised version of the manuscript. This invitation does not imply that the manuscript will be accepted for publication. Revised manuscripts must be sent to the Editorial Office within 4 (four) weeks, otherwise they will be considered as a new application. The corresponding author will be notified of the decision to accept or reject the manuscript for publication.

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The manuscript will not be returned to the authors whether the article is accepted or not. Copyright fee is not paid for the articles published in the journal. A copy of the journal will be sent to the corresponding author.

Language of the Journal

The official languages of the Journal are Turkish and English. The manuscripts that are written in Turkish have abstracts in English, which makes the abstracts available to a broader audience.

Authorship Criteria

After accepted for publication, all the authors will be asked to sign "Coyright Transfer Form" which states the following: " This work is not under active consideration for publication, has not been accepted for publication, nor has it been published, in full or in part (except in abstract form). I confirm that the study has been approved by the ethics committee. " All authors should agree to the conditions outlined in the form.

Pediatric Practice and Research Journal has agreed to use the standards of the International Committee of Medical Journal Editors. The author(s) should meet the criteria for authorship according to the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication. It is available at www.icmje.org.

Ethical Responsibility

The protocol of clinical research articles must be approved by the Ethics Committee.

In all studies conducted on humans, the "Material and Method" section was approved by the relevant committee or the Helsinki Declaration of Principles (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/).

It should be stated in the text that all persons included in the study signed the am Informed Consent Form ".

The articles submitted to the Pediatric Practice and Research Journal will be deemed to have been conducted in accordance with the Helsinki Declaration of Principles, and have received ethical and legal permissions and will not be held responsible.

If the "Animal" item was used in the study, the authors stated that in the Material and Method section of the article, they protect the animal rights in their studies in accordance with the principles of Guide for the Care and Use of Laboratory Animals (www.nap.edu/catalog/5140.html) and that they have received approval from the ethics committees of their institutions. must specify.

In case reports, Informed Consent a should be obtained from patients regardless of the identity of the patient.

If the article includes the institution (directly or indirectly) providing financial support for the commercial connection or work, the authors; the commercial product used, the drug, the company has no commercial relationship with, or if there is any relationship (consultant, other agreements, etc.), the editor must inform the presentation page.

If Ethics Committee Approval is required in the article; the received document should be sent with the article.

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The manuscript should be submitted to the Academic Plagiarism Prevention Program by the authors.

It is the authors' responsibility to ensure that the article complies with the ethical rules.

Policy of Screening for Plagiarism

The manuscripts are scanned by the Journal using the iThenticate program for determination of plagiarism and non-ethical situations. Pediatric Practice and Research Journal will immediately reject manuscripts leading to plagiarism.

TYPES OF MANUSCRIPT

Manuscripts should be submitted online via www.pprjournal.com

Original Articles should not exceed 3000 words and should be arranged under the headings of Abstract (not more than 300 words), Introduction, Materials and Methods, Results, Discussion, Conclusion and References.

Case Reports should not exceed 1000 words and 10 references, and should be arranged as follows: Abstract, Introduction, Case Report, Discussion and References. It may be accompanied by only one figure or table.

Letter to the Editor should not exceed 500 words. Short relevant comments on medical and scientific issues, particularly controversies, having no more than five references and one table or figure are encouraged. Where letters refer to an earlier published paper, authors will be offered right of reply.

Reviews are not accepted unless written on the invitation of the Editorial Board.

PREPARATION OF MANUSCRIPTS

All articles submitted to the Journal must comply with the following instructions:

a) Submissions should be doubled-spaced and typed in Arial 10 points.

b) All pages should be numbered consecutively in the top right-hand corner, beginning with the title page.

c) The title page should not include the names and institutions of the authors.

d) The manuscript should be presented in the following order: Title page, Abstract (English, Turkish), Keywords (English, Turkish), Introduction, Materials and Methods, Results, Discussion, Conclusion, Acknowledgements (if present), References, Figure Legends, Tables (each table, complete with title and foot-notes, on a separate page) and Appendices (if present) presented each on a separate page.

Title

The title should be short, easy to understand and must define the contents of the article.

Abstract

Abstract should be in both English and Turkish and should consist "Aim, Materials and Methods, Results and Conclusion". The purpose of the study, the setting for the study, the subjects, the treatment or intervention, principal outcomes measured, the type of statistical analysis and the outcome of the study should be stated in this section (up to 300 words). Abstract should not include reference. No abstract is required for the letters to the Editor.

Keywords

Not more than five keywords in order of importance for indexing purposes should be supplied below the abstract and should be selected from Index Medicus Medical Subject Headings (MeSH), available at www.nlm.nih.gov/meshhome.html.

Text

Authors should use subheadings to divide sections regarding the type of the manuscript as described above. Statistical methods used should be specified in the Materials and Methods section.

References

In the text, references should be cited using Arabic numerals in parenthesis in the order in which they appear. If cited only in tables or figure legends, they should be numbered according to the first identification of the table or figure in the text. Names of the journals should be abbreviated in the style used in Index Medicus. The names of all authors should be cited when there are six or fewer; when seven or more, the first three should be followed by et al. The issue and volume numbers of the referenced journal should be added.

References should be listed in the following form:

Journal article

Teke Z, Kabay B, Aytekin FO et al. Pyrrolidine dithiocarbamate prevents 60 minutes of warm mesenteric ischemia/reperfusion injury in rats. Am J Surg 2007;194(6):255-62.

Supplement

Solca M. Acute pain management: Unmet needs and new advances in pain management. Eur J Anaesthesiol 2002; 19(Suppl 25): 3-10.

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Online article not yet published in an issue

Butterly SJ, Pillans P, Horn B, Miles R, Sturtevant J. Off-label use of rituximab in a tertiary Queensland hospital. Intern Med J doi: 10.1111/j.1445-5994.2009.01988.x

Book

Sample1: Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.

Sample 2: Sümbüloğlu K, Akdağ B. Regresyon Yöntemleri ve Korelasyon Analizi. Hatiboğlu Yayınevi: Ankara; 2007.

Chapter in a book

Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. I n: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York: McGraw-Hill; 2002. p. 93113.

Journal article on the Internet

Abood S. Quality improvement initiative in nursing homes: The ANA acts in an advisory role. Am J Nurs [serial on the Internet] 2002 [cited 12 Aug 2002]; 102. Available from: www.nursingworld.org/AJN/2002/june/wawatch.htm

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An organization as an author

The Intensive Care Society of Australia and New Zealand. Mechanical ventilation strategy in ARDS: Guidelines. Int Care J Aust 1996;164:282-4.

Acknowledgements

The source of financial grants and the contribution of colleagues or institutions should be acknowledged.

Tables

Tables should be complementary, but not duplicate information contained in the text. Tables should be numbered consecutively in Arabic numbers, with a descriptive, self-explanatory title above the table. All abbreviations should be explained in a footnote. Footnotes should be designated by symbols in the following order: *,†, ‡, §, ¶.

Figures

All illustrations (including line drawings and photographs) are classified as figures. Figures must be added to the system as separate .jpg or .gif files (approximately 500x400 pixels, 8 cm in width and at least 300 dpi resolution). Figures should be numbered consecutively in Arabic numbers and should be cited in parenthesis in consecutive order in the text.

Figure Legends

Legends should be self-explanatory and positioned on a separate page. The legend should incorporate definitions of any symbols used and all abbreviations and units of measurements should be explained. A letter should be provided stating copyright authorization if figures have been reproduced from another source.

Measurements and Abbreviations

All measurements must be given in metric system (Système International d'Unités, SI). Example: mg/kg, µg/kg, mL, mL/kg, mL/kg/h, mL/kg/min, L/min, mmHg, etc. Statistics and measurements should always be given in numerals, except where the number begins a sentence. When a number does not refer to a unit of measurement, it is spelt out, except where the number is greater than nine.

Abbreviations that are used should be defined in parenthesis where the full word is first mentioned. Some common abbreviations can be used, such as iv, im, po, and sc.

Drugs should be referred to by their generic names, rather than brand names.

Editorial Correspondence

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YAZARLARA BİLGİ

AMAÇ ve KAPSAM

Pediatric Practice and Research Dergisi, dört ayda bir yayımlanır ve üç sayı ile bir cilt tamamlanır. Dergi; pediatri ile ilgili tüm nitelikli klinik ve deneysel araştırmaları, olgu sunumlarını ve editöre mektupları yayımlar.

Pediatric Practice and Research Dergisi, bilimsel yayınlara açık erişim sağlar. Dergi basımından hemen sonra, makalelerin tam metinlerine ücretsiz ulaşılabilir.

Dergide yayımlanmak üzere gönderilen yazıların daha önce başka bir yerde yayımlanmamış veya yayımlanmak üzere gönderilmemiş olması gerekir. Daha önce kongrelerde sunulmuş çalışmalar, bu durum belirtilmek koşuluyla kabul edilir. Makale, yazar(lar) ın daha önce yayımlanmış bir yazısındaki konuların bir kısmını içeriyorsa bu durum belirtilmeli ve yeni yazı ile birlikte önceki makalenin bir kopyası da Yayın Bürosu'na gönderilmelidir.

Gerekli tüm belgelerin sunulduğunu teyit etmek ve dergiye uygunluğunu değerlendirmek için makale ve ek dosyaların ön değerlendirmesini yapmak üzere teknik bir inceleme yapılır. Herhangi bir eksiklik olması halinde makale yazara iade edilecektir. Pediatric Practice and Research Dergisi kör bir inceleme süreci yürütmektedir. Uygun görülen yazılar daha sonra makalenin bilimsel kalitesini değerlendirmek için çalışma alanında en az iki bağımsız uzmana gönderilir. Editör / Editörler makalelerin kabulü veya reddi ile ilgili nihai karardan sorumludur.

Editörün kararı kesindir. Gerekli olduğu durumlarda, yazar(lar) dan düzeltme istenebilir. Yazardan düzeltme istenmesi, yazının yayımlanacağı anlamına gelmez. Bu düzeltmelerin en geç 21 gün içinde tamamlanıp dergiye gönderilmesi gereklidir. Aksi halde yeni başvuru olarak değerlendirilir. Sorumlu yazara yazının kabul veya reddedildiğine dair bilgi verilir.

Dergide yayımlanan yazıların etik, bilimsel ve hukuki sorumluluğu yazar(lar)a ait olup Editör, Editör Yardımcısı ve Yayın Kurulu'nun görüşlerini yansıtmaz.

Dergide yayımlanması kabul edilse de edilmese de, yazı materyali yazarlara geri verilmez. Dergide yayımlanan yazılar için telif hakkı ödenmez. Bir adet dergi, sorumlu yazara gönderilir.

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

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Dergide yayınlanması uygun bulunan tüm yazıların araştırma ve yayın etiğine uygun hazırlandığı, varsa sağlanan fonun kaynağının tanımlandığı, başka yerde yayımlanmadığı veya yayımlanmak üzere gönderilmediği, çalışmaya katılan tüm yazarlar tarafından yazının son halinin onaylandığı, yayımlanacak yazı ile ilgili telif haklarının dergiye devredildiği, tüm yazarların imzaları ile "Yayın Hakkı Devir Formu"nda belirtilmesi gerekir.

Pediatric Practice and Research Dergisi, Uluslararası Tıp Dergileri Editörleri Kurulu'nun (International Committee of Medical Journal Editors) "Biyomedikal Dergilere Gönderilen Makalelerin Uyması Gereken Standartlar: Biyomedikal Yayınların Yazımı ve Baskıya Hazırlanması (Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication)" standartlarını kullanmayı kabul etmektedir. Bu konudaki bilgiye www.icmje.org adresinden ulaşılabilir.

Etik Sorumluluk

Etik Sorumluluk / Kurallar: Klinik araştırma makalelerinin protokolü Etik Komitesi tarafından onaylanmış olmalıdır.

İnsanlar üzerinde yapılan tüm çalışmalarda "Gereç ve Yöntem" bölümünde çalışmanın ilgili komite tarafından onaylandığı veya çalışmanın Helsinki İlkeler Deklarasyonu'na (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/) uyularak gerçekleştirildiğine dair bir cümle yer almalıdır.

Çalışmaya dahil edilen tüm kişilerin Bilgilendirilmiş Onam Formu'nu imzaladığı metin içinde belirtilmelidir.

Pediatric Practice and Research Dergisi'ne gönderilen makalelerdeki çalışmaların Helsinki İlkeler Deklarasyonu'na uygun olarak yapıldığı, kurumsal etik ve yasal izinlerin alındığı varsayılacak ve bu konuda sorumluluk kabul edilmeyecektir.

Çalışmada "Hayvan" öğesi kullanılmış ise yazarlar, makalenin Gereç ve Yöntem bölümünde hayvan haklarını Guide for the Care and Use of Laboratory Animals (www.nap.edu/catalog/5140.html) prensipleri doğrultusunda koruduklarını, çalışmalarında ve kurumlarının etik kurullarından onay aldıklarını belirtmek zorundadır.

Olgu sunumlarında hastanın kimliğinin ortaya çıkmasına bakılmaksızın hastalardan "Bilgilendirilmiş rıza" alınmalıdır.

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Makalede Etik Kurul Onayı alınması gerekli ise; alınan belge makale ile birlikte gönderilmelidir.

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Makale yazarlar tarafından akademik intihal önleme programından geçirilmelidir.

Makalenin etik kurallara uygunluğu yazarların sorumluluğundadır.

İntihal Taraması Politikası

Makaleler, intihal ve etik olmayan durumların belirlenmesi için iThenticate programı kullanılarak Journal tarafından taranır. Pediatric Practice and Research Dergisi intihallere yol açan makaleleri derhal reddedecektir.

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Yazılar, elektronik ortamda www.pprjournal.com adresine gönderilir.

Orijinal makaleler, 3000 sözcük sayısını aşmamalı, "Öz (en fazla 300 kelime), Giriş, Gereç ve Yöntem, Bulgular, Tartışma, Sonuç, Kaynaklar" bölümlerinden oluşmalıdır.

Olgu Sunumu, "Öz, Giriş, Olgu Sunumu, Tartışma, Kaynaklar" şeklinde düzenlenmelidir. En fazla 1000 sözcük ile sınırlıdır. Sadece bir tablo veya şekil ile desteklenebilir.

Editöre Mektup, yayımlanan metinlerle veya mesleki konularla ilgili olarak 500 sözcüğü aşmayan ve beş kaynak ile bir tablo veya şekil içerecek şekilde yazılabilir. Ayrıca daha önce dergide yayınlanmış metinlerle ilişkili mektuplara cevap hakkı verilir.

Yayın Kurulu'nun daveti üzerine yazılanlar dışında derleme kabul edilmez.

MAKALENİN HAZIRLANMASI

Dergide yayınlanması istenilen yazı için aşağıdaki kurallara uyulmalıdır.

a) Yazı; iki satır aralıklı olarak, Arial 10 punto ile yazılmalıdır.
b) Sayfalar başlık sayfasından başlamak üzere, sağ üst köşesinde numaralandırılmalıdır.
c) Online makale sistemine yüklenen word dosyasının başlık sayfasında (makalenin adını içeren başlık sayfası), yazarlara ait isim ve kurum bilgileri yer almamalıdır.
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Yazının Başlığı

Kısa, kolay anlaşılır ve yazının içeriğini tanımlar özellikte olmalıdır.

Özetler

Türkçe (Öz) ve İngilizce (Abstract) olarak yazılmalı, Amaç, Gereç ve Yöntem, Bulgular ve Sonuç (Aim, Materials and Methods, Results, Conclusion) olmak üzere dört bölümden oluşmalı, en fazla 300 sözcük içermelidir. Araştırmanın amacı, yapılan işlemler, gözlemsel ve analitik yöntemler, temel bulgular ve ana sonuçlar belirtilmelidir. Özette kaynak kullanılmamalıdır. Editöre mektup için özet gerekmemektedir.

Anahtar Sözcükler

Türkçe Öz ve İngilizce Abstract bölümünün sonunda, Anahtar Sözcükler ve Keywords başlığı altında, bilimsel yazının ana başlıklarını yakalayan, Index Medicus Medical Subject Headings (MeSH)'e uygun olarak yazılmış en fazla beş anahtar sözcük olmalıdır. Anahtar sözcüklerin, Türkiye Bilim Terimleri'nden (www.bilimterimleri.com) seçilmesine özen gösterilmelidir.

Metin

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

Kaynaklar

Pediatric Practice and Research Dergisi, Türkçe kaynaklardan yararlanmaya özel önem verdiğini belirtir ve yazarların bu konuda duyarlı olmasını bekler.

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

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

Dergilerdeki yazılar

Teke Z, Kabay B, Aytekin FO et al. Pyrrolidine dithiocarbamate prevents 60 minutes of warm mesenteric ischemia/reperfusion injury in rats. Am J Surg 2007;194(6):255-62.

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Ek sayı (Supplement)
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Henüz yayınlanmamış online makale
Butterly SJ, Pillans P, Horn B, Miles R, Sturtevant J. Off-label use of rituximab in a tertiary Queensland hospital. Intern Med J doi: 10.1111/j.1445-5994.2009.01988.x

Kitap
Örnek 1: Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.
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Kitap bölümü
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Yazar olarak bir kuruluş
The Intensive Care Society of Australia and New Zealand. Mechanical ventilation strategy in ARDS: Guidelines. Int Care J Aust 1996;164:282-4.

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

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

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

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

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

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

İlaçların yazımında jenerik isimleri kullanılmalıdır.

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ORİJİNAL ARAŞTIRMA
ORIGINAL ARTICLE

Çocuk Acil Servisine Başvuran Zehirlenme Vakalarının Retrospektif Olarak Değerlendirilmesi

Retrospective Evaluation of Poisoning Cases Admitted to Pediatric Emergency Unit

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Öz

Amaç: Çocukluk çağı zehirlenmeleri önemli bir halk sağlığı sorunudur. Zehirlenme vakaları, ailelerin bilinçlenmesi, tıbbi gelişmeler gibi faktörlerle yıllar içinde farklılık gösterebilmektedir. Bu konuda yapılan çalışmalar, hastaların tanı ve tedavilerine ışık tutmakta hem de hasta mortalite ve morbiditesi olumlu yönde etkilenmektedir. Biz de bölgesel zehirlenme profilimizi belirlemek, erken tanı ve tedavi yaklaşımları konusunda farkındalığı artırmak amacıyla bu çalışmayı planladık.

Gereç ve Yöntem: Ocak 2016 ve Mayıs 2020 tarihleri arasında, hastanemiz çocuk acil servisine başvuran ve zehirlenme tanısıyla izlenen 472 vakanın klinik ve epidemiyolojik özellikleri hastane kayıtları üzerinden tarandı ve incelendi.

Bulgular: Acil servise başvuran 472 zehirlenme vakasının %47.3'ü kız, 52.7'si erkekti. Zehirlenme etkeninin %87.1 oranında oral yolla alındığı, %12,9'nun inhalasyon yoluyla aldığı belirlendi. Vakaların en sık 0-5 yaş grubunda görüldüğü tespit edildi (%73). Majör zehirlenme etkeninin kostik/koroziv maddelerin olduğu (%42,8), bunu ilaçların takip ettiği görüldü (%30,5). İlaçlardan en sık parasetamol zehirlenmesi görüldü (%6.1). 0-23 ay ve 2-5 yaş çocuklarda majör zehirlenme etkenin kostik/koroziv maddeler (%48 ve %33,7) olduğu, 6-11 yaş çocuklarda ise majör etkenin ilaç dışı maddeler (%59) olduğu, bu etken madde grubunda en sık CO zehirlenmesi olduğu görüldü (%12.5). Zehirlenmelerin sıklıkla kaza sonucu meydana geldiği belirlendi (%95.1). Ergenlerde, kızlarda intihar oranının erkeklerden anlamlı derecede yüksek olduğu görüldü. 472 hastanın 13'ü (%2,8) dış merkeze sevk edildi, kliniğimizde takip edilen 459 hastadan 1 hasta intihar amaçlı ilaç alımı sonrası yoğun bakımda takibe alındı ve exitus oldu.

Sonuç: Çocukluk çağı zehirlenmelerinde 0-5 yaş grubu risk altındadır ve kostik/koroziv maddelerin evde uygun şekilde saklanması önemlidir. İntihar oranlarının arttığı 12 yaş üstü çocukların psikososyal gelişimleri yakından takip edilmeli, gerekli hallerde uzman desteği almaları için yönlendirilmelidir.

Anahtar Kelimeler: Çocukluk çağı, mortalite, zehirlenme

Abstract

Aim: Childhood poisoning is an important public health problem. Poisoning cases may vary over the years due to factors such as family awareness and medical developments. Studies conducted on this subject shed light on both the diagnosis and treatment of patients and positively affect patient mortality and morbidity. We planned this study to determine our regional poisoning profile and raise awareness about early diagnosis and treatment approaches.

Material and Method: Clinical and epidemiological characteristics of 472 cases who admitted to our pediatric emergency department between January 2016 and May 2020 with the diagnosis of intoxication were retrospectively reviewed from hospital records.

Results: Of the 472 poisoning cases, 47.3% were female and 52.7% were male. It was found that 87.1% of the poisonous substances were ingested orally and 12.9% by inhalation. The most common age group was 0-5 years (73%). The most common poisoning agent was caustic/corrosive substances (42.8%), followed by drugs (30.5%). In children aged 0-23 months and 2-5 years, the main poisoning agent was caustic/corrosive substances (48% and 33.7%), whereas in children aged 6-11 years, the main poisoning agent was non-drug substances (59%), followed by CO poisoning (12.5%). Accidental exposure was found to be the most common cause of poisoning (95.1%). Among adolescents, the suicide rate was significantly higher in girls than in boys. Out of 472 patients, 13 (2.8%) were referred to an external centre, and rest of the patients followed up in our clinic, 1 patient was admitted to intensive care after taking drugs with suicidal intent and died.

Conclusion: Proper storage of caustic/corrosive substances and pharmaceuticals at home is very important. The psychosocial development of children over the age of 12, where suicide rates increase, should be closely monitored and they should be directed to receive specialized support when necessary.

Keywords: Childhood, mortality, poisoning

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GİRİŞ

Çocukluk çağı zehirlenmeleri önemli bir halk sağlığı sorunudur. Ülkemizde ve dünyada her yıl binlerce çocuk zehirlenme sebebi ile sağlığını kaybetme tehlikesi ile karşı karşıya kalmaktadır.

Zehirlenmeler; trafik kazası, yanıklar, boğulma ve düşmeyi takiben, en sık kaza sonucu ölüme sebebiyet veren durumlar arasında yer almaktadır (1). Zehirlenmeye bağlı ölüm oranı gelişmiş ülkelerde %1 seviyelerinde iken gelişmekte olan ülkelerde bu oran %3-%5 arasındadır (2,3). Amerika Birleşik Devletleri zehir kontrol merkezinin çalışmalarında bu oran %0,036 olarak bildirilmiştir (4). Zehirlenme vakalarıyla ilgili ülkemizde yapılan çalışmalar sonucunda mortalite oranı yaklaşık %0,4 ila %5 arasında saptanmıştır. Yine bu çalışmalar sonucunda ülkemizde zehirlenmelerin düşme, trafik kazası ve yanıklardan sonra dördüncü sıklıkta görülen kaza grubu olduğu kaydedilmiştir (5). Önleyici yaklaşımlar ve tedavi yöntemlerinin geliştirilmesi ile ölüm oranları gelişmiş ülkelerde azalmaktadır (6,7).

Zehirli maddenin organizmaya alınışı oral alım, solunum yolu, damar içi yol ve deri /mukoza teması şeklinde dört yolla olabilmektedir (8). Çocukluk çağı zehirlenmelerinde tablo asemptomatik başlayıp hızlı bir şekilde dramatik bozulmaya doğru gidebilmektedir. Tablonun seyrini etkileyen birçok faktör bulunmaktadır. Bunlar arasında toksik maddenin türü, miktarı, formülasyonu ve etkinliği, maruz kalma yolu, çocuğun yaşı, çocuğun kilosu, eşlik eden hastalık varlığı, böbrek fonksiyon testlerinin durumu, çoklu zehirlenme olup olmaması ve tedavinin başlama zamanı gibi faktörler sayılabilir (9).

Biz çalışmamızda, çocuk acil servisimize başvuran ve zehirlenme tanısı ile izlenen vakaların sosyodemografik, klinik ve laboratuvar bulgularını retrospektif olarak incelemeyi ve diğer çalışmalarla karşılaştırmayı amaçladık. Böylelikle bölgesel zehirlenme profilimizi oluşturup erken tanı ve tedavi yaklaşımları konusunda farkındalığı arttırarak pediyatrik zehirlenmelerin önlenebilmesine katkıda bulunmayı hedefledik.

GEREÇ VE YÖNTEM

Bu çalışmada Ocak 2016 ve Mayıs 2020 tarihleri arasında, Necmettin Erbakan Üniversitesi Tıp Fakültesi Çocuk Acil Servis'e başvuran ve zehirlenme tanısıyla izlenen 0-17 yaş arası vakaların hastane kayıtları retrospektif olarak tarandı ve incelendi. Bilgilerine ulaşılabilen hastaların kayıtlarından elde edilen klinik ve epidemiyolojik veriler değerlendirilip hasta takip formlarına kaydedildi. Hastaların tanıları otomasyon sistemine T36-T65 arası ICD kodları girilerek taratıldı.

Hastalar 0-23 ay, 2-5 yaş, 6-11 yaş, 12-17 yaş olacak şekilde dört ayrı yaş grubuna ayrıldı. Kaydedilen demografik ve klinik veriler arasında hastanın yaşı, cinsiyeti, doğum tarihi, başvuru yılı ve mevsimi, başvuru şekli, hasta öyküsü, semptomları, fizik muayene bulguları ve uygulanan tedaviler yer aldı.

Zehirlenme etkenlerine göre vakalar ilaçlar, kostik/korozif maddeler ve ilaç dışı ajanlarla zehirlenen vakalar olarak 3 gruba ayrıldı. İlaç ile zehirlenen vakaların ilaç etkeni kaydedildi. İlaç dışı ajanlar ise kendi içerisinde organofosfatlar, bitkiler, mantarlar, karbon monoksit, hidrokarbon, naftalin, tiner, aseton, fare zehri, insektisit, alkol (etanol-metanol), uyuşturucu ve diğer kimyasallar şeklinde gruplandırıldı. Kostik/korozif madde alt grubu da kozmetik maddeleri, temizlik ürünleri ve piller ile zehirlenen vakalar olmak üzere üçe ayrıldı.

İstatistiksel Analiz

Tüm istatistiksel analizler SPSS 23 (Statistical Package for Social Science) programı ile yapıldı. Kategorik değişkenler için frekans, yüzde değerleri verildi. Sürekli değişkenler için ortalama, standart sapma, medyan, minimum ve maksimum değerleri verildi. Sürekli değişkenlerin normal dağılım sınaması Kolmogorov Smirnov testi ile yapıldı. Kategorik değişkenler arası ilişkiler için Ki-kare analizi ile yapıldı. Uygun olan durumlarda kategorik değişkenler Fisher Freeman Halton Testi ile değerlendirildi. $P < 0.05$ değerleri istatistiksel olarak anlamlı kabul edildi.

BULGULAR

Çocuk acil servisimize Ocak 2016 ve Mayıs 2020 tarihleri arasında başvuran ve zehirlenme tanısıyla izlenen 0-17 yaş arası hastalardan hastane kayıtlarına ulaşılabilen 472 hasta çalışmaya dahil edildi. Olguların 249'unun erkek (% 53) ve 223'ünün kız (%43) olduğu görüldü. Hastaların yaş ortalaması 4,86±4,76 yıl [0,04-17,79] ve medyan yaş değeri ise 2,55 yıl olarak bulundu. Hastaların birçoğunun 0-23 ay yaş grubunda (n=175, %37,1) ve 2-5 yaş grubunda (n =170, %36) olduğu, az sayıda olgunun ise 12 yaşından büyük olduğu (n = 65, %13,8) belirlendi.

Olgularının %91,5'ü (n=432) bireysel, %8,5'i (n=40) ise 112 Acil ambulansıyla kliniğimize getirilmişti. En sık başvurunun 2016 yılında ve kış mevsiminde olduğu görüldü. Hastaların demografik özellikleri **Tablo 1**'de verilmiştir

Olgularda zehirlenme etkeninin %87.1 oranında oral yolla alındığı (n:411), %12,9'nun inhalasyon yoluyla aldığı belirlendi (n=61). Hastaların büyük çoğunluğunun kaza sonucu zehirlendiği (n=449, %95,1), 19'nun intihar maksadıyla kendini zehirlediği (%4,0) tespit edildi. 4 olgunun ise (%0,9) uyuşturucu kullanımı sonucunda zehirlendiği belirlendi. Zehirlenme etkenlerinin dağılımı **Tablo 2**'de verilmiştir.

Tablo 1. Hastaların demografik verileri

Parametre	n=472
Cinsiyet, n (%)	
Kız	223 (47,25)
Erkek	249 (52,75)
Yaş, n (%)	
Ortalama ± Standart Sapma(SS)	4,86 ± 4,76
Medyan [Min-Maks]	2,55 [0,04-17,79]
Yaş Grupları, n (%)	
0-23 ay	175 (37,1)
2-5 yaş	170 (36)
6-11 yaş	62 (13.1)
12-17 yaş	65 (13,8)
Başvuru Yılı, n (%)	
2016	140(29,7)
2017	127(26,9)
2018	88 (18,6)
2019	51 (10,8)
2020	66 (14,0)
Başvuru Mevsimi, n (%)	
Kış	133(28,2)
İlkbahar	132(28,0)
Yaz	109(23,1)
Sonbahar	98(20,8)
Başvuru Şekli, n (%)	
112 Acil	40(8,5)
Bireysel	432 (91,5)
Ön Müdahale, n (%)	
Yapılmamış	429 (90,9)
Kusturma	13 (2,8)
Süt/Su/Ayran İçirme	9 (1,9)
Mide yıkama	4 (0,9)
Aktif Kömür	3 (0,6)
Mide yıkama + Aktif kömür	14 (3,0)
İzlem Yeri, n (%)	
Acil Gözlem	455 (96,3)
Acil Gözlem+ Genel servis	2 (0,4)
Yoğun Bakım	2 (0,4)
Sevk Edildi	13 (2,8)
Prognoz, n (%)	
Exitus	3 (0,6)
Taburcu	456 (96.6)
Sevk edildi/Bilinmiyor	13 (2,8)
Başvurudan ne kadar süre önce aldığı (saat) Ortalama ± SS	2,83 ± 6,5
İzlem Süresi (saat) Ortalama ± SS	9,60 ± 23,7

Tablo 2. Zehirlenme Etkenlerinin Dağılımı

Zehirlenme etkeni	
İlaçlar	144 (30,5)
Kostik /koroziv maddeler	202 (42,8)
Diğer	126 (26,7)
İlaçlar, n (%)	
Parasetamol	29 (6,1)
Nonsteroid	10 (2,1)
SSRI benzeri antidepresanlar	3 (0,6)
Trisiklik antidepresanlar	3 (0,6)
Antimikrobiyaller	8 (1,7)
Astım ilaçları	2 (0,4)
Antihistaminikler	2 (0,4)
Vitaminler	6 (1,3)
Antipsikotikler	2 (0,4)
Antiepileptik	6 (1,3)
Aspirin	2 (0,4)
Metilfenidat	1 (0,2)
Parasetamol + Nonsteroid	2 (0,4)
Kas gevşetici	2 (0,4)
Oral antidiyabetik	5 (1,1)
Hormon-steroid	12 (2,5)
Kolşisin	2 (0,4)
KVS ilaçları	7 (1,5)
Demir preparatları	5 (1,1)
Topikal ajanlar	9 (1,9)
Antibiyotik+antihistaminik	1 (0,2)
Diğer	24 (5,1)
Bilinmiyor	1 (0,2)
Kostik/Korozif Maddeler, n (%)	
Kozmetik	11 (2,3)
Temizlik Ürünleri	188 (39,8)
Piller	3 (0,6)
Diğer, n (%)	
Organofosfatlar	5 (1,1)
Bitkiler mantarlar	9 (1,9)
Karbonmonoksit	59 (12,5)
Hidrokarbon/ Naftalin	3 (0,6)
Tiner/ Aseton	11 (2,3)
Fare zehiri	3 (0,6)
İnsektisit	3 (0,6)
Alkol (etanol-metanol)	8 (1,7)
Uyuşturucu	4 (0,9)
Diğer kimyasallar	21 (4,5)

Zehirlenme etkeninin mevsimlere göre dağılımı istatistiksel anlamlı farklılık gösterdi (p=0,0055). Kış ve ilkbahar aylarında en sık zehirlenme etkeni ilaçlar iken, kostik/korozif maddeler en sık ilkbahar ve sonbahar aylarında tespit edildi.

Zehirlenmelerin sıklıkla kaza sonucu meydana geldiği belirlendi (n=449). Ergenlerde, kızlarda intihar oranının erkeklerden anlamlı derecede yüksek olduğu görüldü (p=0,011) (**Tablo 3**). Çalışma grubunun mortalite durumu incelendiğinde, 13 yaşında bir kız çocuğunun propofenon alarak intihar ettiği ve 5 ve 9 yaşlarında iki erkek çocuğun ise karbonmonoksit zehirlenmesi sonucu öldüğü belirlendi. Dört kız ve dokuz erkek hasta, farklı kurumlara sevk edildiği için takip edilemedi.

Tablo 3. Zehirlenme sebebine göre cinsiyet, yaş, mortalite ve izlem yeri dağılımlarının karşılaştırılması

Parametre	Zehirlenme Sebebi, n (%)			p değeri
	Kaza ile (n= 449)	İntihar (n=19)	Madde kötüye kullanımı (n=4)	
Cinsiyet				
Kadın	209 (46,5)	14 (73,7)*	0 (0)	0,011
Erkek	240 (53,5)	5 (26,3)	4 (100)	
Yaş Grubu				
0-23 ay	175 (39)	0	0 (0)	<0,0001
2-5 yaş	170 (37.8)	0	0 (0)	
6-11 yaş	62 (13,8)	0	0 (0)	
12-17 yaş	42 (9,4)	19 (100)*	4 (100)	
İzlem yeri				
Acil Gözlem	437 (97,3)	16 (84,2)	4 (100)	0,0221
Acil Dışı Gözlem	12 (2,7)	3 (15,8)	0 (0)	
Mortalite				
Yok	436 (97,1)	16 (84,2)	4 (100)	0,0221
Var	2 (0,4)	1 (5,3)	0 (0)	

Çalışmamızın son 5 aylık süresi COVID19 pandemisindeki vakaları içermektedir. Ülkemizdeki etkileri mart 2020 itibarı ile görülmeye başladığından son 3 aylık hastalar pandemi öncesi ve sonrası olarak karşılaştırılmıştır. Vakalar yaş grupları, alım nedeni ve zehirlenme etkeni açısından karşılaştırıldığında anlamlı fark saptanmamıştır. (**Tablo 4**).

Tablo 4. Pandemi öncesi dönem ve pandemi döneminde zehirlenme vakalarının karşılaştırılması

Parametre	Pandemi Öncesi (n = 441)	Pandemi Esnasında (n = 31)	p değeri
Yaş Grubu			0,388
0-23 ay	164 (37,1)	11 (35,4)	
2-5 yaş	159 (36,1)	11 (35,4)	
6-11 yaş	60 (13,6)	2 (6,4)	
12-17 yaş	58 (13,2)	7 (22,5)*	
Zehirlenme Etkeni			0,103
İlaçlar	130 (29,5)	14 (45,1)	
Kostik/Korozif Maddeler	189 (42,8)	13 (41,9)	
Diğer	122 (27,7)	4 (13)	
Alım Nedeni			0,611
Kaza	420 (95,2)	29 (93,5)	
İntihar	17 (3,9)	2(6,5)	
Madde kötüye kullanımı	4 (0,9)	0 (0)	

TARTIŞMA

Çocukluk çağı zehirlenmeleri önemli bir halk sağlığı sorunudur. Zehirlenme vakaları yıllar içinde ailelerin bilinç ve eğitim durumlarının değişmesi, farkındalığın artması ve sürekli ve hızlı olan tıbbi gelişmeler gibi faktörlere bağlı olarak yıllar içinde farklılık gösterebilmektedir. Bu sebeple uygun zaman aralıklarında çalışmalar yapılarak her bölgenin zehirlenme profili belirlenmeli, zehirlenme vakalarının önlenmesi ve erken tedavisinin planlanması sağlanmalıdır. Bu konuda yapılan çalışmalar hastaların hem tanı hem de tedavilerine ışık tutmakta hem de hasta mortalite ve morbiditesi olumlu yönde etkilenmektedir. Biz de bu çalışmamız ile bu konulara katkı sağladığımızı düşünüyoruz.

Çalışmamızda zehirlenme olgularının %52,75'i erkek ve %47,25'i kız idi. Vakaların büyük çoğunluğunun 0-23 ay yaş grubunda (%37,1) ve 2-5 yaş aralığında (%36) olduğu, az bir kısmının ise 12 yaşından büyük olduğu (%13,8) tespit edildi. Elde ettiğimiz veriler daha önce yapılan çalışmalarla benzerlik göstermektedir.

Ülkemizde yapılan çalışmalarda zehirlenmelerin çoğunluğunun (%75 -%95) oral yolla meydana geldiği belirlenmiştir. Oral alımı sırasıyla, solunum, deri ve mukoza yolu ile olan zehirlenmeler izlemiştir (10). Literatürde olduğu gibi, çalışmamızda majör zehirlenme yolunun oral alım olduğu (%87,1) ve vakaların sadece %12,9'unun inhalasyon yoluyla zehirlendiği belirlenmiştir.

Genel olarak çocukluk çağı zehirlenmelerinin %80-85'i kazalara bağlı olurken, %5-20'si ise intihar amaçlı olmaktadır (11). Bizim çalışmamızda, vakaların %95,1'inin kaza sonucu, %4.8'inin ise intihar amaçlı zehirlendiği görülmüştür. 0-11 yaş aralığındaki çocukların neredeyse tümünün kaza sonucu zehirlendiği fakat 12 yaş üzeri çocukların %29'unun intihar amacıyla ve %6'sının madde kötüye kullanımı ile kendini zehirlediği tespit edilmiştir. Literatürle uyumlu olarak, vakalarımızdan kaza sonucu zehirlenmelerin çoğunun, hareketliliğin arttığı, araştırma ve öğrenme merakının geliştiği 0-5 yaş arasında olduğu görüldü.

İlaç alımı, yüksek gelirli ülkelerde, çocukluk çağı zehirlenmelerin önde gelen nedenlerinden biridir (12). Ülkemizde çocuk zehirlenme olgularının değerlendirildiği diğer çalışmalarda zehirlenme etkenlerinin ilk sırasında genellikle ilaçlar yer almıştır (13,14). Bizim çalışmamızda ilaçlar 2. sırada yer almaktadır. Çalışmamızda en sık zehirlenme etkeni kostik/korozif maddeler idi ve bunların çoğu temizlik ürünleriydi. Çalışmamızda en sık zehirlenmeye neden olan ilaç ise parasetamol (%6,1) idi. Parasetamol içeren ilaçlar, hastalıklarda en sık kullanılan ve kolay ulaşılabilen ilaçlardır ve zehirlenmelerde ciddi akut karaciğer hasarlarına yol açabilmektedir.

Karbon monoksit (CO) zehirlenmesi, ülkemizde ve tüm dünyada zehirlenmeye bağlı morbidite ve mortalitenin en yaygın nedenlerinden biridir (13).Karbon monoksit zehirlenme oranları bölgenin sosyoekonomik seviyesine, bölgede doğalgaz mevcudiyetine, şofben ve soba kullanım sıklığına göre değişebilmektedir (11). Vakalarımızın %12,5'inde karbon monoksit zehirlenmesine rastladık, bu oranın Konya ilimiz için düşük olduğunu ve bunun sebebinin de, bu vakaların, ilimizde hiperbarik oksijen tedavisi uygulanabilen bir başka merkeze sevk edilmesi olduğunu düşünüyoruz.

Çalışmamızda, zehirlenme sonrası tüm hastane başvuruları 0-72 saat içinde yapılmış ve 300 hasta (%63,6) ilk 1 saatte başvurmuştur. Ülkemizin batı ve güney bölgelerinde zehirlenme vakalarının hastaneye erken getirildiği, doğu ve kuzey bölgelerinde ise acil servise başvuruların geç yapıldığı belirtilmiştir. Farklı bölgelerde arazi şartlarının olumsuzluğu ve ulaşımın kötü olmasına bağlı olarak sağlık hizmetlerinin uzaklığı ve yetersizliği, o bölgelerde yaşayanların sosyoekonomik ve eğitim düzeyinin bu süreyi etkilediği bilinmektedir (15).

Çocukluk çağı zehirlenme olgularında yaş grubu, hastaneye başvuru süresi, zehirlenme etkeninin cinsi ve miktarı mortaliteye etki eden en önemli faktörlerdir (16). Gelişmiş ülkelerde zehirlenmelerde mortalite oranı %0,4 ile %1 aralığında iken, gelişmekte olan ülkelerde %1,8 ile %11,6 arasında değiştiği bildirilmiştir (17). Ülkemizde yapılan bazı çalışmalarda çocukluk çağında zehirlenme sebebiyle mortalite görülmezken, bazı çalışmalarda ise %0,3-5,5 arasında mortalite bildirilmiştir (18,19). Dünyada yapılan bazı çalışmalarda da mortalite görülmemiştir ve bu durumun vakaların çoğunun kazayla küçük miktarlarda veya minimal toksisitede maddelerin yutulmasına bağlı olduğu savunulmuştur (20). Bizim çalışmamızda 2'si erkek 1'i kız çocuğu olmak üzere 3 hasta exitus olmuştur. Beş ve 9 yaşlarında iki erkek kardeş, karbon monoksit zehirlenmesine bağlı olarak acil serviste; 13 yaşında bir kız çocuğu ise propofenon etken maddeli ilaç ile intihar sonucunda yoğun bakımda exitus olmuştur.

Çalışma Kısıtlılıkları

Çalışmamızın retrospektif olmasına bağlı olarak, hastaların verilerinin eksik veya kaydedilememiş olması veya tanıların yanlış girilmesi sebebiyle tüm hastaların çalışmaya alınamamış olması mümkündür ve bu çalışmamızın bir kısıtlaması olabilir. Ayrıca sevk edilen 13 hastanın takip edilememiş olması, diğer bir kısıtlamamızdır.

SONUÇ

çocukluk çağı zehirlenmeleri genellikle 0-5 yaş grubunda meydana gelmektedir. Çocuklarda, kostik/korozif maddeler ve ilaçlar zehirlenmenin en yaygın nedenleridir. Kostik/korozif maddelerin ve ilaçların evde uygun şekilde saklanması çok önemlidir. İntihar oranlarının arttığı 12 yaş üstü çocukların psikososyal gelişimleri yakından takip edilmeli, gerekli hallerde uzman desteği almaları için yönlendirilmelidir. Zehirlenme vakalarının asgariye indirilebilmesi, zehirlenme durumu gerçekleştiğinde erken başvuru ve ön müdahalelerin yapılabilmesi için toplumun bilinçlendirilmesi çok önemlidir. Hem bu bilinçlendirmeye ışık tutması için, hem de zehirlenmeye bağlı mortalite ve morbidite oranlarının en aza indirilebilmesi için uygun aralıklarla güncel çalışmaların yapılması önem arz etmektedir.

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Aydınlatılmış Onam: Çalışma retrospektif olarak dizayn edildiği için hastalardan aydınlatılmış onam alınmamıştır.

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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Evaluation of Anemia Distribution According to Erythrocyte Morphology in Hospitalized Children

Hastanede Yatırılarak Takip Edilen Çocuklarda Eritrosit Morfolojisine Göre Anemi Dağılımının Değerlendirilmesi

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ABSTRACT

Aim: While the prevalence of anemia among hospitalized children varies in the literature, there is currently a lack of studies in our region that specifically examine the distribution of anemia based on erythrocyte morphology. Therefore, our aim was to compare the prevalence of anemia based on sex and age distribution among children undergoing hospitalization in our region and investigate the distribution of anemia according to erythrocyte morphology.

Material and Method: Children aged between 6 months and 18 years who were only hospitalized and followed up in the Department of Pediatrics at the Health Sciences University Konya Beyhekim Training and Research Hospital between January 2021 and March 2024 were retrospectively analyzed.

Results: Of the 1148 children hospitalized in the pediatric clinic, 876 (76.3%) had hemoglobin levels within the reference range for their age, while 272 (23.7%) were found to have anemia. A statistically significant difference was observed in the presence of anemia among age groups, with the 6 months-<2 years and 2-<6 years age groups differing significantly from the other age groups (p: 0.001).

Conclusion: Our study results indicated that mild anemia was the most common type of anemia detected in hospitalized children, with the highest frequency observed in the 6 months-<2 years age group, and microcytic anemia was the most common type based on erythrocyte morphology. Hemogram analysis, which is a simple and cost-effective method, can assist in classifying anemia based on erythrocyte morphology. This can facilitate further testing for the underlying etiology in patients diagnosed with anemia.

Keywords: Anemia, red cell morphology, hospitalized children, hemogram, prevalence

ÖZ

Amaç: Hastanede yatan çocuklar arasındaki anemi yaygınlığı literatürde değişmekle birlikte, bölgemizde eritrosit morfolojisine dayalı anemi dağılımını özellikle inceleyen çalışmaların eksikliği bulunmaktadır. Bu nedenle amacımız, bölgemizde hastaneye yatırılan çocuklar arasında cinsiyet ve yaş dağılımına göre anemi yaygınlığını karşılaştırmak ve eritrosit morfolojisine göre anemi dağılımını araştırmaktı.

Gereç ve Yöntem: Ocak 2021 ile Mart 2024 tarihleri arasında Sağlık Bilimleri Üniversitesi Konya Beyhekim Eğitim ve Araştırma Hastanesi Çocuk Hastalıkları Bölümü'nde yalnızca hastaneye yatırılan ve takip edilen 6 ay ile 18 yaş arasındaki çocuklar retrospektif olarak analiz edildi.

Bulgular: Pediatri kliniğinde yatırılan 1148 çocuktan, 876'sının (%76.3) yaşlarına göre referans aralıkta hemoglobin seviyelerine sahip olduğu, 272'sinde (%23.7) ise anemi olduğu belirlendi. Yaş grupları arasında anemi varlığında istatistiksel olarak anlamlı farklılık gözlendi, 6 ay-<2 yaş ve 2-<6 yaş aralığındaki grupların diğer yaş gruplarından önemli ölçüde farklı olduğu görüldü (p: 0.001).

Sonuç: Çalışmamızın sonuçları, hastanede yatırılan çocuklarda tespit edilen aneminin en yaygın türünün hafif anemi olduğunu gösterdi. En yüksek sıklığın 6 ay-<2 yaş grubunda olduğu ve eritrosit morfolojisine dayalı olarak mikrositik aneminin en yaygın tür olduğu belirlendi. Hemogram analizi, basit ve maliyet etkin bir yöntem olup, eritrosit morfolojisine dayalı anemi sınıflandırmasında yardımcı olabilir. Bu, anemi tanısı konmuş hastalarda temel etiyoloji için daha fazla test yapılmasını kolaylaştırabilir.

Anahtar Kelimeler: Anemi, kırmızı küre morfolojisi, hastanede yatan çocuklar, hemogram, prevalans

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INTRODUCTION

Childhood anemia, a persistent public health issue in developing nations, is characterized by a decrease in red blood cell mass or hemoglobin (Hb) concentration (1).

Anemia is known to be a potential cause of death in developing nations, especially in hospitalized children under five years old. In Tanzania, frequency rates of anemia have been reported to be approximately 77% (2,3).

The most frequent reason for childhood anemias is iron deficiency anemia, often preventable in the absence of additional medical history. Other nutritional deficiencies such as vitamin B12 and folate similarly fall among preventable causes of anemia. Childhood represents a period of rapid growth and development, where issues related to anemia can have lasting consequences, emphasizing the importance of preventive measures over treatment. Given the severe impact of childhood anemia, screening programs are recommended for monitoring and supporting its treatment, particularly in children under two years old, as anemia significantly affects growth, development, and cognitive functions, underscoring the crucial role of early diagnosis and treatment (4).

Hematological analyses, including complete blood count, are routinely conducted across various healthcare facilities in our country, facilitating the prompt diagnosis of anemia. Although the literature shows varying rates of anemia among hospitalized children, there is currently a lack of studies in our region that specifically examine the distribution of anemia based on erythrocyte morphology. Therefore, our aim was to compare the prevalence of anemia based on sex and age distribution among children undergoing hospitalization in our region and investigate the distribution of anemia according to erythrocyte morphology.

MATERIAL AND METHOD

Retrospective analysis was done on children between the ages of 6 months and 18 years who were hospitalized and monitored in the pediatric department at the Konya Beyhekim Training and Research Hospital between January 2021 and March 2024. Patient data were obtained from the hospital's records system. Individuals over 18 years of age and children under 6 months of age were excluded from the study. Those with known chronic illnesses were also not included.

To compare the distribution of anemia among different age groups, patients were divided into four groups based on age ranges: 6 month-<2 years, 2-<6 years, 6-12 years, and >12 years.

Hemogram analysis was performed utilizing the flow cytometric method on the Shenzhen Mindray Auto Haematology Analyzer BC-6800 (Shenzhen, China). Parameters including Hb, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and red cell distribution width (RDW) were evaluated based on established reference ranges for the study cohort. The diagnostic criteria for anemia were in accordance with the guidelines set forth by the World Health Organization (5). Specifically, anemia was defined as Hb levels falling below 11 g/dL for children aged 2.1-4.9 years, below 11.5 g/dL for children aged 5-11.9 years, below 12 g/dL for females aged 15 years and older, and below 13 g/dL for males aged 15 years and older.

Classification of anemia based on red cell morphology categorized individuals into microcytic if their MCV values were below the age- and sex-specific normal range, normocytic if MCV values were within the normal range, and macrocytic if MCV values were above the normal range. The Mentzer index was calculated as the ratio of MCV to red blood cell count. Anemia severity was stratified as mild for Hb levels between 10.0-10.9 g/dL, moderate for levels between 7.0-9.9 g/dL, and severe for levels ≤6.9 g/dL (5,6).

This study was approved by KTO-Karatay University Pharmaceutical and Non-Medical Device Research Ethics Committee (Date:09.05.2024, Decision No: 2024/030).

Statistical Analysis

Statistical Package for Social Sciences for Windows Version 16.0, or SPSS 23.0, was used to perform the statistical analysis of the data. Descriptive statistics were reported as mean±standard deviation (SD) for numerical variables that fit into a normal distribution, and as median (range) for variables that didn't. The presentation of categorical variables consisted of counts and percentages (%). For categorical variables, group comparisons were carried out using Fisher's exact test and the chi-square test. We evaluated the normality of numerical parameters by applying the Shapiro-Wilk and Kolmogorov-Smirnov tests. For variables with a normal distribution, the t-test and ANOVA variance analysis were used to examine differences between group means; for variables without a normal distribution, the Mann-Whitney U test and Kruskal-Wallis test were employed. The outcomes were deemed statistically significant. For p-values less than 0.05, the results were deemed statistically significant.

RESULTS

Among the patients, 622 (54.2%) were male and 526 (45.8%) were female. The age was 5.25±4.05 years (median age 4.4, minimum-maximum age 0.7-17.8), with males having an average age of 5.29±4.14 years and females 5.21±3.94 years. Regarding the age distribution by sex, there was no significant difference (p: 0.184). The distribution of demographic and laboratory characteristics of the patients by sex is presented in **Tables 1** and **2**. Of the patients, 876 (76.3%) had Hb levels within the reference range for their age, while 272 (23.7%) were found to have anemia. Among

those with anemia, 149 (54.8%) were male and 123 (45.2%) were female. There was no discernible variation in the frequency of anemia between the sexes (p: 0.428). When examining the severity of anemia based on Hb levels, 209 patients (18.2%) had mild anemia, 62 (5.4%) had moderate anemia, and 1 had severe anemia. There was no statistically significant difference in the level of anemia by sex (p: 0.152).

Table 1. Demographic and laboratory characteristics of the hospitalized children according to sex

Variable	Males	Females	Total	p
Year				0.623
2021	51 (56.0)	40 (44.0)	91 (7.9)	
2022	224 (54.8)	185 (45.2)	409 (35.6)	
2023	282 (54.8)	233 (45.2)	515 (44.9)	
2024	65 (48.9)	68 (51.1)	133 (11.6)	
Age groups				0.195
6 months-2 years	170 (58.8)	119 (41.2)	289 (25.1)	
2.0-6.0 years	240 (51.2)	229 (48.8)	469 (40.9)	
6.0-12.0 years	153 (53.3)	134 (46.7)	287 (25.0)	
>12.0 years	59 (57.3)	44 (42.7)	103 (9.0)	
Hemoglobin				0.438
Normal	473 (54.0)	403 (46.0)	876 (76.3)	
Anemia	149 (54.8)	123 (45.2)	272 (23.7)	
Anemia Status				0.152
Mild	108 (51.7)	101 (48.3)	209 (18.2)	
Moderate	41 (66.1)	21 (33.9)	62 (5.4)	
Severe	0 (0)	1 (100.0)	1 (0.1)	
MCV level				0.112
<80 fL	416 (57.5)	308 (42.5)	724 (63.1)	
81-100 fL	206 (48.6)	218 (51.4)	424 (36.9)	
RDW level				0.001
Normal	422[a] (51.1)	404[a] (48.9)	826 (71.9)	
Increased	200[b] (62.1)	122[b] (37.9)	322 (28.1)	
Platelet count				0.276
Normal	528 (54.9)	434 (45.1)	962 (83.8)	
Thrombocytosis	94 (50.5)	92 (49.5)	186 (16.2)	
Mentzer index				0.173
< 13	47 (66.2)	24 (33.8)	71 (6.2)	
>13	575 (53.4)	502 (46.6)	1077 (93.8)	
Total	622 (54.2)	526 (45.8)	1148 (100.0)	

Regarding age groups, 289 patients (25.1%) were aged 6 months-<2 years, 469 (40.9%) were aged 2-<6 years, 287 (25.0%) were aged 6-12 years, and 103 (9.0%) were aged >12 years. The distribution of demographic and laboratory characteristics of the patients by age groups is shown in **Tables 3** and **4**. When analyzing the distribution of anemia by age group, Upon examining the anemia distribution by age group, it was found that 131 patients (48.2%) belonged to the 6 months–<2 years age group, 108 patients (39.7%) to the 2-<6 years age group, 27 patients (9.9%) to the 6–12 years age group, and 6 patients (2.2%) to the age group exceeding 12 years. Anemia frequency varied among age groups in a statistically significant way, with the 6-month–2-year and 2-<6-year age groups significantly different from the other age groups (p: 0.001) (**Table 3**).

The Hb level of the patients was 12.33±1.45 g/dl (median; min-max: 12.3; 7.5-17). The Hb levels did not significantly differ between the sexes (p: 0.858) (**Table 2**). When examining Hb levels by age groups, the levels were 11.41±1.22 g/dl for 6 months-2 years, 12.14±1.04 g/dl for 2-6 years, 12.96±1.09 g/dl for 6-12 years, and 13.73±1.53 g/dl for those over 12 years old. Between the age groups, there was a significant difference in Hb levels (p: 0.001) (**Table 4**).

Patients' MCV levels were examined in the study, revealing that 724 patients (63.1%) had low MCV levels, while 424 patients (36.9%) had levels within the normal range. When comparing MCV levels by sex, there was no significant difference (p: 0.112). Of the patients with low MCV levels, 251 (34.7%) belonged to the age group of 6 months-< 2 years, 315 (43.5%) to the age group of 2 -<6 years, 132 (18.2%) to the age group of 6 to 12 years, and 26 (3.6%) to the age group of more than 12 years. A statistical analysis of the MCV level distribution by age group revealed a significant difference (p: 0.001) between the 6-months-<2 years and 2-<6 years age groups and the other age groups (p: 0.001) (**Table 3**).

Table 2. Comparison of hemogram results of the hospitalized children according to sex

Variable	Males		Females		Total		p
	Mean±SD	Median (min-max)	Mean±SD	Median (min-max)	Mean±SD	Median (min-max)	
WBC (10^3/µL)	9.53±4.25	8.67 (2.31-31.58)	9.4±4.55	8.35 (2.16-33.88)	9.47±4.39	8.51 (2.16-33.88)	0.855
Neutrophil (10^3/µL)	5.21±3.29	4.35 (0.55-23.67)	4.9±3.08	4.3 (0.29-18.73)	5.07±3.2	4.32 (0.29-23.67)	0.118
Lymphocyte (10^3/µL)	3.57±2.3	3.01 (0.38-15.13)	3.69±2.03	3.26 (0-17.97)	3.62±2.18	3.16 (0-17.97)	0.171
RBC (10^6/µL)	4.8±0.44	4.76 (3.62-6.87)	4.71±0.41	4.7 (3.47-6.22)	4.76±0.43	4.73 (3.47-6.87)	0.002
Hemoglobin (g/dL)	12.33±1.45	12.3 (7.5-17)	12.3±1.23	12.3 (6-15.8)	12.31±1.35	12.3 (6-17)	0.858
Htc (%)	36.77±3.92	36.5 (24.1-49.3)	36.81±3.43	36.8 (21.7-47.9)	36.79±3.7	36.7 (21.7-49.3)	0.540
MCV (fL)	76.95±6.77	77.75 (53.7-96.4)	78.48±6.16	79.25 (51.6-99)	77.65±6.54	78.6 (51.6-99)	0.001
MCH (pg)	25.86±2.67	26.2 (16.6-35.1)	26.33±2.49	26.6 (16.2-43.5)	26.07±2.6	26.4 (16.2-43.5)	0.003
MCHC (g/dL)	33.64±1.37	33.6 (27-37.8)	33.61±1.63	33.6 (27.5-56)	33.62±1.49	33.6 (27-56)	0.408
RDW (%)	14.34±1.6	13.95 (11.8-24)	13.98±1.36	13.7 (11.9-21.9)	14.18±1.51	13.8 (11.8-24)	0.001
PLT (103/µL)	342.44±123.39	325.5 (33-1168)	342.24±118.19	316 (74-950)	342.35±120.98	322 (33-1168)	0.939
MPV (fL)	9.06±1.03	8.9 (7-13.1)	9.09±1.01	8.95 (6.8-13.5)	9.07±1.02	8.9 (6.8-13.5)	0.562
PDW (fL)	15.33±1.27	15.6 (9.7-17.1)	15.2±1.44	15.6 (10-17.3)	15.27±1.35	15.6 (9.7-17.3)	0.294
PCT (%)	0.34±0.3	0.29 (0.03-3.54)	0.33±0.23	0.29 (0.09-2.73)	0.33±0.27	0.29 (0.03-3.54)	0.718

Table 3. Demographic and laboratory characteristics of the hospitalized children according to age groups

Variable	Age groups				p
	6 months-<2 years	2-<6 years	6-12 years	>12 years	
Year					0.513
2021	24 (26.4)	38 (41.8)	23 (25.2)	6 (6.6)	
2022	105 (25.7)	172 (42.1)	95 (23.2)	37 (9.0)	
2023	125 (24.3)	197 (38.3)	145 (28.2)	48 (9.3	
2024	35 (26.3)	62 (46.6)	24 (18.0)	12 (9.0)	
Hemoglobin					0.001
Normal	158^{a} (18.0)	361^{b} (41.2)	260^{b} (29.7)	97^{b} (11.1)	
Anemia	131^{a} (48.2)	108^{b} (39.7)	27^{c} (9.9)	6^{c} (2.2)	
Anemia status					0.001
Normal	158^{a} (18.0)	361^{b} (41.2)	260^{b} (29.7)	97^{b} (11.1)	
Mild	92^{a} (44.0)	89^{b} (42.6)	623^{c} (11.0)	5^{c} (2.4)	
Moderate	39^{a} (62.9)	19^{b} (30.6)	4^{b} (6.5)	0 (0)	
Severe	0^{a} (0)	0^{a} (0)	0 (0)	1^{a} (100.0)	
MCV (fL)					0.001
<80	251^{a} (34.7)	315^{b} (43.5)	132^{c} (18.2)	26^{c} (3.6)	
81-100	38^{a} (9.0)	154^{b} (36.3)	155^{c} (36.6)	77^{c} (18.2)	
RDW (%)					0.001
Normal	139^{a} (16.8)	351^{b} (42.5)	246^{c} (29.8)	90^{c} (10.9)	
Increased	150^{a} (46.6)	118^{b} (36.6)	41^{c} (12.7)	13^{c} (4.0)	
Platelet count					0.001
Normal	205^{a} (21.3)	396^{b} (41.2)	261^{bc} (27.1)	100^{c} (10.4)	
Thrombocytosis	84^{a} (45.2)	73^{b} (39.2)	26^{bc} (14.0)	3^{c} (1.6)	
Mentzer index					0.003
<13	31^{a} (43.7)	24^{b} (33.8)	11^{b} (15.5)	5^{ab} (7.0)	
>13	258^{a} (24.0)	445^{b} (41.3)	276^{b} (25.6)	98^{ab} (9.1)	
Total	289 (25.1)	469 (40.9)	287 (25.0)	103 (9.0)	

Table 4. Comparison of hemogram results of the hospitalized children by age groups

Variable	6 months-<2 years Mean±SD	2.0-<6.0 years Mean±SD	6.0-12.0 years Mean±SD	>12.0 years Mean±SD	p
RBC (106/µL)	4.70±0.43^{a}	4.69±0.39^{a}	4.83±0.43^{b}	4.92±0.47^{b}	0.001
Hemoglobin (g/dL)	11.41±1.22^{a}	12.14±1.04^{b}	12.96±1.09^{c}	13.73±1.53^{d}	0.001
MCV (fL)	73.82±6.63^{a}	77.48±5.71^{b}	79.81±5.30^{c}	83.12±6.54^{d}	0.001
MCH (pg)	24.44±2.63^{a}	26.10±2.30^{b}	26.97±2.06^{c}	27.98±2.57^{d}	0.001
MCHC (g/dL)	33.11±1.42^{a}	33.77±1.62^{b}	33.86±1.27^{b}	33.69±1.31^{b}	0.001
RDW (%)	15.09±1.81^{a}	14.08±1.38^{b}	13.61±0.91^{c}	13.62±1.20^{c}	0.001

The MCV level of the patients was 77.65±6.54 fL (51.6–99.0), with males having a mean MCV level of 76.95±6.77 fL (53.7-96.4) and females 78.48±6.16 fL (51.6-99). When the mean MCV levels were compared by sex, a significant difference was found (p: 0.001) (**Table 2**). When MCV levels were divided by age groups, all groups showed important differences (p: 0.001) (**Table 3**).

Of the patients diagnosed with anemia based on Hb levels, 223 (82.0%) had microcytic anemia while 49 (18.0%) had normocytic anemia. A significant difference was found in the MCV levels of patients diagnosed with anemia when compared statistically (p: 0.001). The distribution of demographic and laboratory findings of patients diagnosed with anemia based on their Hb levels is presented in **Table 5**. The distribution of anemia status among patients by age groups is illustrated in **Figure 1**.

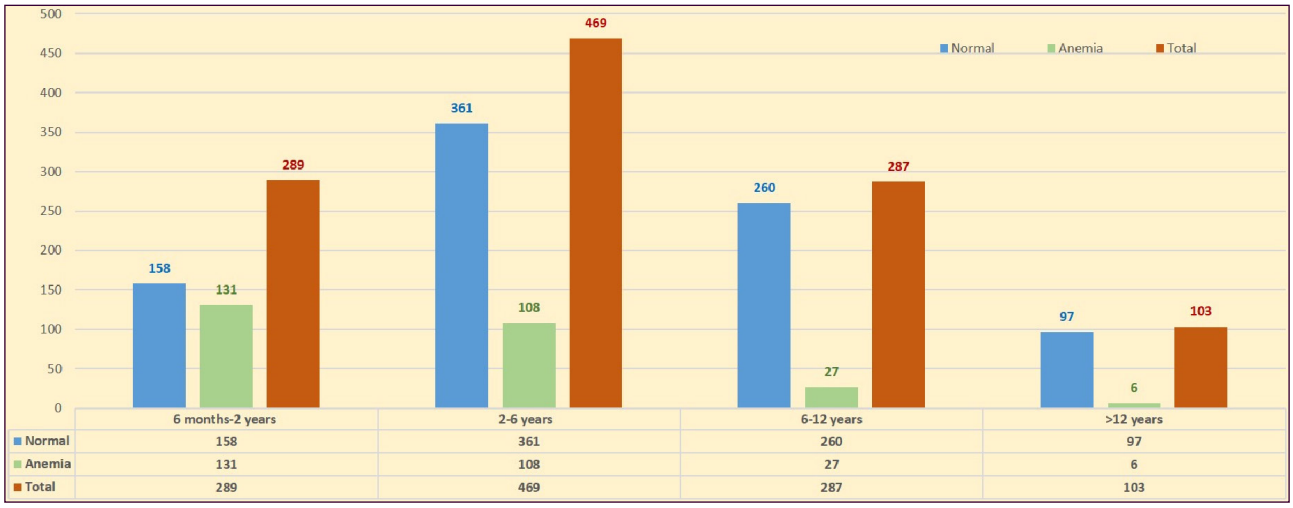

Figure 1. Distribution of anemia in hospitalized children according to age groups

Table 5. Comparison of demographic and laboratory findings of hospitalized children without and with anemia

Variable	Children without anemia n (%)	Children with anemia n (%)	p
Sex			0.821
Male	473 (54.0)	149 (54.8)	
Female	403 (46.0)	123 (45.2)	
Age groups			0.001
6 months-<2 years	158[a] (54.7)	131[b] (45.3)	
2.0-<6.0 years	361[a] (77.0)	108[b] (23.0)	
6.0-12.0 years	260[a] (90.6)	27[b] (9.4)	
>12.0 years	97[a] (94.2)	6[b] (5.8)	
Year			0.005
2021	80[a] (9.1)	11[b] (4.0)	
2022	322[a] (36.8)	87[a] (32.0)	
2023	381[a] (43.5)	134[a] (49.3)	
2024	93[a] (10.6)	40[a] (14.7)	
MCV level			0.001
<80 fL	501[a] (57.2)	223[b] (82.0)	
81-100 fL	375[a] (42.2)	49[b] (18.0)	
RDW level			0.005
Normal	713[a] (81.4)	113[b] (41.5)	
Increased	163[a] (18.6)	159[b] (58.5)	
Platelet count			0.001
Normal	751[a] (85.7)	211[b] (77.6)	
Thrombocytosis	125[a] (14.3)	61[b] (22.4)	
Mentzer index			0.001
<13	25[a] (35.2)	46[b] (64.8)	
>13	851[a] (79.0)	226[b] (21.0)	
Total	876 (76.3)	272 (23.7)	

Among the patients, 186 (16.2%) were diagnosed with thrombocytosis, while 962 (83.8%) had platelet counts within the normal range. Of those with thrombocytosis, 94 (50.5%) were male and 92 (49.5%) were female. When patients with thrombocytosis were analyzed by age groups, 84 (45.2%) were in the 6 months-<2 years age group, 73 (39.2%) were in the 2-<6 years age group, 26 (14.0%) were in the 6-12 years age group, and 3 (1.6%) were >12 years old. When the distribution of platelet counts among patients diagnosed with anemia was examined, 211 (77.6%) had platelet counts within normal ranges, while 61 (22.4%) had thrombocytosis. A significant difference was observed in the distribution of platelet counts among patients diagnosed with anemia (p: 0.001) (**Table 5**).

71 (6.2%) of the study's patients had a Mentzer index of less than 13 after being examined. There was no discernible difference in the Mentzer index when compared by sex (p: 0.173). There was a significant difference between the 6 months-2 years and 2-6 years age groups and other age groups in the distribution of patients with a Mentzer index <13 by age groups (p: 0.003) (**Table 3**).

DISCUSSION

Anemia in children is a major global public health concern, leading to substantial morbidity (7). The frequency of anemia varies according to age, sex, socioeconomic status, and geographic regions. In regions with low to moderate socioeconomic conditions, inadequate and unbalanced nutrition remains a primary cause of anemia. Clinical manifestations may or may not be present in anemic patients, and the diagnosis may be incidental during laboratory testing (8). Our study results demonstrated a frequency of anemia in nearly one out of every four children hospitalized in our region.

Childhood represents a period of rapid growth and development, during which both nutritional deficiencies and anemia-related issues can have lasting effects. Identifying deficiencies and determining at-risk children before clinical manifestations of nutritional deficiencies or anemia emerge is crucial for improving public health. To implement national health programs, it is essential to identify anemia and associated risk factors for anemia development across all age groups nationwide. In our country, interpretations are based on studies conducted

in different cities and age groups, as there is no nationwide frequency study encompassing all children. A hospital-based study in India in 2014 reported an anemia frequency of approximately 73% among hospitalized children aged 6 months to 12 years (9). Another study in India in 2017 found a general anemia frequency of 32.21% among hospitalized children aged 2-12 years (10). A study conducted in Pakistan in 2021 revealed that 63.7% of hospitalized children aged 1-5 years had anemia (11). In our study, 23.7% of the 1148 children hospitalized in the pediatric clinic were diagnosed with anemia. Anemia was more prevalent in the 6 months-2 years age group (48.2%) and the 2-6 years age group (39.7%). The rapid growth and development during these periods contribute to the increased frequency of anemia. Additionally, during and after the school years, we found a decline in the prevalence of anemia in our study.

According to a 2016 meta-analysis, Middle and Western Sub-Saharan Africa had the highest anemia frequencies, at 45% and 43%, respectively. While Chile, Venezuela, Canada, and Ukraine had anemia rates exceeding 14%, they were globally reported to have the lowest levels of anemia (12). Studies from different regions of our country have reported varying rates of anemia frequency. These epidemiological studies included different age groups in different regions. The reported frequency of anemia in various studies conducted in different cities in our country ranged from 3.5% to 45.6%. For instance, a study in Manisa including children aged 0-14 years reported a frequency of 44%, while in Tokat, the frequency was as high as 43.7% among elementary school children (15,16). In a study conducted in Konya in 2013, the frequency of anemia among hospitalized children was found to be 3.29% (17). This variation may be attributed to factors such as the level of development in the country or region, sample size, age groups, and whether the children were hospital admissions or part of school screenings.

Childhood encompasses periods of rapid growth and development, such as infancy and puberty, during which there is a heightened need for various nutritional factors, particularly iron (18). Our study also highlighted the period of 6 months-2 years as one with a high frequency of anemia, characterized by external dependency on nutrition, unbalanced and irregular dietary issues, frequent infections, and rapid growth. It is natural for the frequency of anemia to be higher in this age group compared to others. Our study also observed a significantly high frequency of anemia in the pre-school period, which decreased during the school years.

Children under the age of five are particularly at risk due to the rapid growth and development during this period. In a study by Stevens et al. in 2011, it was found that 43% of children under the age of five were anemic worldwide (19). This issue suggests that globally, 273 million children under the age of 5 are anemic. In Africa, Southeast Asia, and the Eastern Mediterranean countries, the frequency of anemia was found to be 67.6%, 65.5%, and 46.7%, respectively (20). The frequency of anemia is much lower in developed countries like Europe (22%) and America (29%). In India, the frequency of anemia was reported as 74.35% in the 6-35 months age group, 78% in Nepal in the 6-59 months age group, and 73.7% in Kazakhstan in the 0-23 months age group (21). In a study by Akkermans et al. involving patients from the Netherlands, Germany, and the UK, 18.9% of children aged 1-3 years were found to be anemic (22). It is estimated that 20% of children in America have anemia (23).

In our country, a study by Karagün et al. in Sivas found an anemia frequency of 5.9% in children aged 1-15 years (24). In a study by Güngör et al. in Samsun involving children aged 7-14 years, the frequency of anemia was 9.4% (25). In Zonguldak, a study in 2017 including 392 children aged 6-14 years found an anemia frequency of 13.5% (26). In a study conducted in Amasya in 2018 involving 213 patients aged 1-17 years, an anemia frequency of 29.6% was reported (27). Although anemia rates varied by region, overall, high rates of anemia were found in children under the age of five, similar to our study findings.

The World Health Organization reported an anemia frequency of 25.4% in school-age children, including this age group. In the same publication, the frequency of anemia in school-age children in Europe was reported as 9.3% (28). In a study by Gür et al. in our country, the frequency of anemia in children aged 6-16 years was reported as 27.6%, with a prevalence of 26.2% in the 6-10 year age group (29). In Samsun, Güngör et al. found a prevalence of 9.4% in children aged 7-14 years (25). In our study, we found a lower frequency of anemia in children during the school-age period.

Anemia frequency varies in different studies in terms of sex distribution. Zuffo et al. observed a higher frequency of anemia in males in daycares and nurseries in Brazil (30). However, Gür et al. did not find a difference in terms of sex in their study (29). In our study, 12.9% of males and 10.7% of females were anemic. We found a significantly higher frequency of anemia, especially in the 6 months-<2 years age group compared to other age groups.

A Hb level of less than 7 g/dl in children under 5 years old and less than 8 g/dl in other age groups is considered severe anemia. Severe anemia can lead to high-output heart failure and death. A cross-sectional study in Pakistan in 2022 involving children aged 1 month to 12 years found anemia in 43.1% of children, with 26.7% having mild anemia and 45.5% having moderate anemia (31). Similarly, in our study, we found a high rate of mild anemia and a low rate of severe anemia.

Reactive thrombocytosis is frequently described in children with iron deficiency. However, the mechanism of development is not well understood. Due to the homologous structure of thrombopoietin and erythropoietin (EPO), it has been thought that EPO increases thrombopoiesis, but this has not been proven (32). In our study, thrombocytosis was found in 22.4% of anemic patients. Other etiological diagnostic tests were not performed in hospitalized patients, as the aim of the study was not focused on this aspect. It should also be noted that thrombocytosis is an acute-phase reactant.

Thalassemia is a disease that affects 1-4% of the global population (33). It is more commonly observed in regions such as the Mediterranean, Sub-Saharan Africa, the Middle East, and India (34). Given the high frequency of thalassemia in our region, it should be considered as a differential diagnosis for microcytic anemia in our province. In our study, we found that 16.9% of our anemic patients had a Mentzer index <13, while 83.1% had a Mentzer index >13. Therefore, the Mentzer index can be easily applied in the differential diagnosis of microcytic anemia.

Limitations of Our Study

The goal of this study was to find out how common anemia is among hospitalized patients, with a focus on erythrocyte morphology. Notably, biochemical markers including B12 vitamin, folate, and ferritin levels were not assessed in the current analysis, owing to its retrospective nature. As a result, it's possible that the results of this study cannot be applied to a larger pediatric population. There is a need for comprehensive studies aimed at investigating anemia in both inpatient and outpatient populations. These studies should include the analysis of vitamin B12, folate, and ferritin levels, as these parameters are essential for a thorough understanding of the pathophysiology and potential causes of anemia. Nevertheless, the substantial sample size of the study cohort represents a notable strength of the investigation.

CONCLUSION

Our study results indicated that mild anemia was the most common type of anemia detected in hospitalized children, with the highest frequency observed in the 6 months-<2 years age group, and microcytic anemia was the most common type based on erythrocyte morphology. Hemogram analysis, which is a simple and cost-effective method, can assist in classifying anemia based on erythrocyte morphology. This can facilitate further testing for the underlying etiology in patients diagnosed with anemia.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by KTO-Karatay University Pharmaceutical and Non-Medical Device Research Ethics Committee (Date:09.05.2024, Decision No: 2024/030).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Evaluation of Cardiac Clues in Patients Admitted to Pediatric Cardiology Outpatient Clinic with Syncope

Çocuk Kardiyoloji Polikliniğine Senkop ile Başvuran Olgularda Kardiyak İpuçlarının Değerlendirilmesi

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ABSTRACT

Aim: In our study, we aimed to determine the incidence rates of children admitted to the pediatric cardiology outpatient clinic with syncope according to their etiologies; and especially to reveal the clues that distinguish cardiac syncope cases from other cases.

Material and Method: The study was conducted by obtaining the information of 795 children aged 5-17 years who were diagnosed with syncope in the pediatric cardiology outpatient clinic of our tertiary university hospital between 01.01.2021 and 01.06.2024 from the data in our hospital automation system. Medical history of the patient and his/her family, syncopal event, physical examination findings, 12-lead electrocardiography (ECG), echocardiography, 24-hour rhythm holter and exercise ECG records were analyzed.

Results: Cardiac syncope was 14.5% (10.8% arrhythmia and 3.7% structural heart disease) while noncardiac syncope was 85.5% (VVS 60.6%, OH 18.6%, situational 1% and 4.8% idiopathic). The most common conditions associated with cardiac syncope were a history of arrhythmia and heart disease, a family history of sudden death at a young age, and syncope associated with exercise-palpitations-chest pain. Rhythm holter test had a low diagnostic rate, while exercise ECG test had a high diagnostic rate.

Conclusion: It is important to diagnose cardiac syncope as it can cause sudden death. Standard 12-lead ECG, echocardiography and rhythm holter examination should be performed in all suspected patients; exercise ECG, head-up tilt test, genetic arrhythmia/cardiomyopathy investigations and electrophysiologic study should be performed in selected cases. In addition, simultaneous ECG monitoring during electroencephalography (EEG) examination in patients presenting with atonic seizures will be very useful in terms of clarifying the etiology.

Keywords: Syncope, cardiac syncope, children, arrhythmia

ÖZ

Amaç: Çalışmamızda çocuk kardiyoloji polikliniğine senkop nedeni ile başvuran çocukların etiyolojilerine göre görülme oranlarının; ve özellikle kardiyak senkoplu olguları diğer olgulardan ayıran ip uçlarının ortaya konulması amaçlanmıştır.

Gereç ve Yöntem: Çalışma üçüncü basamak üniversite hastanemiz çocuk kardiyoloji polikliniğinde 01.01.2021 ile 01.06.2024 tarihleri arasında senkop tanısı konulan 5-17 yaşlarındaki 795 çocuğun bilgilerinin hastanemiz kayıt sistemindeki verilerinden elde edilmesiyle gerçekleştirildi. Hastanın kendisi ve ailesinin tıbbi öyküsü, senkobun görülme şekli, fizik muayene bulguları, 12 kanallı elektrokardiyografi (EKG), ekokardiyografi, 24 saatlik ritim holter ve egzersiz EKG kayıtları incelendi.

Bulgular: Kardiyak senkop 14.5% oranında (10.8% aritmi ve 3.7% yapısal kalp hastalığı) iken nonkardiyak senkop 85.5% (VVS 60.6 %, OH 18.6%, situational 1% ve 4.8% idiyopatik) olarak tespit edildi. Kardiyak senkopla en çok ilişkilendirilen durumlar; hastanın kendisinde aritmi-kalp hastalığı öyküsü bulunması, ailesinde genç yaşta ani ölüm öyküsü bulunması ve senkobun egzersiz, çarpıntı ve göğüs ağrısı ile ilişkili olması idi. Ritim holter tetkikinin tanı koyma oranı düşük iken egzersiz EKG testinin ise yüksekti.

Sonuç: Ani ölüme neden olabildiği için kardiyak senkop tanısının konulması önem arz etmektedir. Şüphelenilen bütün hastalara standart 12 kanallı EKG, ekokardiyografi ve ritim holter tetkiki yapılmalı; seçilmiş olgulara da egzersiz EKG incelemesi, head-up tilt testi, genetik aritmi/kardiyomiyopati araştırmaları ve elektrofizyolojik çalışma uygulanmalıdır. Ayrıca atonik nöbet ile başvuran olgulara EEG tetkiki esnasında eş zamanlı olarak EKG monitörizasyonu yapılması etiyolojinin aydınlatılması açısından oldukça faydalı olacaktır.

Anahtar Kelimeler: Senkop, kardiyak senkop, çocuk, aritmi

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INTRODUCTION

Loss of consciousness is a cognitive state in which a person is not aware of himself/herself and his/her condition and is unable to respond to stimuli. Transient loss of consciousness is defined as a real or apparent loss of consciousness with loss of awareness, characterized by abnormal motor control, loss of responsiveness and short-term amnesia. Syncope is defined as transient loss of consciousness due to cerebral hypoperfusion; it is characterized by rapid onset, short duration and spontaneous full recovery. The pathophysiology of syncope involves a fall in systemic blood pressure and cerebral hypoperfusion. Systemic blood pressure is determined by cardiac output and peripheral vascular resistance; low levels of both are frequently involved in syncope. Therefore, epilepsy, hypoxic ischemic attack, intracerebral or subarachnoid hemorrhage, psychogenic pseudosyncope and post-traumatic loss of consciousness that do not have this pathophysiology are not defined as syncope (1).

The most common causes of syncope in children include noncardiac causes such as vasovagal (VVS) and orthostatic hypotension (OH). However, since syncope cases with cardiac causes such as arrhythmias and structural heart diseases including hypertrophic cardiomyopathy (HCMP) may cause sudden death, it is very important to make a rapid and accurate differential diagnosis (1). Patients with cardiac syncope have unique features that distinguish them from other syncope etiologies, such as a family history of sudden death at a young age and cardiac disease in the child, abnormal cardiovascular system examination and association with exercise-palpitations-chest pain.

In our study, we aimed to make the etiologic differentiation of patients consulted to the pediatric cardiology department with syncope by utilizing the anamnesis-physical examination-12 lead standard electrocardiography (ECG)-24-hour rhythm holter-echocardiography and exercise ECG records in the automation system of our hospital; and to reveal clues that may help in the diagnosis of syncope cases with cardiac causes.

MATERIAL AND METHOD

On May 29, 2024, the Clinical Research Ethics Committee of our hospital granted approval for our study under decision number 2024-9/4. In this study, the Declaration of Helsinki's tenets were adhered to.

Our study was conducted by obtaining the information of children aged 5-17 years who presented to the pediatric cardiology outpatient clinic of our tertiary university hospital with transient loss of consciousness between 01.01.2021 and 01.06.2024 and were diagnosed with syncope from the data on the automation system. The history of systemic disease-arrhythmia-congenital heart disease (with or without surgery), family history of sudden death-arrhythmia-cardiomyopathy, prodromal symptoms before syncope (such as pallor, sweating and nausea) and syncopal event syncope (prolonged standing, sudden standing up from a sitting position, bloodletting and exercise-related syncope) were recorded. All patients underwent a detailed physical examination including cardiac examination, standard 12-lead ECG and echocardiography examination. Patients with a life-threatening syncope (e.g. head trauma), three or more episodes of syncope, symptoms suspicious for cardiac syncope (e.g. syncope accompanied by palpitations and/or chest pain, syncope during exercise, family history of sudden death, and a history of arrhythmia-congenital heart disease-cardiac surgery) or arrhythmia detected during a standard 12-lead ECG underwent rhythm holter examination. In addition, rhythm holter examination was performed in patients who presented with atonic seizures and were found to have arrhythmia as a result of simultaneous ECG monitoring during electroencephalography (EEG) examination. Exercise ECG test was performed in patients with syncope during exercise who could not be diagnosed by 12-lead ECG-echocardiography-rhythm holter examinations. Genetic examination was performed in all patients with long QT. Ajmaline stimulation test was performed in patients with a family history of Brugada syndrome that could not be detected by standard ECG-rhythm holter examination.

According to the causes of syncope, patients were divided into cardiac and noncardiac syncope. Cardiac causes of syncope were divided into two groups as arrhythmia and structural heart disease, while noncardiac causes were divided into three groups as vasovagal, situational and orthostatic hypotension.

Vasovagal syncope was diagnosed in patients who had prodromal symptoms including pallor, sweating and nausea in the anamnesis and who developed short-term transient loss of consciousness in prolonged standing or sitting, pain-fear, crowded-hot-airless environments (2).

Situational syncope was diagnosed in cases of transient loss of consciousness in situations such as urination, defecation, retching, swallowing, coughing, sneezing and after exercise (2).

A diagnosis of syncope due to orthostatic hypotension was made in the case of transient loss of consciousness within three minutes (blood pressure drop of more than 20 mmHg systolic and 10 mmHg diastolic) when the patient suddenly stood up from the bed or toilet during morning awakening after the use of blood pressure-lowering drugs such as antidepressants and diuretics for autonomic reasons such as diarrhea-vomiting-bleeding, diabetes and chronic renal failure (2).

Cardiac syncope was suspected in the presence of palpitations and/or chest pain with syncope, development of syncope during exercise, a family history of sudden death without cause or arrhythmia, a history of arrhythmia, congenital heart disease or cardiac operation in the patient, or pathologic findings on cardiovascular examination. Cardiac syncope was diagnosed in patients with structural heart diseases that may cause syncope such as HCMP, dilated CMP, valve lesions with stenosis, myocarditis, pulmonary hypertension (PHT), and rhythm disorders that may cause syncope such as long QT, Brugada syndrome, ventricular tachycardia (VT), supraventricular tachycardia (SVT) and severe atrioventricular block on electrocardiography (2).

Patients who were thought to have transient loss of consciousness with neurologic cause were evaluated by a pediatric neurology specialist.

Exclusion criteria were as follows: Generalized seizures, complex partial seizures, absence epilepsy, falls without transient loss of consciousness, posttraumatic transient loss of consciousness, psychogenic pseudosyncope, intracerebral or subarachnoid hemorrhage, transient ischemic attack, hypoglycemia, hypoxia, hypocapnia, metabolic disorders including hyperventilation with hypocapnia, intoxication and coma (1-2).

In the design of our study, we utilized the algorithm for classification of patients presenting with loss of consciousness given in the ESC guideline (**Figure 1**).

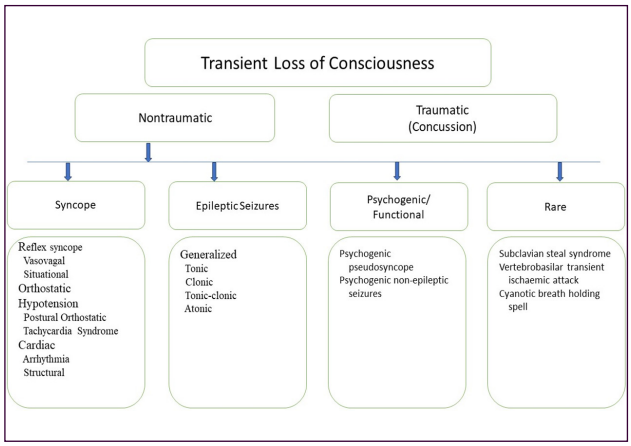

Figure 1. Classification of patients presenting with loss of consciousness (1)

Statistical Analysis

Statistical analysis of the study was performed using the Statistical Package for the Social Sciences for Windows ver. 26.0 package program was used. For categorical variables, n (%) was used, for continuous variables, mean ± SD (standard deviation) was used in case of conformity to normal distribution, and median and IQR (Inter Quantile Range) values were used when conformity was not achieved. Descriptive analyses were employed to assess the distribution and frequency of the data. Normality analysis was performed using the Kolmogorov–Smirnov test. In intergroup comparisons, independent t test was used for those with normal distribution and Mann Whitney U test was used for those without normal distribution.

RESULTS

Our study consisted of 795 children aged between 5-17 years [mean 13 (5-17)], 494 of whom were girls (62.1%). Children presenting with cardiac syncope accounted for 14.5% (115 cases) of the cases, while those presenting with non-cardiac causes accounted for 85.5% (680 cases).

Among patients with cardiac syncope, 86 (10.8% of total syncope cases and 74.8% of cardiac syncope cases) were due to arrhythmia and 29 (3.7% of total syncope cases and 25.2% of cardiac syncope cases) were due to structural heart disease. Among the non-cardiac causes of syncope, most of the patients (60.6%) were in the VVS group, followed by OH (18.6%) and situational (1%). Thirty-eight (4.8%) patients were accepted idiopathic. The proportion of female patients was high in the noncardiac syncope group (noncardiac 65.4% - cardiac 49.6%, p<0.001). The highest proportion of female patients (67.3%) was found in the VVS group. The mean age of patients in the noncardiac syncope group was higher [noncardiac 14 years (8-17) vs cardiac 11 years (5-17), p<0.001]. The highest mean age was found in the VVS group [14 years (9-17)] and the lowest in the structural heart disease group [10 years (5-16)]. The number of syncope episodes was 1.4±0.3 in the cardiac syncope group and 2±0.4 in the noncardiac syncope group (p<0.001). The number of syncope episodes was highest in the VVS group (2.1±0.3) and lowest in the structural heart disease group (1.3±0.3) (**Table 1**).

Table 1. Distribution of children diagnosed with syncope

	Reflex syncope and OH, N=638 (80.2%)			Cardiac, N=115 (14.5%)		Idiopathic, N=42 (5.3)	Total, N=795
	VVS	Situational	OH	Arrhythmia	Structural		
N (%)	482 (60.6)	8 (1)	148 (18.6)	86 (10.8)	29 (3.7)	42 (5.3)	795 (100)
F (%)	338 (67.3)	4 (50)	75 (62.5)	42 (48.8)	15 (51.7)	20 (52.6)	494 (62.1)
Age	14 (9-17)	12 (9-16)	13 (8-17)	11 (5-17)	10 (5-16)	14 (10-17)	13 (5-17)
Number of episode	2.1±0.3	1.2±0.2	1.8±0.3	1.4±0.3	1.3±0.3	2±0.3	1.9±0.3

Cardiac syncope was diagnosed in 40 of 72 patients (55.6%) with palpitations and/or chest pain during syncope. Of these 40 patients; 19 had arrhythmia [nine paroxysmal SVT (four on standard 12 lead ECG and five on rhythm holter)], [five sustained VT (three on standard 12 lead ECG and two on rhythm holter)], [two had catecholaminergic polymorphic ventricular tachycardia (CPVT) (on exercise ECG], [three had Wolff Parkinson White syndrome (all three on 12 lead ECG)] and 21 had structural cardiac pathology (on echocardiography: five HCMP, five myocarditis, four dilated CMP, three aortic valve stenosis, two anomalous origin of coronary artery and two PHT).

Of 73 patients with syncope during exercise 39 (53.4%) were diagnosed with cardiac syncope; seven had long QT (three on 12 lead ECG and four on exercise ECG), four had grade 2 AV block (three on 12 lead ECG and one rhythm holter), one complete AV block (12 lead ECG), two catecholaminergic polymorphic ventricular tachycardia (exercise ECG), two sinus bradycardia (rhythm holter), four aortic valve stenosis (AS), two pulmonary valve stenosis (PS), five HCMP, four dilated CMP, two anomalous origin of coronary artery, two pulmonary hypertension (PHT) and four acute myocarditis.

Cardiac syncope was diagnosed in eight of 18 patients (44.4%) with family history of sudden death; three of these eight patients had long QT, two had Brugada syndrome and three had HCMP.

Thirty (25.6%) of the patients presenting with cardiac syncope had a known history of arrhythmia/structural heart disease/heart surgery. Of these patients, 14 (12.2%) had arrhythmia (three Wolff Parkinson White syndrome, three 2nd degree AV block, two long QT, two SVT, one VT, one sinus bradycardia, one sinus pause lasting longer than 3 seconds and one complete AV block), 12 (10. 4%) had structural heart disease (five AS, three dilated CMP, two HCMP, one PS and one PHT) and four patients (3%) had a history of cardiac surgery (three for tetralogy of Fallot and one for subvalvular and valvular aortic stenosis).

Of the 86 arrhythmia cases we detected in our study, 30 were detected in standard 12 lead ECG at the first admission, 40 were detected in rhythm holter when the admission ECG was normal and six were detected in exercise ECG when 12 lead ECG and rhythm holter were normal. In addition, 10 arrhythmias were detected of arrhythmia during EEG in neurology clinic.

Detection of arrhythmia during EEG in neurology clinic six of the 10 patients had grade 2 AV block, two had long QT, one had pause lasting longer than 3 seconds and one had sinus bradycardia.

In 80 (17.6 %) of a total of 455 patients who underwent rhythm holter examination, rhythm disturbances that could cause syncope were detected. However, when 40 patients who were known to have arrhythmia before rhythm holter examination were excluded (10 patients with arrhythmia detected of during EEG in neurology clinic and 30 patients with arrhythmia detected on standard 12 lead ECG in order to fully reveal the arrhythmia pattern), the rate of arrhythmia detection in rhythm holter examination was 9.6% (40/415). In 7 patients with arrhythmia that did not cause syncope on standard 12-lead ECG (two patients with 1st AV block, two patients with ventricular extrasystole, two patients with mild sinus bradycardia, one patient with premature atrial beat), rhythm holter examination revealed arrhythmia that could cause syncope (2nd degree AV block in two patients, VT in two patients, marked sinus bradycardia in two patients and supraventricular tachycardia in one patient).

Exercise ECG testing was performed in 14 patients; and cardiac syncope was diagnosed in eight of them (57.1%). Arrhythmias were detected in six of these eight patients (long QT in four and CPVT in two), and an abnormal origin of the coronary artery was suspected in two of them because ischemic changes were observed (diagnosis confirmed by diagnostic cardiac catheterization).

Genetic analysis was performed in all 15 patients with long QT and genetic mutations were found in 8 (53.3%). All patients with Brugada syndrome had a positive family history; three of the five patients had a classic pattern on 12-lead ECG, while the other two patients were diagnosed with ajmaline test.

In a total of 42 (5.3%) patients (34 patients with syncope during exercise, four patients with syncope accompanied by palpitations/chest pain and four patients with syncope in supine position), we could not elucidate the etiology and classified them as idiopathic syncope (**Table 2**).

Table 2: Supportive findings at the time of initial diagnosis of cardiac syncope

N=115	N (%)		
Accompanied by palpitations and/or chest pain	40 (34.8)		
Syncop during exercise	39 (33.9)		
Family history of sudden death	8 (7)		
History of arrhythmia-CHD or cardiac surgery in the patient	Arrhytmia	CHD	Cardiac surgery
	14 (12.2)	12 (10.4)	4 (3)
Detection of arrhythmia during EEG in neurology clinic	10 (8.7)		
Detection of arrhythmia on standard 12 lead ECG	30 (26.1)		
Detection of arrhythmia on 24-hour rhythm holter monitoring	80 (69.6) (during EEG in neurology + 12 lead ECG + rhythm holter) 40 (34.8) (only rhythm holter)		
Detection of arrhythmia during cardiac exercise stress test	6 (5.2)		
Detection of structural heart disease by echocardiography	29 (25.2)		

In the arrhythmia group of patients with cardiac syncope, 2nd degree AV block (32 (27.8%) and long QT (15 (13%)) were the most common; in the structural heart disease group, valvular aortic stenosis was detected in 6 (5.2%) and HCMP in 6 (5.2%) patients (**Table 3**).

Table 3: Distribution of children diagnosed with cardiac syncope

	N (%)	Age (year)	F (%)	Frequency of Syncope
Cardiac Arrhytmia				
Long QT	15 (13)	12 (8-17)	7 (26.7)	1.4±0.3
Brugada	5 (4.3)	8 (8-13)	0 (0)	1.2 (1-2)
2nd degree AV block	32 (27.8)	11 (6-13)	15 (48)	1.5±0.3
3rd degree AV block	3 (2.6)	12 (5-10)	3 (100)	1.3 (1-2)
Sinus node dysfunction (pause lasting longer than 3 seconds)	5 (4.3)	10 (7-12)	3 (60)	1.3 (1-3)
Wolff Parkinson White syndrome	5 (4.3)	12 (12-17)	3 (60)	1.3 (1-2)
Paroxysmal supraventricular tachycardia	9 (7.8)	9 (5-14)	3 (33.3)	1.3 (1-3)
Sustained ventricular tachycardia	5 (4.3)	9 (7-15)	3 (60)	1.3 (1-2)
Catecholaminergic polymorphic ventricular tachycardia	2 (1.7)	12 (9-13)	1 (50)	1.5 (1-2)
Sinus bradycardia (heart rate less than 35/min)	5 (4.3)	15 (12-15)	4 (80)	1.3 (1-3)
Total	**86 (74.8)**	**11 (5-17)**	**42 (48.8)**	**1.4±0.3**
Structural Cardiac Disease				
Valvular aortic stenosis	6 (5.2)	7 (5-12)	3 (50)	1.3 (1-3)
Pulmonary stenosis	2 (1.7)	6 (7-14)	1 (50)	1.5 (1-2)
Hypertrophic cardiomyopathy	6 (5.2)	12 (8-16)	2 (33)	1.2 (1-2)
Dilated cardiomyopathy	5 (4.3)	11 (6-14)	2 (40)	1.2 (1-2)
Anomalous origin of coronary artery	2 (1.7)	10 (7-9)	4 (40)	1
Pulmonary hypertension	3 (2.6)	11 (8-14)	1 (33)	1.3 (1-2)
Acute myocarditis	5 (4.3)	10 (6-16)	2 (40)	1.4 (1-2)
Total	**29 (25.2)**	**10 (5-16)**	**14 (48.3)**	**1.3±0.3**
Total	**115 (100)**	**11 (5-17)**	**56 (48.7)**	**1.4 (1-3)**

DISCUSSION

In our study including patients admitted to the pediatric cardiology outpatient clinic with syncope, we found that 14.5% of the syncope had cardiac causes; 10.8% of which were arrhythmia and 3.7% of which were structural heart disease. Syncope is a very common health problem that can be seen at any age and is responsible for 3% of emergency room visits. 40% of people have experienced syncope at least once in their lifetime. 17% of children have had at least one syncope attack until the end of adolescence (1,3). The majority of syncope seen in childhood is benign, such as syncope due to VVS and OH, and those that may be life-threatening are those that occur due to a sudden decrease in cardiac output due to arrhythmia or structural heart disease. The AHA guideline reported the sudden death rate in unselected cases in the pediatric period as 0.00001 cases per patient year in cases with syncope (2).

Cui et al reported that in their study including 1,947 children and adolescents aged 1-18 years (mean 11.1 ± 3.1) diagnosed with syncope within 30 years (female rate 55.37%), the rate of syncope increased over the years, the rate of neurally-mediated syncope increased while the rate of idiopathic syncope gradually decreased. It was also reported that the rate of cardiac syncope was 8.91% between 1992 and 2001 and 5.50% between 2012 and 2021. Zavala et al reported noncardiac syncope rate as 77.7%, cardiac 4% and idiopathic 18.3% in their meta-analysis including 11 articles and 3700 children aged between 3 months and 21 years. Landwehr et al reported reflex syncope in 69.8%, presyncope in 13.7%, idiopathic syncope in 13.4% and cardiac syncope in 3.1% of 262 patients (female 61.5%) aged 12±3.9 years admitted to general pediatrics with syncope. Bozlu et al in their study of 1020 cases (59.2% female) between the ages of 1-18 years (12.8± 4.8) admitted to the pediatric emergency outpatient clinic with syncope (12.8± 4.8%) reported the etiologies as: reflex/neural mediated 55%, orthostatic 23.72%, epilepsy 4.90% and cardiac syncope 5.39%. In another study from our country, 65.7% VVS, 9% POTS, 7.5% epilepsy, 4.5% hysterical seizure, 4.5% OH, 3% exercise-related syncope, 3% cardiogenic syncope and 3% breath holding were reported. In our study, children presenting with cardiac syncope constituted 14.5% of the cases (Arrhythmia: 10.8% of total syncope cases and 74.8% of cardiac syncope cases - Structural heart disease: 3.7% of total syncope cases and 25.2% of cardiac syncope cases), while those presenting with noncardiac causes constituted 85.5% (VVS 60.6%, OH 18.6%, situational 1% and 4.8% idiopathic). The reason why we found the rate of cardiac syncope higher than the literature may be attributed to the fact that our case group consisted of patients referred to the pediatric cardiology outpatient clinic and had undergone a certain preliminary evaluation and screening by emergency and pediatric physicians prior to their presentation to us.

Studies have shown that syncope occurs more frequently in girls than boys during childhood. This is due to the fact that noncardiac causes such as VVS and OH, which

constitute the majority of syncope, are more common in girls. No gender difference has been reported among cardiac syncope cases. Prodromal symptoms such as pallor, sweating, nausea and hypotensive complaints are mostly seen in adolescent girls, but cardiac syncope including arrhythmia and structural heart diseases can occur at any age; therefore, noncardiac syncope is common in older girls, whereas cardiac syncope is found at younger ages and equally in both sexes (2-4,7-10). In our study, we found that the age and female ratio of patients presenting with cardiac syncope were lower than in the noncardiac group. Cases with cardiac syncope occur more unexpectedly (not during prolonged standing, sudden standing up and seeing blood; without prodromal symptoms and accompanied by exercise-palpitation and chest pain). In addition, a family history of sudden death-arrhythmia-cardiac disease and pathologic cardiovascular examination findings are also common in these patients. Therefore, patients usually present to the emergency physician or pediatrician at the first episode and are then referred to the pediatric cardiology department. Cases with noncardiac syncope occur in young adolescents with typical findings and do not cause much concern in the community because they are common; in addition, since these patients are well known by emergency physicians and pediatricians, they are usually not consulted by a pediatric cardiologist at the first episode. Therefore, in our study, the number of syncope episodes was lower in the cardiac syncope group compared to the noncardiac syncope group (1.4±0.3 and 2±0.4, $p<0.001$).

Cardiac causes of syncope can be divided into two groups: arrhythmias and structural heart diseases. Unlike noncardiac causes of syncope, cardiac syncope can occur at any age, including infancy, and in both sexes at the same rate. Arrhythmias that may lead to syncope include long QT, severe AV blocks and tachyarrhythmias such as SVT-VT, while structural heart diseases include left ventricular outflow tract stenosis including hypertrophic cardiomyopathy, acute myocarditis and dilated cardiomyopathy (1.2,5,7, 10, 11). A family and personal history of arrhythmia/structural heart disease, association with exercise-chest pain and palpitations, and absence of prodromal symptoms have been associated with cardiac syncope (12). In order to diagnose these patients, 12-lead standard ECG, echocardiography, 24-hour rhythm holter, exercise ECG, tilt test, genetic and electrophysiologic examinations can be performed. In a study of 3122 children presenting with syncope, Uysal et al. reported a low rate of 2.4% for the diagnosis of arrhythmia-related cardiac syncope (13). In our study, we performed 12-lead ECG, echocardiography and rhythm holter examination in all patients suspected of cardiac syncope. We also performed exercise ECG test in exercise-related cases that we could not diagnose with these. The rate of rhythm holter examination to diagnose syncope due to cardiac arrhythmia was 9.6% in patients without previously detected arrhythmia. As a result of our study, being younger and presenting at the first syncope attack seemed to be risk factors for cardiac syncope. In addition, being female was not found to be a risk factor in contrast to noncardiac syncope. In the arrhythmia group, 2nd degree AV block and long QT were most common, while in the structural heart disease group, AS and HCMP were found. While genetic mutation was reported in 75% of long QT cases in the literature (14), it was found to be 53.3% in our study. The reason why we found a lower rate is that we could not screen all mutations that may cause long QT in our genetic laboratory. Cardiac syncope was diagnosed in 55.6% of patients with palpitations and/or chest pain during syncope, 53.4% of patients with syncope during exercise and 44.4% of patients with family history of sudden death. Among patients presenting with cardiac syncope, 26.1% had a previously known arrhythmia or structural heart disease that could cause syncope. Cardiac syncope was diagnosed in 57.1% of patients who underwent exercise ECG testing. Ten of the arrhythmia-related syncope cases (8.7% of cardiac syncope cases) were detected during EEG in patients presenting with atonic seizures in the neurology clinic.

Tilt test has been used for many years to diagnose reflex syncope,OH and psychogenic syncope. However, if hypotensive susceptibility occurs in syncope other than reflex syncope, false-positive results may be obtained regardless of etiology (including cardiac causes of syncope such as arrhythmias, aortic stenosis and hypertrophic cardiomyopathy) and in patients with true reflex syncope, positive results cannot always be obtained even with pharmacological provocation (false-negative rate is also high). In addition, the diagnosis of reflex syncope can be made to a great extent if a detailed anamnesis is taken and a complete physical examination including the cardiovascular system is performed. Today, the availability of cardiac evaluations such as ECG, echocardiography, rhythm holter and exercise ECG greatly reduces the need for tilt testing for diagnostic purposes. For these reasons, the indication for tilt testing is limited to patients with frequent recurrent syncope in whom the diagnosis of reflex syncope cannot be made after all investigations despite suspicion, and for whom tilt training and pharmacologic treatments will be planned (1,2).

Limitations

Our study had limitations such as its retrospective design, not accurately reflecting the general rate of cardiac syncope in the population because it consisted only of patients admitted to the pediatric cardiology outpatient clinic of a tertiary university hospital, and not performing tilt testing in patients.

CONCLUSION

Cardiac syncope should be suspected if the child has a family history of sudden death at an early age, a history of arrhythmia/congenital heart disease/heart surgery, pathologic findings on cardiovascular examination, absence of prodromal symptoms, syncope accompanied by chest pain/palpitation or developing during exercise and seen in any position including supine position. Routine standard 12-lead ECG, echocardiography and rhythm holter examination should be performed in these patients; exercise ECG examination, head-up tilt test, genetic arrhythmia/cardiomyopathy investigations and electrophysiologic study should be performed in selected cases. In addition, simultaneous ECG monitoring during EEG examination in patients presenting with atonic seizures will be very useful in terms of clarifying the etiology.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by Bursa City Hospital Scientific Researches Ethics Committee (Date: 29.05.2024, Decision No: 2024-9/4).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Can Apigenin Be an Effective Therapeutic Agent Against Experimental Renal Ischemia-Reperfusion Injury?

Apigenin Deneysel Renal İskemi-Reperfüzyon Hasarına Karşı Etkili Bir Terapötik Ajan Olabilir mi?

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ABSTRACT

Aim: This study aims to reveal the effects of two doses of apigenin (API) against renal ischemia-reperfusion injury (R I/R).

Material and Method: For this purpose, 5 and 10 mg/kg doses of API were preferred in our study, and the groups were designed as sham, R I/R, 5 mg/kg API, and 10 mg/kg API groups for the implementation of the experimental protocol. In the R I/R model, 1-hour ischemia and 24-hour reperfusion periods were preferred. Oxidative and inflammatory markers were measured biochemically in samples taken at the end of the experiment.

Results: Biochemical results showed that oxidative and inflammatory markers increased significantly in the R I/R group, but antioxidant activities decreased significantly. In the 5 and 10 mg/kg API groups, R I/R damage was alleviated considerably, with these markers approaching the sham group values.

Conclusion: As a result, the study's results determined that two different doses of API were effective against R I/R-induced kidney damage.

Keywords: Apigenin, kidney, ischemia/reperfusion

ÖZ

Amaç: Bu çalışma, iki doz apigenin (API) kullanımının renal iskemi-reperfüzyon hasarına (R I/R) karşı etkilerini ortaya koymayı amaçlamaktadır.

Gereç ve Yöntem: Bu amaçla çalışmamızda API'nin 5 ve 10 mg/kg dozları tercih edilmiş ve deneysel protokolün uygulanması için gruplar sham, R I/R, 5 mg/kg API ve 10 mg/kg API grupları olarak tasarlanmıştır. R I/R modelinde 1 saatlik iskemi ve 24 saatlik reperfüzyon periyotları tercih edilmiştir. Deney sonunda alınan örneklerde oksidatif ve inflamatuvar belirteçler biyokimyasal olarak ölçüldü.

Bulgular: Biyokimyasal sonuçlar oksidatif ve inflamatuar belirteçlerin R I/R grubunda anlamlı olarak arttığını, ancak antioksidan aktivitelerin anlamlı olarak azaldığını gösterdi. 5 ve 10 mg/kg API gruplarında, R I/R hasarı önemli ölçüde hafifledi ve bu belirteçler sham grubu değerlerine yaklaştı.

Sonuç: Sonuç olarak, çalışmanın sonuçları iki farklı API dozunun R I/R ile indüklenen böbrek hasarına karşı etkili olduğunu göstermiştir.

Anahtar Kelimeler: Apigenin, böbrek, iskemi/reperfüzyon

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INTRODUCTION

In general, in various situations such as organ transplantations, heart surgeries, and vascular surgeries, ischemic damage is initiated due to obstruction of blood flow to tissues due to microcirculation disruption and obstruction in the microvascular area. However, maintaining circulation by re-establishing blood flow in the tissue causes reperfusion injury, which is a more dramatic damaging response than the ischemic period. Reperfusion injury causes the pathophysiology of many cases, such as acute renal failure, myocardial infarction, and ischemic stroke. Kidneys are one of the organs most easily affected by this damage. The pathophysiological basis of I/R is often associated with hypoxia, post-reperfusion inflammation, and oxidative stress. I/R occurring in the kidney tissue results in the accumulation of free oxygen radicals (ROS), excessive increase in cytokines that initiate the inflammatory process, cellular calcium (Ca^{2+}) accumulation, apoptosis, oxidative stress, and even autophagy. Therefore, this process may result in kidney loss (1-4). For this reason, studies have been conducted on pharmacologically active drugs and agents that can potentially reduce apoptosis, oxidative stress, and autophagy to alleviate the severity of R I/R damage (5,6).

Apigenin (API, 4,5,7-trihidroksiflavon), a natural flavonoid found primarily on plants such as chamomile and celery, has various pharmacological activities such as antioxidant, anti-carcinogenic and anti-inflammatory properties and has been used in different experimental studies (7-10). Previous studies have shown that API supports cellular antioxidant defense and increases the contractile force on the heart by reducing reactive oxygen species (ROS) (2). In two different studies, doxorubicin-induced and adriamycin-induced, it was reported that API treatment had a protective effect against cardiotoxicity by suppressing autophagy and apoptosis (8,11). Another study documented that API inhibited ethanol-induced oxidative stress and LPS-induced inflammatory cytokine production in rat hepatocytes (12).

Based on this and similar studies in the literature, no study has been found investigating the effects of API treatment against R I/R damage. For this reason, this study was considered to evaluate the potential antioxidant and anti-inflammatory activities of API against R I/R-induced renal tissue damage.

MATERIAL AND METHOD

Experimental Protocol

All animal experiments were carried out at Atatürk university's Animal Experiments Research Center (ATADEM). All animals were kept at 55±5% humidity, 12h/12h, day/night, and an average room temperature of 25±2°C, and all animals were fed tap water and standard laboratory chow. 24 female Wistar albino rats were weighed (210-220 g) and randomly divided into 4 groups. Groups were defined as Sham, R I/R, 5 mg/kg API, and 10 mg/kg API. Sham group rats were anesthetized with ketamine/xylazine (100/15 mg/kg, intraperitoneally "i.p.") mixture. The back area was shaved and cleaned with an antiseptic solution (povidone-iodine), and an incision was made and closed again without any other procedure. In the R I/R group, bilateral renal artery and veins were clamped with a microvascular clamp to prevent blood flow for 1 hour. Subsequently, the clamps were opened for reperfusion, blood circulation was continued for 24 hours, and the incision was sutured with 3/0 silk. During reperfusion, the animals were sacrificed, and kidney tissues were removed. A single dose of API was given i.p. at doses of 5 mg/kg and 10 mg/kg, and then the I/R model was created as defined in the R I/R group. API (Apigenin; 95.0% (HPLC) | CAS No. 520-36-5) was purchased from Sigma Aldrich Co. (Missouri, USA). Xylazine hydrochloride (Rompun, Bayer, Istanbul) and ketamine (Ketalar, Pfizer, Istanbul) anesthesia were provided for the experiment. In the final stage, the kidney tissues taken at the end of the experiment were preserved in appropriate conditions for biochemical and histopathological studies.

Biochemical Analysis

Testicular tissues were homogenized using tissue lyser to perform biochemical analyses. Total antioxidant status (TAS) and total oxidant status (TOS) values (Elabscience Wuhan, China) were measured in the resulting homogenates using ELISA. The OSI value was also calculated as the TOS/TAS ratio (6). In addition, myeloperoxidase (MPO) (13) activity, malondialdehyde (MDA) (14) level, and superoxide dismutase activity (SOD) (15) analyses were performed according to the methods specified in studies in the literature.

Statistical Analysis

SPSS 20 (SPSS Corporation, Chicago, IL, USA) statistical program was used for data analysis. The results were expressed as mean±standard error (deviation) (SD), and $p<0.05$ was considered statistically significant. One-way analysis of variance was used for statistical analysis, and the Tukey post hoc test was applied to determine the difference between groups

RESULTS

Considering the Sham group results, MPO activity, OSI, TOS, and MDA levels were significantly increased in the R I/R group ($p<0.001$). In addition, it was observed that these results decreased statistically significantly in the 5 and 10 mg/kg API groups. When antioxidant

levels were evaluated, TAS level and SOD activity decreased significantly in the R I/R group (p<0.001). It was determined that the antioxidant system was strengthened in the API groups compared to the R I/R group decreased (p<0.001). API pretreatments increased SOD levels compared to the R I/R group. These data show that API can increase antioxidant enzyme levels and suppress oxidative stress (**Table 1**). TNF-α and IL-1β levels in the R I/R group (p < 0.001) were significantly increased compared to the sham group. However, in comparison with the R I/R group (p < 0.001), TNF-α and IL-1β levels significantly decreased in 5 and 10 mg/kg API groups (p < 0.001).

DISCUSSION

Oxidative stress is the disruption of the balance between endogenous antioxidants and oxidants in favor of oxidants. Oxidants, defined as ROS, interact with cellular molecules, causing peroxidation and disrupting homeostasis. ROS are responsible for lipid peroxidation, DNA, and mitochondria damage by primarily attacking membrane lipids in the tissue (16-18). The antioxidant system provides the first defense against ROS accumulating in the tissue. In particular, SOD, an endogenous antioxidant, is the first defense against attack by ROS (18,19).

Moreover, SOD and Glutathione peroxidase enzymes are reliable indicators of oxidative stress damage. MPO is a peroxidase enzyme found in large amounts in neutrophils and monocytes. In cases of I/R, drug toxicities, and sepsis, MPO levels increase due to neutrophil migration and ROS accumulation (20-23). I/R induces sterile inflammation, including neutrophil stimulation, cytokine production, and other proinflammatory processes. As it is known, TNF-α and interleukin-1 (IL-1) are pro-inflammatory cytokines (24). In a study evaluating the effect of vitamin C on R I/R injury, t lipid peroxidation in the kidney tissue decreased due to I/R, and accordingly, MPO activity increased, SOD activity decreased, and even TNF-α and IL levels increased (25). In a different study on R I/R, it was reported that oxidant and pro-inflammatory cytokines increased in the kidney tissue, antioxidant defense was inadequate, and in this way, in vivo and in vitro apoptosis and oxidative stress developed (26). In their study evaluating kidney damage caused by I/R, Wong et al. documented that pro-apoptotic proteins increased and anti-apoptotic proteins decreased, resulting in an apoptotic response (27). Current approaches have increased interest in natural agents that have as few side effects as possible, have a low toxic reaction in tissue, and are natural in various pathological cases. In a study evaluating the anti-inflammatory effects of apigenin and genistein on the rat intestinal epithelial cells with TNF-α stimulation in response to heat treatment, It has been observed that API suppresses inflammation in the tissue by showing anti-inflammatory effects (28). In a study evaluating the impact of API against cyclosporine-induced free radical-induced renal damage. It has been detected that API protects tissue against nephrotoxicity by reducing the lipid hydroperoxides and increasing the total antioxidants (29).

When we examine the literature for the protective effects of API against R I/R, various research studies consider several parameters. Liu et al. discovered the impact of API in R I/R via activation of the JAK2/STAT3 pathway (30). API prevented apoptosis through PI3K/Akt mediated mitochondria-dependent apoptosis signaling pathway in a R I/R model (31). Another API-R I/R study demonstrated the effects of API on the expression levels of B-cell lymphoma-2, Fas, and Fas ligand (32). All these research approaches the impact of API in R I/R. Different from the literature; our study focused on the effects of API for oxidative stress and anti-inflammatory mechanisms by investigating related parameters, which makes the current data a contribution to the literature and supporting it.

CONCLUSION

The results obtained in this study revealed the tissue protective effect of API against oxidative stress and inflammatory response in R I/R damage. However, the critical point to be noted here is that further experimental and clinical research is needed on this subject in light of the results of API in this study.

Table 1. Kidney tissue SOD (U/mg protein), MDA (nmol/g protein), MPO (U/mg protein), TAS (mmol Trolox Eq/mg protein), TOS (μmol H2O2 Eq/mg protein), OSI, TNF-α (pg/mg protein), IL-1β (pg/mg protein) results of all groups.

	Sham	R I/R	5mg/kg API	10mg/kg API
TNF-α (pg/mg protein)	23847.05±4159.65	37750.80±4269.17	25428.02±3426.39	22488.35±3024.37
IL-1β (pg/mg protein)	26525.48±2356.75	72800.17±4996.07	37700.13±6381.10	28098.01±3627.29
SOD (U/mg protein)	516.71±85.69	276.35±14.70	448.46±35.29	481.32±26.34
MDA (nmol/g protein)	72.92±5.73	113.96±7.91	79,85±6.29	76.17±7.30
MPO (U/mg protein)	38574.75±4973.37	76829.40±12252.96	45795,08±3319,54	40052.15±2069.50
TAS Level (mmol Trolox Eq/mg protein)	2.32±0.37	1.33±0.11	1.93±0.21	2.18±0.19
TOS Level (μmol H2O2 Eq/mg protein)	6.3±0.28	9.46±0.60	7.03±0.59	6.5±0.51
OSI Level (Arbitrary units)	0.27±0.04	0.71±0.05	0.36±0.05	0.29±0.04

ap<0.001 Compared to the Sham group, bp<0.001 Compared to the R I/R group, and *p<0.05 Compared to 5 mg/kg and 10 mg/kg API groups. Data are presented as Mean±SD.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by the Atatürk University Animal Experiments Local Ethics Committee (Date:28.07.2017, Decision No:81).

Informed Consent: Not necessary

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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ORIGINAL ARTICLE
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Hepatic Hydatid Cyst in Children: An Experience from East of Turkey

Çocuklarda Karaciğer Hidatik Kisti: Türkiye'nin Doğusundan bir Deneyim

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ABSTRACT

Aim: Hydatid cyst is a parasitic disease caused by the infection of Echinococcus granulosus and rarely Echinococcus alveolaris eggs, which are endemic in our country. Current treatment options for liver hydatid cysts; They can be listed as medical treatment, surgical treatment, percutaneous drainage and only clinical follow-up.

Material and Method: Child patients between the ages of 0-16 who were diagnosed with KcKH and followed-up and treated were evaluated retrospectively. In pre-operative evaluation, lung radiography, abdominal ultrasonography, serological tests, hemogram and liver function tests were routinely performed.

Results: 250 pediatric patients between the ages of 0 and 16, whose data were fully available, were included in the study. 118 of the cases were girls and 132 were boys. The average age was 11.2 years. Most of the KcKH patients were admitted to the hospital for another reason and the cyst was detected incidentally. Of the 65 patients requiring surgery, 17 were patients who initially underwent primary intervention with PAIR. Patients who underwent PAIR were observed for one night and discharged in an average of 18 hours. Patients with free drainage were discharged in 2-4 days. The average length of stay for patients who underwent open surgery was found to be 9 days.

Conclusion: The Gharbi classification updated by WHO is effective and reliable in determining the KcKH treatment strategy. In cases who are receiving chemotherapy and an intervention decision is made, a final USG is performed just before the procedure; It can provide both a change in treatment management and more patients benefiting from medical treatment.

Keywords: Liver, cyst hydatic, child

ÖZ

Amaç: Hidatik kist, ülkemizde endemik olan Echinococcus granosus ve nadiren Echinococcus alveolaris yumurtalarının enfeksiyonunun neden olduğu paraziter bir hastalıktır. Karaciğer hidatik kistlerinde güncel tedavi seçenekleri; Bunları medikal tedavi, cerrahi tedavi, perkütan drenaj ve sadece klinik takip olarak sıralayabiliriz.

Gereç ve Yöntem: Karaciğer kist hidatik tanısı konularak takip ve tedavi edilen 0-16 yaş arası çocuk hastalar geriye dönük olarak değerlendirildi. Ameliyat öncesi değerlendirmede rutin olarak akciğer grafisi, batın ultrasonografisi, serolojik testler, hemogram ve karaciğer fonksiyon testleri yapıldı.

Bulgular: Verileri tam olarak mevcut olan 0-16 yaş arası 250 pediatrik hasta çalışmaya dahil edildi. Vakaların 118'i kız, 132'si erkekti. Ortalama yaş 11,2 idi. KcKH hastalarının çoğu başka bir nedenden dolayı hastaneye başvurmuş ve kist tesadüfen tespit edilmişti. Ameliyat gerektiren 65 hastanın 17'si başlangıçta PAIR ile birincil müdahale uygulanan hastalardı. PAIR uygulanan hastalar bir gece gözlem altında tutuldu ve ortalama 18 saatte taburcu edildi. Serbest drenajı olan hastalar 2-4 gün içinde taburcu edildi. Açık ameliyat olan hastaların ortalama kalış süresi 9 gün olarak belirlendi.

Sonuç: DSÖ tarafından güncellenen Gharbi sınıflaması Karaciğer kist hidatik tedavi stratejisinin belirlenmesinde etkili ve güvenilirdir. Kemoterapi alan ve müdahale kararı verilen vakalarda işlemden hemen önce son ultrasonografi yapılır; Hem tedavi yönetiminde değişiklik yapılmasını hem de daha fazla hastanın tıbbi tedaviden faydalanmasını sağlayabilir.

Anahtar Kelimeler: Karaciğer, kist hidatik, çocuk

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INTRODUCTION

Hydatid cyst is a parasitic disease caused by the transmission of Echinococcus granulosus and rarely Echinococcus alveolaris eggs, which is endemic in Turkey. The orally ingested eggs enter the portal venous system through the mucosa of the upper gastrointestinal tract and evolve into the larval stage in the last organ to which they attach. Cysts are localized in the liver with a rate of 50-70%, in the lung with a rate of 20-30% and rarely in the spleen, kidney, heart, bone, central nervous system and other organs(1- 3). Current treatment options for liver hydatid cysts include medical treatment, surgical treatment, percutaneous drainage and clinical monitoring only (2,3).

In 2011, a new treatment strategy was proposed by WHO-IWGE based on Gharbi's radiologic classification(4,5). In this study, we evaluated the efficacy of the WHO-IWGE (**Table 1**) protocol in terms of diagnosis and treatment strategies in our pediatric patients with hepatic hydatid cyst in a tertiary care institution in eastern Turkey in the light of the literature.

Table 1: WHO-IWGE classification of the hydatid cyst

Stage	Ultrasonographically aspect according to WHO-IWGE Classification
CL	Anechogenic uniloculated cyst, with no echoes or internal sepsis
CE 1	Anechogenic cyst, with fine echoes inside, representing the hydatic sand - active cyst
CE 2	Cyst with multiple septums at the interior, giving it a multivesicular aspect or "honeycomb" aspect,with a uniloculated primary cyst - active cyst
CE 3	Uniloculated cyst with decolated proligere membrane ("waterlily sign") (CE3a) or daughter vesicles associating hypo/hyperechogene images (CE3b) - cyst in transition phase
CE 4	Cyst with mixed content, hypo/hyperechogenic, without daughter vesicles - "wool clew" aspect-cyst in the degenerative phase
CE 5	Cyst with partial or totally calcified wall - inactive cyst

MATERIAL AND METHOD

Ethical approval for this study was received from Van Training and Research Hospital, dated 03.10.2019 and numbered 2019/18.

We retrospectively evaluated pediatric patients aged 0-16 years who were diagnosed and followed-up and treated for hepatic hydatid cyst between 2015 and 2024. Pre-operative chest radiography, abdominal ultrasonography, serologic tests, hemogram and liver function tests were routinely performed. All patients were started on Albendazole 10mg/kg in 2 doses at least 3-4 weeks before surgery or percutaneous intervention. All hepatic hydatid cysts were radiologically classified according to Gharbi. The Gharbi classification was updated by the World Health Organization (WHO) Echinococcus Working Group(5).

According to the WHO classification, CE1 and CE3a cysts larger than 5 cm were treated with PAIR (puncture - aspiration - scolocidal injection - reaspiration) or PAIDS (puncture - aspiration - scolocidal injection - drainage catheter placement - sclerosing agent injection) and those smaller than 5 cm were treated medically. CE2 and CE3b cysts larger than 5 cm were treated surgically due to the risk of perforation, and cysts smaller than 5 cm were treated medically. All cysts that were found to be associated with the biliary tract underwent surgical intervention regardless of size. CE4 and CE5 cysts were followed up without treatment regardless of size.

In patients eligible for percutaneous intervention, US-guided PAIR technique (for cysts smaller than 6 cm) and PAIDS catheterization technique (for cysts larger than 6 cm) were used. We used 20% hypertonic saline solution as a scolocidal agent and 95% pure alcohol as a sclerosing agent. Ul

The results were statistically assessed by using SPSS version 24. Normality controls were done using Shapiro-Wilk Test. Groups were compared in terms of mortality using independent sample t-test. Statistical significance level was set as $p<0.05$.

RESULTS

250 child patients between the ages of 0 and 16, whose data were fully available, were included in the study. 118 of the cases were girls and 132 were boys. The average age was 11.2 years.

Most of the hepatic hydatid cysts detected at the time of initial admission were type 1 hydatid cysts (**Figure 1**). No statistically significant difference was found in the ratio of girls to boys ($p>0.05$). No significant relationship was found between the radiological type of the cyst and the average age. The cyst size of patients with type 1 and type 3 hydatid cysts was found to be significantly larger. This was attributed to the growth tendency of active cysts. Additional organ involvement was more common in active cysts (20%).

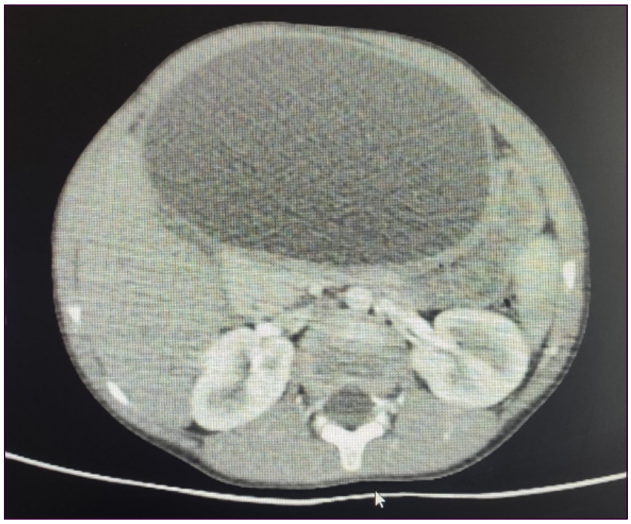

Figure 1. CT of Type 1 Cyst Hydatid of left hepatic lobe

Most of the hepatic hydatid cyst patients were admitted to the hospital for another reason and the cyst was detected incidentally. Symptomatic patients often presented for reasons such as abdominal pain and a feeling of abdominal fullness. These symptoms were frequently detected in children over the age of 10 who could express themselves easily. The patients diagnosed as a result of our screening were siblings or other family members who shared the same environmental environment.

Of the 65 patients requiring surgery, 17 were patients who initially underwent primary intervention with PAIR. The remaining 48 patients underwent primary surgical intervention. Infection developed in the cyst site in 4 of the patients who underwent surgery. In 10 of these patients, the bile ducts were sutured due to bile leakage. Bile drainage lasting more than 6 weeks developed in 4 of them. Of the 6 patients who were found to have bleeding from the drain in the first week after surgery, bleeding from the abdominal drain stopped spontaneously on the 3rd day on average. Surgical intervention was required in 17 of the patients who underwent PAIR because of bile leakage or lack of cyst resolution. In 4 patients, PAIR was preferred again. All cysts that were smaller than 5 cm, did not show exophytic extension, were unlikely to rupture due to trauma, and had a change in type with medical treatment were followed up with medical treatment.

Hydatid cyst was positive in 62% of our patients. Almost all of the patients were diagnosed with ultrasound (97%) and treatment was planned, in line with the literature. In patients with additional complications whose relationship with the vascular structures and bile ducts could not be clearly determined, the surgical decision was made according to the CT (3%) result.

Patients who underwent PAIR were observed for one night and discharged in an average of 18 hours. Patients with free drainage were discharged in 2-4 days. The average length of stay for patients who underwent open surgery was found to be 9 days.

Cure was achieved after 3-6 months of chemotherapy in 21 patients (8%) whose type change was detected according to the Gharbi classification in the pre-procedural ultrasonography, although the decision for PAIR, PAIDS or surgery was made at the first application.

DISCUSSION

Eggs excreted in the feces of dogs, the main host of Echinococcus granulosus, are the main source of this type of infection in both livestock and humans. Hepatic hydatid cyst disease is widespread globally, especially in endemic regions. In our country, a high prevalence of parasites is observed in the Eastern and Southeastern regions, where livestock farming is the main livelihood (6, 7, 8). The hepatic hydatid cyst disease mostly manifests itself as a solitary and single cystic lesion in the right lobe (9). Hepatic hydatid cyst disease has a growth rate of approximately 1-3 cm in diameter per year (8). Clinical findings vary depending on the mass compression effect of the cyst and its complications. Physical examination findings are not guiding in the diagnosis, since hepatic hydatid cyst disease usually does not give a prominent clinical sign. However, if the cyst is complicated or ruptured, it produces a distinct clinical presentation.

In a study by Cıgşar et al. in which abdominal ultrasonography was performed in 2138 patients who presented to the emergency department in city of Turkey for any reason, incidental detection of hepatic hydatid cyst disease was found in 96 of the patients (1/22)(8). The prevalence of the disease was found to be 1.05% in our country (3).

Although the diagnosis can be made with anamnesis, clinical findings, laboratory tests and radiologic examinations, surgical excision and histopathologic examination are required for definitive diagnosis (1,7,8).

Among laboratory tests, ELISA basic immunodiagnostic tests are frequently used but their contribution to the diagnosis is limited(5). Its sensitivity is reported between 85-98% (5,7). As organ involvement increases, sensitivity may increase to 90-100% (7). There may be cases with negative serology results despite having hydatid cysts as well as cases with false positive results despite the absence of cysts(5). In our cases, the most common mode of presentation was incidental, and it was learned that these patients were diagnosed by ultrasound performed in an external center for another reason. The most common clinical finding was nonspecific abdominal pain.

Radiologically, the classification system proposed by Gharbi is used in hepatic hydatid cyst disease. Abdominal ultrasonography, which is an inexpensive and easily applicable method, should be preferred for the diagnosis (8,10). CT is the best method to determine the type and location of the cyst, but high dose radiation and cost are the most important disadvantages (10).Even if cross-sectional imaging modalities are used to determine cyst typing and treatment modality in hydatid cysts, each patient should be evaluated by ultrasonography by the same radiologist before the procedure(5).

Diagnosis; although it can be diagnosed by anamnesis, clinical findings, laboratory tests and radiological examinations, surgical excision and histopathological examination are required for a definitive diagnosis (1,7,8). Among laboratory tests, ELISA basic immunodiagnostic tests are frequently used, but their contribution to diagnosis is limited (5). Its sensitivity is reported to be between 85-98% (5,7). As organ involvement increases, sensitivity can increase to 90-100% (7). While there may be cases with negative serology despite having hydatid disease, there may also be cases with false positive results even though they do not have a cyst (5). In

our cases, the most common presentation was incidental; it was learned that these patients were diagnosed with an abdominal ultrasoundperformed for another reason at an external center. The most common clinical finding was nonspecific abdominal pain.

In hepatic hydatid cyst disease, the radiological classification system suggested by Gharbi is used. In diagnosis, abdominal ultrasonography, which is a cheap and easily applicable method, should be preferred first (8,10). CT is the best method to determine the type and location of the cyst, but high dose radiation and cost are its most important disadvantages (10). Even though cross-sectional imaging modalities have been performed to determine cyst typing and treatment in hydatid cysts, each patient must be evaluated with ultrasonography by the same radiologist before the procedure (5). Thus, by detecting the type change, more patients can benefit from medical treatment. In all our cases, the diagnosis was confirmed by abdominal ultrasonography and serological tests.

Complications such as allergic reaction due to spontaneous, traumatic, iatrogenic rupture, secondary infection and cholangitis are seen in 2%-4% of hepatic hydatid cyst disea (5,8,11,12). The most common complication is cystobiliary fistula. The aim of hydatid cyst treatment should be interventions to prevent infection, obstruction, rupture to neighboring organs and anaphylaxis. Since chemotherapy will be added to each patient regardless of the treatment method used, hemogram and liver fonction tests should be monitored before starting the treatment to monitor the side effects of chemotherapy (5,8,10,11).

Treatment methods can be examined under four headings: surgical, medical, percutaneous and follow-up (2,3). Surgical treatment was the traditional method in the treatment of hydatid cyst until recently, but in the last two decades, percutaneous intervention procedures and medical treatment; They have become the preferred methods instead of surgery in selected cases. Surgery is the definitive treatment method in the treatment of hepatic hydatid cyst disease, but its mortality, morbidity and recurrence rates are higher than other methods. While complication rates are reported to be between 1.7-8.6% (8,11) in the literature, mortality rates of up to 25% have also been reported, especially in cases of rupture (8). Major complications of surgery are bleeding, sepsis and fistula formation(5,8,11). Omentoplasty, capitonnage, simple closure, deroofing and external drainage (12,13) are the most commonly used methods in the management of the residual cavity. ERCP can be used effectively in the treatment of biliary fistula in the preoperative and postoperative periods (5,9). In hepatic hydatid cyst disease patients, ERCP is performed when intrabiliary rupture is suspected before the operation or when there is persistent icterus in the postoperative period, common bile duct pathologies in radiological imaging, or laboratory abnormalities; It can be used effectively in the diagnosis and treatment of these undesirable conditions (9).

Although it is reported that the results of medical treatment are not satisfactory, in selected cases, it can be used as a stand-alone treatment method, and in many cases, it is used as a complementary agent before or after surgical or percutaneous intervention (2,5). Preoperative use of chemotherapy reduces the viability of the cyst, and postoperative use reduces the risk of recurrence. Albendazole and mebendazole are most commonly used as chemotherapeutic agents in the treatment of hepatic hydatid cyst disease (2,6). It is recommended that medical treatment be used alone, especially for CE1 - CE3a (iwge) cysts smaller than 5 cm (3,5,12).

Percutaneous drainage of hepatic hydatid cyst in children under ultrasonography guidance is an effective method. Treatment success in suitable cases with the PAIR/PAIDS method is reported to be over 95% (2). Percutaneous treatment is widely used and minimal morbidity is reported (2,3,5,12). The aim of percutaneous treatment is to drain the endocyst and destroy the germinal membrane. The best results with PAIR treatment are seen in active unilocular cysts (IWGE CE1 or GHARBI Type I) and cysts with a separated membrane (IWGE CE3a and GHARBI Type 2). In the PAIR method, the presence of daughter vesicles (**Figure 2**) in the cyst content reduces the success of treatment, so it is important to classify the cyst correctly at the beginning. In the presence of a daughter vesicle, cyst drainage is provided by placing a large lumen percutaneous catheter (modified catheterization) instead of the PAIR method. In addition, PAIR is contraindicated in cysts related to the biliary ducts due to the risk of the sclerosing cholangitis caused by the scholicidal agent. After percutaneous intervention, albendazole treatment should be continued for 3 months (2,3,12). The average follow-up period is 24 months (5).

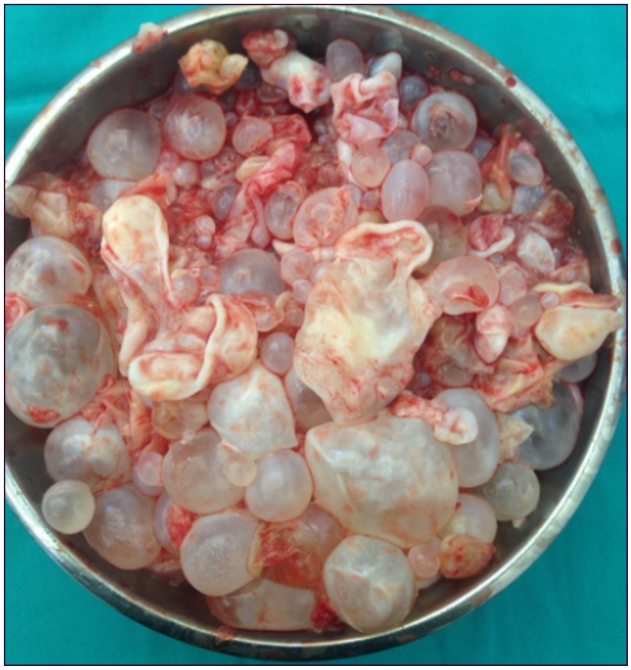

Figure 2. Cyst Hydatic constitutive parts

In our study, all patients were started on 10 mg/kg albendezol treatment for 3 weeks before the intervention. Medical treatment was continued in cases where the size of the cyst decreased on ultrasound, its type changed early in the classification, and in patients who were not considered to be at risk of perforation. We think that the decision whether to continue medical treatment should be made by checking the cyst with ultrasound before the procedure and depending on the behavior of the cyst. It is known that newly formed and active cysts with thin walls, smaller than 5 cm, respond better to medical treatment. It is active but smaller than 5 cm and does not show exophytic extension, ii) it is predicted that the possibility of rupture with trauma is low, iii) it does not have symptoms of compression on major vascular structures and/or large bile ducts, iiii) during follow-up with medical treatment (1-3 months). No surgical intervention or drainage was considered for patients with type change (in controls) and medical treatment was continued.

In conclusion, the Gharbi classification updated by the WHO is effective and reliable in determining the treatment strategy for hepatic hydatid cyst disease. In patients who are receiving chemotherapy and in whom intervention is decided, a final ultrasound performed just before the procedure may lead to a change in treatment management and more patients may benefit from medical treatment. We also recommend that family screening should be routinely performed by family physicians with chest radiography and ultrasonography, especially considering the high incidence in endemic areas.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by the Van Training and Research Hospital Ethics Committee (Date: 03.10.2019, Decision No:2019/18).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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CASE REPORT
OLGU SUNUMU

A Rare Clinical Form of Candidaemia: A Pediatric Case of Leukemia with Skin Involvement

Kandideminin Nadir Bir Klinik Formu: Cilt Tutulumu Olan Lösemi Tanılı Çocuk Vaka

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ABSTRACT

Cutaneous involvement of candidemia is seen in hematological-oncological patients with weak immune systems and is rare. Lesions may be maculopapular or nodular. This case report presents cutaneous lesions due to disseminated candidemia in an 8-year-old child who was followed up with a diagnosis of leukemia and hospitalized with febrile neutropenia. The patient's general condition was very poor. There was resistant *Candida* growth in blood and port culture. The diagnosis was made clinically in consultation with the dermatology department. Amphotericin B and voriconazole combination therapy was given. The lesions disappeared. Today, *Candida* spp. infections are becoming more common, and the rate of skin involvement is also increasing. However, the diagnosis of *Candida* skin involvement may be difficult. Histopathology can be used in the diagnosis. Skin involvement is more common in candidemia patients with risk factors, especially those with *Candida tropicalis* growth.

Keywords: Candidaemia, cutaneous involvement, child, leukemia

ÖZ

Kandideminin kutanöz tutulumu, immün sistemi zayıf olan, hematolojik-onkolojik hastalarda görülür ve nadirdir. Lezyonlar makülopapüler ya da nodüler olabilir. Bu olgu sunumunda lösemi tanısıyla takip edilen, febril nötropeni ile yatışı yapılan 8 yaş çocuk hastada dissemine kandidemiye bağlı kutanöz lezyonlara yer verilmektedir. Hastanın genel durumu çok kötüydü. Kan ve port kültüründe dirençli *Candida* üremesi tespit edildi. Tanı dermatoloji bölümüne danışılarak klinik olarak koyuldu. Hastaya amfoterisin B ve vorikanazol kombinasyon tedavisi verildi. Lezyonları kayboldu. Günümüzde *Candida* spp. enfeksiyonlarının sık görülmesiyle beraber cilt tutulumu oranı da artmaktadır. Fakat *Candida* deri tutulumu tanısı güç olabilmektedir. Tanıda histopatoloji kullanılabilir. Risk faktörlerine sahip kandidemili olgularda özellikle *Candida tropicalis* üremesi olan olgularda deri tutulumu daha sık görülmektedir.

Anahtar Kelimeler: Kandidemi, kutanöz tutulum, çocuk, lösemi

INTRODUCTION

Candida is the most common causative agent of invasive fungal infections, and the most common species is *Candida albicans* (1,2). Involvement of the eye, liver, spleen, heart, brain, and, more rarely, skin can also be observed during candidemia (3,4). Skin involvement is very rare and may be overlooked. Cutaneous manifestations of candidaemia may start as macules and appear as papular, pustular, nodular, or erythematous lesions. It is usually seen on the trunk and extremities (5).

In this case report, we aimed to present a case of catheter-associated candidemia with skin involvement in a pediatric patient with leukemia.

CASE REPORT

An eight-year-old male patient with acute lymphoblastic leukemia (ALL) was treated with vancomycin and meropenem for febrile neutropenia. On the eighth day, metronidazole, amikacin, and caspofungin were added to the treatment because the patient developed a fever again. Laboratory tests revealed white blood cell count was 100/µl, absolute neutrophil count was 0/µl, and procalcitonin was 30 ng/ml. The blood and urine cultures of the patient showed yeast growth signals, and no involvement in favor of *Candida* was detected in organ scans.

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On the 14th day of vancomycin, the 14th day of meropenem, the sixth day of amikacin, the sixth day of caspofungin, the sixth day of metronidazole, the patient developed a rash on his upper extremities, but he had no fever at that time. The lesions were 0.5 cm-1 cm in size, more intense on the upper extremity, and irregular macular (**Figure 1**). The patient was isolated. Measles, rubella, parvovirus, chlamydia, mycoplasma, human immunodeficiency virus (HIV) serologic tests were negative. Dermatology and our team thought the patient's skin lesions were *Candida* skin involvement. On the ninth day of caspofungin, *Candida parapsilosis* was detected in the blood and port cultures taken simultaneously, *Candida tropicalis* (*C. tropicalis*) was detected in the subsequent repetitive growths, and 5.000 colonies of *Candida* spp. were detected in the urine culture. The patient was evaluated as having disseminated candidiasis. Caspofungin was stopped, voriconazole and amphotericin B intravenous combination, and intra-port amphotericin B treatment was started as the patient had resistant growths and clinical deterioration under antifungal treatment. The patient's fever was controlled, and procalcitonin values decreased. The patient's skin lesions faded on the 12th day of amphotericin B and voriconazole. The port was removed in the follow-up. The patient received antifungal therapy for two more weeks after port removal. The patient's candidemia was controlled, but severe neutropenia did not improve. During follow-up, the patient developed coagulopathy and gastrointestinal bleeding. Multidrug resistant *Klebsiella pneumoniae* growth was detected in blood culture. Despite all treatments, the patient died of resistant health-related infection and gastrointestinal bleeding.

Written and verbal consent was obtained from the patient's mother regarding the patient's illness and photo sharing.

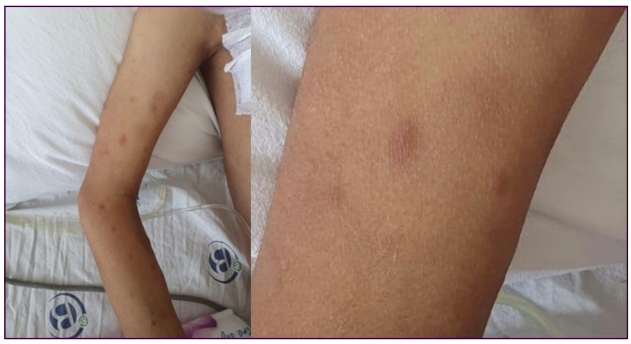

Figure 1. *Candida* skin involvement lesions

DISCUSSION

Nowadays, the rate of *Candida* skin involvement is increasing along with the frequency of *Candida* spp. infections. Although *Candida albicans* is the most common species of candidemia, *C. tropicalis* is the most common species in cutaneous diseases (6). *C. tropicalis* was also grown in our case.

One of the most important risk factors for *Candida* skin involvement is neutropenia, and neutrophil support should be provided to these patients (7). Factors such as malignancy, chemotherapy, radiotherapy, long-term use of broad-spectrum antibiotics, and central venous catheters are risk factors for *Candida* skin involvement. Most of these risk factors were present in our case.

The diagnosis of *Candida* skin involvement may be difficult. Histopathology can be used in the diagnosis (5,6). In our case, the diagnosis was made on the basis of history, physical examination, and supportive examinations; a biopsy could not be performed because of severe thrombocytopenia.

Candida skin involvement should be considered in patients with candidemia who have risk factors, especially in cases with *C. tropicalis* growth.

It is most important to protect patients with hematological malignancies from candidemia. Therefore, antifungal prophylaxis is recommended for those with an expected duration of neutropenia longer than 7 days, those with recurrence of the disease, those who have undergone allogeneic stem cell transplantation, and those in moderate and severe risk groups such as graft versus host disease (8).

ETHICAL DECLARATIONS

Informed Consent: Written and verbal consent was obtained from the patient's mother.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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