



Turkish Journal of  
**GERIATRICS**

Volume: 21 • Number:1 • Year: 2018



The Official Scientific Journal of Turkish Geriatrics Society

ISSN: 1304-2947 e-ISSN: 1307-9948

[www.turkgeriatri.org](http://www.turkgeriatri.org)





[www.turkgeriatri.org](http://www.turkgeriatri.org)

ISSN: 1304-2947 • e-ISSN: 1307-9948

The official scientific journal of Turkish Geriatrics Society



Member  
of  
IAGG

#### OWNER

On Behalf of Turkish Geriatrics Society  
Yeşim GÖKÇE-KUTSAL

#### EDITORIAL MANAGER

Orhan YILMAZ

#### TECHNICAL ASSISTANCE

Selma ÜNAL

"Turkish Journal of Geriatrics" is indexed in: Science Citation Index Expanded (Sci Search), Journal Citation Reports/Science Edition, Social Sci Search, Journal Citation Reports/Social Sciences Edition, Index Copernicus Master List, EMBASE, SCOPUS, ELSEVIER, EBSCO and "Turkish Medical Index" of Turkish Academic Network and Information Center in The Scientific and Technological Research Council of Turkey (TÜBİTAK-ULAKBİM), Turk Medline and Turkey Citation Index.

Published four times (March, June, September, December) a year

#### CORRESPONDANCE

Turkish Geriatrics Society

[www.turkgeriatri.org](http://www.turkgeriatri.org)

[info@geriatri.org](mailto:info@geriatri.org)

[www.geriatri.dergisi.org](http://www.geriatri.dergisi.org)

[editor@geriatri.dergisi.org](mailto:editor@geriatri.dergisi.org)

Date of Publication: 15 March 2018

# Turkish Journal of GERIATRICS

Volume: 21 • Number:1 • Year: 2018

#### EDITOR-IN-CHIEF

Yeşim GÖKÇE KUTSAL

#### EDITORIAL BOARD

Dilek ASLAN  
Orhan YILMAZ  
Sercan ÖZYURT  
Alfonso CRUZ-JENTOFT  
Peter FERRY  
Clemens TESCH-ROEMER

#### INTERNATIONAL ADVISORY BOARD

Vladimir ANISIMOV	RUSSIA
Jean-Pierre BAEYENS	BELGIUM
Yitshal BERNER	ISRAEL
Harrison BLOOM	USA
C.J. BULPITT	UK
Robert N. BUTLER	USA
Roger Mc CARTER	USA
Mark CLARFIELD	ISRAEL
Cyrus COOPER	UK
Gaetano CREPALDI	ITALY
Michael FARTHING	UK
Marvin FORMOSA	MALTA
Ghada El-Hajj FULEIHAN	LEBANON
David GELLER	USA
Barry J. GOLDLIST	CANADA
Melvin GREER	USA
Renato M. GUIMARAES	BRASIL
Gloria M. GUTMAN	CANADA
Carol HUNTER-WINOGRAD	USA
Alfenso JC JENTOFT	SPAIN
Vladimir KHAVINSON	RUSSIA
John KANIS	UK
Tom KIRKWOOD	UK
Jean-Pierre MICHEL	SWITZERLAND
John E. MORLEY	USA
Robert MOULIAS	FRANCE
Desmond O'NEILL	IRELAND
Sokrates PAPAPOULOS	HOLLAND
Mirko PETROVIC	BELGIUM
Russel REITER	USA
Rene RIZZOLLI	SWITZERLAND
Ego SEEMAN	AUSTRALIA
Walter O. SEILER	SWITZERLAND
Alan SINCLAIR	UK
Raymond C. TALLIS	UK
Adele TOWERS	USA
Joseph TROISI	MALTA
Guy VANDERSTRATEN	BELGIUM
Alan WALKER	UK
Ken WOODHOUSE	UK
Archie YOUNG	UK

## **TURKISH JOURNAL OF GERIATRICS**

---

Turkish Journal of Geriatrics is a peer-reviewed journal and is devoted to high standards of scientific rules and publication ethics. The Editors of the Journal accepts to follow 'Editorial Policy' of the 'Council of Science Editors' ([www.councilscienceeditors.org/](http://www.councilscienceeditors.org/)). Any article published in the journal is also published in electronic format and is shown at <http://www.geriatri.org>.

Instructions for authors are based on the report of International Committee of Medical Journal Editors [(Last Version)- (Uniform Requirements for manuscripts Submitted to Biomedical Journals, [www.icmje.org](http://www.icmje.org)).

## **INSTRUCTIONS FOR AUTHORS**

---

[www.geriatri.dergisi.org](http://www.geriatri.dergisi.org)

Turkish Journal of Geriatrics is an official publication of Turkish Geriatrics Society and is published four times a year. Official languages of the journal are Turkish and English. Turkish Journal of Geriatrics invites submission of Original Articles based on clinical and laboratory studies, Review Articles including up to date published material, Original Case Reports, Letters to the Editor and News and Announcements of congress and meetings concerning all aspects of Geriatrics, Aging and Gerontology and related fields.

**Manuscripts should be submitted online at [www.turkgeriatri.org](http://www.turkgeriatri.org).**

Address for e-collitera author guide (communication to author's module, registration to system, entry into the system and sending a new article) is: [www.geriatri.dergisi.org](http://www.geriatri.dergisi.org)

### **Attention ! Last Control Before Submission (Checklist for Submitted Articles)**

1. Letter of submission written for the editor.
2. E-mail address as well as postal address, official telephone and mobile phone number of corresponding author.
3. Affiliations of all the authors.
4. Copy of "Ethical Committee Approval Document" (will also be sent via mail)
5. Signed "Informed Consent Form" for the case reports (will also be sent via mail)
6. "Copyright Transfer Form" signed by all the authors (will also be sent via mail)
7. "Author Contribution Form" signed by all the authors (will also be sent via mail)
8. "Certificate of Language Control and Correction" (will also be sent via mail)
9. Turkish and English heading
10. Structured Abstract (Both in Turkish and English) (250 words at maximum)
11. Keywords in accordance with "Medical Subjects Headings-MeSH" List (up to 6)
12. Article divided into appropriate sections (1500-3500 words)
13. All figures (with legends) and tables (with titles) cited
14. Complete and accurate references (all references cited in text by numbers in standard brackets; references should be 25 at maximum with the PMID numbers and written according to the rules of the journal)



## FROM THE EDITOR IN CHIEF

Turkish Journal of Geriatrics (TJG) is welcoming you with its new face in the first issue of 2018. Our scientific journey has started in 1998 and since then, our efforts specifically targeted to improve health and wellbeing of aging societies globally.

The Journal has been indexed by both national and international indexes for many years. Among all, one of the major milestone was the acceptance of the TJG both to the "Science Citation Expanded Index" and "Social Citation Index" in 2008. Not only the number of the published manuscripts increased, but the admission profile has also enlarged since that time. Significant number of qualified authors are submitting their manuscripts to our journal to access to the scientists working on aged populations.

Focus of continuous improvement causes to give priority to the high quality of the content. In this regard, a rationale balance between original researches, clinical cases, and "invited" review articles is considered. The members of the Editorial Board are determined to maintain its current publication policy depending on universal ethical values for the future studies.

Prof. Dr. Yeşim GÖKÇE KUTSAL, M.D.  
Editor in Chief



## EDITORIAL

- Orhan YILMAZ<sup>1</sup>
- Dilek ASLAN<sup>1</sup>
- Sercan ÖZYURT<sup>1</sup>
- Yeşim GÖKÇE KUTSAL<sup>2</sup>

<sup>1</sup> Editorial Board Members,  
Turkish Journal of Geriatrics  
<sup>2</sup> Editor in Chief,  
Turkish Journal of Geriatrics

## TWENTY YEARS OF SCIENCE WITHIN THE SCOPE OF TURKISH JOURNAL OF GERIATRICS

Turkish Journal of Geriatrics (TJG), the official scientific publication of the Turkish Geriatrics Society (1), was first published in 1998 giving priority on the aging population both in Turkey and in the world with its previous name "Geriatri" (Figure 1).

**Figure 1.** Geriatri



The Journal has been indexed in Index Copernicus Master List, EMBASE, SCOPUS, ELSEVIER, EBSCO and "TR index of Turkish Academic Network and Information Center in The Scientific and Technological Research Council of Turkey (TÜBİTAK-ULAKBİM-TR index)" for many years.

In 2008 the Journal has started to be indexed in the Science Citation Index Expanded and the Social Science Citation Index. These two recent indexes were established by Thomson Reuters (2). This exciting improvement has opened a "new" vision and has given more responsibility to the journal for 10 years. With this responsibility, the Editorial Team decided to enlarge its vision basically to the international population which also will help the Turkish scientists to be more acknowledged by their international colleagues meeting on the scientific platform of the journal. The name of the journal was changed to "Turkish Journal of Geriatrics (TJG)" (Figure 2a) and the format of the TJG has been renewed very recently with its first issue in 2018 (Figure 2b).

**Figure 2.** Turkish Journal of Geriatrics



After indexed in SCI-exp and SSCI, the number of manuscript admissions increased sharply and to meet this demand, the editorial team has changed its structure as well. Editor in chief, expanded Editorial Team composed of national and international members, expanded national and international reviewers are currently working all together with their different scientific backgrounds in aging (3). Both health and social sciences aspects of aging are examined within the scope of the Journal.

Since now, 873 manuscripts in 78 issues were published (325 in the first 10 years and 548 in the second 10 years). Additionally, four special issues were also published. These special issues were prepared basically for the abstracts of the international congresses organized by the Turkish Geriatrics Society. The total page numbers from the beginning were counted as 5293. Thousands of authors (n=2986) contributed to the Journal and they cited 19.216 references.<sup>1</sup> The Editorial Team has shared this updated information of the Journal with its scientific team on 28<sup>th</sup> of February 2018 in its 20th anniversary meeting (4).

As the Editorial Team, we are very aware of the responsibility which TJG has given to us since many years.

We are committed to continuing our efforts to the improvement of the scientific work on aging related issues at the highest level of our agenda.

### **Acknowledgement**

We cordially thank to the current and previous members of both the Editorial and the Advisory Boards for being with us with all their positive and helpful efforts/suggestions in this long journey.

### **References**

1. Turkish Geriatrics Society website. [Internet] Available from: <http://geriatri.dergisi.org/>. Accessed:10.3.2018.
2. Thomson Reuters website. [Internet] Available from: <https://www.thomsonreuters.com/en.html>. Accessed:9.3.2018.
3. Editorial Board of Turkish Journal of Geriatrics. [Internet] Available from: <http://geriatri.dergisi.org/static.php?id=2>. Accessed:9.3.2018.
4. Turkish Journal of Geriatrics 20<sup>th</sup> year celebration ceremony. [Internet] Available from: [http://www.geriatri.org.tr/haber\\_detay?id=61](http://www.geriatri.org.tr/haber_detay?id=61). Accessed:1.3.2018.

1 All issues of TJG (1998-2018)



# Turkish Journal of **GERIATRICS**

Volume: 21 • Number:1 • Year: 2018

## RESEARCH ARTICLE

- ▶▶ **A Population-Based Study: The Appropriateness of Drug Use in the Elderly According to Beers Criteria** 1-15  
*Biröl ÇIBİK, Erkan Melih ŞAHİN, Mehmet Göktuğ KILINÇARSLAN*
- ▶▶ **An Evaluation of Abuse and Neglect in Elderly with the Hwalek-Sengstock Elder Abuse Screening Test** 16-24  
*Hande ŞAHİN, Sibel ERKAL*
- ▶▶ **Ageist Attitudes and Their Association with Burnout and Job Satisfaction Among Nursing Staff: A Descriptive Study** 25-32  
*Serkan PEKÇETİN*
- ▶▶ **Can an Elective Geriatric Nursing Course Change Nursing Students' Attitudes and Willingness in Caring for the Elderly? A Quasi-Experimental Design Study** 33-40  
*Burcu AKPINAR SÖYLEMEZ, Özlem KÜÇÜKGÜÇLÜ, Merve Aliye AKYOL*
- ▶▶ **Prevalence of Multidrug-Resistant Bacterial Colonization and Risk Factors in Geriatric Nursing Home Residents** 41-48  
*Oya Özlem EREN KUTSOYLU, Vildan AVKAN OĞUZ, Madina ABDULLAYEVA, Nil TEKİN, Nur YAPAR*
- ▶▶ **Fall Risk and Related Factors in Knee Osteoarthritis** 49-55  
*Meltem ALKAN MELİKOĞLU, Ayhan KUL*
- ▶▶ **Neuropathic Pain and Disability in Patients with Lumbar Spinal Stenosis** 56-61  
*Mehmet AĞIRMAN, Ayşe Serap AKGÜN*
- ▶▶ **Mortality Factors in Geriatrics with Non-Traumatic Abdominal Pain at the Emergency Department** 62-69  
*Süha SERİN, Bahadır ÇAĞLAR, Gökhan YILMAZ, Alper TORUN, İsmet PARLAK, Başak GÖL SERİN*
- ▶▶ **Effects of Lower Gastrointestinal Tract Surgery on Survival in Elderly and Octogenarian Patients** 70-80  
*Hüseyin Onur AYDIN, Tevfik AVCI, Tuğcan TEZCANER, Erdal KARAGÜLLE, Sedat YILDIRIM*
- ▶▶ **One-Year Retrospective Evaluation of Hip Fracture Patients Aged More than 80 Years and Postoperatively Monitored in the Intensive Care Unit** 81-86  
*Uygar DAŞAR*

## REVIEW ARTICLE

- ▶▶ **A Clinical Review of the Consequences of Anesthesia and Surgery in the Elderly Brain: "The Dark Side of the Moon"** 87-99  
*Gözde İNAN, Zerrin ÖZKÖSE ŞATIRLAR*
- ▶▶ **Urinary Incontinence in Elderly From a View of a Pharmacist: Detrusor Impairment and Treatment** 100-107  
*Nezahat Tuğba DURLU KANDILCI*

## CONTENTS





Turkish Journal of Geriatrics  
DOI:10.31086/tjgeri.2018137962  
2018;21 (1):1-15

- Birol ÇIBIK<sup>1</sup>
- Erkan Melih ŞAHİN<sup>2</sup>
- Mehmet Göktuğ  
KILINÇARSLAN<sup>2</sup>

#### CORRESPONDANCE

Mehmet Göktuğ KILINÇARSLAN  
Çanakkale Onsekiz Mart University  
Faculty of Medicine, Department  
of Family Medicine  
Çanakkale, Turkey

Phone: 2862636471  
e-mail: goktugmk@gmail.com

Received: 15/11/2017  
Accepted: 09/02/2018

- <sup>1</sup> Tokat State Hospital, Family Medicine Clinic  
Tokat, Turkey
- <sup>2</sup> Çanakkale Onsekiz Mart University  
Faculty of Medicine, Department  
of Family Medicine  
Çanakkale, Turkey

#### RESEARCH

## A POPULATION-BASED STUDY: THE APPROPRIATENESS OF DRUG USE IN THE ELDERLY ACCORDING TO BEERS CRITERIA

### ABSTRACT

**Introduction:** The elderly population has the highest rates of drug use and is more sensitive to drug effects. Inappropriate drug use can cause unwanted effects in such a population. We aimed to evaluate inappropriate drug use in the elderly population according to Beers criteria.

**Materials and Method:** This cross-sectional, descriptive study used a simple systematic method to select individuals aged >65 years residing in Kepez district of Çanakkale. All medicines used by participants were identified and evaluated according to Beers criteria.

**Results:** The mean age of the participants was 74.1±6.5 (65–91) years. In our study, 95.7% of the participants had at least one chronic illness and 84.5% had at least three chronic illnesses. The mean total number of drugs used was 5.0±3.2 (0–15). According to Beers criteria, inappropriate drug use was detected in 35 (30%) instances. Non-steroidal anti-inflammatory drugs were the most frequent inappropriately used drugs in the study population [n=13 (11.2%)].

**Conclusion:** In this study, the rates of inappropriate drug use (35; 30%) were lower than those previously reported. Our findings underline the importance of adhering to guidelines for rational drug use in prescribing medications to elderly.

**Keywords:** Potentially inappropriate medication list; Drug interactions; Drug-related side effects and adverse reactions; Chronic disease; Inappropriate prescribing; Turkey

#### ARAŞTIRMA

## TOPLUM TABANLI BİR ÇALIŞMA: YAŞLILARDA İLAÇ KULLANIMININ BEERS KRİTERLERİNE UYGUNLUK DURUMU

### Öz

**Giriş:** Yaşlı popülasyon en yüksek ilaç kullanım oranına sahip olup ilaç etkilerine daha duyarlıdır. Uygun olmayan ilaç kullanımı bu hastalarda istenmeyen etkilerin ortaya çıkmasına neden olabilmektedir. Bu çalışmada Beers kriterlerine göre yaşlılarda uygun olmayan ilaç kullanımının değerlendirilmesi amaçlanmaktadır.

**Gereç Yöntem:** Kesitsel, tanımlayıcı desendeki araştırmamızda Çanakkale Kepez beldesinde ikamet eden 65 yaş ve üzeri bireylerden basit sistematik yöntemle örneklem seçildi. Çalışmaya alınan yaşlıların aktif kullandıkları tüm ilaçlar belirlenip Beers kriterleri açısından değerlendirildi.

**Bulgular:** Katılımcıların yaş ortalaması 74.1±6.5 65-91 idi. Çalışmamızda yaşlıların %95.7'sinde en az bir kronik hastalık, %84.5'inde ise en az üç kronik hastalık varlığı saptanmıştır. Yaşlıların kullandıkları toplam ilaç sayısı ortalama 5.0±3.2 0-15 idi. Beers kriterlerine göre toplam 35 (%30) durumda uygun olmayan ilaç kullanımı saptandı. Çalışmamızda en sık uygun olmayan kullanılan ilaç olarak 13 (%11.2) bireyde non-steroidal antiinflamatuar ilaçlar saptandı.

**Sonuç:** Literatürdeki diğer araştırmalara göre daha az oranda olsa da çalışmamızda yaşlı hastalarda (35; %30) uygun olmayan ilaç kullanımı olduğu saptanmıştır. Yaşlı hastalara ilaç reçete edilirken akılcı ilaç kullanım kurallarına uymanın önemi ortaya çıkmıştır.

**Anahtar sözcükler:** Potansiyel uygun olmayan ilaç listesi; İlaç etkileşimi; İlaç yan etkisi; Kronik hastalık; Uygun olmayan reçeteleme; Türkiye

## INTRODUCTION

Elderly individuals are more prone to experience drug adverse effects and drug–drug interaction because of physiological changes associated with ageing, which are liable to affect drug metabolism (1). The population that consumed the most drugs was aged  $\geq 65$  years, and 17%-19% consumed at least 10 drugs per week (2).

The use of drugs in elderly people is often inappropriate partly because of the complexities of prescribing as well as other patient, provider, and health-system factors so inappropriate prescribing in elderly people has therefore become an important public-health issue worldwide. Even while there are too many terms to describe prescribing quality (such as good, poor, optimal), the term of appropriate drug use can be used to express the quality level needed to be reached in practice (3).

Various criteria have been developed to guide appropriate drug use in elderly individuals and they can be grouped in 1. implicit criteria (judgement based) such as the Medication Appropriateness Index-MAI and 2. explicit criteria (criterion-based) such as Beers and STOPP/START criterias (4).

Explicit criteria are composed by literature review and expert consensus. Using explicit criteria is easier than using implicit criteria in practice because of explicit criteria are just focus on drugs and/or drug-disease relation without any need to clinical judgement (such as patient preferences, all medicines of patient) (5).

O'Mahony and Gallagher (6), offer six principles for selecting optimal explicit criteria: (i) organization based on physiological systems and rapid applicability in daily practice; (ii) inclusion of the more common errors of commission and omission in prescribing for older adults; (iii) generalizability to the global community of physicians and pharmacists; (iv) ease of interface

with computer records of co-morbidities of patients and lists of drugs; (v) ability to reduce the prevalence of potentially inappropriate medications in older adults in different settings; and (vi) ability to reduce the incidence and negative impact of adverse drug reactions but there is no explicit criteria can fulfil all principles (4). Because of there is not any ideal criteria for screening inappropriate drug use, any of them can be selected according to situations such as for research or daily clinical routine (5).

The use of certain medications in elderly individuals should be avoided according to the Beers criteria developed by the American Geriatrics Society to prevent inappropriate drug use among elderly and updated in 2015 (Tables 2-4). In these criteria, all drugs with a high potential to cause adverse effects in elderly individuals are listed; adverse effects of each drug group are specified and recommendations for use are provided. Depending on the changes in kidney function and drug interactions in elderly individuals, special restrictions may be required with respect to dosage, dose interval and treatment duration. Beers criteria were found to be a highly useful guide for reducing inappropriate drug use, minimising drug-related adverse effects and reducing treatment costs (7). Inappropriate drug use rate according to Beers criteria change from %10.3 to %66.7 in literature (8,9).

Beers criteria has also some limitations but it is still widely used (10). Also Beers criteria is most cited explicit criteria in literature (4). STOPP/START has three implicit prescribing rules unlike Beers criteria, that means using STOPP/START criteria to screen inappropriate drug use need clinical judgement (11).

In this study we aimed to assess the appropriateness of drug use in the elderly population in the Kepez district of Canakkale on the basis of Beers criteria.



## MATERIALS AND METHOD

### Sampling methodology

This cross-sectional, descriptive study included 1161 individuals aged  $\geq 65$  years residing in Kepez district of Canakkale. The sample size is calculated 124 people for estimated prevalence for inappropriate drug use rate of 0.10 with the precision value of 0,05 (8). A simple systematic method was used to select the study sample. The list of elderly individuals was obtained from the Kepez Municipality and sorted according to age and sex. One from every 10 in a row like 1.-11.-21. were invited to participate in the study. The selected individuals were contacted via telephone calls or by personal visits to their residence addresses. In case the selected individuals were not reachable or did not meet the selection criteria, the next individual in the list was contacted till the set total number of targeted participants was achieved.

### Inclusion and exclusion criteria

Individuals aged  $\geq 65$  years were eligible for the study. Exclusion criteria included presence of illness or disability that would prevent compliance with the study method (such as the presence of a psychiatric disorder that would disrupt reality assessment or a medical condition that would impair the ability to respond to questions).

### Application

A total of 37 elderly persons could not be reached because of death, change in address or owing to errors in the recorded data. Two participants with dementia and hearing loss were excluded, whereas 36 (%31) participants were excluded because they did not agree to participate in the study. Data collection was completed after reaching 10% (116) of the target group.

Participants were invited to the Family Medicine clinic at the Canakkale Onsekiz

Mart University Hospital for interview and 30 participants were interviewed at their home after they expressed their inability to visit the clinic. Written informed consent of the participants was obtained before administering the questionnaires. The data were anonymously recorded.

### Permits and approvals

Before initiating the study, approval was obtained from the Clinical Research Ethics Committee at the Canakkale Onsekiz Mart University. Elderly individuals invited to participate in the study were provided verbal data regarding the study, and written consent was obtained.

### Statistical analysis

Data were analysed using the descriptive features in IBM SPSS v20 software. Non-parametric analysis (Mann Whitney U test for two independent samples, Kendall's tau-b correlation) were used when appropriate.

## RESULTS

### Sociodemographic characteristics

Of the 116 elderly individuals, 56 (48.3%) were males and 60 (51.7%) were females. The mean age of the participants was  $74.1 \pm 6.5$  (65–91) years; there was no significant difference between the mean age of males ( $73.7 \pm 6.2$  years) and those of females ( $74.4 \pm 6.8$  years) ( $p=0,680$ ). Furthermore, 77 (66.4%) participants were married and 39 (33.6%) were widowed. Seventy-five (64.7%) participants were primary school graduates. For male participants, the mean weight was  $78.5 \pm 14.6$  (range, 50–135) kg, mean height was  $171.2 \pm 7.1$  (155–195) cm and mean body mass index (BMI) was  $26.7 \pm 5.6$  kg/m<sup>2</sup>. For of female participants, the mean weight was  $70.9 \pm 13.0$  (44–110) kg, mean height was  $155.7 \pm 7.0$  (143–171) cm and mean BMI was  $29.3 \pm 5.6$  kg/m<sup>2</sup>.

### Chronic diseases

In our study, 95.7% of the participants had at least one chronic illness and 84.5% had at least three chronic illnesses. Five (4.3%) participants stated that they did not have any chronic disease. The mean number of chronic diseases in the study population was  $5.7 \pm 2.9$  (0–12). The chronic diseases and their prevalence in our study population are given in Table 1.

### Drug use, adverse effects and drug–drug interactions

Eleven (9.5%) participants were not using any medication. The mean total number of drugs used by the participants was  $5.0 \pm 3.2$  (0–15); the average daily dose of medication was  $5.7 \pm 4.1$  (0–26). In our study, the most frequently used medicines according to the anatomic therapeutic chemical classification were cardiovascular system drugs (69.8%), digestive system and metabolism drugs (62.1%), nervous system drugs (47.4%), blood and blood-forming drugs (44.8%), musculoskeletal drugs (37.1%), sensory organ drugs (13.8%) and respiratory system drugs (12.1%).

Sixty-four (55.2%) participants used five or more drugs per day. A positive correlation was observed between the number of medications used and age ( $\tau\text{-}b=0.140$ ;  $p=0.036$ ). The total number of drugs used by female participants ( $5.6 \pm 2.9$ ) was significantly higher than that used by male participants ( $4.3 \pm 3.4$ ) ( $U=1208.0$ ;  $p=0.009$ ). There was no significant difference between female ( $6.0 \pm 3.4$ ) and male ( $5.4 \pm 4.8$ ) participants ( $U=1441.0$ ;  $p=0.185$ ) with respect to the number of daily medication doses. The incidence of chronic illness among the participants was positively correlated with the number of medications used ( $\tau\text{-}b=0.546$ ;  $p<0.001$ ) and daily doses of medication ( $\tau\text{-}b=0.470$ ;  $p<0.001$ ).

There was a positive correlation between the number of drugs used by the participants and

the incidence of adverse effects ( $\tau\text{-}b=0.288$ ;  $p<0.001$ ). The number of medicines used and the number of medicines taken daily were significantly higher in participants with adverse effects ( $7.0 \pm 3.1$  and  $8.2 \pm 3.5$ , respectively) than in those who did not have experience any adverse effects ( $4.4 \pm 3.0$  and  $4.9 \pm 4.0$ , respectively) ( $U=651.0$ ;  $p<0.001$  and  $U=580.0$ ;  $p<0.001$ , respectively).

According to Beers criteria updated in 2015 by the American Geriatrics Society, Twenty-four (20.7%) participants were on long-term NSAID therapy. Eleven (9.5%) participants who use NSAIDs were using PPI, whereas 13 (11.2%) participants were inappropriately using NSAIDs. Forty-five (38.8%) participants were using proton-pump inhibitors (PPIs). Except for high-risk individuals such as those on long-term non-steroidal anti-inflammatory drug (NSAID) therapy, the use of PPI for more than 8 weeks is inappropriate in elderly individuals. We were unable to assess the appropriateness of use of PPIs owing to inadequate data regarding the duration of use of PPI (Table 2).

Inappropriate drug use that could cause aggravation of disease in elderly individuals owing to drug–disease interactions was also evaluated according to Beers criteria. Inappropriate NSAID use was detected in two (1.7%) of eight participants with chronic heart failure. In two (1.7%) of eight participants with dementia, inappropriate drug use, which could lead to disease aggravation, was detected. Participants with syncope, delirium and history of falls could not be evaluated because of inadequate data (Table 3).

Drug groups that are not suitable for use in combination in elderly individuals owing to drug–drug interactions were evaluated according to Beers criteria. In three (2.6%) participants, combined use of three CNS-active drugs



was detected, and in one (0.9%) participant, combined use of five CNS-active drugs was found (Table 4). Overall, we determined 35 (30%) instances of inappropriate drug use according to

Beers criteria. The numbers and percentages of participants who met the 2015 Beers criteria are given in Tables 2-4.

**Table 1.** Prevalence of chronic diseases in the study population.

Diseases	n	%
None	5	4.3
Hypertension	76	65.5
Diseases of the sensory organs (cataract, glaucoma, visual defects, xerophthalmia, hearing loss, etc.)	69	59.5
Diseases of the gastrointestinal system (peptic ulcer, gastritis, reflux, constipation, irritable bowel disease, etc.)	65	56.0
Gonarthrosis	57	49.1
Cardiovascular diseases (coronary artery disease, arrhythmia, valve diseases, orthostatic hypotension, peripheral vascular diseases, etc.)	55	47.4
Hyperlipidaemia	49	42.2
Osteoporosis	40	34.5
Rheumatic diseases (joint rheumatism/aching joints, gout, etc.)	38	32.8
Diabetes mellitus	36	31.0
Neurological/cerebrovascular diseases (Alzheimer's disease, Parkinson's disease, ischaemic or haemorrhagic stroke, migraine, etc.)	36	31.0
Anaemia (Iron deficiency anaemia, chronic disease anaemia, etc.)	35	30.2
Benign prostatic hyperplasia	24	20.7
Psychological diseases (depression, anxiety, sleep disturbance, psychotic disorders, etc.)	21	18.1
Lung diseases (chronic obstructive pulmonary disease, asthma, etc.)	19	16.4
Cancer (lung, colon, stomach, breast, prostate, lymphoma, leukaemia)	13	11.2
Thyroid/parathyroid diseases	9	7.8
Urinary system diseases (urinary incontinence, urinary infection, chronic kidney disease, etc.)	9	7.8
Skin diseases/allergic disorders	6	5.2

**Table 2.** Potentially inappropriate medication use in elderly individuals.

Organ system, therapeutic category and drugs	Rationale	Recommendation	Number of individuals (percentage)
<b>Anticholinergics</b>			
<b>First-generation antihistamines</b>			
Brompheniramine, Carbinoxamine, Chlorpheniramine, Clemastine, Cyproheptadine, Dexbrompheniramine, Dexchlorpheniramine, Dimenhydrinate, Doxylamine, Diphenhydramine (oral), Hydroxyzine, Meclizine Promethazine, Triprolidine	Highly anti-cholinergic; clearance reduced with advanced age, and tolerance develops when used as a hypnotic; risk for confusion, dry mouth, constipation and other anti-cholinergic effects or toxicity Use of diphenhydramine in situations such as acute treatment of severe allergic reaction may be appropriate	Avoid	-
<b>Anti-parkinsonian agents</b>			
Benzotropine (oral), Trihexyphenidyl	Not recommended for preventing extrapyramidal symptoms in combination with anti-psychotics; more-effective agents available for treating Parkinson's disease	Avoid	-
<b>Anti-spasmodics</b>			
Atropine (excludes ophthalmic), Belladonna alkaloids, Clidinium-Chloridazepoxide, Dicyclomine, Hyoscynamine, Propantheline, Scopolamine	Highly anti-cholinergic, uncertain effectiveness	Avoid	3 (2.6%)
<b>Anti-thrombotics</b>			
Dipyridamole, oral short-acting (not applicable to extended-release drug combination with aspirin)	May cause orthostatic hypotension; more-effective alternatives available; intravenous form acceptable for use in cardiac stress testing	Avoid	2 (1.7%)
Ticlopidine	Safer, effective alternatives available	Avoid	-
<b>Anti-infective</b>			
Nitrofurantoin	Potential for pulmonary toxicity, hepatotoxicity and peripheral neuropathy, particularly with long-term use; safer alternatives available	Avoid in individuals with creatinine clearance of <30 mL/min or for long-term suppression of bacteria	1 (0.9%)
<b>Cardiovascular</b>			
<b>Peripheral alpha-1 blockers</b>			
Doxazosin Prazosin Terazosin	High risk for orthostatic hypotension; not recommended as a routine treatment for hypertension; alternative agents have superior risk-benefit profile	Avoid use as an anti-hypertensive	-
<b>Central alpha blockers</b>			
Clonidine Guanabenz Guanfacine Methyldopa Reserpine (>0.1 mg/d)	High risk for adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension	Avoid clonidine as first-line anti-hypertensive. Avoid others as listed	-
Disopyramide	Disopyramide is a potent negative inotrope and therefore may induce heart failure in elderly individuals; strongly anti-cholinergic; other anti-arrhythmic drugs preferred	Avoid	-



Organ system, therapeutic category and drugs	Rationale	Recommendation	Number of individuals (percentage)
Dronedarone	Worse outcomes have been reported in individuals with permanent atrial fibrillation or severe or recently decompensated heart failure who are taking dronedarone	Avoid in individuals with permanent atrial fibrillation or severe or recently decompensated heart failure	-
Digoxin	Use in atrial fibrillation: should not be used as a first-line agent in atrial fibrillation because more-effective alternatives exist and it may be associated with increased mortality  Use in heart failure: questionable effects on risk for hospitalisation and may be associated with increased mortality in elderly individuals with heart failure; in heart failure, higher dosages not associated with additional benefit and may increase risk for toxicity  Decreased renal clearance of digoxin may lead to increased risk for toxic effects; further dose reduction may be necessary in individuals with stage 4 or 5 chronic kidney disease	Avoid as first-line therapy for atrial fibrillation  Avoid as first-line therapy for heart failure  If used for atrial fibrillation or heart failure, avoid dosages of >0.125 mg/d	-
Nifedipine, immediate release	Potential for hypotension; risk for precipitating myocardial ischaemia	Avoid	-
Amiodarone	Amiodarone is effective for maintaining sinus rhythm but has greater toxicities than other anti-arrhythmics used in atrial fibrillation; it may be a reasonable first-line therapy for individuals with concomitant heart failure or substantial left ventricular hypertrophy if rhythm control is preferred over rate control	Avoid amiodarone as first-line therapy for atrial fibrillation unless the individual has heart failure or substantial left ventricular hypertrophy	1 (0.9%)
<b>Central nervous system</b>			
<b>Anti-depressants, alone or in combination</b> Amitriptyline Amoxapine Clomipramine Desipramine Doxepin >6 mg/d Imipramine Nortriptyline Paroxetine Protriptyline Trimipramine	Highly anti-cholinergic, sedating and cause orthostatic hypotension; safety profile of low-dose doxepin (≤6 mg/d) comparable with that of placebo	Avoid	1 (0.9%)
<b>Anti-psychotics</b> First- (conventional) and second- (atypical) generation	Increased risk for cerebrovascular accident (stroke) and greater rate of cognitive decline and mortality in persons with dementia. Avoid anti-psychotics for behavioural problems of dementia or delirium unless non-pharmacological options (e.g. behavioural interventions) have failed or are not possible and the elderly individual is threatening substantial harm to self or others	Avoid, except for schizophrenia, bipolar disorder, or short-term use as anti-emetic during chemotherapy	3 (2.6%)
<b>Barbiturates (Amobarbital and Butabarbital)</b> Butalbital Mephobarbital Pentobarbital Phenobarbital Secobarbital	High rate of physical dependence, tolerance to sleep benefits, greater risk for overdose at low dosages	Avoid	-
<b>Benzodiazepines</b> <u>Short- and intermediate-acting</u> Alprazolam Estazolam Oxazepam Temazepam Triazolam <u>Long-acting</u> Clonazepam Clonazepam Quazepam Diazepam Flurazepam Chlordiazepoxide (alone or in combination with amitriptyline or clidinium)	Elderly individuals have an increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; in general, all benzodiazepines increase risk for cognitive impairment, delirium, falls, fractures and motor vehicle crashes in elderly individuals  May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalised anxiety disorder and periprocedural anaesthesia	Avoid	-

Organ system, therapeutic category and drugs	Rationale	Recommendation	Number of individuals (percentage)
<i>Meproamate</i>	High rate of physical dependence; very sedating	Avoid	-
<b>Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics</b> <i>Eszopiclone</i> <i>Zolpidem</i> <i>Zaleplon</i>	Benzodiazepine receptor agonists have adverse events similar to those of benzodiazepines in elderly individuals (e.g. delirium, falls, fractures); increased emergency department visits and hospitalisations; motor vehicle crashes; minimal improvement in sleep latency and duration	Avoid	-
<i>Ergoloid mesylates (dehydrogenated ergot alkaloids)</i> <i>Isoxsuprine</i>	Lack of efficacy	Avoid	-
<b>Endocrine</b>			
<b>Androgens</b> <i>Methyltestosterone</i>	Potential for cardiac problems; contraindicated in men with prostate cancer	Avoid unless indicated for confirmed hypogonadism with clinical symptoms	-
<i>Desiccated thyroid</i>	Concerns about cardiac effects; safer alternatives available	Avoid	-
<i>Oestrogens with or without progestins</i>	Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in elderly women Evidence indicates that vaginal oestrogens for treating vaginal dryness are safe and effective; women with a history of breast cancer who do not respond to non-hormonal therapies are advised to discuss the risk and benefits of low-dose vaginal oestrogen (dosages of oestradiol <25 lg twice weekly) with their healthcare provider	Avoid oral and topical patch Vaginal cream or tablets: acceptable to use low-dose intravaginal oestrogen for managing dyspareunia, lower urinary tract infections and other vaginal symptoms	-
<b>Growth hormone</b>	Impact on body composition is small and associated with oedema, arthralgia, carpal tunnel syndrome, gynaecomastia, impaired fasting glucose	Avoid, except as hormone replacement after pituitary gland removal	-
<i>Insulin, sliding scale</i>	Higher risk of hypoglycaemia without improvement in hyperglycaemia management regardless of the care setting; refers to sole use of short- or rapid-acting insulins to manage or avoid hyperglycaemia in absence of basal or long-acting insulin; does not apply to titration of basal insulin or use of additional short- or rapid-acting insulin in conjunction with scheduled insulin (i.e. correction insulin)	Avoid	-
<b>Megestrol</b>	Minimal effect on weight; increases risk for thrombotic events and possibly death in elderly individuals	Avoid	-
<i>Sulfonylureas, long-duration</i> <i>Chlorpropamide</i> <i>Glyburide</i>	Chlorpropamide: prolonged half-life in elderly individuals; can cause prolonged hypoglycaemia; causes syndrome of inappropriate antidiuretic hormone secretion Glyburide: higher risk for severe prolonged hypoglycaemia in elderly individuals	Avoid	-
Gastrointestinal			
<i>Metoclopramide</i>	Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail elderly individuals	Avoid, unless for gastroparesis	-
<i>Mineral oil, given orally</i>	Potential for aspiration and adverse effects; safer alternatives available	Avoid	-





Organ system, therapeutic category and drugs	Rationale	Recommendation	Number of individuals (percentage)
Proton-pump inhibitors	Risk of <i>Clostridium difficile</i> infection and bone loss and fractures	Avoid scheduled use for >8 weeks unless for high-risk individuals (e.g. oral corticosteroids or chronic NSAID use), erosive esophagitis, Barrett's esophagitis, pathological hypersecretory condition or demonstrated need for maintenance treatment (e.g. owing to failure of drug discontinuation trial or H <sub>2</sub> blockers)	-
Pain medications			
Meperidine	Not effective oral analgesic in dosages commonly used; may have higher risk for neurotoxicity, including delirium, than other opioids; safer alternatives available	Avoid, particularly in individuals with chronic kidney disease	-
<b>Non-cyclooxygenase-selective NSAIDs, oral:</b> Aspirin (>325 mg/d) Diclofenac Diflunisal Etodolac Fenopropfen Ibuprofen Ketoprofen Meclofenamate Mefenamic acid Meloxicam Nabumetone Naproxen Oxaprozin Piroxicam Sulindac Tolmetin	Increased risk for gastrointestinal bleeding or peptic ulcer disease in high-risk groups, including those aged >75 years or taking oral or parenteral corticosteroids, anticoagulants or antiplatelet agents; use of proton-pump inhibitor or misoprostol reduces but does not eliminate risk. Upper gastrointestinal ulcers, gross bleeding or perforation caused by NSAIDs occur in approximately 1% of individuals treated for 3–6 months and in approximately 2%–4% of individuals treated for 1 year; these trends continue with longer duration of use	Avoid chronic use, unless other alternatives are not effective and individual can take gastroprotective agent (proton-pump inhibitor or misoprostol)	13 (11.2%)
Indomethacin Ketorolac, includes parenteral	Indomethacin is more likely than other NSAIDs to have adverse CNS effects. Of all NSAIDs, indomethacin has the most adverse effects. Increased risk for gastrointestinal bleeding, peptic ulcer disease and acute kidney injury in elderly individuals	Avoid	-
Pentazocine	Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other opioid analgesic drugs; is also a mixed agonist and antagonist; safer alternatives available	Avoid	0
<b>Skeletal muscle relaxants</b> Carisoprodol Chlorzoxazone Cyclobenzaprine Metaxalone Methocarbamol Orphenadrine	Most muscle relaxants poorly tolerated by elderly individuals because some have anti-cholinergic adverse effects, sedation, increased risk for fractures; effectiveness at dosages tolerated by elderly individuals is questionable	Avoid	2(1.7%)
<b>Genitourinary</b>			
Desmopressin	High risk for hyponatraemia; safer alternative treatments	Avoid for treating nocturia or nocturnal polyuria	-
∅: was not evaluated			

**Table 3.** Potentially inappropriate medication use in elderly individuals owing to drug–disease or drug–syndrome interactions that may exacerbate the disease or syndrome.

Disease or syndrome	Drug(s)	Rationale	Recommendation	Number and percentage of individuals
<b>Cardiovascular</b>				
Heart failure	NSAIDs and COX-2 inhibitors; non-dihydropyridine CCBs (diltiazem, verapamil)—avoid only for heart failure with reduced ejection fraction Thiazolidinediones (pioglitazone, rosiglitazone) Cilostazol Dronedarone (severe or recently decompensated heart failure)	Potential to promote fluid retention and exacerbate heart failure	Avoid	2 (1.7%)
Syncope	AChEIs Peripheral alpha-1 blockers- <i>Doxazosin Prazosin Terazosin</i> - Tertiary TCAs Chlorpromazine Thioridazine Olanzapine	Increases risk for orthostatic hypotension or bradycardia	Avoid	-
<b>Central nervous system</b>				
Chronic seizures or epilepsy	Bupropion Chlorpromazine Clozapine Maprotiline Olanzapine Thioridazine Tramadol	Lowers seizure threshold; may be acceptable in individuals with well-controlled seizures in whom alternative agents have not been effective	Avoid	-
Delirium	Anticholinergics Anti-psychootics Benzodiazepines Chlorpromazine Corticosteroids H2-receptor antagonists: <i>-Cimetidine Famotidine</i> <i>Nizatidine Ranitidine-Meperidine</i> Sedative hypnotics	Avoid in elderly individuals with or at a high risk for delirium because of the potential of inducing or worsening delirium. Avoid anti-psychootics for behavioural problems of dementia or delirium unless non-pharmacological options (e.g. behavioural interventions) have failed or are not possible and the elderly individual is threatening substantial harm to self or others Anti-psychootics are associated with a greater risk for cerebrovascular accident (stroke) and mortality in persons with dementia	Avoid	-
Dementia or cognitive impairment	Anticholinergics Benzodiazepines H2-receptor antagonists Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics <i>-Eszopiclone Zolpidem Zaleplon-</i> Anti-psychootics, chronic and as-needed use	Avoid because of adverse CNS effects Avoid anti-psychootics for behavioural problems of dementia or delirium unless non-pharmacological options (e.g. behavioural interventions) have failed or are not possible and the elderly individual is threatening substantial harm to self or others. Anti-psychootics are associated with a greater risk for cerebrovascular accident (stroke) and mortality in individuals with dementia	Avoid	2 (1.7%)



Disease or syndrome	Drug(s)	Rationale	Recommendation	Number and percentage of individuals
History of falls or fractures	Anti-convulsants Anti-psychootics Benzodiazepines Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics: -Eszopiclone Zaleplon Zolpidem-TCAs SSRIs Opioids	May cause ataxia, impaired psychomotor function, syncope, additional falls; shorter-acting benzodiazepines are not safer than long-acting ones if one of the drugs must be used, consider reducing use of other CNS-active medications that increase the risk for falls and fractures (i.e. anti-convulsants, opioidreceptor agonists, anti-psychootics, anti-depressants, benzodiazepine receptor agonists, other sedatives and hypnotics) and implement other strategies to reduce fall risk	Avoid unless safer alternatives are not available; avoid anti-convulsants except for seizure and mood disorders Opioids: avoid, excludes pain management owing to recent fractures or joint replacement	-
Insomnia	Oral decongestants: -Pseudoephedrine Stimulants:- Amphetamine Methylphenidate Modafinil -Theobromines:- Theophylline Caffeine-	CNS stimulant effects	Avoid	1 (0.9%)
Parkinson's disease	All anti-psychootics (except aripiprazole, quetiapine, clozapine) Anti-emetics:- Metoclopramide Prochlorperazine Promethazine-	Dopamine-receptor antagonists with a potential to worsen parkinsonian symptoms Quetiapine, aripiprazole, clozapine appear less likely to precipitate worsening of Parkinson disease	Avoid	-
<b>Gastrointestinal</b>				
History of gastric or duodenal ulcers	Aspirin (>325 mg/d) Non-COX-2 selective NSAIDs	May exacerbate existing ulcers or cause new or additional ulcers	Avoid unless other alternatives are not effective and individual can take gastroprotective agent (i.e. proton-pump inhibitor or misoprostol)	-
<b>Kidney and urinary tract</b>				
Chronic kidney disease stages IV or less (creatinine clearance of <30 mL/min)	NSAIDs (non-COX and COX-selective, oral and parenteral)	May increase risk for acute kidney injury and further decline of renal function	Avoid	-
Urinary incontinence (all types) in females	Oestrogen oral and transdermal (excludes intravaginal oestrogen) Peripheral alpha-1 blockers:- <i>Doxazosin Prazosin Terazosin</i> -	Aggravation of incontinence	Avoid in females	-
Lower urinary tract symptoms, benign prostatic hyperplasia	Strongly anti-cholinergic drugs, except anti-muscarinics for urinary incontinence	May decrease urinary flow and cause urinary retention	Avoid in males	-
Ø: was not evaluated				

**Table 4.** Potentially clinically important non-anti-infective drug–drug interactions that should be avoided in elderly individual.

Object drug and class	Interacting drug and class	Risk rationale	Recommendation	Number and percentage of individuals
ACEIs	Amiloride or triamterene	Increased risk of hyperkalaemia	Avoid routine use; reserve for individuals with demonstrated hypokalaemia while taking an ACEI	-
Anti-cholinergic	Anti-cholinergic	Increased risk for cognitive decline	Avoid, minimise the number of anti-cholinergic drugs	-
Anti-depressants (i.e. TCAs and SSRIs)	≥2 other CNS-active drugs	Increased risk for falls	Avoid total of ≥3 CNS-active drugs; minimise the number of CNS-active drugs	
Anti-psychotics	≥2 other CNS-active drugs	Increased risk for falls	Avoid total of ≥3 CNS-active drugs; minimise the number of CNS-active drugs	
Benzodiazepines and Non-benzodiazepine, benzodiazepine receptor agonist hypnotics	≥2 other CNS-active drugs	Increased risk for falls	Avoid total of ≥3 CNS-active drugs; minimise the number of CNS-active drugs	4 (3.4%)
Opioid receptor agonist analgesics	≥2 other CNS-active drugs	Increased risk for falls	Avoid total of ≥3 CNS-active drugs; minimise the number of CNS-active drugs	
Lithium	ACEIs Loop diuretics	Increased risk for lithium toxicity	Avoid, monitor lithium concentrations	-
Corticosteroids, oral or parenteral	NSAIDs	Increased risk for peptic ulcer disease or gastrointestinal bleeding	Avoid; if not possible, provide gastrointestinal protection	-
Peripheral alpha-1 blockers	Loop diuretics	Increased risk for urinary incontinence in elderly females	Avoid in elderly women, unless conditions warrant both drugs	-
Theophylline	Cimetidine	Increased risk for theophylline toxicity	Avoid	-
Warfarin	Amiodarone NSAIDs	Increased risk for bleeding	Avoid when possible; closely monitor international normalised ratio	-



## DISCUSSION

Ageing is associated with an increase in the incidence of many diseases, particularly chronic diseases (12). In a study conducted in the United States, 86%–92% of individuals aged  $\geq 65$  years were found to have at least one chronic illness; whereas 30.7%–41.3% of individuals had at least three concomitant chronic illnesses (13). In our study, 95.7% of participants had at least one chronic disease, whereas 84.5% of participants had at least three chronic diseases. While the proportion of individuals with one chronic disease was comparable between the two studies, the rate of comorbidity in our study was much higher than that reported in the study conducted in the United States. Greater disease burden naturally leads to an increased drug use. The proportion of elderly individuals in the United States is 13%, and they account for 34% of the population that uses written prescriptions. It was found that 95% of elderly individuals use drugs at least once a week, and 12% use drugs  $\geq 10$  times per week (14). In the present study, 55.2% of participants used five or more medications per day, while a corresponding rate of 66.9% was recently reported in India (15).

### Potentially inappropriate medication use

In our study, inappropriate drug use was found in 22.4% of the participants according to Beers criteria [NSAID (11.2%), antispasmodic drug (2.6%), muscle relaxant (1.7%) and dipyridamol (1.7%)]. Nitrofurantoin and amiodarone were each used by 0.9% of participants; these were considered inappropriate drugs for use in the elderly population. The use of PPI could not be assessed owing to lack of data regarding the duration of use.

### Potentially drug–disease or drug–syndrome interactions

In our study, drug use in five (4.3%) participants were found to be inappropriate according to Beers criteria because of the potential for drug–disease interaction. Inappropriate drug use was detected in two (1.7%) of eight participants with chronic heart failure; all were attributable to inappropriate NSAID

use. Doctors need to be careful while prescribing a combination of drugs to prevent unwanted situations; for example, non-dihydropyridine-derived calcium channel blockers are found in many anti-hypertensive medications and their use is not appropriate in individuals with chronic heart failure. Two (1.7%) of eight participants with dementia were categorised as those with inappropriate drug use (inappropriate use of anti-psychotic and  $H_2$  receptor blocker, respectively).  $H_2$  receptor antagonists are generally believed to be safe drugs; however, according to Beers criteria, these should be avoided in individuals with dementia. Although found at a very low rate in our study, in a previous study (15),  $H_2$  receptor antagonists were found to be the most prescribed inappropriate drugs according to Beers criteria. In our study, one (0.9%) of the four participants with insomnia was categorised as an inappropriate drug user (inappropriate use of psychostimulant drug). Although we did not detect inappropriate use of oral decongestants in our study, doctors should avoid prescribing oral decongestants to individuals with complaints of insomnia because oral decongestants are found in many over-the-counter medications. Although these are included in Beers criteria, studies regarding syncope, delirium and falling history could not be assessed owing to inadequacy of data (Table 3).

### Potentially drug–drug interactions

In our study, four (3.4%) participants had inappropriate drug use owing to potential drug–drug interactions according to Beers criteria. Three (2.6%) participants used a combination of three drugs that affected the central nervous system and one (0.9%) participant used a combination of five drugs (Table 4).

### General considerations

In our study we found inappropriate drug use in 30% instances. These data are obtained from population based study and important for Turkey the country that have limited data about inappropriate drug usage. Studies conducted

overseas have yielded inconsistent results (16). A study in Switzerland found inappropriate drug use in 10.3% of elderly individuals (8). In another study 66.7% of elderly individuals used inappropriate drugs (9).

In general, earlier studies in the literature were conducted in individuals who were admitted to emergency services or hospitals with complaints of drug adverse effects. This may explain the lower rates of inappropriate drug use found in our study (35; 30%). Nevertheless, a community-based study in Spain found a higher prevalence (44.8%) of inappropriate drug use than that found in our study (17). Differences can be due to limitation of Beers criteria that it is not applicable outside the US (18).

According to our study results, the rate of inappropriate drug use among elderly individuals is at an unacceptable level. Therefore, adapting to the guidelines of rational drug use in elderly individuals for clinical practice is more important. NSAIDs were found to account for a large proportion of inappropriate drug use in our study. NSAIDs tend to be perceived as non-harmful by the population and are widely used as over-the-counter drugs (19). In addition to adapting to guidelines of rational drug use while prescribing drugs, population-based education interventions should be performed to reduce inappropriate drug use. The physician should follow the guidelines for rational drug use while prescribing drugs and should review the medicines used by elderly individuals during each follow-up visit.

## REFERENCES

1. Brahma DK, Wahlang JB, Marak MD, Ch Sangma M. Adverse drug reactions in the elderly. *J Pharmacol Pharmacother* 2013;4(2):91-94. (PMID:23761706).
2. Patterns of medication use in the United States. A Report from the Slone Survey, Boston University. Slone Epidemiology Center, 2006, p 1. [Internet] Available from: <http://www.bu.edu/slone/files/2012/11/SloneSurveyReport2006.pdf>. Accessed:01.03.2016.
3. Spinewine A, Schmader KE, Barber N, et al. Appropriate prescribing in elderly people: how well can it be measured and optimised? *Lancet* 2007;370(9582):173-84. (PMID:17630041).
4. Chang C-B, Chan D-C. Comparison of published explicit criteria for potentially inappropriate medications in older adults. *Drugs Aging* 2010;27(12):947-57. (PMID:21087065).
5. Kaufmann CP, Tremp R, Hersberger KE, Lampert ML. Inappropriate prescribing: a systematic overview of published assessment tools. *Eur J Clin Pharmacol* 2014;70(1):1-11. (PMID:24019054).
6. O'Mahony D, Gallagher PF. Inappropriate prescribing in the older population: need for new criteria. *Age Ageing* 2008;37(2):138-41. (PMID:18349010).
7. American Geriatrics Society 2015 Updated Beers Criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2015;63(11):2227-46. (PMID:26446832).
8. Blozik E, Rapold R, von Overbeck J, Reich O. Polypharmacy and potentially inappropriate medication in the adult, community-dwelling population in Switzerland. *Drugs Aging* 2013;30(7):561-68. (PMID:23553511).
9. Yang P-J, Lee Y-T, Tzeng S-L, et al. Potentially inappropriate prescribing in disabled older patients with chronic diseases: a screening tool of older persons' potentially inappropriate prescriptions versus Beers 2012 Criteria. *Med Princ Pract* 2015;24(6):565-70. (PMID:26279164).
10. Bjerre LM, Halil R, Catley C, et al. Potentially inappropriate prescribing (PIP) in long-term care (LTC) patients: validation of the 2014 STOPP-START and 2012 Beers criteria in a LTC population - a protocol for a cross-sectional comparison of clinical and health administrative data. *BMJ Open* 2015;5(10):e009715. (PMID:26453592).
11. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing* 2015;44(2):213-18. (PMID:25324330).
12. Henschel F, Redaelli M, Siegel M, Stock S. Correlation of incident potentially inappropriate medication prescriptions and hospitalization: an analysis based on the PRISCUS List. *Drugs-real world outcomes*. 2015;2(3):249-59. (PMID:27747571).



13. Hung WW, Ross JS, Boockvar KS, Siu AL. Recent trends in chronic disease, impairment and disability among older adults in the United States. *BMC Geriatr* 2011;11:47. (PMID:21851629).
14. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States:the Slone survey. *JAMA* 2002;287(3):337-44. (PMID:11790213).
15. Narvekar RS, Bhandare NN, Gouveia JJ, Bhandare PN. Utilization pattern of potentially inappropriate medications in geriatric patients in a tertiary care hospital: a retrospective observational study. *J Clin Diagn Res* 2017;11(4):FC04-FC08. (PMID:28571163).
16. Ay P, Akici A, Harmanc H. Drug utilization and potentially inappropriate drug use in elderly residents of a community in Istanbul, Turkey. *Int J Clin Pharmacol Ther* 2005;43(4):195-202. (PMID:15966466).
17. Pastor Cano J, Aranda García A, Gascón Cánovas JJ, Sánchez Ruiz JF, Rausell Rausell VJ, Tobaruela Soto M. Identifying potentially inappropriate prescriptions in patients over 65 years-old using original Beers criteria and their Spanish adaptation. *Aten primaria* 2017;49(5):3123. (PMID:28506569).
18. Levy HB, Marcus E-L, Christen C. Adverse reactions/medication safety: beyond the Beers Criteria: a comparative overview of explicit criteria. *Ann Pharmacother* 2010;44(12):1968-75. (PMID:21081709).
19. Hamilton K, Davis C, Falk J, Singer A, Bugden S. High risk use of OTC NSAIDs and ASA in family medicine: a retrospective chart review. *Int J Risk Saf Med* 2015;27(4):191-199. (PMID:26756892).



Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137961  
2018;21 (1):16-24

- Hande ŞAHİN<sup>1</sup>
- Sibel ERKAL<sup>2</sup>

#### CORRESPONDANCE

Hande ŞAHİN  
Kırıkkale University, Faculty of Health Sciences  
Department of Social Work  
Kırıkkale, Turkey

Phone: 318 3573738  
e-mail: hande\_k1979@yahoo.com

Received: 22/02/2017  
Accepted: 18/12/2017

- <sup>1</sup> Kırıkkale University, Faculty of Health Sciences, Department of Social Work  
<sup>2</sup> Hacettepe University, Faculty of Economics and Administrative Sciences, Department of Family and Consumer Sciences

#### RESEARCH

## AN EVALUATION OF ABUSE AND NEGLECT IN ELDERLY WITH THE HWALEK-SENGSTOCK ELDER ABUSE SCREENING TEST

### ABSTRACT

**Introduction:** The participants in this study, which was conducted to evaluate abuse and neglect in the elderly using the Hwalek–Sengstock Elder Abuse Screening Test, comprised older adults aged 65 and over, residing in Etimesgut, Ankara.

**Materials and Method:** The study employed the Hwalek–Sengstock Elder Abuse Screening Test as the data collection instrument. In addition to standard deviation and arithmetic mean, the t-test was used for data comparisons between two groups, and analysis of variance was conducted when analyzing more than two groups.

**Results:** The abuse and neglect status of the participants displayed significant differences with respect to educational attainment, monthly income, number of children, other household members, ownership of residence, and social security ( $p < 0.05$ ).

**Conclusion:** The elderly experience serious health problems because of physical, psychological, sexual, and economic violence and neglect.

**Keywords:** Aged; Elder abuse; Surveys and Questionnaires/standards

#### ARAŞTIRMA

## YAŞLILARIN İSTİSMAR VE İHMAL UĞRAMA DURUMLARININ HWALEK-SENGSTOCK YAŞLI İSTİSMARI TARAMA TESTİ İLE DEĞERLENDİRİLMESİ

### Öz

**Giriş:** Yaşlıların istismar ve ihmale uğrama durumlarının Hwalek-Sengstock Yaşlı İstismarı Tarama Testi ile değerlendirilmesini amaçlayan bu çalışmaya Ankara ili, Etimesgut ilçesinde ikamet eden 65 yaş ve üzeri yaşlılar katılmıştır.

**Gereç ve Yöntem:** Çalışmada veri toplama aracı olarak “Hwalek-Sengstock Yaşlı İstismarı Tarama Testi” kullanılmıştır. Verilerin çözümlenmesinde standart sapma, aritmetik ortalama, ikili gruplar için t testi, ikiden daha fazla grup için ise varyans analizi kullanılmıştır.

**Bulgular:** Yaşlıların istismar ve ihmale uğrama durumlarının öğretim düzeyine, aylık gelire, çocuk sayısına, birlikte yaşanılan kişiye, yaşadığı evin mülkiyet durumuna ve sosyal güvencesine göre anlamlı bir farklılık gösterdiği ( $p < 0.05$ ) belirlenmiştir.

**Sonuç:** Yaşlılar yaşadıkları fiziksel, psikolojik, cinsel, ekonomik şiddetten ve ihmalden dolayı ciddi sağlık sorunları yaşamaktadır.

**Anahtar sözcükler:** Yaşlı; Yaşlı istismarı; Değerlendirme





## INTRODUCTION

The proportion of elderly persons within the global population is rapidly increasing with decreasing natality, improving living standards, and the consequent increasing human longevity (1). According to the United Nations World Population Prospects Report published in 2010, the 69.31-year life expectancy at that time was expected to reach 75.5 years by 2050. In Turkey, the 78-year life expectancy in 2014 is anticipated to reach 78.5 years by 2050 (2,3). The number of elderly victims of abuse and neglect is expected to rise in line with the increase in the elderly population (4).

The increasing population, physical and socio-cultural changes in old age, and deteriorating economic conditions lead to inadequate home or institutional care support for older adults, and elder abuse and neglect (5). According to the International Network for the Prevention of Elder Abuse and the World Health Organization Toronto Declaration, elder abuse is "a single or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust which causes harm or distress to an older person," while neglect is an intentional or unintentional failure to meet the social, physical, or emotional needs of an older adult (4,6). It can take many forms, including physical, emotional, financial, and sexual abuse, as well as self-neglect- where there is no perpetrator (7). The United Nations International Plan of Action (2002) adopted in Madrid recognized the importance of addressing abuse and neglect of older adults and incorporated it within its framework for universal human rights (8).

The current evidence, as reported by the WHO European Report 2011, shows an estimated 2500 annual homicides among older people, as a result of maltreatment committed by family members. In addition, the document estimated that about 29 million of the European subjects analyzed (19.4% of the total) are victims of psychological abuse, 6 million of financial abuse, 4 million of physical mistreatment and 1 million of sexual mistreatment (9).

Several studies on elder abuse and neglect have been conducted both in Turkey and abroad (10-15). These studies show that elder abuse is often perpetrated by the relatives and caregivers of the older person, and that emotional abuse is the most frequently committed form. The present study was planned and conducted to evaluate abuse and neglect in older adults using the Hwalek-Sengstock Elder Abuse Screening Test.

## MATERIALS AND METHOD

The participants in this study, which aimed at evaluating elder abuse and neglect using the Hwalek-Sengstock Elder Abuse Screening Test, comprised older adults aged  $\geq 65$ , residing in Etimesgut, Ankara. The study employed systematic sampling, a probability sampling method, because of time and cost restrictions. The sample group comprised 508 older adults.

Sample size calculation was performed to estimate the overall score of Hwalek-Sengstock test. In the research sample size was calculated using the formula  $n = N \cdot s^2 \cdot Z^2 \cdot 2 / ((N-1) \cdot d^2 + s^2 \cdot Z^2 \cdot 2)$  that is recommended for quantitative studies and finite population (16). From the parameters that form the formula; standard deviation calculated was  $s = 0.22$ , the effect size was  $d = 0.02$ , the significance level was  $\alpha = 0.05 = Z\alpha = 1.96$  and the minimum sample was calculated with this formula was 465 people. Considering missing and not returning questionnaires, a total of 550 questionnaires were distributed and 508 questionnaires were evaluated. In the study aiming to determine the level of abuse in the elderly, the overall mean value of the effect size and  $s$  values for the abuse variables 1 and 2 was taken into account.

Questionnaires were used as the data collection method. The study made use of the Hwalek-Sengstock Elder Abuse Screening Test developed by Hwalek and Sengstock and adapted to Turkish by Özmete (4,17).

### **Hwalek–Sengstock Elder Abuse Screening**

**Test:** The scale consists of 15 items and three conceptual categories (factors). These three factors are “overt violation of personal rights and direct abuse” (items 4, 9, 10, 11, and 15), “characteristics of the elder that make him or her vulnerable to abuse” (items 1, 3, and 6) and “characteristics of potentially abusive situations” (items 2, 5, 7, 8, 12, 13, and 14) (4). In the study, responses to each item in the measure were coded as 1 for experiencing abuse and neglect and 2 for not experienced. In this case, the average scores ranged from 1 to 2, and approaching 1 indicates that the level of abuse and neglect of the elderly increases. Items 1, 2, 4, 6, 12 and 14 in the test are reverse-coded.

In the study, it was found that the obtained parametric test assumptions were met. normality assumption was checked by Kolmogorov-Smirnov test, skewness and kurtosis coefficient.

Each item in the Hwalek–Sengstock Elder Abuse Screening Test was represented as percentage distribution, arithmetic mean, and standard deviation. In comparing participants’ demographic characteristics with the scale items, the t-test was used when analyzing two groups and an analysis of variance was conducted for more than two groups (for the given parametric test assumptions obtained). As a result of the variance analysis, the source of the difference was determined by the Tukey test. Additionally, reliability was assessed with Cronbach’s Alpha coefficient, which was computed as 0.745.

### **Ethical consideration**

Signed informed consent was obtained from all elderly. The ethics committee of university approved the study, which was conducted according to the Declaration of Helsinki.

## **RESULTS**

The study data revealed that 29.9% of the older adults were female and 82.1% were male, while 82.1% of the participants were 75 years old and

under. Of the total, 50.4% were elementary school graduates, 78% had a monthly income of 2250 TL and under, 91% had two or more children, and 53% lived with their spouses. Homeowners accounted for 85.8% of the participants. The percentages of participants who were socially insured by SSK (for private and public sector workers), Emekli Sandığı (for civil servants), and Bağ-kur (for artisans, farmers, and the self-employed) were 51%, 28%, and 15.2%, respectively (Table 1).

Descriptive statistics for the Hwalek–Sengstock Elder Abuse Screening Test are presented in Table 2. An overall majority of the older adults replied “Yes” to “Do you have anyone who spends time with you, taking you shopping or to the doctor?” “Are you helping to support someone?” and replied “No” to “Who makes decisions about your life?” the overall majority replied “I.” Subscale and scale scores are overall scores with a maximum of 2.

Descriptive statistics for the subscales (factors) of the Hwalek–Sengstock Elder Abuse Screening Test are presented in Table 3. In general, the level of neglect and abuse was low for all three subscales. The highest subscale means were computed for “Characteristics of potentially abusive situations” ( $\bar{X}=1.810$ ). And the lowest subscale means were computed for “Characteristics of the elder that make him or her vulnerable to abuse” ( $\bar{X}=1.778$ ).

The t-test and analysis of variance results are presented in Table 4. No significant differences in neglect and abuse status of the participants were observed with respect to gender or age ( $p>0.05$ ), while there were significant differences with respect to educational attainment, monthly income, number of children, other household members, ownership of residence, and social security ( $p<0.05$ ). The groups with increased exposure to neglect and abuse than the other groups were those who had an elementary school degree or less, who had a monthly income of 1000TL and under, who were childless, who lived alone, who were tenants, who had no social security, and who had a green card.

**Table 1.** Distribution of participants according to their individual characteristics (n=508).

Variables	Group	n	%
Gender	Female	152	29.9
	Male	356	70.1
Age	65-70	278	54.7
	71-75	139	27.4
	76-80	62	12.2
	81-85	19	3.7
	≥85	10	2.0
Education Level	Elementary school or less	256	50.4
	Middle School	100	19.7
	High School	92	18.1
	University	60	11.8
Monthly Income	≤1000 TL	68	13.4
	1001–1500	188	37.0
	1501–2250	140	27.6
	2251–3000	63	12.4
	3001 and over	49	9.6
Number of Children	None	16	3.1
	1	30	5.9
	2	128	25.2
	3	150	29.5
	4	109	21.5
	5 or more	75	14.8
Other Household Members	Alone	83	16.3
	With spouse	269	53.0
	With relative	14	2.8
	With spouse and children	117	23.0
	Other	25	4.9
Ownership of Residence	Home owner	436	85.8
	Tenant	72	14.2
Social Security	None	7	1.4
	Green Card	23	4.5
	Emekli Sandığı	142	28.0
	Bağ-kur	77	15.2
	SSK	259	51.0
<b>Total</b>		<b>508</b>	<b>100.0</b>

**Table 2.** Descriptive statistics for the Hwalek–Sengstock Elder Abuse Screening Test.

Items	Yes		No	
	f	%	f	%
1. Do you have anyone who spends time with you, taking you shopping or to the doctor?	372	73.2	136	26.8
2. Are you helping to support someone?	305	60.0	203	40.0
3. Are you sad or lonely often?	126	24.8	382	75.2
4. Who makes decisions about your life- like how you should live or where you should live?		Myself	Someone else	
	445	87.6	63	12.4
5. Do you feel uncomfortable with anyone in your family?	52	10.4	455	89.6
6. Can you take your own medication and get around by yourself?	432	85.0	76	15.0
7. Do you feel that nobody wants you around?	79	15.6	429	84.4
8. Does anyone in your family drink a lot?	67	13.2	441	86.8
9. Does someone in your family make you stay in bed or tell you you're sick when you know you're not?	73	14.4	435	85.6
10. Has anyone forced you to do things you did not want to do?	41	8.1	467	91.9
11. Has anyone taken things that belong to you without your consent?	59	11.6	449	88.4
12. Do you trust most of the people in your family?	440	86.6	68	13.4
13. Does anyone tell you that you give them too much trouble?	55	10.8	453	89.2
14. Do you have enough privacy at home?	462	90.9	46	9.1
15. Has anyone close to you tried to hurt you or harm you recently?	45	8.9	463	91.1

**Table 3.** Descriptive statistics for the subscales of the Hwalek–Sengstock Elder Abuse Screening Test.

Subscales / Factors	n	Number of Items	$\bar{X}$	sd
Overt violation of personal rights and direct abuse	508	5	1.789	0.172
Characteristics of the elder that make him or her vulnerable to abuse	508	3	1.778	0.259
Characteristics of potentially abusive situations	508	7	1.810	0.233
Overall	508	15	1.796	0.148



**Table 4.** Distribution of the Hwalek–Sengstock Elder Abuse Screening Test by the demographic characteristics of the participants (n=508).

Variable	Group	$\bar{X}$	sd	t/F	P
Gender	Female	1.81	0.11	1.772	0.077
	Male	1.78	0.14		
Age	65–70	1.79	0.14	0.880	0.476
	71–75	1.80	0.12		
	76–80	1.80	0.12		
	81–85	1.82	0.07		
	≥85	1.74	0.19		
Education	Elementary school or less	1.77a	0.13	2.703	0.045*
	Middle School	1.80b	0.13		
	High School	1.81b	0.12		
	University	1.82b	0.13		
Monthly Income	≤1000 TL	1.73a	0.16	5.346	p<0.001**
	1001–1500	1.79b	0.13		
	1501–2250	1.80b	0.13		
	2251–3000	1.82b	0.10		
	3001 and over	1.83b	0.12		
Number of Children	None	1.67a	0.21	4.540	p<0.001**
	1	1.77b	0.16		
	2	1.81b	0.11		
	3	1.81b	0.12		
	4	1.79b	0.14		
	5 or more	1.77b	0.13		
Other Household Members	Alone	1.74a	0.15	6.387	p<0.001**
	With spouse	1.81b	0.12		
	With relative	1.79b	0.17		
	With spouse and children	1.80b	0.13		
	Other	1.80b	0.10		
Ownership of Residence	Homeowner	1.80	0.12	3.875	p<0.001**
	Tenant	1.73	0.16		
Social Security	None	1.71a	0.06	6.598	p<0.001**
	Green Card	1.68a	0.20		
	Emekli Sandığı	1.79b	0.13		
	Bağ-kur	1.78b	0.14		
	SSK	1.81b	0.11		

\*p<0.05 \*\*p<0.01; the differences between the averages containing different letters are significant.

## DISCUSSION

The elderly experience serious health problems because of physical, psychological, sexual and economic violence and neglect. However, incidents of violence and abuse are usually kept within the family. In incidents reported to the public authorities, older adults, believing that their relatives would be prosecuted, choose to remain silent as to the perpetrator, and thus accept violence (18).

An overall majority of the older adults replied "Yes" to "Do you have anyone who spends time with you, taking you shopping or to the doctor?" and "Are you helping to support someone?" and replied "No" to "Do you feel uncomfortable with anyone in your family?" "Do you feel that nobody wants you around?" and "Does anyone in your family drink a lot?"

In general, the participants reported that no one close to them had recently tried to hurt or harm them, they had enough privacy at home, and there was no one who forced them to do things they did not want to do. This could be attributed to the fact that slightly over 50% of the participants were less aged people in the 65–70 age group; therefore, they were capable of living with their spouses without being dependent on others. Özmete and Megahead reported that the highest rate of abuse was observed for "Do you have anyone who spends time with you, taking you shopping or to the doctor?" (12).

In the present study, most older adults said that they were the ones who made decisions about their lives. This result reveals that more than half of the participants retained authority over their life decisions as they were less elderly adults.

According to the descriptive statistics for the subscales (factors) of the Hwalek–Sengstock Elder Abuse Screening Test, neglect and abuse were not excessively experienced in any of the three subscales. The overall mean score for the scale was computed as  $\bar{X}=1.843$ . "Characteristics of the elder that make him or her vulnerable

to abuse" ( $\bar{X}=1.778$ ) and "Characteristics of potentially abusive situations" ( $\bar{X}=1.810$ ) were the subscales with the lowest and the highest mean scores, respectively. This indicates greater neglect and abuse in the "Characteristics of the elder that make him or her vulnerable to abuse" subscale in comparison with the other subscales. In the present study, the overall level of elder neglect and abuse was low, indicating elderly individuals were given due importance and were protected in the traditional family structure. In the Turkish adaptation study of the Hwalek–Sengstock Elder Abuse Screening Test carried out by Özmete and Megahead, the overall mean score for the scale was reported as  $\bar{X}=2.46$  (12). In the study conducted by Keskinoglu et al. in the Inonu Health Center district in Izmir, Turkey, the researchers reported that the prevalence of physical and/or financial abuse among the elderly was 1.5% (11). In the study by Kalayci et al. 57.5% of the respondents with elder relatives reported that their elder relatives were victims of violence and mistreatment perpetrated by family members or close relatives (18).

The neglect and abuse status of the participants were not significantly different with respect to gender and age ( $p>0.05$ ), while there were significant differences with respect to educational attainment, monthly income, number of children, other household members, ownership of residence, and social security ( $p<0.05$ ). The groups with increased exposure to neglect and abuse were those who had an elementary school degree or less, who had a monthly income of 1000TL and under, who were childless, who lived alone, who were tenants, who had no social security, and who had a green card. This indicates that older adults who had low educational attainment, low income, no social security, were childless, and who lived alone were more frequently victims of neglect and abuse. In the literature, there are various studies that associate increased incidence of elder abuse with low educational attainment and low



income (14,19,20). This result could be attributed to greater dependence on others and failure to adequately protect oneself because of the frequent presence of economic deprivation in older adults with low educational attainment. In their study, Özmete and Megahead stated that elder abuse was correlated with life satisfaction, use of social benefits, and satisfaction with income and age. They demonstrated that older adults younger than 75 years of age who were satisfied with their lives and incomes had a decreased risk of abuse (12). In their cohort study covering a period of 9 years, Lanch et al., identified age, race, poverty, functional disability, and cognitive impairment as risk factors for exposure to elder mistreatment (19).

In the present study, participants who lived alone reported greater exposure to neglect and abuse compared to those living with others. The higher self-reported neglect and abuse in the older adults living alone is an interesting finding that requires in-depth analysis. In the present study, our researchers did not attempt to conduct an in-depth inquiry into the subject. Ergin found that living in an extended family affected psychological abuse (13).

The study results revealed increased exposure to neglect and abuse in participants who were tenants,

who did not have social security, and those with a green card. This indicates the importance of a social security system that protects and supports senior citizens. The results of the study conducted by Ergin et al. demonstrated that the lack of social security, not being married, having physical disabilities, social exclusion, and a low level of life satisfaction affected psychological abuse (13).

In conclusion, the neglect and abuse status of participants were significantly different with respect to educational attainment, monthly income, number of children, other household members, ownership of residence, and social security ( $p < 0.05$ ). In view of the study results, the researchers would like to make a couple of recommendations:

- ✓ With the support of the media, educate the public, caregivers, and family members of older adults about old age, elder problems, elder abuse, and elder neglect.
- ✓ Use the media to raise public awareness through informative and instructional efforts on elder abuse and neglect.
- ✓ Conduct more comprehensive studies to identify possible risk factors through focus groups or in-depth interviews.

## REFERENCES

1. Beşer T, Yavuzer H. Old age and old age epidemiology. *Clinical Development* 2012;3(25):1-3. (in Turkish).
2. Ministry of Family and Social Policy. The situation of the elderly in Turkey and the national action program on aging. 2013. [Internet] Available from: <http://www.eyh.ov.r/upload/Node/8638/files/blob.docx>. Accessed: 15.10.2015 (in Turkish).
3. Turkish Statistical Institute. Life tables. 2013-2014. [Internet] Available from: <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18618> Accessed:10.10.2015 (in Turkish).
4. Özmete E. The Hwalek-Sengstock elder abuse screening test: the adaptation study into Turkish. *Anatolian Journal of Psychiatry* 2016;17(Suppl.1):45-52. (in Turkish).
5. Kissal A, Beşer A. Identifying and evaluating elder abuse and neglect. *TAF Prev Med Bull* 2009; 8(4):357-64. (in Turkish).
6. WHO. The Toronto Declaration on the global prevention of elder abuse. Geneva, World Health Organization, University of Toronto, Ryerson University, INPEA, 2002 pp 1-4.
7. Moore C, Browne C. Emerging innovations, best practices, and evidence-based practices in elder abuse and neglect: A review of recent developments in the field. *Journal of Family Violence* 2017;32(4):383-97.
8. Political declaration and Madrid International plan of action on ageing. United Nations, 2002. New York. [Internet] Available from: [http://www.un.org/en/events/pastevents/pdfs/Madrid\\_plan.pdf](http://www.un.org/en/events/pastevents/pdfs/Madrid_plan.pdf). Accessed:15.10.2015.

9. Gallione C, Dal Molin A, Cristina F, Ferns H, Mattioli M, Suardi B. Screening tools for identification of elder abuse: A systematic review. *Journal of Clinical Nursing* 2017;26:2154-76. (PMID:28042891).
10. Ergöner AT, Can İÖ, Toprak G. Elderly abuse in women who applied to the gynecology policlinic. *Journal of Forensic Psychiatry* 2007;4(2):13-8. (in Turkish).
11. Keskinöğlü P, Giray H, Pıçakçıefe M, Bilgiç N, Uçku R. Physical abuse, financial abuse and neglect in elderly. *Turkish Journal of Geriatrics* 2004;7(2):57-61. (in Turkish).
12. Özmeye Ö, Megahead HA. Screening for elder abuse among Turkish older people: Validity of the Hwalek-Sengstock elder abuse screening test (H-S "East"). *Research on Social Work Practice* 2006;1-12.
13. Ergin F, Evcı-Kiraz ED, Saruhan G, Benli C, Okyay P, Beser E. Prevalance and risk factors of elder abuse and neglect in a western city of Turkey: Community based study. *Bulletin of the Transilvania University of Braşov, Series VI, Medical Sciences* 2012;5(54):33-50.
14. Oh J, Kim HS, Martins D, Kim H. A study of elder abuse in Korea. *Int J Nurs Stud* 2006;43(2):203-14. (PMID:15913631).
15. Souza JA, Freitas MC, Queiroz TA. Violence against the aged: document analysis. *Rev Bras Enferm* 2007; 60;3:268-72. (PMID:17684902).
16. Sekaran, U. *Research methods for business:A skill building approach*, 4th Edition, John Wiley High Education. New York 2003, pp 270-99.
17. Hwalek M, Sengstock M. Assessing the probability of abuse of the elderly: Toward the development of a clinical screening instrument. *J Appl Gerontol* 1986;5:153-73.
18. Kalaycı I, Yazıcı SÖ, Şenkaynağı A. Violence perception of the old people's attendants: Sample of Suleyman Demirel University Hospital. *Elderly Issues Research Journal* 2015; 8(1):22-3. (In Turkish).
19. Lachs MS, Williams C, O'Brien S, Hurst L, Horwitz R. Risk factors for reported elder abuse and neglect: A nine-year observational cohort study. *The Gerontologist* 1997;37:469-74. (PMID:9279035).
20. Keskinöğlü P, Pıçakçıefe M, Bilgiç N, Giray H, Karakus, N, Uçku, R. Elder abuse and neglect in two different socioeconomic districts in Izmir, Turkey. *International Psychogeriatrics* 2007;16:1-13 (PMID:17433122).





Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137963  
2018;21 (1):25-32

■ Serkan PEKÇETİN<sup>1</sup>

#### CORRESPONDANCE

Serkan PEKÇETİN  
Trakya University, Faculty of Health Sciences  
Department of Occupational Therapy  
Edirne, Turkey

Phone: 905057579384  
e-mail: serkanpekcecin@gmail.com

Received: 30/11/2017  
Accepted: 04/02/2018

<sup>1</sup> Trakya University, Faculty of Health Sciences  
Department of Occupational Therapy  
Edirne, Turkey

#### RESEARCH

## AGEIST ATTITUDES AND THEIR ASSOCIATION WITH BURNOUT AND JOB SATISFACTION AMONG NURSING STAFF: A DESCRIPTIVE STUDY

### ABSTRACT

**Introduction:** The various factors affecting burnout and job satisfaction among nursing staff have yet to be clearly identified. Accordingly, this study examines one of those potential factors, ageist attitudes, and its relation with burnout and job satisfaction among nursing home employees.

**Materials and Method:** This was a cross sectional multi-center study which was conducted in 2017. Ageism was evaluated using the Ageism Attitude Scale (subscales: restricting life of the elderly, positive ageism, and negative ageism); burnout level was evaluated using the Maslach Burnout Inventory (subscales: emotional exhaustion, depersonalization, and personal satisfaction); and job satisfaction was evaluated using the Short-Form Minnesota Satisfaction Questionnaire. Correlation between variables were analyzed Spearman Correlation test.

**Results:** Positive ageism was positively correlated with personal accomplishment and job satisfaction scores ( $p<.05$ ) and negatively correlated with depersonalization ( $p<.05$ ). Short-Form Minnesota Satisfaction Questionnaire scores were negatively correlated with emotional exhaustion and depersonalization and positively correlated with personal accomplishment variables ( $p<.05$ ).

**Conclusion:** Ageism negatively impacts not only elderly individuals but also the nursing staff who care for them. Educational programs to prevent ageism should be evaluated for efficiency and implemented if proven to be beneficial.

**Keywords:** Ageism; Job satisfaction; Nursing homes; Nursing staff

#### ARAŞTIRMA

## YAŞLI BAKIM PERSONELLERİNİN YAŞLI AYRIMCILIĞI İLE İLGİLİ TUTUMLARI İLE TÜKENME VE İŞ MEMNUNİYETİ ARASINDAKİ İLİŞKİSİNİN İNCELENMESİ: TANIMLAYICI BİR ÇALIŞMA

### Öz

**Giriş:** Yaşlı bakım personellerinin tükenmişlik düzeyleri ve iş doyumlarını etkileyen faktörlerin pek çoğu henüz tam olarak tanımlanmamıştır. Dolayısıyla, bu çalışma bahsedilen potansiyel faktörlerden biri olan yaşlı ayrımcılığı tutumları ve bunun yaşlı bakım personelinin tükenmişlik ve iş doyumunu ile ilişkisini incelemektedir.

**Gereç ve Yöntem:** Bu çalışma, 2017 yılında gerçekleştirilen kesitsel çok merkezli bir çalışmaydı. Yaşlılık ile ilgili tutumlar Yaşlı Ayrımcılığı Tutum Ölçeği (Alt boyutları: Yaşlılığın yaşamını sınırlandırma, pozitif tutumlar ve negatif tutumlar), tükenmişlik düzeyleri Maslach Tükenmişlik Envanteri (Alt Boyutları: Duygusal Tükenme, duyarsızlaşma ve kişisel başarı) ve iş doyumunu Kısa Form Minnesota İş Doyum Ölçeği ile değerlendirildi. Değişkenler arasındaki ilişki Spearman Korelasyon testi ile incelendi.

**Bulgular:** Pozitif tutum puanları ile kişisel başarı ve iş doyumunu puanları arasında pozitif yönde önemli bir ilişki ( $p<.05$ ) ve duyarsızlaşma ile negatif yönde önemli bir ilişki saptandı ( $p<.05$ ). Kısa Form Minnesota İş Doyum Ölçeği puanının duygusal tükenme ve duyarsızlaşma ile negatif yönde, kişisel başarı puanı ile pozitif yönde ilişkisi olduğu saptandı ( $p<.05$ ).

**Sonuç:** Yaşlılık ile ilgili olumsuz tutumlar yalnızca yaşlıyı olumsuz etkilemez, aynı zamanda onların bakımını yapan bakım personelinin de olumsuz etkileyebilir. Yaşlılık ile ilgili olumsuz tutumların engellenmesi için eğitim programları etkinlik açısından değerlendirilmeli ve yararlı olduğu kanıtlanırsa uygulanmalıdır.

**Anahtar sözcükler:** Yaşlı ayrımcılığı; İş doyumunu; Huzurevi; Yaşlı bakım personeli

## INTRODUCTION

The technological and scientific advances in the last century have greatly improved healthcare quality, thus extending average life expectancy and increasing the total number of elderly people worldwide (1). In Turkey, the elderly population increased by 17.1% between 2011 and 2016 (2). In addition, other concurrent social changes such as decreasing birth rates, large-scale migration from rural to urban areas, and greater emphasis on women's professional opportunities have increased the need for nursing homes.

Physical and mental changes associated with the aging process increase the care needs of older adults (3), which are generally met by nursing staff. Caring for elderly individuals in nursing homes is emotionally and physically demanding, but it can also be a satisfying experience for nurses.

### **Burnout in nursing staff**

Burnout, a term describing emotional, physical, and mental fatigue, is an insidious process. Maslach et al. described occupational burnout in terms of three dimensions: emotional exhaustion, characterized by workers' loss of motivation due to excessive demands and psychological stress at their job; depersonalization, which leads workers to respond to clients in negative, callous, and dehumanizing ways to create emotional distance from them; and lack of personal accomplishment, as workers negatively evaluate themselves and their profession (4). Burnout is important because of its association with loss of productivity, decreased ability to work, and low job satisfaction (5).

Previous studies have demonstrated that burnout is a key problem among nursing staff (6,7). To the best of our knowledge, only one prior study has investigated burnout among Turkish nursing staff. In that study, contrary to most findings in the literature, Özçakar et al. revealed that Turkish nursing staff did not experience burnout. They cited the participants' young age and specific training for elderly care as possible explanations for this unexpected result

(8). Nursing staff burnout is affected by multiple factors, including work-related and personal factors (5). However, no studies have evaluated the relation between burnout and ageism.

### **Ageism in nursing staff**

Ageism is defined as assumptions, prejudice, discrimination, and arbitrary decisions regarding an individual based on his or her age (9). Factors that may be related to ageism include the individual's own age, experiences, educational background, and cultural beliefs and values (10).

The presence of ageist attitudes can negatively impact the performance of healthcare providers who care for elderly individuals. A study investigating ageist attitudes among nursing students, nurses, and physicians in the Turkish context demonstrated that Turkish healthcare providers' attitudes toward older individuals were generally positive (11-13). However, to the best of our knowledge, no studies have evaluated ageist attitudes of Turkish nursing staff and its relation with occupational burnout and job satisfaction.

Therefore, this study fills this research gap by assessing ageist attitudes among Turkish nursing staff and determining the relation between ageism and burnout and job satisfaction. Furthermore, it examines the association between demographic variables and ageism attitudes, burnout, and job satisfaction among nursing staff.

## MATERIALS AND METHOD

This study was performed at two public nursing homes for the elderly in Ankara, Turkey. The study protocol was approved by local ethic committee. All participants signed written informed consent forms prior to the study.

### **Participants**

A total of 126 individuals were employed as care staff in these nursing homes. To be included in the study, employees must have been working



for at least one year as nursing staff. To maximize the number of participants, all staff members who met the inclusion criteria were invited to participate. However, 11 nursing staff could not participate because they were on annual leave or shift leave, 9 others declined to participate, and 1 was excluded as the participant did not meet the inclusion criteria. Therefore, the final study sample comprised 105 nursing staff.

## INSTRUMENTS

### Ageism Attitude Scale

The Ageism Attitude Scale (AAS) was developed by Yılmaz and Terzioğlu in Turkey to evaluate the ageist attitudes of young people and adults. It comprised 23 items organized into 3 dimensions: 9 items on restricting life of the elderly, 8 on positive ageism, and 6 on negative ageism. Statements describing attitudes of positive ageism were scored as 5=*completely agree*, 4=*agree*, 3=*unsure*, 2=*disagree*, and 1=*absolutely disagree*; statements describing negative ageist attitudes were reverse-scored items. A higher score indicated positive ageism attitudes. Total scores ranged from 23 to 115 points overall, from 9 to 45 for restricting life of the elderly, from 8 to 40 for positive ageism, and from 6 to 30 for negative ageism. The intra-class correlation coefficient (ICC) for the scale was determined to be .80 (14).

### Maslach Burnout Inventory

Maslach and Jackson developed the Maslach Burnout Inventory (MBI) to assess the frequency and intensity of perceived burnout among people in the helping professions. The Turkish version of the MBI was created in 1992. The MBI comprised 22 items organized into 3 subscales: emotional exhaustion (EE, 9 items), depersonalization (D, 5 items), and personal accomplishment (PA, 8 items). Each item was scored on a five-point scale (0=*never*, 1=*several times a year*, 2=*several times a month*, 3=*several times a week*, 4=*every day*). High EE or D scores

and low PA scores indicated burnout. Reliability coefficients of the subscales were determined as follows: EE=.83, D=.72, and PA=.67 (15).

### Short-Form Minnesota Satisfaction Questionnaire

The Short-Form Minnesota Satisfaction Questionnaire (SFMSQ) captures an employee's degree of satisfaction with his or her job. It comprised 20 items from the Long-Form Minnesota Satisfaction Questionnaire that best represent each of the 20 scales. Factor analysis of the 20 items resulted in two factors, intrinsic and extrinsic satisfaction. Intrinsic job satisfaction included factors such as activity, ability utilization, and achievement; extrinsic job satisfaction encompassed supervisor–employee relations, compensation, and company policies among other factors. Each item was rated on a five-point scale (5=*very satisfied*, 4=*satisfied*, 3=*neither satisfied nor dissatisfied*, 2=*dissatisfied*, 1=*very dissatisfied*). The general satisfaction score was the mean of all responses; intrinsic and extrinsic satisfaction scores were determined by calculating the mean of the relevant items (12 intrinsic and 8 extrinsic factors). High scores indicated higher levels of job satisfaction. Turkish SFMSQ validity research was conducted and the Cronbach's alpha value was found as 0.87 (16).

### Statistical analyses

The data were analyzed using SPSS version 22.0. Normality of data was analyzed using the Shapiro–Wilk test. Using the Mann–Whitney U test, comparisons of the participants' AAS, MBI, and SFMSQ values were made on the basis of four demographic variables (age, gender, education level, and marital status). Correlations between variables were analyzed using the Spearman correlation test. Spearman's correlation coefficient (*r*) values were classified as indicating "weak" (.00–.19), "mild" (.20–.39), "moderate" (.40–.59), "moderately strong" (.60–.79), and "strong" (.80–1.0) relations between variables. *P* values less than .05 were considered to be statistically significant.

## RESULTS

The mean age of the participants was 36.40±6.80 years (ranging from 20 to 51 years). The mean time of employment in the nursing home was 3.32±3.74 years. The mean number of elderly people for whom the participants cared was 41.17±10.38 per day.

Table 1 presents the demographic characteristics of the participants. The mean total AAS score was 82.76±7.44. Mean MBI scores were 9.69±6.04 for EE, 2.34±2.61 for D, and 24.85±5.86 for PA; the mean total SFMSQ score was 3.83±.56. Table 2 indicates the AAS, MBI, and SFMSQ values for the participants.

**Table 1.** Demographic characteristics of the participants (Ankara-Turkey, 2017) (n=105).

Demographic variables	n	%
Sex		
Male	31	29.5
Female	74	70.5
Marital status		
Married	92	87.6
Single	10	9.5
Widowed	3	2.9
Education level		
Primary school	46	43.8
High school	55	52.4
Associate degree	4	3.8

**Table 2.** Descriptive statistics for the AAS, MBI and SFMSQ scales (Ankara-Turkey, 2017).

Evaluation Instruments	n	Minimum	Maximum	Mean	Standard deviation
<b>aAS</b>					
Restricting life of elderly	105	25.00	45.00	34.86	3.95
Positive ageism	105	16.00	40.00	30.52	4.32
Negative ageism	105	10.00	25.00	17.44	3.55
AAS total	105	60.00	100.00	82.76	7.44
<b>MBI</b>					
Emotional exhaustion	105	0.00	27.00	9.69	6.04
Depersonalization	105	0.00	14.00	2.34	2.61
Personal accomplishment	105	1.00	32.00	24.85	5.86
<b>SFMSQ</b>					
Intrinsic satisfaction	105	2.25	5.00	3.91	.54
Extrinsic satisfaction	105	1.38	5.00	3.70	.71
SFMSQ Total	105	2.15	5.00	3.83	.56

Note. AAS=Ageism Attitude Scale; MBI=Maslach Burnout Inventory; SFMSQ=Short Form Minnesota Satisfaction Questionnaire.



No statistically significant differences were observed in AAS dimension scores according to participants' demographic characteristics. On the MBI scale, female participants had significantly higher EE scores than males ( $p<.01$ ). Participants who had high school or associate degrees had higher PA scores than those who graduated from primary school ( $p<.05$ ). Primary school graduates had higher extrinsic satisfaction scores on the SFMSQ than high school graduates and associate degree holders ( $p<.05$ ) (Table 3).

A mild positive correlation was observed between positive ageism and PA scores on the MBI scale and among intrinsic, extrinsic, and general satisfaction scores on the SFMSQ. The MBI results revealed a mild negative correlation between positive ageism and D scores, a mild positive correlation between general satisfaction scores and PA scores, and a moderate negative correlation between general satisfaction scores and EE and D scores. Table 4 presents the Spearman correlation analysis results.

**Table 3.** Comparison of AAS, MBI and SFMSQ scales according to demographic characteristics (Ankara-Turkey, 2017).

	RL	PosA	NegA	EE	D	PA	IS	ES
<b>Gender</b>								
Female (n=74)	34.90±4.10	30.41±4.32	17.83±3.53	10.77±6.38	2.55±2.90	24.64±6.37	3.89±.52	3.62±.72
Male (n=31)	34.77±3.65	30.77±4.37	16.51±3.48	7.12±4.20	1.83±1.67	25.35±4.46	3.97±.58	3.88±.65
	p: .65	p: .53	p: .053	p: .005**	p: .59	p: .83	p: .72	p: .07
<b>Age</b>								
≤35 years (n=46)	35.21±4.01	30.71±3.85	16.86±3.60	9.82±5.69	1.93±2.28	26.04±4.12	3.97±.47	3.70±.67
>36 years (n=59)	34.59±3.93	30.37±4.68	17.89±3.47	9.59±6.34	2.66±2.82	23.93±6.81	3.87±.58	3.70±.74
	p: .49	p: .80	p: .17	p: .75	p: .18	p: .21	p: .88	p: .72
<b>Marital Status</b>								
Married (n=92)	34.92±3.99	30.59±4.45	17.56±3.65	9.45±6.12	2.39±2.69	24.90±5.84	3.92±.53	3.73±.68
Single/ Widowed (n=13)	34.46±3.84	30.00±3.26	16.61±2.69	11.38±5.26	2.00±2.04	24.53±6.19	3.83±.56	3.49±.89
	p: .92	p: .52	p: .30	p: .19	p: .79	p: .89	p: .49	p: .43
<b>Education level</b>								
Primary school (n=46)	34.34±4.18	30.32±5.34	17.34±3.49	8.95±6.03	2.06±2.45	23.50±6.31	3.90±.50	3.85±.67
High school/ Associate degree (n=59)	35.27±3.76	30.67±3.35	17.52±3.63	10.27±6.03	2.55±2.73	25.91±5.30	3.92±.57	3.58±.72
	p: .20	p: .96	p: .78	p: .17	p: .30	p: .024*	p: .92	p: .019*

Note. AAS=Ageism Attitude Scale; MBI=Maslach Burnout Inventory; SFMSQ=Short Form Minnesota Satisfaction Questionnaire; RL= Restricting life of the elderly; PosA=Positive ageism; NegA=Negative ageism; EE=Emotional exhaustion; D=Depersonalization; PA=Personal accomplishment; IS=Intrinsic satisfaction; ES=Extrinsic satisfaction. \*\* $p<0.01$ ; \* $p<0.05$ .

**Table 4.** Correlations among AAS, MBI and SFMSQ results (Ankara-Turkey, 2017).

	1	2	3	4	5	6	7	8	9
1 Restricting life of elderly	–								
2 Positive ageism	.105	–							
3 Negative ageism	.250*	-.036	–						
4 Emotional exhaustion	.068	-.180	-.058	–					
5 Depersonalization	-.086	-.318**	.026	.395**	–				
6 Personal accomplishment	.159	.213*	-.057	-.147	-.388**	–			
7 Intrinsic satisfaction	-.091	.289**	-.080	-.323**	-.415**	.243*	–		
8 Extrinsic satisfaction	-.201	.320**	-.098	-.487**	-.450**	.120	.681**	–	
9 SFMSQ Total	-.163	.336**	-.114	-.449**	-.474**	.212*	.909**	.905**	–

Note. AAS=Ageism Attitude Scale; MBI=Maslach Burnout Inventory; SFMSQ=Short Form Minnesota Satisfaction Questionnaire. \*Correlation is significant at the 0.05 level (2-tailed). \*\*Correlation is significant at the 0.01 level (2-tailed).

## DISCUSSION

This study found that ageist attitudes among nursing staff were not related to their age, gender, education level, or marital status. However, ageist attitudes were associated with burnout levels and job satisfaction.

Elderly people in nursing homes spend much of their time with nurses while receiving assistance, with activities of daily living such as eating, bathing, dressing, and moving. Adverse changes in the attitudes and behavior of healthcare providers can impact quality of care (17,18). Therefore, ageist attitudes, emotional burnout, and job satisfaction are critical issues among nursing home employees.

Previous studies have evaluated the presence of ageist attitudes among Turkish healthcare providers and nursing students. These studies have reported general tendencies toward positive ageism (12,13).

Consistent with this literature, this study found a predominantly positive attitude toward the elderly among the nurses.

Polat et al. indicated that ageist attitudes among Turkish healthcare providers were not related to demographic characteristics such as age, gender, and education level (12). Usta et al. found a correlation between gender and positive ageism among Turkish nursing students. However, males constituted only 10% of the total study population in their study, indicating an important limitation that precludes the generalization of this result to the general population (11). The results of our study indicated that ageist attitudes were not associated with the demographic characteristics of the participants. The similar scores on positive ageism among Turkish healthcare providers and the lack of relation between ageist attitudes and demographic variables indicated that these



attitudes may be primarily influenced by cultural factors. This interpretation is supported by Kydd et al., who reported differences in the ageist attitudes of healthcare personnel in three countries (19).

Studies have reported that nurses have a high risk of burnout, which may affect the quality of care that they provide (20,21). However, the study by Özçakar et al. indicated lower levels of burnout among Turkish nursing staff compared with other studies in the literature. Similarly, we found that the nurses in our study experienced low burnout levels. These contradictory findings may stem from the differences in occupational context between the studies.

This study suggested that female participants experience more burnout than males, a finding consistent with that of Özçakar et al. (8). In contrast, Kendelman et al. reported that gender was not a risk factor for burnout among caregivers (6). Numerous earlier studies have demonstrated higher burnout levels among Turkish female professionals than among their male colleagues (22,23). Turkish women have more household and child-care responsibilities compared with their male counterparts, and this factor may contribute to their higher risk of burnout.

Iecovic and Avivi examined ageist attitudes among nurses in long-term care centers. They found that ageism was related with depersonalization and personal accomplishment but not with emotional exhaustion (24). Our findings are similar

to those results; however, the correlations that we observed with depersonalization and personal accomplishment parameters were not as strong as those reported by Iecovic and Avivi. In this study, no direct relation was observed between ageism and burnout; however, work-related parameters, the role of which was not assessed in this study, may significantly impact burnout among nursing staff.

The relation between burnout and job satisfaction among geriatric care workers has been previously demonstrated (25). As expected, our findings are consistent with those of a prior study. Overall, we believe that this is the first study to show a relation between ageist attitudes and job satisfaction among nursing staff. However, we cannot conclude that nursing staff should receive education or training aimed at preventing the incidence of ageism because the evidence of the effectiveness of such training is insufficient. Further prospective studies should be conducted to determine whether educational interventions can reduce ageist attitudes.

This study has two important limitations. First, it was performed in only two nursing homes, limiting the generalizability of the findings. Second, the scope of our analysis did not include all organizational and personal variables that may affect ageism, burnout, and job satisfaction. However, despite these limitations, this study demonstrates that ageism negatively impacts not only elderly individuals receiving care but also nursing staff.

## REFERENCES

1. He W, Goodkind D, Kowal PR. An aging world: 2015 United States Census Bureau. U.S. Government Publishing Office, Washington DC 2016, pp 1-15.
2. Press Releases of Turkish Statistical Institute; Elderly Statistic, 2016 [Internet] Available from: <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=24644>. Accessed:01.10.2017. (in Turkish).
3. Solanki SL, Singhal G, Mishra N, Meharda B. Health problems of elderly: a challenge for care. *Int J Cur Res Rev* 2015;7(5):38-42.
4. Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Ann Rev Psychol* 2001;52(1):397-422. (PMID:11148311).
5. Westermann C, Kozak A, Harling M, Nienhaus A. Burnout intervention studies for inpatient elderly care nursing staff: Systematic literature review. *Int J Nurs Stud* 2014;51(1):63-71. (PMID:23273537).
6. Kendelman N, Mazars T, Levy A. Risk factors for burnout among caregivers working in nursing homes. 2018 Jan;27(1-2):e147-e153. (PMID:28543882).

7. Sanchez S, Mahmoudi R, Moronne I, Camonin D, Novella JL. Burnout in the field of geriatric medicine: Review of the literature. *Eur Geriatr Med* 2015;6(2):175-83.
8. Özçakar N, Kartal M, Dirik G, Tekin N, Güldal D. Burnout and relevant factors in nursing staff: What affects the staff working in an elderly nursing home? *Turkish Journal of Geriatrics* 2012;15(3):266-72.
9. Kydd A, Fleming A. Ageism and age discrimination in health care: Fact or fiction? A narrative review of the literature. *Maturitas* 2015;81(4):432-38. (PMID:26044073).
10. Akdemir N, Cınar FI, Gorgulu U. Perception of ageing and ageism. *Turkish Journal of Geriatrics* 2007;10(4):215-22. (In Turkish).
11. Usta YY, Demir Y, Yonder M, Yildiz A. Nursing students' attitudes toward ageism in Turkey. *Arch Gerontol Geriatr* 2012;54(1):90-93. (PMID:21353316).
12. Polat U, Karadag A, Ulger Z, Demir N. Nurses' and physicians' perceptions of older people and attitudes towards older people: Ageism in a hospital in Turkey. *Contemp Nurs* 2014;48(1):88-97. (PMID:25410199).
13. Özdemir Ö, Bilgili N. Attitudes of Turkish nursing students related to ageism. *J Nurs Res* 2016;24(3):211-16. (PMID:26998768).
14. Vefikuluçay YD, Terzioğlu F. Development and psychometric evaluation of ageism attitude scale among the university students. *Turkish Journal of Geriatrics* 2011;14(3):259-68.
15. Ergin C. The norms of Maslach Burnout Inventory in Turkish Medical Staff. *Journal of 3P*. 1996;4(1):28-33. (In Turkish).
16. Köroğlu Ö. Determination of the relationship between the levels of intrinsic and extrinsic job satisfaction with level of general job satisfaction: an investigation on tour guides. *DUJ* 2012;13(2):275-89. (in Turkish).
17. Wallace JE, Lemaire JB, Ghali WA. Physician wellness: A missing quality indicator. *Lancet* 2009;374(9702):1714-21. (PMID:19914516).
18. Nantsupawat A, Nantsupawat R, Kunaviktikul W, Turale S, Poghosyan L. Nurse burnout, nurse-reported quality of care, and patient outcomes in Thai hospitals. *J Nurs Sch* 2016;48(1):83-90. (PMID:26650339).
19. Kydd A, Touhy T, Newman D, Fagerberg I, Engstrom G. Attitudes towards caring for older people in Scotland, Sweden and the United States. *Nurs Older People* 2014;26(2):33-40. (PMID:24576249).
20. Cocco E, Gatti M, Lima C, Camus V. A comparative study of stress and burnout among staff caregivers in nursing homes and acute geriatric wards. *Int J Geriatr Psychiatry* 2003;18(1):78-85. (PMID:12497560).
21. Cañadas-De la Fuente GA, Vargas C, Luis CS, García I, Cañadas GR, Emilia I. Risk factors and prevalence of burnout syndrome in the nursing profession. *Int J Nurs Stud* 2015;52(1):240-49. (PMID:27623931).
22. Anil M, Yurtseven A, Yurtseven I. et al. The evaluation of burnout and job satisfaction levels in residents of pediatrics. *Turk Pediatri Ars* 2017;52(2):66-71. (PMID:28747836).
23. Kaptanoğlu AY, Demir T. Examining job satisfaction among perfusionists: A brief report from Istanbul. *J Pak Med Assoc* 2013;63(9):1157-62. (PMID:24601197).
24. Iecovich E, Avivi M. Agism and burnout among nurses in long-term care facilities in Israel. *Aging Ment Health* 2017;21(3):327-35. (PMID:26496232).
25. Rouxel G, Michinov E, Dodeler V. The influence of work characteristics, emotional display rules and affectivity on burnout and job satisfaction: A survey among geriatric care workers. *Int J Nurs Stud* 2016;62:81-89. (PMID:27468116).





Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137964  
2018;21 (1):33-40

- Burcu AKPINAR SÖYLEMEZ<sup>1</sup>
- Özlem KÜÇÜKGÜÇLÜ<sup>1</sup>
- Merve Aliye AKYOL<sup>1</sup>

#### CORRESPONDANCE

Burcu AKPINAR SÖYLEMEZ  
Dokuz Eylül University, Faculty of Nursing  
İzmir, Turkey

Phone: 02324124793  
Fax: 02324124798  
e-mail: burcu.akpinar@deu.edu.tr

Received: 23/11/2017  
Accepted: 28/12/2017

<sup>1</sup> Dokuz Eylül University, Faculty of Nursing  
İzmir, Turkey

**Presented In:** It was presented as a poster in  
19<sup>th</sup> National Internal Medicine Congress,  
11-15 October 2017.

#### RESEARCH

## CAN AN ELECTIVE GERIATRIC NURSING COURSE CHANGE NURSING STUDENTS' ATTITUDES AND WILLINGNESS IN CARING FOR THE ELDERLY? A QUASI-EXPERIMENTAL DESIGN STUDY

### ABSTRACT

**Introduction:** The elderly population is rapidly growing, and healthcare professionals are currently providing increased care for the elderly. This study was conducted to evaluate the effect of an elective geriatric nursing course on the attitude of students toward the elderly and students' willingness to work with them.

**Materials and Method:** This study was a quasi-experimental. Pretest-posttest design was used. The sample comprised 108 nursing students (46 of the students were educated in an elective geriatric nursing course, 62 were educated in an elective emergency and surgery nursing course). The Student Information Form and Kogan's Attitudes Towards Old People Scale were used. Value, average, percentage frequency distribution, paired t tests, independent t test, McNemar's test, and chi-square test were used.

**Results:** Students who participated in the elective geriatric nursing course developed more positive and less negative attitudes toward the elderly after the course in comparison with students who participated in the elective emergency and surgery nursing course.

**Conclusion:** It is important that the curriculum of the geriatric nursing course should create awareness and knowledge in students regarding care of and attitudes toward the elderly. Adopting a more positive and less negative attitude ensures a higher quality care for the elderly. There is a need to revise the nursing curriculum and develop innovative schemes that will increase the students' willingness to work with the elderly.

**Keywords:** Attitude; Aged; Students; Nursing; Curriculum

#### ARAŞTIRMA

## GERİATRİ HEMŞİRELİĞİ SEÇMELİ DERSİ HEMŞİRELİK ÖĞRENCİLERİNİN YAŞLI BAKIMI KONUSUNDAKİ TUTUM VE İSTEKLİLİĞİNİ DEĞİŞTİREBİLİR Mİ? YARI DENEYSEL BİR ARAŞTIRMA

### Öz

**Giriş:** Yaşlı nüfusu giderek artmakta ve sağlık bakım profesyonelleri yaşlılara daha fazla hizmet verir hale gelmektedir. Bu araştırma, geriatri hemşireliği seçmeli dersinin öğrencilerin yaşlı bakımı konusundaki tutum ve yaşlıyla çalışma istekliliği üzerine etkisini incelemek amacıyla yapılmıştır.

**Gereç ve Yöntem:** Bu çalışma yarı deneyseldir. Ön test son test modeli kullanılmıştır. Örneklem sayısı 108 hemşirelik öğrencisidir (öğrencilerin 46'sı seçmeli geriatri hemşireliği dersini, 62'si seçmeli acil ve cerrahi hemşireliği dersini almıştır). Öğrenci Bilgi Formu ve Kogan Yaşlı İnsanlara Karşı Tutum Ölçeği kullanılmıştır. Ortalama, yüzde frekans dağılımı, iki eş arasındaki farkın önemlilik testi, iki ortalama arasındaki farkın önemlilik testi, McNemar testi, ki kare testi kullanılmıştır.

**Bulgular:** Seçmeli geriatri hemşireliği dersi alan öğrenciler, seçmeli acil ve cerrahi hemşireliği dersi alan öğrencilerle karşılaştırıldığında, ders sonrasında yaşlılara yönelik daha pozitif ve daha az negatif tutum oluşturmuştur.

**Sonuç:** Yaşlılara yönelik tutum ve bakım hakkında farkındalık ve bilgi sağlamak amacıyla hemşirelik müfredatlarının geriatri derslerini içermesi büyük önem taşımaktadır. Daha fazla pozitif daha az negatif tutum sergilemek yaşlılara yönelik daha fazla kaliteli bakım sunulması anlamına gelmektedir. Hemşirelik müfredatının, öğrencilerin, yaşlılarla çalışmak konusunda isteklilik durumlarını arttırmak üzere, yeniden düzenlenmesine ve yenilikçi yaklaşımlara ihtiyaç duyulmaktadır.

**Anahtar sözcükler:** Tutum; Yaşlılık; Öğrenciler; Hemşirelik; Müfredat

## INTRODUCTION

Owing to the increase in the elderly population, healthcare professionals are currently providing increasing care for the elderly population. This trend is expected to increase in the future. Lack of policies and awareness of the necessity and importance of geriatric nursing education and the shortage of geriatric nurses to provide care for the increasing population of elderly patients remains an urgent and important problem (1). There is still no national infrastructure for geriatric nursing in Turkey because geriatric nursing is not considered a specialty. In recent years, although courses in geriatrics care have been organized, there are no approved certification programs available. Ayoglu et al. (2) stated that Turkish students emphasized that their education regarding the care of the elderly was inadequate.

Nurses who have not graduated with a specific level of knowledge about care for the elderly, nevertheless, do come across many elderly individuals or patients at work and must take care of them. The curriculum should thus be designed in order to positively influence the attitude of nursing students toward the elderly. The attitude of healthcare professionals is one of the key factors in providing quality care for the elderly. Many studies have evaluated the attitude of students, who are the future health professionals, toward the elderly (3-6). In their systematic review, Liu et al. (5) reviewed studies published between 2000 and 2011 that investigated the attitude of nurses and nursing students toward the elderly. This systematic review concluded that positive attitudes of nurses and nursing students toward the elderly had decreased slightly since 2000.

Students who have a more negative attitude toward the elderly are negatively affected in terms of their willingness to work with the elderly in the future, and the number of people wanting to work with the elderly is decreasing in the healthcare industry, although there is a greater need for such people (7). Willingness to work with the elderly is closely related to having a positive attitude (5,8,9).

There are studies showing that attitude toward the elderly is affected by education (7,10-12). The

results of these studies have been interpreted to indicate that nursing students are positively affected by this education. These results, therefore, suggest that adjustments must be made to geriatric education, and the curriculum must be enriched with better information to improve teaching skills and practices that meet the needs of the elderly and improve the quality of their care (3-6,9). Many nursing schools in Turkey do not have any geriatrics courses, but a limited number of schools do offer elective geriatrics courses. There have been no studies in Turkey evaluating the effect of elective geriatric nursing courses. For this reason, the present study was conducted to evaluate the effect of an elective geriatric nursing course on the attitude of students toward the elderly and students' willingness to work with them.

## MATERIALS AND METHOD

A quasi-experimental pretest-posttest design was used.

### Sample

The sample consisted of a total of 155 students, who were 2<sup>nd</sup> year students at a university faculty of nursing and took either the geriatric nursing (n=52) or emergency nursing and surgery nursing (n=103) course as an elective. Students who volunteered to participate (n=129) constituted the subjects for this study.

### Education program

The geriatric nursing course was taught for 14 weeks, for two hours once a week. Topics included in the syllabus were: changes in society and the place of the elderly in a changing society, understanding changes that come with aging, psychosocial aspects of aging, syndromes/complications frequently associated with aging, and the perception of aging in society. A local "Awareness Center" operated by the municipality, was visited as part of the curriculum to enable them to empathize with elderly people who have physical disabilities. Students participated in simulation studies in order to understand the physical disabilities experienced by the elderly.



Students also visited a government-run nursing home to interact with the elderly. In the emergency and surgery nursing course, which was selected to be the control group, no topics related to care for the elderly were discussed.

### **Instruments**

The Student Information Form and Kogan's Attitudes Towards Old People Scale were used.

#### **Student information form**

The form was prepared to obtain socio-demographic information about the students in the sampling group and data that can affect their attitudes toward the elderly (age, gender, living with elderly people, giving care to the elderly, willingness to work with elderly after graduation).

#### **Kogan's Attitudes Towards Old People Scale**

Kogan's Attitudes Towards Old People Scale is a tool that has been used to evaluate attitudes toward the elderly for more than 50 years. The systematic review by Neville (6) investigated eight different scales used in 42 different studies published between 2008 and 2013 to examine the attitudes of nursing students toward the elderly. Among these scales, Kogan's scale was described as the most trusted and frequently used scale for measuring attitudes toward elderly people.

The Kogan's scale is a six-point Likert scale consisting of 34 items. The scale contains 17 positively and 17 negatively worded items about the elderly. The negative statements are reverse-scored to attribute more positive attitudes to a higher score. The minimum and maximum scores obtained from Kogan's scale are 34 and 238, respectively. Higher scores indicate a positive attitude toward the elderly, and lower scores indicate the opposite. In Kogan's original study, the total-item correlation of the scale was between 0.1 and 0.7, in the Turkish version of the scale, Cronbach's alpha reliability coefficient was found to be 0.89 (13).

### **Procedure**

Data were collected between February and June 2017 for the 2016/2017 academic year. Data were collected at predetermined times and dates set by

the course coordinators within this 14-week period (the first and last two weeks). In order to not influence how students filled the form, the third author was responsible for collecting the data from the students on the geriatrics course because the first two authors were faculty members teaching the course. Students were informed about the research by the third author, and consent forms were signed by the students who had volunteered to participate. Because the forms were going to be filled again in the last two weeks of the course, pseudonyms were used in order to conceal the identity of the students.

### **Statistical analysis**

Data analysis was performed by the researchers using the SPSS 22.0 software. Value, average, and percentage frequency distribution were examined. Pre- and posttest changes were assessed using paired *t* tests because the data were normally distributed. An independent *t* test was used to compare the variables between the elective course groups. The students' willingness to work with the elderly before and after taking the elective geriatric nursing course was examined using the McNemar's test. The results were evaluated using a 95% confidence interval, and  $p < 0.05$  was considered statistically significant.

### **Ethical considerations**

Approval to conduct the research was obtained from X Faculty of Nursing and X University Ethical committee (3134-GOA-2017/03-06). Oral and written information was given to the nursing students prior to the study. Written consent was obtained from all students.

## **RESULTS**

A total of 155 students registered for these elective courses, and the first study data collected comprised results from 129 students (83%). The second and final data group comprised results from 108 students (70%).

The average age was 20.24 years (1.07) for students enrolled in the geriatric nursing course and 20.57 years (0.85) for students enrolled in the emergency nursing and surgery nursing course. More than half

of the students (79%) were female. More than half of the students (69.8%) had previous experience living with an elderly person. When the first data from both groups were compared, it was found that in terms of variables both groups were similar (Table 1).

There were no significant differences found in the baseline data from both groups when positive and negative attitudes of students toward the elderly were compared (Table 2). According to the baseline data from both groups, the average positive attitude scores were higher than the average negative attitude scores (Table 2). When posttest results were compared, there was a significant difference between the groups in terms of the average negative attitude scores ( $p=0.016$ , Table 2). The average negative attitude scores significantly decreased among the students who took the elective geriatric nursing course, whereas the positive attitude scores remained the same for both groups ( $p=0.666$ , Table 2).

The average attitude scores of the students who took geriatric nursing as an elective course were compared before and after taking the course. The average positive attitude scores of the students showed a significant difference ( $p=0.034$ ) indicating that the course had a positive impact on the attitude of students. The average negative attitude scores of students showed an extremely significant difference ( $p<0.001$ ), and the negative attitude of students toward the elderly decreased after taking the course.

The average attitude scores of students who took emergency nursing and surgery as an elective course were compared before and after taking the course, and no significant differences were found (Table 3).

Students' willingness to work with an elderly person after graduation was examined with McNemar's test, and no differences were found in both groups (Table 4).

**Table 1.** Sociodemographic characteristics of the participants.

Variable	Elective geriatric nursing course (n:49)	Elective emergency and surgery nursing course (n:80)	t value	p value
		<b>Mean (sd)</b>		
<b>Age (years)</b>	20.24 (1.07)	20.57 (0.85)	-1.93	.056 <sup>a</sup>
<b>Gender</b>	<b>n (%)</b>	<b>n (%)</b>		
Female	36 (73.5)	66 (82.5)	1.001 <sup>b</sup>	.317
Male	13 (26.5)	14 (17.5)		
<b>Living with elderly people</b>	<b>n (%)</b>	<b>n (%)</b>		
Yes	36 (73.5)	54 (67.5)	.269 <sup>b</sup>	.604
No	13 (26.5)	26 (32.5)		
<b>Giving care to the elderly</b>	<b>n (%)</b>	<b>n (%)</b>		
Yes	23 (46.9)	40 (50.0)	.024 <sup>b</sup>	.876
No	26 (53.1)	40 (50.0)		
<b>Willingness to work with elderly after graduation</b>	<b>n (%)</b>	<b>n (%)</b>		
Yes	34 (69.4)	46 (57.5)	1.353 <sup>b</sup>	.245
No	15 (30.6)	34 (42.5)		

Abbreviations: sd, standard deviation <sup>a</sup>:  $p > .05$ , <sup>b</sup> yates correction



**Table 2.** Comparison of dependent variables between groups at baseline and post test.

	Baseline		t	p
	Elective geriatric nursing course (n=49)	Elective emergency and surgery nursing course (n=80)		
		Mean (sd)		
Positive attitudes scores	72.39 (10.46)	73.14 (11.35)	-.375	.708 <sup>a</sup>
Negative attitudes scores	63.77 (8.35)	65.17 (11.54)	-.738	.462 <sup>a</sup>
		Mean (sd)		
	(n=46)	(n=62)		
		Mean (sd)		
Positive attitudes scores	76.93 (10.33)	76.03 (10.99)	.433	.666 <sup>a</sup>
Negative attitudes scores	57.83 (10.06)	63.16 (12.03)	-2.439	.016 <sup>b</sup>

t value: independent samples t test <sup>a</sup>: p > .05, <sup>b</sup>: p<.05

**Table 3.** Dependent variable scores at pretest and post test.

Instrument	Elective geriatric nursing course (n=46)		Elective emergency and surgery nursing course (n=62)	
	Pretest Mean (sd)	Post-test Mean (sd)	Pretest Mean (sd)	Post-test 1 Mean (sd)
Positive scores of KOGAN	73.00 (10.46)	76.93 (10.33)	73.83 (11.41)	76.03 (10.99)
T value (p)	-2.190 (.034) <sup>a</sup>		-1.614 (.112)	
Negative scores of KOGAN	64.10 (8.29)	57.83 (10.06)	63.87 (10.52)	63.16 (12.03)
T value (p)	4.207 (<.001) <sup>b</sup>		.442 (.660)	

T value: paired samples t test

<sup>a</sup> p<.05

<sup>b</sup> p<.001

Pretest, baseline measurement beginning of the semester; post-test, ending of the semester

**Table 4.** Participants' willingness to work with an elderly person after graduation.

Elective geriatric nursing course				
Baseline	Post test		Total	
	Yes	No		
Yes	30	4	34	
No	9	3	12	
<b>Total</b>	39	7	46	

Elective emergency and surgery nursing course				
Baseline	Post test		Total	
	Yes	No		
Yes	30	6	36	
No	4	22	26	
<b>Total</b>	34	28	62	

$\chi^2$  McNemar Test was used, binominal distribution used.  $p=.146$  for students who participate the elective geriatric nursing course,  $p=.754$  for students who participate the elective emergency and surgery nursing course

## DISCUSSION

Elderly people avail healthcare services more frequently, which increases demand for skilled nursing. Along with the increasing need for care of the elderly, there is an increasing need for nurses providing care for the elderly. Although the increase in the need for care for the elderly is an immediate concern, nursing education is not developed well enough to meet this need (2). Ayoglu et al. (2) stated that Turkish students emphasized that their education regarding the care of the elderly was inadequate.

The present study has indicated that taking a geriatric nursing course as an elective course had a positive effect on the attitude toward the elderly and was particularly effective in decreasing the negative attitude of students. These results correspond with those of previous studies, which show that educational programs of study prepared for students are effective in increasing positive attitudes toward the elderly (12,14,15).

Students in both groups were similar in terms of the variables that can affect attitudes toward the elderly. Both groups were of similar ages and similar in variables such as living with an elderly person and providing care for the elderly. The reason for the higher baseline data in terms of students' positive attitudes is thought to originate from Turkish culture. The results of the present study show similarity with other studies conducted in the same cultural environment (2, 10). Respect for the elderly is an important aspect of Turkish culture. Attitudes are mostly formed within the family. In both groups, more than half of the students had previous experience of living with an elderly person. The higher baseline data for students' positive attitude in both groups is thought to have arisen from previous experiences of living with an elderly person. Additionally, at the end of the semester, the students who took the elective course said that they had been affected in a very positive way, particularly after visiting the nursing home and Awareness



Center. Students' positive attitude average scores may have changed as a result of the course they took and the two institutions they visited.

Average attitude scores were almost the same among the students who participated emergency and surgery nursing as an elective course, and their positive attitudes slightly increased, whereas their negative attitudes slightly decreased. This change was thought to originate from the practical experience of students during their medical surgical nursing course. Students practiced at the internal medicine and surgery clinic of the university hospital, where there were many elderly patients. It is thought that the attitude scores of students may have been slightly affected because of their experience of working with the elderly.

Along with the increasing number of elderly people in need of care, the number of nurses willing to work with the elderly should also be considered. Willingness to work with an elderly person is a much-debated topic in literature. According to the results of Ayoglu et al. (2) 66.6% of students stated that they were willing to work with elderly people after graduation. Darling et al. (16) found that more than half of the students (55%) stated that they were willing to work with the elderly. When the results from Turkey are compared with those from other countries, it was seen that Turkish nursing students are more willing to work with elderly people. It is believed that this result reflects the positive attitude toward the elderly that is present in Turkish society. Social norms have important roles in shaping attitudes.

In a qualitative study conducted by Gould et al. (17) about nursing students' opinions of geriatric nursing, it was concluded that students did not want to work with the elderly after their graduation. It was stated that this result originated from negative thoughts such as geriatric nursing is less prestigious in the eyes of other nurses or that it does not require a special knowledge set. According to results of a study conducted by Rathnayake et al. (8), students were unwilling to work with the elderly. They based

their decision on various reasons such as not having enough experience working with the elderly, having trouble communicating with elderly people, and that working with the elderly is boring and depressing. In literature, inadequate number of academic staff in the field of geriatrics has also attributed to the unwillingness of students to work with the elderly (18). In the present study, although there are no statistically meaningful results regarding students' willingness to work with the elderly before and after their education, the increase in the number of students who want to work with the elderly after their graduation is a promising result.

In conclusion, geriatric nursing as an elective course increased the positive attitude and decreased the negative attitudes of students toward the elderly. In order to provide better care for the elderly, it is important that graduates adopt a positive attitude toward them and develop an interest for geriatric nursing. Adopting a more positive and less negative attitude ensures higher quality care for the elderly. Therefore, it is recommended that nationally credited and structured geriatric education programs should be developed in nursing schools. Students stated that they were positively influenced by their visits to nursing homes and Awareness Centers. For this reason, the curricula of geriatric nursing courses should be enriched with practical courses and simulations. Undergraduate and graduate level geriatric nursing certificate programs should be initiated. There is also a need for innovative schemes that will increase the students' willingness to work with the elderly. It is believed that willingness to work with the elderly can be further increased, particularly through practical courses. Culture can be an important factor in curriculum studies. For this reason, cultural heritage can be used as a resource to help students understand elderly people better and socialize with them more positively.

#### **Conflicts of interest**

The authors declare no conflict of interest.

## REFERENCES

1. Pepper GA. A new era in geriatric nursing education. *J Proff Nurs* 2014;30(6):443-4. (PMID:25455324).
2. Ayoğlu FN, Kulakçı H, Ayyıldız TK, Korkmaz Aslan G, Veren F. Attitudes of Turkish nursing and medical students toward elderly people. *J Transcult Nurs* 2014;25(3):241-8. (PMID:24381117).
3. Algosio M, Peters K, Ramjan L, East L. Exploring undergraduate nursing students' perceptions of working in aged care settings: A review of the literature. *Nurse Educ Today* 2016;36:275-80. (PMID:26296542).
4. Cheng M, Cheng C, Tian Y, Fan X. Student nurses' motivation to choose gerontological nursing as a career in China: A survey study. *Nurse Educ Today* 2015;35(7):843-8. (PMID:25792382).
5. Liu Y-E, Norman IJ, While AE. Nurses' attitudes towards older people: a systematic review. *Int J Nurs Stud* 2013;50(9):1271-82. (PMID:23265870).
6. Neville C. Undergraduate nurse attitudes toward older adults and perceptions of working with older adults: An analysis of measurement instruments. *Nurse Educ Today* 2015;35(1):183-8. (PMID:25245662).
7. King BJ, Roberts TY, Bowers BJ. Nursing student attitudes toward and preferences for working with older adults. *Gerontol Geriatr Educ* 2013;34(3):272-91. (PMID:23383875).
8. Rathnayake S, Athukorala Y, Siop S. Attitudes toward and willingness to work with older people among undergraduate nursing students in a public university in Sri Lanka: a cross sectional study. *Nurse Educ Today* 2016;36:439-44. (PMID:26507448).
9. Zhang S, Yan-Hui L, Hong-Fu Z, Li-Na M, Peng-Xi L. Determinants of undergraduate nursing students' care willingness towards the elderly in China: Attitudes, gratitude and knowledge. *Nurse Educ Today* 2016;43:28-33. (PMID:27286941).
10. Turan E, Yanardağ M, Metintas S. Attitudes of students of health sciences towards the older persons. *Nurse Educ Today* 2016;36:53-7. (PMID:26239278).
11. Tufan F, Yuruyen M, Kizilarlanoglu MC, et al. Geriatrics education is associated with positive attitudes toward older people in internal medicine residents: a multicenter study. *Arch Gerontol Geriatr* 2015;60(2):307-10. (PMID:25532778).
12. Dy-Boarman, EA, Nisly SA, Martin D. Use of a health screening and education event to change student attitudes toward the elderly. *Curr Pharm Teach Learn* 2017;9(1):101-7. (PMID:29180141).
13. Küçükgüçlü Ö, Mert H, Akpınar B. Reliability and validity of Turkish version of attitudes toward old people scale. *J Clin Nurs* 2011;20(21-22):3196-203. (PMID:21518058).
14. Conti G, Bowers C, O'Connell MB, et al. Examining the effects of an experiential interprofessional education activity with older adults. *J Interprof Care* 2016;30(2):184-90. (PMID:26913632).
15. Ross L, Williams B, Jennings P. The effectiveness of educational interventions designed to improve health care students behaviors and/or attitudes toward older people: a systematic review protocol. *JBI Database of System Rev Implement Rep* 2015;13(7):13-23. (PMID:26455843).
16. Darling R, Sendir M, Atav S, Buyukyılmaz F. Undergraduate nursing students and the elderly: An assesment of attitudes in a Turkish university. *Gerontol Geriatr Educ* 2017;1-12. (PMID:28353413).
17. Gould ON, Dupuis-Blanchard S, MacLennan A. Canadian nursing students and the care of older patients: How is geriatric nursing perceived? *J Appl Gerontol* 2013;34(6):797-814. (PMID:24652901).
18. Abbey J, Abbey B, Bridges P, et al. Clinical placements in residential aged care facilities: the impact on nursing students' perception of aged care and the effect on career plans. *Aust J Adv Nur* 2006;23(4):14-9. (PMID:16800215).





Turkish Journal of Geriatrics  
DOI:10.31086/tjgeri.2018137965  
2018;21 (1):41-48

- Oya Özlem EREN KUTSOYLU<sup>1</sup>
- Vildan AVKAN OĞUZ<sup>1</sup>
- Madina ABDULLAYEVA<sup>1</sup>
- Nil TEKİN<sup>2</sup>
- Nur YAPAR<sup>1</sup>

#### CORRESPONDANCE

Vildan AVKAN OĞUZ  
Dokuz Eylül University, Faculty of Medicine  
İzmir, Turkey

Phone: 0232 4124306  
e-mail: vildan.oguz@gmail.com

Received: 03/01/2018  
Accepted: 28/02/2018

<sup>1</sup> Dokuz Eylül University, Faculty of Medicine  
İzmir, Turkey

<sup>2</sup> Narlıdere Geriatric Care Center and  
Residential Home  
İzmir, Turkey

This study was presented in English in IDWEEK  
2017 and for KLİMİK 2017 congress in Turkish.

#### RESEARCH

## PREVALENCE OF MULTIDRUG-RESISTANT BACTERIAL COLONIZATION AND RISK FACTORS IN GERIATRIC NURSING HOME RESIDENTS

### ABSTRACT

**Introduction:** Aim of this study is to determine the frequency of nasal, axillary and rectal colonization by multidrug-resistant bacteria and the risk factors for colonization in nursing home residents.

**Materials and Method:** In this cross-sectional study, demographic data and risk factors of the residents were recorded. Data regarding patients' independence were collected using activities of daily living form. Nasal and axillary swabs were analyzed for methicillin-resistant *Staphylococcus aureus* and rectal swabs for vancomycin-resistant enterococci, extended-spectrum beta-lactamase-producing Enterobacteriaceae, and carbapenemase-producing *Klebsiella pneumoniae*.

**Results:** From 247 residents, 247 axillary, 246 nasal, and 245 rectal swabs were obtained. Median age was 85±6.7 and 190 (77%) residents were female. Swab samples from 75 (30%) residents yielded *S. aureus*, 8 (3.2%) of which were methicillin-resistant. Of the residents, 10 (4.1%) vancomycin-resistant enterococci, 17 (6.9%) extended-spectrum beta-lactamase--producing Enterobacteriaceae, one (0.4%) carbapenemase-producing *K. pneumoniae* were found. Colonization with more than one type of multidrug-resistant bacteria was found in 3 (1.2%) residents. Colonization rates of multidrug-resistant bacteria were 2.7 times higher with antibiotic use in the last month and 3.1 times with immobility and enteral support. Colonization rate of multidrug-resistant bacteria increased with higher activities of daily living scores (p=0.004).

**Conclusion:** The prevalence of multidrug-resistant bacterial colonization was 12.9% and the risk factors have been changed according to bacterial species. Colonization rate increased with greater dependence in activities of daily living. In nursing homes, for management of multidrug-resistant bacterial infections, risk factors for colonization and surveillance analysis should be considered.

**Keywords:** Nursing homes; Drug Resistance, Multiple; Methicillin-Resistant *Staphylococcus*

#### ARAŞTIRMA

## YAŞLI BAKIMEVİ SAKİNLERİNDE ÇOK İLACA DİRENÇLİ BAKTERİ KOLONİZASYONUNUN PREVALANSI VE RİSK FAKTÖRLERİ

### Öz

**Giriş:** Bu çalışmanın amacı yaşlı bakım evi sakinlerinde çok ilaca dirençli bakterilerle nazal, aksiller ve rektal kolonizasyon sıklığını ve kolonizasyon risk faktörlerini saptamaktır.

**Gereç ve Yöntem:** Kesitsel çalışmada, sakinlerin demografik özellikleri ve risk faktörleri kaydedildi. Sakinlerin fonksiyonel bağımlılığı ile ilişkili veriler, günlük yaşam formunun genel ve enstrümental aktiviteleri birlikte kullanılarak toplandı. Nazal ve aksiller sürüntülerde metisiline dirençli *Staphylococcus aureus* kolonizasyonu, rektal sürüntüde vankomisin dirençli enterokok, genişletilmiş spektrumlu beta laktamaz salgılayan Enterobacteriaceae, karbapenemaz üreten *Klebsiella pneumoniae* kolonizasyonu araştırıldı.

**Bulgular:** Çalışmaya katılan 247 sakinden 247 aksiller, 246 nazal, 245 rektal sürüntü örneği alındı. Medyan yaş 85±6.7 olup, 190 (%77) sakin kadındı. 75 (%30) sakinde *S. aureus* ve bunların 8'inde (%3.2) metisiline direnç belirlendi. Sakinlerin 10 (%4.1)'unda vankomisine dirençli enterokok, 17'sinde (%6.9) genişletilmiş spektrumlu beta laktamaz salgılayan Enterobacteriaceae, birisinde (%0.4) karbapenemaz üreten *K. pneumoniae* saptandı. Üç (%1.2) sakinde birden fazla çok ilaca dirençli bakteri ile kolonizasyon bulundu. Kolonizasyon risk faktörleri bakteri türüne göre değişmektedir. Çok ilaca dirençli bakteri ile kolonizasyon oranı son bir ayda antibiyotik kullanımı ile 2.7 kat, immobilite ve enteral destek ile 3.1 kat artmaktadır. Çok ilaca dirençli bakteri kolonizasyon oranı günlük yaşam aktivite skoru arttıkça artar (p=0.004).

**Sonuç:** Bu çalışmada çok ilaca dirençli bakteri kolonizasyon yüzdesi 12.9'dur ve risk faktörleri bakteri türüne göre değişir. Kolonizasyon oranı günlük yaşam aktivitelerinde bağımlılık arttıkça artmaktadır. Bu nedenle yaşlı bakım evlerinde çok ilaca dirençli bakteri enfeksiyonlarını yönetmek için risk faktörleri ve surveyans analizleri göz önünde bulundurulmalıdır.

**Anahtar sözcükler:** Yaşlı bakım evi; Çok ilaca Direnç, MRSA, Vankomisin Dirençli Enterokok, Türkiye, Risk faktörleri

## INTRODUCTION

Infections caused by multidrug-resistant (MDR) bacteria are major healthcare concerns worldwide (1). Geriatric long-term care facilities in particular are considered reservoirs of MDR bacteria because they serve patients who are unable to perform activities of daily living and require frequent hospitalization. Colonization by these bacteria lays the foundation for resistant bacterial infections (2,3). Infections caused by these microorganisms result in high mortality rates independent of age and increase the length of hospital stays and therefore medical costs (4). In long-term care residents, MDR bacterial infections are more difficult to manage and show poorer response to treatment because of the presence of underlying chronic diseases (5,6). Therefore, the present study aimed to determine the prevalence of MDR bacterial colonization in geriatric patients and the risk factors that promote colonization in this age group.

## METHODS

### Ethics statement

Approval for this study was obtained from the Dokuz Eylül University (DEU) Non-invasive Research Ethics Committee (Approval Date:19/06/2014, No:2014/22-21). The study was supported under the scope of DEU Scientific Research Projects.

### Study design

This cross-sectional study included individuals aged 65 years of age and older, residing at the Nursing Home unit of the Narlidere Elderly Care and Rehabilitation Center. This center has the highest capacity for elderly care in Turkey with 269 geriatric nursing home residents and a total of 1040 residents including those in the assisted living units; each room has a maximum of two occupants. The Nursing Home unit provides long-term care mainly for dependent elderly people with chronic illnesses. Residents of this nursing home include retired civil service workers and their relatives. Therefore, the

average education and socioeconomic level of these residents is middle to high.

All the nursing home residents included in the study or their relatives signed an informed consent form. Residents in this unit stay in single-or double-occupancy rooms. The data of all consenting participants were recorded using data collection forms which included demographic data regarding age, gender, height, weight, immobility (activities of daily living score), and information regarding comorbidities, urinary/vascular catheterization, feeding method [enteral, parenteral, and/or percutaneous endoscopic gastrostomy (PEG)], presence of skin lesions including bed sores, history of hospitalization in the last three months, and use of antibiotics in the last month. A single form assessing both the activities of daily living scale and instrumental activities of daily living was used. Therefore, we used the Katz Index of Activities of Daily Living, which is designed to evaluate self-care functions in patients with chronic disease and elderly populations, and the Lawton Instrumental Activities of Daily Living Scale, which is designed to assess the performance of the elderly on activities of daily living (7, 8). Based on this form, the total activities of daily living (ADL) scores ranged from 1 to 36, with higher scores indicating greater dependence. Scores of 1–19 were considered independent, 20–29 as partially dependent, and scores of 30–36 as totally dependent.

### Bacterial identification

In order to evaluate colonization in the elderly nursing home residents, nasal, axillary, and rectal swab samples were obtained using sterile cotton swabs. The nasal and axillary swab samples were cultured using CHROMagar™ Staph aureus agar (Liofilchem® Staph aureus, Italy) and 5% sheep blood agar (RTA, Turkey) to evaluate *Staphylococcus aureus* colonization. Rectal swabs were inoculated at bedside into eosin–methylene blue (EMB) agar (RTA, Turkey) and CHROMagar™



*Enterobacteriaceae* agar (Liofilchem® Chromatic CRE, Italy) to evaluate colonization with *Enterobacteriaceae* producing extended-spectrum beta lactamase (ESBL) and/or carbapenemase and were inoculated into enterococcosel liquid medium with vancomycin (RTA, Turkey) and 5% sheep blood agar in order to detect colonization by vancomycin-resistant enterococci (VRE). The cultures were incubated for 18–24 h at 35°C. As per the Clinical and Laboratory Standards Institute (CLSI) recommendations, bacterial identification was performed using traditional methods based on the Gram nature of the isolates (9). API (BD BBL Crystal™ Gram-Positive ID System, USA) was used for the identification of VRE.

### Susceptibility tests

Antibiotic susceptibility tests were performed according to CLSI recommendations using Mueller–Hinton agar (RTA, Turkey) using the Kirby–Bauer disc diffusion method. Oxacillin susceptibility of the isolated *S. aureus* colonies was determined using a cefoxitin disc (30 mcg). Minimum inhibitor concentration (MIC) was determined using the vancomycin Etest (Liofilchem® MTS VANCOMYCIN, Italy).

Antimicrobial susceptibility of the *Escherichiae coli* and *Klebsiella* strains isolated from the *Enterobacteriaceae* family was assessed using ampicillin (10 mcg), amoxicillin/clavulanic acid (20/10 mcg), cefotaxime (30 mcg), ceftazidime (30 mcg), cefoxitin (30 mcg), ertapenem (10 mcg), and ceftazidime/clavulanic acid (30/10 mcg) discs. The presence of ESBL in resistant gram-negative strains was determined using cefotaxime/ceftazidime+clavulanic acid Etest (Liofilchem® s.r.l. 4 mg/L) and double disc synergy test. To determine carbapenem resistance, rectal swab samples were incubated in brain heart infusion broth, then analyzed using Chromogenic KPC (Biolife, Ref CHR174 Lot: 174206) medium and ertapenem (10 mcg) disc.

### Statistical analysis

Statistical analysis was performed using SPSS 15.0 software. The participants were classified into groups with and without colonization, and statistical comparisons between the two groups were made using the chi-square test for a two-way table, Fisher's exact test, and independent samples t-test. Multivariate backward logistic regression analyses were used to identify independent risk factors for MDR bacteria.

### RESULTS

During the study period, 247 (91.8 %) residents were present in the nursing home with 269 beds, and all of them were included. In total, 247 axillary, 246 nasal, and 245 rectal swab samples were obtained from the 247 elderly nursing home residents who participated in the study. A nasal swab could not be obtained from one participant because of history of nasal fracture surgery, and two participants chose not to give rectal swab samples.

**Risk factors:** Of the 247 nursing home residents, 190 (77%) were females and the average age was  $85 \pm 6.7$  (67–103) years. The median duration of residence for each resident in the nursing home was  $6.66 \pm 4.57$  years (14 days–14.58 years). Only 5 (2.0%) of the residents had no underlying chronic disease. Alzheimer's disease or dementia associated with other causes was present in 160 (64.5%) of the nursing home residents. The total ADL score was above 30 for 125 (51.0%) residents, and 84 (33.9%) were immobile. Of the immobile residents, 57 (67.8%) had dementia. Thirty-two (12.9%) of the residents had taken antibiotics in the last month and 11 (4.4%) had been hospitalized in the last 3 months. Eight (3.23%) of the residents had bedsores, 31 (12.6%) were receiving enteral nutrition support, and 7 (2.8%) were being fed via PEG. Only one (0.4%) patient had a urinary catheter and one (0.4%) had a vascular catheter. The risk factor analyses for patients with and without colonization are shown in Table 1. Antibiotic use in the last month,

malignancy, immobility, enteral supplementation, and PEG were statistically significant risk factors in univariate analysis of residents with colonization by any MDR bacteria. Multivariate logistic regression analysis of independent risk factors for MDR bacteria is shown in Table 2. Twenty-nine

(90.6%) of the colonized patients had lived in the nursing home unit for more than one year. The colonization rate increased as ADL scores (i.e. dependence) increased ( $p = 0.004$ ). ADL scores and immobility of residents colonized with MDR bacteria are presented in Table 3.

**Table 1.** Presence of risk factors for MDR bacteria.

Risk factors	Colonized with MDR n=32(%)*	p value	Colonized with gram negative MDR n= 17(%)	p value	Colonized with gram positive MDR n =18(%)	p value
Antibiotic use (Last month)	9 (28.1)	<b>0.006</b>	6 (35.2)	<b>0.004</b>	4 (22.2)	0.265
Skin lesions	2 (6.3)	0.619	1 (5.8)	0.442	1 (5.5)	0.459
Hospitalization in the last 3 months	3 (9.4)	0.323	3 (17.6)	<b>0.032</b>	0 (0.0)	-
Malignancy	5 (15.6)	<b>0.024</b>	2 (11.2)	0.306	3 (16.6)	0.099
Dementia/Alzheimer's disease	25 (78.1)	0.082	14 (82.3)	0.118	14 (77.7)	0.244
Immobility	19 (59.4)	<b>0.001</b>	11 (64.7)	<b>0.006</b>	11 (61.1)	<b>0.011</b>
Enteral support	10 (31.2)	<b>0.001</b>	6 (35.2)	<b>0.003</b>	1 (5.5)	0.415
PEG	3 (9.4)	<b>0.05</b>	2 (11.7)	<b>0.022</b>	6 (33.3)	<b>0.004</b>

\*In 3(1.2%) residents colonized with more than one MDR bacteria

**Table 2.** Multivariate logistic regression analysis of independent risk factors for MDR bacteria.

Risk factors	p value	Odds Ratio	95 % CI
Antibiotic use(Last month)	0.032	2.774	1.091–7.055
Immobility	0.05	3.107	1.412–6.836
Enteral support	0.012	3.194	1.287–7.922

Of the 247 participants, 32 (12.9%) were colonized with Gram-positive [VRE, methicillin-resistant *S. aureus* (MRSA)] and/or Gram-negative bacteria (ESBL-producing *E. coli*, ESBL-producing

*Klebsiella*, carbapenemase-producing *Klebsiella*). Seventeen (6.9%) were colonized with only resistant Gram-negative bacteria, and 18 (7.3%) with only resistant Gram-positive bacteria.



**Table 3.** The activity of daily living scale and immobility of residents colonized with MDR.

The colonisation of MDR bacteria(n)	Total (n)	The activity of daily living scale(n)			Immobility (n)
		1-19	20-29	30-36	
<b>MDR</b>	<b>32 *</b>	<b>1</b>	<b>6</b>	<b>25</b>	<b>19</b>
<b>Gram negative MDR</b>	<b>17</b>	<b>1</b>	<b>3</b>	<b>13</b>	<b>11</b>
ESBL <i>K. pneumoniae</i> (KPC)	3	-	-	2 (1)	2 (1)
ESBL <i>E. coli</i>	14	1	2	11	9
<b>Gram positive MDR</b>	<b>18</b>	<b>-</b>	<b>3</b>	<b>15</b>	<b>11</b>
MRSA	8	-	1	7	5
VRE	10	-	2	8	6
<b>Gram positive +negative MDR</b>	<b>3</b>			<b>3</b>	<b>3</b>
MRSA + ESBL <i>E. coli</i>	1	-	-	1	1
VRE + ESBL <i>E. coli</i>	2	-	-	2	2

**Gram-positive resistant bacterial colonization**  
MDR *S. aureus* was isolated from the nasal and/or axillary swab samples of 75 (30%) residents. MRSA was detected in 3.2 % (8/247) of the participants and 10.6 % (8/75) of those with *S. aureus* colonization. Three of the eight MRSA isolates were from nasal carriers. Ten (4.1%) of the nursing home residents were perianal VRE carriers. All of the isolates were identified as *Enterococcus faecium* and had a vancomycin MIC level of  $\geq 4$  mg/L.

**Gram-negative resistant bacterial colonization**  
ESBL-producing bacteria were detected in a total of 17 (6.9%) of the nursing home residents. Of these bacteria, 14 (82%) were identified as *E. coli* and 3 (18%) as *K. pneumoniae* [1(0.4%) of which was carbapenemase-producing *K. pneumoniae*].

Colonization with multiple resistant bacteria was detected in three (1.2%) participants. One (0.4%) of these residents was colonized with both MRSA and ESBL-producing *E. coli*, and 2 (0.8%) were colonized with ESBL-producing *E. coli* and VRE.

## DISCUSSION

Although the carriage and spread of MDR microorganisms shows regional variation, it presents an important and growing health concern worldwide (10). The MDR bacterial colonization rate in this study group was 12.9%. Routine surveillance assessing MDR bacterial colonization is not yet practiced in nursing homes in Turkey. Our literature search did not yield any studies investigating both Gram-negative and Gram-positive resistant bacterial colonization in Turkish geriatric care centers. The colonization rate we determined emphasizes that elderly nursing homes in Turkey are reservoirs for MDR bacteria. Colonization rates in our study group were 3.2% for MRSA, 4.1% for perianal VRE, and 6.9% for resistant *Enterobacteriaceae* which vary according to the species of MDR bacteria. These rates were reported to be 6.2% for MRSA, 12.2% for ESBL-E, and 0% for VRE among 2791 residents of 60 nursing homes in Belgium (11). In Germany, the prevalence of ESBL-positive *E. coli* was found to be 14.7% in a study conducted with 156 nursing

home residents (12). These rates vary according to country and nursing home, emphasize that elderly care homes in our country are reservoirs for MDR bacteria.

Drug-resistant bacterial colonization poses a risk for the development of invasive infection and cross-contamination between people (5). It was previously reported that the rate of co-colonization with multiple MDR gram-negative bacteria was 18.4% among 152 residents with dementia (13). It has also been emphasized that genetically related MDR gram-negative bacteria colonize multiple residents of the same nursing home (14). Although we could not perform molecular analyses in the present study, co-colonization was detected in 1.2% of the residents.

#### **Risk factors**

The correlation between MDR bacterial colonization rates and ADL indices (i.e. dependence) among nursing home residents must be taken into account when evaluating risk factors. Statistically significant risk factors for MDR bacterial colonization were antibiotic use in the last month, malignancy, immobility, enteral supplementation, and PEG. When significant risk factors were assessed by multivariate logistic regression analysis, antibiotic use in the last month increased MDR bacterial colonization by 2.7-fold. In the literature, antibiotic exposure is reported to increase colonization with MDR Gram-negative bacteria by 5.6-fold (13). Studies have shown that using antibiotics affected bowel colonization, and the mean duration of colonization with ESBL-E was 144(41-349) days (5, 12). Colonization duration was reported as 126.6±79.1 days for MRSA and 176±94.1 days for VRE (15). Because we obtained cultures from a single time point, we could not determine duration of colonization. However, our finding that 90.6% of the colonized residents had lived in the geriatric care unit for more than one year, though statistically nonsignificant, suggests that duration of residence may influence colonization.

Other significant risk factors (diet, ADL score, malignancy) are related to the host characteristics

of the nursing home residents. ADL scores of the nursing home residents included both general and instrumental ADL (7, 8, 16-18). In this study, the colonization rates of MDR bacteria increased 3.1 times with immobility or enteral support. Fifty-one percent of the residents had a total ADL score above 30, indicating complete dependence, and 33.9% were immobile. It has been reported in the literature that functional disability promotes colonization with MDR bacteria (2, 6). In particular, researchers have stressed that rates of MDR bacterial colonization are 3-fold higher in residents with advanced dementia compared to those without dementia (6). Approximately two-thirds of the immobile patients in our study had dementia, which is consistent with the literature. While urinary and vascular catheters were used by only one resident each in our study, those receiving enteral support and undergoing PEG likely had mucosal barrier disruption, which we believe facilitated MDR bacterial colonization during care.

#### **Skin colonization**

As in the rest of the world, antibiotic resistant Gram-positive bacteria (VRE, MRSA) are a concern Turkey, yet these bacteria are not yet considered an important public health issue, except in small hospital-based epidemics. In the present study, MRSA and VRE rates were below 5%. MRSA colonization rates in geriatric nursing homes vary between 10% and 50% (19, 20). In a 2013 study conducted in the Kahramanmaraş Nursing Home in Turkey, Kireççi et al. (21) reported that 98 residents were screened and the prevalence of nasal MRSA colonization was 40.8%. The MRSA colonization rate in our study was lower than the global average. In our 2006 study, which was conducted in the same long-term care facility, we only investigated nasal and axillary MRSA colonization. In that study, 163 nursing home residents were screened and the rate of colonization with *S. aureus* was 9.3%, and none of the isolated strains were methicillin-resistant (22). In the present study, 30% of the 247 nursing home residents were colonized with *S. aureus* and 3.2% with MRSA. These findings indicate that the



MRSA colonization rate is increasing in this nursing home over time. However, the overall rate of MRSA colonization was still low compared to those reported in other studies. This may be explained by the fact that despite the residents of this nursing home having a high average age and long life expectancy, they also had a high socioeconomic level, and the unit provides a high standard of medical care with an interdisciplinary team. These data highlight the variability of colonization rates and the need for surveillance in long-term care facilities.

### Rectal colonization

Previous studies have reported intestinal ESBL-producing *Enterobacteriaceae* colonization rates of 20%–56% in geriatric nursing home residents, whereas the prevalence of VRE colonization was lower, at 4.0 % – 9.6% (12-15). Valenza et al. determined the prevalence of rectal carriage of ESBL-producing *Enterobacteriaceae* in a long-term care facility to be 14.7 % (12). Although the prevalence of resistant Gram-negative bacteria in the present study is lower than that in the literature, the rate of VRE colonization is comparable to those reported in other publications. This difference may be attributable to the microbiological properties of VRE and resistant Gram-negative bacteria, to different policies concerning antibiotic use, or to host properties. In our study group, 12.9% were using antibiotics from different classes, 51 % were completely dependent based on their ADL index, and 33.9% were immobile.

Apart from resistant bacterial epidemics, there are very limited data about carbapenemase-

producing *Enterobacteriaceae* colonization in long-term care facilities. Recent studies have reported the carriage rate of asymptomatic carbapenemase-producing *Enterobacteriaceae* in hospitals as 1.1%–13% (23-24). In a study of nursing home residents, Cunha et al. (24) determined the prevalence of carbapenemase-producing *Enterobacteriaceae* colonization to be 1.4%. The prevalence in our study was 0.4%, which is rather low.

Because of limited funding for this research, our study has a few limitations. Firstly, we were unable to investigate MDR bacterial colonization in the nursing home staff simultaneously. Secondly, molecular studies could not be performed on the isolated MDR bacterial strains. Finally, we could only conduct the colonization screening once. Therefore, permanent and transient colonization could not be evaluated. However, this was the first study in Turkey that investigated multiple MDR bacteria and will form the basis for further research.

In summary, the rate of colonization with any MDR bacteria was 12.9% in this group of Turkish nursing home residents. Colonization rates of MDR increased 2.7 times with antibiotic use in the last month and approximately 3.1 times with immobility and enteral support. Risk factors for colonization vary according to the species of resistant bacteria. Therefore, evaluating elderly nursing home residents for risk of MDR bacterial colonization whenever possible and conducting surveillance for MDR bacterial colonization in new residents upon arrival will facilitate the management of infectious complications in residents.

### REFERENCES

1. Roca I, Akova M, Baquero F, et al. The global threat of antimicrobial resistance: science for intervention. *New Microbes New Infect* 2015;6:22-9. (PMID:27257501).
2. Dumyati G, Stone ND, Nace DA, Cmich CJ, Jump RL. Challenges and strategies for prevention of multidrug-resistant organism transmission in nursing homes. *Curr Infect Dis Rep* 2017;19(4):18. doi: 10.1007/s11908-017-0576-7. (PMID:28382547).
3. Reddy P, Malczynski M, Obias A, et al. Screening for extended-spectrum beta-lactamase-producing *Enterobacteriaceae* among high risk patients and rates of subsequent bacteremia. *Clin Infect Dis* 2007;45:846-52. (PMID:17806048).
4. Schwaber MJ, Navon-Venezia S, Kaye KS, Ben-Ami R, Schwartz D, Carmeli Y. Clinical and economic impact of bacteremia with extended- spectrum beta-lactamase-producing *Enterobacteriaceae*. *Antimicrob Agents Chemother* 2006;50:1257-62. (PMID:16569837).

5. Lautenbach E, Patel JB, Bilker WB, Edelstein PH, Fishman NO. Extended-spectrum beta-lactamase-producing *Escherichia coli* and *Klebsiella pneumoniae*: risk factors for infection and impact of resistance on outcomes. *Clin Infect Dis* 2001;32:1162-71. (PMID:11283805).
6. Mitchell SL, Shaffer ML, Loeb MB, et al. Infection management and multidrug-resistant organism in nursing home residents with advanced dementia. *JAMA Intern Med* 2014;174:1660-67. (PMID:25133863).
7. Katz S, Ford AB, Moskowitz RW, et al. Katz Index of activities of daily living, In: A. John Rush, Michael B. First, Deborah Blacker (Eds). *Handbook of Psychiatric Measures*. American Psychiatric Association, American Psychiatric Publishing, USA 2000, pp 130-1.
8. Lawton MP, Brody EM. Lawton Instrumental Activities of Daily Living Scale (Lawton IADL): In: A. John Rush, Michael B. First, Deborah Blacker (Eds). *Handbook of Psychiatric Measures*. American Psychiatric Association, American Psychiatric Publishing, USA 2000, pp 131-3.
9. Clinical Laboratory Standards Institute. Performance standards for Antimicrobial Susceptibility Testing, 17<sup>th</sup>-23<sup>rd</sup> supplement M100-S13-M100 S23, Wayne, PA. [Internet] Available from: <http://www.facm.ucl.ac.be/intranet/CLSI/CLSI-M100S23-susceptibility-testing-2013-no-protection.pdf>. Accessed:02.01.2018.
10. Huttner A, Harbarth S, Carlet J, et al. Antimicrobial resistance: a global view from the 2013 World Healthcare-Associated Infections forum. *Antimicrob Resist Infect Control* 2013;2:31. (PMID:24237856).
11. Jans B, Schoevaerdt D, Huang TD, et al. Epidemiology of multidrug-resistant microorganisms among nursing home residents in Belgium. *PLoS One*. 2013;8:e64908. (PMID:23738011).
12. Valenza G, Nickel S, Pfeifer Y, et al. Prevalence and genetic diversity of extended-spectrum  $\beta$ -lactamase (ESBL)-producing *Escherichia coli* in nursing homes in Bavaria, Germany. *Vet Microbiol* 2017;200:138-41. (PMID:26494113).
13. D'Agata EM, Habtemariam D, Mitchell S. Multidrug-resistant gram-negative bacteria: Inter- and Intradissemiation among nursing homes of residents with advanced dementia. *Infect Control Hosp Epidemiol* 2015;36(8):930-5. (PMID:25920002).
14. O'Fallon E, Schreiber R, Kandel R, D'Agata EM. Multidrug-resistant gram-negative bacteria at a long-term care facility: assessment of residents, healthcare workers, and inanimate surfaces. *Infect Control Hosp Epidemiol*. 2009;30(12):1172-9. (PMID:19835474).
15. Fisch J, Lansing B, Wang L, et al. New acquisition of antibiotic-resistant organisms in skilled nursing facilities. *J Clin Microbiol* 2012;50(5):1696-1703. (PMID:22378900).
16. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. The Index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963;185:914-9. (PMID:14044222).
17. Katz S, Downs TD, Cash HR, Grotz RC. Progress in development of the index of ADL. *Gerontologist* 1970;10:20-30. (PMID:5420677).
18. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily. *Gerontologist* 1969;9:179-186. (PMID:5349366).
19. Denis O, Jans B, Deplano A, et al. Epidemiology of methicillin-resistant *Staphylococcus aureus* (MRSA) among residents of nursing homes in Belgium. *J Antimicrob Chemother* 2009;64:1299-1306. (PMID:19808236).
20. Hogardt M, Proba P, Mischler D, Cuny C, Kempf VA, Heudorf U. Current prevalence of multidrug-resistant organisms in long-term care facilities in the Rhine-Main district, Germany, 2013. *Euro Surveill*. 2015;20(26):21171. (PMID:26159310).
21. Kirecci E, Ozer A, Gul M, Tanis H, Sucaklı MH. Nasal MRSA carriage in nursing home residents. *Kocatepe Med J*. 2013;14:77-82.
22. Avkan-Oguz V, Sezak N, Yapar N, et al. Nasal and axillar carriage of *Staphylococcus aureus* patients among elderly population in a nursing home. *Clin Microbiol Infect* 2006;12(Suppl 4):R2003. [Internet] Available from: [http://www.clinicalmicrobiologyandinfection.com/article/S1198-743X\(15\)30007-0/fulltext#cesec1280](http://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(15)30007-0/fulltext#cesec1280). Accessed: 02.01.2018.
23. Zhao ZC, Xu XH, Liu MB, Wu J, Lin J, Li B. Fecal carriage of carbapenem-resistant Enterobacteriaceae in a Chinese university hospital. *Am J Infect Control* 2014;42:e61-4. (PMID:24773806).
24. Cunha CB, Kassakian SZ, Chan R, et al. Screening of nursing home residents for colonization with carbapenem-resistant Enterobacteriaceae admitted to acute care hospitals: Incidence and risk factors. *Am J Infect Control* 2016;44(2):126-30. (PMID:26631643).





Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137966  
2018;21 (1):49-55

- Meltem ALKAN MELİKOĞLU<sup>1</sup>
- Ayhan KUL<sup>2</sup>

#### CORRESPONDANCE

Dr. Ayhan KUL  
Erzurum Regional Training and Research  
Hospital, Department of Physical Medicine and  
Rehabilitation, Erzurum, Turkey

Phone: 90 533 5761514  
e-mail: drayhankul@gmail.com

Received: 06/10/2017  
Accepted: 18/12/2017

<sup>1</sup> Atatürk University, Faculty of Medicine,  
Department of Physical Medicine and  
Rehabilitation, Rheumatology,  
Erzurum, Turkey

<sup>2</sup> Erzurum Regional Training and Research  
Hospital, Department of Physical Medicine and  
Rehabilitation, Erzurum, Turkey

Presented In: Annual European Congress of  
Rheumatology : Madrid, Spain, 14-17 June  
2017.

#### RESEARCH

## FALL RISK AND RELATED FACTORS IN KNEE OSTEOARTHRITIS

### ABSTRACT

**Introduction:** The aim of this study was to determine the fall risk in patients with knee osteoarthritis with an objective computerized technique and to evaluate the potential risk factors for falls in these patients.

**Materials and Method:** Patients with knee osteoarthritis and controls were included in this cross-sectional study. Gender, age, and body mass index were recorded. Pain was evaluated with a visual analog scale. The Western Ontario and McMaster Universities Osteoarthritis Index was used to assess the patients and the Falls Efficacy Scale International was used for the evaluation of fall efficacy. Knee radiographs were recorded with the Kellgren–Lawrence grading scale. Fall risk analysis was performed by using the Tetrax Interactive Balance System.

**Results:** One hundred patients with knee osteoarthritis and 30 controls were included. The age, gender, and body mass index scores were similar between the groups. Falls Efficacy Scale International scores were significantly higher in the cases than in the controls ( $p<0.000$ ). Using a computerized system, significantly higher fall risk results ( $p<0.000$ ) and significantly low, moderate, and high fall risk distribution were recorded in the cases than in the controls ( $p<0.000$ ). Fall risk was significantly related to age, pain, and the Western Ontario and McMaster Universities Osteoarthritis Index scores of the patients.

**Conclusions:** Our study demonstrated a higher fall risk in patients with knee osteoarthritis than in healthy individuals. This higher risk was shown even in the early radiographic phases of the disease related to age, pain, and dysfunction. An understanding of factors on postural control seems to be critical in successful fall prevention in these patients.

**Keywords:** Osteoarthritis, Knee; Accidental falls; Postural balance

#### ARAŞTIRMA

## DİZ OSTEOARTRİTDE DÜŞME RİSKİ VE İLİŞKİLİ FAKTÖRLER

### Öz

**Giriş:** Bu çalışmanın amacı diz osteoartriti olan hastalardaki düşme riskini komputerize bir teknikle değerlendirmek ve bu hastalarda düşme riski için potansiyel risk faktörlerini belirlemektir.

**Gereç ve Yöntem:** Bu çalışmada, diz osteoartriti hastalar ve kontrol vakaları kesitsel olarak değerlendirildi. Katılımcıların cinsiyet, yaş ve beden kütle indeksi değerleri kaydedildi. Ağrı görsel analog skala ile, kısıtlılık "The Western Ontario and Mc Master Universities Osteoarthritis Index" ile, düşme etkisi ise "Falls Efficacy Scale International" ile değerlendirildi. Kellgren–Lawrence sınıflandırması kullanılarak diz radyografileri değerlendirildi. Düşme riski analizi ise "Tetrax Interactive Balance System" kullanılarak gerçekleştirildi.

**Bulgular:** Diz osteoartriti 100 hasta ve 30 kontrol vakası incelemeye alındı. Yaş, cinsiyet ve beden kütle indeksi değerleri gruplar arasında benzerdi. "Falls Efficacy Scale International" değerleri diz osteoartriti hastalarda kontrol grubundan anlamlı şekilde yüksekti ( $p<0.000$ ). Kullanılan komputerize sistemle, diz osteoartriti olan hastalarda kontrollere göre istatistiksel olarak anlamlı şekilde yüksek düşme riski ( $p<0.000$ ) ve düşük, orta ve yüksek düşme riski dağılımı kaydedildi ( $p<0.000$ ). Düşme riski hastaların "The Western Ontario and Mc Master Universities Osteoarthritis Index" skorları, yaş ve ağrıları ile belirgin derecede ilişkiliydi.

**Sonuç:** Çalışmamız, düşme riskinin diz osteoartriti hastalarda sağlıklı bireylerden daha yüksek olduğunu ortaya koymaktadır. Bu yüksek riskin yaş, ağrı ve disfonksiyon ile ilişkili şekilde hastalığın erken radyografik döneminde bile var olduğu gösterilmiştir. Postural kontrol üzerine etkili faktörlerin anlaşılması bu hastalarda düşmenin başarılı bir şekilde önlenmesinde önemli rol oynayacaktır.

**Anahtar sözcükler:** Diz osteoartriti; Düşme riski; Postural denge

## INTRODUCTION

Osteoarthritis (OA) is a chronic joint condition that affects one in ten adults (1). The knee is the joint most commonly affected in OA and knee OA (KOA) results in a loss of physical function (2). Balance, as a complex task, may be affected in KOA and this may cause postural instability and fall risk. A fall can be defined as "an unexpected event in which participants come to rest on the ground, floor or other lower level" according to the consensus guidelines (3). Its consequences are highly variable and may include loss of confidence, injury and even death (4). Although its etiology seems to be multifactorial which includes a complex interaction of intrinsic, behavioral or environmental risk factors, age and related comorbidities are considered to be the most important risk factors for falls in the normal population (5,6). Rheumatic diseases were suggested as the second strongest independent risk factor for serious fall related injury in elderly (7). In spite of its reasonable commonness and often serious consequences in patients with rheumatic diseases, falls are still underestimated and poorly researched in this population. In studies about falls in patients with several rheumatic diseases, there is a wide range in reported falls incidence, which may be due to inconsistency in falls data attainment. Suggested potential fall risk factors were also conflicting as a result of the several different methodologies in previous studies. A definition of the term "fall" is frequently missing from falls researches (8). The differences in falls rates in previous studies have been attributed to variation in the definition of a fall event (4). Also most of the previous studies used "self-reported" falls data. An objective technique seems to be needed in the evaluation of fall risk in these patients.

In our research, we couldn't find any study investigating fall risk in patients with KOA with an objective technique. To determine the fall risk and related risk factors in these patients may lead to the awareness and prevention of falls and may contribute to the management. The aim of this study was to determine the fall risk in patients with KOA with an objective computerized technique and

to evaluate the potential related risk factors for falls in these patients.

## MATERIALS AND METHOD

### *Patients*

This cross-sectional study was approved by the Local Ethics Committee and it was conducted in accordance with the 1989 Declaration of Helsinki. All subjects signed an informed consent form before participating in the study. After calculating the sample size as 28 with 95% reliability and  $\pm 5\%$  deviation, one hundred patients (for 4 subgroups) with KOA and 30 healthy controls with similar age (range 40-75 years) and gender profile were included in the study. All patients fulfilled the combined clinical and radiographic criteria of knee OA, as established by the American College of Rheumatology (9,10). Patients who were not able to cooperate or tolerate the fall risk evaluation, patients with a history of or previous orthopedic surgery, with a known balance problem or patients using medicines that may cause balance disorder were excluded from the study. The control subjects were selected among hospital staff and their relatives in order to make a similar age profile to patients.

### *Evaluations*

The characteristics of the participants including gender, ages and body mass index (BMI) were recorded. Pain was evaluated with visual analogue scale (VAS).

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used to assess the patients with KOA (11). It has been used to assess pain, stiffness, and physical function in patients with OA. The WOMAC consists of 24 items divided into 3 subscales: Pain (5 items), stiffness (2 items) and physical function (17 items). On the Likert scale version, the scores are summed for items in each subscale, with possible ranges as follows: pain=0-20, stiffness=0-8, physical function=0-68.

The grading of knee radiographs was performed by an experienced observer who was blinded to the



source of subjects. Knee radiographs were scored with the Kellgren–Lawrence grading scale (Grade I–IV) (12).

For the evaluation of fall efficacy in patients with KOA, we used the Falls Efficacy Scale International (FES-I) which is a self-reported questionnaire. This scale is a short, easy to administer tool that measures the level of concern about falling during social and physical activities inside and outside the home whether or not the person actually does the activity. It contains 16 items scored on a four point Likert scale (1=not at all concerned to 4=very concerned) providing a total score ranging from 16 (absence of concern) to 64 (extreme concern). The FES-I was developed in a collaborative effort with members of the Prevention of Falls Network Europe (ProFaNE) (13) and it was translated into several languages as well as our language (14). Fall risk analysis of patients with KOA and controls were performed by Tetrax Interactive Balance System (Sunlight Medical Ltd., Israel) with the same technique which is directed by the user's guide of the device. Tetrax static posturography device has a computer and software system, and all the data obtained from the device were the results of the software. The device uses a system of force gauges in four plates on which subject stands, and translates the vertical forces on the plates into wave signals into a computer digitally. Before the task, the patients were instructed to place their feet side by side on lined places of the platform in shape of feet, not to speak and move during the task. Measurements are made in eight different positions in all subjects with the same technique, sequence, and directions (each position takes about 40 s): (i) head straight, eyes open, on a hard ground; (ii) head straight, eyes closed, on a hard ground; (iii) head straight, eyes open, on a soft ground (sponge under feet); (iv) head straight, eyes closed, on a soft ground; (v) head turned to the right, eyes closed, on a hard ground; (vi) head turned to the left, eyes closed, on a hard ground; (vii) neck fully extended, eyes closed, on a hard ground; and (viii) neck fully flexed, eyes closed, on a hard ground (15). A fall index derived from Tetrax balance parameters has been

developed to produce a score that will express the patient's risk of falling based on the specific balance factors that affect falling. Fall risk is a numeric value from 0 to 100, with three numerical ranges 0 to 35, 36 to 57, and 58 to 100, indicating low, moderate, or high risk of fall, respectively (16).

### Statistical analysis

Analyses were performed using the SPSS 20.0 software package program. Descriptive data were presented as mean±standard deviation (sd). Mann–Whitney U, one-way ANOVA and Spearman correlation tests were used for statistical analysis. P values less than 0.05 were considered statistically significant.

## RESULTS

Eleven patients were excluded from the study for the following reasons: patients Three patients due to the non-cooperation in computerized measurements, one patient due to previous orthopedic surgery and seven patients using medicines that may cause balance disorder. Finally, one hundred patients with KOA (55 female and 45 male) and age and gender similar 30 controls (17 female and 13 male) were included in our study. The mean ages of the patients and controls were  $64.7\pm 10.6$  and  $62.8 \pm 11.4$  years, respectively. The BMI scores were similar between patients and controls. FES-I scores were found to be significantly higher in cases than controls ( $36\pm 4$  and  $20\pm 2$  respectively;  $p<0.000$ ). With the computerized system used, significantly higher fall risk results were recorded in patients than the controls ( $68.2\pm 28.1$  and  $35.8\pm 26.9$ , respectively;  $p<0.000$ ). Low, moderate and high fall risks were recorded as 14%, 24% and 62% of the cases and 53%, 23% and 23% of the controls. This distribution was also significantly worse in cases than controls ( $p<0.000$ ). The comparisons of the demographic characteristics, BMI, scores of FES-I and fall risk assessments of the participants were shown in Table 1.

We compared the scores of FES-I and fall risk assessments among KOA radiographic grade

subgroups (grade 0-IV). As possible related factors to fall risk, age and BMI scores were not significantly different among groups, although grade IV group had a slight higher age profile (data were not shown). FES-I was significantly higher in grade III and IV compared to controls ( $p < 0.05$  and  $0.001$  respectively). Fall risk assessment was significantly higher in patient groups than controls as well ( $p < 0.05$  for grade I compared to controls and  $p < 0.001$  for other grades compared to controls). This was also similar for fall risk category. Among OA subgroups

(radiological grade I-IV), in spite of increasing scores in fall risk and fall risk categories, the differences were not able to reach to statistical significance in the post hoc analysis. Data were shown in Table 2.

We evaluated the correlation between fall risk assessment and patients' characteristics including gender, age, BMI, radiographic grade, pain and WOMAC. It was demonstrated that fall risk was significantly correlated with age, pain and WOMAC scores of the patients. Data were shown in Table 3.

**Table 1.** Demographic characteristics, BMI, scores of FES-I and fall risk assessments of the participants.

Variable	Patients with KOA (n=100)	Controls (n=30)	p
Age (years)	64.7 (sd=10.6)	62.8 (sd=11.4)	NS
Gender			
Female/ Male (n)	55/45	17/13	NS
BMI (Kg/m <sup>2</sup> )	33.5 (sd=5.7)	32.1 (sd=6.8)	NS
FES-I (16-64)	36 (sd=4)	20 (sd=2)	0.000
Fall risk assessment (0-100)	68.2 (sd=28.1)	35.8 (sd=26.9)	0.000
Fall risk category			
Low (0 to 35) n (%)	14 (14)	16 (53)	
Moderate (36 to 57) n (%)	24 (24)	7 (23)	0.000
High (58 to 100) n (%)	62 (62)	7 (23)	

KOA; knee osteoarthritis, NS; not significant, FES-I; Falls Efficacy Scale International

**Table 2.** Comparison of the scores of FES-I and fall risk assessments among KOA radiographically graded subgroups.

	Grade 0 (controls) (n=30)	Grade I (n=21)	Grade II (n=27)	Grade III (n=28)	Grade IV (n=24)
FES-I (16-64)	20.6 (sd=16.2)	24.1 (sd=7.5)	31.8 (sd=21.4)	34.9 (sd=16.9)*	61.7 (sd=22.1)**
Fall risk assessment (0-100)	35.8 (sd=26.9)	60.2 (sd=36.4)*	70.6 (sd=27.3)**	66.5 (sd=27.2)**	72.0 (sd=24.8)**
Fall risk category					
Low (0 to 35) (%)	53	40*	12**	7**	8**
Moderate (36 to 57) (%)	23	6	21	35	25
High (58 to 100) (%)	23	53*	66**	57**	66**

FES-I: Falls Efficacy Scale International

\* $p < 0.05$ ; compared to controls

\*\* $p < 0.000$ ; compared to controls

**Table 3.** The correlations between fall risk assessment and patients' characteristics.

Variable	Fall risk assessment	Fall risk category
Gender	NS	NS
Age	0.367 0.000	0.368 0.000
BMI (kg/m <sup>2</sup> )	NS	NS
Radiological grade	NS	NS
WOMAC		
Pain	0.345 r 0.001 p	0.388 r 0.001 p
Stiffness	0.381 r 0.001 p	0.374 r 0.001 p
Physical function	0.376 r 0.001 p	0.359 r 0.001 p
Pain (VAS; 0-10)	0.176 r 0.05 p	NS

BMI: Body Mass Index

WOMAC: The Western Ontario and McMaster Universities Osteoarthritis Index

## DISCUSSION

With an objective computerized technique, fall risk found to be higher in patients with KOA than controls in this study. This higher risk was correlated with age, WOMAC sores and pain, but not with OA radiological grade.

Our results showing higher fall risk in patients with KOA with an objective technique is compatible with several previous studies highlighting the high incidence of falls in these patients (17-19). OA has been reported to be associated with an increased risk of falling, with fall rates up to 50% of individuals with OA, compared to 30% of healthy older adults (1). Our results; with its methodology using an objective computerized technique, may contribute to previous studies mostly used "self-reported" falls data.

In our study the higher fall risk in KOA was found to be age related regardless of the gender of the patients. Although a few studies has described possible gender differences in falls, previous studies seem to be in a consensus on the effect of the increasing age on fall risk in patients with KOA

(1,20-22). In fact, OA prevalence increases with age, with 30% of those over the age of 75 exhibiting severe radiographic disease (2). Aging is associated with significant changes in dynamic postural control which is a central factor in fall risk. Higher fall risk in KOA related to increasing age may be the consequence of normal aging associated with neuromuscular changes. However, those with KOA have been reported to be at a higher risk of falls than healthy elderly individuals (18,21). Similarly, in our study, fall risk was found to be higher in patients with KOA than age similar controls. In order to develop fall prevention strategies for patients with KOA, it is important to understand the role other deficits beyond normal aging that are attributed to the disease.

In this study pain was found to be related to increased fall risk in patients with KOA. Similarly, the relation between pain and falls were demonstrated in previous studies with different methodologies (23,24).

Joint pain is a central characteristic of OA and it alters the kinematics and kinetics of postural

responses (1). Due to the link between pain and the increased risk of falls, whether pain relief will be effective in reducing the risk of falls in these patients needs to be researched.

Impaired physical function was one of the related factors to fall risk in our study. Similarly reduced functions were found as an associated factor to increased risk of falling in previous studies (24). Also in a previous study using the same scale with us, KOA patients with a fall history had a worse functional status as measured by WOMAC when compared to those without such an anamnesis (25). Our objective results were parallel to previous studies demonstrating correlation between fall risk and functional status.

In our study, when compared one by one each subgroup of patients (Grade I-IV radiologically) to controls, all groups showed higher fall risk scores than healthy individuals. However, in spite of

increasing fall risk scores among radiological graded subgroups of patients with KOA, the differences were not able to reach to statistical significance. Our study demonstrated a higher fall risk even in radiologically grade I KOA than controls. It may be considered that higher fall risk may be present in the early phases of KOA. Patients with KOA exhibit several neuromuscular changes beyond that seen with aging. Future researches are needed to evaluate the effect of such changes on postural control.

In conclusion, with an objective technique, our study demonstrated a higher fall risk in patients with KOA than healthy controls. This higher risk was shown even in the early radiographic phases of the disease related to age, pain and dysfunction. In addition to the known effects of aging in balance, an understanding of other neuromuscular factors on postural control seems to be critical in successful fall prevention in patients with KOA.

## REFERENCES

1. Takacs J, Carpenter MG, Garland SJ, Hunt MA. The role of neuromuscular changes in aging and knee osteoarthritis on dynamic postural control. *Aging Dis* 2013 Jan;4(2):84-99. (PMID:23696951).
2. Bakilan F, Armagan O, Ozgen M, Tascioglu F, Bolluk O, Alatas O. Effects of native type ii collagen treatment on knee osteoarthritis: a randomized controlled trial. *Eurasian J Med* 2016;48(2):95-101. (PMID:4970562).
3. Lamb SE, Jorstad-Stein EC, Hauer K, Becker C. Development of a common outcome data set for fall injury prevention trials: The Prevention of Falls Network Europe consensus. *J Am Geriatr Soc* 2005;53:1618-22. (PMID:16137297).
4. Brenton-Rule A, Dalbeth N, Bassett S, Menz HB, Rome K. The incidence and risk factors for falls in adults with rheumatoid arthritis: a systematic review. *Semin Arthritis Rheum* 2015;44:389-98. (PMID:25216947).
5. McKay C, Anderson KE. How to manage falls in community dwelling older adults: a review of the evidence. *Postgrad Med J* 2010;86:299-306. (PMID:20406801).
6. Deandrea S, Lucenteforte E, Bravi F, Foschi R, LaVecchia C, Negri E. Risk factors for falls in community-dwelling older people: a systematic review and meta-analysis. *Epidemiology* 2010;21:658-68. (PMID:20585256).
7. Bergland A, Wyller TB. Risk factors for serious fall related injury in elderly women living at home. *Inj Prev* 2004;10:308-13. (PMID:15470013).
8. Hauer K, Lamb SE, Jorstad EC, Todd C, Becker C. Systematic review of definitions and methods of measuring falls in randomized controlled fall prevention trials. *Age Ageing* 2006;35:5-10. (PMID:16364930).
9. American College of Sports Medicine Position Stand (ACSM). Progression models in resistance training for healthy adults. *Med Sci Sports Exerc.* 2009;41:687-708. (PMID:19204579).
10. Fernandes L, Hagen KB, Bijlsma JQJ, et al. EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Ann Rheum Dis* 2013;72:1125-35. (PMID:23595142).



11. Bellamy N, Buchanan W, Goldsmith C, Campbell J, Stitt L. Validation study of WOMAC health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol* 1988;15:1833-40. (PMID:3068365).
12. Kellgren JH, Lawrence JS. Radiologic assessment of osteoarthritis. *Ann Rheum Dis* 1957 Dec;16(4):494-502. (PMID:13498604).
13. Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, Todd C. Development and initial validation of the Falls Efficacy Scale- International (FES-I). *Age and Ageing* 2005;34:614-9. (PMID:16267188).
14. Ulus Y, Durmus D, Akyol Y, Terzi Y, Bilgici A, Kuru O. Reliability and validity of the Turkish version of the Turkish version of the Falls Efficacy Scale International (FES-I) in community-dwelling older persons. *Arch Gerontol Geriatr* 2012;54:429-33. (PMID:21831462).
15. Akkaya N, Akkaya S, Atalay NS, Acar M, Catalbas N, Sahin F. Assessment of the relationship between postural stability and sleep quality in patients with fibromyalgia. *Clin Rheumatol* 2013;32:325-31. (PMID:23179001).
16. Ozdemir O, GokceKutsal Y. Fall risk assessment of elderly by using posturography. *Turk J Geriatr* 2009;12:177-80.
17. Prieto-Alhambra D, Nogues X, Javaid MK, et al. An increased rate of falling leads to a rise in fracture risk in post menopausal women with self-reported osteoarthritis: a prospective multinational cohort study (GLOW). *Ann Rheum Dis* 2013;72:911-7. (PMID:22730372).
18. Scott D, Blizzard L, Fell J, Jones G. Prospective study of self-reported pain, radiographic osteoarthritis, sarcopenia progression, and falls risk in community-dwelling older adults. *Arthritis Care Res (Hoboken)* 2012;64:30-7. (PMID:21739619).
19. Wright NC, Lisse JR, Walitt BT, Eaton CB, Chen Z. Arthritis Increases the Risk for Fractures-Results from the Women's Health Initiative. *J Rheumatol* 2011;38:1680-8. (PMID:21572148).
20. Prieto-Alhambra D, Judge A, Javaid MK, Cooper C, Diez-Perez A, Arden NK. Incidence and risk factors for clinically diagnosed knee, hip and hand osteoarthritis: influences of age, gender and osteoarthritis affecting other joints. *Ann Rheum Dis* 2014;73:1659-64. (PMID:23744977).
21. Levinger P, Menz HB, Wee E, Feller JA, Bartlett JR, Bergman NR. Physiological risk factors for falls in people with knee osteoarthritis before and early after knee replacement surgery. *Knee Surg Sports Traumatol Arthrosc* 2011;19:1082-9. (PMID:21107530).
22. Williams SB, Brand CA, Hill KD, Hunt SB, Moran H. Feasibility and outcomes of a home-based exercise program on improving balance and gait stability in women with lower-limb osteoarthritis or rheumatoid arthritis: A pilot study. *Arch Phys Med Rehabil* 2010;91:106-14. (PMID:20103404).
23. Muraki S, Akune T, Oka H, En-Yo Y, Yoshida M, Nakamura K, Kawaguchi H, Yoshimura N. Prevalence of falls and the association with knee osteoarthritis and lumbar spondylosis as well as knee and lower back pain in Japanese men and women. *Arthritis Care Res (Hoboken)* 2011;63:1425-31. (PMID:21793231).
24. Levinger P, Wallman S, Hill K. Balance dysfunction and falls in people with lower limb arthritis: factors contributing to risk and effectiveness of exercise interventions. *Eur Rev Aging Phys Act* 2012; 9:17-25.
25. Bugdayci DS, Paker N, Tekdos D, Topal K, Erbil E, Ersoy S. The functional status of knee in faller or non-faller female patients with knee osteoarthritis. *Turkish J Physical Med Rehab* 2012;58:22-5.



Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137967  
2018;21 (1):56-61

- Mehmet AĞIRMAN<sup>1</sup>
- Ayşe Serap AKGÜN<sup>2</sup>

#### CORRESPONDANCE

Mehmet AĞIRMAN  
İstanbul Medipol University,  
Faculty of Medicine, Department of Physical  
Medicine and Rehabilitation  
İstanbul, Turkey

Phone: 4447070  
e-mail: mehmetagirman@yahoo.com

Received: 14/02/2018  
Accepted: 05/03/2018

<sup>1</sup> İstanbul Medipol University,  
Faculty of Medicine, Department of Physical  
Medicine and Rehabilitation  
İstanbul, Turkey

<sup>2</sup> İstanbul Medipol University  
Department of Radiology  
İstanbul, Turkey

#### RESEARCH

## NEUROPATHIC PAIN AND DISABILITY IN PATIENTS WITH LUMBAR SPINAL STENOSIS

### ABSTRACT

**Introduction:** In this study, we aimed to determine the characteristics of neuropathic pain and clarify the relationships between the clinical signs, symptom characteristics and disability in patients with lumbar spinal stenosis.

**Materials and Method:** Seventy-nine patients diagnosed with clinical and radiological lumbar spinal stenosis were included in the study. Pain severity was assessed using a self-administered visual analog scale (0–10 cm). Subjective disability was measured using the Oswestry Disability Index and Istanbul Low Back Pain Disability Index. To identify neuropathic pain, the physician-administered Douleur Neuropathique 4 questionnaire was utilized.

**Results:** A total of 79 patients (35 males, 44 females) with a mean age of  $56.88 \pm 12.13$  (range, 35–89) years were included in the study. The average symptom duration was 24.5 months. The Douleur Neuropathique 4 score was  $\geq 4$  in 41 patients (51.8%), indicating that they had neuropathic pain. A significant correlation was observed between the Douleur Neuropathique 4 score and age ( $R=0.350$ ,  $p=0.002$ ), body mass index ( $R=0.239$ ,  $p=0.034$ ), and visual analog scale ( $R=0.453$ ,  $p<0.001$ ).

**Conclusion:** Approximately half of all patients with lumbar spinal stenosis in our cohort had neuropathic pain. Higher age, body mass index and increased pain scores demonstrate important relationships with neuropathic pain.

**Keywords:** Neuralgia; Spinal Stenosis; Pain; Aged

#### ARAŞTIRMA

## LOMBER SPİNAL STENOZLU HASTALARDA NÖROPATİK AĞRI VE YETİ KAYBI

### Öz

**Giriş:** Bu çalışmada, lomber spinal stenoz hastalarında nöropatik ağrı karakterini belirlemeyi ve klinik semptom, bulgu ve yeti kaybı ile olan ilişkisini araştırmayı amaçladık.

**Gereç ve Yöntem:** Çalışmaya klinik ve radyolojik olarak lomber spinal stenoz tanısı alan yetmiş dokuz hasta alındı. Ağrı düzeyi için visüel analog skala (0-10 cm), fonksiyonel durum için Oswestry Dizabilite İndeksi ve İstanbul Bel Ağrısı Dizabilite İndeksi ölçüldü. Nöropatik ağrıyı belirlemek için Douleur Neuropathique 4 anketi dolduruldu.

**Bulgular:** Ortalama yaşı  $56.88 \pm 12.13$  (35-89 yaş aralığı) olan 79 hasta (35 erkek, 44 kadın) çalışmaya dahil edildi. Ortalama semptom süresi 24,5 ay idi. Hastaların 41'inde (%51.8) Douleur Neuropathique 4 skoru  $\geq 4$  (nöropatik ağrı) idi. Douleur Neuropathique 4 sonucu ile yaş ( $R=0.350$ ,  $p=0.002$ ), vücut kitle indeksi ( $R=0.239$ ,  $p=0.034$ ) ve visüel analog skala ( $R=0.453$ ,  $p<0.001$ ) arasında anlamlı ilişki görüldü.

**Sonuç:** Çalışmamızda, hastaların yaklaşık yarısında nöropatik ağrı gözlemlendi. İleri yaş, yüksek vücut kitle indeksi ve artmış ağrı skorları ile nöropatik ağrı arttığı sonucuna ulaşıldı.

**Anahtar sözcükler:** Nöralji; Spinal stenoz; Ağrı; Yaşlı





## INTRODUCTION

Lumbar spinal stenosis (LSS) is one of the most common conditions, which causes pain and disabilities in older people (1). This condition is commonly associated with lumbar degenerative disc disease and spondylosis so-called acquired lumbar stenosis (2). It results in the narrowing of the spinal canal, lateral nerve roots, and intervertebral neural foramina at one or more levels. Clinical signs occur because of compression of the spinal cord, nerve roots, and vascular elements of the lumbar spine (3). These symptoms include pain in the back, buttocks, and lower leg; numbness in the leg or foot, weakness in the lower extremities, and neurogenic claudication (4).

There are several classifications and types of pain, including nociceptive, chronic, radicular, and neuropathic. Understanding these can aid in diagnosis and planning appropriate treatment (5). Neuropathic pain (NeP) has been defined as pain caused by a lesion or disease of the somatosensory system. Patients usually complain of burning and electrical sensations, with pain often resulting from typically non-painful stimulation (e.g., light touch) (6).

LSS can be diagnosed based on clinical, neurological, and radiological findings. However, radiological LSS can be detected using magnetic resonance imaging (MRI) or computed tomography in asymptomatic patients. A clinical diagnosis of LSS requires both the characteristic clinical presentation and radiographic evidence of LSS (7). Neurogenic claudication and radicular pain are best described in the literature for patients with LSS (7,8). However, there are few studies on NeP in patients with spinal stenosis (9,10).

In this study, we aimed to determine the characteristics of NeP and clarify the relationships between the clinical signs and symptom characteristics in patients with LSS.

## MATERIALS AND METHOD

### Participants

One-hundred and sixteen patients with LSS symptoms were included in the study between

February 2016 and November 2017. All patients signed written informed consent forms to participate in the study, which was approved by the local ethics committee. This study was conducted in accordance with the principles of the Declaration of Helsinki.

All patients were recruited from the outpatient clinic of the Department of Physical Medicine and Rehabilitation. Clinical LSS was diagnosed based on symptoms of pain in the buttocks or thighs, pain in the lower leg induced by lumbar spine extension, numbness or tingling in the leg or foot, and neurogenic claudication. Patients diagnosed with clinical LSS were included if lumbar spine MRI showed signs of LSS. Radiological LSS was accepted as absolute if the sagittal spinal canal diameters measured  $\leq 10$  mm in at least one intervertebral disc (11). Initially, seventy nine patients with both the characteristic clinical presentation and radiographic evidence of LSS were collected. Patients were excluded if they had previously undergone spine (n=3), hip, and/or lower limb-related surgery (n=3); diabetes (n=7); peripheral vascular disease (n=1); and/or inflammatory disorders (n=2). Furthermore, we also excluded those with a symptom duration of  $< 1$  month (n=7) and those taking drugs for NeP, such as pregabalin, gabapentin, tricyclic antidepressants, or selective serotonin–norepinephrine reuptake inhibitors (n=14).

### Assessment of symptoms and functional disability

All questionnaires and clinical evaluations were recorded by a blinded physician to the clinical and radiological findings. A detailed medical history was taken and physical examination was performed, and age, gender, height, weight, body mass index (BMI), and symptom duration were recorded for each patient.

Low back pain severity was assessed using a self-administered visual analog scale (VAS; range, 0–10 cm). Subjective disability was measured using the Oswestry Disability Index (ODI; range 0-100) and Istanbul Low Back Pain Disability Index (ILBPDI; range 0-90). ODI is a 10-item, self-administered questionnaire that is commonly used to assess

limitations in activities of daily living because of low back pain. Disability increases as the total ODI score increases. ILBPDI focuses on activities required to function in daily life, such as transport, sitting, standing, dressing, and hygiene, and where they are done (e.g., room, kitchen, car, or street).

To identify NeP, the physician-administered Douleur Neuropathique 4 (DN4) questionnaire was utilized. This questionnaire contains seven items related to symptoms and three related to clinical examination. Each item is scored as 1 (positive) or 0 (negative), and a total score of  $\geq 4$  out of 10 suggests NeP. The questionnaires have Turkish validity and reliability (12,13).

### Statistical analysis

All qualitative variables are reported as frequencies and percentages. Continuous variables are expressed as means $\pm$ standard deviations. The correlations between DN4, ODI, ILBPDI, VAS, and other clinical signs were calculated using the Spearman's correlation coefficient. IBM SPSS for Windows, Version 21 (IBM Corp., Armonk, NY, USA) was used for all statistical analyses. *P*-values $<0.05$  were considered to be statistically significant.

## RESULTS

The clinical and demographic characteristics of the participants are summarized in Table 1. A

total of 79 patients (35 males, 44 females) with a mean age of  $56.88\pm 12.13$  (range, 35–89) years were included in the study. All patients were clinically and radiologically diagnosed with LSS. The average symptom duration was 24.5 months (Table 1).

In terms of the questionnaires, the average VAS, ODI, ILBPDI, and DN4 scores were  $6.84\pm 1.38$ ,  $29.93\pm 5.92$ ,  $23.08\pm 7.73$ , and  $4.07\pm 2.26$ , respectively. The DN4 score was  $\geq 4$  in 41 patients (51.8%), indicating that they had NeP. A significant correlation was observed between the DN4 score and age ( $R=0.350$ ,  $p=0.002$ ), BMI ( $R=0.239$ ,  $p=0.034$ ), and VAS ( $R=0.453$ ,  $p<0.001$ ). There was also a significant correlation between the ODI score and age ( $R=0.438$ ,  $p<0.001$ ), VAS score ( $R=0.420$ ,  $p<0.001$ ), and ILBPDI score ( $R=0.708$ ,  $p<0.001$ ). Finally, there was a significant correlation between the ILBPDI score and both age ( $R=0.426$ ,  $p<0.001$ ) and VAS score ( $R=0.250$ ,  $p=0.026$ ). However, the symptom duration was not significantly correlated with any of the questionnaires (Table 2).

Claudication was present in 41.8% of patients. Using DN4, most patients complained of tingling (67.1%) and numbness (51.9%), with the least number of patients complaining of itching (13.9%; Table 3). In the physical examination, hypoesthesia to touch, hypoesthesia to pinprick, and increased pain by brushing were present in 61.9%, 65.8%, and 21.5% of the patients, respectively.

**Table 1.** The clinical and demographic characteristics of patients.

Characteristics	Mean $\pm$ sd	Minimum-Maximum
Age	56.88 $\pm$ 12.13	33-89
Gender (M/F)	44/35	
BMI	29.91 $\pm$ 3.54	19.81-38.28
sd (month)	24.50 $\pm$ 27.75	1-120
VAS (0-10 cm)	6.84 $\pm$ 1.38	4-10
ODI (0-100)	29.93 $\pm$ 5.92	13-46
ILBPDI (0-90)	23.08 $\pm$ 7.73	7-46
DN4 (0-10)	4.07 $\pm$ 2.26	1-10

BMI: Body mass index; SD: Symptom duration; VAS: Visual analog scale; ODI: Oswestry Disability Index; ILBPDI: Istanbul Low Back Pain Disability Index; DN4: Douleur Neuropathique 4



**Table 2.** Correlations of demographical findings, pain, subjective disability and neuropathic pain (r-values).

Characteristics	Age	BMI	sd	VAS	ODI	ILBPDI	DN4
Age	1						
BMI	0.037	1					
sd	0.159	0.075	1				
VAS	0.322**	0.210	0.094	1			
ODI	0.438**	0.205	0.001	0.420**	1		
ILBPDI	0.426**	0.079	-0.042	0.250	0.708**	1	
DN4	0.350**	0.239*	0.174	0.453**	0.221	0.211	1

BMI: Body mass index; SD: Symptom duration; VAS: Visual analog scale; ODI: Oswestry Disability Index; ILBPDI: Istanbul Low Back Pain Disability Index; DN4: Douleur Neuropathique 4

\*. Correlation is significant at the 0.05 level

\*\* . Correlation is significant at the 0.01 level

**Table 3.** The percentage of neurogenic claudication and positive signs and symptoms assessed by DN4 questionnaire in LSS patients.

Characteristics	Yes (%)	No (%)
Claudication	41.8	58.2
<b>DN4 questions</b>		
Burning	43.0	57.0
Painful cold	25.3	74.7
Electric shocks	39.1	60.9
Tingling	67.1	32.9
Pins and needles	45.6	54.4
Numbness	51.9	48.1
Itching	13.9	86.1
Hypoesthesia to touch	61.9	38.1
Hypoesthesia to prick	65.8	34.2
Brushing	21.5	78.5

## DISCUSSION

In this study, we showed that most patients with LSS had NeP associated with age; BMI; and ODI, VAS, and ILBPDI scores. The prevalence of degenerative disc disease and neuropathic pain syndromes

are known to increase with both aging and spinal stenosis (14,15). In our study, a correlation was observed between increased age and DN4, ODI, and ILBPDI scores. These results might have resulted from increased degeneration and stenosis typically associated with increased aged.

Lumbar spinal stenosis has heterogeneous and nonspecific signs and symptoms and may even be asymptomatic, with symptoms assumed to result from nerve compression, local vascular insufficiency, or both (1). Indeed, radiological findings do not prove that symptoms arise from nerve root compression (16). Neurogenic claudication, back and leg pain, comorbidities, and other nociceptive pain indexes are well studied in patients with LSS (16-19). It has also been reported that patients with LSS have less intense leg pain than those with lumbar disc herniation and that their symptoms are more often increased by lumbar extension and relieved by bending forward or sitting (2,17,20).

The pain in LSS can be divided into two main categories: nociceptive and neuropathic. NeP is defined as the pain caused by a lesion or disease of the somatosensory system, and it is estimated to affect 15%–25% of patients with chronic pain (8,21). Although NeP is a clinical diagnosis, there are several diagnostic criteria. In Turkey, DN4 has been the best performing screening tool with good validity and reliability (13). This tool assesses symptoms of burning, tingling, sensitivity to touch, pain caused by mild pressure, electric shock-like pain, pain to cold or heat, and numbness, which are characteristic NeP symptoms.

In our study, 41 patients (51.8%) had NeP according to the DN4 questionnaire, and this was shown to be correlated with increased BMI. In another study of 102 patients, the painDETECT questionnaire was used to show that nociceptive, neuropathic, and unclear pain were present in 57.9%, 17.6%, and 24.5% of patients, respectively (9). Even if the unclear pain is combined with the NeP group, the NeP rate still only reached 42.1%. Our high values of NeP, may have resulted from using the DN4 questionnaire. In the above study, they showed that the group with NeP had a significantly poorer

quality of life than the other groups. However, ODI, ILBPD1 and symptom duration did not significantly correlate with DN4 questionnaire (Table 2).

In patients with LSS, pain mostly spreads to the buttock or thighs and to both lower legs, with patients also complaining of numbness and tingling (19). For patients with chronic low back pain and LSS, other researchers have also reported that buttock and leg pain were significantly associated with NeP (10,22). Our results are consistent with these results, showing that most subjects complained of leg symptoms (e.g., tingling in 67.1% and numbness in 51.9%), including claudication (41.8%), and that very few complained of itching (Table 3).

There are conflicting results about the association between radiological and clinical findings. In a multicenter study, no relationship was shown between the radiological severity and the presence of back or leg pain in patients with LSS (23). In another research, the opposite was shown to some extent (24). Although we believe that the radiological distinction could be ignored because of the selection of only symptomatic patients in our study, further research is needed in relation to this topic.

Except the radiological distinction there are other limitations in the present study. Although the frequency of neurogenic claudication determined in the study, the walking distance/duration was not measured. The other limitation is that the quality of life was not evaluated.

In conclusion, approximately half of all patients with LSS in our cohort had NeP. Higher age, BMIs and increased VAS scores demonstrate important relationships with NeP.

#### **Conflict of interest**

The authors have no conflict of interest to declare.



## REFERENCES

1. Backstrom KM, Whitman JM, Flynn TW. Lumbar spinal stenosis-diagnosis and management of the aging spine. *Man Ther* 2011;16(4):308-17. (PMID:21367646).
2. Gilbert JW, Martin JC, Wheeler GR, et al. Lumbar stenosis rates in symptomatic patients using weight-bearing and recumbent magnetic resonance imaging. *J Manipulative Physiol Ther* 2011;34(8):557-61. (PMID:21907413).
3. Ishimoto Y, Yoshimura N, Muraki S, et al. Associations between radiographic lumbar spinal stenosis and clinical symptoms in the general population: the Wakayama Spine Study. *Osteoarthritis Cartilage* 2013;21(6):783-8. (PMID:23473979).
4. Battié MC, Jones CA, Schopflocher DP, Hu RW. Health-related quality of life and comorbidities associated with lumbar spinal stenosis. *Spine J* 2012;12(3):189-95. (PMID:22193054).
5. Nalamachu S. An overview of pain management: the clinical efficacy and value of treatment. *Am J Manag Care* 2013;19(14):261-6. (PMID:24494608).
6. Cohen SP, Mao J. Neuropathic pain: mechanisms and their clinical implications. *BMJ* 2014;348:f7656. (PMID:24500412).
7. Suri P, Rainville J, Kalichman L, Katz JN. Does this older adult with lower extremity pain have the clinical syndrome of lumbar spinal stenosis? *JAMA* 2010;304(23):2628-36. (PMID:21156951).
8. Djurasovic M, Glassman SD, Carreon LY, Dimar JR. Contemporary management of symptomatic lumbar spinal stenosis. *Orthop Clin North Am* 2010;41(2):183-91. (PMID:20399357).
9. Takahashi N, Shirado O, Kobayashi K, Mashiko R, Konno S. Classifying patients with lumbar spinal stenosis using pain DETECT: a cross-sectional study. *BMC Fam Pract* 2016;17:90. (PMID:27443164).
10. Orita S, Yamashita T, Ohtori S, et al. Prevalence and Location of Neuropathic Pain in Lumbar Spinal Disorders: Analysis of 1804 Consecutive Patients With Primary Lower Back Pain. *Spine (Phila Pa 1976)* 2016;41(15):1224-31. (PMID:26967122).
11. Kalichman L, Cole R, Kim DH, et al. Spinal stenosis prevalence and association with symptoms: the Framingham Study. *Spine J* 2009;9(7):545-50. (PMID:19398386).
12. Duruöz MT, Özcan E, Ketenci A, Karan A. Development and validation of a functional disability index for chronic low back pain. *J Back Musculoskeletal Rehabil* 2013;26(1):45-54. (PMID:23411648).
13. Unal-Cevik I, Sarioglu-Ay S, Evcik D. A comparison of the DN4 and LANSS questionnaires in the assessment of neuropathic pain: validity and reliability of the Turkish version of DN4. *J Pain* 2010;11(11):1129-35. (PMID:20418179).
14. Zeifang F, Schiltenswolf M, Abel R, Moradi B. Gait analysis does not correlate with clinical and MR imaging parameters in patients with symptomatic lumbar spinal stenosis. *BMC Musculoskelet Disord* 2008;9:89. (PMID:18570636).
15. Kutsal YG, Eyigör S, Dogan A, et al. Neuropathic pain in elderly: a multicenter study. *Turkish Journal of Geriatrics* 2016;19(1):9-18.
16. Konno S, Kikuchi S, Tanaka Y, et al. A diagnostic support tool for lumbar spinal stenosis: a self-administered, self-reported history questionnaire. *BMC Musculoskelet Disord* 2007;8:102. (PMID:17967201).
17. Rainville J, Lopez E. Comparison of radicular symptoms caused by lumbar disc herniation and lumbar spinal stenosis in the elderly. *Spine (Phila Pa 1976)* 2013;38(15):1282-7. (PMID:23462576).
18. Kim YU, Kong YG, Lee J, et al. Clinical symptoms of lumbar spinal stenosis associated with morphological parameters on magnetic resonance images. *Eur Spine J* 2015;24(10):2236-43. (PMID:26292958).
19. Yamashita K, Aono H, Yamasaki R. Clinical classification of patients with lumbar spinal stenosis based on their leg pain syndrome: its correlation with 2-year surgical outcome. *Spine (Phila Pa 1976)* 2007;32(9):980-5. (PMID:17450073).
20. Ozcan-Eksi EE, Yagci I, Erkal H, Demir-Deviren S. Paraspinal muscle denervation and balance impairment in lumbar spinal stenosis. *Muscle Nerve* 2016;53(3):422-30. (PMID:26138076).
21. Bouhassira D, Lantéri-Minet M, Attal N, Laurent B, Touboul C. Prevalence of chronic pain with neuropathic characteristics in the general population. *Pain* 2008;136:380-7. (PMID:17888574).
22. Park SY, An HS, Moon SH, et al. Neuropathic Pain Components in Patients with Lumbar Spinal Stenosis. *Yonsei Med J* 2015;56(4):1044-50. (PMID:26069129).
23. Weber C, Giannadakis C, Rao V, et al. Is There an Association Between Radiological Severity of Lumbar Spinal Stenosis and Disability, Pain, or Surgical Outcome?: A Multicenter Observational Study. *Spine (Phila Pa 1976)* 2016;41(2):E78-83. (PMID:26352747).
24. Sigmundsson FG, Kang XP, Jönsson B, Strömqvist B. Correlation between disability and MRI findings in lumbar spinal stenosis: a prospective study of 109 patients operated on by decompression. *Acta Orthop* 2011;82(2):204-10. (PMID:21434811).



Turkish Journal of Geriatrics  
DOI:10.31086/tjgeri.2018137968  
2018;21 (1):62-69

- Süha SERİN<sup>1</sup>
- Bahadır ÇAĞLAR<sup>2</sup>
- Gökhan YILMAZ<sup>3</sup>
- Alper TORUN<sup>3</sup>
- İsmet PARLAK<sup>3</sup>
- Başak GÖL SERİN<sup>4</sup>

#### CORRESPONDANCE

Süha SERİN  
Urla City Hospital, Emergency Medicine Clinic  
İzmir, Turkey

Phone: 02327354444  
e-mail: suhaserin@gmail.com

Received: 04/01/2018  
Accepted: 05/03/2018

- <sup>1</sup> Urla City Hospital, Emergency Medicine Clinic  
İzmir, Turkey
- <sup>2</sup> Elazığ Training and Research Hospital  
Emergency Medicine  
Elazığ, Turkey
- <sup>3</sup> Bozyaka Training and Research Hospital  
Emergency Medicine  
İzmir, Turkey
- <sup>4</sup> Tepecik Training and Research Hospital  
Infectious Diseases and Clinical Microbiology  
İzmir, Turkey

Presented in: ACEM 2017 (oral presentation)  
9<sup>th</sup> Asian Conference on Emergency Medicine  
& 13<sup>th</sup> Turkish Emergency Medicine Congress  
November 22-25, 2017, Regnum Carya Belek,  
Antalya / Turkey

#### RESEARCH

## MORTALITY FACTORS IN GERIATRICS WITH NON-TRAUMATIC ABDOMINAL PAIN AT THE EMERGENCY DEPARTMENT

### ABSTRACT

**Introduction:** The purpose of this study was to determine the factors affecting mortality in geriatric patients presenting with non-traumatic abdominal pain at the emergency department.

**Materials and Method:** This cross-sectional, retrospective study included patients aged  $\geq 65$  years who presented with non-traumatic abdominal pain at the emergency department. The demographic characteristics, laboratory test results, and in-hospital course of the patients were examined. The relationship between mortality and the data obtained was analyzed at a 95% confidence level and with a p value of  $<0.05$  considered statistically significant. The study was conducted following the approval of the ethics committee.

**Results:** A total of 1110 patients were included and comprised 619 (55.8%) women; 719 (64.8%) were admitted to the general surgery clinic and 211 (19%) were operated on. Of those admitted to the general surgery clinic, 106 (9.5%) cases resulted in mortality. The cut-off value of age for mortality was 73 years [73.6% sensitivity, 40.4% specificity, and receiver operating characteristic - area under the curve (ROC-AUC) 0.581]. A high lactate value (cut-off value 2.4) was associated with mortality (with 78.2% sensitivity, 68.8% specificity, and ROC-AUC 0.786). The most common predictors of mortality were perforation [odds ratio (OR)=20.7], ileus (OR=17.9), high lactate (OR=7.6), and hypocalcemia (OR=3.9).

**Conclusion:** In geriatric patients who presented with abdominal pain at the emergency department, mortality, which increased at the age of over 73 years, was determined mainly by electrolyte and lactate values.

**Keywords:** Geriatrics, Emergencies, Abdominal Pain, Mortality

#### ARAŞTIRMA

## ACİL SERVİSTE TRAVMATİK OLMAYAN KARIN AĞRILI GERİATRİK HASTALARDAKİ MORTALİTE FAKTÖRLERİ

### Öz

**Giriş:** Bu çalışmanın amacı acil servise travmatik nedenli olmayan karın ağrısı ile başvuran geriatric hastalarda mortaliteye etkileyen faktörleri belirlemektir.

**Gereç ve Yöntem:** Bu retrospektif kesitsel çalışma, acil servise travmatik olmayan karın ağrısı ile başvuran 65 yaş ve üstü hastaları kapsamaktadır. Hastaların demografik özellikleri, laboratuvar test sonuçları ve hastane içi seyri incelendi. Mortalite ile elde edilen veriler arasındaki ilişki, %95 güven düzeyinde ve  $p<0.05$  ise istatistiksel olarak anlamlı kabul edildi. Çalışmamız etik kurul onayı ile gerçekleştirildi.

**Bulgular:** Toplam 1110 hasta dahil edildi; hastaların; 619'u (% 55.8) kadındı, 719'u (% 64.8) genel cerrahi kliniğine yatırıldı, 211'i (% 19) ameliyat edildi. Genel cerrahi kliniğine yatanlardan 106 (%9.5) olgu mortalite ile sonlandı. Mortalite yaş ilişkisinin cut-off değeri 73 yaş olarak bulundu [sensitivite % 73.6, spesifisite % 40.4 ve roc analizi - eğri altı alan (ROC-AUC) 0.581]. Laktat yüksekliği (cut-off değeri 2.4) mortalite ile ilişkili bulundu (%78.2 sensitivite, 68.8 % spesifisite ve ROC-AUC) 0.786). Mortaliteye etki eden en sık faktörler; perforasyon [odds oranı (OR)=20.7], ileus (OR 17.9), laktat yüksekliği (OR=7.6) ve hipokalsemi (OR=3.9) olarak bulundu.

**Sonuç:** Acil serviste travmatik nedenli olmayan karın ağrısı ile başvuran geriatric hastalarda mortaliteye etki eden en sık faktörlerin;  $>73$  yaş olmak, elektrolit bozukluğu ve laktat yüksekliği olduğu saptandı.

**Anahtar sözcükler:** Yaşlılık, Aciller, Karın ağrısı, Mortalite



## INTRODUCTION

It was predicted that by 2020, 1 in 6 people in the United States will be in the geriatric age group (1). According to the Turkish Statistical Institute (TSI) data, the population of Turkey in 2013 was 76.481.847, of which 7.7% (5,878,603 people) accounted for the geriatric population. This rate is estimated to be in 10.2% in 2023, 20.8% in 2050, and 27.7% (24.672.343 people) in 2075 (2).

Abdominal pain is one of the most common reasons for visit of geriatric patients at ED, accounting for approximately 2% of the total ED presentations (3). The age-related physiologic conditions make it difficult to evaluate geriatric patients (4,5); as such, the ED has a critical role in the care of such patients because delays in the diagnosis and treatment can lead to increased morbidity and mortality (4,5).

There have been studies suggesting that parameters, such as hypocalcemia and hyperlactatemia, reflected the current clinical picture and increased the in-hospital mortality in the geriatric population (6,7). However, there have not been enough studies showing that these values affected mortality in patients complaining of abdominal pain. The aim of this study was to investigate the independent risk factors affecting mortality in geriatric patients presenting with non-traumatic abdominal pain at the ED.

## MATERIALS AND METHOD

Approval for the study was granted by the local ethics committee. This retrospective cross-sectional study included patients who presented at the Emergency Medicine Clinic of Izmir Bozyaka Training and Research Hospital between January 2013 and December 2015. During the study period, 570,428 patients were admitted to the ED of the hospital and 13% these patients were in the geriatric age group. Patient information was obtained by reviewing electronic files. Patients were included in the study consecutively.

For this study, files of patients aged 65 years and older who admitted to the emergency department and who had diagnosis codes that associated with abdominal pain for the ICD-10 list were analyzed (ICD codes between R10-19). Patients were not included in the study if they were younger than 65 years, presented at the ED due to trauma, had a trauma history in the past week, had no information on file or with missing data, left or were transferred from the hospital on their own request during the diagnosis or treatment phase, and when the acute abdominal pain was determined to be related to a non-abdominal pathology, such as acute myocardial infarction and pneumonia.

The laboratory parameters analyzed in the study were leukocyte count, renal function tests (RFT; i.e., urea and creatinine), liver function tests (LFTs; aspartate aminotransferase and alanine aminotransferase), amylase, total bilirubin, calcium, sodium, potassium, and chlorine. The levels of the electrolytes and the other parameters were taken into consideration. The reference values of the hospital laboratory were considered as the limit for all parameters.

### Statistical analysis

The SPSS 22.0 (IBM Corporation, Armonk, New York, USA) and Medcalc 9 (Acacialan 22, B-8400 Ostend, Belgium) programs were used for data analysis. The normal distribution of the data was tested with the Shapiro–Wilk test and variance homogeneity was analyzed with the Levene test. In the comparison of two independent groups, the independent sample t-test was used with Bootstrap results and the Mann–Whitney U test was used with the Monte Carlo simulation technique. In the comparison of categorical data, the Pearson Chi-Square and the Fisher's Exact tests were used together with the Monte Carlo simulation technique; the column ratios were compared with each other and expressed according to the p-values obtained after Bonferroni correction.

The odds ratio (OR) was used to determine the most important risk factor in the comparison of categorical data. Backward logistic regression analysis was used to determine the cause-and-effect relationship of the categorical response variable with the explanatory variables in the diatom and multinomial categories. Quantitative data were expressed in the tables as mean±standard deviation, median±interquartile range (IQR), and median range (maximum–minimum) values. Categorical data were expressed as n (number) and percentage (%). The data were analyzed at 95% confidence level

and a p value of <0.05 was considered statistically significant.

## RESULTS

The study included a total of 1,110 patients that comprised 619 (55.8%) women and 491 (44.2%) men, with a mean age of 76.2±7.2 years (range, 65–105 years). Clinical diagnoses were made in 783 patients (70.5%). Non-specific abdominal pain was seen in 327 patients who were discharged following ED follow-up. The distribution of the clinical diagnoses are summarized in Table 1.

**Table 1.** Clinical diagnosis distributions of the patients.

Diagnosable	n	%
Bile pathologies	177	22.6
Pancreatic pathologies	162	20.7
Ileus and subileus	155	19.8
Perforation	54	6.9
Hernia	49	6.2
Appendix pathologies	44	5.7
Intra-abdominal abscess	9	1.1
Mesentery ischemia	22	2.8
Diverticulitis	16	2.0
Other diagnoses	95	12.1

Other Diagnoses: Gastrointestinal system (GIS) malignancy, intestinal fistula, intra-abdominal fluid, spleen infarction, GIS bleeding, hematoma, ileal torsion, hydatid cyst, inflammatory bowel disease (IBD), lymphoma, ovarian mass, rectovaginal fistula, urinary stone and volvulus–

In the study population, laboratory tests showed leukocytosis in 53.6%, high RFT in 59.1%, high LFT in 34.5%, hyperamylasemia in 35.4%, hyperbilirubinemia in 22.8%, hypocalcemia in 14.6%, hypercalcemia in 2.6%, hyponatremia in 29.8%, hypernatremia in 3.2%, hypokalemia in 12.3%, hyperkalemia in 3.5%, hypochloremia in

25%, and hyperchloremia in 5.8%. Compared with the patient group who was not hospitalized, the hospitalized patient group had significantly higher rates of high RFT ( $p=0.001$ ), high LFT ( $p<0.001$ ), hyperamylasemia ( $p<0.001$ ), hyponatremia ( $p=0.003$ ), hypokalemia ( $p=0.034$ ), and hypochloremia ( $p=0.019$ ).

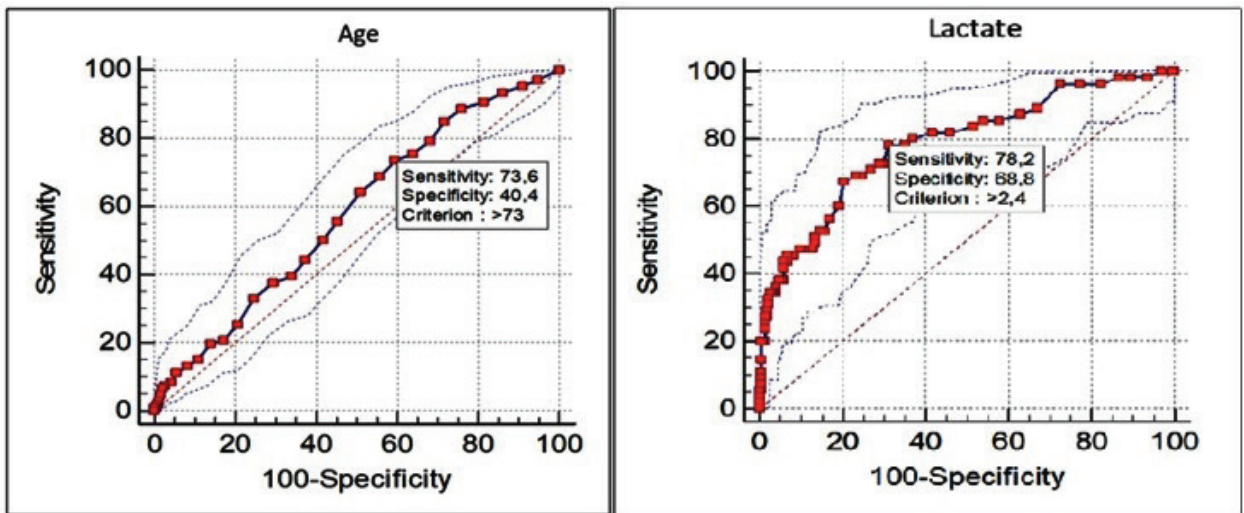




Of the 1,110 patients included in the study, 719 (64.8%) were admitted to the general surgery clinic, of which 211 (19%) were operated on. Of the patients for whom hospitalization was recommended, 83 (7.5%) refused to be hospitalized. The clinical course of 106 (9.5%) patients resulted in mortality. The mean age was 78.2 years in the patient group that resulted in mortality and 76.0 years in the surviving patient group, with a significant difference between the groups ( $t=2.91, p<0.05$ ).

Upon analysis of the 106 patients who died using 95% CI, mortality risk was noted to increase by 1.3 times in patients aged  $\geq 80$  years ( $OR=1.3,$

$95\% CI=0.84-1.91$ ) and by 1.9 times in patients aged  $\geq 73$  years ( $OR=1.9, 95\% CI=1.2-2.9$ ). Therefore, the optimal cut-off value for age-related mortality was determined to be 73 years. At this cut-off value of  $\geq 73$  years (73.6% sensitivity, 40.4% specificity,  $AUC 0.581\pm 0.027, p=0.004$ ), mortality rate was observed to be 3.8 (95%CI, 1.9-7.4) times higher in patients who underwent operation, but it was not significantly affected in patients who did not undergo surgery ( $p<0.001$ ). A lactate value of  $>2.4$  (78.2% sensitivity, 68.8% specificity,  $AUC 0.786\pm 0.035$ ) on presentation was determined to increase the mortality risk by 7.9 times ( $OR=7.9, 95\% CI=3.97-15.76$ ) (Graphic 1).



Graphic 1. The mortality risk for the cut-off value for age is  $> 73$  years & the cut-off value for lactate is  $> 2.4$

Among the diagnoses made, only the diagnosis of perforation was shown to increase mortality rate ( $OR=10, 95\% CI, p<0.001$ ) (Table 2).

Considering the effects of all the non-diagnostic parameters analyzed, mortality was significantly increased in patients who were operated on

( $OR=9.3, 95\% CI=6.1-14.3$ ) and in those with high RFT level ( $OR=2.1, 95\% CI=1.3-3.2$ ); hypocalcemia ( $OR=2.9, 95\% CI=1.8-4.6$ ); hyponatremia ( $OR=1.6, 95\% CI=1.03-2.35$ ); hypokalemia ( $OR=2.9, 95\% CI=1.8-4.7$ ); and hypochloremia ( $OR=2.14, 95\% CI=1.4-3.2$ ) (Table 3).

**Table 2.** The predictivite effect of the diagnoses on mortality.

Diagnosis	Survival		Odds Ratio (95% CI)	p value
	Alive Number of patients n (%)	Exitus Number of patients n (%)		
Appendix pathologies	43 (5.8)	1 (1.0)	0.15 (0.02-1.15)	<b>&lt;0.001</b>
Other	122 (16.4)	20 (19.0)	1.25 (0.7-2)	
Hernia	46 (6.2)	3 (2.9)	0.45 (0.13-1.47)	
Ileus and subileus	131 (17.6)	24 (22.9)	1.4 (0.8-2.5)	
Pancreas pathologies	157 (21.1)	5 (4.8)	<b>0.18 (0.07-0.46)</b>	
Perforation	26 (3.5)	28 (26.7)	<b>10 (5.6-17.8)</b>	
Bile pathologies	157 (21.1)	20 (19.0)	0.8 (0.5-1.5)	
Examination + Follow up	62 (8.3)	4 (3.8)	0.4 (0.15-1.22)	

Pearson Chi-Square Test (Monte Carlo) - Fisher Exact Test (Exact)

**Table 3.** Predictivite effect of clinic and laboratory parameters on mortality.

		Survival		Odds Ratio (95% CI)	p value
		Alive Number of patients n (%)	Exitus Number of patients n (%)		
Operation	Absent	/ 858 (85.5) /	41 (38.7) /	<b>9.3 (6.1 - 14.3)</b>	<b>&lt;0.001</b>
	Present	146 (14.5)	65 (61.3)		
RFT level	Absent	/ 426 (42.4) /	28 (26.4) /	<b>2.1 (1.3 - 3.2)</b>	<b>&lt;0.001</b>
	Present	578 (57.6)	78 (73.6)		
LFT level	Absent	/ 661 (65.8) /	66 (62.3) /	1.2 (0. - 1.767)	0.454
	Present	343 (34.2)	40 (37.7)		
Amylase level	Absent	/ 651 (64.8) /	66 (62.3) /	1.1 (0.7 - 1.7)	0.595
	Present	353 (35.2)	40 (37.7)		
Hypocalcemia	Absent	/ 874 (87.1) /	74 (69.8) /	<b>2.9 (1.8 - 4.6)</b>	<b>&lt;0.001</b>
	Present	130 (12.9)	32 (30.2)		
Hypercalcemia	Absent	/ 978 (97.4) /	103 (97.2) /	1.1 (0.33 - 3.68)	0.752
	Present	26 (2.6)	3 (2.8)		
Hyponatremia	Absent	/ 714 (71.1) /	65 (61.3) /	<b>1.6 (1.03 - 2.35)</b>	<b>0.044</b>
	Present	290 (28.9)	41 (38.7)		
Hypernatremia	Absent	/ 973 (96.9) /	101 (95.3) /	1.5 (0.59 - 4.1)	0.38
	Present	31 (3.1)	5 (4.7)		
Hypopotassemia	Absent	/ 895 (89.1) /	78 (73.6) /	<b>2.9 (1.8 - 4.7)</b>	<b>&lt;0.001</b>
	Present	109 (10.9)	28 (26.4)		
Hyperpotassemia	Absent	/ 969 (96.5) /	102 (96.2) /	1.1 (0.38 - 3.1)	0.783
	Present	35 (3.5)	4 (3.8)		
Hypochloremia	Absent	/ 768 (76.5) /	64 (60.4) /	<b>2.14 (1.4 - 3.2)</b>	<b>&lt;0.001</b>
	Present	236 (23.5)	42 (39.6)		
Hyperchloremia	Absent	/ 950 (94.6) /	96 (90.6) /	1.8 (0.9 - 3.7)	0.12
	Present	54 (5.4)	10 (9.4)		

Pearson Chi-Square Test (Monte Carlo) - Fisher Exact Test (Exact) C.I: Confidence Interval



In this study, all parameters were analyzed using multiple logistic regression. After exclusion of the confounding effects, the following five basic conditions were detected to increase the mortality risk; these included surgery (OR 2.53, 95% CI 1.03–6.22); the diagnoses of perforation (OR 20.7, 95% CI

1.72–249.51) and ileus–subileus (OR 17.96, 95% CI 1.91–169.09); and laboratory results on presentation at the ED showing hypocalcemia (OR 3.92, 95% CI 1.49–10.33) and lactate >2.4 (OR 7.67, 95% CI 3.04–19.32) (Table 4).

**Table 4.** Factors affecting mortality when confounding effects are excluded.

Independent Variables	B±sd	p value	Odds Ratio (95% CI)
Undergoing surgery	-0.292±0.459	<b>0.043</b>	2.53 (1.03 - 6.22)
Lactate (> 2.4)	-2.037±0.472	<b>&lt;0.001</b>	7.67 (3.04 - 19.32)
Ileus and Subileus	2.888±1.144	<b>0.012</b>	17.96 (1.91 - 169.09)
Perforation	3.030±1.270	<b>0.017</b>	20.70 (1.72 - 249.51)
Hypocalcemia	-1.367±0.0494	<b>0.006</b>	3.92 (1.49 - 10.33)

**Dependent Variable: Mortality Predicted Survivals=95% Predicted Ex=95% Predicted:%88.1 P Model<0.001**

*Multiple Logistic Regression (Method=Backward Stepwise (Wald))*

*C.I.: Confidence Interval B: Regression coefficients Sd: Standard Deviation*

## DISCUSSION

Abdominal pain is one of the most difficult symptoms to be investigated and diagnosed in the geriatric age group (8). In previous studies, rates of hospitalization, duration of hospitalization, need for surgery, and mortality rates have been found to be relatively high in the geriatric age group with abdominal pain (9-12). Approximately 20% of patients in this age group undergo an invasive intervention or surgery (13). In addition, these patients may present with atypical or delayed abdominal pain or extra-abdominal pathologies (14,15). For example, one study showed that the classic symptoms of perforated appendicitis were limited to only 17% in the geriatric age group (16). Inadequate diagnosis or misdiagnosis increases the morbidity and mortality rates significantly (17). These patients are not only exposed to more aggressive interventions and investigations, but they also tend to be cured less than younger patients. Cumulatively, patients in this age group create a higher economic burden.

The most common pathology of the patients in this study was biliary (22.6%). In a study on 131 geriatric patients, the most common diagnosis was biliary disease in men and non-specific abdominal pain in women. In a study conducted by Catherine et al. on geriatric patients who presented with abdominal pain at the ED, infection (19.2%) was the most common diagnosis, whereas biliary pathology accounted for only 5.9% of the diagnoses (18). In the present study, 19% of the patients were operated on.

In the study by Catherine et al, the mortality rate was found to be 5.3% (18). There were studies showing mortality rates as high as 40% in patients over 80 years of age who presented with abdominal pain (13). In the present study, the mortality rate was 9.5%.

In this study, mortality rate was measured based on in-hospital data only; this fact suggested that the actual mortality rate can be higher. In the study by Gardner et al on 131 geriatric patients, mortality

within three months following admission to the ED occurred in 19% of men and in 1% of women. A study performed on 132 patients over 80 years of age and who presented with acute abdominal pain showed an in-hospital mortality rate of 17%. Of these patients, 35 needed operations, and the mortality rate was 34% in those who underwent surgery (12). Similarly, in the present study, operation was one of the independent variables that affected mortality. This high risk of perioperative mortality was probably due to the increased number of comorbid diseases in the geriatric population and the varying age-related physiologic characteristics that make postoperative care difficult (19,20).

Studies have shown that lactate level, which is one of the important indicators of hypoperfusion, predicted the prognosis in some adult age groups. The lactate level is also known to be associated with mortality in the geriatric population; in fact, various studies showed that increased lactate levels increased the mortality rate by 2–20 times in the geriatric group (7,21,22). There were studies showing that venous lactate level, compared with conventional vital sign monitoring, was a stronger predictor of mortality in a geriatric group that presented with trauma (22). In addition, several studies showed the value of lactate levels in predicting mortality in geriatric patients in septic shock, those who underwent trauma laparotomy, and those who needed intensive care (7,23). In the present study, a lactate level of  $>2.4$  was shown to predict mortality. However, to the best of our knowledge, the number of published studies that analyzed the relationship between lactate and mortality in geriatric patients presenting with abdominal pain is limited. Further studies applied in this context will ensure clarification of the subject.

Several studies have shown that hypocalcemia was an important prognostic factor in acute pancreatitis. In addition, recent studies have shown that patients with comorbidities associated with hypocalcemia had increased mortality rates

upon presentation at the ED and that correction of hypocalcemia in critical care patients reduced the mortality risk (24,25). However, there have not been enough studies showing the relationship between hypocalcemia and mortality in a geriatric population presenting with abdominal pain. In this study, hypocalcemia was one of the independent variables that predicted mortality.

Although factors, such as high RFT, hyponatremia, hypokalemia, and hypochloremia increased mortality in the univariate analysis, these were not determined to independently increase mortality in the multivariate analysis. There is a limited number of published studies that investigated the association of electrolyte disturbances with mortality in geriatric patients presenting with abdominal pain.

On investigation of geriatric patients presenting with abdominal pain at the ED, the factors affecting mortality were found to be laboratory test results of elevated lactate levels and hypocalcemia; diagnoses of perforation and ileus–subileus; and surgical intervention. Mortality significantly increased in patients aged  $\geq 73$  years. In the management of geriatric patients at the ED, attention must be paid to these factors that can increase mortality.

#### **Limitations of the study**

In the present study, only in-hospital mortality was evaluated, and the possible morbidity and post-discharge mortality could not be analyzed. Future studies on out-of-hospital mortality rate in the geriatric age group would be of particular contribution.

#### **ACKNOWLEDGMENTS**

We clearly declare that there are no conflicts of interest. SS, BC, and AT collected the data. SS, GY, BGS and IP analyzed the data.



## REFERENCES

1. US Bureau of the census. Statistical abstract of the United States, 2012; ed:131, Washington DC, 2011. [Internet] Available from: <https://www2.census.gov/library/publications/2011/compendia/statab/131ed/2012-statab.pdf>. Accessed:01.11.2017.
2. Turkish Statistical Institute. Statistics by Theme; Population Projections; Statistical Tables and Dynamic Search; Statistical Tables; Population Projections and Estimations; Population of Selected Age Groups by Scenarios. (In Turkish) [Internet] Available from: [http://www.turkstat.gov.tr/PreTablo.do?alt\\_id=1027](http://www.turkstat.gov.tr/PreTablo.do?alt_id=1027). Accessed:01.11.2017.
3. Fagbohun CF, Toy EC, Baker B. The evaluation of acute abdominal pain in the elderly patient. *Prim Care Update Ob/Gyns* 1999;6(6):181-5.
4. Mion LC, Palmer RM, Anetzberger GJ, et al. Establishing a case finding and referral system for at-risk older individuals in the emergency department setting: the SIGNET model. *J Am Geriatr Soc* 2001;49:1379-86. (PMID:11890500).
5. Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med* 2002;39:238-47. (PMID:11867975).
6. Chang WT, Radin B, McCurdy MT. Calcium, magnesium, and phosphate abnormalities in the emergency department. *Emerg Med Clin North Am* 2014;32(2):349-66. (PMID:24766937).
7. Joseph B, Zangbar B, Pandit V, et al. Mortality after trauma laparotomy in geriatric patients. *J Surg Res* 2014;190(2):662-6. (PMID:24582068).
8. McNamara RM, Rousseau E, Sanders AB. Geriatric emergency medicine: a survey of practice in emergency physicians. *Ann Emerg Med* 1992;21:796-801. (PMID:1610035).
9. Bugliosi TF, Meloy TD, Vukov LF. Acute abdominal pain in the elderly. *Ann Emerg Med* 1990;19:1383-6. (PMID:2240749).
10. Kizer KW, Vassar MJ. Emergency department diagnosis of abdominal disorders in the elderly. *Am J Emerg Med* 1998;16:357-62. (PMID:9672450).
11. Lewis LM, Banet GA, Blanda M, et al. Etiology and clinical course of abdominal pain in senior patients: a prospective, multicenter study. *J Gerontol A Biol Sci Med Sci* 2005;60:1071-6. (PMID:16127115).
12. vanGeloven AA, Biesheuvel TH, Luitse JS, et al. Hospital admissions of patients aged over 80 with acute abdominal complaints. *Eur J Surg* 2000;166:866-71. (PMID:11097153).
13. Magidson PD, Martinez JP. Abdominal pain in the geriatric patient. *Emerg Med Clin North Am* 2016;34(3):559-74. (PMID:27475015).
14. Ragsdale L, Southerland L. Acute abdominal pain in the older adult. *Emerg Med Clin North Am* 2011;29(2):429-48. (PMID:21515186).
15. Gardner RL, Almeida R, Maselli JH et al. Does gender influence emergency department management and outcomes in geriatric abdominal pain? *J Emerg Med* 2010;39(3):275-81. (PMID:18993017).
16. Paranjape C, Dalia S, Pan J, et al. Appendicitis in the elderly: a change in the laparoscopic era. *Surg Endosc* 2007;21(5):777-81. (PMID:17285390).
17. Fenyo G. Acute abdominal disease in the elderly: experience from two series in Stockholm. *Am J Surg* 1982;143:751-4. (PMID:7091511).
18. Marco CA, Schoenfeld CN, Keyl PM, et al. Abdominal pain in geriatric emergency patients: variables associate with adverse outcomes. *Acad Emerg Med* 1998; 5:1163-8. (PMID:9864129).
19. Aubrun F, Gazon M, Schoeffler M, et al. Evaluation of perioperative risk in elderly patients. *Minerva Anesthesiol* 2012;78(5):605-18. (PMID:22269928).
20. Desserud KF, Veen T, Søreide K. Emergency general surgery in the geriatric patient. *Br J Surg* 2016;103(2):e52-61. (PMID:26620724).
21. Julián-Jiménez A, González-Del-Castillo J, Martínez-Ortiz-de-Zárate M, et al. Short-term prognostic factors in the elderly patients seen in emergency departments due to infections. *Enferm Infecc Microbiol Clin* 2017;35(4):214-219. (PMID:26702902).
22. Salottolo KM, Mains CW, Offner PJ, et al. A retrospective analysis of geriatric trauma patients: venous lactate is a better predictor of mortality than traditional vital signs. *Scand J Trauma Resusc Emerg Med* 2013;21:7. (PMID:23410202).
23. Mock K, Keeley J, Moazzez A, et al. Predictors of mortality in trauma patients aged 80 years or older. *Am Surg* 2016;82(10):926-29. (PMID:27779975).
24. Sauter TC, Lindner G, Ahmad SS, et al. Calcium disorders in the emergency department: independent risk factors for mortality. *PLoS One* 2015;10(7): e0132788. (PMID:26172117).
25. Miura S, Yoshihisa A, Takiguchi M, et al. Association of hypocalcemia with mortality in hospitalized patients with heart failure and chronic kidney disease. *J Card Fail* 2015;21(8):621-7. (PMID:25982827).



Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137969  
2018;21 (1):70-80

- Hüseyin Onur AYDIN<sup>1</sup>
- Tefvik AVCI<sup>1</sup>
- Tugan TEZCANER<sup>1</sup>
- Erdal KARAGÜLLE<sup>2</sup>
- Sedat YILDIRIM<sup>1</sup>

#### CORRESPONDANCE

Hüseyin Onur AYDIN  
Başkent University, Faculty of Medicine  
Dept of General Surgery  
Ankara, Turkey

Phone: 03122030520  
Fax: 03122030521  
e-mail: dronuraydin@hotmail.com

Received: 21/01/2018  
Accepted: 06/03/2018

<sup>1</sup> Başkent University, Faculty of Medicine  
Department of General Surgery  
Ankara, Turkey

<sup>2</sup> Başkent University, Faculty of Medicine  
Department of General Surgery  
Konya, Turkey

#### RESEARCH

## EFFECTS OF LOWER GASTROINTESTINAL TRACT SURGERY ON SURVIVAL IN ELDERLY AND OCTOGENARIAN PATIENTS

### ABSTRACT

**Introduction:** Life expectancy has significantly increased in the last decade. The decision to perform surgery has always been challenging in elderly patients. We aimed to evaluate outcomes in patients who underwent surgery for lower gastrointestinal tract diseases and investigate factors influencing morbidity and mortality, particularly in octogenarian patients, and the effects of age on prognosis and survival in the postoperative period.

**Materials and Method:** This study included patients aged  $\geq 70$  years who underwent lower gastrointestinal tract surgery; patients were divided into three groups as 70–75 years, 75–79 years, and  $\geq 80$  years. Age, gender, type of surgery, ASA score, length of hospital stay, morbidity, 30-day mortality, and overall survival were evaluated.

**Results:** The surgery was performed to 598 patients due to lower gastrointestinal tract diseases. There was a significant increase in the ASA score with increasing age (Chi-square=35.472;  $p < 0.001$ ). The survival rate was significantly higher in patients with malignancies than in those with benign diseases, and in patients who underwent elective surgery than in those who underwent emergency surgery ( $p < 0.001$ ). When patients were examined according to age groups, the overall survival was similar across groups ( $p = 0.217$ ).

**Conclusion:** There was no significant difference between octogenarian and younger patients for complications and survival. Thus, planned surgical interventions in elderly patients will not negatively affect survival and surgical interventions and can be safely performed in these patients.

**Keywords:** Life expectancy; Lower gastrointestinal tract; Aged, 80 and over; Neoplasms; Elective surgical procedures

#### ARAŞTIRMA

## YAŞLI VE OKTOGENARIAN HASTALARDA ALT GASTROİNTESTİNAL SİSTEM CERRAHİSİNİN SAĞKALIMA ETKİLERİ

### Öz

**Giriş:** Son on yılda ortalama yaşam süresi anlamlı derecede arttı. Yaşlı hastalarda cerrahi girişim kararı ise her zaman zorlu olmuştur. Alt gastrointestinal sistem hastalıkları nedeniyle cerrahi uygulanan hastaların sonuçlarını değerlendirmek, özellikle oktogenarian hastalarda morbidite ve mortaliteyi etkileyen faktörleri ve yaşın postoperatif dönemde prognoz ve sağkalım üzerindeki etkilerini araştırmayı amaçladık.

**Gereç ve Yöntem:** Çalışmaya alt gastrointestinal sistem cerrahisi geçirmiş 70 yaş ve üstü hastalar dahil edildi; hastalar 70-75 yaş, 75-79 yaş ve  $\geq 80$  yaş olmak üzere üç gruba ayrıldı. Yaş, cinsiyet, cerrahi tipi, ASA skoru, hastanede kalış süresi, morbidite, 30 günlük mortalite ve genel sağkalım değerlendirildi.

**Bulgular:** 598 hastaya alt gastrointestinal sistem hastalıkları nedeniyle cerrahi uygulandı. ASA skorunda yaşla birlikte anlamlı bir artış vardı ( $p < 0.001$ ). Malign hastalık nedeniyle ameliyat edilen hastalarda benign nedenlerle ameliyat edilen hastalara göre ve elektif cerrahi uygulanan hastalarda acil cerrahi uygulanan hastalara göre sağkalım oranı anlamlı derecede yüksekti ( $p < 0.001$ ). Hastalar yaş gruplarına göre incelendiğinde genel sağ kalım gruplar arasında benzerdi ( $p = 0.217$ ).

**Sonuç:** Oktogenarian ve daha genç hastalar arasında komplikasyon ve sağkalım açısından anlamlı farklılık olmadığı görüldü. Bu nedenle, yaşlı hastalarda planlanan cerrahi müdahaleler sağkalımı olumsuz yönde etkilememektedir ve bu hastalarda cerrahi müdahaleler güvenle yapılabilir.

**Anahtar sözcükler:** Yaşam beklentisi; Alt gastrointestinal sistem; Yaşlı, 80 yaş ve üzeri; Neoplaziler, Elektif cerrahi prosedürler



## INTRODUCTION

Life expectancy has significantly increased in the last decade. An important demographic increase has been observed in the elderly population because of decreasing birth rate and increasing life time (1). Therefore, clinicians around the world have started coming across elderly patients more frequently (2). According to the World Health Organization (WHO) data, there are approximately 125 million octogenarian people in the world (3). This demographic increase has been contributed by decreasing birth rates, improved healthcare services, advances in intensive care medicine, improvements in technical information and capabilities, and technological advancements. The growing elderly population has necessitated the evaluation of outcomes in all branches of surgery.

The decision to perform surgery has always been challenging in elderly patients because of limited life expectancy. Previous studies reported higher rate of postoperative complications in elderly patients than in younger patients because the rate of comorbidities was higher in elderly patients, they more often required emergency procedures, and physiologic problems arose with increasing age (4). Recent studies reported that abdominal surgery can be safely performed in patients aged  $\geq 70$  years (5,6). The efficacy of surgical interventions in these patients should be maximized and surgery should not interfere with the possibility of curing the disease.

The purpose in our study was to evaluate the outcomes in patients who underwent surgery due to lower gastrointestinal tract diseases, and to investigate the factors influencing morbidity and mortality in patients and the effects of age on prognosis and survival in the postoperative period. In this evaluation, we aimed to evaluate the outcomes of lower GIT surgery in a large sample of elderly patients by employing no restrictions in patient selection.

## MATERIALS AND METHOD

This study included patients aged  $\geq 70$  years and who underwent emergency/elective laparoscopic/open lower GIT surgery for malignant and benign jejunal, ileal, and colorectal diseases between January 2000 and June 2017. The patients were divided into three groups according to age as patients aged 70–74 years, those aged 75–79 years, and  $\geq 80$  years. Age, gender, type of surgery, ASA score, length of hospital stay, morbidity, 30-day mortality, and overall survival were evaluated. Patients with no accessible follow-up data were excluded from the study. The ASA score and pathologic stage in malignancy were not used as exclusion criteria in the study.

All patients were evaluated preoperatively by an anesthesiologist with respect to the presence of comorbidities, medication use, and physical performance. The American Society of Anesthesiologists (ASA) physical status score was recorded. Preoperative preparation was conducted by multidisciplinary evaluation of patients with an ASA score of  $\geq 3$ . Comorbidities of patients who were included in the study were evaluated by using the Charlson Comorbidity Index (7). Antibiotic and venous thrombosis prophylaxis was administered to all patients, according to the previously published guidelines (8,9). Complications observed during the postoperative period were recorded according to Clavien–Dindo Classification (10).

This study was approved by institutional review board. The surgical intervention to be performed and risks were explained to all patients, and informed consent was obtained from all patients preoperatively.

### Statistical analysis

SPSS 15.0 (SPSS Inc., Chicago, Illinois) software was used for statistical analysis. Crosstab analysis was used for evaluating the relationship between age group and categorical variables, and the Chi-square value was calculated. Survival analysis was used for evaluating the effect of age group and other categorical variables on survival, and Kaplan–Meier estimates were calculated. Log Rank (Mantel–

Cox), Breslow (Generalized Wilcoxon), Tarone-Ware statistics were used. K-independent Kruskal–Wallis was used for comparison of data without normal distribution based on the age group, and one-way analysis of variance was used for evaluating data with normal distribution. Spearman correlation coefficient was used for evaluating the significance of relationship between two continuous variables without normal distribution. All statistical analyses were performed at the significance level of 0.05.

## RESULTS

In total, 598 patients aged  $\geq 70$  years underwent surgery for lower GIT diseases between January 2000 and June 2017. 294 patients (49.7%) were male and 304 patients (50.8%) were female. It was detected that surgical treatments were more frequently performed in female patients with increasing age (Chi-square=8.460;  $p=0.015$ ). Surgery was performed on 359 patients (60%) due to malignant causes, 280 patients (46.8%) underwent emergency surgery, and 497 patients (83.1%) underwent laparoscopic surgery. The most common diagnosis in the group was colon cancer ( $p=0.022$ ). It was observed that ASA score of 2 was more frequent with the rate of 68.7% in the 70–74 years age group and 63.1% in the 75–79 years age group. The ASA score was higher in octogenarian patients. It was detected that the increase in the ASA score with age in groups was statistically significant (Chi-square=35.472;  $p<0.001$ ); however, the Charlson Comorbidity Index showed no difference between the groups (Chi-square=2.670;  $p=0.263$ ) (Table 1).

The most common performed surgical procedure was right hemicolectomy ( $p=0.043$ ). The total number of cases which developed complications in the groups was 161 (26.9%). There was no statistical difference between the groups with regard to Clavien–Dindo Classification score and postoperative complications (Chi-square=16.533,  $p=0.085$  and Chi-square=7.263,  $p=0.297$ , respectively). Conversely, wound-site infection (33.3%) was more common in the 70–74 years age group, pneumonia (28.6%) was more common in the 75–79 years age group, and sepsis (28.1%) was

more common in octogenarians. In the first 30 days after the surgery, postoperative mortality occurred in 14 patients (28%) in the 70–74 years age group, 10 patients (20%) in the 75–79 years age group, and 26 patients (52%) in the octogenarian patient group. There was no statistically significant difference between the groups, although 30-day mortality rate was higher in octogenarian patients, as shown in Table 2 ( $p=0.120$ ).

During the evaluation before the allocation of patients into the age groups, survival was significantly higher in patients with malignant diseases than in those with benign diseases and in patients underwent elective surgery than in those underwent emergency surgery ( $p<0.001$ ). There was no statistical difference in survival rates between patients underwent open surgical procedures and those underwent laparoscopic procedures ( $p=0.084$ ). It was observed that the higher ASA score had a negative effect on survival. There was a significant decrease in survival rate with higher ASA scores ( $p<0.001$ ), whereas there was no relationship between Clavien–Dindo Classification and survival ( $p=0.837$ ) (Figure 1). When the patients were examined by dividing them into age groups, the overall survival rate was similar across the groups ( $p=0.217$ ) (Table 3).

In the subgroup analysis which was performed due to the fact that patients with malign diseases had longer life expectancy, the life expectancy of octogenarian patients who underwent surgery because of malign diseases was found significantly high ( $p<0.001$ ) (Figure 2). 297 patients (87.2 %) underwent surgery due to malign diseases under elective conditions. On the other hand, it was observed that 218 patients (91.2 %) underwent surgery due to benign diseases under emergency conditions ( $p<0.001$ ). The ASA score of patients who underwent surgery due to both malign and benign diseases was found similar, and the most frequent ASA score was calculated 2 ( $p<0.001$ ). Although Clavien–Dindo Classification grade 1 complications were observed more frequent, the postoperative sepsis was observed more common in patients who underwent surgery due to benign diseases ( $p<0.001$ ) (Table 4).



**Table 1.** Findings according to age groups [N (%)].

Variable		Age group			Total	Statistical test
		70–74	75–79	≥80		
Gender	Male	121 (56.5)	86 (48.0)	87 (42.4)	294 (49.2)	Chi-square=8.460 p=0.015
	Female	<b>93 (43.5)</b>	<b>93 (52.0)</b>	<b>118 (57.6)</b>	<b>304 (50.8)</b>	
ASA score	1	7 (3.3)	2 (1.1)	0 (0.0)	9 (1.5)	Chi-square=35.472 p<0.001
	2	<b>147 (68.7)</b>	<b>113 (63.1)</b>	<b>101 (49.3)</b>	<b>361 (60.4)</b>	
	3	54 (25.2)	55 (30.7)	100 (48.8)	209 (34.9)	
	4	6 (2.8)	9 (5.0)	4 (2.0)	19 (3.2)	
Charlson Comorbidity Index	Mean (SD)	6.7 (±1.69)	6.41 (±1.65)	6.57 (±1.72)		Chi-square=2.670 p=0.263
Diagnosis	Acute appendicitis	28 (13.1)	23 (12.8)	18 (8.8)	69 (11.5)	Chi-square=29.293 p=0.022
	Bride ileus	17 (7.9)	18 (10.1)	19 (9.3)	54 (9.0)	
	Diverticular disease	15 (7.0)	7 (3.9)	13 (6.3)	35 (5.9)	
	Colon cancer	<b>89 (41.6)</b>	<b>66 (36.9)</b>	<b>93 (45.4)</b>	<b>248 (41.5)</b>	
	Mesenteric vascular Occlusion	22 (10.3)	15 (8.4)	15 (7.3)	52 (8.7)	
	Perforation	2 (0.9)	7 (3.9)	1 (0.5)	10 (1.7)	
	Rectal cancer	34 (15.9)	36 (20.1)	25 (12.2)	95 (15.9)	
	Strangulated hernia	5 (2.3)	5 (2.8)	13 (6.3)	23 (3.8)	
	Volvulus	2 (0.9)	2 (1.1)	8 (3.9)	12 (2.0)	
Malignant/Benign	Malignant	132 (61.7)	111 (62.0)	116 (56.6)	359 (60.0)	Chi-square=1,550 p=0.461
	Benign	82 (38.3)	68 (38.0)	89 (43.4)	239 (40.0)	
Emergency/Elective	Emergency	93 (43.5)	82 (45.8)	105 (51.2)	280 (46.8)	Chi-square=2,638 p=0.267
	Elective	121 (56.5)	97 (54.2)	100 (48.8)	318 (53.2)	
Open/Laparoscopic	Open	171 (79.9)	152 (84.9)	174 (84.9)	497 (83.1)	Chi-square=2,437 p=0.296
	Laparoscopic	43 (20.1)	27 (15.1)	31 (15.1)	101 (16.9)	
Length of hospital stay (days)	Median (min–max)	5 (1–65)	5 (1–96)	6 (1–81)		Chi-square=3,892 p=0.143

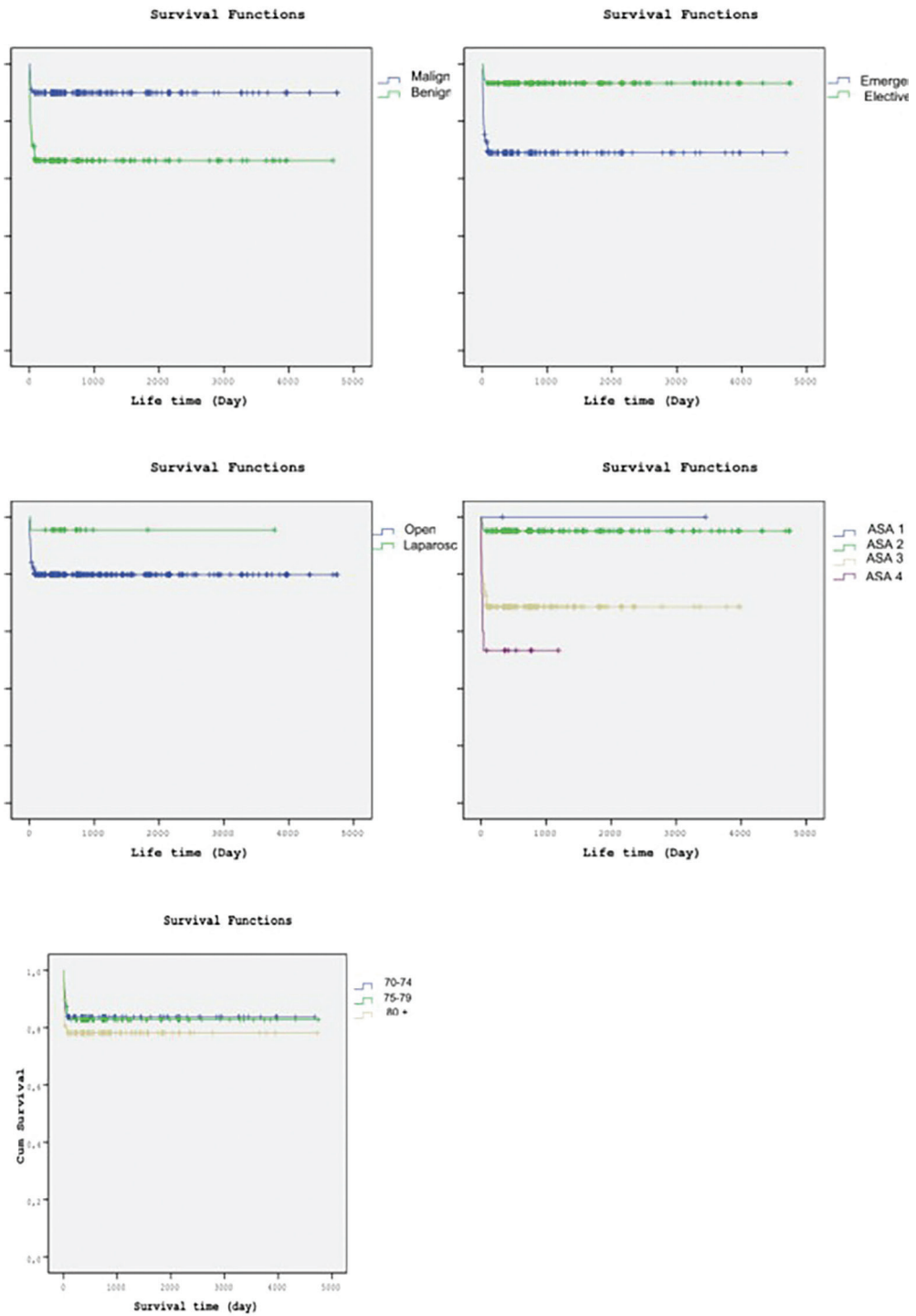


Figure 1. Factors affecting the survival.

**Table 2.** Postoperative findings [N (%)].

Variable		Age group			Total	Statistical test
		70–74	75–79	≥80		
Type of surgery	Abdominoperineal resection	5 (2.3)	8 (4.5)	4 (2.0)	17 (2.8)	Chi-square=26.832 p=0.043
	Left hemicolectomy	43 (20.1)	30 (16.8)	35 (17.1)	108 (18.1)	
	Appendectomy	51 (23.8)	34 (19.0)	28 (13.7)	113 (18.9)	
	Lysis of adhesions	11 (5.1)	11 (6.1)	14 (6.8)	36 (6.0)	
	Subtotal colectomy	7 (3.3)	1 (0.6)	8 (3.9)	16 (2.7)	
	Low anterior resection	34 (15.9)	31 (17.3)	22 (10.7)	87 (14.5)	
	Right hemicolectomy	<b>36 (16.8)</b>	<b>38 (21.2)</b>	<b>61 (29.8)</b>	<b>135 (22.6)</b>	
	Segmental small bowel resection	24 (11.2)	24 (13.4)	28 (13.7)	76 (12.7)	
	Segmental colon resection	3 (1.4)	2 (1.1)	5 (2.4)	10 (1.7)	
Clavien–Dindo Classification	0	162 (75.7)	125 (69.8)	133 (64.9)	420 (70.2)	Chi-square=16.533 p=0.085
	1	4 (1.9)	6 (3.4)	7 (3.4)	17 (2.8)	
	2	14 (6.5)	19 (10.6)	23 (11.2)	56 (9.4)	
	3	14 (6.5)	9 (5.0)	6 (2.9)	29 (4.8)	
	4	4 (1.9)	2 (1.1)	9 (4.4)	15 (2.5)	
	5	16 (7.5)	18 (10.1)	27 (13.2)	61 (10.2)	
Complication	Wound site infection	16 (33.3)	12 (24.5)	16 (25.0)	44 (27.3)	Chi-square=7.263 p=0.297
	Pneumonia	7 (14.6)	14 (28.6)	14 (21.9)	35 (21.7)	
	Sepsis	8 (16.7)	7 (14.3)	18 (28.1)	33 (20.5)	
	Other	17 (35.4)	16 (32.7)	16 (25.0)	49 (30.4)	
Mortality (30 days)	30 days	14 (28%)	10 (20%)	26 (52%)	50 (8.3%)	F=2.215; p=0.120

## DISCUSSION

Factors influencing morbidity and mortality following lower GIT surgery in patients aged ≥70 years were investigated in the present study. Moreover, the 30-day mortality rate and overall survival were compared. In the evaluation conducted

without considering the type of surgery, it was detected that there was no relationship between age and overall survival postoperatively. On the other hand, the morbidity rate was lower, and the mortality rate was higher with increasing age. Our data showed that, there was no negative effect of abdominal surgery on survival in elderly patients.

**Table 3.** Overall survival.

Age group (years)	Mean (days)	Standart error	Statistical test (p value)
70–74	3918,337	168,960	Log Rank (Mantel–Cox): Chi-square=2.747 (0.253) Breslow (Generalized Wilcoxon): Chi-square=3.379 (0.185) Tarone-Ware: Chi-square=3.057 (0.217)
75–79	3937,173	168,709	
≥80	3638,936	178,365	
Overall	3840,681	100,874	

Studies conducted in previous years reported that abdominal surgical procedures performed particularly on octogenarian patients were related to high morbidity and mortality (1,11). However, these studies included a heterogeneous group of surgical patients who underwent various orthopedic, vascular, and thoracic procedures. Recent studies reported that morbidity and mortality were not high in octogenarian patients who underwent abdominal surgery (4). In our study as it was reported in other studies, the risk of major complications after abdominal surgeries performed in octogenarian patients was similar to younger patients, with an increase in minor complications (6).

There was no mortality occurred in patients with ASA score of 1. The patients with high ASA score were associated with high mortality underwent various types of surgery (12,13). Also, high ASA score in elderly patients undergoing abdominal surgery is associated with the higher mortality rate consistent with the present study (6). Increase in the rate of comorbidities with age and decrease in the ability of coping with increased stress due to limited physiological reserves can be suggested as possible causes (14). It was observed that there was no significant change in complication rates with increasing patient age. Complications, such as anastomotic leakage, perforation, and intra-abdominal hemorrhage, occurred less often among the age groups, whereas complications, such as wound-site infection, pneumonia, and sepsis, were observed more frequently. Previous studies reported that the prevalence of sepsis increases

with age (15). It was considered that sepsis might be developed more frequently in octogenarian patients as emergency procedures were performed more frequently in this patient group. Also, the conditions with systemic effects, such as obstruction and perforation, were observed more frequently in patients undergoing emergency surgery. Pneumonia is another common complication that occurs as a result of the decrease in the respiratory muscle mass and pulmonary functional capacity (16). Moreover, it could be considered that more frequent performance of open surgery in patients who were included in the study might cause may have caused more frequent observation of wound-site infection. In particular, emergency surgical interventions and open surgery methods were associated with increased wound-site infections (17).

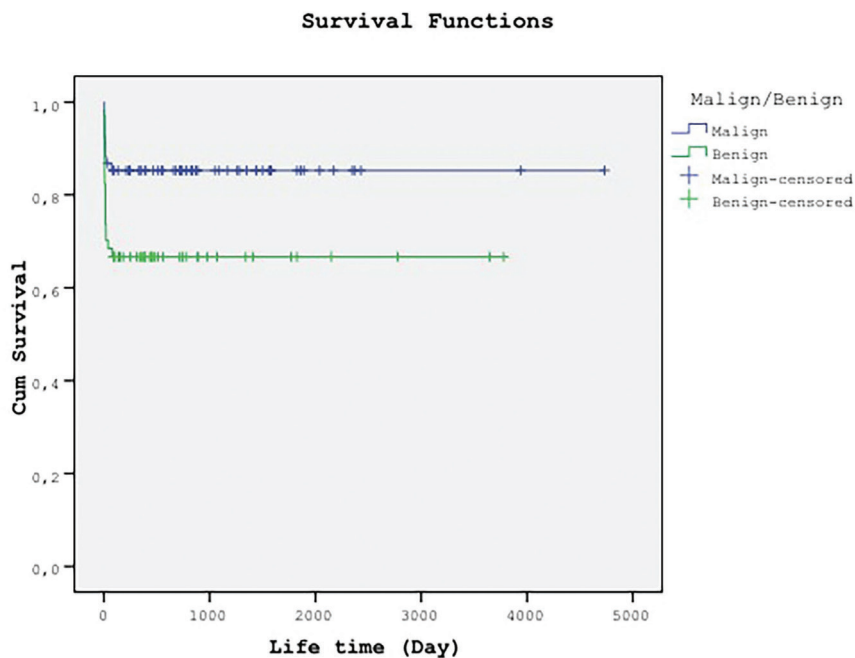
A significant increase was observed in the ASA score with increasing age; however, there was no difference in the Charlson Comorbidity Index among the groups. Although higher CCI are associated with mortality risk in elderly patients, there is no correlation between mortality and CCI in our study (18). There was no difference among the groups in terms of complications evaluated according to the Clavien–Dindo Classification. Moreover, wound-site infection was observed more frequently in the 70–74 years age group, pneumonia was more common in the 75–79 years age group, and sepsis was more common in patients aged ≥80 years. In a comparison of 235 elderly patients and 211 younger patients who underwent surgery for colorectal cancer, Grosso et al reported that the



Clavien-Dindo Classification score was higher in patients aged 65 years and older, and complications such as ileus, peritonitis, and septic shock were more frequent (19). On the other hands, Straatman et al reported that there was no difference between the octogenarian patients and the young patients in terms of major complications, and an increase in minor complication rates such as wound infection and pneumonia (6).

The 30-day mortality rate was higher in the octogenarian patient group. It was probably caused by higher ASA score with increasing age. In the evaluation conducted in our study without considering the age groups, it was determined that postoperative survival rate was higher in patients with malignancies than in those with benign diseases and in patients underwent elective surgery than in those underwent emergency surgeries. Previous studies reported that the mortality rate of patients who underwent emergency abdominal

surgery was approximately 20% (20,21). Most of preoperative diagnoses in our patients who were operated on due to benign diseases were because of emergency surgical reasons, and surgical procedures being performed more frequently for colon cancer were possible causes of these findings. Nonetheless, survival rates after elective surgical procedures performed due to malignant causes were significantly higher in all patients groups, particularly in the octogenarian patient group. This result was probably due to adequate evaluation period and preparation to the surgery of the patients on elective oncologic surgery. Moreover, previous studies reported that laparoscopic surgery could be safely performed on elderly patients, and there were no differences in complication rates compared with those of open surgery (5,22). In our study, it was detected that there was no difference in terms of complications between the patients who underwent laparoscopic surgery and those underwent open surgery, and the survival rates were similar.



**Figure 1:** Factors affecting the survival.

**Table 4.** Characteristics of patients who underwent surgery for malignant and benign diseases [N (%)].

		<b>Malignant</b>	<b>Benign</b>	<b>Total</b>	<b>Statistical test</b>
<b>Gender</b>	<b>Male</b>	188(52.4)	106(44.4)	294(49.2)	Chi-square=3.689 p=0.055
	<b>Female</b>	171(47.6)	133(55.6)	304(50.8)	
<b>Age</b>	<b>70-74</b>	132(36.8)	82(34.3)	214(35.8)	Chi-square=1.550 p=0.461
	<b>75-80</b>	111(30.9)	68(28.5)	179(29.9)	
	<b>≥80</b>	116(32.3)	89(37.2)	205(34.3)	
<b>Emergency/Elective</b>	<b>Emergency</b>	62(17.3)	218(91.2)	280(46.8)	<b>Chi-square=315.068</b> <b>p&lt;0.001</b>
	<b>Elective</b>	297(82.7)	21(8.8)	318(53.2)	
<b>Open/Laparoscopic</b>	<b>Open</b>	284(79.1)	213(89.1)	497(83.1)	<b>Chi-square=10.248</b> <b>p=0.001</b>
	<b>Laparoscopic</b>	75(20.9)	26(10.9)	101(16.9)	
<b>ASA score</b>	<b>1</b>	6(1.7)	3(1.3)	9(1.5)	<b>Chi-square=25.598</b> <b>p&lt;0.001</b>
	<b>2</b>	245(68.2)	116(48.5)	361(60.4)	
	<b>3</b>	101(28.1)	108(45.2)	209(34.9)	
	<b>4</b>	7(1.9)	12(5.0)	19(3.2)	
<b>Clivien-Dindo Classification</b>	<b>1</b>	275(76.6)	151(63.2)	426(71.2)	<b>Chi-square=24.572</b> <b>p&lt;0.001</b>
	<b>2</b>	38(10.6)	26(10.9)	64(10.7)	
	<b>3</b>	18(5.0)	11(4.6)	29(4.8)	
	<b>4</b>	7(1.9)	8(3.3)	15(2.5)	
	<b>5</b>	21(5.8)	43(18.0)	64(10.7)	
<b>Type of Surgery</b>	<b>Abdominoperineal resection</b>	16(4.5)	1(0.4)	17(2.8)	<b>Chi-square=198.143</b> <b>p&lt;0.001</b>
	<b>Left hemicolectomy</b>	72(20.1)	36(15.1)	108(18.1)	
	<b>Appendectomy</b>	42(11.7)	71(29.7)	113(18.9)	
	<b>Lysis of adhesions</b>	3(0.8)	33(13.8)	36(6.0)	
	<b>Subtotal colectomy</b>	10(2.8)	6(2.5)	16(2.7)	
	<b>Low anterior resection</b>	78(21.7)	9(3.8)	87(14.5)	
	<b>Right hemicolectomy</b>	117(32.6)	18(7.5)	135(22.6)	
	<b>Segmental small bowel resection</b>	15(4.2)	61(25.5)	76(12.7)	
	<b>Segmental colon resection</b>	6(1.7)	4(1.7)	10(17)	
<b>Complication</b>	<b>Wound site enfection</b>	28(35.9)	16(19.0)	44(27.2)	<b>Chi-square=20.646</b> <b>p&lt;0.001</b>
	<b>Pneumonia</b>	16(20.5)	19(22.6)	35(21.6)	
	<b>Sepsis</b>	5(6.4)	28(33.3)	33(20.4)	
	<b>Other</b>	29(37.2)	21(25.0)	50(30.9)	



Retrospective study design and small sample size were important limitations of this study. Additionally, diseases occurring in a large spectrum and heterogeneous patient groups were other limitations. Nonetheless, ASA scores of patients included in our study and the inclusion of patients who had advanced stage malignancy contributed to the achievement of objective results.

In conclusion, although it was observed in our study that survival rates decreased with

increasing age after lower GIT surgery, there was no statistically significant difference, particularly, in octogenarian patients compared with younger patients. Moreover, survival was significantly higher in patients with malignancies and those underwent elective surgery than in patients with benign diseases and those underwent emergency surgery. Thus, it should be considered that planned surgical interventions will not negatively affect survival rates in elderly patients, and surgical interventions can be safely performed in these patients.

## REFERENCES:

1. Bufalari A, Ferri M, Cao P, Cirocchi R, Bisacci R, Moggi L. Surgical care in octogenarians. *Br J Surg* 1996;83(12):1783-7. (PMID:9038570).
2. Etzioni DA, Liu JH, Maggard MA, Ko CY. The aging population and its impact on the surgery workforce. *Ann Surg* 2003;238(2):170-7. (PMID:12894008).
3. World report on ageing and health. Geneva, Switzerland: World Health Organization; 2015;p:43-88. [Internet] Available from: [http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811_eng.pdf). Accessed:05.12.2017.
4. Simmonds PD, Best L, George S, et al. Surgery for colorectal cancer in elderly patients: a systematic review. *The Lancet*;356(9234):968-74. (PMID:11041397).
5. Kazama K, Aoyama T, Hayashi T, et al. Evaluation of short-term outcomes of laparoscopic-assisted surgery for colorectal cancer in elderly patients aged over 75 years old: a multi-institutional study (YSURG1401). *BMC Surg* 2017;17(1):29. (PMID:PMC5361779).
6. Straatman J, Van der Wielen N, Cuesta MA, de Lange-de Klerk ES, van der Peet DL: Major abdominal surgery in octogenarians: should high age affect surgical decision-making? *Am J Surg* 2016;212(5):889-95. (PMID:27270411).
7. Charlson ME, Charlson RE, Peterson JC, Marinopoulos SS, Briggs WM, Hollenberg JP. The Charlson comorbidity index is adapted to predict costs of chronic disease in primary care patients. *J Clin Epidemiol* 2008;61(12):1234-40. (PMID:18619805).
8. Gould MK, Garcia DA, Wren SM, et al. Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest* 2012;141(2 Suppl):e227S-e277S. (PMID:22315263).
9. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999;20(4):250-78. (PMID:10219875).
10. Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. *Ann Surg* 2009;250(2):187-96. (PMID:19638912).
11. Hamel MB, Henderson WG, Khuri SF, Daley J. Surgical outcomes for patients aged 80 and older: morbidity and mortality from major noncardiac surgery. *J Am Geriatr Soc* 2005;53(3):424-9. (PMID:15743284).
12. Helkin A, Jain SV, Gruessner A, et al. Impact of ASA score misclassification on NSQIP predicted mortality: a retrospective analysis. *Perioper Med (Lond)* 2017; 6:23. (PMID:PMC5725975).
13. Zhang R, Kyriss T, Dippon J, Hansen M, Boedeker E, Friedel G. American Society of Anesthesiologists physical status facilitates risk stratification of elderly patients undergoing thoracoscopic lobectomy. *Eur J Cardiothorac Surg* 2017;Dec 8. (PMID:29228138).
14. Lagoo-Deenadayalan SA, Newell MA, Pofahl WE. Common perioperative complications in older patients. In: Roshental RA, Zenilman ME, Katlic MR (Eds). *Principles and practice of geriatric surgery*. Second Edition, Springer, 2011, pp 361-76.

15. Gaieski DF, Edwards JM, Kallan MJ, Carr BG. Benchmarking the incidence and mortality of severe sepsis in the United States. *Crit Care Med* 2013;41(5):1167-74. (PMID:23442987).
16. Sieber FE, Barnett SR. Preventing postoperative complications in the elderly. *Anesthesiol Clin* 2011;29(1):83-97. (PMID:PMC3073675).
17. Gronnier C, Grass F, Petignat C, et al. Influence of Enhanced Recovery Pathway on Surgical Site Infection after Colonic Surgery. *Gastroenterol Res Pract* 2017;2017:9015854. (PMID:29225618).
18. Olufajo OA, Reznor G, Lipsitz SR, et al. Preoperative assessment of surgical risk: creation of a scoring tool to estimate 1-year mortality after emergency abdominal surgery in the elderly patient. *Am J Surg* 2017 Apr;213(4):771-777.e1. (PMID:27743591).
19. Grosso G, Biondi A, Marventano S, Mistretta A, Calabrese G, Basile F. Major postoperative complications and survival for colon cancer elderly patients. *BMC Surg* 2012;12 Suppl 1:S20. (PMID:PMC3499273).
20. Saunders DI, Murray D, Pichel AC, Varley S, Peden CJ, Network UKEL. Variations in mortality after emergency laparotomy: the first report of the UK Emergency Laparotomy Network. *Br J Anaesth* 2012;109(3):368-75. (PMID:22728205).
21. Sharrock AE, McLachlan J, Chambers R, Bailey IS, Kirkby-Bott J. Emergency Abdominal Surgery in the Elderly: Can We Predict Mortality? *World J Surg* 2017;41(2):402-9. (PMID:PMC5258798).
22. Inoue Y, Kawamoto A, Okugawa Y, et al. Efficacy and safety of laparoscopic surgery in elderly patients with colorectal cancer. *Mol Clin Oncol* 2015;3(4):897-901. (PMID:26171203).





Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137970  
2018;21 (1):81-86

■ Uygur DAŞAR<sup>1</sup>

#### CORRESPONDANCE

Uygur DAŞAR  
Karabük University, Faculty of Medicine  
Department of Orthopaedics and Traumatology  
Karabük, Turkey

Phone: 90 370 433 04 90  
e-mail: udasar@yahoo.com

Received: 22/01/2018  
Accepted: 27/02/2018

<sup>1</sup> Karabük University, Faculty of Medicine  
Department of Orthopaedics and Traumatology  
Karabük, Turkey

This study was presented as a poster at the 26<sup>th</sup>  
of Turkish National Congress of Orthopedics.

#### RESEARCH

## ONE-YEAR RETROSPECTIVE EVALUATION OF HIP FRACTURE PATIENTS AGED MORE THAN 80 YEARS AND POSTOPERATIVELY MONITORED IN THE INTENSIVE CARE UNIT

### ABSTRACT

**Introduction:** As in all the world, expected life time has extended in our country as well which increases yearly operated elderly patient rate. Surgical intervention for hip fracture is one of the most common operations among them

**Materials and Method:** This study was done between 2014 and 2015 at Karabük Education and Research Hospital ICU. Who were older than age of 80, operated for hip surgery and monitored at ICU postoperatively included to study.

**Results:** The mean age of our patients was 84.65±3.36 years, and 50 of them were female (69.44%). 40 patients showed trochanteric femur fracture and 32 showed femoral neck fracture. Proximal femoral nail was implanted in 38 patients and partial hip prosthesis in 34. Regional anesthesia was administered to 57 patients and general anesthesia to 15. The hospital mortality rate was 16.6%. When we grouped the patients as surviving (60) or died (12), we found that the time before surgery was significantly longer for the died patients than for the surviving ones. The need for MV, duration of MV, and the need for inotropic agents were higher in died patients. The duration of ICU follow-up and hospital stay were longer for died patients. Other parameters showed no significant differences.

**Conclusion:** In our study, mental status of our patients and post-discharge conditions could not be evaluated. Not describing the cause of delay to the surgery and not recording patient satisfaction was other limitations. Therefore, we have decided to form a new research protocol for evaluating patient satisfaction and causes of delay to the surgery.

**Keywords:** Aged; Hip fractures; Mortality; Risk factors; Intensive care units

#### ARAŞTIRMA

## POSTOPERATİF YOĞUN BAKIM ÜNİTESİNDE TAKİP EDİLEN 80 YAŞ ÜSTÜ KALÇA KIRIKLI HASTALARIN BİR YILLIK RETROSPEKTİF DEĞERLENDİRİLMESİ

### Öz

**Giriş:** Tüm dünyada olduğu gibi ülkemizde de beklenen yaşam süresinin uzaması yıllık opere edilen yaşlı hasta yüzdesini artırmaktadır. Bu operasyonlar arasında en sık yapılanlardan biri kalça kırıklarına bağlı cerrahi girişimlerdir.

**Gereç ve Yöntem:** Bu araştırma, 2014-2015 yılları arasında Karabük Eğitim ve Araştırma Hastanesi Yoğun Bakım Ünitesinde yapılmıştır. Çalışmamıza, 80 yaş üzerinde, kalça kırığı nedeniyle operasyon geçirmiş olan ve postoperatif Yoğun Bakım Ünitesinde takibi yapılan hastalar alındı.

**Bulgular:** Hastaların yaş ortalaması 84.65±3.36 yıl idi ve bunların 50 si kadındı. 40 hastada trokanterik femur kırığı ve 32 hastada femur boyun kırığı vardı. Proksimal femur çivisi 38 ve parsiyel kalça protezi 34 hastaya uygulandı. 57 hastaya rejyonel anestezi 15 hastaya genel anestezi verildi. Hastane mortalitesi %16.6 idi. Hastalar yaşayan (60) ve ölenler (12) olarak gruplandırıldığında; ameliyat öncesi süre ölenlere yaşayanlara göre uzundu. Mekanik ventilatör ihtiyacı ve mekanik ventilatör süresi ve inotrop ihtiyacı ölen hastalarda yüksekti. Yoğun bakım ünitesi ve hastanede yatış süreleri de ölen hastalarda uzundu. Diğer parametrelerde anlamlı bir fark yoktu.

**Sonuç:** Çalışmamızda hastalarımızın mental değerlendirmeleri ve taburcu edildikten sonraki değerlendirmeleri yapılamamıştır. Operasyon gecikme nedenlerinin tanımlanmamış ve hastamemnuniyetinin kaydedilmemiş olması diğer bir kısıtlılıklarıdır. Bununla beraber operasyon gecikmedenlerini ve hasta memnuniyetini değerlendirmek için yeni bir araştırmaprotokolü oluşturmaya karar verdik.

**Anahtar sözcükler:** Yaşlı; Kalça kırıkları; Mortalite; Risk faktörleri; Yoğun bakım üniteleri

## INTRODUCTION

As observed worldwide, life expectancy has been increasing in our country with a resultant increase in the annual rate of elderly patients who are operated. Surgical intervention for hip fracture is one of the most common surgeries among these patients (1,2).

Elderly patients with cardiovascular and respiratory comorbid diseases experience increased complications and mortality rates (3-6). Previous national and international studies have investigated risk factors that affect morbidity and mortality in these patients, including age, sex, ASA score, present comorbid diseases, drug usage, type of fracture, surgical interventions, method of anesthesia, duration of surgery, patients' referral time to the emergency ward (IWH, in working hours; OWH, out of working hours), time before surgery, and intensive care unit (ICU) and hospital stay durations. However, the results were controversial. Some studies suggested ASA score as the primary factor to predict complications and mortality rate (7,8). Age and male sex (9) and general anesthesia and time before surgery (10) were suggested as the primary factors causing high mortality rates. However, some other studies have reported contrasting results (11-13).

In this study, we aimed to analyze specific patients who were aged >80 years, classified as ASA III or IV, and postoperatively monitored at the ICU, and conduct a descriptive research on the factors that affect the prognosis of patients at our clinic in our newly built hospital.

## MATERIALS AND METHOD

This descriptive study was performed between 2014 and 2015 at the ICU of the Karabük Education and Research Hospital. Using our hospital's digital data bank and patient files, data were collected for patients who were aged >80 years, who underwent a hip surgery, and who were postoperatively

monitored at the ICU. Patients who were aged <80 years, who did not require ICU care, and who died before the operation were excluded from the study.

A total of 72 patients were analyzed during the stated study period. The following patient characteristics and surgical parameters were recorded: age, sex, present comorbid diseases, time of referral to the emergency room (IWH/OWH), ASA score, fracture type [femoral neck fracture (FNF) or trochanteric femur fracture (TFF)], time before surgery, surgical intervention method [proximal femoral nail (PFN) or partial hip prosthesis (PHP)], anesthesia method [regional anesthesia (RA) or general anesthesia (GA)], duration of surgery, and the need for blood transfusion.

The following parameters were recorded during ICU follow-ups: need for mechanical ventilation (MV), dialysis, or inotropic agents and the durations of MV and ICU stay. Duration of hospitalization and hospital mortality were also evaluated.

Statistical analysis: Statistical analysis were performed using SPSS 14.0. Data were presented as the mean and standard deviation or number and percentage. The mean data were compared using the Student's *t*-test. Categorical data were compared using chi-square test or Fisher's exact test upon compatibility. *P*-values of <0.05 and <0.001 were considered significant.

## RESULTS

The mean age of the patients was  $84.65 \pm 3.36$  years, and there were 50 female patients (69.44%). The numbers of patients admitted to the emergency room IWH and OWH were 41 and 31, respectively. Sixteen patients had three or more comorbid diseases such as hypertension, diabetes, congestive heart disease, Alzheimer's disease, dementia, and cerebrovascular disease. The mean waiting time at the emergency room was  $74.86 \pm 35.77$  minutes, and the mean time before surgery was  $3.09 \pm 1.33$  days.



Regarding the fracture type, 40 patients showed TFF and 32 showed FNF. PFN was implanted in 38 patients and PHP in 34. RA was administered to 57 patients and GA to 15. The mean duration of surgery was  $60.04 \pm 8.81$  minutes.

Arterial catheterization was applied in 91% of the patients and central venous catheterization in 76%, intraoperatively or postoperatively. MV

was used during ICU follow-up in 18 patients, and the mean MV duration was  $0.93 \pm 2.72$  days. Eight patients underwent dialysis treatment and 19 required inotropic treatment. Preoperative blood transfusion was performed in 56 patients. The mean duration of ICU follow-up was  $3.41 \pm 3.48$  days and that of hospital stay was  $8.34 \pm 5.19$  days. The hospital mortality rate was 16.6% (Table 1).

**Table 1.** Demographics and other examined parameters of the patients.

Variables	
Age (years), mean $\pm$ sd	84.65 $\pm$ 3.36
Sex (female/male), n (%)	50/22 (69.44/30.56)
Time of referral to hospital (IWH/OWH), n (%)	41/31 (56.94/43.05)
Duration of waiting at emergency room (minutes), mean $\pm$ sd	74.86 $\pm$ 35.77
Time before surgery (days), mean $\pm$ sd	3.09 $\pm$ 1.33
Three or more comorbid diseases, n (%)	16 (22.22)
ASA (III/IV), n (%)	45/27 (62.5/37.5)
Type of fracture (TFF/FNF), n (%)	40/32 (55.56/44.44)
Anesthesia method (RA/GA), n (%)	57/15 (79.17/20.83)
Surgery method (PFN/PHP), n (%)	38/34 (52.77/47.23)
Duration of surgery (minutes), mean $\pm$ sd	60.04 $\pm$ 8.81
Duration of ICU follow-up (days), mean $\pm$ sd	3.41 $\pm$ 3.48
Duration of hospitalization (days), mean $\pm$ sd	8.41 $\pm$ 5.19
Need for MV, n (%)	18 (25)
Duration of MV (days), mean $\pm$ sd	0.92 $\pm$ 2.72
Artery catheter, n (%)	66 (91.66)
Central venous catheter, n (%)	55 (76.38)
Need for inotropics, n (%)	19 (26.38)
Need for blood transfusion, n (%)	56 (77.78)
Need for dialysis, n (%)	8 (11.11)
Mortality, n (%)	12 (16.67)

Data are stated as mean $\pm$ standard deviation (mean $\pm$ sd) or patient number and percentage (n, %).

TFF:trochanteric femur fracture, FNF:femoral neck fracture, GA:general anesthesia, RA:regional anesthesia, PHP:partial hip prosthesis, PFN:proximal femoral nail, ICU:intensive care unit, MV:mechanical ventilation.

When we grouped the patients as surviving (60) or deceased (12), we found that the time before surgery was significantly longer for the deceased patients than for the surviving ones. Additionally, the need for MV, its duration, and the need for inotropic agents were higher among deceased

patients than among the surviving ones. Also, the duration of ICU follow-up and hospital stay were longer for deceased patients than for the surviving ones. On the contrary, other parameters showed no significant differences between the two groups (Table 2).

**Table 2.** Comparison of demographic and clinical data of the surviving and deceased patients.

Variable	Surviving (n = 60)	Deceased (n = 12)	p value
Age (years), mean±sd	84.5±3.43	85.41±2.99	NS
Female sex, n (%)	42 (70)	8 (66.67)	NS
Time of referral to hospital, IWH, n (%)	34 (56.67)	7 (58.33)	NS
Time before surgery (days), mean±sd	2.85±1.23	4.33±1.15	< 0.01† *
Three or more comorbid diseases, n (%)	10 (16.67)	6 (50)	< 0.001* *
ASA IV, n (%)	19 (31.66)	8 (66.66)	< 0.001* *
Type of fracture, TFF, n (%)	32 (53.33)	8 (66.66)	NS
Anesthesia method, RA, n (%)	47 (78.33)	10 (83.33)	NS
Surgery method, PFN, n (%)	32 (53.33)	6 (50)	NS
Duration of surgery (minutes), mean±sd	58.14±10.4	62.21±9.2	NS
Duration of ICU follow-up (days), mean±sd	2.4±1.60	8.5±5.53	< 0.01† *
Duration of hospitalization (days), mean±sd	8.08±4.95	10.08±6.25	< 0.01† *
Need for MV, n (%)	8 (13.33)	10 (83.33)	< 0.001* *
Duration of MV (days), mean±sd	0.2±0.54	4.58±5.38	< 0.01† *
Need for inotropics, n (%)	10 (16.66)	9 (75)	< 0.001* *
Need for blood transfusion, n (%)	46 (76.66)	10 (83.33)	NS
Need for dialysis, n (%)	6 (10)	2 (16.66)	NS

Data are stated as mean±standard deviation (mean±sd) or patient number and percentage (n, %). †Student's t-test, \*Pearson's chi-square test, \*Statistically significant difference between groups

## DISCUSSION

Our study revealed that the time before surgery, need and duration of MV, need for inotropic agents, and durations of ICU and hospital stays were significantly greater in the deceased patients than in the surviving ones. In addition, 50% of the

deceased patients had three or more comorbid diseases. We found no significant differences in the time of referral to the hospital, surgery and anesthesia methods, and type of fracture, which were examined and reported as effective, among the two groups.



The presence of comorbid diseases has been reported to affect mortality in elderly hip fracture patients. Meyer et al reported that the presence of two or more comorbid diseases caused a three-fold increase in the mortality rate (14). In a similar study, Roche et al found that the presence of three or more comorbid diseases was a major risk factor for mortality in elderly hip fracture patients (15). Similar to these results, 50% of the deceased patients in our study had three or more comorbid diseases.

Dailiana et al. reported a hospital mortality rate of 6.9%, and male sex, age of  $\geq 85$  years, presence of three or more comorbid diseases, and time before surgery of  $>48$  hours increased the mortality rates (10). In our study, the deceased patients had waited longer than the surviving ones before undergoing a surgery.

Kannegaard et al. observed that male sex, advanced age, and presence of comorbid diseases were linked to high mortality rates (9). Liu et al found that the ASA score and postoperative complications were linked to mortality rates (8). In our study, we found that 66.66% of the deceased patients had an ASA score of IV.

Daugaard et al stated that ASA score, male sex, advanced age, and TFF increased the mortality rates; however, time of referral to hospital had no effect on the mortality rate (11). Foss et al and Schilling et al showed that patients who were

admitted on weekends and holidays had higher mortality rates (16,17). We found that the time of referral to hospital and duration of waiting at the emergency room did not differ between surviving and deceased patients.

Kilci et al stated that the presence of comorbid diseases, high ASA scores, and usage of prostheses with bone cement increased the mortality rates, but anesthesia method had no effect on mortality rate (12). Kopp et al found that type of fracture, time before surgery, and anesthesia and surgery methods had no effect on mortality rates (13). We found that the methods of surgery and anesthesia had similar effects between the two groups. There are, however, controversies regarding this topic in literature.

Our aim was to analyze a specific patient group with high risk, aged  $>80$  years, classified as ASA III or IV, and postoperatively monitored at the ICU.

The main limitation of our study was its retrospective, single-center design and the absence of data regarding the patients' mental status and post-discharge conditions. In addition, patient satisfaction and the causes for delayed surgical intervention were not recorded. Therefore, in the light of this illustrative study, we have decided to form a new research protocol for a detailed evaluation of patient satisfaction and causes of delay for surgery.

## REFERENCES

1. Kim BH, Lee S, Yoo B, et al. Risk factors associated with outcomes of hip fracture surgery in elderly patients. *Korean J Anesthesiol* 2015;68(6):561-7. (PMID:26634079).
2. Çetinkaya E, Yavuz U, Lapcin O, et al. Assessment of peroperative parameters affecting mortality in geriatric hip fractures. *JAREM* 2016;6:183-7. (in Turkish).
3. González-Zabaleta J, Pita-Fernandez S, Seoane-Pillado T, López-Calviño B, Gonzalez-Zabaleta JL. Comorbidity as a predictor of mortality and mobility after hip fracture. *Geriatr Gerontol Int* 2016;16(5):561-9. (PMID:25981487).
4. Pugely AJ, Martin CT, Gao Y, Klocke NF, Callaghan JJ, Marsh JL. A risk calculator for short-term morbidity and mortality after hip fracture surgery. *J Orthop Trauma* 2014;28(2):63-9. (PMID:23872716).
5. Belmont PJ Jr., Garcia EJ, Romano D, Bader JO, Nelson KJ, Schoenfeld AJ. Risk factors for complications and in-hospital mortality following hip fractures: a study using the National Trauma Data Bank. *Arch Orthop Trauma Surg* 2014;134(5):597-604. (PMID:24570142).
6. Kesmezacar H, Ayhan E, Unlu MC, Seker A, Karaca S. Predictors of mortality in elderly patients with an intertrochanteric or a femoral neck fracture. *J Trauma* 2010;68(1):153-8. (PMID:19797990).

- 7- Koç M, Saçan Ö, Gamlı M, et al. Retrospective Evaluation of Anaesthesia Techniques for Hip Replacement Operations. *Turk J Anaesthesiol Reanim* 2014;42(3):133-9. (PMID:27366407).
- 8- Liu Y, Peng M, Lin L, Liu X, Qin Y, Hou X. Relationship between American Society of Anesthesiologists (ASA) grade and 1-year mortality in nonagenarians undergoing hip fracture surgery. *Osteoporos Int* 2015;26(3):1029-33. (PMID:25300530).
- 9- Kannegaard PN, van der Mark S, Eiken P, Abrahamsen B. Excess mortality in men compared with women following a hip fracture. National analysis of comedications, comorbidity and survival. *Age Ageing* 2010;39(2):203-9. (PMID:20075035).
- 10- Dailiana Z, Papakostidou I, Varitimidis S, Michalitsis S, Vloni A, Malizos K. Surgical treatment of hip fractures: factors influencing mortality. *Hippokratia* 2013;17(3):252-7. (PMID:24470737).
- 11- Daugaard CL, Jørgensen HL, Riis T, Lauritzen JB, Duus BR, van der Mark S. Is mortality after hip fracture associated with surgical delay or admission during weekends and public holidays? A retrospective study of 38,020 patients. *Acta Orthop* 2012;83(6):609-13. (PMID:23140106).
- 12- Kilci O, Un C, Sacan O, et al. Postoperative mortality after hip fracture surgery: a 3 years follow up. *PLoS One* 2016;11(10):e0162097. (PMID:27788137).
- 13- Kopp L, Edelmann K, Obruba P, Procházka B, Blstáková K, Dzupa V. Mortality risk factors in the elderly with proximal femoral fracture treated surgically. *Acta Chir Orthop Traumatol Cech* 2009;76(1):41-6. (PMID:19268048).
- 14- Meyer HE, Tverdal A, Falch JA, Pedersen JI. Factors associated with mortality after hip fracture. *Osteoporos Int* 2000;11:228-32. (PMID:10824238).
- 15- Roche JJW, Wenn RT, Sahota O, et al. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. *BMJ* 2005;331(7529):1374. (PMID:16299013).
- 16- Foss NB, Kehlet H. Short-term mortality in hip fracture patients admitted during weekends and holidays. *Br J Anaesth* 2006;96(4):450-4. (PMID:16443639).
- 17- Schilling PL, Campbell DA Jr., Englesbe MJ, Davis MM. A comparison of in-hospital mortality risk conferred by high hospital occupancy, differences in nurse staffing levels, weekend admission, and seasonal influenza. *Med Care* 2010;48(3):224-32. (PMID:20168260).



Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137971  
2018;21 (1):87-99

- Gözde İNAN<sup>1</sup>
- Zerrin ÖZKÖSE ŞATIRLAR<sup>1</sup>

#### CORRESPONDANCE

Gözde İNAN  
Gazi University School of Medicine,  
Department of Anesthesiology and Reanimation  
Ankara, Turkey

Phone: 3122025325  
e-mail: inangozde@yahoo.com

Received: 27/12/2017  
Accepted: 06/03/2018

<sup>1</sup> Gazi University School of Medicine,  
Department of Anesthesiology  
and Reanimation  
Ankara, Turkey

#### REVIEW ARTICLE

## A CLINICAL REVIEW OF THE CONSEQUENCES OF ANESTHESIA AND SURGERY IN THE ELDERLY BRAIN: "THE DARK SIDE OF THE MOON"

### ABSTRACT

It has been a concern since the 1950s that elderly patients undergoing surgery and anesthesia may suffer from postoperative cognitive changes. Because postoperative cognitive deterioration in the elderly may lead to serious medical and social consequences and is associated with increased morbidity, mortality, and high health care costs, the issue should be precisely addressed, and preventive strategies should be developed. An emerging body of evidence suggests that anesthesia and surgery have an undesirable effect on long-term cognitive function in the elderly; however, there are no convincing human data to support this correlation. Thus, the effects of anesthesia and surgery on cognition and on the natural course of underlying neurodegenerative diseases are not clear. This review presents a systemic and comprehensive clinical view of cognitive decline following anesthesia and surgery. It aims to emphasize the pathophysiological processes and risk factors of aging and potential anesthesia- and surgery-related neurodegeneration, since defining high-risk patients and preventing the problem can provide benefits for patients with neurodegenerative disease.

**Keywords:** Cognitive Dysfunction; Aging; Anesthesia; General Surgery; Alzheimer Disease; Dementia

#### DERLEME MAKALESİ

## YAŞLI BEYİNDE ANESTEZİ VE CERRAHİNİN SONUÇLARI ÜZERİNE BİR KLİNİK İNCELEME: "AYIN KARANLIK YÜZÜ"

### Öz

1950'lerden beri cerrahi ve anestezi uygulanan yaşlı hastalarda postoperatif bilişsel değişiklikler yaşanması endişe kaynağı olmuştur. Yaşlılarda postoperatif bilişsel bozulma, ciddi tıbbi ve sosyal sonuçlara neden olabilir ve morbidite, mortalite ve yüksek sağlık masrafları ile ilişkili olduğundan, konu tam olarak ele alınmalı ve önleyici stratejiler geliştirilmelidir. Ortaya konan kanıtlar, anestezinin ve ameliyatın yaşlılarda uzun süreli bilişsel işlev üzerinde istenmeyen bir etkiye sahip olduğunu göstermektedir. Bununla birlikte, bu korelasyonu desteklemek için inandırıcı insan verileri mevcut değildir. Bu nedenle, anestezi ve cerrahinin kognisyon ve nörodejeneratif hastalıkların doğal seyri üzerindeki etkileri açık değildir. Bu derlemede, anestezi ve ameliyat sonrasında bilişsel bozulmanın sistemik ve kapsamlı bir klinik görünümü sunulmaktadır. Derleme, yaşlılık, potansiyel anestezi ve cerrahi ile ilişkili nörodejenerasyonun patofizyolojik süreçlerini ve risk faktörlerini vurgulamayı amaçlıyor, çünkü yüksek riskli hastaları tanımlamak ve sorunun engellenmesi nörodejeneratif hastalığı olan hastalar için fayda sağlayabilir.

**Anahtar sözcükler:** Bilişsel Bozulma; Yaşlılık; Anestezi; Genel Cerrahi; Alzheimer Hastalığı; Demans

## INTRODUCTION

The global population is aging. As life expectancy rises, the proportion of the population aged 60 or above rapidly rises. The number of people aged 60 or above worldwide is projected to double by 2050 and triple by 2100. The increase in the aging population will result in an increase in the surgery workforce, and greater longevity will pose challenges for clinicians who are likely to encounter more geriatric patients undergoing surgery (1). Despite improvements in medicine, elderly patients are proportionately more prone to perioperative complications because of physiologic changes due to aging, accompanying comorbidities, and the increased incidence of pre-existing illness and polypharmacy. As we are living longer, the incidence of age-related diseases, including neurodegenerative diseases, in particular Alzheimer's disease, is also increasing (2).

Among the many postoperative complications, postoperative cognitive dysfunction (POCD) is a vital concern that may result in increased morbidity, mortality, and health care costs (3). Cognitive dysfunction is common following anesthesia and surgery, especially in elderly patients. In most cases, cognitive function returns to baseline within a few months, but in some cases, recovery may be delayed or incomplete. Advanced age is the strongest known risk factor for the development of POCD (4). It is evident that older patients are vulnerable to developing POCD, and several factors, including pre-morbid cognitive status, may put them at risk. For the elderly, this complication often means a life that they can no longer manage by themselves (3).

### Overview of general considerations

Postoperative cognitive changes were described in the previous century. In 1955, Bedford reported "the cerebral side effects of anesthesia on old people" as the development of confusion after surgery (5). He examined 1193 patients over the age of 50 years who underwent general anesthesia and suggested that POCD developed with an incidence of approximately 7% and that the resulting cognitive changes might be due to anesthetic agents and

hypotension. Based on this idea, the results of the first international POCD research group (ISPOCD 1) were published in 1998 (6). Similar to Bedford's findings, an incidence of POCD of 10% was found. Older age, duration of anesthesia, low educational level, recurrent surgeries, postoperative infection, and respiratory complications were reported as risk factors for early POCD. Among these risk factors, age was the only statistically significant risk factor at long-term (3 months) follow-up. The same study group then searched long-term outcomes and found POCD in 1% of patients after 1 to 2 years of surveillance (ISPOCD 2). In these extensive studies, only advanced age and the type and duration of surgery were identified as possible risk factors.

Historically, all cognitive changes observed following surgery have been classified as POCD. However, to understand the underlying mechanisms and to develop prevention strategies, it is necessary to be aware of the diversity in the cognitive change spectrum and to consider interpersonal differences.

The two most common types of impairment in cognitive function are postoperative delirium (POD) and POCD. Postoperative delirium manifests with acute onset, occurs from days (often within 24 to 72 hours) to weeks following surgery, is characterized by fluctuating levels of cognition and awareness with a reduced level of focus and orientation, and is accompanied by emotional disorder and decreased psychomotor behavior (1). Postoperative delirium remains a serious and costly issue threatening public health, as it is associated with increased morbidity and mortality, prolonged cognitive impairment, and prolonged hospital stay (3). The most common tests to assess POD are the Confusion Assessment Method and the Delirium Rating Scale, which are subjective. The incidence of POD varies between 10% and 40%, rising to 50% to 65% following orthopedic, cardiac, and emergency surgeries (7,8).

Postoperative cognitive dysfunction occurs weeks or even months after surgery, and it may be prolonged (9). Unlike POD, POCD is characterized not by disorientation but by a decrease in information perception and knowledge man-





agement functions. Postoperative cognitive dysfunction does not have a uniform definition. The diagnosis requires the patient to undergo neuropsychometric testing to objectively determine the reduction in cognition when compared with preoperative baseline tests (10). The Mini-Mental State Examination (MMSE) was developed as a delirium screening test and has also been used for POCD because it takes a short time to administer; however, the questions can be learned during repeated tests. The incidence of POCD was reported to range from 8.9% to 46.1%, rising to 80% following cardiac surgery (8,11).

Dementia is classified as a chronic, irreversible, progressive neurocognitive disorder that affects both cognitive function and the performance of everyday activities. Alzheimer's disease is a neurodegenerative disease that is the most common form of dementia among the elderly. By affecting memory, problem-solving ability, decision-making, judgment, orientation, and other cognitive skills, it alters a person's ability to perform everyday activities (2). More than 5 million people in the United States older than 65 years are estimated to have Alzheimer's disease (2). Alzheimer's disease has three clinical stages: preclinical, mild cognitive impairment, and dementia. People with preclinical Alzheimer's disease are asymptomatic for up to 20 years. Although measurable biomarkers of the pathogenesis of Alzheimer's disease accompany preclinical Alzheimer's disease, there is still no formal way to diagnose the condition. Mild cognitive impairment due to Alzheimer's disease is defined as mild but measurable changes in one or more cognitive domains in comparison with the patient's previous level, greater than would be expected for the patient's age and education, without any interference with usual activities (9). In about 50% of patients, mild cognitive impairment progresses to dementia in about 5 years after diagnosis. The MMSE is a well-established cognitive screening instrument, but additional assessment of executive functions and visuospatial ability is needed for the identification of mild cognitive impairment and dementia (1).

There are certain similarities between POCD, POD, and dementia, including risk factors, clinical presentation, and pathognomonic features. Recent studies have focused on whether POD and POCD are prodromal forms of Alzheimer's disease or whether there is an association among POD, POCD, and the development of dementia; the evidence remains inconclusive (4). A recent study confirmed previous findings that elderly patients with baseline cognitive impairment at the time of surgery are at higher risk for clinically evident POD, and furthermore, elderly patients who are cognitively normal before surgery and who develop POD are more likely to develop mild cognitive impairment or dementia on follow-up than are those who do not develop POD (12). Moreover, with normal aging processes of the brain, POD, POCD, and even dementia can overlap. The course of cognitive impairment following anesthesia and surgery is schematized in Figure 1A.

The risk factors for cognitive changes of POD, POCD, and dementia are multifactorial and can be categorized as patient-related and surgery-related or nonmodifiable and potentially modifiable (Table 1). Some of these are pre-existing factors that are linked to previous fragility, while others are factors that accelerate the situation, such as stress response to trauma. Modifiable lifestyle-related risk factors are important, since controlling these factors would alter the incidence of POCD, might even reduce the incidence of Alzheimer's disease, and would ameliorate or delay the onset of and mild cognitive impairment (13). Although minor cognitive changes have been shown in younger patients, age is the main risk factor for POCD. The ability to compensate for cognitive deficits decreases with advancing age (14). Low educational level, preoperative use of narcotics and benzodiazepines, existing cognitive impairment, depressive symptoms, attention deficit, previous POD, alcoholism, visual disturbances, and electrolyte and fluid abnormalities are among the several other risk factors (7,10,14). Preoperative poor cognition, physical limitations, and accompanying systemic diseases are associated with worse postoperative outcomes. Environmental and genetic (ApoE4) risk factors are among the determinants of Alzheimer's disease (15).

**Table 1.** Predisposing factors, risk factors, perioperative triggers for postoperative cognitive dysfunction in the elderly.

Predisposing Factors	Cerebral	Structural Decreased brain volume Hippocampal changes Reduced neurogenesis Damaged blood-brain barrier Amyloid and/or tau accumulation
	Systemic	Inflammation Changes in levels of neurotransmitters Cerebrovascular disease Pre-operative cognitive impairment Vulnerability and reduction in cognitive reserve Advanced age Vulnerability Co-morbidities Increased incidence of pre-existing illness and polypharmacy Systemic vascular disease
	Social	Low educational level
Risk Factors	Patient-related	Advanced age Pre-operative cognitive impairment Pre-operative physical impairment, immobility Pre-operative depression, depressive symptoms, attention deficits, sleep disorders Pre-existing dementia, mild-cognitive dysfunction Pre-operative use of narcotics or benzodiazepines Cognitive impairment during hospitalization History of alcohol abuse, tobacco use Previous POCD History of stroke Vision and hearing impairment
	Surgery-related	Cardiac and/or vascular surgery Major and invasive surgery Greater surgical blood loss Greater intraoperative transfusion Longer operation duration Post-operative complications
	Non-modifiable	Advanced age Female gender Genetic risk factors (Apolipoprotein E)
	Modifiable	Vascular (DM, HT, hypercholesterolemia) Nutritional (low levels of vitamin B12 and folate, hyperhomocysteinemia) Head injuries
Perioperative Triggers	Acute pain Use of physical restraints Malnutrition, dehydration >3 medications in 24-48 h Urinary bladder catheter Anemia, intraoperative transfusion Electrolyte and fluid abnormalities	



Major and invasive surgeries (abdominal, thoracic, vascular), long duration of operation and anesthesia, and excessive blood loss increase the risk of POCD. The severity, duration, and type of the surgical procedure, particularly cardiac and orthopedic surgeries, have been associated with cognitive impairment (14). It has been discussed whether cardiopulmonary bypass, microembolisms, and cerebral hypoperfusion are responsible for POCD following cardiac surgery (1,4). However, similar cognitive changes were observed after off-pump cardiac surgery (1). Coronary bypass surgery has been found to cause neuronal damage due to inflammatory responses during the normothermic rewarming phase. In the cardiopulmonary bypass mouse model, limited warm-up and prolonged postoperative hypothermia have been shown to reduce the incidence of POCD (16). Hovens et al. suggested that POCD following cardiac surgery affects more extensive brain regions than does POCD following noncardiac surgery (17). Hence, POCD following cardiac surgery may be associated with a greater affected area of the brain rather than greater severity (17).

### **Pathophysiology and potential mechanisms**

Various hypotheses have been proposed for the pathophysiology of POCD. Neurotransmitters, inflammation, psychological stress, metabolic changes, electrolyte imbalance, and genetic factors are thought to cause damage to neuronal functioning (3). However, the pathophysiology of POCD is not yet fully understood. Most of the risk factors are up-regulated by aging.

Acetylcholine, melatonin and norepinephrine are some mediators that have been shown to correlate with delirium. Neuroinflammation has been hypothesized to underlie the mechanism of the development of POCD (18,19). Inflammation in the periphery due to surgical trauma is transferred to the central nervous system and causes glial activation, exaggerated expression of proinflammatory mediators within the central nervous system, and neural dysfunction (19). Aging itself creates glial al-

terations, and the cause of the transition from normal aging glia to pathologic glia remains unclear. It is suspected that events during an individual's early life, including infection, stress, and nutrition, can impact immune reactivity within the brain and cause subsequent exaggerated glial activation called "glial priming" for the remainder of life, thereby altering cognition and increasing the risk of neuroinflammatory disorders, POCD, and Alzheimer's disease (20). In rats made vulnerable by infection early in life, even aging has been shown to impact glial reactivity (18,19). Proinflammatory cytokines involved in neuroinflammation are thought to cause neuronal damage. In a study that compared the occurrence of POD in elderly patients undergoing minimally invasive laparoscopic surgery versus open colon surgery, significantly higher levels of inflammatory markers were found in patients receiving open surgery, a result consistent with a higher stress response in this group of patients (21).

### **Association between anesthesia and surgery**

Several studies have tried to clarify the role of anesthetics in the pathophysiology of POCD. There are still no conclusive human data to support this correlation. This hypothesis has been supported only by experimental and in vitro models. The mechanism of cognitive impairment after surgery is not clear. Since distinguishing the effects of surgery and anesthesia on POCD is not possible, these two factors are considered together. Animal studies emphasize that surgery creates an inflammatory response, which plays a significant role (18). Peripheral surgery activates inflammatory cytokines and impairs the integrity of the blood-brain barrier, allowing macrophages to easily migrate into the hippocampus and cause memory problems.

The effects of anesthesia on POCD have been attributed to potential neurotoxicity of anesthetics that exacerbates age-related neuronal changes such as losses in cerebral reserve and increased permeability of the blood-brain barrier. The pivotal mechanism causing cognitive decline is abnormal deposition of naturally occurring peptides in the

brain. Anesthesia-related POCD shares this common pathological mechanism through amyloid beta ( $A\beta$ ) deposition and tau phosphorylation (22,23). Preclinical data suggest that inhalation anesthetics, in particular isoflurane and sevoflurane, increase the production, precursors, and accumulation of  $A\beta$ , which results in caspase activation, mitochondrial damage, and ultimately apoptosis (24,25). In contrast, desflurane and nitrous oxide have not been shown to enhance  $A\beta$  accumulation *in vivo* or *in vitro* (26,27). Additional studies are necessary to determine the superiority of desflurane over isoflurane or sevoflurane in regard to neurotoxicity (28).

Tau phosphorylation causes formation of neurofibrillary tangles, the other pathologic hallmark of Alzheimer's disease. Anesthesia-induced hypothermia may be a mediator of tau hyperphosphorylation (29). However, both volatile anesthetics and propofol also induce tau production and phosphorylation under normothermic conditions (23).

Given the significant role of inflammation in the pathogenesis of POCD, anesthetic drugs could affect cognitive decline via their effects on inflammation and the immune system. Studies have found divergent findings for the anti-inflammatory effects of volatiles versus propofol (30). Calcium metabolism also plays some role in the pathogenesis of Alzheimer's disease. High levels of volatile anesthetics are reported to increase intracellular calcium levels and cause excitotoxic neuronal injury in cultured neuronal cells.

Clinical epidemiological studies investigating whether anesthesia and surgery increase the risk of developing Alzheimer's disease are limited. Retrospective cohort and case-control studies have been used to investigate a possible link, and the results are conflicting (Table 2). Seitz et al. in a review investigated the epidemiological evidence for GA as a risk factor for Alzheimer's disease and concluded that there was not sufficient evidence to show a relationship (42). On the basis of population-based case-control studies, some authors suggest that exposure to anesthetics increases the risk of Alzhei-

mer's disease, whereas other authors suggest that it does not (36,40).

### **Identifying high-risk patients, prevention, and anesthesia management**

A review focusing on preventive factors for Alzheimer's disease suggested that any interventions that can delay the onset of the disease will play a major role in delaying the onset of clinical Alzheimer's disease (43). Patients at risk should be identified preoperatively. Frailty assessment and identification of high-risk patients may include the use of biomarkers, cognitive tests, imaging, and genome studies (15,44). Surgery and anesthesia may be associated with some biomarkers of neuronal injury, such as increases in total and phosphorylated tau and decrease in  $A\beta$  in cerebrospinal fluid. Imaging with computed tomography, magnetic resonance, and single-photon emission computed tomography is also recommended for screening vulnerable surgical patients (9). Nevertheless, the correlations between changes in biomarkers and cognitive deficits are unclear, and further studies are warranted to interpret their relevance to clinical outcomes. High-risk patients who may benefit from geriatrics consultation are listed in Table 3.

The multifactorial etiology of POCD necessitates multimodal interventions to reduce its incidence. Preventive measures for POCD may be classified as preoperative, perioperative, and postoperative (Figure 1B). In particular, preoperative preventive programs aim at controlling risk factors, mainly focusing on hearing and vision problems, cognitive problems, sleep disturbances, immobility and dehydration, and nutrition, and they recommend fluid support, exercise programs, mind exercises, orientation studies, and nonpharmacological sleep regulators (45). Perioperative measures include maintaining homeostasis, avoiding long-acting benzodiazepines, preferring minimally invasive surgeries with short operative duration, optimizing anesthetics, early recovery, and optimal pain relief (14).

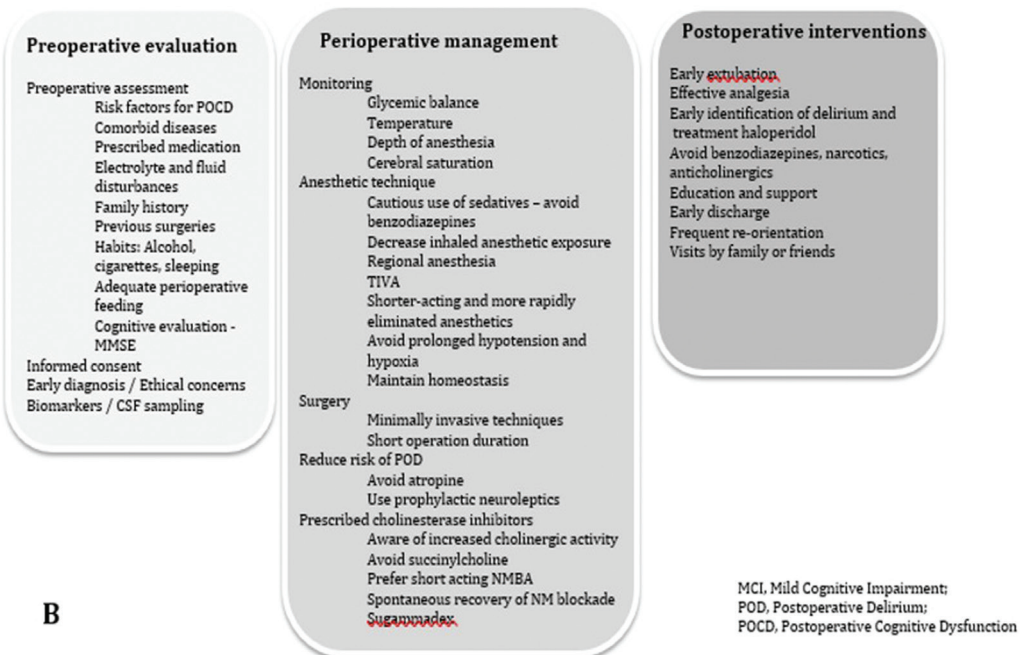
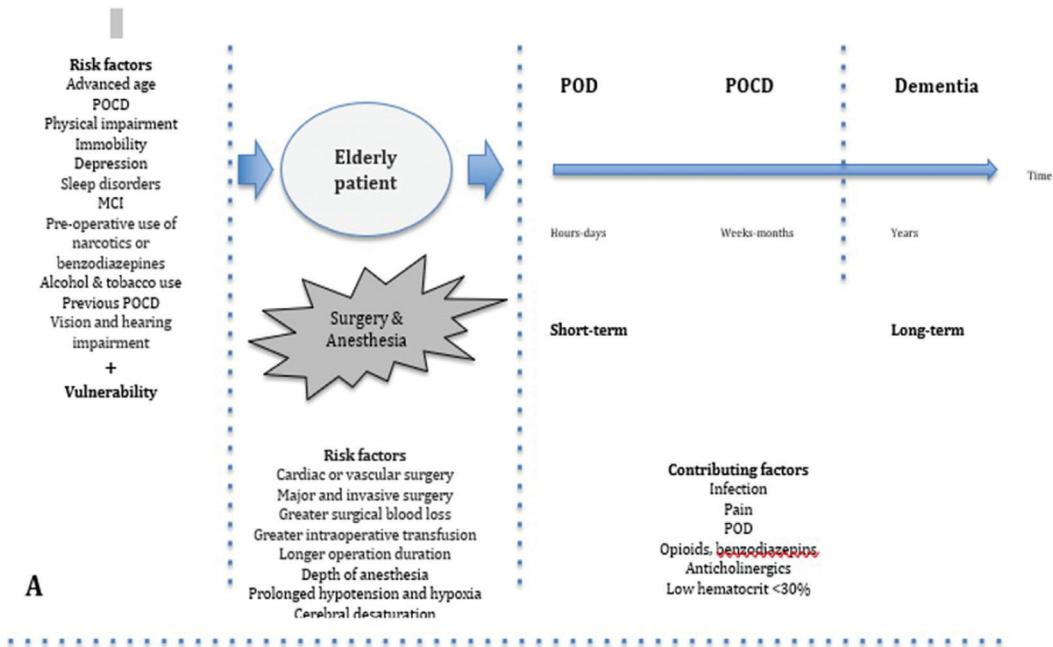


**Table 2.** Clinical studies on the association between exposure to anesthesia and surgery and risk of dementia.

Study	Design	Number or Type of Study Subjects	Type of Surgery/ Anesthesia	Findings
Pálotas et al(31)	Biomarker studies	30	CABG	CSF A $\beta$ decreased Injury biomarkers (S100B, tau) elevated at 6 months
Tang et al(32)	Biomarker studies 11		Idiopathic nasal CSF leak repair	Total-tau/A $\beta$ ratio in CSF increased <sup>1-42</sup> Proinflammatory cytokines, IL-6, TNF- $\alpha$ , and IL-10 elevated postoperatively
Shiyya et al(33)	Biomarker studies	28	Prosthetic replacement of the descending thoracic or thoracoabdominal aorta	CSF tau and S100beta only increased in individuals with brain infarction or transient neurologic dysfunction
Reinsfelt et al(34)	Biomarker studies	10	Cardiac valve replacement surgery with cardiopulmonary bypass	Levels of S100beta and glial fibrillary acidic protein increased by 35% postoperatively Total tau, neurofilament light chain protein, and neuron-specific enolase did not change significantly IL-6 and IL-8 in the CSF increased significantly after anesthesia and surgery
Seitz et al(35)	Retrospective case-control studies (A meta-analysis of 15 case-control studies)	1.752 cases and 5.261 controls	GA	No statistically significant association between GA and the development of AD
Sprung et al(36)	Retrospective case-control studies	877 Patients with incident dementia recorded between 1985-1994	GA	A total of 70% of the dementia patients had been exposed to GA compared with 72.5% of the control group No significant association between exposure to GA >45 years and the diagnosis of dementia
Chen et al(37)	Retrospective case-control studies	5.345 patients >50 years 21.380 controls Patients who were newly diagnosed with dementia and individuals without dementia for control group from 2005-2009	GA exposure was categorized into three subtypes: endotracheal tube intubation GA (ETGA), intravenous injection GA (IVGA), or intramuscular injection	GA (IMGA), versus heavy sedation Individuals exposed to surgery under ETGA were found to be at significantly higher risk of developing dementia in a dose-dependent response

Lee et al(38)	Cohort studies	119 patients (CABG=78; PTCA=41) >55 years without a diagnosis of dementia prior to surgery	One group underwent CABG under GA The other group received sedation for PTCA	5-year follow-up, patients who had undergone CABG and GA had a 1.7-fold increased risk of developing AD compared with those who only received sedation and PTCA
Vanderweyde et al(39)	Cohort studies	Subjects undergoing hernia operations (under GA (N= 2,658) or local (N = 1,111) anesthesia, as well as subjects undergoing prostate operations under GA (N = 2,820) or local (N = 3,691) anesthesia	Prostate or hernia surgery under either GA or RA	Patients who had received GA developed dementia less frequently than those who had received RA
Chen et al(40)	Cohort studies	24.901 patients >50 years who were anesthetized for the first time from 2004-2007 Control group 110.972 patients	GA or RA	Follow-up period of 3-7 years, risk of dementia in the anesthesia group was found significantly higher than that in the control group Both exposure to GA and to regional anesthesia yielded increased risks of incident dementia Patients who undergo anesthesia and surgery may be at increased risk for developing dementia
Liu et al(41)	Prospective studies	180 aMCI patients 60 aMCI outpatients as the control group	Lumbar spinal surgery Sevoflurane, propofol, or lidocaine epidural anesthesia	2-year follow-up, the number of aMCI patients who progressed to AD did not differ between the groups The number of patients who exhibited progression of aMCI was greater in the sevoflurane group than in the control group
AielloBowles et al (11)	Prospective studies	3.988 Community-dwelling members of the adult changes in thought cohort >65 age, free of dementia at baseline	Participants self-reported all prior surgical procedures with GA or neuraxial anesthesia at baseline and reported new procedures every 2 years	High-risk surgery with general anesthesia was not associated with greater risk of dementia than no history of anesthesia Anesthesia exposure was not associated with of dementia or AD in older adults

CSF; Cerebrospinal fluid  
 CABG; Coronary artery bypass grafting  
 GA; General anesthesia  
 PTCA; Percutaneous transluminal coronary angioplasty  
 RA; Regional anesthesia  
 aMCI; Amnesic mild cognitive impairment



**Figure 1A.** Schema of postoperative cognitive dysfunction with preoperative and perioperative risk factors and postoperative contributing factors. **1B.** Preoperative evaluation, perioperative management and postoperative interventions as preventive measures for postoperative cognitive dysfunction.

**Table 3.** Patient features for pre-operative geriatrics consultation.

Age > 80 years
Baseline cognitive dysfunction or dementia
Multiple medical comorbidities
Chronic use of psychotropic medications
Dependence on alcohol or other drugs
Poor social support
Hearing or vision impairment
Immobility or history of functional decline
Recurrent hospitalizations within the last year
Urgent or emergent surgery
Prolonged hospital and/or ICU stay

Controlling chronic hypoperfusion of the brain and triggered neuroinflammation by treating comorbid disease conditions (hypertension, diabetes, hypoxia, obstructive sleep apnea, obesity, vitamin B<sub>12</sub>-folate deficiency, depression, traumatic brain injury) may enhance cognition (46). Because chronic systemic inflammation promotes aging of glia through excessive neuroinflammation, it is argued that antioxidant nutrients may be beneficial for preventing aging of glia, thereby improving cognitive functions (20). Hypothetically, environmental stimuli (toxins, drugs of abuse, dietary fatty acids) might also trigger neurodegeneration via inflammation in long-term outcomes (19). However, based on the accumulating data on inflammation and POCD, studies seeking anti-inflammatory agents for prevention of POCD have not been successful to date.

Some studies have proposed that avoiding general anesthesia by preferring regional anesthesia techniques would promote cognitive functions in the elderly (47). Nevertheless, most studies have suggested that the occurrence of POCD is irrespective of the type of anesthetic technique (47-51). Lack of evidence for any difference between regional and

general anesthetic techniques can be explained by the use of intravenous sedation during regional anesthesia (52). Among general anesthetics, volatile anesthetics have been suggested to be associated with a higher rate of POCD than propofol by animal studies. Optimizing anesthesia by monitoring the depth of anesthesia and cerebral oxygenation has been advocated to reduce the risk of POCD (7). For those patients who are more sensitive to anesthetics, deep anesthesia has been associated with a higher rate of POD (9).

It has been suggested in the literature that because both patients with mild cognitive impairment and those with dementia have increased sensitivity to anesthetics, surgery and anesthesia can worsen their symptoms (6). The main question will be how to provide the best perioperative care for patients who are at high-risk or who already have mild cognitive impairment or dementia. A consensus statement from the First International Workshop on Anesthetics and Alzheimer's Disease initially shed some light on this possible link and provided some recommendations (53). A tailored anesthesia is needed for surgical patients of advanced age with





underlying neurodegenerative disease: choosing total intravenous anesthesia, avoiding inhalational agents and benzodiazepines, monitoring the depth of anesthesia and if possible brain oxygenation, monitoring and controlling temperature and glycemia, and considering early extubation with a multimodal postoperative analgesic plan (23,54,55). In the only randomized study, Liu et al. (41) evaluated whether exposure to anesthetics induces progression of mild cognitive impairment. The authors concluded that sevoflurane anesthesia accelerated cognitive decline, and they recommended regional anesthesia or intravenous anesthesia with propofol rather than volatile anesthetics for patients with pre-existing Alzheimer's disease. This finding is consistent with the preclinical data that suggest a greater production of A $\beta$  by volatile anesthetics, as discussed above.

In conclusion, the extent of cognitive decline following surgery and anesthesia has a significant impact on patient health and is substantially associated with prolonged recovery, greater morbidity, and loss of independence in these patients. Recognition of the risk factors will provide us with better

prevention and management strategies to provide the best care for elderly patients who have or are at high-risk for POCD. In summary, possible strategies for the prevention and treatment of postoperative cognitive impairment in elderly patients include the use of perioperative cognitive education, geriatric consultation for high-risk patients, cooperation with family members to promote early rehabilitation, preference for minimally invasive surgical techniques, careful use of sedative premedication drugs, preference for short-acting anesthetic agents, maintenance of fluid, electrolyte, and glycemic homeostasis, and use of electroencephalogram. In the elderly patient, especially in the presence of other comorbid diseases, the surgical decision should be made carefully while considering possible cognitive deterioration. A multidisciplinary perioperative approach, with collaboration between surgery, anesthesiology, and geriatrics, is a necessity in caring for geriatric patients.

### Acknowledgement

The authors have no conflict of interest to disclose.

### REFERENCES

1. O' Brien H, Mohan H, Hare CO, Reynolds JV, Kenny RA. Mind over matter? The hidden epidemic of cognitive dysfunction in the older surgical patient. *Ann Surg* 2017;265(4):677-91. (PMID:27537541).
2. Alzheimer's Association. 2016 Alzheimer's disease facts and figures. *Alzheimer's Dement* 2016;12(4):459-509. (PMID:27570871).
3. Müller A, Lachmann G, Wolf A, Mörgeli R, Weiss B, Spies C. Peri-and postoperative cognitive and consecutive functional problems of elderly patients. *Curr Opin Crit Care* 2016;22:406-11. (PMID:27272100).
4. Steinmetz J, Rasmussen LS. Peri-operative cognitive dysfunction and protection. *Anaesthesia* 2016;71:58-63. (PMID:26620148).
5. Bedford PD. Adverse cerebral effects of anaesthesia on old people. *Lancet* 1955;269(6884):259-63. (PMID:13243706).
6. Moller JT, Cluitmans P, Rasmussen LS, et al. Long-term postoperative cognitive dysfunction in the elderly ISPOCD1 study. ISPOCD investigators. International Study of Post-Operative Cognitive Dysfunction. *Lancet* 1998;351(9106):857-61. (PMID:9525362).
7. Strøm C, Rasmussen LS, Sieber FE. Should general anaesthesia be avoided in the elderly? *Anaesthesia* 2014;69:35-44. (PMID:24303859).
8. Androsova G, Krause R, Winterer G, Schneider R. Biomarkers of postoperative delirium and cognitive dysfunction. *Front Aging Neurosci* 2015;7:112. (PMID:26106326).
9. Berger M, Burke J, Eckenhoff R, Mathew J. Alzheimer's disease, anesthesia, and surgery: a clinically focused review. *J Cardiothorac Vasc Anesth* 2014;28(6):1609-23. (PMID:25267693).
10. Deiner S, Silverstein JH. Postoperative delirium and cognitive dysfunction. *Br J Anaesth* 2009;103:i41-6. (PMID:20007989).
11. Aiello Bowles EJ, Larson EB, Pong RP, et al. Anesthesia exposure and risk of dementia and Alzheimer's disease: a prospective study. *J Am Geriatr Soc* 2016;64(3):602-7. (PMID:26865152).

12. Sprung J, Roberts RO, Weingarten TN, et al. Postoperative delirium in elderly patients is associated with subsequent cognitive impairment. *Br J Anaesth* 2017;119(2):316-23. (PMID:28854531).
13. Daulatzai MA. "Boomerang neuropathology" of late-onset Alzheimer's disease is shrouded in harmful "BDDS": breathing, diet, drinking, and sleep during aging. *Neurotox Res* 2015;28(1):55-93. (PMID:25911292).
14. Hartholt KA, van der Cammen TJ, Klimek M. Postoperative cognitive dysfunction in geriatric patients. *Z Gerontol Geriatr* 2012;45(5):411-6. (PMID:22538789).
15. Terrando N, Brzezinski M, Degos V, et al. Perioperative cognitive decline in the aging population. *Mayo Clin Proc* 2011;86(9):885-93. (PMID:21878601).
16. de Lange F, Jones WL, Mackensen GB, Grocott HP. The effect of limited rewarming and postoperative hypothermia on cognitive function in a rat cardiopulmonary bypass model. *Anesth Analg* 2008;106(3):739-45. (PMID:18292411).
17. Hovens IB, van Leeuwen BL, Mariani MA, Kraneveld AD, Schoemaker RG. Postoperative cognitive dysfunction and neuroinflammation; cardiac surgery and abdominal surgery are not the same. *Brain Behav Immun* 2016;54:178-93. (PMID:26867718).
18. Hovens IB, Schoemaker RG, van der Zee EA, Absalom AR, Heineman E, van Leeuwen BL. Postoperative cognitive dysfunction: Involvement of neuroinflammation and neuronal functioning. *Brain Behav Immun* 2014;38:202-10. (PMID:24517920).
19. Bilbo SD, Smith SH, Schwarz JM. A lifespan approach to neuroinflammatory and cognitive disorders: a critical role for glia. *J Neuroimmune Pharmacol* 2012;7(1):24-41. (PMID:21822589).
20. Wu Z, Yu J, Zhu A, Nakanishi H. Nutrients, Microglia Aging, and Brain Aging. *Oxid Med Cell Longev* 2016;2016:7498528. (PMID:26941889).
21. Tan CB, Ng J, Jeganathan R, et al. Cognitive changes after surgery in the elderly: does minimally invasive surgery influence the incidence of postoperative cognitive changes compared to open colon surgery? *Dement Geriatr Cogn Disord* 2015;39(3-4):125-31. (PMID:25471533).
22. Fodale V, Santamaria LB, Schifilliti D, Mandal PK. Anaesthetics and postoperative cognitive dysfunction: a pathological mechanism mimicking Alzheimer's disease. *Anaesthesia* 2010;65(4):388-95. (PMID:20136805).
23. Inan G, Özköse Satırlar Z. Alzheimer disease and anesthesia. *Turk J Med Sci* 2015;45(5):1026-33. (PMID:26738343).
24. Xie Z, Xu Z. General anesthetics and  $\beta$ -amyloid protein. *Prog Neuropsychopharmacol Biol Psychiatry* 2013;47:140-6. (PMID:22918033).
25. Zhou R, Bickler P. Interaction of isoflurane, tumor necrosis factor- $\alpha$  and  $\beta$ -amyloid on long-term potentiation in rat hippocampal slices. *Anesth Analg* 2017;124(2):582-7. (PMID:28099324).
26. Zhang Y, Xu Z, Wang H, et al. Anesthetics isoflurane and desflurane differently affect mitochondrial function, learning, and memory. *Ann Neurol* 2012;71(5):687-98. (PMID:22368036).
27. Zhen Y, Dong Y, Wu X, et al. Nitrous oxide plus isoflurane induces apoptosis and increases beta-amyloid levels. *Anesthesiology* 2009;111(4):741-52. (PMID:19741497).
28. Jiang J, Jiang H. Effect of the inhaled anesthetics isoflurane, sevoflurane and desflurane on the neuropathogenesis of Alzheimer's disease (review). *Mol Med Rep* 2015;12(1):3-12. (PMID:25738734).
29. Whittington RA, Papon MA, Chouinard F, Planel E. Hypothermia and Alzheimer's disease neuropathogenic pathways. *Curr Alzheimer Res* 2010;7(8):717-25. (PMID:20678067).
30. Wu X, Lu Y, Dong Y, et al. The inhalation anesthetic isoflurane increases levels of proinflammatory TNF- $\alpha$ , IL-6, and IL-1 $\beta$ . *Neurobiol Aging* 2012;33(7):1364-78. (PMID:21190757).
31. Palotás A, Reis HJ, Bogáts G, et al. Coronary artery bypass surgery provokes Alzheimer's disease-like changes in the cerebrospinal fluid. *J Alzheimers Dis* 2010;21(4):1153-64. (PMID:21504113).
32. Tang JX, Baranov D, Hammond M, et al. Human Alzheimer and inflammation biomarkers after anesthesia and surgery. *Anesthesiology* 2011;115(4):727-32. (PMID:21857497).
33. Shiya N, Kunihara T, Miyatake T, Matsuzaki K, Yasuda K. Tau protein in the cerebrospinal fluid is a marker of brain injury after aortic surgery. *Ann Thorac Surg* 2004;77(6):2034-8. (PMID:15172260).
34. Reinsfelt B, Ricksten SE, Zetterberg H, Blennow K, Fredén-Lindqvist J, Westerlind A. Cerebrospinal fluid markers of brain injury, inflammation, and blood-brain barrier dysfunction in cardiac surgery. *Ann Thorac Surg* 2012;94(2):549-55. (PMID:22698770).
35. Seitz DP, Shah PS, Herrmann N, Beyene J, Siddiqui N. Exposure to general anesthesia and risk of Alzheimer's disease: a systematic review and meta-analysis. *BMC Geriatr* 2011;11:83. (PMID:22168260).
36. Sprung J, Jankowski CJ, Roberts RO, et al. Anesthesia and incident dementia: a population-based, nested, case-control study. *Mayo Clin Proc* 2013;88(6):552-61. (PMID:23642337).



37. Chen CW, Lin CC, Chen KB, Kuo YC, Li CY, Chung CJ. Increased risk of dementia in people with previous exposure to general anesthesia: a nationwide population-based case-control study. *Alzheimers Dement* 2014;10(2):196-204. (PMID:23896612).
38. Lee TA, Wolozin B, Weiss KB, Bednar MM. Assessment of the emergence of Alzheimer's disease following coronary artery bypass graft surgery or percutaneous transluminal angioplasty. *J Alzheimers Dis* 2005;7(4):319-24. (PMID:16131734).
39. Vanderweyde T, Bednar MM, Forman SA, Wolozin B. Iatrogenic risk factors for Alzheimer's disease: surgery and anesthesia. *J Alzheimers Dis* 2010;22(3):91-104. (PMID:20858967).
40. Chen PL, Yang CW, Tseng YK, et al. Risk of dementia after anaesthesia and surgery. *Br J Psychiatry* 2014;204(3):188-93. (PMID:23887997).
41. Liu Y, Pan N, Ma Y, et al. Inhaled sevoflurane may promote progression of amnesic mild cognitive impairment: a prospective, randomized parallel-group study. *Am J Med Sci* 2013;345(5):355-60. (PMID:23044653).
42. Seitz DP, Reimer CL, Siddiqui N. A review of epidemiological evidence for general anesthesia as a risk factor for Alzheimer's disease. *Prog Neuropsychopharmacol Biol Psychiatry* 2013; 47:122-7. (PMID:22771690).
43. Selekler K. Are there preventive factors in Alzheimer's disease? Part: I. Antioxidants, non-steroid anti-inflammatory drugs, estrogen and statins. *Turkish Journal of Geriatrics* 2007;10(2):88-99. (In Turkish).
44. Karadas O, Koc G, Ozon AO, Ozturk B, Konukoglu D. Biomarkers of Alzheimer's disease and vascular dementia simultaneously sampled from serum and cerebrospinal fluid. *Turkish Journal of Geriatrics* 2017;20(1):1-7.
45. Aldecoa C, Bettelli G, Bilotta F, et al. European Society of Anaesthesiology evidence-based and consensus-based guidelines on postoperative delirium. *Eur J Anaesthesiol* 2017;34(4):1-23. (PMID:28187050).
46. Daulatzai MA. Cerebral hypoperfusion and glucose hypometabolism: Key pathophysiological modulators promote neurodegeneration, cognitive impairment, and Alzheimer's disease. *J Neurosci Res* 2017;95(4):943-972. (PMID:27350397).
47. Mason SE, Noel-Storr A, Ritchie CW. The impact of general and regional anesthesia on the incidence of post-operative cognitive dysfunction and post-operative delirium: a systematic review with meta-analysis. *J Alzheimers Dis* 2010;22(3):67-79. (PMID:20858956).
48. Rasmussen LS, Johnson T, Kuipers HM, et al. Does anaesthesia cause postoperative cognitive dysfunction? A randomised study of regional versus general anaesthesia in 438 elderly patients. *Acta Anaesthesiol Scand* 2003;47(3):260-6. (PMID:12648190).
49. Atay IM, Aslan A, Atay T, Burc H. Prevalence of delirium, risk factors and cognitive functions in elderly hip fracture patients with general and spinal anesthesia. *Turkish Journal Of Geriatrics* 2012;15(3):273-8. (in Turkish).
50. Wu CL, Hsu W, Richman JM, Raja SN. Postoperative cognitive function as an outcome of regional and general anaesthesia. *Reg Anesth Pain Med* 2004;29(3):257-68. (PMID:15138912).
51. Ilango S, Pulle RC, Bell J, Kuys SS. General versus spinal anaesthesia and postoperative delirium in an orthogeriatric population. *Australas J Ageing* 2016;35(1):42-7. (PMID:26364948).
52. Vanderweyde T, Bednar MM, Forman SA, Wolozin B. Iatrogenic risk factors for Alzheimer's disease: surgery and anesthesia. *J Alzheimers Dis* 2010;22(3):91-104. (PMID:20858967).
53. Baranov D, Bickler PE, Crosby GJ, et al. First international workshop on anesthetics and Alzheimer's disease consensus statement: first international workshop on anesthetics and Alzheimer's disease. *Anesth Analg* 2009;108(5):1627-30. (PMID:19372347).
54. Lobo FA, P Saraiva A. Playing games with the brain: the possible link between anesthesia and Alzheimer's disease revisited. *Rev Esp Anesthesiol Reanim* 2014;61(8):417-21. (PMID:25171825).
55. Chan MT, Cheng BC, Lee TM, Gin T, CODA Trial Group. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol* 2013;25(1):33-42. (PMID:23027226).



Turkish Journal of Geriatrics  
DOI: 10.31086/tjgeri.2018137972  
2018;21 (1):100-107

■ Nezahat Tuğba  
DURLU KANDİLCİ<sup>1</sup>

#### CORRESPONDANCE

Nezahat Tuğba DURLU KANDİLCİ  
Hacettepe University, Faculty of Pharmacy  
Department of Pharmacology  
Ankara, Turkey

Phone: 3123051088  
e-mail: ndurlu@hacettepe.edu.tr

Received: 06/12/2017  
Accepted: 09/02/2018

<sup>1</sup> Hacettepe University, Faculty of Pharmacy  
Department of Pharmacology  
Ankara, Turkey

#### REVIEW ARTICLE

## URINARY INCONTINENCE IN ELDERLY FROM A VIEW OF A PHARMACIST: DETRUSOR IMPAIRMENT AND TREATMENT

### ABSTRACT

Aging results in impairments in the bladder function and causes alterations in many organs. In recent clinical studies, aging has been shown to alter the bladder function based on the observed decrease in filling, storage and emptying capacities of the bladder. In experimental studies, it has been postulated that aging changes the bladder function via symptoms such as a decrease in its voiding efficacy and an unwanted increase in its activity. This causes enuresis, also known as urinary incontinence, an important social concern that negatively affects the quality of the patient's social life. The incidence of urinary incontinence is particularly an issue in older women; the adverse effects of the drugs used for treatment and compliance issues prevent a successful treatment. In some studies examining the effects of aging on rat bladder, it has been proposed that the intracellular signalling mechanisms of agonist-induced contractile responses may be altered with an increase in age. The permeabilised smooth muscle model is an efficient tool for investigating the functions of contractile proteins and intracellular organelles, which play a role in smooth muscle contractions. This model facilitates the study of the contractile functions in young and old animals to develop new drug molecules for the treatment of urinary incontinence. Although currently, antimuscarinic drugs are primarily used for the treatment of this condition, their adverse effects limit their efficacy.

**Keywords:** Aged; Urinary incontinence; Quality of life.

#### DERLEME MAKALE

## ECZACI BAKIŞ AÇISIYLA YAŞLILARDA ÜRİNER İNKONTİNANS: DETRUSOR HASARI VE TEDAVİ

### Öz

Yaşlanma, mesane fonksiyonlarında bozukluklara yol açmaktadır ve birçok organda değişikliğe neden olmaktadır. Son zamanlarda yapılan klinik çalışmalarda, yaşlanmanın mesanenin fonksiyonlarını mesanenin dolun, depolama ve boşaltım fonksiyonlarında azalmaya bağlı olarak değiştirdiği gösterilmiştir. Deneysel çalışmalarda ise, yaşlanmanın mesane fonksiyonlarını işleme etkinliğinde azalma ve mesane aktivitesinde istenilmeyen artış gibi bazı semptomlar aracılığı ile değiştirdiği gösterilmiştir. Bu da idrar tutamama yani üriner inkontinans gibi hastanın sosyal yaşam kalitesini negatif olarak etkileyen önemli bir sosyal probleme neden olmaktadır. Üriner inkontinans görülme sıklığı özellikle yaşlı kadınlarda önemli bir konudur; tedavide kullanılan ilaçların yan etkileri ve hastaların uyuncu problem başarılı bir tedaviyi önlemektedir. Siçan mesanesi üzerine yaşlanmanın etkisini inceleyen bazı çalışmalarda, agonist ile indüklenen kasılma yanıtlarının hücre içi sinyal iletim mekanizmalarının yaştaki artışa bağlı olarak değişebileceği öne sürülmüştür. Permeabilize düz kas modeli düz kasın kasılmasında rol oynayan proteinlerin ve hücre içi organellerin fonksiyonlarını araştırmak için değerli bir yöntemdir. Bu yöntem üriner inkontinans tedavisinde yeni ilaç moleküllerinin geliştirilmesi için genç ve yaşlı deney hayvanlarındaki kasılma yanıtlarının çalışılmasını kolaylaştırmaktadır. Günümüzde primer olarak antimuskarinik ilaçlar bu hastalığın tedavisinde kullanılsa da yan tesirleri bu ilaçların etkinliklerini kısıtlamaktadır.

**Anahtar sözcükler:** Yaşlı; Üriner inkontinans; Yaşam kalitesi.



## INTRODUCTION

The lower urinary tract has three main parts: the urinary bladder, urethra and the urethral sphincter complex. The urinary bladder wall consists of the mucosa, muscularis propria (also known as the detrusor muscle) and adventitia. The mucosa consists of the urothelium that comes in contact with the urine directly and at the same time acts as a blood–urine barrier against various types of pathogens, ions and molecules found in the urine. The urothelium, which has different types of receptors and ion channels, receives and then transmits information to other bladder components such as sensory nerve fibres, myofibroblasts and smooth muscle cells (1). The autonomic nervous system helps coordinate the normal bladder function by releasing mediators from the urothelium. The smooth muscles are arranged in three layers in the muscularis propria of the bladder; although in the innermost and the outermost layers, the muscles are arranged longitudinally, in the middle layer, the detrusor smooth muscle fibres are arranged in a circular manner (2).

The wall of the urinary bladder mainly consists of the detrusor smooth muscles, which play an important role in urine storage, filling and emptying. Urine is continuously produced by the kidneys, whereas voiding is not a continuous process. In a healthy young adult, the function of the urinary bladder depends on the synchronised relaxation of the detrusor smooth muscles and contraction of the urethral sphincter during urine storage; during micturition, the situation is the complete opposite. These functions are all elicited by the coordinated activity of the spinal cord, pons and excitatory, inhibitory and sensory nerves in the forebrain. The innervation of the bladder is obtained by the actions of the cholinergic, nitrenergic, purinergic, monoaminergic and peptidergic mechanisms (3). Detrusor sensitivity to agonists, its spontaneous activity and the levels of the contractile proteins may vary under situations such as urethral obstruction, urinary incontinence and aging.

## AGING AND BLADDER FUNCTIONS

Aging causes changes in many organs and bodily functions, including a significant decrease in the filling, storage and emptying functions of the bladder. Among the symptoms of this decrease in the various bladder functions, the more pronounced ones are reduced voiding efficiency and bladder overactivity that may lead to a concern, i.e. urinary incontinence, which affects the patient's quality of social life (4). In particular, in women, high impact exercising and childhood enuresis are found to be related with further development of urinary incontinence and so mechanisms associated with pelvic floor gain importance in prevention of this disease (5). Urinary incontinence incidences increase with age, and the side effects of the currently used drugs hinder successful treatment. In parallel with age, bladder outlet obstruction, sphincter injury, polypharmacy and urinary tract infections may also lead a pronounced urinary incontinence in the patient (6).

There are several studies, particularly on rats, examining the effects of aging on the bladder. Although it seems that the contractile proteins are not affected by aging, several studies have shown that intracellular mechanisms involving secondary messengers may alter with aging and affect the response of the bladder to agonists (7).

Voiding occurs approximately eight times a day in a healthy young adult. The urinary bladder can adjust its volume to more than 500 ml without any increase in the intravesical pressure, allowing the storage of a large amount of urine. During the filling phase, the increase in the intravesical pressure does not exceed the filtration pressure, preventing renal failure. The relaxation of the bladder supported by the resistance of the internal and external urethral sphincter aids the filling phase. On the contrary, the voiding phase starts with the contraction of the bladder accomplished by a low outflow resistance. The autonomic and somatic nervous systems control the smooth and the skeletal muscle contractile

activity of the urinary bladder and urethra to sustain the filling and the voiding phases (8). Therefore, to understand the pathophysiology of incontinence and to develop further treatments, one should focus on how the smooth muscle of the urinary bladder, i.e. the detrusor muscle, is affected by the aging process.

Activation of the muscarinic receptors is primarily responsible for the sustained contraction necessary for the emptying of the urinary bladder.  $M_2$  and  $M_3$  muscarinic receptor subtypes have been identified in rat and guinea pig bladders (and in taenia caecum), of which the  $M_3$  receptor subtype has been shown to mediate the contraction in these three tissues. It has been reported that both  $M_2$  and  $M_3$  receptor subtypes are involved in normal rat bladder contractions, with the  $M_3$  subtype activating PI-PLC, PC-PLC, and PKA and the  $M_2$  subtype activating ROK and PKC through an additional contractile signal transduction mechanism (9). Detrusor sensitivity to agonists such as carbachol, prostaglandins and serotonin, its spontaneous activity, and contractile proteins levels can change in some conditions, such as during urinary incontinence. Therefore, it is important to understand the mechanisms underlying agonist-induced contractions in the detrusor smooth muscles to further develop therapeutic management strategies for bladder instability associated with the incontinence.

### **DETRUSOR IMPAIRMENT PATHWAYS**

Smooth muscle contraction is primarily brought about by an increase in cytosolic calcium produced by calcium entry through voltage-sensitive calcium channels or by calcium release from the sarcoplasmic reticulum [often via a mechanism involving the  $Ca^{2+}$  mobilising messenger inositol triphosphate ( $IP_3$ )]. The main intracellular calcium store is the "sarcoplasmic reticulum." Calcium release from the sarcoplasmic reticulum can be mediated by both ryanodine and  $IP_3$  receptors. The two mechanisms of calcium release from the

internal calcium stores, calcium-induced calcium release (CICR) that is sensitive to ryanodine and  $IP_3$ -induced calcium release (IICR), take place in smooth muscles, i.e. the detrusor muscles in the urinary bladder (10). Agonists activating G-protein-coupled receptors (GPCRs) increase force in the smooth muscles via calcium/calmodulin-dependent myosin light-chain phosphorylation. The ratio of activities of calcium/calmodulin-dependent myosin light-chain kinase (MLCK) and myosin light-chain phosphatase (MLCP) determines the level of myosin light-chain phosphorylation and hence the activation of the smooth myocytes. Inhibition of MLCP can be induced directly by Rho-kinase (ROK) or by phosphorylation of the phosphatase inhibitor CPI-17 through protein kinase C (PKC). There are, however, mechanisms, which can lead to muscle contraction without any necessary change in intracellular calcium ( $[Ca^{2+}]_i$ ). When  $[Ca^{2+}]_i$  and MLCK activity is constant, agonists activating GPCRs may cause a leftward shift of the calcium/force response curve, (*calcium sensitisation*). A major pathway that can cause this operates through ROK and PKC and is thought to involve the inhibition of myosin phosphatase activity under constant calcium conditions, thereby enhancing myosin light-chain phosphorylation and causing an increase in force (11, 12).

In recent years, two other major intracellular  $Ca^{2+}$  mobilising messengers, cyclic adenosine diphosphate ribose (cADPR) and nicotinic acid adenine dinucleotide phosphate (NAADP), have been implicated in the pharmacomechanical coupling of the smooth muscles. In a previous study, we provided the first systematic analysis of the ability of  $IP_3$ , cADPR and NAADP to cause contraction in the smooth muscles, and using the permeabilised urogenital tract smooth muscles, we showed that these  $Ca^{2+}$  mobilising messengers along with  $IP_3$  evoke contractions. NAADP uniquely mobilises acidic calcium stores, likely activating the two-pore channel protein 2 (TPC2), a key component of the NAADP receptor (13). The proposal that the TPC family involves  $Ca^{2+}$ -permeable channels regulated



by NAADP was a promising development that may be used for new drug therapy innovations in elderly people suffering from urinary incontinence.

### PERMEABILISED DETRUSOR

The intracellular mechanisms of contractions, including calcium sensitisation, can be studied using chemically permeabilised smooth muscle preparations in which the plasma membrane is permeabilised using a chemical substance. In these preparations, the external and internal media contain the same ions (which can be manipulated). Chemically permeabilised smooth muscle is an experimental model for studying the intracellular organelles and signal cascades responsible for agonist-induced smooth muscle contraction and hence investigating the different levels of molecular control. For instance,  $\beta$ -escin is a saponin ester, which opens the pores of the plasma membrane and makes the cell membrane permeable to higher molecular weight compounds (up to 150 kDa), including heparin and  $IP_3$ , and retains receptor–effector coupling (14). We also used the  $\beta$ -escin permeabilisation method while investigating how aging affects the intracellular calcium movements due to carbachol-induced contractions in permeabilised female rat bladder smooth muscles. In this study, we observed that carbachol-induced contractions decrease with age in rat bladder detrusor as a result of a reduction in calcium-induced calcium release (CICR), rather than carbachol-induced calcium sensitization. We believe that these results obtained constitute a positive contribution to the development of new drug molecules in the treatment of urinary incontinence (15).

We have developed a functional permeabilised smooth muscle preparation to be used in rat, mouse and guinea pig bladders and by using this method, we have observed many intracellular mechanisms including Rho kinase and protein kinase C pathways revealing important data on how agonist-induced contractile responses may change from one species

into another or also under disease states (13,16). This preparation retains sensitivity to membrane receptor agonists and can be activated by the exogenous application of intracellular messengers causing contractions.  $\beta$ -escin is a saponin ester that opens the pores in the plasma membrane of cells, allowing the passage of molecules having a molecular weight of up to 30000-40000 kilodalton. The ability to introduce larger molecules into the cell makes  $\beta$ -escin a preferable molecule for the study of the pathways mediating agonist-induced contractile responses in the smooth muscles by retaining receptor–effector coupling and at the same time enabling the access of heparin and calmodulin into the cells. Smooth muscle preparations treated with  $\beta$ -escin have been shown to respond to excitatory agonists through the  $IP_3$ -mediated release of  $Ca^{2+}$  and have also shown calcium sensitisation as in our studies investigating the agonist-mediated intracellular pathways, i.e. affected under pathological conditions like urinary incontinence (13,15,16).

### AGING AND INTRACELLULAR MECHANISMS

Investigating the roles of intracellular calcium signalling pathways in the treatment of urinary incontinence is a new therapeutic approach. This has evolved owing to the pronounced role of ROK in the regulation of urinary bladder smooth muscle tone and contraction demonstrated in many studies. It has also been suggested that variations in agonist-induced contractions due to aging depend on impairments in the intracellular signal transduction pathways. Furthermore, it was observed that the decreased response of the bladder to  $\beta$ -adrenergic stimulation due to aging is related to both an inhibition in the adenylyl cyclase activity and changes in the G protein content or function (17). However, the intracellular mechanisms underlying the functional changes that may occur with aging in the bladder have not been completely explained.

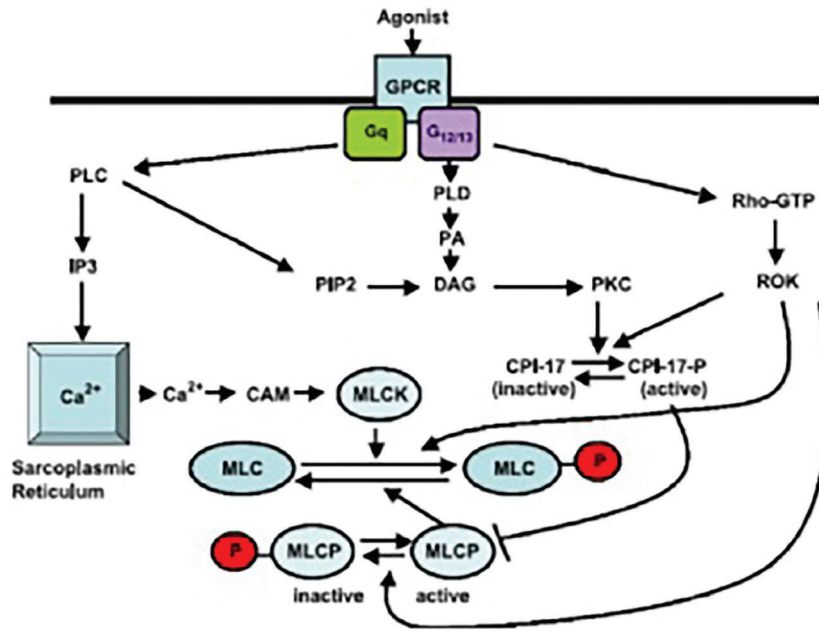


Figure 1. Mechanism of smooth muscle contraction and calcium sensitisation (12).

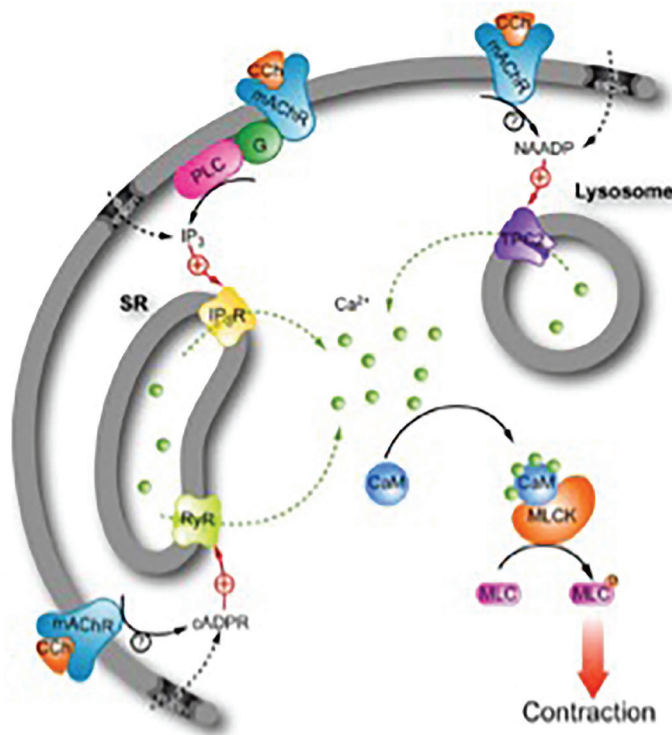


Figure 2. Receptor-mediated  $Ca^{2+}$  signalling pathways in the detrusor smooth muscles. Muscarinic receptor activation causes release of  $Ca^{2+}$  from both sarcoplasmic reticulum and lysosomal stores (13).





Another promising area of investigation with respect to the pathophysiology and treatment of urinary incontinence is the contribution of one of the endogenous gas mediators, hydrogen sulphide. Interstitial cystitis is a syndrome characterised by chronic inflammation of the bladder in which detrusor smooth muscle contractions may vary. It is known as a syndrome of bladder hypersensitivity that is characterised by bladder sensation and fullness, i.e. urgency to urinate even with a low volume of urine. It has been known that carbachol-induced contractions in the bladder of rats increase in cyclophosphamide-induced experimental cystitis. However, the mechanism underlying this change is unclear. Because inflammation, like other abnormal changes, may cause an impairment in bladder functions leading to increased urination frequency (overactive bladder syndrome), this may easily lead to urinary incontinence. Overactive bladder syndrome, with concomitant interstitial cystitis, is a chronic disease characterised by suprapubic pain depending on bladder filling. *Escherichia coli* is responsible for the majority of urinary tract infections, and it may cause interstitial cystitis. Therefore, interstitial cystitis is a syndrome often caused by overactive detrusor and chronic inflammation of the bladder and may alter the contractile function of the bladder detrusor smooth muscles. Under pathological conditions, muscarinic receptor subtypes in the bladder change and particularly in cases of bladder inflammation, it was determined that contractile responses decreased due to changes in cholinergic responses (18). In a recent paper, endogenous hydrogen sulphide was shown to play a role in bladder pain through the activation of T-type calcium channels in mice with cyclophosphamide-induced cystitis (19).

## DRUG THERAPY IN ELDERLY WITH URINARY INCONTINENCE

Antimuscarinic drugs are still the first line therapy in the treatment of urinary incontinence (20). Although they have a good initial response, because these

drugs are typically used for many years, their efficacy decreases and rate of adverse effects increases over time. Ones treating the patients should be aware of the adverse effects of these drugs and apply a pharmacotherapy that is individually developed (21). Hence, the long-term necessity of new drug therapies is inevitable.

There are some therapies targeting the urothelium of the urinary bladder. For instance, nerve growth factor (NGF) antibodies are thought to be effective in the treatment of urinary incontinence. However, because these drugs block all NGFs involved in many physiological situations throughout the body, the incidence of adverse effects is very high. Additional treatment candidates might be the use of muscarinic receptor antagonists, purinergic receptor antagonists and prostaglandin receptor antagonists (20).

Drugs that act on the detrusor smooth muscles are more important in terms of reducing the severity of incontinence symptoms in the elderly. One of the drugs that has been used for many years is from the muscarinic receptor antagonist family, namely, acetylcholine. Acetylcholine is mainly effective in the filling phase of the bladder, and to an extent, it increases the voiding contraction. However, its secondary effect occurs at high doses and leads to adverse effects that are not acceptable to patients (20). Another group acting on the smooth muscles is  $\beta_3$  adrenergic receptor agonists, which promise a decrease in urgency and a relief from urinary incontinence. A prototype drug from this group is miragebron (22). Particularly, in elderly males with both incontinence and erectile dysfunction, phosphodiesterase type 5 inhibitors such as sildenafil or tadalafil could be good therapeutic candidates, but their use in females remains unclear (23). Depending on the research mentioned above on the ROK pathways involved in incontinence, ROK inhibitors may also be effective treatment candidates. Unfortunately, currently, there is insufficient information about their potential adverse effects (24).

## BOTULINUM TOXIN A

Intravesical botulinum toxin A (BTX-A) is a potential treatment for incontinence emanating from interstitial cystitis. BTX-A is a very potent neurotoxin derived from the anaerobic bacterium *Clostridium botulinum*. It inhibits the release of the neurotransmitter acetylcholine at the neuromuscular junction and therefore decreases the muscle contractility at the injection site. This intravesical therapy is generally well-tolerated by the elderly population, particularly women. However, some adverse effects may occur, i.e. dysuria, haematuria, impaired detrusor contractility and a decrease in the voiding strength. Such patients on BTX-A therapy also show a high incidence of urinary tract infections (particularly of those caused by viruses) (25). However, BTX-A treatment does not cause adverse effects such as dry mouth, constipation, dyspepsia and dizziness that commonly occur with antimuscarinic therapy, thus increasing patient compliance.

Moreover, there might be drug combinations to help the elderly who suffer with the symptoms of incontinence. Alpha 1-adrenergic antagonists and 5-alpha reductase inhibitors are two such examples (20).

## REFERENCES

1. Andersson KE, Arner A. Urinary bladder contraction and relaxation: physiology and pathophysiology. *Physiol Rev* 2004;84(3):935-86. (PMID:15269341).
2. Michel MC, Igawa Y. Therapeutic targets for overactive bladder other than smooth muscle. *Expert Opin Ther Targets* 2015;19(5):687-705. (PMID:25704500).
3. de Groat WC, Yoshimura N. Pharmacology of the lower urinary tract. *Annu Rev Pharmacol Toxicol* 2001;41:691-721. (PMID:11264473).
4. Smith PP. Aging and the Underactive Detrusor: A Failure of Activity or Activation? *Neurourol and Urodyn* 2010;29:408-12. (PMID:19760756).
5. Almousa S, van Loon AB. The prevalence of urinary incontinence in nulliparous adolescent and middle-aged women and the associated risk factors: A systematic review. *Maturitas* 2018;107:78-83. (PMID:29169586).

## CONCLUSION

It is well known that the prevalence of bladder dysfunctions, i.e. impaired urine storage and voiding performance, increases with age. In the human urinary bladder, due to the aging process, it is difficult to determine the exact reasons underlying the impairment of the detrusor. There are useful data obtained from studies conducted on age-related changes in animal models. However, both morphological changes and intracellular signal transduction pathway impairments may lead to incontinence in the elderly population. Impaired contractility may be related to different pathophysiological changes due to aging. Therefore, among the drug therapies that are available, those aiding in curing symptoms might lead to many adverse effects in elderly people. Due to improved data on intracellular pathways involved in incontinence, there are now good candidates for new therapeutic agents. The use of hydrogen sulphide and similar agents might be important in developing new drug therapies for incontinence.

6. Hester AG, Kretschmer A, Badlani G. Male Incontinence: The Etiology or Basis of Treatment. *Eur Urol Focus* Oct;3(4-5):377-84. (PMID:29249687).
7. Derweesh IH, Wheeler MA, Weiss RM. Alterations in G-proteins and beta-adrenergic responsive adenylyl cyclase in rat urinary bladder during aging. *J Pharmacol Exp Ther* 2000;294(3):969-74. (PMID:10945848).
8. Fry CH, Meng E, Young JS. The physiological function of lower urinary tract smooth muscle. *Auton Neurosci* 2010;154(1-2):3-13. (PMID:19939745).
9. Braverman AS, Tibb A, Ruggieri MR. M<sub>2</sub> and M<sub>3</sub> muscarinic receptor activation of urinary bladder contractile signal transduction. I. Normal rat bladder. *J Pharmacol Exp Ther* 2006;316(2):869-74. (PMID:16243961).
10. Wibo M, Godfraind T. Comparative localization of inositol 1,4,5-trisphosphate and ryanodine



- receptors in intestinal smooth muscle: an analytical subfractionation study. *Biochem J* 1994;297(Pt 2):415-23. (PMID:8297349).
11. Somlyo AP, Somlyo AV.  $\text{Ca}^{2+}$  sensitivity of smooth muscle and nonmuscle myosin II: modulated by G proteins, kinases, and myosin phosphatase. *Physiol Rev* 2003;83(4):1325-58. (PMID:14506307).
  12. Watterson KR, Ratz PH, Spiegel S. The role of sphingosine-1-phosphate in smooth muscle contraction. *Cell Signal*. 2005;17(3):289-98. (PMID:15567060).
  13. Tugba Durlu-Kandilci N, Ruas M, Chuang KT, Brading A, Parrington J, Galione A. TPC2 proteins mediate nicotinic acid adenine dinucleotide phosphate (NAADP)- and agonist-evoked contractions of smooth muscle. *J Biol Chem* 2010;285(32):24925-32. (PMID:20547763).
  14. Kitazawa T, Kobayashi S, Horiuti K, Somlyo Av, Somlyo AP. Receptor-coupled, permeabilized smooth muscle. Role of the phosphatidylinositol cascade, G-proteins, and modulation of the contractile response to  $\text{Ca}^{2+}$ . *J Biol Chem* 1989;264(10):5339-42. (PMID:2494163).
  15. Durlu-Kandilci NT, Denizalti M, Sahin-Erdemli I. Aging changes agonist induced contractile responses in permeabilized rat bladder. *Age* 2015;37(4):9807. (PMID:26153091).
  16. Durlu-Kandilci NT, Brading AF. Involvement of Rho kinase and protein kinase C in carbachol-induced calcium sensitization in beta-escin skinned rat and guinea-pig bladders. *Br J Pharmacol* 2006;148(3):376-84. (PMID:16565731).
  17. Kirschstein T, Protzel C, Porath K, Sellman T, Köhling R, Hakenberg OW. Age-dependent contribution of Rho kinase in carbachol-induced contraction of human detrusor smooth muscle in vitro. *Acta Pharmacol Sin* 2014;35(1):74–81. (PMID:24122009).
  18. Palea S, Artibani W, Ostardo E, Trist DG, Pietra C. Evidence for purinergic neurotransmission in human urinary bladder affected by interstitial cystitis. *J Urol* 1993;150(6):2007-12. (PMID:8230554).
  19. Matsunami M, Miki T, Nishiura K, et al. Involvement of the endogenous hydrogen sulfide/ $\text{Ca}^{2+}$  3.2 T-type  $\text{Ca}^{2+}$  channel pathway in cystitis-related bladder pain in mice. *Br J Pharmacol* 2012;167(4):917-28. (PMID:22646666).
  20. Andersson KE. Drugs and future candidates. *Can Urol Assoc J* 2011;5(5Suppl2):S131-3. (PMID:21989523).
  21. Geoffrion R. No. 283-Treatments for Overactive Bladder: Focus on Pharmacotherapy. *J Obstet Gynaecol Can* 2018;40(1):e22-e32. (PMID:29274717).
  22. Chapple CR, Dvorak V, Radziszewski P, et al. A phase II dose-ranging study of mirabegron in patients with overactive bladder. *Int Urogynecol J* 2013;24(9):1447-58. (PMID:23471546).
  23. McVary KT, Roehrborn CG, Kaminetsky JC, et al. Tadalafil relieves lower urinary tract symptoms secondary to benign prostatic hyperplasia. *J Urol* 2007;177:1401-7. (PMID:17382741).
  24. Morelli A, Vignozzi L, Filippi S, et al. BXL-628, a vitamin D receptor agonist effective in benign prostatic hyperplasia treatment, prevents RhoA activation and inhibits RhoA/Rho kinase signaling in rat and human bladder. *Prostate* 2007;67:234-47. (PMID:17163492).
  25. Tirumuru S, Al-Kurdi D, Latthe P. Intravesical botulinum toxin A injections in the treatment of painful bladder syndrome/interstitial cystitis: a systematic review. *Int Urogynecol J* 2010;21:1285–1300. (PMID:20449567).

International Institute on Ageing ve United Nations destekli

# 6. Geriatri ve Gerontoloji Kursu

7-11 Mayıs 2018

Neva Palas Otel  
Esat cad. No: 32 Küçükesat  
Ankara

[www.turkgeriatri.org](http://www.turkgeriatri.org)  
[www.gebam.hacettepe.edu.tr](http://www.gebam.hacettepe.edu.tr)



# Turkish Journal of Geriatrics

2018; 21(1)

## **A Population-Based Study: The Appropriateness of Drug Use in the Elderly According to Beers Criteria**

*Birol ÇIBİK, Erkan Melih ŞAHİN, Mehmet Göktuğ KILINÇARSLAN*

## **An Evaluation of Abuse and Neglect in Elderly with the Hwalek-Sengstock Elder Abuse Screening Test**

*Hande ŞAHİN, Sibel ERKAL*

## **Ageist Attitudes and Their Association with Burnout and Job Satisfaction Among Nursing Staff: A Descriptive Study**

*Serkan PEKÇETİN*

## **Can an Elective Geriatric Nursing Course Change Nursing Students' Attitudes and Willingness in Caring for the Elderly? A Quasi-Experimental Design Study**

*Burcu AKPINAR SÖYLEMEZ, Özlem KÜÇÜKGÜÇLÜ, Merve Aliye AKYOL*

## **Prevalence of Multidrug-Resistant Bacterial Colonization and Risk Factors in Geriatric Nursing Home Residents**

*Oya Özlem EREN KUTSOYLU, Vildan AVKAN OĞUZ, Madina ABDULLAYEVA, Nil TEKİN, Nur YAPAR*

## **Fall Risk and Related Factors in Knee Osteoarthritis**

*Meltem ALKAN MELİKOĞLU, Ayhan KUL*

## **Neuropathic Pain and Disability in Patients with Lumbar Spinal Stenosis**

*Mehmet AĞIRMAN, Ayşe Serap AKGÜN*

## **Mortality Factors in Geriatrics with Non-Traumatic Abdominal Pain at the Emergency Department**

*Süha SERİN, Bahadır ÇAĞLAR, Gökhan YILMAZ, Alper TORUN, İsmet PARLAK, Başak GÖL SERİN*

## **Effects of Lower Gastrointestinal Tract Surgery on Survival in Elderly and Octogenarian Patients**

*Hüseyin Onur AYDIN, Tevfik AVCI, Tugan TEZCANER, Erdal KARAGÜLLE, Sedat YILDIRIM*

## **One-Year Retrospective Evaluation of Hip Fracture Patients Aged More than 80 Years and Postoperatively Monitored in the Intensive Care Unit**

*Uygar DAŞAR*

## **A Clinical Review of the Consequences of Anesthesia and Surgery in the Elderly Brain: "The Dark Side of the Moon"**

*Gözde İNAN, Zerrin ÖZKÖSE ŞATIRLAR*

## **Urinary Incontinence in Elderly From a View of a Pharmacist: Detrusor Impairment and Treatment**

*Nezahat Tuğba DURLU KANDİLCİ*