# Clinical Profiles of Centenarian Patients Presenting to the Emergency Department with an Acute Disease

## Acil Servise Akut Bir Hastalıkla Başvuran Asırlık Hastaların Klinik Profilleri

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## Abstract

**Objective:** With the aging of society, the number of centenarians, i.e., individuals aged 100 years and over, is increasing. This study aimed to develop strategies to prevent mortality and morbidity by determining the clinical profiles of patients aged 100 and over who applied to the emergency department (ED).

**Materials and Methods:** The study was a retrospective analysis of patients aged 100 years and older that presented to the ED of tertiary hospital with an acute disease between 2012 and 2021. An analysis was performed using the patient files and computer database containing information on demographic characteristics, presentation complaints, clinical findings, emergency severity index (ESI) triage categories, final diagnoses and outcomes in the ED, length of hospital stay, and discharge characteristics.

**Results:** Of the 222 patients that presented to the ED, 98.6% were women, 78.8% lived in their own homes, and 71.6% were transferred to the hospital by ambulance. At the time of presentation, 72.1% of the patients were in the ESI 3 triage category. Overall, 35.1% of the patients were hospitalized, and the median length of stay in the ED was 240 minutes. Mortality was the in-hospital outcome in 10.4% of the patients. The ESI triage categories, number of consultations, and length of hospital stay were found to be directly related to mortality (p<0.001).

**Conclusion:** Defining patient profile and reasons for mortality and morbidity in centenarian patients, can be used to both prevent possible adverse events and effectively plan healthcare services in this population.

**Keywords:** Centenarian patients, emergency severity index, comorbidity, mortality, hospitalization

## Öz

**Amaç:** Toplumun yaşlanması ile birlikte asırlık yani 100 yaş ve üzeri bireylerin sayısı artmaktadır. Bu çalışma, acil servise başvuran 100 yaş ve üzeri hastaların klinik profillerini belirleyerek mortalite ve morbiditeyi önleyebilecek stratejiler geliştirmeyi amaçlamıştır.

**Gereç ve Yöntemler:** Çalışma 2012-2021 yılları arasında üçüncü basamak bir hastanenin acil servisine akut hastalık şikayeti ile başvuran 100 yaş ve üstü hastaların retrospektif analizini içermektedir. Çalışmada hastaların demografik özellikleri, başvuru şikayetleri, klinik bulguları, emergency severity index (ESI) triyaj kategorileri, acil servisteki kesin tanıları ve son durumları, hastanede kalış süreleri ve taburculuk gibi bilgiler hasta dosyaları ve bilgisayar veri tabanı kullanılarak analiz edildi.

**Bulgular:** Acil servise başvuran 222 hastanın %98,6'sı kadındı, %78,8'i kendi evinde yaşıyordu ve %71,6'sı ambulansla hastaneye sevk edilmişti. Başvuru anında hastaların %72,1'i ESI 3 triyaj kategorisindeydi. Genel olarak, hastaların %35,1'i hastaneye kaldırıldı ve acil serviste medyan kalış süresi 240 dakikaydı. Hastaların %10,4'ü mortalite ile sonuçlandı. ESI triyaj kategorileri, konsültasyon sayısı ve hastanede kalış süresinin mortalite ile doğrudan ilişkili olduğu bulundu (p<0,001).

**Sonuç:** Asırlık hastalarda mortalite ve morbidite nedenlerini ve hasta profilini belirlemek, bu popülasyonda hem olası yan etkileri önlemek hem de sağlık hizmetlerini etkin bir şekilde planlamak için kullanılabilir.

**Anahtar Kelimeler:** Asırlık hastalar, emergency severity index, komorbidite, mortalite, hastaneye yatış

## Introduction

The aging of the world population has led to the emergence of patient groups with different physiological and biological structures. With the continuation of aging, the number of centenarians, i.e., individuals aged 100 years and over is increasing day by day. The number of people aged 100 years and over differs from one country to another and was reported as 5,859 in Türkiye in 2021, constituting 0.1% of the entire elderly population in the country (1). Emergency departments (ED), located at the crossroads in terms of medical care, have become indispensable areas for these individuals with their easy access and provision of healthcare services 24 hours a day, seven days a week (2,3). However, there are also a series of difficulties concerning this patient population, such as the use of multiple drugs, presence of comorbid diseases in medical history, requirement of more resources in their diagnosis and treatment, and their higher need for social services, which have resulted in the necessity of restructuring the health system (4). The priority to prevent adverse events that may arise in the ED related to this patient group is to determine their specific needs, organize healthcare services accordingly, and making healthcare professionals competent in this regard, thereby improving the quality of care provided (5,6). This study aimed to develop strategies that can prevent mortality and morbidity in centenarians by determining the clinical profiles of patients aged 100 years and over that presented to the ED of a tertiary hospital.

## Materials and Methods

This retrospective study was conducted with the retrospective analysis of patients aged 100 years and older, who presented to the ED of a tertiary hospital between January 2012 and December 2021. During the 10-year study period, a total of 206,309 patients aged 65 years and over presented to the ED, and 222 of these patients met the inclusion criteria. Approval for the study was obtained from the Recep Tayyip Erdogan University Faculty of Medicine Non-invasive Clinical Research Ethics Committee (decision number: 2023/08, date: 05.01.2023).

### Study Design

The computer-based hospital information management system, in which patient records are kept, and ED patient files were used to collect data on the patients aged 100 years and older included in the study. Patients with missing data were excluded from the study. The patients' modes of transportation, presentation complaints, emergency severity index (ESI) triage categories, demographic data, medical history, last diagnosis, length of ED stay, ED outcome, consultation and epicrisis notes, ward admitted for treatment and follow-up, length of hospital stay, in-hospital outcome, and the Charlson comorbidity index (CCI) were reached.

### Study Data

The patients' modes of transportation of were categorized as by ambulance or by private vehicle, and where they lived was categorized as their own home, hospital, or nursing home. The triage categories of the patients at the time of presentation were classified between 1 and 5 according to ESI. CCI was calculated according to the comorbid conditions present in the medical history of the patients at the time of presentation and classified as 0, 1-2, 3-4, and ≥5 points. The length of stay in the ED was recorded in minutes, and in the case of admission to any inpatient ward, the length of hospital stay was noted in days. Outcomes were evaluated as discharge with recovery or mortality.

### Statistical Analysis

All statistical analyses were performed using Jamovi v.1.6 statistics software [The Jamovi Project (2021) Computer Software, version 1.6. Sydney, Australia]. Categorical data were expressed as frequency (n) and percentage. Normally distributed continuous variable data were defined as mean and standard deviation, and non-normally distributed continuous variable data as median and interquartile range (IQR). The normality of data distribution was determined using the Shapiro-Wilk test. In the comparison of continuous variables, the t-test was used in case of a normal distribution, and the Mann-Whitney U test otherwise. The chi-square test was conducted to compare categorical variables between groups.

## Results

### Demographic Characteristics

During the 10 year study period, there were a total of 298 ED presentations belonging to 222 patients aged 100 years or older. Of the 206,309 patients aged 65 years and over that presented to the ED during this period, 0.11% constituted those of aged 100 years and over. Our dataset included 219 women and three managed from 100 to 113 (median 102, IQR 101-104) years. Of the patients included in the study, 175 (78.8%) lived in their own homes, and 159 (71.6%) were transported to the hospital by ambulance.

When the medical history of the patients was examined, 135 (60.8%) had cardiovascular system diseases (CVSs) and 100 (45%) had central nervous system diseases (CNSs). The demographic characteristics of the centenarian patients are given in Table 1.

### Presentation Characteristics and Emergency Management

At the time of presentation, the most common ESI triage category was 3 (n=160, 72.1%). Figure 1 shows the distribution of the triage category by years. In general, the most common reason for presentation to the ED was shortness of breath (n=55, 24.8%), followed by trauma (n=26, 11.7%).

As a result of their evaluation in the ED, 28 (12.6%) patients were diagnosed with pneumonia, 21 (9.5%) with heart failure,

and 14 (6.3%) with musculoskeletal injuries. According to the pathological condition detected, 91 (41%) patients were referred to one clinic and two patients (0.9%) were referred to four different clinics for consultation. Twelve of the 78 (35.1%) patients that required inpatient medical care were directly admitted from the ED to the intensive care unit (ICU) for follow-up and treatment (Table 2).

| Table 1. Demographic characteristics of centenarian patients presenting to the emergency department | |
|---|---|
| **Gender,** female | 219 (98.6%) |
| **Age,** median (IQR) (years) | 102 (101-104) |
| Living arrangement | |
| Own home | 175 (78.8%) |
| Nursing home | 1 (0.5%) |
| Other | 46 (20.7%) |
| Mode of transportation to ED | |
| Private vehicle | 63 (28.4%) |
| Ambulance | 159 (71.6%) |
| Recurrent presentation to ED within 72 hours | 10 (4.5%) |
| Recurrent presentation within the same calendar year | |
| 1 | 39 (17.6%) |
| 2 | 15 (6.8%) |
| 3 | 5 (2.3%) |
| 4 | 6 (2.7%) |
| 5 | 2 (0.9%) |
| 6 | 3 (1.4%) |
| 7 | 0 |
| 8 | 1 (0.5%) |
| 9 | 1 (0.5%) |
| Number of annual presentations | |
| 2012 | 13 (5.6%) |
| 2013 | 18 (8.1%) |
| 2014 | 20 (9%) |
| 2015 | 25 (11.3%) |
| 2016 | 23 (10.4%) |
| 2017 | 20 (9%) |
| 2018 | 31 (14%) |
| 2019 | 30 (13.5%) |
| 2020 | 21 (9.5%) |
| 2021 | 20 (9%) |
| IQR: Interquartile range, ED: Emergency department | |
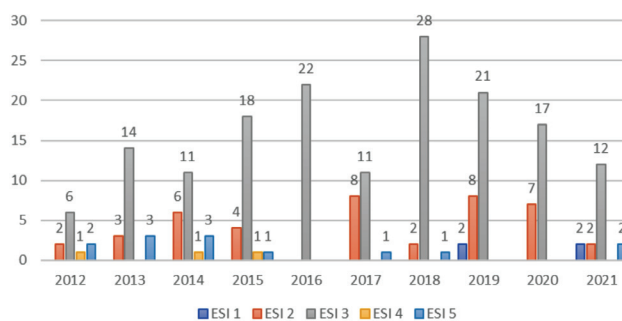


**Figure 1.** ESI triage distribution of the centenarian patients by years
ESI: Emergency severity index

| Table 2. Presentation complaints and emergency department outcomes and diagnoses of the centenarian patients | |
|---|---|
| **Presentation complaint** | |
| Shortness of breath | 55 (24.8%) |
| Trauma | 26 (11.7%) |
| Chest pain | 16 (7.2%) |
| Weakness | 14 (6.3%) |
| Muscle pain | 14 (6.3%) |
| Abdominal pain | 12 (5.4%) |
| Altered state of consciousness | 12 (5.4%) |
| Headache | 10 (4.5%) |
| Fever | 10 (4.5%) |
| Loss of strength | 7 (3.2%) |
| Bloody stool | 7 (3.2%) |
| Fainting | 6 (2.7%) |
| Dizziness | 6 (2.7%) |
| Other | 37 (17.5%) |
| **ED outcome** | |
| Discharge | 142 (64%) |
| Inpatient ward admission | 62 (27.9%) |
| Admission to ICU | 12 (5.4%) |
| Referral to another hospital | 4 (1.8%) |
| Mortality | 2 (0.9%) |
| **Last diagnosis in ED** | |
| Pneumonia | 28 (12.6%) |
| Heart failure | 21 (9.5%) |
| Soft tissue trauma | 14 (6.3%) |
| Anemia | 12 (5.4%) |
| Cerebrovascular disease | 11 (5%) |
| Urinary tract infection | 11 (5%) |

| Table 2. Continued | |
|---|---|
| **Last diagnosis in ED** | |
| Acute bronchitis | 8 (3.6%) |
| Acute renal failure | 8 (3.6%) |
| Stabil angina pectoris | 8 (3.6%) |
| Hypertensive urgency | 8 (3.6%) |
| Gastrointestinal system bleeding | 7 (3.2%) |
| Myalgia | 7 (3.2%) |
| Femoral fracture | 7 (3.2%) |
| Cerebral concussion | 7 (3.2%) |
| Pulmonary embolism | 6 (2.7%) |
| Other | 59 (26.3%) |
| **In-hospital outcome** | |
| Discharge | 59 (26.6%) |
| Mortality | 23 (10.4%) |
| **Length of stay in ED**, median (IQR) (min) | 240 (120-413) |
| **Patients staying in ED for more than 480 min** | 43 (19.4%) |
| **Length of stay of patients hospitalized for follow-up and treatment** (day) | 2.7±7.60 (min:1 - max: 90) |
| IQR: Interquartile range, ED: Emergency department, min-max: Minimum-maximum | |

The median length of stay in the ED during the follow-up and diagnosis stage was 240 (IQR, 120-413) minutes. According to the Republic of Türkiye Ministry of Health Communique on the Principles of Implementation of Emergency Services in Inpatient Healthcare Facilities (7), patients must be discharged home within eight hours after presentation or hospitalized if inpatient treatment is required or transferred to another hospital if there is no vacant patient room. Accordingly, 43 (19.4%) patients were followed up in the ED for more than 480 minutes.

Among the patients hospitalized to receive healthcare services, the mean length of hospital stay was 2.7±7.60 (minimum: 1 - maximum: 90) days. Twenty-three (10.4%) of the inpatients died, and their median length of hospital stay was 11.5 (IQR: 2.75-20.8) days.

## Mortality

When factors affecting mortality were evaluated, a statistically significant relationship was found between mortality and the ESI triage category, number of consultations requested, and length of hospital stay (days) in those receiving inpatient medical care services (p<0.001). The mortality statistics of the centenarian patients are given in Table 3.

| Table 3. Patients' statistics by mortality | | | |
|---|---|---|---|
| | No mortality (n=199) | Mortality (n=23) | p-value |
| **CCI-Orginal** | | | |
| 0 | 29 | 4 | |
| 1 | 24 | 7 | |
| 2 | 40 | 4 | |
| 3 | 41 | 3 | |
| 4 | 40 | 3 | 0.555* |
| 5 | 11 | 1 | |
| 6 | 10 | 1 | |
| 7 | 2 | 0 | |
| 8 | 2 | 0 | |
| **CCI-Age** | | | |
| 5 | 18 | 3 | |
| 6 | 26 | 7 | |
| 7 | 34 | 3 | |
| 8 | 46 | 4 | |
| 9 | 37 | 4 | 0.513* |
| 10 | 22 | 1 | |
| 11 | 8 | 0 | |
| 12 | 6 | 1 | |
| 13 | 2 | 0 | |
| **CCI-2011** | | | |
| 0 | 37 | 6 | |
| 1 | 9 | 3 | |
| 2 | 62 | 7 | |
| 3 | 30 | 2 | 0.503* |
| 4 | 29 | 4 | |
| 5 | 15 | 1 | |
| 6 | 14 | 0 | |
| 7 | 3 | 0 | |
| **ESI** | | | |
| 1 | 2 | 2 | |
| 2 | 24 | 18 | |
| 3 | 157 | 3 | 0.001* |
| 4 | 3 | 0 | |
| 5 | 13 | 0 | |
| **Length of stay in the ED (minute)** | 240 (IQR 120-413) | 198 (IQR 129-416) | 0.959^ |

| Table 3. Continued | | | |
|---|---|---|---|
| | No mortality (n=199) | Mortality (n=23) | p-value |
| **Number of consultations** | | | |
| 0 | 95 | 0 | |
| 1 | 75 | 16 | |
| 2 | 22 | 6 | 0.001* |
| 3 | 5 | 1 | |
| 4 | 2 | 0 | |
| Length of hospitalization (day) | 0 (IQR 0-1.5) | 4 (IQR 2-11) | 0.001^ |
| **Re-application rate within a calendar year** | | | |
| 0 | 128 | 22 | |
| 1 | 38 | 1 | |
| 2 | 15 | 0 | |
| 3 | 5 | 0 | |
| 4 | 6 | 0 | 0.313* |
| 5 | 2 | 0 | |
| 6 | 3 | 0 | |
| 7 | 0 | 0 | |
| 8 | 1 | 0 | |
| 9 | 1 | 0 | |

*Chi-square test; ^Mann-Whitney U test, CCI: Charlson comorbidity index, ESI: Emergency severity index, IQR: Interquartile range, ED: Emergency department

## Discussion

The growing number of centenarian patients presenting to the ED has brought about the necessity of developing emergency service delivery strategies for this special patient group. This study was conducted to describe the impact of centenarian patients on the ED and their specific requirements.

We determined that there was a direct correlation between the centenarians' ESI triage category at the time of presentation to the ED and the mortality rates among the inpatients. Although ESI is effective in predicting ICU admission and short-term mortality in patients aged 65 years and over presenting to the ED, its utility in predicting long-term mortality has not been determined (7). In this study, 72.1% of the centenarian patients were included in triage category 3, especially in this group of patients, showing that this patient population requires the use of more resources in the presence of emergency medical conditions added to their existing comorbidities. In patients that required follow-up and treatment after admission, the increase in the number of hospitalization days was associated with mortality rates. This can be considered as an indication that both in the ED and other inpatient clinics, patient-centered multidisciplinary alternative care strategies should be developed and used in the management of unstable centenarians presenting to the ED with an acutely developing condition.

In this study, 71.6% of the patients were transported from their home to the hospital by ambulance. This rate is similar to previous international studies (8). However, the living spaces of centenarian patients may change due to social and sociocultural differences.

The reasons for presentation to the ED were determined as shortness of breath triggered by CVS and CNS comorbidities, followed by injuries. The presentation complaints and comorbidities of the patients were in line with their diagnoses leading to their discharge or hospitalization. Pneumonia is an important medical condition, especially in centenarians. This condition has a different clinical manifestation in centenarians than in younger patients, further contributing to negative outcomes and placing an additional financial burden on acute healthcare services (9,10). Trauma-related injuries, on the other hand, were consistent with the literature as the second most common reason for presentation to the ED in these patients (11). After trauma, 3.2% of the patients were discharged with surgical treatment due to femoral fracture, and no adverse events or mortality was encountered in this group. However, the data of our study differ from the literature (12).

Increasing age is associated with chronic comorbid diseases Although some studies in the literature have determined that centenarian patients have lower rates of chronic disease (10,13), more than half (60.9%) of the patients in our study had CVSs and 45% had chronic comorbidities affecting their cognitive functions. The association of existing comorbidities with acute events results in the need for more complex medical care involving more than one discipline, as well as increasing the possibility of mortality. Similarly, in the current study, a statistically significant correlation was found between the increased number of consultations requested and mortality, once again revealing the necessity of multidisciplinary care strategies.

We observed that 10.3% of the patients included in the study died while receiving treatment in the hospital. The presentation complaints and last diagnoses in the ED were parallel to each other, with neurological and renal system pathologies being the most common causes of mortality. In studies conducted with centenarian patients, the causes of mortality vary (14,15). However, we did not evaluate the main causes of mortality, which can be considered as one of the limitations of our study. The identification of the leading causes of death in patients aged 100 years and older can provide a more accurate estimate of the future healthcare needs of this population.

In terms of gender, it is anticipated that the increase in the number of men is higher than that of women in the

centennial population across the world (16). However, when we evaluated the centennial patients that presented to the ED according to gender, we observed that the number of women was higher. This can be attributed to physiological differences between men and women, and it is an issue that should not be overlooked in healthcare service provided.

The main limitation of our study concerns its single-center and retrospective design. The data were not collected specifically for the study; we obtained them from the existing routine hospital records.

## Conclusion

The increased number of hospital presentations of centenarians increases the average life expectancy. Thus, this patient population has become important users of emergency services. It is important to establish multidisciplinary health strategies by identifying data on when and how centenarians benefit from healthcare services. However, the lack of studies on the care and management of these patients and the lack of education of healthcare service providers emerge as problems in this process. A multidisciplinary approach should be adopted in the development of care strategies for this patient group. In addition, in vulnerable centenarians, improving pre-hospital services to reduce the need for hospitalization should be part of the programs to be developed in order to minimize adverse events associated with hospital stay, such as delirium and functional impairment. Therefore, the data obtained from this study, defining patient profile and reasons for mortality and morbidity in centenarian patients, can be used to both prevent possible adverse events and effectively plan healthcare services in this population.

### Ethics

**Ethics Committee Approval:** Approval for the study was obtained from the Recep Tayyip Erdogan University Faculty of Medicine Non-invasive Clinical Research Ethics Committee (decision number: 2023/08, date: 05.01.2023).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally and internally peer-reviewed.

### Authorship Contributions

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

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

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## References

1. Turkish Statistical Institute. https://data.tuik.gov.tr/Bulten/Index?p=Elderly -Statistics-2021-45636#:~:text

2. Goebeler S, Jylhä M, Hervonen A. Use of hospitals at age 90. A population-based study. Arch Gerontol Geriatr 2004; 39: 93-102.

3. Mert E. Use of emergency department by elderly patients. Turkish Journal of Geriatrics 2006; 9: 70-4.

4. Ackroyd-Stolarz S, Read Guernsey J, Mackinnon NJ, Kovacs G. The association between a prolonged stay in the emergency department and adverse events in older patients admitted to hospital: a retrospective cohort study. BMJ Qual Saf 2011; 20: 564-9.

5. Arnold J, Dai J, Nahapetyan L, Arte A, Johnson MA, Hausman D, et al. Predicting successful aging in a population-based sample of georgia centenarians. Curr Gerontol Geriatr Res 2010; 2010: 989315.

6. Beauchet O, Galery K, Vilcocq C, Maubert É, Afilalo M, Launay CP. PRISMA-7 and Risk for Short-Term Adverse Events in Older Patients Visiting the Emergency Department: Results of a Large Observational and Prospective Cohort Study. J Nutr Health Aging 2021; 25: 94-9.

7. Kemp K, Alakare J, Kätkä M, Lääperi M, Lehtonen L, Castrén M. Accuracy of Emergency Severity Index in older adults. Eur J Emerg Med 2022; 29: 204-9.

8. Mane G, Alkhouri H, Dinh M, McCarthy S. One hundred and counting: Centenarian use of emergency departments in New South Wales. Emerg Med Australas 2019; 31: 626-31.

9. Brandão D, Ribeiro O, Freitas A, Paúl C. Hospital admissions by the oldest old: Past trends in one of the most ageing countries in the world. Geriatr Gerontol Int 2017; 17: 2255-65.

10. Thomas CP, Ryan M, Chapman JD, Stason WB, Tompkins CP, Suaya JA, et al. Incidence and cost of pneumonia in medicare beneficiaries. Chest 2012; 142: 973-81.

11. Carey MR, Howell EM, McHugh MC. Emergency department use by centenarians: the 2008 Nationwide Emergency Department Sample. Prev Chronic Dis 2013; 10: E198.

12. Morice A, Reina N, Gracia G, Bonnevialle P, Laffosse JM, Wytrykowski K, et al. Proximal femoral fractures in centenarians. A retrospective analysis of 39 patients. Orthop Traumatol Surg Res 2017; 103: 9-13.

13. Ailshire JA, Beltrán-Sánchez H, Crimmins EM. Becoming centenarians: disease and functioning trajectories of older US Adults as they survive to 100. J Gerontol A Biol Sci Med Sci 2015; 70: 193-201.

14. Martins SC, Sanches AR, Carvalho MS. Centenarians in an Internal Medicine Ward: An 11 Years Analysis. Medicina Interna 2018; 25: 95-9.

15. Yu R, Tam W, Woo J. Trend of centenarian deaths in Hong Kong between 2001 and 2010. Geriatr Gerontol Int 2017;17:931-6.

16. Ministry Of Health. Communiqué on Implementation Procedures and Principles of Emergency Services in Inpatient Health Facilities. Official Newspaper. 2022; 31952.