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Charlson Comorbidity Index and Mortality in Geriatric Forensic Cases in the Emergency Department

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ABSTRACT

Objective: Morbidity and mortality are high in trauma patients over 65 years of age. The Charlson Comorbidity Index (CCI) is an assessment tool that has been shown to predict mortality in different clinical populations. The aim of this study was to analyze age-related clinical differences and to examine the relationship between CCI and mortality in patients over 65 years of age who admitted to the emergency department due to a forensic event.

Material and Methods: The study was designed as single-center and retrospective. Patients over 65 years of age admitted to the emergency department due to forensic situation were included in the study. The patients included in the study were divided into two groups as 65-79 (Group 1) years old and over 80 (Group 2) years old to analyze age-related demographic and clinical differences. Demographic characteristics of the patients, Charlson comorbidity index, forensic case forms were obtained from patient files and hospital electronic information processing system and recorded in data form.

Results: The study included 430 patients over 65 years of age. Of the geriatric patients included in the study, 85.6% were in Group 1 and 14.4% were in Group 2. When hospital provision records were examined, it was determined that 62.6% of the patients were registered in the system as forensic incidents, 34.7% as traffic accidents and 2.8% as occupational accidents. When the relationship between forensic events and age groups was examined, it was found that 27.6% of Group 1 and 73.2% of Group 2 admitted with the complaint of falling from the same level, and the difference between the groups was statistically significant ($p< 0.001$). When the relationship between CCI and age groups was examined, it was found that it was 2.9 ± 1.1 in Group 1 patients, and 4.7 ± 1 in Group 2 patients. CCI was found to be statistically significantly higher in patients over 80 years of age ($p< 0.001$). When the relationship between CCI and mortality was analyzed, it was found that it was 3.1 ± 1.1 in surviving patients and 4.2 ± 1.8 in non-surviving patients ($p< 0.001$).

Conclusion: CCI for mortality estimation in patients over 65 years of age presenting to the emergency department with forensic event may help the clinician in the early period.

Keywords: Emergency department, forensic case, Charlson comorbidity index, mortality

ÖZ

Acil Serviste Geriyatrik Adli Vakalarda Charlson Komorbidite İndeksi ve Mortalite

Giriş: Altmış beş yaş üstü travma hastalarında morbidite ve mortalite yüksektir. Charlson Komorbidite İndeksi (CCI) farklı klinik popülasyonlarda mortaliteyi tahmin ettiği gösterilmiş bir değerlendirme aracıdır. Bu çalışmanın amacı adli durum nedeni ile acil servise başvuran 65 yaş üstü hastalarda yaşa bağlı klinik farklılıkları analiz etmek ve CCI ile mortalite arasındaki ilişkiyi incelemektir.

Gereç ve Yöntemler: Çalışma tek merkezli ve retrospektif olarak planlandı. Adli durum nedeniyle acil servise başvuran 65 yaş üstü hastalar çalışmaya dahil edildi. Çalışmaya dahil edilen hastalar, yaşa bağlı demografik ve klinik farklılıkları analiz etmek için 65-79 yaş (Grup 1) ve 80 yaş üstü (Grup 2) olmak üzere iki gruba ayrıldı. Hastaların demografik özellikleri, CCI, adli vaka formları hasta dosyalarından ve hastane elektronik bilgi işlem sisteminden elde edilerek veri formuna kaydedildi.

Bulgular: Çalışmaya 65 yaş üstü 430 hasta dahil edildi. Çalışmaya alınan geriyatrik hastaların %85.6'sı Grup 1, %14.4'ü ise Grup 2 idi. Hastane provizyon kayıtları incelendiğinde; hastaların %62.6'sının adli olay, %34.7'sinin trafik kazası ve %2.8'inin iş kazası olarak sisteme kaydedildiği tespit edildi. Adli olaylar ile yaş grupları arasındaki ilişki incelendiğinde; Grup 1'in %27.6'sının, Grup 2'nin ise %73.2'sinin aynı seviyeden düşme şikayeti ile başvurduğu ve gruplar arasındaki farkın istatistiksel olarak anlamlı olduğu tespit edildi ($p< 0.001$). CCI'nın yaş grupları ile arasındaki ilişkisi incelendiğinde Grup 1 hastalarda ortalama 2.9 ± 1.1, Grup 2 hastalarda ise ortalama 4.7 ± 1 olduğu tespit edildi. CCI'nın, 80 yaş üzeri hastalarda istatistiksel olarak anlamlı yüksek olduğu görüldü ($p< 0.001$). CCI ile mortalite arasındaki ilişkisi incelendiğinde yaşayan hastalarda ortalama 3.1 ± 1.1, ölen hastalarda 4.2 ± 1.8 olduğu tespit edildi ($p< 0.001$).

Sonuç: Acil servise adli olaylar ile başvuran 65 yaş üzeri hastalara CCI'nın mortalite tahmini için kullanılmasının klinisyene erken dönemde yardımcı olabilir.

Anahtar Kelimeler: Acil servis, adli vaka, Charlson komorbidite indeksi, mortalite

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INTRODUCTION

While the World Health Organization (WHO) emphasizes that the world population is aging rapidly, it estimates that its ratio in the geriatric population will exceed 20% between 2015 and 2050 (1). The most obvious effect of this process on the emergency health system will be the increasing number of elderly patients admitted to emergency services.

Forensic cases are victims of violence and crime that require the intervention of the justice and health systems due to the nature of their injuries (2). Forensic cases apply to emergency services for medical help after severe and/or minor injuries (3,4). Therefore, patients presenting to the emergency department with traumatic injuries are potentially considered as forensic cases until proven otherwise. Elderly people aged 65 and over account for approximately one quarter of trauma admissions (5). Decreased visual acuity, postural imbalance, impaired reflexes and/or slowed reaction time, decreased functions in the musculoskeletal and nervous systems, accompanying comorbidities and chronic multiple drug use increase the trauma exposure of geriatric patients in their active lives. Trauma-related injuries in this age group are the fifth leading cause of death after cardiac diseases and stroke.

CCI (6) is an assessment tool that has been shown to predict long-term mortality in different clinical populations such as critically ill patients (7), trauma (8) and cancer patients (9). There are studies showing that CCI predicts one- and five-year mortality in hospitalized patients over 65 years of age (10), and short-term (30-day) mortality in patients with trauma (11).

The aim of this study was to analyze age-related clinical differences and to examine the relationship between CCI and mortality in patients over 65 years of age who applied to the emergency department with a forensic case.

MATERIALS and METHODS

Study Design

A total of 430 patients over the age of 65 who applied to the emergency department of a tertiary hospital between 01/01/2020 and 31/12/2020 as a forensic case were included in the study. The study was conducted as a retrospective observational case series. The study was started after having received the approval of the local ethics committee (Meeting Date: 21.04.2022 Meeting No: 104 Decision No: 1899).

Data Collection

Patients under the age of 65 whose forensic case forms and file data could not be fully accessed were excluded from the study. The patients included in the study were divided into two groups as those aged 65-79 years and those aged over 80 years to analyze age-related demographic and clinical differences. Demographic characteristics of the patients, comorbidities, CCI, reasons for admission to hospital (traffic accident, falling from a height, falling from the same level, injury with a firearm, injury with a sharp object, beating, burns, poisoning, electric shock, eye trauma and drowning), trauma sites (head, neck, chest, abdomen, pelvis, vertebrae and extremities), blood transfusion and surgical intervention needs and outcome data were obtained from patient files and hospital electronic data processing system and recorded in the case form.

Forensic cases are recorded in the hospital provision system as forensic incidents, traffic accidents and work accidents, and a forensic case form is prepared for the relevant patients. Forensic case forms of the patients were reviewed retrospectively. The hospital record provision of the patients who applied to the emergency department due to falling from a height, falling from the same level, injury with a firearm, injury with a sharp object, beating, burns, poisoning, electric shock, eye trauma and drowning were recorded as forensic events. Events that resulted in death, injury and/or damage involving one or more vehicles moving on the highway were recorded as traffic accidents. Accidents occurring during work and/or transportation to work were recorded as work accidents in the hospital automation system.

CCI (6) is a validated, simple and easily applicable assessment tool for estimating the risk of death from a comorbid disease.

The primary outcome of the study is to determine the relationship between CCI and outcome status of patients over the age of 65 who applied to the emergency department with a forensic case. The secondary outcome is the analysis of age-related clinical differences.

Statistical Analysis

Data were expressed as mean ± SD for continuous variables and as percentages for categorical variables. Normal distribution of the variables was measured with the Kolmogorov-Smirnov test. Student's t test was used to compare normally distributed continuous variables, and Mann-Whitney U test was used to compare non-normally distributed samples. Chi-square (χ^2) test was used to compare categorical variables. Fisher's exact test was used when the Chi-square (χ^2) test conditions were not met. SPSS 22.0 (SPSS 22.0 for Windows, Chicago, IL, USA) and MedCalc programs were used in the analysis. A p value of <0.05 was considered statistically significant for all analyses.

RESULTS

During the study dates, 301.125 patients over the age of 18 were admitted to the adult emergency service, and 3.9% (n= 11.743) of these patients were registered in the system as forensic cases. In our study, it was determined that 3.8% (n= 443) of the patients who applied to the emergency department with a forensic case were over 65 years old, and 14.7% (n= 65) of the geriatric age group were over 80 years old. Thirteen patients whose file data and forensic registration forms could not be accessed were excluded from the study. A total of 430 patients over 65 years of age, whose file data and forensic registration forms were accessed, were included in the study. 85.6% of the geriatric patients included in the study were Group 1 (65-79 years old), and 14.4% were Group 2 (over 80 years old) (Table 1).

Of the patients included in the study, 39.8% were females and 60.2% were males. Mean age of the patients was 71.9 ± 6.7 years. When the accompanying comorbidities are examined, hypertension (20.9%) and diabetes mellitus (13.7%) were observed most frequently. When the relationship between comorbidities and age groups was examined, chronic heart failure was statistically significantly higher in patients in Group 2 (p= 0.011). Mean CCI of the patients was calculated as 3.2 ± 1.2. When the relationship between CCI and age groups was examined, it was found that it was 2.9 ± 1.1 in Group 1 patients, and 4.7 ± 1 in Group 2 patients. CCI was found to be statistically significantly higher in patients over 80 years of age (p< 0.001) (Table 1). When the relationship between Charlson comorbidity index and mortality was examined, it was found that it was 3.1 ± 1.1 in surviving patients and 4.2 ± 1.8 in deceased patients (p< 0.001).

When hospital provision records were examined, it was determined that 62.6% of the patients were recorded in the system as forensic incidents, 34.7% as traffic accidents and 2.8% as work accidents. There was no statistically significant difference between hospital provision records between age groups (p= 0.794). When the reasons for admission to the emergency department of the patients who were registered as a forensic event were examined, it was determined that the patients' records were filed as "falling from the same level, beating, falling from a height, poisoning, injury with a sharp object, burn, injury with a firearm, falling of an object from a height, electric shock, suffocation, foreign body in the eye, and other reasons". It was observed that the patients whose forensic event records were recorded most frequently applied to the emergency department due to falling from the same level (21.6%), assault (13.5%) and falling from a height (9.1%). When the relationship between forensic events and age groups was examined, it was determined that 17.1% of Group 1 and 48.4% of Group 2 applied with the complaint of falling from the same level, and the difference between the groups was statistically significant (p< 0.001) (Table 2).

Table 1. Comparison of the demographic characteristics of patients admitted to the emergency department as forensic cases among age groups

	Total n= 430	Group 1 n= 368	Group 2 n= 62	p
Sex				
Female	171 (39.8%)	143 (38.9%)	28 (45.2%)	0.400
Male	259 (60.2%)	225 (61.1%)	34 (54.8%)	
Age (Year %)	71.9 ± 6.7	69.7 ± 4.1	84.9 ± 4	<0.001
Comorbid Disease				
Hypertension	90 (20.9%)	75 (20.4%)	15 (24.2%)	0.501
Diabetes mellitus	59 (13.7%)	51 (13.9%)	8 (12.9%)	1.000
Coronary artery disease	43 (10%)	34 (9.2%)	9 (14.5%)	0.249
Chronic obstructive pulmonary disease	20 (4.7%)	15 (4.1%)	5 (8.1%)	0.187
Chronic heart failure	19 (4.4%)	12 (3.3%)	7 (11.3%)	0.011
Cerebrovascular disease	13 (3%)	11 (3%)	2 (3.2%)	1.000
Chronic renal failure	11 (2.6%)	8 (2.2%)	3 (4.8%)	0.202
Dementia	10 (2.3%)	8 (2.2%)	2 (3.2%)	0.642
Malignancy	9 (2.1%)	8 (2.2%)	1 (1.6%)	1.000
Chronic liver disease	2 (0.5%)	1 (0.3%)	1 (1.6%)	0.268
Charlson Comorbidity Index	3.2 ± 1.2	2.9 ± 1.1	4.7 ± 1	<0.001

Group 1: Patients aged between 65-79 years, Group 2: Patients aged over 80 years.

Table 2. Comparison of reasons for admission and injury sites among age groups according to hospital provision records

	Total n= 430	Group 1 n= 368	Group 2 n= 62	p
Hospital Provision Record				
Forensic case	269 (62.6%)	228 (62%)	41 (66.1%)	0.573
Fall from the same level	93 (21.6%)	63 (17.1%)	30 (48.4%)	**<0.001**
To be beaten	58 (13.5%)	56 (15.2%)	2 (3.2%)	0.003
Fall from height	39 (9.1%)	37 (10.1%)	2 (3.2%)	0.088
Poisoning	33 (7.7%)	31 (8.4%)	2 (3.2%)	0.192
Injury by sharp objects	14 (3.3%)	11 (3%)	3 (4.8%)	0.455
Burn	13 (3.02%)	12 (3.3%)	1 (1.6%)	0.699
Firearm injury	8 (0.5%)	7 (2%)	1 (1.6%)	1.000
Object falling on to the person	2 (0.5%)	2 (0.6%)	0 (0%)	1.000
Electric shock	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Suffocation	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Foreign body in the eye	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Other causes	6 (1.4%)	6 (1.6%)	0 (0%)	0.595
Traffic accident	149 (34.7%)	129 (35.1%)	20 (32.3%)	0.773
Non-vehicle traffic accident	66 (15.3%)	58 (15.8%)	8 (12.9%)	0.810
In-vehicle traffic accident	59 (13.7%)	50 (13.6%)	9 (14.5%)	0.629
Motor vehicle accident	21 (4.9%)	18 (4.9%)	3 (4.8%)	1.000
Tractor accident	3 (0.7%)	3 (0.8%)	0 (0%)	1.000
Work accident	12 (2.8%)	11 (3%)	1 (1.6%)	1.000
Injury with a sharp object	3 (0.7%)	3 (0.8%)	0 (0%)	1.000
Falling from the same level	2 (0.5%)	1 (0.3%)	1 (1.6%)	0.167
Falling from height	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
To be beaten	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Object falling on the person	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Poisoning	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Electric shock	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Foreign body in the eye	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Chest pain	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Injury Site	229 (53.3%)	192 (52.2%)	37 (59.7%)	0.336
Head-Neck	199 (46.3%)	176 (47.8%)	23 (37.1%)	0.131
Thorax	113 (26.3%)	102 (27.7%)	11 (17.7%)	0.119
Vertebrae	55 (12.8%)	48 (13%)	7 (11.3%)	0.838
Pelvis	35 (8.1%)	28 (7.6%)	7 (11.3%)	0.318
Abdomen	27 (6.3%)	25 (6.8%)	2 (3.2%)	0.401

Group 1: Patients aged between 65-79 years, Group 2: Patients aged over 80 years.

When the reasons for applying to the emergency service of the patients registered as work accident were examined, it was determined in patient files that it was recorded as "falling from the same level, beating, falling from a height, poisoning, injury with a sharp object, falling of an object from a height, electric shock, foreign body in the eye and chest pain". It was observed that only one patient over the age of 80 was admitted to the emergency department with the complaint of falling from a height under work accident provision.

When the examinations of the patients in the emergency room were reviewed, head and neck injuries were found as 53.3%, extremities as 46.3%, thorax as 26.3%, vertebrae as 12.3%, pelvis as 8.1%, and abdomen as 6.3%. There was no statistically significant difference between injury site and age groups (Table 2).

The need for blood transfusion developed in 3.7% of the patients over the age of 65 whose forensic case was registered in the emergency department. When the relationship

Table 3. Comparison of blood transfusion need, surgical intervention need, and outcome data between the age groups

	Total	Group 1	Group 2	
	n= 430	n= 368	n= 62	p
Blood Transfusion Need	16 (3.7%)	6 (1.6%)	10 (16.1%)	<0.001
Surgical Intervention Need	58 (13.5%)	49 (13.3%)	9 (14.5%)	0.814
Outcome				
Discharge from the ER	283 (65.8%)	242 (65.8%)	41 (64.5%)	1.000
Referral from the ER	22 (5.1%)	18 (4.9%)	5 (8.1%)	0.354
ER treatment refusal	18 (4.2%)	16 (4.3%)	2 (3.2%)	1.000
Admission to the ward	62 (14.4%)	54 (14.7%)	7 (12.9%)	0.560
Admission to the ICU	33 (7.7%)	27 (7.3%)	6 (9.7%)	0.604
Mortality	33 (7.7%)	23 (6.3%)	10 (16.1%)	0.016

Group 1: Patients aged between 65-79 year, Group 2: Patients aged over 80 years, ER: Emergency room, ICU: Intensive care unit.

between the need for blood transfusion and age groups of the patients was examined, it was observed that 1.6% of Group 1 and 16.1% of Group 2 were transfused, and this difference was statistically significant (p< 0.001). In 13.5% of the patients, the need for surgical intervention developed during follow-up and treatment. There was no statistically significant difference between age groups and the need for surgical intervention (p= 0.814) (Table 3).

When the outcome data of the patients were analyzed, it was determined that 65.6% of them were discharged from the emergency service after examination and treatment, 14.4% were hospitalized in the service and 7.7% were treated in the intensive care unit. Considering all of the patients, it was seen that 7.7% died during their follow-up and treatment. Of the patients, 2.8% died in the emergency room and 4.9% in the intensive care unit. When the relationship between age groups and mortality was examined, it was observed that 6.3% of Group 1 and 16.1% of Group 2 died, and this difference was statistically significant (p= 0.016) (Table 3).

DISCUSSION

According to the study data, the most common reason for patients over 80 years of age to apply to the emergency department was falling from the same level. The need for blood transfusion and mortality were found to be statistically significantly higher in this age group. The CCI calculated in geriatric patients presenting with a forensic case was found to be statistically significantly higher both in patients over 80 years of age and in patients with a mortal course.

Trauma is the leading cause of morbidity and mortality for all age groups. However, the risk of serious disability and death is higher in elderly patients than in younger patients due to reasons such as having more comorbidities, multiple drug use, and decreased physiological responses that increase with age (12,13). DeMaria et al. have defined the 'phenomenon over the age of 80' in their study on trauma patients over 65 years of age and found the mortality rate in patients older than 80 years to be four times higher than in patients aged 65-79 years (14). In a study conducted with trauma patients over the age of 65, mean age of patients who died within 30 days (85.2 ± 10.4) has been found to be statistically significantly higher (15). In our study, it was seen that mortality rates increased significantly with increasing age in trauma patients over the age of 65, which is consistent with the literature.

Deaths from unintentional injuries are the seventh leading cause of death among older adults (16), and falls account for the largest percentage of these deaths. WHO shows falling as one of the most important health problems of old age. Approximately 28% to 35% of the elderly experience a fall event annually, and 32% to 42% of these accidents occur in patients older than 70 years (17). In a study examining fall cases aged 65 and over in the USA, it was noted that 18.334 cases died as a result of falls in 2007, of which 50.1% were patients aged 85 and over. In the same study, when looking at the year 2016, it was seen that the mortality rate of 85 years and older was 55.5% (5). Our study shows that deaths from falls from the same level increase with increasing age. Injuries resulting from falls in elderly patients cause an increase in mortality, functional limitation, decrease in quality of life and increase in hospital costs, thus creating a major public health problem. Considering that unintentional falls are largely preventable, we think that the risk of falling in elderly patients should be evaluated early and preventive measures should be taken for patients at risk. Taking early precautions before falling by providing education to risky patients and their relatives can reduce injuries and mortality as a result of falls.

The prevalence of multiple morbidity increases significantly with age. Accordingly, an increase is observed in the need for polytherapy and health institutions. There are many studies showing that CCI, which was first developed by Charlson et al. (6) to predict the long-term survival of patients with malignant diseases, is also useful in predicting the prognosis of patients with comorbidities (18,19). In a study conducted with patients aged 85 years and older, it has been shown that a CCI≥ 6 is associated with mortality, and each unit increase rises mortality 1.7 times (20). In a study of 1.313 patients over the age of 65, it has been shown that the mortality rate of patients with a CCI= 3 score and above is statistically significant (10). In another study conducted with critically ill patients aged 65 and over, the CCI of those who died has been found to be significantly higher (21). In a study conducted with 8.145 trauma patients aged 65 and over, it has been found that CCI has an effect on mortality in patients with moderate injuries, but the death rate in severe injuries does not correlate with the presence of comorbidity (22). Our study showed that high CCI rate was statistically associated with both advancing age and mortality in patients over 65 years of age who presented to the emergency department with a forensic case. We think that the use of CCI for mortality estimation in patients over 65 years of age presenting to the emergency department with forensic cases may help the clinician in the early period.

The fact that our study is single-centered and retrospective is a limitation. With this single-center study, it may be wrong to generalize for all patients over the age of 65 applying to the forensic emergency department. Larger, prospective and multicenter studies are needed to support the use of CCI in predicting mortality in trauma patients over 65 years of age.

CONCLUSION

Trauma patients over the age of 65 pose a public health problem in terms of both medical, social and economic aspects. Preventive measures that can be taken early in this age group may prevent unintentional accidents. The use of CCI to predict mortality in patients over 65 years of age presenting to the emergency department with forensic cases may predict the need for close follow-up and aggressive treatment at an earlier stage.

Ethics Committee Approval: This study was approved by Adana City Training and Research Hospital Clinical Research Ethics Commitee (Decision Number: 1899, Date: 21.04.2022).

Author Contributions: Concept/Design: AA, SA, SS, MG; Analysis/Interpretation: AA, SA, SS, MG; Data Acquisition: AA, SA, Çİ, MB; Writting: AA, SA, SS; Critical Revision: All of authors; Final Approval: All of authors.

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