■ Özkan GÖRGÜLÜ[1] ID
■ Mehmet Nuri KOŞAR[2] ID

CORRESPONDANCE

Özkan GÖRGÜLÜ
Antalya Training and Research Hospital,
Department of Anesthesiology and Reanimation,
Antalya, TURKEY.

Phone: +905326378360
e-mail: drozkangorgulu@hotmail.com

[1] Antalya Training and Research Hospital,
Department of Anesthesiology and
Reanimation, Antalya, TURKEY.

[2] Antalya Training and Research Hospital,
Department of General Surgery, Antalya,
TURKEY.

RESEARCH

DIAGNOSIS AND MORTALITY OUTCOMES OF THREE DIFFERENT GERIATRIC AGE GROUPS IN THE INTENSIVE CARE UNIT: 10−YEAR RETROSPECTIVE ANALYSIS

ABSTRACT

Introduction: In addition to bringing many physiological changes with it, aging is a period in which morbidity and mortality rates increase due to the increase in the incidence of chronic diseases and malignant diseases. The aim of this study was to determine the prevalence of conditions requiring intensive care and the mortality incidence based on geriatric age groups followed-up in the intensive care unit.

Materials and Method: Three different geriatric age groups were formed out of the 65 years old and older patients (n=5932) included in the study as young old (65−74 years), middle old (75−84 years) and oldest old (85 years and older). In each group, disease prevalence and mortality rate by diagnostic groups were analysed.

Results: The resulting diagnostic groups were found to be at different rates in different age groups (p = 0.01 p <0.05). Malignancy was high in young elderly patients (p = 0.01 p <0.05), while cardiovascular diseases were higher in other groups (p = 0.01 p<0.05). Patients admitted to the intensive care unit with cardiac arrest had the highest mortality rate (p = 0.01 p<0.05).

Conclusion: Geriatric patients constitute an important part of intensive care patients, therefore the mortality rate is high. In all three groups, 30−day mortality results were highest in patients with cardiac arrest followed by sepsis and cardiovascular diseases, respectively.

Keywords: Geriatrics; Intensive Care Units; Mortality; Age groups; Prevalence.

INTRODUCTION

The World Health Organisation defines old age as the beginning of the chronological age of 65 years. Besides bringing several physiological changes, aging increases the rate of morbidity and mortality due to an increased incidence of chronic and malignant diseases. Furthermore, geriatric patients have a high incidence of chronic diseases developing because of diabetes and hypertension (1–3). Moreover, elderly individuals have a higher rate of acute kidney injury compared with young people (4) and are, therefore, at an increased risk of renal failure. Notably, diabetes and hypertension are the two most common causes of chronic renal failure (5). The most common comorbidities observed in the intensive care unit (ICU) are hypertension, heart failure and diabetes mellitus (6). In addition, trauma is associated with increased morbidity and mortality rates in geriatric individuals (7, 8). Moreover, weakened immunity, chronic diseases and organ physiology changes make geriatric patients susceptible to infections, such as sepsis and bacteremia (9). Notably, the fact that the age and preoperative albumin levels were found to be significantly correlated with hospital length of stay and 30-day ICU admissions (10) indicates the need for intensive care in the geriatric age group and the elderly with chronic diseases. Given that the geriatric population in the United States is expected to increase from 52 million in 2018 to 95 million in 2060 (11), a corresponding increase in the geriatric patient population needing intensive care can be expected as well in the future. Until date, no guidelines or recommendations have been suggested for geriatric intensive care, and no randomized controlled studies have been performed (12). The mortality rate of elderly patients in the ICU is not only related to age but also the decrease in functional reserves and age-related physiological weakness (12). Various disease groups may come into prominence in three different geriatric age groups depending on the possible pathophysiology and aging. Determining mortality rates for diagnostic groups may provide insight for disease prevention and geriatric disease groups at risk. Therefore, this study determined the prevalence of conditions requiring intensive care and the mortality incidence in geriatric age groups followed in the ICU.

MATERIALS AND METHOD

Study population

This study was conducted in accordance with the Declaration of Helsinki from 2008 to 2017 after obtaining approval from the Institutional Ethics Committee (Date of Approval-Protocol No: 10.10.2019-22/14).

This research was conducted as a single-center retrospective descriptive study by scanning the data in the electronic health records system (SARUS) of 17819 patients who were treated in the ICU (Reanimation Intensive Care Unit, Surgical Intensive Care Unit) of our Level 3 hospital. Of these, 8639 patients (mean ± SD: 76.64 ± 8.32 years, 62% were females) aged 65 years and above were included in the study. Overall, 2707 patients were excluded from the study because of an uncertain diagnosis. Finally, the study was conducted on 5932 patients over 65 years of age who had a definite diagnosis. Notably, patients under 65 years of age were excluded from the study.

Assessments

Patients included in the study (n = 5932) were grouped into the following three different geriatric age groups: young-old (65–74 years), middle-old (75–84 years) and oldest-old (85 years and above). Accordingly, various diagnostic groups were formed based on the most frequent causes of mortality in each of the three geriatric age groups, such as cardiovascular diseases (acute coronary syndrome, heart failure, etc), malignancies (cancers of brain, larynx, lung, stomach, colon, bladder and kidneys), cerebrovascular diseases (stroke, intracerebral haemorrhage, etc), gastrointestinal diseases (non-malignant liver, biliary tract diseases, inflam-

matory and haemorrhagic diseases of the stomach and intestine), trauma (multiple fractures, hip fractures, etc), urinary system (non-malignant pathologies of the urinary system) and other diseases. Differently from cardiovascular disease diagnostic group, cardiac arrest diagnostic group was formed according to the results of the emergency code blue calls made from the other departments of the hospital. Age-based analyses of various diagnostic groups were performed to determine the indication for intensive care admission and the 30-day mortality rate of each diagnostic group. Geriatric patients admitted to the ICU for postoperative follow-up were excluded from the study.

Statistical analysis

The descriptive statistics of the groups were calculated as frequency and percentage values to examine the relevant data. Chi-square analysis (Fisher's exact test) was performed to explore the diagnoses according to patient characteristics. The Bonferroni method was used to identify the group that created the difference in different groups. In the study, p values less than 0.05 were considered statistically significant. SPSS 22.0 software was used for analysis.

RESULTS

2236 (38%) of the 5932 study patients in the ICU were men, and 3696 (62%) were women. The number of patients in three study groups was as follows: 2444 (41%) young-old (70.02 ± 6.42), 2488 (42%) middle-old (79.35 ± 5.23) and 1000 (17%) oldest-old patients (89.50 ± 15, 12). Overall, 2389 (40%) patients passed away, and 3543 (60%) patients were transferred from the ICU to the ward.

Our study detected that geriatric patients were treated in the ICU for the following conditions: 1323 patients (22.3%) for cardiovascular diseases, 883 (14.9%) for malignancies, 807 (13.6%) for gastrointestinal diseases, 754 (12.7%) for acute respiratory failure, 536 (9%) for cerebrovascular diseases, 534 (9%) for trauma, 219 (3.7%) for pneumonia,

173 (2.9%) for sepsis, 155 (2.6%) for chronic renal failure, 125 (2.1%) for urinary system diseases, 113 (1.9%) for ileus, 91 (1.5%) for cardiac arrest, 65 (1.1%) for diabetes mellitus, 63 (1.1%) for high fever, 47 (0.8%) for acute renal failure and 44 (0.7%) for burns (Table 1).

The diagnostic groups of young-old patients had statistically different incidence rates (p = 0.01, p < 0.05) (Table 2). Identified in 504 patients (20.6%), malignancy had the highest rate.

The diagnostic groups of middle-old patients had statistically different incidence rates (p = 0.01, p < 0.05) (Table 3). Identified in 589 patients (23.7%), cardiovascular diseases had the highest rate.

The diagnostic groups of oldest-old patients had statistically different incidence rates (p = 0.01, p < 0.05) (Table 4). Identified in 239 patients (23.9%), cardiovascular diseases had the highest rate.

Furthermore, the 30-day mortality rates of geriatric age groups varied for different diagnostic groups (p = 0.01, p < 0.05) (Table 5). Cardiac arrest, sepsis and cardiovascular diseases are the most common causes of mortality. Although the incidence of acute renal failure was at 0.7 and urinary system diseases at 1.5% in the over 85 years old patient group, mortality rates were significantly higher compared to other geriatric age groups, being 85.7% and 53.3%, respectively.

In the young and middle old geriatric groups, mortality rates of patients diagnosed with pneumonia were found to be higher than patients diagnosed with acute respiratory failure.

DISCUSSION

The fact that 8639 patients (48.4%) in our study were aged 65 years and above indicates the importance of intensive care treatment in geriatric age groups. Per the literature, the rate of ICU admission of elderly patients was noted to be 46% (6),

Table 1. Patient characteristics and diagnostic groups.

Sex	n	% Percentage
Male	2236	37.7
Female	3696	62.3
Age (mean ± SD)	n	% Percentage
65-74 years of age (70.02 ± 6.42)	2444	41.2
Age 75-84 years (79.35 ± 5.23)	2488	41.9
85 years and older (89.50 ± 15.12)	1000	16,9
Treatment Result	n	% Percentage
Exitus	2389	40,3
Discharge	3543	59,7
Diagnosis	n	% Percentage
Cardiovascular Disease	1323	22.3
Malignancy	883	14.9
Gastrointestinal Diseases	807	13.6
Acute Respiratory Failure	754	12.7
Cerebrovascular Diseases	536	9.0
Trauma	534	9.0
Pneumonia	219	3.7
Sepsis	173	2.9
Chronic Renal Failure	155	2.6
Urinary System	125	2.1
Ileus	113	1.9
Cardiac Arrest	91	1.5
Diabetes Mellitus	65	1.1
High Fever	63	1.1
Acute Kidney Failure	47	0.8
Burn	44	0.7

Table 2. Analysis of Diagnosis Distribution of 65-74 Age Group.

Age	Diagnosis	n	Percentage %	p
65-74	Malignancy	504	20.6	0.01
	Cardiovascular Disease	495	20,3	
	Acute Respiratory Failure	339	13.9	
	Gastrointestinal Diseases	307	12.6	
	Cerebrovascular Diseases	203	8.3	
	Trauma	172	7.0	
	Sepsis	77	3.2	
	Pneumonia	73	3.0	
	Urinary System	67	2.7	
	Chronic Renal Failure	51	2.1	
	Ileus	40	1.6	
	Cardiac Arrest	39	1.6	
	High Fever	25	1.0	
	Burn	21	0.9	
	Diabetes Mellitus	16	0.7	
	Acute Kidney Failure	15	0.6	

*Single ratio chi-square analysis was performed.

which corresponds to the rate of 48.4% observed in our study. Our study determined the mortality rate in geriatric intensive care patients to be 40%. In a study that did not discriminate between adult and geriatric age, the mortality rate was observed to be 19.6% (13). Among the 5932 patients included in the study, the proportion of female geriatric patients was determined to be high with 3696 female patients (62%). Notably, the young-old and middle-old patient groups exhibited proportionality with 2444 (41%) and 2488 (42%) patients in the groups, respectively. Per the literature, the prevalence of geriatric patients over the age of 80 in the ICU is 20% (14), whereas our study observed that the rate of patients aged 85 and above was 16.9%.

Malignancy was high in the young-old and young-old male patient groups, whereas cardiovascular diseases were observed to be high in the other groups.

Notably, advanced age increases the mortality rate even if the existing morbidity is controlled (15). When we evaluated the 30-day mortality rates of geriatric intensive care patient groups, the mortality rate was the highest in all three geriatric age groups admitted to the ICU with the diagnoses of

Table 3. Analysis of the Distribution of Diagnosis in 75-84 Age Groups.

Age	Diagnosis	n	Percentage %	p
75 - 84	Cardiovascular Disease	589	23.7	0.01
	Gastrointestinal Diseases	373	15.0	
	Malignancy	303	12.2	
	Acute Respiratory Failure	295	11.9	
	Cerebrovascular Diseases	233	9.4	
	Trauma	212	8.5	
	Pneumonia	96	3.9	
	Chronic Renal Failure	79	3.2	
	Sepsis	66	2.7	
	Ileus	56	2.3	
	Urinary System	43	1.7	
	Cardiac Arrest	38	1.5	
	Diabetes Mellitus	34	1.4	
	High Fever	30	1.2	
	Acute Kidney Failure	25	1.0	
	Burn	16	0.6	

*Single ratio chi-square analysis was performed.

cardiac arrest, closely followed by sepsis, cardiovascular diseases and acute renal failure. In our study, the mortality rate was 40% (n = 2389), whereas other studies noted it to be 37% (16) and 52.3% (6) in patients in the critical intensive care. In a prospective study conducted on patients in the ICU with an average age of 84 years, the 30-day mortality rate was 41.9% (17). In another study, the 30-day mortality was determined to be 43.7% (15). Per the literature, the mortality rate of cardiovascular disease was 66.6% (18), whereas our study observed it to be 57.90% in the middle-old geriatric group. Notably, our study determined that the mortality rates of sepsis and acute renal failure were identical. A study that analysed this occurrence demonstrated that sepsis was the most common cause of acute renal failure (19). In our study, in the geriatric group aged over 85 years, the mortality rate was higher than 85% in patients with high fever and acute renal failure, probably secondary to sepsis. A retrospective study in the literature conducted on ICU patients over 85 years of age determined the sepsis-related survival rate to be 38.5% (20), whereas in our study, the survival and mortality rates were 30% and 70%, respectively. The literature revealed a trauma-related mortality rate of 15.5% in geriatric

Table 4. Analysis of the Distribution of Diagnosis in 85 and Older Age Groups.

Age	Diagnosis	n	Percentage %	p
85 years and older	Cardiovascular Disease	239	23.9	0.01
	Trauma	150	15.0	
	Gastrointestinal Diseases	127	12.7	
	Acute Respiratory Failure	120	12.0	
	Cerebrovascular Diseases	100	10.0	
	Malignancy	76	7.6	
	Pneumonia	50	5.0	
	Sepsis	30	3.0	
	Chronic Renal Failure	25	2.5	
	Ileus	17	1.7	
	Diabetes Mellitus	15	1.5	
	Urinary System	15	1.5	
	Cardiac Arrest	14	1.4	
	High Fever	8	0.8	
	Acute Kidney Failure	7	0.7	
	Burn	7	0.7	

*Single ratio chi-square analysis was performed.

patients over 80 years of age, whereas our study identified this rate to be 10.70% (16, 21).

CONCLUSION

Geriatric patients constitute a significant fraction of intensive care patients, thereby increasing the mortality rate. Regarding the disease prevalence in the three different geriatric age groups in ICU, malignancy was prominent in young-old geriatric patients, whereas the incidence of cardiovascular disease increased in middle-old and oldest-old geriatric patients.

Mortality rates of the patients in young and middle old geriatric groups diagnosed with pneumonia are at high levels, respectively, 47.9%(35) and 58.3%(56). In all three groups, the 30-day mortality results were highest in patients with cardiac arrest, followed by sepsis and cardiovascular diseases. Therefore, in individuals who are 85 years and older, caution should be taken in case of acute renal failure and high fever, bearing in mind the possibility of high mortality, and such instances warrant appropriate treatment management strategies. Nonetheless, when treating critically ill elderly patients in the ICU, well-organized team

Table 4. Analysis of the Distribution of Diagnosis in 85 and Older Age Groups.

Diagnosis	Age						P
	65-74		75 - 84		85 years and older		
	n	Mortality	n	Mortality	n	Mortality	Mortem
Acute Kidney Failure	10	66.70%	12	48.00%	6	85.70%	
Acute Respiratory Failure	117	34.50%	107	36.30%	66	55.00%	
Diabetes Mellitus	7	43%-80%	5	14.70%	2	13.30%	
Gastrointestinal Diseases	58	18.90%	116	31.10%	38	29.90%	
Ileus	15	37.50%	19	33.90%	7	41.20%	
Cardiac Arrest	37	94.90%	36	94.70%	13	92.90%	
Cardiovascular Disease	274	55.20%	341	57.90%	170	71.10%	
Chronic Renal Failure	19	37.30%	40	50.60%	10	40.00%	0.01*
Malignancy	95	18.80%	93	30.70%	23	30.30%	
Pneumonia	35	47.90%	56	58.30%	27	54.00%	
Sepsis	60	77.90%	51	77.30%	21	70.00%	
Cerebrovascular Diseases	75	36.90%	121	51.90%	60	60.00%	
Trauma	38	22.10%	35	16.50%	16	10.70%	
Urinary System	5	7.50%	9	20.90%	8	53.30%	
Burn	8	38.10%	3	18.80%	2	28.60%	
High Fever	7	28.00%	9	30.00%	7	87.50%	

*Chi-square analysis was used to analyse mortality rates and Bonferrioni post hoc test was used to analyse different groups.

management can substantially reduce morbidity and mortality.

CONFLICT OF INTEREST:

No conflict of interest was declared by the authors.

FINANCIAL DISCLOSURE

No financial disclosure was declared by the authors.

REFERENCES

1. Alsuwaidan A, Almedlej N, Alsabti S, et al. A Comprehensive Overview of Polypharmacy in Elderly Patients in Saudi Arabia. Geriatrics (Basel) 2019;4(2). pii: E36. (PMID: 31096616).

2. Tariq M, Khalid J, Sania HS, Sarfraz S, Aslam Z, Butt LQ. Morbidity profile of chronic diseases in geriatric patients. J Pak Med Assoc. 2018;68(6):978-981. (PMID: 30323381).

3. Shruthi R, Jyothi R, Pundarikaksha HP, Nagesh GN, Tushar TJ. A Study of Medication Compliance in Geriatric Patients with Chronic Illnesses at a Tertiary Care Hospital. J Clin Diagn Res. 2016;10(12):FC40-FC43. (PMID: 28208878).

4. Chao CT, Wang J, Wu HY, Huang JW, Chien KL. Age modifies the risk factor profiles for acute kidney injury among recently diagnosed type 2 diabetic patients: a population-based study. Geroscience. 2018;40(2):201-217. (PMID: 29488059).

5. Herrera Valdés R, Almaguer López M, Chipi Cabrera JA, Pérez-Oliva Díaz JF, Landrove Rodríguez O, Mármol Sóñora A. Prevalence and incidence of chronic kidney disease in Cuba. Clin Nephrol. 2019:24. (PMID: 31549629).

6. Unal AU, Kostek O, Takir M, Caklili O, Uzunlulu M, Oguz A. Prognosis of patients in a medical intensive care unit. North Clin Istanb. 2015;2(3):189-195. (PMID: 28058366).

7. Mulvey HE, Haslam RD, Laytin AD, Diamond CA, Sims CA. Unplanned ICU Admission is Associated With Worse Clinical Outcomes in Geriatric Trauma Patients. J Surg Res. 2019;245:13-21. (PMID: 31394403).

8. Muñoz E, Josephson J, Tenenbaum N, Goldstein J, Shears AM, Wise L. Diagnosis-related groups, costs, and outcome for patients in the intensive care unit. Heart Lung. 1989;18(6):627-33. (PMID: 2511164).

9. Esme M, Topeli A, Yavuz BB, Akova M. Infections in the Elderly Critically-Ill Patients. Front Med (Lausanne). 2019;6:118. (PMID: 31275937).

10. Shahrokni A, Vishnevsky BM, Jang B, et al. Geriatric Assessment, Not ASA Physical Status, Is Associated with 6-Month Postoperative Survival in Patients With Cancer Aged ≥75 Years. J Natl Compr Canc Netw. 2019;17(6):687-694. (PMID: 31200361).

11. Owusu C, Berger NA. Geriatric management of older cancer patients: A call for action beyond assessments. J Geriatr Oncol. 2019; pii: S1879-4068(19)30367-4. (PMID: 31474472).

12. Michels G, Müller-Werdan U. [Intensive Care in Elderly Patients - Consideration of Age-Related Organ Dysfunction and Vulnerability]. Dtsch Med Wochenschr. 2019;144(20):1411-1416. (PMID: 31594015).

13. Sodhi K, Singla MK, Shrivastava A, Bansal N. Do Intensive Care Unit treatment modalities predict mortality in geriatric patients: An observational study from an Indian Intensive Care Unit. Indian J Crit Care Med. 2014;18(12):789-95. (PMID: 25538413).

14. Voga G, Gabršček-Parežnik L. Early hemodynamic assessment and treatment of elderly patients in the medical ICU. Wien Klin Wochenschr. 2016;128(Suppl 7):505-511. (PMID: 27896466).

15. Nielsson MS, Christiansen CF, Johansen MB, Rasmussen BS, Tønnesen E, Nørgaard M. Mortality in elderly ICU patients: a cohort study. Acta Anaesthesiol Scand. 2014;58(1):19-26. (PMID: 24117049).

16. Phillips GD, Austin KL, Runciman WB, Vedig AE. Deaths in intensive care: analysis and prediction. Med J Aust. 1980;1(9):424-6. (PMID: 7393094).

17. de Lange DW, Brinkman S, Flaatten H, et al. Cumulative Prognostic Score Predicting Mortality in Patients Older Than 80 Years Admitted to the ICU. J Am Geriatr Soc. 2019;67(6):1263-1267. (PMID: 30977911).

18. Taneva E, Bogdanova V, Shtereva N. Acute coronary syndrome, comorbidity, and mortality in geriatric patients. Ann N Y Acad Sci. 2004;1019:106-10. (PMID: 15247001).

19. Saxena A, Meshram SV. Predictors of Mortality in Acute Kidney Injury Patients Admitted to Medicine Intensive Care Unit in a Rural Tertiary Care Hospital. Indian J Crit Care Med. 2018;22(4):231-237. (PMID: 29743761).

20. Keet O, Chisholm S, Goodson J, Browne T. A retrospective observational study of mortality rates in elderly patients with shock in a New Zealand district hospital ICU. N Z Med J. 2017;130(1453):29-34. (PMID: 28384144).

21. Chico-Fernández M, Sánchez-Casado M, Barea-Mendoza JA, et al. Neurointensive Care and Trauma Working Group of the Spanish Society of Intensive Care Medicine (SEMICYUC). Outcomes of very elderly trauma ICU patients. Results from the Spanish trauma ICU registry. Med Intensiva. 2019:pii: S0210-5691(19)30034-8. (PMID: 30799042).