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Evaluating the Optimal Care for Octogenarian Patients: A Comparative Study of CICU and Ward Outcomes

Objective: Globally, more octogenarian patients require hospitalization for cardiovascular conditions, but deciding between Coronary Intensive Care Units (CICU) and general medical wards (GMW) is challenging due to frailty and comorbidities.

Materials and Methods: This retrospective study at a tertiary heart center (March 2017-December 2022) included octogenarian patients (≥ 80 years) hospitalized for acute coronary syndrome (ACS), heart failure (HF), or cardiac arrhythmias. Patients were categorized into CICU ($n=512$) and GMW ($n=548$) groups, with analysis of clinical, demographic, and outcomes data.

Results: Mean ages were similar between CICU and GMW groups (84.8 ± 6.8 vs. 85.0 ± 5.8 years; $p=0.440$). In-hospital mortality was higher in the CICU group (18.0% vs. 10.0% , $p<0.001$), as were complications like sepsis (10.5% vs. 6.9% , $p=0.024$), acute kidney injury (15.8% vs. 10.2% , $p=0.008$), and delirium (32.0% vs. 17.5% , $p<0.001$). Logistic regression showed STEMI ($OR=2.80$, $p<0.001$), intubation ($OR=3.50$, $p<0.001$), acute kidney injury ($OR=2.10$, $p<0.001$), sepsis ($OR=2.30$, $p<0.001$), and delirium ($OR=1.50$, $p=0.002$) as significant predictors of mortality.

Conclusion: CICU admission, while critical for high-risk octogenarians, especially those with STEMI, correlates with increased mortality and complications. Effective patient selection and preventive measures are vital to improve outcomes in this vulnerable group.

Key Words: Octogenarians, coronary intensive care unit, general ward, in-hospital mortality, elderly care

Seksen Yaş Üstü Hastalarda Optimal Bakımın Değerlendirilmesi: KYBÜ ve Servis Sonuçlarının Karşılaştırılması

Amaç: Dünya genelinde kardiyovasküler hastalıklar nedeniyle hastaneye kaldırılması gereken yaşlı hastaların oranı önemli ölçüde artmıştır, ancak Koroner Yoğun Bakım Üniteleri (KYBÜ) ile genel tıp servisleri (GTS) arasında seçim yapmak, kırılganlık ve komorbiditeler nedeniyle zorlayıcıdır.

Gereç ve Yöntem: Mart 2017 - Aralık 2022 tarihleri arasında, üçüncü basamak bir kalp merkezinde akut koroner sendrom (AKS), kalp yetmezliği (KY) veya kardiyak aritmiler nedeniyle hastaneye kaldırılan 80 yaş ve üzeri hastaları kapsayan bu retrospektif çalışmada, hastalar KYBÜ ($n=512$) ve GTS ($n=548$) olarak iki gruba ayrılmıştır. Klinik, demografik ve sonuç verileri analiz edilmiştir.

Bulgular: KYBÜ ve GTS gruplarının ortalama yaşları benzerdi (84.8 ± 6.8 vs. 85.0 ± 5.8 yıl; $p=0.440$). KYBÜ grubunda hastane içi ölüm oranı daha yüksekti (18.0% 'a karşı 10.0% , $p<0.001$), sepsis (10.5% 'a karşı 6.9% , $p=0.024$), akut böbrek yaralanması (15.8% 'a karşı 10.2% , $p=0.008$) ve deliryum (32.0% 'a karşı 17.5% , $p<0.001$) gibi komplikasyonlar daha sık görülmüştür. Lojistik regresyon, STEMI ($OR=2.80$, $p<0.001$), entübasyon ($OR=3.50$, $p<0.001$), akut böbrek yaralanması ($OR=2.10$, $p<0.001$), sepsis ($OR=2.30$, $p<0.001$) ve deliryum ($OR=1.50$, $p=0.002$)'un ölüm üzerinde bağımsız ve önemli prediktörler olduğunu göstermiştir.

Sonuç: KYBÜ kabulleri, özellikle STEMI olan yüksek riskli yaşlı hastalar için kritik olmakla birlikte, artmış mortalite ve komplikasyonlarla ilişkilidir. Etkili hasta seçimi ve önleyici tedbirler bu kırılgan grupta sonuçları iyileştirmek için hayati önem taşımaktadır.

Anahtar Kelimeler: Oktogenaryenler, koroner yoğun bakım ünitesi, genel servis, hastane içi mortalite, yaşlı bakımı

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Introduction

With the aging population worldwide, the proportion of individuals aged 80 years and older, often referred to as octagenarians, is rapidly increasing. This demographic change has led to an increase in the number of elderly patients presenting with acute cardiac conditions such as acute coronary syndrome (ACS), heart failure (HF), and arrhythmias, necessitating hospitalization (1). Despite advances in cardiovascular care, the management of octagenarian patients remains challenging due to frailty, multiple comorbidities, and unique physiologic responses to acute illness (2).

The decision to admit octagenarian patients to a general ward rather than a coronary intensive Care Unit (CICU) is often complex and depends on factors such as severity of illness, availability of resources, and clinician judgment. CICUs provide the intensive monitoring and specialized care that is critical for patients with high-risk

cardiac events such as ST elevation myocardial infarction (STEMI), cardiogenic shock, or life-threatening arrhythmias (3, 4). However, admission to the CICU may expose frail elderly patients to potential risks such as hospital-acquired infections, delirium, and prolonged immobilization, which may compromise recovery (5, 6). On the other hand, care in general wards may be appropriate for stable patients, but may lead to delays in intensifying care when complications develop (6).

Previous studies have shown that elderly patients, including octogenarians, benefit from evidence-based treatments such as early revascularization and intensive pharmacological therapy in the setting of ACS (7). However, data comparing outcomes between CICU and general ward admissions, particularly in the octogenarian population, are limited. There remains an urgent need to determine whether CICU admission confers a survival advantage or improvement in these patients in terms of mortality, complication rates, length of hospital stay, and postdischarge outcomes (8).

This study aimed to evaluate the clinical outcomes of octogenarian patients in CICU versus those followed in general medical wards. We aim to provide evidence-based recommendations for the optimal management of this fragile population by identifying differences in mortality, complication rates, and resource use.

Materials and Methods

Research and Publication Ethics: The study protocol was approved by the Istanbul-Cerrahpasa University Institute of Cardiology Ethics Committee in 06.02.2019 with reference number B0806500.05.005. The study was conducted in line with the ethical considerations set forth in the Declaration of Helsinki and Good Clinical Practice Guidelines. Informed consent was obtained from all participants included in the study.

This study was designed as a retrospective observational cohort study and contained patients between March 2017 and December 2022 at a tertiary heart center, Istanbul University Cerrahpasa, Institute of Cardiology. Octogenarian patients (≥ 80 years old) who hospitalized due to acute coronary syndrome (ACS), heart failure or cardiac arrhythmias were enrolled in the study. Patients were divided into two groups based on their initial hospitalization setting: those admitted to the CICU and those managed in the general medical ward (GMW). Patients were identified using the hospital's electronic medical records system, and data were collected retrospectively.

Patients were included in the study if they were 80 years old age or older at the time of admission, had a confirmed diagnosis of ACS, heart failure, or cardiac arrhythmias, and had complete clinical and laboratory records available for analysis. Patients were excluded if they were admitted with terminal illness, admitted with cardiac arrest, hospitalized due to social indications, had previous hospitalization in another center, neurological or psychiatric disorder at admission, required immediate

escalation to mechanical circulatory support (e.g., intra-aortic balloon pump or extracorporeal membrane oxygenation), or were transferred from another facility without complete clinical data.

ST-elevation myocardial infarction (STEMI), Non-STEMI, unstable angina (USAP) were ACS subgroups and the diagnosis based on clinical presentation, electrocardiography (ECG) and cardiac biomarkers were defined according to European Society of Cardiology (ESC) guidelines (9). Decompensated heart failure were diagnosed according to symptoms, physical findings, echocardiographic evaluation, radiological findings and elevated Nt- proBNP levels. Some patients may become decompensated or their clinical condition may deteriorate as a result of pneumonia and/or urosepsis. Patients who had required hospitalization due to valve pathologies were evaluated under the heart failure group. These patients were evaluated in the heart failure group. Cardiac arrhythmias included sustained ventricular tachycardia, bradycardia and newly developed or high rate response atrial fibrillation (AF).

In hospital mortality was the primary outcome of the study while secondary outcomes were length of stay (LOS), complication rates. Complications during the hospital stay were defined as the occurrence of acute kidney injury (AKI) based on KDIGO criteria, sepsis or delirium (10). A hospital stay longer than 7 days was considered a prolonged length of stay.

Data were obtained from the electronic medical recording system belonging to hospital. Patients' characteristics, baseline demographic information including age, gender, comorbidities and admission diagnosis, vital signs, laboratory findings and conventional echocardiographic parameters were recorded. Regarding the treatments, any invasive intervention was noted. In hospital complications, mortality and morbidity outcomes were recorded. All data were stored securely to ensure patients' confidentiality.

Statistical Analysis: SPSS 23.0 (Statistical Product and Service Solutions for Windows, Version 23.0, IBM Corp., Armonk, NY, U.S., 2015) software package was used in the statistical analyses of the collected data. Continuous variables were examined for normality using the kurtosis test. Normally distributed variables were presented as mean $\pm$ standard deviation (SD) while skewed distribution was presented as median and interquartile range (IQR). Normally distributed data were compared using Student's t-test while non-normally distributed data were compared by Mann-Whitney U test. Categorical variables were expressed as percentage values and compared using Chi-square test. Multivariable logistic regression analysis was performed to identify independent factors predicting in-hospital mortality. P value < 0.05 was considered statistically significant and statistical outputs were reviewed to ensure accuracy and reproducibility.

Results

Between 2017 and 2022, the records of 2,654 patients admitted to the tertiary center CICU were reviewed. Among these, 512 patients (19.2%) aged 80 years or older with complete and accessible data in the hospital system were included in the CICU group. Similarly, during the same period, 548 patients (14.3%) aged 80 years or older with adequate data records were identified from a total of 3,823 ward patients and included in the GMW group.

The mean age of patients was comparable between the groups, with 84.8 ± 6.8 years in the CICU group and 85.0 ± 5.8 years in the GMW group ($p=0.440$). Male patients constituted 53.5% (n: 274) of the CICU group and 52.5% (n: 288) of the GMW group ($p=0.226$) (Figure 1). The prevalence of comorbidities such as hypertension, diabetes mellitus, and coronary artery disease was similar across groups. However, the CICU group had a higher proportion of patients presenting with STEMI (40.0% vs. 10.7%, $p<0.001$), while the GMW group had a higher prevalence of USAP and syncope-related admissions (Table 1)

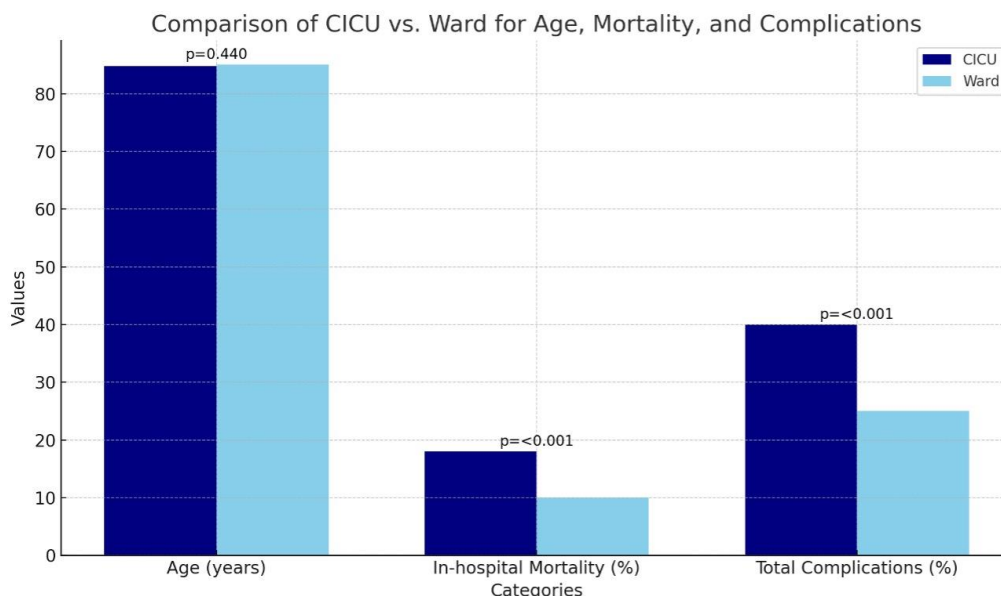
Table 1. Demographics and patients characteristics

Variables	CICU (n: 512)	Ward (n: 548)	p value
Age, years	84.84 ± 6.78	85.01 ± 5.75	0.440
Male Gender, % (n)	53.5 (274)	52.5 (288)	0.226
Hypertension, % (n)	76.2 (390)	73.2 (401)	0.086
Diabetes Mellitus, %(n)	43.2 (221)	43.8 (240)	0.125
BMI, kg/m ²	$25.8 (23.8-33.3)$	$23.3 (19.3-29.0)$	0.087
Coronary artery disease, %(n)	68.3 (350)	68.0 (373)	0.763
Chronic kidney disease, %(n)	36.7 (188)	31.7 (174)	0.134
Chronic obstructive pulmonary disease, % (n)	22.6 (116)	18.2 (100)	0.091
Heart failure, %(n)	40.6 (208)	40.6 (223)	0.951
NYHA functional classification			
NYHA I	8.9 (46)	20.9 (115)	0.021
NYHA II	33.9 (174)	34.6 (190)	0.541
NYHA III	40.6 (208)	35.5 (195)	0.412
NYHA IV	16.4 (84)	8.7 (48)	0.003
LVEF, %	48.3 ± 12.5	52.1 ± 11.8	0.450
Hgb, g/dL	12.5 ± 1.3	12.7 ± 1.2	0.321
WBC ($\times 10^3/\mu\text{L}$)	$8.7 (7.1-10.5)$	$8.2 (6.5-9.8)$	0.087
Neutrophile ($\times 10^3/\mu\text{L}$)	$5.1 (4.0-6.5)$	$4.7 (3.7-6.0)$	0.064
Monocyte ($\times 10^3/\mu\text{L}$)	$0.6 (0.4-0.9)$	$0.5 (0.3-0.8)$	0.049
PLT ($\times 10^3/\text{mm}^3$)	$243 (198-290)$	$238 (185-275)$	0.091
Albumin, g/dL	3.2 ± 0.4	3.4 ± 0.3	0.033
Protein, g/dL	6.5 ± 0.7	6.8 ± 0.6	0.102
Creatinine, mg/dL	$1.1 (0.9-1.5)$	$1.0 (0.8-1.4)$	0.064
Nt-Probnp, pg/mL	$3123 (1890-15340)$	$2450 (1200-13450)$	0.042
T-Cholesterol, mg/dL	182.0 ± 35.6	176.2 ± 40.3	0.780
LDL- C, mg/dL	120.3 ± 30.1	145.8 ± 25.1	0.091
Presentation			
Acute Coronary Syndrome, %(n)	59.1 (303)	48.4 (265)	0.063
STEMI, %(n)	40.0 (205)	10.7 (59)	<0.001
NON-STEMI, %(n)	15.0 (77)	20 (110)	0.120
USAP, %(n)	1.9 (21)	17.5 (96)	<0.001
Decompensate Heart Failure, %(n)	32.2 (165)	35.4 (194)	0.144
Syncope – Arrhythmia issues, %(n)	8.6 (44)	16.2 (89)	0.004

CICU: Coronary intensive care unit, NYHA: New york heart association functional classification, LVEF: left ventricular ejection fraction, Hgb: Haemoglobin, WBC: White blood cell, PLT: Platelet, T-Chol: Total cholesterol, LDL-C: high density lipoprotein, STEMI: ST elevation myocardial infarction, USAP: Unstable angina pectoris

Table 2. Clinical outcomes of octogenarian patients in CICU vs general ward

Variables	CICU (n: 512)	Ward (n: 548)	p value
In hospital mortality, %(n)	18.0 (92)	10 (55)	<0.001
Intubation, %(n)	12.5 (64)	5.5 (30)	<0.001
Dialysis, %(n)	6.8 (35)	4.0 (22)	0.043
Sepsis, %(n)	10.5 (54)	6.9 (38)	0.024
Delirium, %(n)	32.0 (164)	17.5 (96)	<0.001
Length of Stay, %(n)	45.3 (232)	30.2 (166)	0.002
Acute Kidney Injury, %(n)	15.8 (81)	10.2 (56)	0.008
Bleeding, %(n)	8.2 (42)	4.9 (27)	0.039
Parenteral nutrition, %(n)	5.6 (29)	3.3 (18)	0.087

**Figure 1.** Comparison of Age, In-Hospital Mortality, and Complication Rates Between CICU and General Medical Ward Octogenarian Patients

Abbreviations: CICU, Coronary Intensive Care Unit; GMW, General Medical Ward.

In-hospital mortality was significantly higher in the CICU group when compared to the GMW group (18.0% vs. 10.0%, $p<0.001$). The CICU group also had higher rates of invasive procedures, such as intubation (12.5% vs. 5.5%, $p<0.001$) and dialysis (6.8% vs. 4.0%, $p=0.043$). Complications such as sepsis (10.5% vs. 6.9%, $p=0.024$) and AKI (15.8% vs. 10.2%, $p=0.008$) were more frequent in the CICU group rather than GMW. Delirium was also significantly higher in the CICU group (32.0% vs. 17.5%, $p<0.001$). Conversely, the GMW group had a shorter length of stay (30.2% > 7 days vs.

45.3%, $p=0.002$) and lower rates of bleeding complications (Table 2).

Multivariable logistic regression analysis revealed STEMI (OR=2.80, 95% CI: 2.10–3.75, $p<0.001$), intubation (OR=3.50, 95% CI: 2.45–4.98, $p<0.001$), AKI (OR=2.10, 95% CI: 1.50–2.95, $p<0.001$), sepsis (OR=2.30, 95% CI: 1.70–3.10, $p<0.001$), prolonged hospital stay (OR=1.25 95% CI: 1.01–1.55, $p<0.042$) and delirium (OR=1.50 95% CI: 1.15–1.96, $p<0.002$) as independent predictors of in-hospital mortality (Table 3).

Table 3. Multivariable logistic regression analysis for predicting in hospital mortality

Predictors	Exp(B)	95% CI (Lower-Upper)	p value
Age, years	1.05	1.02–1.09	0.001
Male Gender	1.15	0.90–1.46	0.265
STEMI	2.80	2.10–3.75	<0.001
Intubation	3.50	2.45–4.98	<0.001
Acute Kidney Injury	2.10	1.50–2.95	<0.001
Delirium	1.50	1.15–1.96	0.002
Sepsis	2.30	1.70–3.10	<0.001
Length of Stay>7 days	1.25	1.01–1.55	0.042

Discussion

This study compares the outcomes of patients aged over 80 years who were hospitalized in CICU and cardiology wards due to cardiovascular pathologies. The octogenarian population often presents with multiple comorbidities, and adverse events are frequently observed during hospitalizations indicated for this group. The aim is to prevent unnecessary intensive care unit (ICU) admissions for this vulnerable patient population, thereby minimizing complications associated with closed-unit care settings and reducing patient stress.

With the aging population and extended life expectancy, the demand for intensive care units has significantly increased, accompanied by a progressive rise in the average age of admitted patients (11). In developed countries, patients aged over 90 years constitute approximately 5% of CICU admissions, while those aged over 80 years account for more than 25% (12). Patients with advanced cardiac disease constitute the main patient population of coronary intensive care and are exposed to more serious cardiac and/or non-cardiac complications (such as cardiogenic shock, sepsis, acute kidney injury) (13). Austruy et al. (8) in a study conducted with patients over and under the age of 80 who were admitted to the CICU with acute coronary syndrome also showed that octogenarian patients had more in-hospital complications and mortality (14). In our study, although the GMW and CICU groups had similar demographic and patient characteristics, precise propensity matching could not be achieved. CICU patients exhibited higher risk profiles, with greater rates of hemodynamic instability, reflected in increased in-hospital mortality and complication rates. Complications such as intubation, sepsis, delirium, and acute kidney injury (AKI) were significant predictors of mortality, while STEMI remained a strong mortality predictor across all age groups. Consistent with previous literature, STEMI was strongly associated with mortality in our study, underscoring the importance of early diagnosis and intervention in this high-risk cohort (15).

In a retrospective study of 1165 coronary intensive care patients, Campanile et al. (16) found in-hospital mortality to be 7.2%, and age, female gender, heart failure/cardiogenic shock, sepsis and acute kidney injury were observed as predictors of mortality. The proportion

of patients aged over 80 years was 19.2%, aligning with rates reported in developed countries. Unlike previous studies, female gender was not identified as a mortality predictor, possibly due to the advanced age of our study population. This could indicate that the effect of gender on mortality diminishes with advancing age, reflecting the high average age of our study population.

A recent retrospective study showed that 15% of 753 patients followed in the coronary intensive care unit due to acute myocardial infarction developed delirium. Advanced age, female gender, three-vessel disease, frailty, use of mechanical support, respiratory failure and continuous renal replacement therapy were found to be the parameters affecting the development of delirium. Delirium was an important predictor of in-hospital mortality (17). In a larger study, 11,079 patients followed in coronary intensive care with various cardiac emergencies were retrospectively examined and delirium was observed in 8.3%. It was observed that patients who developed delirium were older, had more comorbidities, and were hospitalized due to critical illnesses such as acute decompensated heart failure, cardiac arrest, and cardiogenic shock at a higher rate. In addition, patients who developed delirium were significantly more prone to in-hospital mortality (18). Delirium rates were notably high in both groups (32% in CICU and 17.5% in GMW), likely driven by advanced age, prolonged hospitalization, and severe clinical presentations in the CICU group, including STEMI, intubation, dialysis, and sepsis. The higher delirium rate in the CICU group underscores its role as a key predictor of mortality in our study.

In a single-center observational study by Buargub and Elmokhtar (19), STEMI patients accounted for the majority of coronary intensive care unit admissions. The presence of AKI significantly increased in-hospital mortality. Keskin et al. (20) showed that a high proportion of octogenarian patients hospitalized with acute coronary syndrome had concomitant infection and that in-hospital mortality was higher in this patient group (21). The underlying reasons for the associations between LOS and readmission and LOS and mortality are complex. patients with a longer LOS were older and had more noncardiovascular comorbidities. These comorbidities could predispose to nosocomial infections, in-hospital complications, and further deconditioning, ultimately contributing to mortality risk (22, 23). In our study, CICU patients exhibited significantly longer hospital stays, reflecting the complexity and severity of their conditions.

In conclusion, it is a known fact that patients with more critical cardiac conditions and more comorbidities are admitted to the CICU compared to the GMW. However, it is undeniable that the hospitalization process in the CICU also makes patients prone to some complications. Therefore, it is important to avoid unnecessary CICU follow-up, to keep CICU follow-up as short as possible by considering patient safety, and to maintain patient care conditions in this process at global standards as much as possible. One of the most important takeaways from this study is to protect the

elderly population as much as possible from adverse events that may arise due to hospitalization. Future research should focus on developing evidence-based admission criteria and risk prediction models to optimize care for this growing population.

Limitations: This study has several limitations. Despite efforts to propensity matching was not achieved, which may have introduced selection bias. Additionally, the retrospective design limits the ability to establish causal relationships. Another limitation of the

retrospective design is the inherent bias resulting from the admission of clinically more severe patients to the CICU and relatively more stable patients to the GMW, which cannot be entirely avoided. Although the demographics in our dataset appear similar, we believe that the likelihood of one group being clinically worse than the other may have impacted the accuracy of our results. Further prospective, multicenter studies are needed to validate these findings and develop robust guidelines for managing octogenarian patients.

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