

Clinical profile, outcomes and predictors of mortality in elderly patients admitted to the emergency medicine intensive care unit of a teaching hospital – A single-center registry

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ABSTRACT

Aim: Emergency intensive care of the elderly is often complicated and multifaceted. Understanding the clinical profile of elderly patients admitted in an emergency department-intensive care unit (ED-ICU) is crucial in planning health policies in geriatric emergency medicine. Thus, the aim of the study was to create a local registry of elderly people utilizing the ED-ICU services and to understand the rate and predictors of mortality. **Methods:** A retrospective chart analysis was performed including all patients aged ≥ 60 years who had an ED-ICU admission during a 6-month period (August 2018-January 2019). A structured case record form was used to capture information such as basic demography, clinical profile, and outcomes. **Results:** Total number of records considered for final analysis were 503. Mortality was seen in 21.07% ($n = 106/503$). The most common presenting complaint and cause of death was breathing difficulty ($n = 48/503$; 29.42%) and pneumonia ($n = 41/106$; 38.67%), respectively. The significant predictors of mortality [adjusted odds ratio; 95% confidence intervals; P value] were hypertension (2.195; 1.255, 3.840; 0.006), chronic liver disease (CLD) (4.324; 1.170, 15.979; 0.028), malignancy (2.854; 1.045, 7.796; 0.041), requiring noninvasive ventilation (NIV) (2.618; 1.449, 4.730; 0.001), requiring intubation (6.638; 3.705, 11.894; <0.001), and requiring vasopressors (3.583; 1.985, 6.465; <0.001). **Conclusion:** Approximately one in every five elderly patients getting admitted in ED-ICU died, and respiratory illness was the common diagnosis leading to death. Those with comorbidities such as hypertension, CLD, or malignancy and those requiring NIV, intubation, or vasopressors had higher mortality.

Keywords: Elderly, emergency department, geriatric, intensive care unit, mortality

Introduction

The world's population is aging, and the rate of aging is much faster in developing countries like India when compared to the developed nations.^[1] Globally, the proportion of elderly was 9% in 1994 which rose to 12% in 2014, and is expected to reach 21% by 2050.^[2] In India, the proportion of the elderly is

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on the rise (5.6% in 1961 to 7.4% in 2001) and is expected to reach 12.4% of the population by the year 2026.^[3] Given the high incidence of emergencies in the elderly, they account for an increasing share of emergency department (ED) visits and subsequent intensive care unit (ICU) admissions when compared to young adults.^[4,5] Their visits are often associated with a greater level of urgency, longer stays in the ED/ICU, have repeated ED visits, or experience higher rates of adverse health outcomes after discharge.^[6] The emergency intensive care of the elderly is often complicated and multifaceted due to the low physical capacity caused by aging, multiple comorbidities, increased severity of the disease, and atypical presenting symptoms.^[7] ED utilization by the elderly depends on a large number of factors, some of which include the social and demographic characteristics of the population served, the location of the ED, and the facilities available.^[8] Having an understanding of the clinical profile of elderly patients admitted to an ED-ICU is crucial in planning health policies in geriatric emergency medicine. The data from India on the utilization of ED-ICU by elderly were limited as evident from a PubMed search with search string “((Elderly OR Geriatric* [tiab])) AND emergency department [tiab] AND India [tiab]” Hence, this study was proposed with an aim to create a local registry of elderly patients utilizing the ED-ICU services from a tertiary care teaching hospital. The secondary objective of the study was to assess the proportion of in-hospital deaths and the risk factors of such mortality in our setting.

Methods

Ethics

The study protocol was submitted to the institutional ethics committee who approved the study vide (IEC 365/2019). A consent waiver was sort as the study was retrospective in nature.

Study design and eligibility criteria

This was a retrospective medical record analysis involving all patients aged 60 years and above visiting the ED of a tertiary care teaching hospital during the 6-month period August 2018–January 2019. The hospital serves a catchment area exceeding 1.5 million people in Southern India. There were no exclusion criteria.

Study procedures

After obtaining permission from the medical records department (MRD) of the hospital, a retrospective chart analysis was performed. The personal information and identity of the participants were masked to maintain confidentiality. A structured case record form was used to capture information such as the demographic details, presenting complaints, clinical profile, the treatment offered at ED, and their outcomes.

Data management

Data entry was done in Microsoft Excel (Publisher: Microsoft Corporation, Redmond, Washington, USA, 2016). Statistical analyses were performed using Statistical Package for Social

Sciences (SPSS) Statistics for Windows, Version 20.0 (Publisher: IBM Corp., USA, 2011).

Statistical analysis plan

Demographic characteristics and clinical profile were summarized using descriptive statistics such as mean and standard deviation for continuous data, and frequency and percentages for discrete data. The hypothesized risk factors for mortality were subjected to univariate analysis using binary logistic regression. Those factors whose significance was <0.2 in univariate analysis were subjected to the multivariate analysis again using a binary logistic regression model. The statistical significance was set at $P < 0.05$.

Results

The total number of elderly patients registered with the MRD during the 6-month time period (Aug 2018–Jan 2019) was 503. The mean (SD) age of the study participants was 70.23 (7.182), and 62% of them were men. Tobacco smoking history was present 23/503 (4.57%) patients and consumption of alcohol in 34/503 (6.75%) patients. The baseline demographic characteristics, medical history, and outcomes are summarized in Table 1. The duration of ICU stay for the majority ($n = 405/503$; 80.52%) of the patients was less than a week, and mortality was seen in 106/503 (21.07%). Table 2 summarizes the details of the chief presenting complaints. The three most common complaints were breathing difficulty ($n = 148/503$; 29.42%), fever ($n = 108/503$; 21.47%), and altered sensorium ($n = 79/503$; 15.70%).

The details of the diagnosis and the cause of death of patients are summarized in Table 3. Respiratory conditions such as pneumonia and exacerbations of chronic obstructive pulmonary disease (COPD), bronchial asthma, and obstructive sleep apnoea (OSA) were the most common diagnosis. The commonest cause of death was pneumonia seen in 41/106 (38.67%) fatalities. This was followed by sepsis (nonrespiratory illness related) and cardiac ailments. The posthoc power calculation of the study to determine the proportion of mortality was $>99\%$.

The analysis to identify the risk factors for mortality was performed only in 432/503 patients (excluding patients who received DAMA) whose outcome was known. The significant predictors of mortality [adjusted odds ratio (aOR); 95% confidence intervals (CI); *P*value] as assessed by the multivariate binary logistic regression analysis were hypertension (2.195; 1.255, 3.840; 0.006), chronic liver disease (CLD) (4.324; 1.170, 15.979; 0.028), malignancy (2.854; 1.045, 7.796; 0.041), requiring noninvasive ventilation (NIV) (2.618; 1.449, 4.730; 0.001), requiring intubation (6.638; 3.705, 11.894; <0.001), and requiring vasopressors (3.583; 1.985, 6.465; <0.001). The details of univariate and multivariate analysis are listed in Table 4.

Discussion

We report that the mortality rate seen among elderly reporting to the ED-ICU was 21.07% ($n = 106/503$). The proportion of

Table 1: Demographic characteristics, medical history, and outcomes

Characteristics	Category	Frequency (n=503)	Percentage
Gender	Male	313	62.22
	Female	190	37.77
Age	60-74	362	71.97
	75-84	123	24.45
	85 and above	18	3.58
Comorbidities	Diabetes mellitus	195	38.76
	Hypertension	258	51.29
	Ischaemic heart disease	100	19.88
	Chronic obstructive pulmonary disease	66	13.12
	Cerebrovascular accident	41	8.15
	Chronic kidney disease	41	8.15
	Hypothyroidism	26	5.17
	Malignancy	26	5.17
	Chronic liver disease	16	3.18
	Epilepsy	5	0.99
	Human immunodeficiency virus infection	04	0.79
Risk of Fall	Mild	348	69.18
	Moderate	135	26.83
	High	20	3.9
Treatment offered	Noninvasive ventilation	154	30.61
	Intubation	168	33.39
	Vasopressor	105	20.87
	Dialysis	47	9.34
	Surgery	47	9.34
Duration of hospital stay	Less than a week	405	80.52
	More than a week up to a month	95	18.89
	More than a month	3	0.59
Outcome	Death	106	21.07
	Discharge	326	64.81
	Discharge against medical advice	71	14.11

Table 2: Details of chief presenting complaints

Chief Presenting Complaint	Frequency (n=503)	Percentage
Breathlessness	149	29.62
Fever	111	22.06
Altered sensorium	79	15.70
Trauma	39	7.75
Hematemesis	33	6.56
Limb weakness	24	4.77
Abdominal pain and vomiting	24	4.77
Dizziness	10	1.98
Easy fatigability	11	2.18
Toxins- poisoning + snakebite	14	2.78
Chest pain	9	1.78

patients who were discharged against medical advice (DAMA) was 14.11% (n = 71/503). The three most common causes of mortality were pneumonia, sepsis (nonrespiratory illness related), and cardiac ailments. The significant predictors of mortality based on our study were those who had a medical history of hypertension, CLD, or malignancy and those requiring NIV, intubation, or vasopressors during the course of illness in ED-ICU.

The mortality rate seen in our study is comparable to other such studies conducted across the world. Mukhopadhyay

et al. from Singapore have reported that 20.9% (n = 148/709) of all elderly ≥ 65 years of age died in the ICU following an ED admission.^[9] A similar study conducted in Turkey among elderly ≥ 65 years of age has reported that 16.51% (n = 69/418) of those requiring ED-ICU admissions died.^[8] Results from the SENIOREA cohort also had a near similar mortality rate of 21.6% in the geriatric ICU subset.^[10]

We report that the most common presenting complaint was breathing difficulty, and pneumonia was the main cause of mortality. These findings were similar to those reported by Abhilash *et al.* from India who reported that the most common presenting complaints among elderly ≥ 65 years of age visiting the ED were breathing difficulty (28%) and fever (21.6%).^[11] Lim *et al.*^[12] from Singapore has also reported on similar lines. Further, a study from Thailand conducted over a 6-month period reported that 32.6% of all elderly (aged 65 years and above) ED mortality due to infectious diseases was diagnosed as pneumonia,^[13] thus corroborating the results of our study. Even the nationwide statistics in India suggests that the mortality due to lower respiratory tract infection in elderly aged 70 years and above has increased by 83.4% in the year 2016 when compared to 2000.^[14] The next common causes of death reported in our study were sepsis (nonrespiratory

Table 3: Diagnosis and cause of death

	Diagnosis (n=503)		Cause of death (n=106)	
	n	%	n	%
Pneumonia	107	21.27	41	38.67
Chronic obstructive pulmonary disease/bronchial asthma/obstructive sleep apnoea exacerbations	53	10.53	3	2.83
Cerebrovascular accident- intracranial bleed/ischaemia	54	10.73	7	6.60
Acute coronary syndrome and heart failure	51	10.13	12	11.32
Head and spine injury	32	6.36	6	5.66
Sepsis and septic shock (nonrespiratory illness related)	59	11.72	16	15.09
Chronic kidney disease with acute kidney injury and fluid overload	24	4.77	1	0.94
Tropical fever	17	3.37	2	1.88
Metabolic encephalopathy	18	3.57	0	0
Toxins (poisoning/snake bite)	15	2.98	2	1.88
Gastro-intestinal bleed	32	6.36	5	4.71
Seizures	11	2.18	0	0
Intestinal obstruction	8	1.59	3	2.83
Chest and extremity injuries	6	1.19	0	0
Pulmonary embolism	4	0.79	2	1.88
Myasthenia gravis	3	0.59	0	0
Meningoencephalitis	3	0.59	0	0
Malignancy	6	1.19	1	0.94

Table 4: Predictors of mortality (n=432)

Parameters	Univariate analysis		Multivariate analysis	
	Odds ratio	P	Adjusted Odds ratio (95% CI)	P
Male gender	1.206	0.423	Not included in the analysis	
Higher age	1.001	0.964	Not included in the analysis	
Alcohol consumption	0.977	0.959	Not included in the analysis	
Tobacco smoking	0.564	0.371	Not included in the analysis	
Higher fall risk score	0.939	0.186	0.972 (0.870, 1.085)	0.610
Longer duration of ICU stay	1.065	0.017	1.035 (0.970, 1.104)	0.298
Diabetes mellitus	0.743	0.208	Not included in the analysis	
Hypertension	1.883	0.006	2.195 (1.255, 3.840)	0.006
Ischaemic heart disease	1.157	0.595	Not included in the analysis	
Chronic liver disease	2.113	0.165	4.324 (1.170, 15.979)	0.028
Chronic kidney disease	0.883	0.753	Not included in the analysis	
Seizures	9.466	0.053	2.819 (0.253, 31.350)	0.399
Hypothyroidism	1.582	0.306	Not included in the analysis	
Malignancy	1.924	0.135	2.854 (1.045, 7.796)	0.041
Chronic obstructive pulmonary disease/Bronchial asthma	1.271	0.453	Not included in the analysis	
Cerebrovascular accident	1.168	0.704	Not included in the analysis	
Human immunodeficiency virus infection	6.250	0.136	5.326 (0.303, 93.544)	0.253
Requiring noninvasive ventilation	1.978	0.004	2.618 (1.449, 4.730)	0.001
Requiring intubation	6.918	<0.001	6.638 (3.705, 11.894)	<0.001
Requiring vasopressors	6.792	<0.001	3.583 (1.985, 6.465)	<0.001
Requiring dialysis	2.520	0.005	1.290 (0.562, 2.964)	0.548
Requiring surgery	0.679	0.343	Not included in the analysis	

illness related) and cardiac diseases which are also in line with the latest data (the year 2017) available from the Institute of Health Metrics and Evaluation (IHME). Among the top ten causes of deaths in India among elderly aged above 70 years, the relevant ones that were listed by IHME include cardiovascular diseases (2447.42 deaths per 100,000), enteric infections (799.57 deaths per 100,000), respiratory tract infections (600.52 deaths per 100,000), and other infections (83.78 deaths per 100,000).^[15]

Studies have identified that elderly patients with hypertension, malignancy, and CLD had approximately two, three, and four times the increased odds of mortality, respectively. Comorbidities among the elderly are a known risk for mortality, and the literature is replete in various indications of ED or ICU admissions among the elderly.^[16,17] Our analysis showed that almost all comorbidities that were assessed, except for diabetes mellitus and CKD, showed increased odds of mortality although they did not achieve statistical significance, probably because of the small proportion

of the participants with the said condition in the sample. The study was not planned to determine the duration of comorbid illnesses, the control of the ailment, adherence to the treatment, and hence the protective trend of diabetes mellitus and CKD towards mortality is neither conclusive nor statistically significant.

We further report that those requiring NIV, intubation, and vasopressor had approximately 2.6, 6.6, and 3.6 times the increased odds of mortality, respectively. Mechanical or non-invasive ventilation and vasopressors which are considered as “life-support” are usually used in patients who are severely ill with a poor prognosis. These findings are once again in line with the findings reported by Mukhopadhyay *et al.* wherein those requiring mechanical ventilation and vasopressor therapy were at increased odds of mortality by 2.74 (95% CI: 2.00, 3.76; $P < 0.001$) and 2.56 (95% CI: 2.00–3.26; $P < 0.001$) times, respectively.^[9] Inotropic support was also found as an independent mortality risk factor in geriatric patients with respiratory failure in ICU as demonstrated by Cirik *et al.*^[18]

Our study showed increased odds of mortality with NIV. Other studies have also reported that, apart from reduced expenditure, there is no mortality benefit with NIV when compared with mechanical ventilation.^[19,20]

The elderly in India face a multitude of socioeconomic challenges. Nearly 75% of the elderly population resides in rural areas. (1) This highlights the importance of primary care physicians to be vigilant of the unique problems faced by them. Clinical presentations of the elderly population are different from other populations and require due attention. Breathlessness, fever, and altered sensorium were the most common presentations noted by us for ICU admissions. These presentations in the rural setting should alert the primary care physicians about possible sinister etiology and necessitate investigations and aggressive therapy and even referral if required. With an ICU mortality rate of close to 20%, community health camps with an emphasis on screening and early identification of symptoms should be conducted to help prevent untimely deterioration. Primary physicians and peripheral health care workers should also raise awareness about comorbidity control as well. Comorbidities such as hypertension, cancer, and liver disease have been shown to be associated with poorer outcomes. The elderly need to be oriented towards regular follow ups and routine screening to recognize the acute factors linked to these chronic diseases.

Our study highlights the need for training peripheral health care workers in geriatric medicine. As the population of the elderly increases, so will the disease burden on our rural infrastructure. They need specialized training to learn the nuances of geriatric physiology and disease presentation to mitigate morbidity and mortality. To the best of our knowledge, there are very few studies aimed at geriatric intensive care profile and outcome. This invaluable data can be extrapolated by primary care physicians in their practice to help reduce the disease burden of this special population group. Our study has a few limitations. The patients

with ST-Elevation myocardial infarction, requiring urgent cardiac catheterization, were directly shifted to the cath lab and later to cardiac ICU. Hence, there may be an underestimation of cardiac ailments requiring ICU care. As it was a retrospective record-based study, we were unable to follow up on the outcome of those patients who went DAMA. Further, it was a single center study, and hence the results are reflective only of the population that the hospital catered to. The strengths of our study include adequate power to estimate the proportion of ICU-ED deaths among the elderly although a formal sample size calculation was not done. Further, it is the first of a kind study in our setting to the best of the knowledge of the authors.

Conclusion

Clinical profiling of elderly patients admitted in ED-ICU enables primary care physicians to understand the geriatric emergencies they are likely to encounter and to take swift action when these conditions present early in the disease course. We noted that approximately one in every five patients died in the hospital, and the most common causes were respiratory illnesses such as pneumonia, sepsis (nonrespiratory illness related), and cardiac ailments such as acute coronary syndrome or heart failure. The predictors of mortality as assessed by our study were comorbidities such as hypertension, CLD, or malignancy and those requiring NIV, intubation, or vasopressors. We hope that by understanding the symptomology and red flag signs, primary care physicians can identify these early and plan treatment strategies. This would also help in early referral, thereby helping in reducing morbidity and mortality.

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Informed consent

Written informed consent was obtained from the patients for their anonymized information to be published in this article. All the data were kept confidential and were coded.

Ethical approval

The Kasturba Medical College Institutional Ethics Committee consent was taken. (Ref. IEC 365/2019).

Author contributions

WW and PR researched literature and conceived the study and wrote the first draft.

JPR and UK were involved in protocol development, gaining ethical approval.

VJ BB SK – data acquisition and data analysis.

All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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Conflicts of interest

There are no conflicts of interest.

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