

A Clinical and Demographic Profile of Elderly (>65 Years) in the Medical Intensive Care Units of a Tertiary Care Center

Pruthvi Prabhudev¹, Kusugodlu Ramamoorthi², Raviraja V Acharya³

Received on: 30 December 2022; Accepted on: 29 January 2023; Published on: 28 February 2023

ABSTRACT

Background: The elderly population in India is expected to increase to 319 million by 2050. Managing critically ill elderly patients in intensive care units (ICUs) is a difficult task. Proper planning and development of healthcare infrastructure are of prime importance to face this challenge.

Objectives: To study the clinical profile and outcomes of elderly patients admitted to the medical ICUs.

Materials and methods: A time-bound, prospective observational study on elderly patients admitted to medical ICUs for more than 48 hours was conducted from March 2019 to September 2020. The demographic, biochemical, hematologic, and microbiological data on antibiotic susceptibility patterns on various organisms and procalcitonin (PCT) reports were collected. Acute Physiology and Chronic Health Evaluation II (APACHE II) score was calculated. Various treatment modalities, such as mechanical ventilation, inotropes, hemodialysis, antibiotics, culture report in sepsis patients, and length of ICU stay were collected.

Results: The age of the patients and the length of their ICU stay were not significantly associated with outcomes. Sepsis and APACHE II scores are significantly associated with outcomes. Receipt of mechanical ventilation, vasopressor support, and hemodialysis are significantly associated with mortality ($p < 0.001$).

Conclusion: The patients' ages were not significantly associated with outcomes. The most common cause of death among elderly patients was found to be sepsis, followed by pneumonia. In elderly ICU patients, gram-negative organisms are the most common causative agents in bloodstream infections. The APACHE II score, sepsis, receipt of mechanical ventilation, vasopressor support, and hemodialysis are significantly associated with mortality.

Keywords: Acute kidney injury, APACHE II, Blood culture, Elderly, Gram-negative infection, Hemodialysis, Intensive care units, Pneumonia, Procalcitonin, Sepsis.

Indian Journal of Critical Care Medicine (2023); 10.5005/jp-journals-10071-24416

HIGHLIGHTS

- Gram-negative organisms were commonly isolated from the blood and endotracheal tube cultures of elderly patients admitted to intensive care units.
- The risk factors significantly associated with mortality were sepsis, high APACHE II score, receipt of inotropic supports, and hemodialysis.

INTRODUCTION

In India, geriatric medicine is still an evolving field, and the elderly population is expected to increase to 319 million by 2050.¹ However, addressing the healthcare needs of this growing number of vulnerable and heterogeneous populations is a big challenge. Most of the studies on the elderly population are from Western countries; however, data on the outcomes of elderly patients in Indian ICUs is lacking. This will help in resource management, designing a treatment protocol, and providing counseling to the patient's family members regarding the outcomes.

Objectives of the Study

To study the system-wise disease spectrum and outcomes of elderly patients aged 65 years and above, and to assess disease severity using the APACHE II scoring system, admitted in medical ICUs of a tertiary care centre.

¹⁻³Department of Medicine, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India

Corresponding Author: Kusugodlu Ramamoorthi, Department of Medicine, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India, Phone: +91 9449615194, e-mail: ramamoorthi.k@manipal.edu

How to cite this article: Prabhudev P, Ramamoorthi K, Acharya RV. A Clinical and Demographic Profile of Elderly (>65 Years) in the Medical Intensive Care Units of a Tertiary Care Center. *Indian J Crit Care Med* 2023;27(3):166–175.

Source of support: Nil

Conflict of interest: None

MATERIALS AND METHODS

After getting the institutional ethical committee approval (IEC no.744/2018) a time-bound, prospective observational study was conducted from March 2019 to September 2020. All the patients of age 65 years and above admitted to medical ICUs for a minimum duration of 48 hours were included in this study. We excluded the patients admitted under departments other than internal medicine in medical ICUs. The criteria for ICU admission were not defined, and individualized decisions were made by the admitting unit's physician based on the clinical and physiological conditions of the

Table 1: Demographic and clinical characteristics

Characteristics	Subcategory	Overall of patients (%)
Age-group	65–69	52 (32.5)
	70–79	78 (48.75)
	80–90	30 (18.75)
Gender	Male	111 (69.38)
	Female	49 (30.63)
Comorbidities	DM	79 (49.38)
	HTN	101 (63.13)
	CKD	10 (6.25)
	CVA	23 (14.38)
	IHD	24 (15)
	CLD	2 (1.25)
	Bronchial asthma	3 (1.88)
	COPD	35 (21.88)
	Tuberculosis	3 (1.88)
Total number of comorbidities	0	36 (22.5)
	1	43 (26.88)
	2	55 (34.38)
	3	19 (11.88)
	4	6 (3.75)
	5	1 (0.63)

CLD, chronic liver disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease CVA, cerebrovascular accidents; DM, diabetes mellitus; HTN, hypertension; IHD, ischemic heart disease

patients. Informed written consent was taken from the patient's relatives.

We collected all the demographic, biochemical, hematologic, and microbiological data. Age, sex, laboratory parameters, including complete blood counts, blood urea, serum creatinine, serum electrolytes, liver function tests, HbA1c, Glasgow Coma Scale (GCS), arterial blood gas reports, PCT, cultures from blood, endotracheal tube (ET), urine and catheter tip were collected whenever sepsis and infection were suspected. Data on treatment details including the requirement of mechanical ventilation, vasopressor therapy, and hemodialysis were collected. APACHE II score was calculated using the worst laboratory parameters in the first 24 hours of ICU admission.

The data was analyzed using R i386.3.5.1 statistical software. Continuous data were shown as mean \pm SD and the categorical variables were represented by the frequency table. Association between categorical variables was measured using the Chi-square test. Continuous data were compared using a one-way analysis of variance (ANOVA) test. $P < 0.05$ is considered significant.

RESULTS

Table 1 summarizes the clinical and demographic characteristics of patients. The majority of the participants (48.7%) belonged to the age-group of 70–79 years, followed by 65–69 years (32.5%). The mean \pm SD APACHE II score was found to be 21.4 ± 5.33 with the lowest and highest score being 9 and 33, respectively. **Table 2** shows the association of the types of organisms in different cultures of samples from elderly patients and patient outcomes.

Associations of the type of isolates from blood culture and ET culture and patient outcomes were found to be statistically significant ($p < 0.05$), whereas no significant association was found between the type of organism isolated from urine and catheter tip samples and patient outcomes (**Table 2**).

The resistance and susceptibility of various microbial isolates to different antibiotics obtained from the culture of blood, urine, ET aspirate are shown in **Figures 1 to 3**.

Table 3 shows the final diagnoses of elderly patients admitted to ICU. The most common diagnosis among the elderly was pneumonia in 94 (58.75%), followed by sepsis in 78 (48.7%) of patients. Among the 10 (6.3%) cases of acute febrile illness, 5 (3.13%) had leptospirosis, 4 (2.5%) had scrub typhus, and 1 (0.63%) was diagnosed with malaria. About 9 (5.67%) cases were admitted for intentional self-harm, with 7 (4.4%) due to poisoning by organophosphates, 1 (0.63%) due to phosphorus poisoning, and 1 (0.63%) due to other agents. Out of 54 other diagnoses, 17 (10.63%) were due to encephalopathy, 11 (6.9%) were due to arrhythmias, 9 (5.63%) cases of malignancies, 7 (4.4%) cases of seizures, 3 (1.9%) cases of interstitial lung disease (ILD)/bronchiectasis, and remaining were due to snakebites, pulmonary thromboembolism (PTE), upper gastrointestinal bleed (UGI bleed) (1.25% each), and 1 (0.63%) case of infective endocarditis (IE) (**Table 3**).

The mean duration of ICU stay of elderly patients in this study was observed to be 11.8 ± 9.5 days with the shortest and longest duration being 2 days and 56 days, respectively. The median ICU stay was calculated to be 9 days. Of the 160 patients admitted during the study period, the condition of 81 (50.62%) patients improved after ICU stay. About 36 (22.5%) patients succumbed and 43 (26.87%)

Table 2: Association of type of organism in different cultures of samples from elderly patients with patient outcome

Culture	Organism type	Overall	Improved	Succumbed	DAMA	p-value
			N = 81	N = 36	N = 43	
Blood culture	None	127 (79.38%)	71 (55.91%)	21 (16.54%)	35 (27.56%)	0.0150 ^{CS*}
	Sensitive strain	14 (8.75%)	4 (28.57%)	8 (57.14%)	2 (14.29%)	
	MDR	13 (8.13%)	4 (30.77%)	5 (38.46%)	4 (30.77%)	
	PDR	6 (3.75%)	2 (33.33%)	2 (33.33%)	2 (33.33%)	
ET culture	None	117 (73.13%)	70 (59.83%)	20 (17.09%)	27 (23.08%)	0.0050 ^{CS*}
	Sensitive strain	12 (7.5%)	4 (33.33%)	3 (25%)	5 (41.67%)	
	MDR	26 (16.25%)	6 (23.08%)	10 (38.46%)	10 (38.46%)	
	PDR	5 (3.13%)	1 (20%)	3 (60%)	1 (20%)	
Urine culture	None	143 (89.38%)	73 (51.05%)	30 (20.98%)	40 (27.97%)	0.3238 ^{CS}
	Sensitive strain	9 (5.63%)	4 (44.44%)	4 (44.44%)	1 (11.11%)	
	MDR	7 (4.38%)	4 (57.14%)	1 (14.29%)	2 (28.57%)	
	PDR	1 (0.63%)	0 (0%)	1 (100%)	0 (0%)	
Catheter tip culture	None	158 (98.75%)	80 (50.63%)	36 (22.78%)	42 (26.58%)	0.7201 ^{CS}
	Sensitive strain	1 (0.63%)	0 (0%)	0 (0%)	1 (100%)	
	MDR	1 (0.63%)	1 (100%)	0 (0%)	0 (0%)	
	PDR	–	–	–	–	

*significant association ($p \leq 0.05$). ^{CS}Corrected values; DAMA, discharge against medical advice; ET, endotracheal tube; MDR, multidrug-resistant; PDR, pandrug-resistant

patients were discharged against medical advice (DAMA). In this study, the mortality rate among the elderly patients admitted to ICU was 22.5%. Table 4 shows the causes of death among elderly patients admitted to the ICU.

Sepsis was found to be the most common cause of death among the elderly (35 cases), followed by pneumonia (25 cases). Acute kidney injury (AKI) accounted for 23 deaths among the elderly patients. Other causes of deaths included encephalopathy, arrhythmias, malignancies, seizures, snakebites, PTE, UGI bleed, and IE. In this study, there were no deaths due to intentional self-harm.

The correlation between PCT and sepsis in elderly ICU patients in this study was found to be statistically significant ($p < 0.001$) as shown in Table 5. Table 6 depicts the association of patient outcomes with clinical and demographic characteristics of elderly ICU patients. Except in the case of cerebrovascular accident (CVA) and ischemic heart disease (IHD), there was no significant association between patient outcomes and comorbidities in this study. However, the rate of mortality was highest in patients with four comorbidities as compared to less number of comorbidities. A significant association was found between serum PCT and patient outcomes in this study ($p < 0.001$).

Table 7 shows the correlation between various factors and patient outcomes. The APACHE II score was significantly higher (25 ± 5.09) in non-survivors compared to survivors (19.11 ± 4.45) and DAMA (22.53 ± 5.02) in this study, and this correlation was statistically significant ($p < 0.0001$) as analyzed by one-way ANOVA test. Using Tukey HSD as a *post hoc* analysis, it has been found that the mean of APACHE II scores for succumbed and DAMA patients were significantly different from improved subjects ($p < 0.0001$), whereas there was no significant difference between succumbed and DAMA cases ($p = 0.0594$). Non-survivors had a longer ICU stay than those who recovered or were DAMA (Table 7). The association between the recovery rates, mortality, DAMA, intubation, and

the use of inotropes was found to be statistically significant ($p < 0.0001$). The number of survivors was more in patients who were not intubated, whereas the number of non-survivors was higher in patients who received inotropes (Table 7). In this study, there was a significant association between hemodialysis and patient outcome ($p < 0.001$). About 56.4% of non-survivors were on hemodialysis, indicating that the mortality rate was higher in elderly patients receiving hemodialysis.

Table 8 shows that the patient outcomes were significantly associated with sepsis ($p < 0.0001$), whereas it was not significantly associated with pneumonia. The association of diabetes mellitus with patient outcomes has been given in Table 9. The association of diabetes mellitus with patient outcomes was not found to be statistically significant.

DISCUSSION

Aging is an inevitable and natural process which leads to a decline in immunity and physiological reserves. This, in turn, leads to a rapid deterioration in health in the case of an illness, as the disease remains untreated it progresses rapidly, causing further complications and admission to ICU.

The majority of the participants in this study were in the age-group of 70–79 years (48.7%) and the mean age of the admitted elderly patients was 72.7 ± 6.4 years. This is comparable with other studies.^{2,3} The ICU admission rate for patients aged 80 years and above was about 18%, which was 13% in the earlier report.⁴ Previous studies have found no significant relationship between the patient's age and outcomes.^{2,3,5,6} These studies have consistently established that age by itself cannot be considered a factor for patient outcome, and that other factors, such as severe illness, comorbidities, and the individual's physiological status play an equally significant role in the outcomes of elderly patients.^{2,3,4,7} Similarly, male patients' predominance was observed in our study.^{2–8}

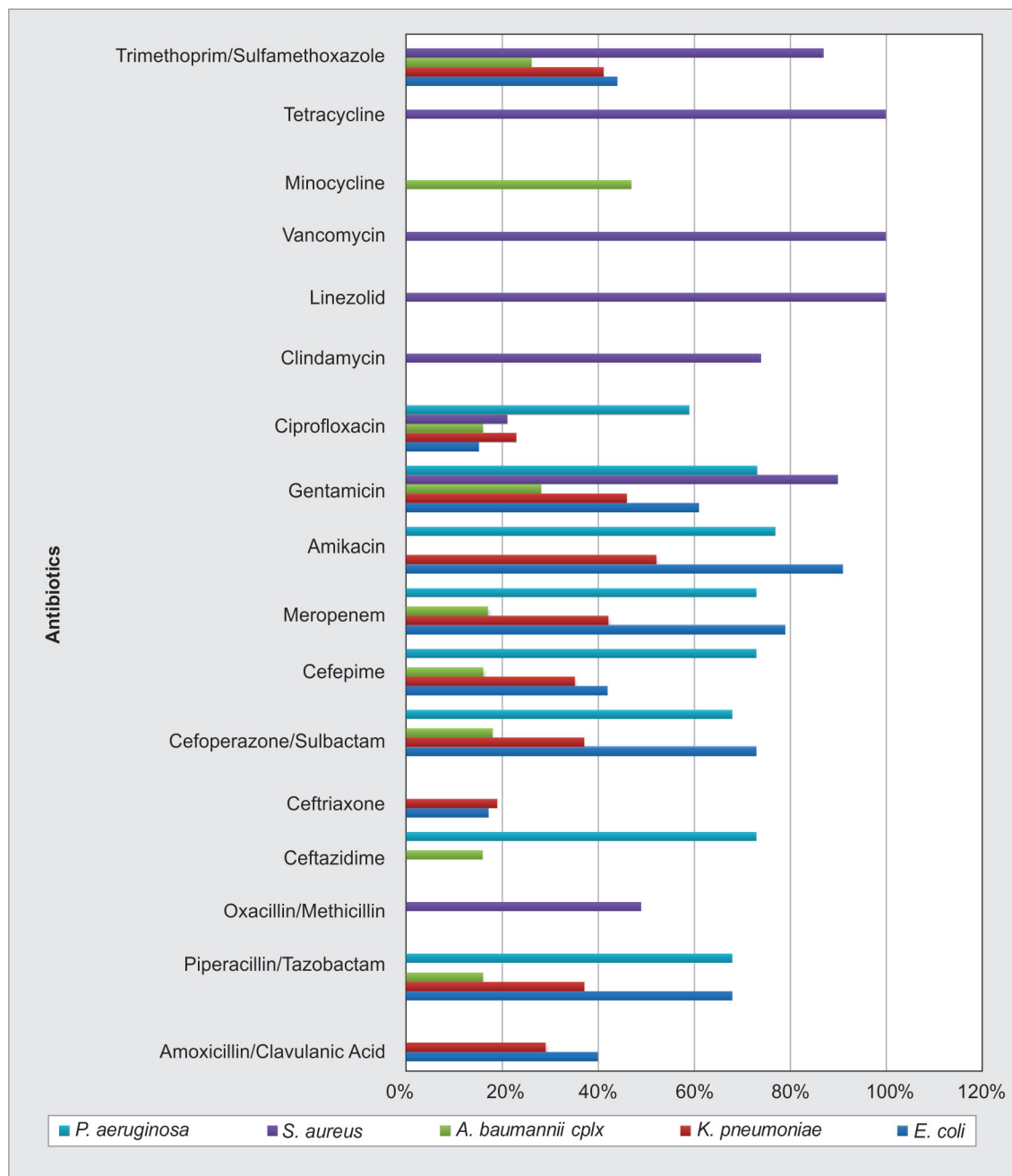


Fig. 1: Antibiotic susceptibility pattern of different isolates from blood samples of elderly patients

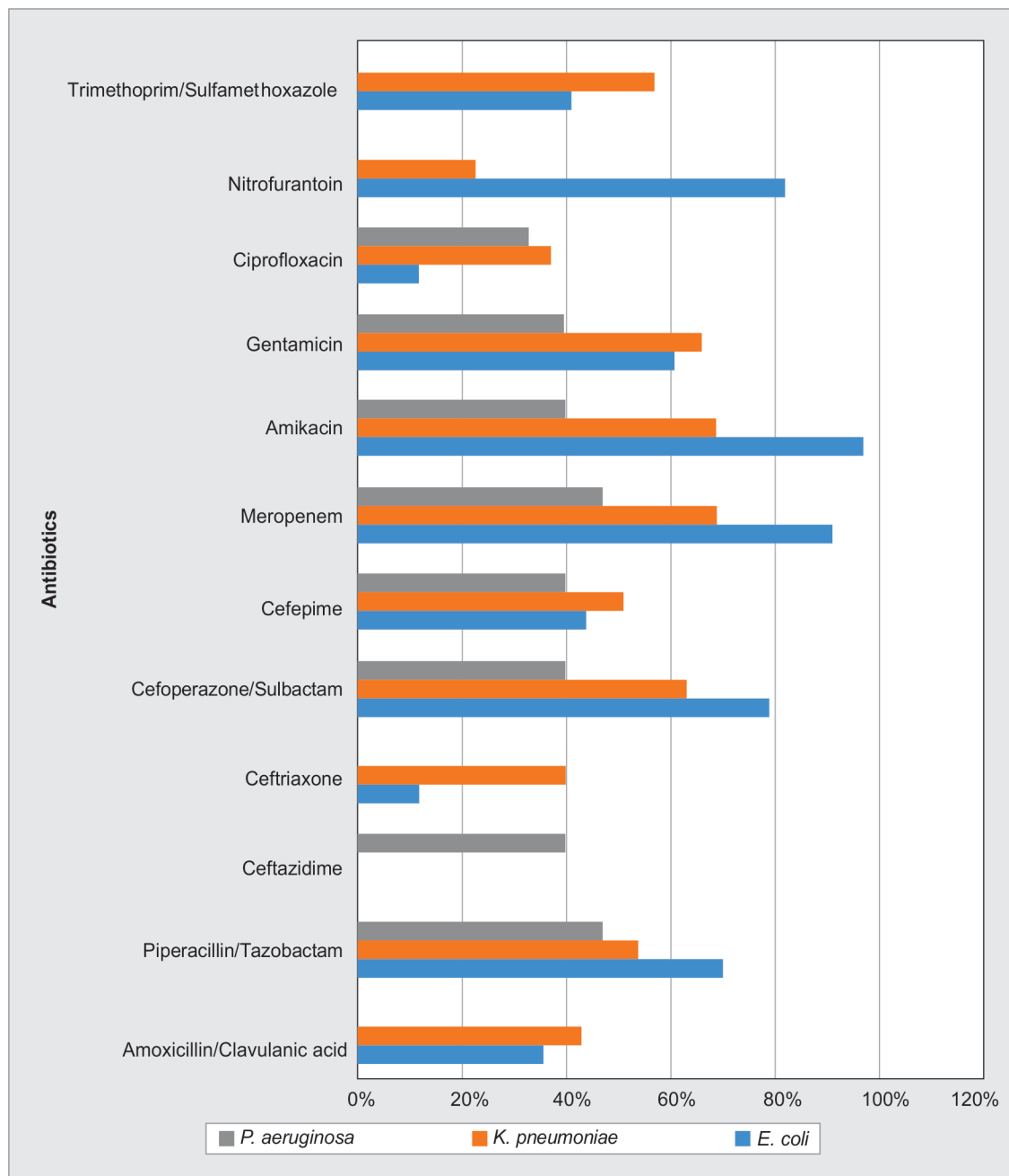


Fig. 2: Antibiotic susceptibility pattern of different isolates from urine samples of elderly patients

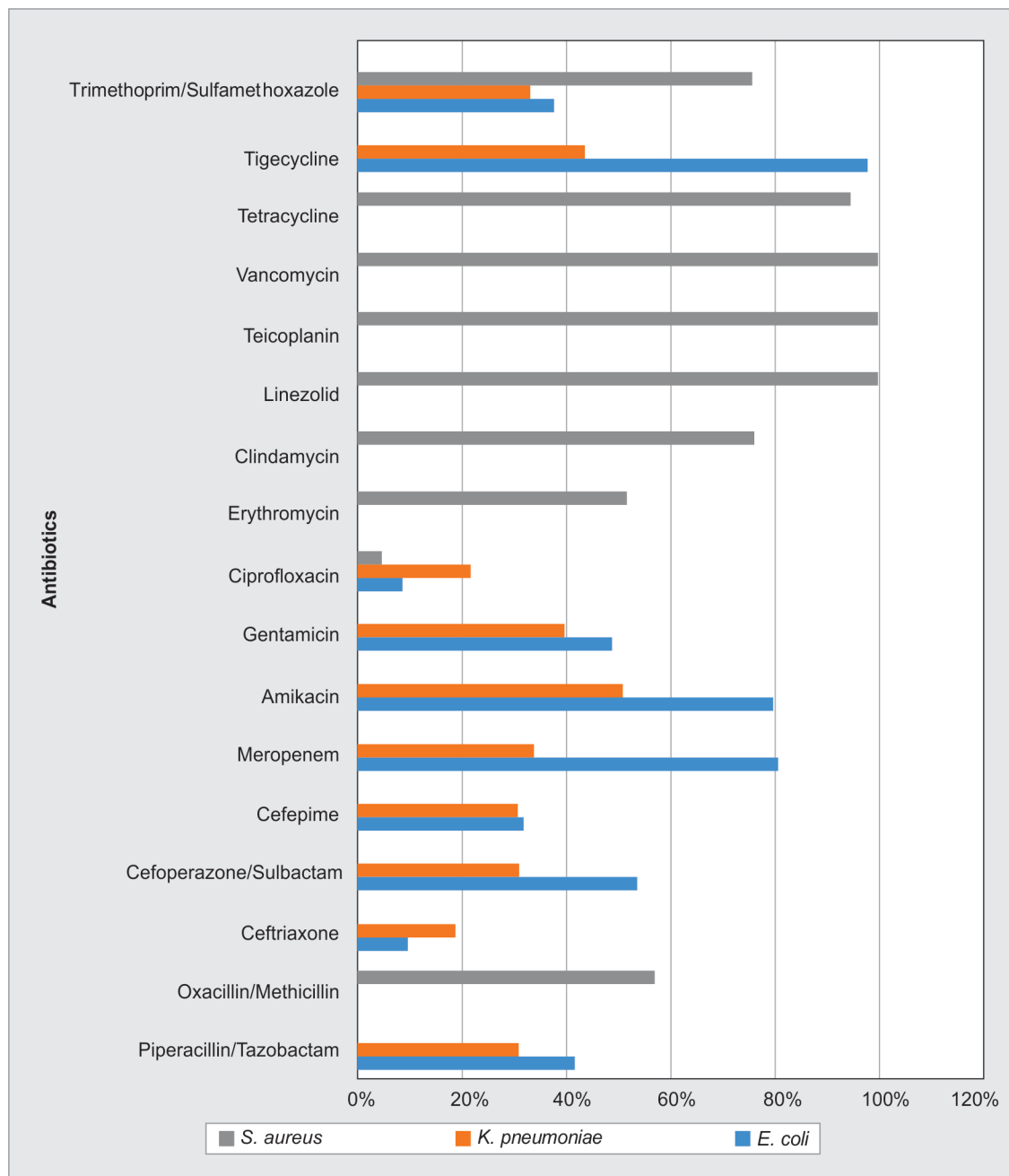


Fig. 3: Antibiotic susceptibility pattern of different isolates from ET samples of elderly patients

Table 3: Final diagnosis of elderly patients admitted to ICU

Cause of death	No. of cases (%)
Pneumonia	94 (58.75)
Sepsis	78 (48.75)
Acute kidney injury	67 (41.88)
Others	54 (33.75)
Acute exacerbation of COPD	41 (25.63)
Stroke	29 (18.13)
Heart failure	26 (16.25)
Acute respiratory distress syndrome	25 (15.63)
Myocardial infarction	25 (15.63)
Urinary tract infection	21 (13.13)
Acute febrile illness	10 (6.25)
Intentional self-harm/poisoning	9 (5.63)
Acute gastroenteritis	8 (5)
Decompensated cirrhosis of the liver	8 (5)

COPD, chronic obstructive pulmonary disease

Table 4: Causes of death among elderly patients admitted to ICU

Sepsis	31
Pneumonia	25
Urinary tract infection	8
Acute respiratory distress syndrome	11
Stroke	6
Acute exacerbation of COPD	8
Heart failure	6
Myocardial infarction	5
Acute kidney injury	23
Acute gastroenteritis	2
Decompensated cirrhosis of liver	3
Acute febrile illness	2
Intentional self-harm/poisoning	0
Others	18

COPD, chronic obstructive pulmonary disease

Table 5: Correlation between PCT and sepsis in elderly ICU patients

Procalcitonin	Subcategory	Sepsis		p-value
		Positive	Negative	
	Positive	43 (71.67%)	17 (28.33%)	<0.0001*
	Negative	35 (35%)	65 (65%)	

*indicates statistically significant. PCT, procalcitonin

Of the 160 elderly patients studied, 124 had one or more comorbidities. Comorbidities are common in elderly patients since chronic illnesses are a natural part of the aging process.^{4,8} Incidences of stroke and heart diseases are often associated with poor outcomes in elderly patients,⁹ as confirmed by this study. APACHE II score is a disease severity score widely used to assess the severity of illness in an ICU.^{3,4,6,10} The non-survivors had a significantly higher APACHE II score as compared to survivors, and

there was a significant association between APACHE II scores of elderly patients with their outcomes.^{4,6,10,11}

The duration of ICU stay, which is one of the main determinants of ICU expenses and resource utilization, and the mean ICU stay of elderly patients in this study was observed to be 11.8 ± 9.5 days. The mean ICU stay in non-survivors was 14.4 ± 12.84 days, while it was 10.74 ± 7.57 days in survivors and 11.42 ± 9.11 days in DAMA. The duration of ICU stay in this study was higher than in earlier reported studies.^{3,4,8,12} Probably this variation in the length of ICU stay may be due to differences in the severity of disease patterns, infections, and other complications.¹² In this study, the association between APACHE II scores of the patients and the duration of ICU stay was insignificant, as observed in previous studies.¹⁰

Comorbidities, reduced immune status, and chronic illnesses all contribute to different microbiological flora in geriatric patients as compared to younger patients. The literature is devoid of information on the microbiological aspects of elderly patients admitted to ICU in India. Among the gram-negative bacteria, 65.63% were susceptible to piperacillin and tazobactam and the majority of the gram-positive bacteria were susceptible to vancomycin, teicoplanin, and linezolid. In this study, multidrug-resistant (MDR) strains of *Acinetobacter* followed by *Pseudomonas* were the major isolates in blood samples and ET tube samples. In the previous report, the most common organisms isolated were *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*.¹³ In elderly patients, gram-negative organisms are the most common causative agents in bloodstream infections.^{13–15} Associations of the type of isolates from blood culture and ET tube culture and patients' outcomes were found to be statistically significant ($p < 0.05$).

In the current study, only 50% of MDR *Acinetobacter* strains were sensitive to minocycline and resistant to all other antibiotics. A similar finding was observed in previous studies, where the *Acinetobacter* strains showed high resistance to carbapenems and other cephalosporins.¹⁵ Among the *Escherichia coli* strains from blood, the majority were sensitive to aminoglycosides, meropenem and piperacillin-tazobactam antibiotics, and the majority of the strains of *E. coli* from urine were sensitive to amikacin, cefoperazone-sulbactam, and nitrofurantoin antibiotics in our study. Among the *E. coli* from the ET aspirate culture majority of strains were sensitive to tigecycline, meropenem, and amikacin antibiotics. However, the majority of *E. coli* strains were sensitive to carbapenems and third and fourth-generation cephalosporins in previous reports.¹⁵ Among *Pseudomonas* strains from blood, the majority of strains were sensitive to aminoglycosides, meropenem, and cephalosporins, and among *Pseudomonas* strains from urine only 40–50% were sensitive to aminoglycosides, meropenem, and piperacillin-tazobactam antibiotics in our study. However, in previous studies, the majority of *Pseudomonas* strains were resistant to cephalosporins and carbapenems.¹⁵ 30–50% and 30–45% of *Klebsiella* strains were sensitive to cephalosporins and amoxicillin/clavulanic acid, respectively. Among *Klebsiella* strains, 50–60% and 40–70% were sensitive to aminoglycosides and carbapenems, respectively. This sensitivity pattern was comparable to previous studies.¹⁵ The correlation between the microbial isolates and patient outcomes further strengthens the need of including microbiological analysis as a criterion to predict the outcome of elderly patients admitted to the ICU and deciding on the treatment strategy accordingly.

Table 6: Association of patient outcome with clinical and demographic characteristics of elderly patients in ICU

		<u>Improved</u>	<u>Succumbed</u>	<u>DAMA</u>	
<i>Factor</i>	<i>Sub-category</i>	<i>N = 81</i>	<i>N = 36</i>	<i>N = 43</i>	<i>p-value</i>
Age-group	65–69	26 (50%)	12 (23.08%)	14 (26.92%)	0.6431
	70–79	43 (55.13%)	17 (21.79%)	18 (23.08%)	
	80–90	12 (40%)	7 (23.33%)	11 (36.67%)	
Gender	Male	50 (45.05%)	27 (24.32%)	34 (30.63%)	0.0969
	Female	31 (63.27%)	9 (18.37%)	9 (18.37%)	
Comorbidities	DM	43 (54.43%)	14 (17.72%)	22 (27.85%)	0.3526
	Hypertension	52 (51.49%)	20 (19.8%)	29 (28.71%)	0.5298
	CKD	4 (40%)	4 (40%)	2 (20%)	0.4018 ^{CS}
	CVA	9 (39.13%)	3 (13.04%)	11 (47.83%)	0.0461*
	IHD	11 (45.83%)	2 (8.33%)	11 (45.83%)	0.0403*
	CLD	1 (50%)	0 (0%)	1 (50%)	>0.99 ^{CS}
	BA	0 (00.00%)	1 (33.33%)	2 (66.67%)	0.194
	COPD	17 (48.57%)	6 (17.14%)	12 (34.29%)	0.554
	TB	2 (66.67%)	1 (33.33%)	0 (00.00%)	0.548
	Total number of comorbidities	0	17 (47.22%)	12 (33.33%)	7 (19.44%)
1		25 (58.14%)	7 (16.28%)	11 (25.58%)	
2		27 (49.09%)	14 (25.45%)	14 (25.45%)	
3		10 (52.63%)	1 (5.26%)	8 (42.11%)	
4		1 (16.67%)	2 (33.33%)	3 (50%)	
5		1 (100%)	0 (0%)	0 (0%)	

*indicates significance. ^{CS}indicates Chi-square test with simulation; BA, bronchial asthma; CKD, chronic kidney disease; CLD, chronic liver disease; COPD, chronic obstructive pulmonary disease; CVA, cerebro-vascular accidents; DM, diabetes mellitus; IHD, ischemic heart disease; TB, tuberculosis

Table 7: Association of different factors with patient outcome among elderly ICU patients

Factors	Improved	Succumbed	DAMA	p-value
	N = 81	N = 36	N = 43	
APACHE II	19.11 ± 4.45	25 ± 5.09	22.53 ± 5.02	<0.0001*
Duration of ICU stay	10.74 ± 7.57	14.4 ± 12.84	11.42 ± 9.11	0.1621
Inotropes				
Yes	21 (28%)	32 (42.67%)	22 (29.33%)	<0.0001*
No	60 (70.59%)	4 (4.71%)	21 (24.71%)	
Intubated				
Yes	42 (38.89%)	31 (28.7%)	35 (32.41%)	<0.0001*
No	39 (75%)	5 (9.62%)	8 (15.38%)	
Hemodialysis				
Present	10 (25.64%)	22 (56.41%)	7 (17.95%)	<0.0001*
Not present	71 (58.68%)	14 (11.57%)	36 (29.75%)	

*indicates statistically significant. DAMA, discharge against medical advice; APACHE II, acute physiology and chronic health evaluation

In this study, the most important cause of hospital admissions among the elderly was pneumonia (58.75%), followed by sepsis (48.7%). It has been reported in previous studies that elderly patients in ICU were more prone to develop pneumonia,^{3,16,17} which is compounded by the presence of a significant number of MDR and pan drug-resistant (PDR) strains in this study's elderly patients.^{13–16}

Leptospirosis was the most common cause of acute febrile illnesses diagnosed in elderly ICU patients in this study. Leptospirosis is prevalent in warm humid regions and has high fatality rates if not treated early.¹⁸

Nine of the 160 elders admitted were due to intentional self-harm, with 7 cases due to poisoning by organophosphates, which are easily accessible to in India. This brings the focus onto the need for regular assessment of the mental health of the elderly along with their physical health. Death from intentional self-harm has been reported in older patients, and it is a major risk factor for suicide in older adults.^{19,20} Poisoning oneself in the elderly population may be a result of depression, which is very common among the elderly. Other factors, such as dementia and confusion, inappropriate use of medicines, inappropriate storage, or incorrect identities, can also lead to self-harm by poisoning in the elderly.^{19,20}

Mortality rates among elderly ICU patients in this study were 22.5%. The mortality rate in various studies on elderly patients varies from 17 to 73%.^{2,3,5,6,8} The reason for this variation in the mortality of elderly patients may be due to disease severity, the expertise of the staff, and the availability of types of equipment and infrastructures of the ICUs in various countries. The main cause of death of elderly patients admitted to ICUs was sepsis followed by pneumonia and AKI. Invasive procedures and instrumentations constitute a considerable risk factor for bloodstream infections in the elderly because they provides direct access to the bloodstream by breaking the body's natural barriers.^{17,21,22}

We observed a significant association between sepsis and patient outcome.^{2,14,21,22} In the elderly, several factors including decreased physiological reserves and reduced immunity

Table 8: Association between sepsis and pneumonia with patient outcome among the elderly

Condition	Sub-category	Improved	Succumbed	DAMA	p-value
Sepsis	Present	19 (24.36%)	32 (41.03%)	27 (34.62%)	<0.0001*
	Absent	62 (75.61%)	4 (4.88%)	16 (19.51%)	
Pneumonia	Present	45 (47.87%)	26 (27.66%)	23 (24.47%)	0.1713
	Absent	36 (54.55%)	10 (15.15%)	20 (30.3%)	

*indicates statistically significant. DAMA, discharge against medical advice

Table 9: Association of DM with patient outcomes in elderly patients

Diabetic mellitus	Outcomes			p-value
	Improved	Succumbed	DAMA	
Present	43 (54.43%)	14 (17.72%)	22 (27.85%)	0.3526
Absent	38 (46.91%)	22 (27.16%)	21 (25.93%)	

DAMA, discharge against medical advice

make sepsis an important cause of mortality.²¹ There was a significant association between sepsis ($p < 0.0001$) and patient outcomes.^{2,17,21,22}

Procalcitonin, a glycoprotein, has emerged as an ideal biomarker for sepsis and early detection of bacteremia. In this study, 71.7% of the sepsis cases were found to be positive for PCT, which is in accordance with the previous reports²³ and can also be used to identify severely ill elderly patients who may need intensive care.²³

The requirement of vasopressors in elderly ICU patients is significantly associated with poor outcomes in this study, which is in agreement with earlier reports.^{2,6,24,26–28} The mortality rate for intubated patients was 28.7%, whereas previous published reports reported mortality rates ranging from 20.3 to 51%.²⁵ Previous research has shown that the intubation and receipt of mechanical ventilation were associated with increased mortality in elderly ICU patients.^{2,5,13,26–28}

AKI was one of the most common diagnoses on admission in the current study. Most commonly, AKI mandates the need for hemodialysis (renal replacement therapy). A significant correlation between the need for hemodialysis and patient outcomes was established in this study ($p < 0.0001$). AKI patients have a high mortality rate than non-AKI patients.²⁵ In previous reports, the incidence of AKI ranged from 45 to 80%.²⁵ Sepsis, shock, inotropes, mechanical ventilation, length of hospital stay, and advanced age are the important independent predictors of AKI.^{25,27}

A significant correlation between the need for hemodialysis and patient outcome was established in this study ($p < 0.0001$). Both short- and long-term mortality rates were increased in more elderly patients compared to relatively young elderly patients who require hemodialysis.^{24,29}

CONCLUSION

The age of the patients was not significantly associated with outcomes. The most common cause of death among elderly patients was found to be sepsis followed by pneumonia. In elderly patients admitted to ICU, gram-negative organisms are the most common causative agents in bloodstream infections. Sepsis was significantly associated with poor outcomes. Pneumonia was the most common diagnosis in elderly patients admitted to ICU. Procalcitonin was significantly associated with sepsis. Duration

of ICU stay was not significantly associated with outcome. There was a significant association between the APACHE II score and outcomes. Receipt of mechanical ventilation, vasopressor support, and hemodialysis are significantly associated with mortality.

LIMITATIONS

Due to the prevailing Covid-19 pandemic, an adequate sample size could not be collected. As the study was done in medical ICUs, cases of acute coronary syndrome and chronic kidney disease may have been missed as they get admitted under the cardiology and nephrology departments, respectively. Social, economic, and psychiatric factors of the subjects were not considered in the study.

ORCID

Pruthvi Prabhudev  <https://orcid.org/0000-0002-3022-3219>

Kusugodlu Ramamoorthi  <https://orcid.org/0000-0002-4264-0079>

Raviraja V Acharya  <https://orcid.org/0000-0002-3849-8356>

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