RESEARCH

Analysis of the Relationship Between Intensive Care Unit Patient Characteristics and Patient Mortality at Adam Malik Hospital, Medan

Rahadhi Putera[✉*], Tasrif Hamdi[**], Cut Meliza Zainumi[**]

[*]Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia
[**]Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

[✉]Correspondence: rahadhi.kuda@gmail.com

ABSTRACT

Background: The intensive care unit (ICU) is a vital unit in hospitals that treats critical patients with physiological instability or organ failure.
Objective: The general objective of this study is to determine the relationship between patient characteristics and ICU mortality, with the specific objective of analyzing the number of patients who died, characteristics (gender, age, type of disease, type of microorganism, route of admission, antibiotic use, tracheostomy time, and SOFA score)**,**
Methods: This study used a cross-sectional descriptive analytical design, Inclusion criteria were medical records of patients aged >18 years in the ICU ward**.**
Result*:* Patient characteristics showed that most patients were admitted to the ICU via referral from other hospitals (132 patients). Fluoroquinolone antibiotics were the most frequently used (118 patients, 10.83%). 140 deceased patients had a sequential organ failure assessment (SOFA) score range of 10-11, with no significant difference (P 0.35). The highest mortality was observed in patients >65 years old (31.43%) and males (57.14%), often associated with respiratory diseases. Most deceased patients had a length of stay of 1-3 days (68.57%) and did not use ventilators (97.14%). Non-surgical patients had the highest mortality, with septic shock, acute myocardial infarct, and chronic heart failure as the primary diagnoses.
Conclusion: Mortality of ICU patient in this research has a multifactorial cause consisting of admission route, microorganism type, tracheostomy timing and antibiotic usage.

Keywords: intensive care unit; mortality; referral; septic shock; SOFA

INTRODUCTION

The intensive care unit (ICU) is a separate unit within a hospital with specialized staff and equipment. The ICU aims to observe, treat, and provide therapy for patients with acute illnesses, injuries, or other potentially life-threatening complications.[1,2] Patients admitted to the ICU are critically ill patients with organ system instability or failure who require, such as ventilators, multi-complex infusions, monitoring, and vasoactive medications.[2,3,4]

Mortality is one indicator of quality in healthcare services. The World Health Organization (WHO) stated that there were 850 deaths per 100,000 population that occurred in 2005-2010. In 2005 in England and Wales, approximately 73% of total deaths occurred in hospitals. When there is a high mortality rate in hospitals, it can be used as a predictor of poor service quality, which is in line with the results of Hayward's 2014 study which found that optimal care with the correct process starting from the availability of guidelines and service standards, appropriate implementation, and monitoring and evaluation can prevent deaths by 22.7%.[5] in Kariadi Hospital Semarang there were reported 86.8% of mortality from ICU Patient. ICU services compared to other inpatient services are specific, maintaining and supporting the safety of lives threatened by death. Based on preliminary studies conducted, the number of ICU visits each year is increasing, but detailed reports on the state of mortality and length of stay at the ICU are not yet available. In the ICU of Adam Malik Hospital, Medan, there is a sparse study that analyses mortality and the patient characteristics in Adam Malik Hospital, Medan. Therefore, this simple study was designed to analyze patient mortality in the ICU.[6,7,8]

METHOD

This research is a cross-sectional analytical descriptive study, describing the characteristics of patients in the ICU of Adam Malik Hospital, Medan. The data was collected from the medical records of Adam Malik Hospital, Medan, from 2022 to 2024. The study design used was cross-sectional, with data collection conducted simultaneously, and data were collected using secondary data, namely, patients treated in the ICU.

This study was conducted by collecting secondary data in the form of medical records of patients treated at the ICU of Adam Malik Hospital, Medan. And were collected with total sampling

The research was conducted after obtaining approval from the Universitas Sumatera Utara Health Ethics Commission, the ethics commission of Adam Malik Hospital, Medan, and permission from the medical committee of Adam Malik Hospital, Medan, to continue. After the data were collected, analysis using the independent t-test and chi-square was conducted.

RESULTS

The study examined patient medical records from 2022 to 2024, with samples meeting the inclusion and exclusion criteria. A total of 390 samples were obtained. In the analysis based on gender based mortality, it was found that 155 (72.8%) male patients died and 106 (56.6%) female patients died. Using chi-square analysis, a p-value of 0.032 was obtained, indicating that there were significant differences in the proportion of deaths between gender groups.

In the age group analysis, the highest mortality rate was found in the 51-60 age group with a total of 91 (62.7%), and the lowest number of deaths was found in

the 18-30 and >70 age groups with the same number, namely 25 (76.4%). The results of the chi-square analysis obtained a p-value of 0.09, indicating that there was no difference in the proportion of deaths between age groups.

Assessing the diseases that aggravate the patient's illness, in this study, the largest number was lung disease, with a total of 242, with a mortality rate of 162, while the smallest type was neuromuscular disease, with a total of 10, with a mortality rate of 6. (Table 3)

Assesses the types of germs found in ICU patients. The germ with the highest mortality rate was *Klebsiella pneumoniae*, with 110 deaths (28.8%), and the type of germ causing the least mortality was 8 deaths (2.0%). The chi-square analysis yielded a p-value of 0.87, indicating no significant comparison. (Table 4)

Table 5 explains the ICU patient admission pathways and patient mortality. The number of deaths of patients referred from outside hospitals was 109 (27.9%). The number of deaths of patients from the treatment room was 72 (18.4%). The number of deaths from the operating room was 80 (20%).

In the antibiotic group, fluoroquinolone antibiotics had the highest mortality rate, while carbapenem antibiotics had the lowest, with the chi-square analysis yielding a p-value of 0.07, indicating no significant difference. (Table 6)

In the analysis of tracheostomy procedures performed on ICU patients, the highest mortality rate was found in the group that did not undergo tracheostomy, with a total of 167 (42.8%), and in the group that underwent tracheostomy, the mortality rate was 94 (24.1%). The chi-square analysis value obtained a p-value of 0.001, which indicates that there is a significant difference. (Table 7)

Table 8 explains mortality with tracheostomy time, which is divided into 2 groups, namely <7 days and > 7 days. It was found that 27 patients died in <7 days, and 100 patients moved rooms in the <7 days group. In the >7 days group, 241 patients died, while 22 patients moved rooms, with an analysis value of 0.001; a significant difference was found.

Table 9 explains the analysis of sequential organ failure assessment (SOFA) scores with patient mortality. In this table, the SOFA Scores were categorized by percentage, which their score would cause mortality percentage. The number of patients who died was found with a SOFA score range of 10-11, with a mortality rate of 140 patients. This data was then analyzed using chi-square and obtained a p-value of 0.35, which indicates that there was no significant difference.

Table 1. Analysis of gender with patient mortality

Gender	Man	Woman	p-value
Die	155(39.7%)	106(27%)	0.058*
Moving rooms	63(27.2%)	71(18%)	

Table 2. Analysis of age with patient mortality

Age	Die	Moving rooms	p-value
18-30 years old	2(0.5%)	6(1.5%)	0.16*
31-40 years	7(2.1%)	7(1.8%)	
41-50 years	24(6.2%)	15(3.8%)	
51-60 years	91(23.2%)	54(13.8%)	
61-70 years	97(24.9%)	35(9.0%)	
>70 years	39(10%)	12(3.1%)	

Table 3. Analysis of disease types with patient mortality

Types of disease	Die	Moving rooms	p-value
Lung disease	162(41.5%)	80(20.5%)	0.001
Kidney disease	122(31.3%)	64(16.1%)	0.001
Post surgery	41(10.5%)	121(31.0%)	0.001
Cerebrovascular	103(26.4%)	45(11.5%)	0.001

Table 4. Analysis of germ types with patient mortality

Types of germs	Die	Moving rooms	p-value
Klebsiella pneumoniae	110(28.8%)	46(11.7%)	0.87
Staphylococcus aureus	50(12.8%)	34(8.7%)	
Escherichia coli	31(7.9%)	15(3.8%)	
Streptococcus pneumoniae	22(5.6%)	10(2.5%)	
Pseudomonas aeruginosa	18(4.6%)	9(2.3%)	
Enterococcus faecalis	12(3.0%)	7(1.7%)	
Acinetobacter baumannii	8(2.0%)	4(1.0%)	
Staphylococcus epidermidis	10(2.5%)	4(1.0%)	

Table 5. Analysis of admission routes with patient mortality

Entry path	Die	Moving rooms	p-value
External hospital referral	109(27.9%)	23(5.8%)	0.15*
Treatment room	72(18.4%)	20(5.1%)	
Operating room	80 (20%)	86(22.0%)	

Table 6. Analysis of antibiotic use with patient mortality

Types of germs	Die	Moving rooms	p-value
Cephalosporins	55(14%)	21(5.4%)	0.07*
Beta lactam	47(12.2%)	15(3.8%)	
Aminoglycosides	39(10)	29(7.4%)	
Carbapenem	13(3.3%)	10(2.5%)	
Fluoroquinolones	74(19%)	44(11.3%)	
Combination Antibiotics	33(8.3%)	10(2.5%)	

Table 7. Analysis of tracheostomy with patient mortality

Tracheostomy	Die	Moving rooms	p-value
Yes	94(24.1%)	104(26.7%)	0.001*
No	167(42.8%)	25(6.4%)	

Table 8. Analysis of tracheostomy time with patient mortality

Tracheostomy time	Die	Moving rooms	p-value	Correlation
<7	27 (6%)	100(25%)	0.001*	-0.899**
>7	241(61%)	22(5%)		

Table 9. Analysis of the SOFA score with patient mortality

SOFA Score	Die	Moving rooms	p-value	Correlation
7-9	43(11%)	15(3.8%)	0.35*	0.91**
10-11	140(35.9%)	65(16.7%)		
12-14	73(18.7%)	46(11.8%)		
>14	5(1.3%)	3(0.8%)		

DISCUSSION

Patient mortality is one indicator of the quality of nursing care in the ICU ward. In 2016, Vincent conducted research in the United States and found that one in five patients died in the ICU, and 500,000 deaths occur annually. In Indonesia, the mortality rate in the ICU reaches 27.6%. Causes of death in ICU patients include septic shock, chronic heart failure, and myocardial infarction.

In this study, the age range with the highest mortality was ICU patients with an age range of 51-60 years. In previous studies, the median age of subjects was 45 (18-86). This was found to be younger in patients in Taiwan, with a median age of 70 (54-79), and in studies in the United States, it was found with a mean of 58.3±17.9 years. The difference in age values in each study. As a developing country, Indonesia has a younger life expectancy.[9]

This study found the highest mortality rate in patients who did not undergo tracheostomy. Several reasons why patients who underwent tracheostomy intervention had a length of stay include: Adam Malik Hospital, Medan, is a type A hospital and a referral center for patients from North Sumatra and Aceh, so most of our patients are critical and terminal patients. In some cases, the higher length of stay at the ICU in tracheostomy patients has positive aspects, such as stricter 24-hour monitoring at the ICU and better maintenance of tracheostomy tube cleanliness.[10]

In this study, patients who underwent tracheostomy earlier were found to have a higher survival rate than patients who underwent tracheostomy later. This finding was also found in a study conducted at Cipto Mangunkusumo Hospital (RSCM), where patients with earlier tracheostomy had a lower mortality rate than those with later tracheostomy, although this study did not find statistical significance.

In this study, mortality based on the patient's admission ward was based on patients referred from outside hospitals. This is supported by the relatively high SOFA score in patients referred from outside hospitals. Many studies have shown significant differences in mortality rates. One study found that the mortality rate of referred patients reached 41%, significantly higher than that of patients from internal emergency departments, which was 32%. Another study in developed countries, with a more organized referral system, showed that referred patients had a two-fold higher risk of death. A high SOFA score in referred patients is the strongest statistical evidence. A higher SOFA

score indicates more severe organ dysfunction or failure. In one study, the average SOFA score of patients who died was 8.63, significantly higher than the SOFA score of patients who survived, which averaged 5.47. Because referred patients tend to have higher SOFA scores, this directly explains their higher mortality rate. Research confirms that each one-point increase in the SOFA score can increase the risk of death by 12%.[11] With higher average SOFA scores in referred patients, this increased risk of mortality is clear. Several statistical factors combine to explain why referred patients die more often in the ICU. First, delays in adequate treatment are critical. Referred patients often experience significant delays, both during transport and because the initial facility lacks adequate resources. For example, one study showed a significant correlation between a long pre-operative period in referred patients and higher mortality. Second, many of these patients have unmanaged comorbidities, such as hypertension, chronic obstructive pulmonary disease, or renal failure, that have not been adequately managed at their previous hospital. This makes them more vulnerable to complications and poor outcomes. Third, suboptimal initial care also plays a significant role. Delays in administering appropriate antibiotics, inadequate fluid resuscitation, or suboptimal shock management can statistically significantly increase the risk of mortality.[12]

For the most common germs in the ICU, Adam Malik Hospital, Medan, *Klebsiella pneumoniae* was found to have the highest mortality rate in this study. In previous research conducted at Adam Malik Hospital, Medan, in 2016, the same thing was found, namely Klebsiella pneumonia bacteria, the cause of the highest mortality.[13] SOFA scores also affect patient mortality, where in previous studies, the higher the SOFA score, the higher the patient mortality. In this study, a higher SOFA score was found, and more mortality was found. This is because the higher the SOFA score found, indicates that there are more impaired organs compared to a lower SOFA score. Many studies have proven that the SOFA score is an effective predictor of mortality. An increase in the SOFA score from day to day or the highest SOFA score achieved by the patient is a strong indicator that the patient's condition is worsening and the risk of death is increasing.

This study assessed the association between initial antibiotic treatment and patient mortality. The highest mortality rate was found in the levofloxacin group. However, when looking at the mortality ratio by room transfer, the mortality rate was higher in the cephalosporin group. Previous research has not assessed the association between initial antibiotic treatment and ICU patient mortality, but Putri's study, conducted at Yarsi Hospital in 2016, found that resistance was common in the cephalosporin group. At Adam Malik Hospital, Medan, antibiotic resistance was also assessed, and a 2024 study found that cephalosporin antibiotics were the most common antibiotic.[14]

In this study, it was found that the highest patient mortality at ICU Adam Malik Hospital, Medan, was in patients with pulmonary disease, with a mortality rate of 162 patients, while those who were transferred from ICU were 80 patients. The least mortality was in patients with neuromuscular disease, with a figure of 6 and 4 patients transferred from the ICU. In previous research at Adam Malik Hospital,

Medan, itself in 2018, patients with co-morbidities experienced more mortality compared to patients without co-morbidities. The most common case experienced by ICU patients was sepsis due to pneumonia.[15]

CONCLUSION

In this study, 261 patients died. The gender with the highest mortality rate was male. The most common type of disease in this study was patients with pulmonary disease. The most common culture result causing patient mortality in this study was *Klebsiella pneumoniae*. Mortality occurred most often in patients referred from outside hospitals. The type of antibiotic found with the highest mortality rate was the cephalosporin group. Longer tracheostomy time was found to be associated with higher mortality rates in patients. Higher SOFA scores were found to be associated with higher mortality in patients.

REFERENCES

1. Kemenkes RI. Pedoman Penyelenggaraan Pelayanan Intensive Care Unit (ICU) di Rumah Sakit. Jakarat: Depkes RI. 2011
2. Setiawan YB, Prambudi DM. Correlation between APACHE II Score and Mortality Rate in PKU Gamping Hospital ICU patients. Asian Journal of Social and Humanities. 2023 Aug 20;1(11):936-40.
3. SCCM: Critical care statistics [Internet]. [cited 2023 Jul 9]. Available from: https://www.sccm.org/Communications/Critical-Care-Statistics
4. Setya AM, Handriani I, Hutagalung MR. Correlation of risk factors with systemic inflammatory response syndrome in burn patients at the Burn Center of Dr Soetomo General Hospital, Surabaya, Indonesia. The Medical journal of Malaysia. 2024 May;79(3):241-4.
5. Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz JV, Dorman T, Fowler RA, Meyfroidt G, Nakagawa S, Pelosi P, Vincent JL. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. Journal of critical care. 2017 Feb 1;37:270-6.
6. Rahmawati FA, Leksana E. *Angka kejadian pneumonia pada pasien sepsis di ICU RS Dr. Kariadi Semarang* (Doctoral dissertation, Faculty of Medicine Diponegoro University).
7. Andrias, Hanafie, A. and Wijaya, D.W. 'Perbandingan validitas Sistem Penilaian Apache II, Sofa, Dan Csofa Sebagai Prediktor mortalitas Pasien Yang Dirawat di Instalasi Rawat Intensif RSUP H. Adam Malik medan', *Jurnal Anestesi Perioperatif*, 2017, 5(1), pp. 21–27.
8. Hardisman H. Lama Rawatan Dan Mortalitas Pasien Intensive Care Unit (ICU) Rs Dr. Djamil Padang Ditinjau Dari Beberapa Aspek. Majalah Kedokteran Andalas. 2015 May 2;32(2).
9. Saragih RJ, Amin Z, Sedono R, Pitoyo CW, Rumende CM. Predictors of mortality in patients with ventilator-associated pneumonia at Cipto Mangunkusumo Hospital. Indonesian Medical eJournal. 2018 Mar 12;2(2):59894
10. Roslina A, Putri NT. Characteristics of Causative Bacteria and Antibiotic Sensitivity Tests in Nosocomial Pneumonia at Haji Adam Malik Hospital, Medan. ANATOMICA MEDICAL JOURNAL|AMJ. 2023 Jun 12;6(2):132-48.

11. Kurniawati L, Pitoyo CW, Rumende M, Mansjoer A. The relationship between tracheostomy interval and mortality of critically ill mechanically ventilated patients in intensive care units. Indones J CHEST Critical Emerg Med. 2014 Jun;1(2):66-73.
12. Bayu Adhy Candra IK, Suranadi IW, Eka Darwinata A, Adi Tarini NM, Gde Wahyudevi Dharmika IA, Dwi Fatmawati NN. Effect of Hypervirulent Strains, Antibiotic Resistance, and Host Characteristics on Mortality of Klebsiella pneumoniae Bacteremia Patients at a Tertiary Referral Hospital in Denpasar, Indonesia.
13. Sejati A. Prognostic Factors of Mortality from Late Phase of Severe Sepsis in Intensive Care Unit at Dr. Cipto Mangunkusumo General Hospital.
14. Sejati A. Prognostic Factors of Mortality from Late Phase of Severe Sepsis in Intensive Care Unit at Dr. Cipto Mangunkusumo General Hospital
15. Sari PA, Tola SM. Study of Broad Spectrum Antibiotic Use in Intensive Care Unit (UPI) Patients at Jakarta Islamic Hospital Cempaka Putih During the Period of January 1, 2016–December 31, 2016. Yarsi Journal of Pharmacology. 2020;1(2):37-49.