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Research Article

Emergency Room Length of Stay and Mortality in Patients with Peritonitis-Induced Sepsis at RSUD Dr. Soegiri Lamongan: A Retrospective Pilot Study

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ABSTRACT

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection, with one of the common sources originating from the abdomen. Sepsis remains one of the leading causes of mortality worldwide. One of the factors contributing to increased mortality in sepsis is delayed management in the emergency department. This study aimed to determine the association between emergency department length of stay and mortality in patients with sepsis due to peritonitis at RSUD Dr. Soegiri Lamongan. This study employed a retrospective observational cohort study. Samples were obtained using a total sampling technique from emergency room medical records of post-laparotomy patients between October 2023 and September 2024. Statistical analysis was performed using Fisher's exact test due to the small sample size. The statistical analysis of 20 patients showed that 1 patient (7.7%) died among those who stayed in the emergency department for ≤ 6 hours, while no deaths (0.0%) were observed among patients with a length of stay > 6 hours. The p-value was 1.000, indicating no statistically significant association between the variables. In conclusion, no statistically significant association was observed in this small cohort.



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INTRODUCTION

Peritonitis is inflammation of the peritoneum, the membrane lining the abdominal cavity and its organs, and is a cause of sepsis. Among sepsis patients, the most common sources of infection are the lungs (64% of cases) and the abdomen (20% of cases) (Cecconi et al., 2018). Sepsis is a leading cause of death worldwide. According to 2017 WHO data, there were 48.9 million cases of sepsis and 11 million sepsis-related deaths worldwide, representing 20% of the global death toll (Rudd et al., 2020). In Indonesia, sepsis remains a major problem. A 2018 study reported that the incidence of sepsis in Indonesia reached 30.29%, with sepsis accounting for 11.56% - 49% of deaths (Batara et al., 2018).

The high mortality rate from sepsis highlights the importance of timely intervention. Based on the 2021 Surviving Sepsis Campaign (SSC) International Guidelines, patients with sepsis are recommended to be admitted to the Intensive Care Unit (ICU) within 6 hours, as delays can increase mortality (Evans et al., 2021). The 2021 SSC recommendations are supported by an observational study of 401 ICU patients, which found a 1.5% increase in ICU mortality for each hour of delay in transfer from the emergency room (ER) to the ICU (Evans et al., 2021).

A retrospective study in the United States found that the sepsis rate increased significantly from 1.2% to 2.7% between 2005 and 2014 (Rubens et al., 2018). A retrospective cohort study of 1,849 patients found that early ICU transfer within 3 hours of ER visit for sepsis was associated with lower 28-day mortality. Longer ER stays are largely attributed to a shortage of inpatient beds, resulting in ER congestion (Shibata et al., 2023).

Long stays in the ER can be attributed to several factors, most notably the time spent on

diagnostic tests, the length of consultations with physicians, and a shortage of ER beds (Fadhilah & Dhamanti, 2024). However, research on the association between the length of stay in sepsis patients due to peritonitis and mortality in Indonesia is still lacking. Therefore, based on the research data above, further research is needed to examine the association between length of stay in the ER and mortality among sepsis patients with peritonitis. This research is expected to prevent deaths in sepsis patients due to delayed treatment in the ER. It is hoped that this study will not only provide further understanding of the impact of treatment duration on mortality but also serve as a basis for improving the clinical management of sepsis patients with peritonitis in the early stages of care in the ER.

METHODS

This study includes quantitative research with an observational approach and a retrospective observational cohort study design using a total sampling technique, based on medical records of post-laparotomy patients for the period of October 2023 - September 2024, in the ER of RSUD Dr. Soegiri Lamongan. The inclusion criteria for this study were as follows: (1) Patients with sepsis caused by peritonitis aged >18 years old; (2) Patients with sepsis caused by peritonitis treated in the ER; (3) Patients with sepsis caused by peritonitis who had undergone laparotomy; (4) Patients with a qSOFA score ≥ 2 .

The Variables used were limited to the qSOFA score as a clinical parameter: Systolic blood pressure, respiratory rate, and the Glasgow Coma Scale. This parameter was chosen because it is non-invasive and clearly documented in the patient's ER medical record. Other parameters, such as the SOFA score, could not be used because some components were not fully available in all patient samples.

This study obtained 26 medical records, but 6 of them were excluded. The reasons for exclusion were as follows: (1) Patients with sepsis who died in the ER; (2) Patients with incomplete medical record data; (3) Sepsis patients who were referred from other health facilities; (4) Sepsis patients who had recovered and improved and then came back to the ER.

The data obtained were then processed using SPSS version 26. This study used bivariate analysis to determine the relationship between ER length of stay and the mortality rate from

peritonitis-related sepsis. The statistical test used to determine the correlation was the chi-square test, with a $p\text{-value} \leq 0.05$, indicating a significant relationship (H_1 is accepted). If the significance value of the $p\text{-value} > 0.05$, it means there is no significant relationship (H_0 is accepted).

Ethical approval for this research protocol was obtained from the Health Research Ethics Committee of RSUD Dr. Soegiri Lamongan under the ethical clearance number: 000.9.2/ 176.10 /413.209//2025. Due to the

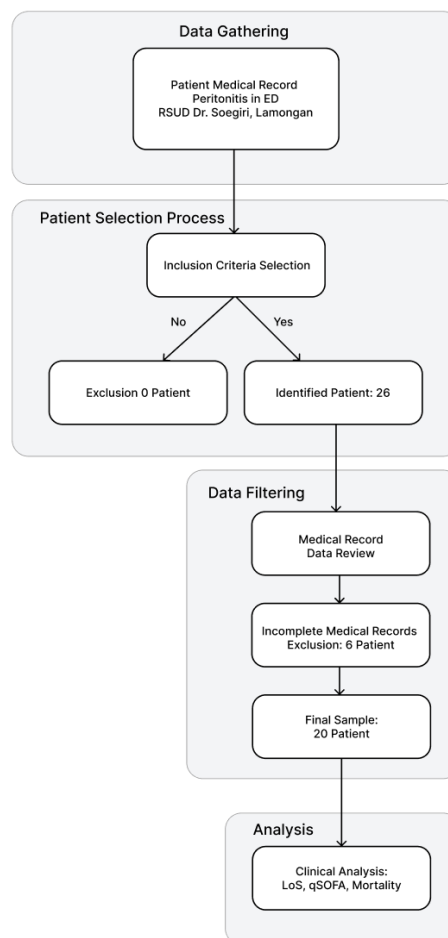


Figure 1. Research flow diagram



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retrospective observational nature of the study, which utilized secondary medical record data, the requirement for direct patient-informed consent was waived by the ethics committee. Patient confidentiality and data privacy were strictly maintained throughout the data extraction and analysis process.

The data collection process began with a review of the medical records of patients with peritonitis in the ER of RSUD Dr. Soegiri, Lamongan. 26 patients were identified during the inclusion criteria selection stage. The process then entered the data-filtering stage by reviewing medical records. 6 patients were specifically excluded due to incomplete

medical records, resulting in a final sample of 20 patients. This final sample of 20 patients was then used in the clinical analysis stage to evaluate Length of Stay (LOS), qSOFA scores, and mortality outcomes.

RESULTS

Research Overview

This study was conducted at RSUD Dr. Soegiri Lamongan, using ER medical records from October 2023 to September 2024 and post-laparotomy patients as the criteria for peritonitis. Data collection yielded 26 data sets, but only 20 of the 26 post-laparotomy patients could be fully processed.

Table 1 Patient Characteristics

No.	Variables	Frequency (n)	Percentage (%)
1	Age		
	≤ 45 years	10	50.0
	45 - 60 years	2	10.0
	> 60 years	8	40.0
2	Sex		
	Male	11	55.0
	Female	9	45.0
3	qSOFA in the Emergency Room (ER)		
	≥ 2	1	5.0
	< 2	19	95.0
4	SIRS in the Emergency Room (ER)		
	≥ 2	20	100.0
	< 2	0	0.0
5	Length of Stay in the Emergency Room (ER)		
	≤ 6 hours	13	65.0
	> 6 hours	7	35.0
6	Disposition		
	Intensive Care Unit (ICU)	1	5.0
	Operating Room	1	5.0
	Inpatient Ward	18	90.0
7	Mortality		
	Died	1	5.0
	Survived	19	95.0
Total		20	100.0

Table 2 Cross-tabulation of Emergency Room Length of Stay and Mortality in Patients with Sepsis due to Peritonitis

ER Length of Stay	Mortality				Total	<i>p-value</i>
	Died		Survived			
	n	%	n	%		
≤ 6 hours	1	7.7%	12	92.3%	13 (100.0%)	1.000
> 6 hours	0	0.0%	7	100.0%	7 (100.0%)	
Total	1	5.0%	19	95.0%	100.0%	

Patient Characteristics

Table 1 describes the patient characteristics, and found that the most common age criteria were ≤ 45 years (10 patients) (50.0%), followed by 8 patients (40.0%) aged > 60 years and 2 patients (10.0%) aged 45-60 years. Eleven patients (55.0%) were male, and nine (45.0%) were female. One patient (5.0%) had an initial qSOFA screening in the ER with a score ≥ 2, and 19 patients (95.0%) had a qSOFA score < 2. Other sepsis parameters were determined using a SIRS score of ≥ 2. 20 patients (100%) had a length of stay in the ER of ≤ 6 hours (13 patients) and > 6 hours (7 patients) (35.0%). It was also found that after leaving the ER, the majority of patients were transferred to inpatient care (18 patients (90.0%), moved to the ICU (1 patient (5.0%)), and moved to the operating room (5.0%). Based on Table 1, 1 patient (5.0%) died, and 19 patients (95%) survived.

Relationship between Length of Stay in the ER and Mortality Rate

Table 2 presents a cross-tabulation of ER length of stay and mortality rates among patients with peritonitis-related sepsis. This cross-tabulation is a statistical test using the chi-square test. However, in this study, the results indicate a small sample size, and the expected frequency of the table is less than 5. Therefore, the p-value used was taken from the Fisher's exact test. According to Table 2, 1 (7.7%) patient died after being treated in the ER within ≤ 6 hours, and no patients (0.0%) died after being treated

in the ER within > 6 hours. The results of the Fisher's exact test in SPSS showed a p-value of 1.000, which is significant at the 0.05 level. Therefore, $1.000 > 0.05$ means that H_0 is accepted. Based on the results, H_0 is accepted and H_1 is rejected. This indicates that the present study was unable to demonstrate a statistically significant association, likely due to the limited sample size and low mortality incidence in this small cohort, rather than a definitive absence of a clinical relationship

DISCUSSION

This study found that of the 20 sepsis patients, 10 (50.0%) were <45 years, followed by 8 (40.0%) who were >60 years. This is inconsistent with the results of a 2021 study conducted in the ICU at Ditan Hospital in Beijing, which included 32 patients with abdominal sepsis, divided into two groups: 18 non-elderly (<65 years) and 14 elderly (≥65 years). The results showed that elderly patients experienced decreased immune cell function and increased cytokine release compared to non-elderly patients (Lu et al., 2022).

Based on sex criteria, the highest proportion was male (11 patients, or 55.0%), while 9 patients were female (45.0%). This is comparable to previous research conducted in Korea using epidemiological data from the Korean National Health Insurance Service-National Sample Cohort from 2005 to 2012, which stated that the highest proportion of



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sepsis patients were men, with a percentage of 53.5% - 58.0% of the 22,882 total sepsis cases (Min et al., 2024). Other research explains that factors that make men more susceptible to sepsis are differences in sex hormones and immune system function. According to an article by Harding and Heaton (2022) Women have higher estrogen levels than men, which can reduce sepsis-induced hyperinflammation by downregulating proinflammatory cytokine expression in women. Conversely, according to an article by Angele et al. (2014) Men have higher testosterone levels, which suppress the innate and adaptive immune systems by reducing the production of immunoglobulins and cytokines and inhibiting lymphocyte proliferation.

In this study, 1 in 20 patients or 5.0% had a qSOFA score ≥ 2 , meaning the patient had a higher risk of sepsis and mortality. According to Marik & Taeb (2017), a qSOFA score ≥ 2 indicates organ dysfunction due to sepsis. In this study, 20 patients were clinically diagnosed as having sepsis based on the presence of a documented source of infection accompanied by organ dysfunction criteria through clinical assessment in the ER. Although we understand the Sepsis-3 Consensus establishes an increasing SOFA score ≥ 2 as the main diagnostic standard, a complete SOFA score cannot be calculated in all study subjects (Guarino et al., 2023). This is due to the limitations of secondary data, which is retrospective in nature, and the unavailability of specific laboratory components, such as bilirubin levels, in medical records in the ER.

Therefore, the 2023 Update on Sepsis and Septic Shock in Adult Patients explains that qSOFA is used not as a diagnostic criterion but as a prognostic instrument to identify patients at high risk. There was 1 in 20 patients or 5.0% who had a qSOFA score ≥ 2 , this figure

is consistent with the known low sensitivity of the instrument in the early phase of sepsis. However, as emphasized in the Sepsis-3 Consensus, this score remains effective for stratifying patients at higher risk of mortality. The selection of qSOFA parameters is based on access to data recorded in medical records in the ER. This is in line with the 2023 Update on Sepsis and Septic Shock in Adult Patients that the management of sepsis and septic shock is a very challenging condition for health workers in the ER. Therefore, for doctors in the ER who seek to improve patient outcomes, the use of practical instruments is crucial to strengthen the main therapy for conditions that are dangerous for patients (Guarino et al., 2023).

However, a prospective, multicenter observational study conducted in 3 emergency units at a German University Hospital found that the qSOFA score alone is insufficiently sensitive; therefore, another biomarker is needed: procalcitonin, with a value $> 0.25 \mu\text{g/L}$, which indicates the presence of infection. In patients with a qSOFA score ≥ 2 , examination should be considered, and in patients with a qSOFA score < 2 but who have clinical symptoms that are suspicious for sepsis, further evaluation and additional examinations, one of which is procalcitonin, should be considered to detect sepsis earlier in patients (Bolanaki et al., 2024). This is consistent with the results of this study, which found that one patient died despite a qSOFA score < 2 . In this regard, it is important for healthcare professionals to pay closer attention to the qSOFA score and clinical symptoms in patients suspected of sepsis during the initial ER assessment.

The results of this study found that the length of stay for sepsis patients with peritonitis in the ER was < 6 hours in 13 patients (65.0%) and > 6 hours in 7 patients (35.0%). These results indicate that the majority of patients suspected of sepsis in the ER were transferred to another room



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for follow-up by more professional healthcare professionals within a short time. This aligns with the 2021 SSC International Guidelines, which recommend that initial treatment for patients suspected of sepsis should be carried out quickly and appropriately from the time of arrival in the ER, followed by triage, initial resuscitation, and referral to the ICU within <6 hours if necessary (Evans et al., 2021). The qSOFA score is also needed to collaborate with procalcitonin testing to detect sepsis risk early in patients (Bolanaki et al., 2024). Therefore, it is important to consider testing collaboration to optimize time management and reduce ER patient length of stay.

This study found that, among 20 patients suspected of sepsis in the ER, 1 (5.0%) was transferred to the ICU and 1 (5.0%) to the operating room. Meanwhile, 18 patients (90.0%) were transferred to inpatient care. This is inconsistent with the 2021 SSC International Guidelines, which recommend that patients with sepsis or septic shock requiring ICU care should be transferred to the ICU within 6 hours (Evans et al., 2021). The 2021 SSC International Guidelines recommendation is supported by several studies, including the study “Impact of Delayed Transfer of Critically Ill Patients from the Emergency Room to the Intensive Care Unit.” A study conducted in 2007 reported that critically ill emergency patients who experienced a delay of ≥ 6 hours in transfer to the ICU had increased length of hospital stay, higher ICU mortality, and greater hospital admission rates (Chalfin et al., 2007). Another study supporting the 2021 SSC International Guidelines is a 2018 prospective cohort study conducted by the National Health Service (NHS), which concluded that immediate transfer to the ICU was associated with lower 90-day mortality among patients assessed and recommended for critical care (Harris et al., 2018). However, although critical care services

are best provided in the ICU, there are reasons why transferring critically ill sepsis patients to the ICU is not always feasible, particularly in low- and middle-income countries with limited ICU bed capacity (Evans et al., 2021).

The primary outcome of this study was in-hospital mortality. This definition encompasses all deaths occurring in patients diagnosed with sepsis due to peritonitis from the time they were admitted to the ER until they were discharged dead. Mortality assessment did not use a 28-day time limit, but rather included the total duration of hospitalization after discharge from the ER, both during inpatient and intensive care unit (ICU) care.

The results of this study showed that 1 patient (5.0%) died and 19 patients (95.0%) survived. This figure is lower than the global sepsis mortality rate of 11 million deaths, representing 19.7% of all global deaths (Rudd et al., 2020), although the study's sample size was smaller. However, the results of a prospective observational study in Lithuania in 2019 revealed that 27 of 67 patients with intra-abdominal sepsis (40%) experienced 30-day in-hospital mortality. Factors contributing to this 40% 30-day mortality included septic shock, which occurred in 24 patients. The second factor was increasing age, which also increased the risk of death. The third factor was symptoms of peritonitis that lasted more than 30 hours until transfer to the operating room. Another factor was post-induction hypotension with a MAP <65 mmHg despite fluid resuscitation (Mačiulienė et al., 2019).

This study found that 1 (7.7%) of 13 patients died after being admitted to the ER within ≤ 6 hours, and none (0.0%) of 7 patients died after being admitted to the ER >6 hours. This finding is similar to a 2017 study, “Impact of Delayed Admission to the Intensive Care Unit from the Emergency Room upon Sepsis Outcomes and



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Sepsis Protocol Compliance,” by Agustin et al. The study found a 22.63% mortality rate for patients transferred to the ICU early (median length of stay of 4.6 hours) and a 24.67% mortality rate for patients transferred to the ICU later (median length of stay of 8.1 hours). A p-value of 0.68 indicates no significant difference in mortality between early and late ICU transfers of sepsis patients. Although the results of Agustin et al., (2017) study align with this study, the research methodologies differed, and the number of patients in Agustin et al.’s study was larger.

However, this finding is inconsistent with the results of a 2023 study entitled “The Association Between Time from Emergency Room Visit to ICU Admission and Mortality in Patients with Sepsis,” which used a retrospective observational cohort method. The study used the time variable from the ER to the ICU, not the length-of-stay classification (≤ 6 hours or > 6 hours) according to the 2021 SSC International Guidelines. The study showed that patients in the lowest quartile (< 3.3 hours) had lower 28-day mortality than those in the highest quartile (> 3.3 hours) (Shibata et al., 2023). According to a study Groenland et al., (2019), which cited several previous studies, several factors contribute to longer ER lengths of stay. These include an inaccurate triage system for critically ill patients and ER resources not commensurate with the number of patients requiring care (Trzeciak & Rivers, 2003), the failure to incorporate the National Early Warning Score (NEWS) as an initial assessment (Bilben et al., 2016), and a lack of ICU bed capacity, which delays transfer from the ER to the ICU (Bagshaw et al., 2018).

Several institutional and systemic factors may explain why a prolonged ER length of stay (> 6 hours) was not associated with increased mortality in this cohort, contrasting

with standard international guidelines. First, potential survivor bias and emergency department triage patterns must be considered. Patients with extreme physiological instability or impending septic shock are typically fast-tracked to the operating theatre or critical care units well within the 6-hour window (Porto, 2024). This clinical prioritization inadvertently concentrates higher-risk patients in the shorter-length-of-stay group, potentially accounting for the single mortality observed in the ≤ 6 hours cohort. Conversely, patients who remained in the ER for more than 6 hours may represent a subset of individuals with greater physiological reserve or more insidious, less rapidly progressive peritonitis symptoms, allowing them to tolerate the delay without an immediate fatal outcome.

Second, a long ER stay at RSUD Dr. Soegiri Lamongan often reflects healthcare system constraints, such as limited ICU bed capacity or structural bottlenecks in inpatient ward transfers, rather than a total failure of early clinical management. In this institutional setting, patients boarding in the ER frequently continue to receive active resuscitation, vital sign monitoring, and empirical antibiotic therapy. Therefore, evaluating a rigid length-of-stay threshold alone is an inadequate surrogate marker for the quality of sepsis care. The prognosis of peritonitis-induced sepsis depends more heavily on the rapid achievement of surgical source control and the quality of bundle compliance during the ER stay, rather than the absolute clock time spent within the physical boundaries of the emergency unit (Levy et al., 2018; Mačiulienė et al., 2019).

Although the analysis in this study did not demonstrate a statistically significant association between ER length of stay and mortality, this finding must be interpreted with extreme caution, given the severely



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underpowered sample and low event rate. Notably, the 0.0% mortality rate observed in the >6 hours group is highly likely a reflection of random variation within a small cohort rather than a true protective clinical effect of prolonged ER stays. Therefore, these statistical results do not discount the clinical importance of prompt and appropriate initial management of sepsis patients in the ER (Evans et al., 2021). In accordance with the 2018 SSC International Guidelines, the 1-hour sepsis bundle aims to provide initial care as soon as possible. Interventions in the 1-hour sepsis bundle consist of measuring serum lactate levels, taking blood cultures before administering antibiotics, administering broad-spectrum antibiotics, initiating crystalloid resuscitation fluids of 30 ml/kg in patients with hypotension or lactate levels ≥ 4 mmol/L, and administering vasopressors if the patient remains hypotensive during or after administration of resuscitation fluids aimed at maintaining MAP ≥ 65 mmHg (Levy et al., 2018).

Furthermore, this study has a critical limitation regarding the lack of adjustment for potential confounders and the absence of key clinical variables required for a comprehensive evaluation of sepsis severity. Mortality in sepsis is notoriously multifactorial and heavily influenced by variables such as age, baseline comorbidities, the specific severity of organ dysfunction, the presence of septic shock, initial lactate levels, and the precise timing of both antibiotic administration and source control (Levy et al., 2018; Mačiulienė et al., 2019; Evans et al., 2021). Due to the retrospective design and limitations in emergency department documentation, critical indicators such as serum lactate levels, complete SOFA scores, vasopressor use, the need for mechanical ventilation, and the explicit status of septic shock could not be systematically retrieved for all patients. The data analysis in this study

was restricted to a simple unadjusted bivariate analysis (Fisher's exact test). Due to the highly restricted sample size and the extremely low event rate, performing multivariate regression to adjust for these confounders was statistically unfeasible. Consequently, confounding biases cannot be excluded, and the isolated impact of ER length of stay on mortality cannot be definitively established from this dataset.

CONCLUSION

This study found that 13 patients with sepsis had an ER length of stay of ≤ 6 hours, while 7 had a length of stay > 6 hours. Regarding mortality outcomes, one patient died among those with a length of stay of ≤ 6 hours, while no deaths were observed among patients with a length of stay of > 6 hours. In conclusion, no statistically significant association was observed in this small cohort.

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