

Profile Hemodynamic and Use Vasoactive Drugs in Critical Sepsis Patients in the Inpatient Unit of RSUD Dr. Soetomo Period 1 February - 31 March 2023

Adella Sabita Putri¹, Bambang Pujo Semedi², I Gde Rurus Suryawan³,
Maulydia⁴

¹Medical Program, Faculty of Medicine, Airlangga University, Surabaya, Indonesia

^{2,3,4}Departement of Anesthesiology, Faculty of Medicine, Airlangga University – Dr. Soetomo General Academic Teaching Hospital Center, Surabaya, Indonesia.

Corresponding Author: Adella Sabita Putri

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ABSTRACT

Background: Patients in critical condition often require intensive care, including ventilatory support, organ/system function assistance, and the administration of vasoactive drugs. Sepsis, a severe and potentially fatal condition marked by organ dysfunction, occurs when the body's response to infection becomes uncontrolled. Vasoactive drugs, which include vasopressors and inotropes, are commonly used in these patients to improve hemodynamic stability and ensure adequate blood flow to organs.

Objective: To understand the profile hemodynamic and use vasoactive drugs in critical sepsis patients in the inpatient unit of RSUD Dr. Soetomo period 1 February – 31 March 2023.

Method: The research was conducted prospectively on sepsis patients who used vasoactive drugs in the period 1 February 2023 - 31 March 2023 at RSUD Dr. Soetomo, Surabaya. All data is collected from medical records, sampling is carried out using the *Accidental Sampling* technique by taking demographic data and clinical data of patients, the use of vasoactive drugs in critical septic patients and recording the results of medical records that will be recorded.

Results: Overall, 65 patients were included in this study (52.31% female and 47.69% male). The most commonly used vasoactive drug was norepinephrine at 64.62%, and the combination of norepinephrine and vasopressin was used in 16.90% of cases.

Conclusions: The findings suggest that the use of vasoactive drugs is a crucial component in the resuscitation of septic shock patients, involving the administration of vasopressor medications and intravenous fluids. This approach aims to achieve the desired hemodynamic stability in septic shock patients experiencing severe hypotension. Norepinephrine was the most commonly used vasoactive drug at Dr. Soetomo Regional General Hospital in Surabaya.

Keywords: Sepsis, critical patients, hemodynamics, vasoactive drugs

INTRODUCTION

A critically ill patient is an unstable patient requiring intensive and titrated therapy, such as ventilatory support, other organ/system support devices, infusion of vasoactive/inotropic drugs, antiarrhythmic drugs, and other continuous treatments. Sepsis is a life-threatening organ dysfunction caused by a dysregulated body response to infection^[1]. Sepsis remains a problem in both

developing and developed countries, in terms of morbidity, mortality, and economics.

According to the *World Health Organization* (WHO) in 2010, sepsis is the leading cause of death in intensive care units in developed countries, and its incidence is increasing. Every year, there are 750,000 cases of sepsis in the United States. A similar situation occurs in developing countries^[2].

Early resuscitation management aims to restore tissue perfusion, particularly to vital organs. If blood pressure does not increase after fluid resuscitation, the administration of vasopressors should not be delayed. Vasopressors should be administered within the first hour to maintain a mean arterial pressure (MAP) > 65 mmHg. A review of several literatures found that the administration of vasopressors/inotropes is an early intervention in the management of sepsis^[3]. Dr. Soetomo General Hospital is a tertiary referral hospital that handles many cases of septic shock. However, specific data on the hemodynamic profile and use of vasoactive drugs in critically ill sepsis patients at Dr. Soetomo General Hospital has not yet been obtained. Based on the above description, more specific research on the "Hemodynamic Profile and Use of Vasoactive Drugs in Critically Ill Sepsis Patients at Dr. Soetomo General Hospital" is needed to provide accurate information.

MATERIALS & METHODS

This study employs a descriptive research design conducted prospectively to determine the hemodynamic profile and use of vasoactive drugs in critically ill sepsis patients at the Inpatient Installation of Dr. Soetomo General Hospital from February 1 to March 31, 2023. The research was approved by the Health Research Ethics Committee of Dr. Soetomo General Hospital, Surabaya, with the number 1330/LOE/301.4.4/VI/2023. This study uses secondary data obtained by collecting data from the patients' medical records. The inclusion criteria for this study include sepsis

patients treated in the inpatient installation at Dr. Soetomo General Hospital Surabaya, patients aged 17 to 80 years, SOFA score criteria < 2 and ≥ 2 , MAP criteria ≤ 65 or < 65, shock index ≥ 1 , and the use of vasoactive drugs in sepsis patients. The exclusion criteria include sepsis inpatients aged < 17 years and > 80 years, patients with MAP > 65, patients not in the inpatient installation, and sepsis patients with incomplete medical records. This research describes the hemodynamic profile and use of vasoactive drugs in critically ill sepsis patients based on age, gender, initial diagnosis, infection location, shock index, mean arterial pressure (MAP), SOFA score, length of hospital stay, and outcome. The data obtained will be compiled in Microsoft Excel and analyzed using descriptive methods to transform the raw data into a more concise form of information, presented in tables for easier comprehension.

RESULT

Table 1. Characteristics of Research Subject Values Based on Gender, Age, and Hospital Referral.

Characteristics	N	%
Gender		
Male	31	47,69
Female	34	52,31
Age		
Late adolescence	1	1,54
Early adulthood	3	4,62
Late adulthood	8	12,31
Early elderly	12	18,46
Late elderly	17	26,15
Geriatrics	24	36,92
Hospital Referral		
Yes	28	43,08
No	37	56,92

The research conducted from 1 February 2023 to 31 March 2023, there were 65 sepsis patients who met the inclusion criteria. The research sample was dominated by women, around 34 patients (52.31%) while there were around 31 male patients (47.69%). The largest age group was the elderly group, namely 24 patients (36.92%).

Table 2. Characteristics of Research Subject Values Based on Diagnosis, SOFA Score, Infection Location, Shock Index, Vasoactive Drugs, Length of Stay, and Outcome.

Characteristics	N	%
Diagnosis		
Gastroenterology	9	13,85
Cardiovascular	4	6,15
Hepatology	3	4,62
Nephrology	4	6,15
Endocrinology	13	20
Rheumatology	3	4,62
Hematology	6	9,23
Respiration	6	9,23
Neurology	10	15,38
Tumors and malignancy	3	4,62
<i>Immunocompromised</i>	4	6,15
Score SOFA		
< 2	3	4,62
≥ 2	62	95,38
Site location		
Lungs	18	27,69
Liver	2	3,08
Kidney	11	16,92
Brain	8	12,31
Heart	2	3,08
Skin	1	1,54
Bile	2	3,08
Blood vessel	13	20
Small intestine	3	4,62
Peritoneum	2	3,08
Index shock		
0,5 – 0,9	25	38,46
≥ 0,9	40	61,54
Drug vasoactive		
Single	40	61,54
Combination	25	38,46
Length of stay		
1 – 10	42	64,62
11 – 20	15	23,08
21 – 30	8	12,30
Outcomes		
Life	15	23,08
Death	50	76,92

Based on table 2, it was found that 13 patients (20%) had the most initial diagnoses coming to the Medical Inpatient Installation, namely diseases related to endocrinology, followed by neurology, 10 (15.38%) patients and gastroenterology diseases, 9 (13.85%) patients. The highest SOFA score was ≥ 2 (95.38%) with the most common organ dysfunction being the lungs (27.69%), blood vessels (20%), and kidneys (16.91%). At the beginning of the patient's arrival at the hospital, the average hemodynamic value of the patient had a shock index ≥ 0.9 , as many

as 40 patients (61.54%). The use of vasoactive drugs is using a single type of drug (61.54%) such as norepinephrine and using a combination type of drug or using more than one type of vasoactive drug (38.46%) such as norepinephrine and vasopressin, with the highest length of stay being 1 to 10 days as many as 42 patients (64.62%) while the length of stay from 11 to 20 was 15 patients (23.08%) and 21 to 30 was 8 patients (12.30%). During treatment, 15 patients (23.08%) lived and 50 patients (76.92%) died.

Table 3. Use of vasoactive drugs in sepsis patients based on SOFA score in the Inpatient Installation of RSUD Dr. Soetomo Surabaya

Score SOFA	Drug vasoactive	
	Single (%)	Combination (%)
< 2	0	3 (4,62)
≥ 2	39 (60)	23 (35,38)

Based on table 3, the use of vasoactive drugs with a SOFA score < 2 shows that the percentage of single vasoactive drug use is 0% and the use of vasoactive drugs in combination is 3 (4.62%) and followed by a SOFA score ≥ 2 with single vasoactive drug administration being 39 (60%) and 23 (35.38%) administered combination drugs.

Table 4. Use of vasoactive drugs based on shock index

Index shock	Drug vasoactive	
	Single (%)	Combination (%)
0,5-0,8	23,08	15,38
≥ 0,9	35,38	26,15

Based on table 4, the use of vasoactive drugs on the shock index is that a single vasoactive drug has a shock index range of 0.5 - 0.8 (23.08%), then the use of combined vasoactive drugs is 0.5 - 0.8 (15.38%). The

percentage of shock index range ≥ 0.9 for single vasoactive drugs was found (35.38%), followed by combined vasoactive drugs (26.15%).

Table 5. Number or percentage of use of types of vasoactive drugs in sepsis patients at the Inpatient Installation of RSUD Dr. Soetomo Surabaya

Drug vasoactive	Percentage (%)
Single	
Norepinephrine	64,62
Combination	
Norepinephrine, Vasopressin	16,90
Norepinephrine, Dobutamin	3,08
Norepinephrine, Dopamine	3,08
Norepinephrine, Dopamine, Vasopressin	3,08
Norepinephrine, Dopamine, Dobutamin	1,54
Adrenaline, Norepinephrine, Vasopressin	1,54
Adrenaline, Vasopressin, Dobutamine	1,54
Adrenaline, Norepinephrine, Vasopressin	1,54
Norepinephrine, Dobutamine, Vasopressin	1,54
Norepinephrine, Dobutamine, Vasopressin	1,54

The highest use of a single drug is norepinephrine with a percentage of (64.62%). The highest use of combination drugs is norepinephrine and vasopressin with

a percentage of (16.90%), followed by the use of a combination of norepinephrine with dobutamine, dopamine and vasopressin with the same percentage (3.08%).

Table 6. Administration of vasoactive drugs by length of stay in the Inpatient Installation at RSUD Dr. Soetomo

Length of stay	Drug vasoactive	
	Single (%)	Combination (%)
1 – 10	36,93	27,69
11 – 20	15,38	7,69
21 – 30	7,69	4,62

The administration of vasoactive drugs with a length of stay of 1 to 10 days is the highest with a single type of vasoactive drug (36.93%), followed by a length of stay of 11 to 20 days using vasoactive drugs with a percentage of (15.38%), and then a length of stay of 21 up to 30 days (7.69%).

DISCUSSION

Based on the research results, the gender of critical sepsis patients in Inpatient Installation Dr. Soetomo 1 February – 31 March 2023 was obtained the majority were women with 34 patients (52.31%) followed by men with 31 patients (47.69%). The results of this research are in line with research conducted by Hatman *et al.* (2021) at Dr. Soetomo, Surabaya, where the majority of sepsis patients were women (57.14%) compared to men (42.86%)^[4]. Another research study Djuang, *et al.* (2022) at the Royal Prima General Hospital, Medan, the results of the gender category research were that women were the most numerous (55.7%) compared to men (44.7%)^[5].

This research shows the age of critical sepsis patients, namely there are several categories in late adolescence (1.54%) aged 17 to 25, followed by early adulthood (4.62%) aged 26 to 35, then late adulthood (12.31%) around the age of 36 to 45, early elderly (18.46%) aged 46 to 55, late elderly (26.15%) aged 56 to 65, seniors (36.92%) over 65 years of age. Sepsis affects all age groups, but its incidence and mortality increase with age, with older adults particularly at risk of sepsis^[6,7]. This research is in line with national research in Taiwan regarding the ages frequently affected by sepsis, the incidence of sepsis in the elderly (≥ 85 years) is 31 times greater than in adults (18 – 64 years) and three times greater than in the elderly (65 – 84 years old)^[8].

The initial diagnosis of patients arriving at the inpatient facility was with an endocrinology diagnosis for 13 (15.38%) patients, followed by neurology 10 (15.38%), gastroenterology 9 (13.85%) and respiration 6 (9.63%). The research results are in line with Djuang, *et al.* (2022) the

largest percentage is endocrine (23.5%) According to theory based on endocrinology diagnosis, the comorbid disease most frequently affected by sepsis is diabetes mellitus^[5]. According to research by D'Almeida, *et al.*, (2021), sepsis in adults with type 2 diabetes mellitus treated at Tupua Tamasese Meaole Hospital has a higher prevalence rate in women, 55% and 62.5%, respectively^[9].

Furthermore, gastroenterology most often occurs in ulceration of the stomach, duodenum and esophagus. The most common respiratory diagnoses with comorbid diseases are tuberculosis (TB), COPD, bronchogenic Ca (Djuang *et al.*, 2022)^[5].

The location of the sepsis infection was in the Inpatient Installation at RSUD Dr. Soetomo 1 February – 31 March 2023 mostly in the lungs (27.69%). The research results are in line with Hatman *et al.* (2021) at RSUD Dr. Soetomo, Surabaya, location of infection in the respiratory system. Other study data Djuang, *et al.*, (2022) the most common location of infection is the lungs with a percentage of (19.6%)^[5]. According to Ibarz *et al.*, (2024) the impact of comorbidities in sepsis patients such as malignancy, diabetes mellitus and dysfunction in the heart, kidney, liver or lung system^[10]. The lungs are the most common site of infection in sepsis as shown by research by Qiao *et al.*, (2023), namely that the respiratory tract is continuously exposed to external pathogens due to inhaling air^[11]. This exposure makes the lungs the main entry point for infectious agents such as bacteria and viruses, fungi, thereby increasing the possibility of infections that can lead to sepsis^[11]. Pneumonia is one of the main causes of sepsis originating from lung infections – the lungs often have worse outcomes compared to other sources due to the important role of the lungs in oxygen exchange and the potential for severe systemic inflammation^[11].

The results of the research, the use of vasoactive drugs based on a SOFA score < 2 , namely the highest use of a combination of 3 patients (4.62%) and a SOFA score ≥ 2 , the

highest use of a single vasoactive drug, 62 patients (95.38%). The highest drug use is the single administration of norepinephrine, followed by the combination of norepinephrine and vasopressin. Data from research by Utariani *et al* (2018) shows that a re-assessment < 2 indicates a good prognosis prediction, if the score is ≥ 2 then the prognosis is poor^[12].

Based on the research results, the most common use of single vasoactive drugs was seen with a shock index of 0.5-0.8 (23.08%) and combined vasoactive drugs (15.38%), followed by the use of single vasoactive drugs with a shock index ≥ 9 , namely (35.38%) and combined vasoactive drugs (26.15%). The most common use of single drugs is norepinephrine and combined use of drugs such as norepinephrine plus vasopressin, dopamine, dobutamine or adrenaline. According to Monnet *et al.*, (2023) administration of norepinephrine must be adjusted to the patient's condition. Firstly, the administration of norepinephrine should be directed to patients with severe hypotension, when arterial tone is very low, as indicated by low diastolic blood pressure (eg, ≤ 40 mmHg), or a high diastolic shock index (heart rate/diastolic blood pressure) for example ≥ 3 ^[13].

Research data shows that the most common use of a single vasoactive drug was norepinephrine (64.62%). The use of combination vasoactive drugs, namely using two drugs, namely norepinephrine and vasopressin, was (16.90%). The SSC guidelines recommend norepinephrine as a first-line vasopressor agent in septic shock^[14]. When the target mean arterial pressure (MAP) is not achieved, it is advisable to add vasopressin rather than increasing the dose of norepinephrine^[15]. As septic shock is a complex disorder associated with high mortality, timely initiation of therapeutic interventions to improve hemodynamics and reverse the state of shock is essential^[16]. Norepinephrine equivalent doses and lactate concentrations may help in determining initiation of vasopressin and angiotensin II in patients with septic shock.

Administration of vasopressin at norepinephrine equivalent doses of 10–15 mcg/min (0.1–0.2 mcg/kg/min in patients weighing 80 kg) or serum lactate below 2.3 mmol/L has been shown to be associated with a mortality benefit (Ammar *et al.*, 2022)^[16]. Administration of combined vasoactive drugs using two drugs, namely norepinephrine and vasopressin, was (16.90%). These results are in line with research by Utariani *et al* (2018) in situations where the need for the addition of exogenous vasopressin has been proven to increase MAP (Mean Arterial Pressure) while reducing the need for norepinephrine in those who have received norepinephrine drug treatment^[12].

Based on the research results, the highest use of vasoactive drugs with a length of stay of 1 to 10 days (36.93%) was used alone. The most common drug use is norepinephrine, followed by combination drugs such as norepinephrine with dopamine, dobutamine or vasopressin. Cheng, L (2019) Multiple treatment meta-analysis studies show that administration of norepinephrine combined with dobutamine may be associated with lower 28-day mortality compared with administration of other vasoactive drugs^[17]. According to meta-analysis research by Li *M* (2020) there was no significant difference in length of treatment between the early and late groups. Early initiation of norepinephrine can achieve earlier maintenance of adequate perfusion pressure, preventing the development of organ dysfunction. However, the use of vasopressor drugs is not without consequences. The risk of reactions, such as arrhythmias, may have been increased for patients with long-term exposure to vasopressors, potentially adding to the increased mortality rate. Another major argument is that high doses of exogenous norepinephrine may have adverse consequences such as myocardial cell injury, oxidative stress, and sepsis-related immunomodulatory changes. Whatever the case, norepinephrine remains the primary vasopressor in septic shock, and evidence suggests that norepinephrine remains a safe

and effective first-line treatment for septic shock^[18].

CONCLUSION

Based on the research conducted, the conclusions regarding the profile of critically ill sepsis patients in the Inpatient Installation at Dr. Soetomo General Hospital Surabaya are as follows:

1. The majority gender was female, totaling 34 patients (52.31%).
2. The largest age group were elderly, with 24 patients. The most common diagnosis was endocrine-related, with 51 patients (78.46%).
3. The majority of patients had a SOFA score of ≥ 2 , totaling 62 patients (95.38%).
4. The most common infection location was the lungs, with 18 patients (27.69%).
5. The majority of patients received single vasoactive drug therapy, with 39 patients (60%).
6. The most common shock index was ≥ 0.9 , with single vasoactive drug therapy in 35.38% of cases.
7. The most common use of vasoactive drugs was single vasoactive drug therapy, with 40 patients (61.54%).
8. The majority of patients had a length of stay of 1 to 10 days, with single vasoactive drug therapy in 24 patients (36.93%).
9. The most common outcome of patients was death, with 50 patients (76.92%).

Declaration by Authors

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