Description of Cerebral Oxygenation Measures after One Hour Bundle in the Treatment of Sepsis Patients in Adam Malik Haji General Hospital, Medan

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Abstract:-

Background: Sepsis is an organ dysfunction because of impaired regulation of the body's response to infection. In non-cardiac ICU cases, sepsis is the second leading cause of mortality. Because of the high mortality of sepsis, the Surviving Sepsis Campaign (SSC) updated the management of sepsis with the latest guidelines, namely the one-hour bundle comprising an examination of lactate levels, blood cultures, administration of broad-spectrum antibiotics, crystalloids, and vasopressors. The SSC guidelines also recommend that ScvO2 monitoring can improve the prognosis of patients with septic shock. One of the non-invasive tissue oxygenation monitoring techniques is near-infrared spectroscopy (NIRS) which can estimate cerebral oxygenation. The study stated that the measurement of cerebral oxygen saturation (rSO2) using NIRS correlated with ScvO2, where rSO2 correlates with ScvO2 in septic patients significantly.

Aim: To figure the description of cerebral oxygenation after one-hour bundle administration in the management of sepsis patients at Haji Adam Malik General Hospital Medan.

Methods: This study is an analytic interventional study to determine the description of cerebral oxygenation after the one-hour bundle administration in septic patients. After obtaining approval from the Ethics Committee of the Faculty of Medicine, University of North Sumatra, based on the inclusion and exclusion criteria, we collect 30 research samples. The study sample was all patients diagnosed with sepsis and treated with one-hour bundle sepsis that met the inclusion and exclusion criteria.

Results: This study found that the mean value of SBP T0 is 88,03. The mean value of SBP T1 is 103. In DBP we found that the mean value of DBP T0 is 55,27, while the mean value of DBP T1 is 59,27. The mean value of HR T0 is 117,57. Mean value of HR T1 is 110,87. In the examination of rSO2, the mean value of right cerebral oxygentation before and 1 hour after the administration of the sepsis bundle are 46,5 and 49,76 and the mean value of left cerebral oxygentation before and 1 hour after the administration of the sepsis bundle are 46,76 dan 50,32 in an order. There was a significant difference in the right rSO2 similar with the left rSO2 before and 1 hour after the administration of the sepsis bundle.

Conclusion: This study concluded that the mean value of right cerebral oxygentation before and 1 hour after the administration of the sepsis bundle are 46,5 and 49,76 and the mean value of left cerebral oxygentation before and 1 hour after the administration of the sepsis bundle are 46,76 dan 50,32 in an order. There was a significant difference in the right rSO2 similar with the left rSO2 before and 1 hour after the administration of the sepsis bundle with p-value < 0,05.

Keywords:- Sepsis, rSO2, SBP, DBP, HR.

I. INTRODUCTION

Sepsis is organ dysfunction due to impaired regulation of the body's response to infection. Sepsis is still a challenge for clinicians around the world because sepsis is still the leading cause of death in several European countries after acute myocardial infarction, stroke and trauma. In the United States, sepsis is the most common cause of death in hospital. The incidence of sepsis in adults in developed countries reaches 19.4 million cases and 5.3 million deaths due to sepsis each year. The worldwide prevalence of sepsis in 1990 was 60.2 million cases, while in 2017 it was 48.9 million. This change represents an 18.8% decrease in cases. Based on data from the World Health Organization (WHO),

A prospective cohort study in the United States showed that 415,280 cases of severe sepsis and septic shock were diagnosed in 2003 and increased to 711,736 cases in 2007, with a mortality rate of 29.1% in 2007. In Asia, research in 2009 of 150 intensive care rooms in 16 countries (including Indonesia) showed severe sepsis and septic shock constituted 10.9% of intensive care diagnoses with a mortality rate of 44.5%. One month observation in 2012 in the intensive care unit of Cipto Mangunkusumo Hospital (RSCM) Jakarta showed that severe sepsis and septic shock were found in 23 of 84 cases of intensive care with a mortality rate in care of 47.8% and a mortality rate in the early phase of 34.7%. Data from the Community Service Coordinator of the Internal Medicine Department of the RSCM showed the number of patients treated with a diagnosis of sepsis was 10.3% of the total patients treated in the internal medicine ward. Septic shock was the highest

cause of death for 3 consecutive years (2009-2011),

According to SSC guidelines, sepsis can be divided into sepsis and septic shock. Septic shock is responsible for 6-15% of cases in the ICU. In non-cardiac ICU cases, sepsis is the second leading cause of mortality up to 30-50%. Due to the high mortality of sepsis, SSC updated the management of sepsis with the latest guidelines, namely the one hour bundle which consists of checking lactate levels, blood culture before giving antibiotics, giving broad-spectrum antibiotics, crystalloids 30 ml/kg if hypotension occurs or lactate levels 4 mmol/L, and vasopressors if the patient is hypotensive during or after fluid resuscitation.

Studies have shown that during fluid resuscitation, there is an increase in central venous oxygen saturation (ScvO2), indicating a concomitant increase in carbon monoxide. The results showed that the value of ScvO2 in septic patients was usually normal or supernormal due to a decrease in the oxygen extraction ratio which is a characteristic of septic shock. In addition, cerebral hypoxia due to sepsis can also reduce brain tissue oxygen saturation which can be measured non-invasively using cerebral oximetry. Clinical ScvO2 measurements are used to assess changes in oxygen delivery and consumption in various clinical conditions. However,

Non-invasive methods of monitoring tissue oxygenation can provide useful information about tissue oxygenation and microcirculation conditions. One technique for monitoring tissue oxygenation, near-infrared spectroscopy (NIRS), also known as cerebral oximetry, uses spectral analysis with a computer in the near-infrared range (680-800 nm) to estimate brain oxygenation by measuring infrared light absorption by tissue chromophores such as hemoglobin. Research has shown that measurement of cerebral oxygen saturation (rSO2) using NIRS correlates with central venous saturation. Detection of rSO2 is also used as a surrogate to assess hemodynamic function. rSO2 has been shown to be associated with disease severity and sepsis prognosis.

The results of previous studies showed that there was a significant correlation between rSO2 and ScvO2 in patients with severe sepsis and septic shock. ScvO2 <70% was indicated by the presence of rSO2 <56.5% with a sensitivity and specificity of 75% and 100%, respectively.

The purpose of this study was to describe cerebral oxygenation after the one hour bundle procedure in the treatment of sepsis patients at Haji Adam Malik General Hospital Medan.

II. METHODS

This study is an interventional analytic study to describe the cerebral oxygenation after the one hour bundle procedure in sepsis patients and took place in the emergency department (ED) and ICU Haji Adam Malik General Hospital Medan. This research was conducted from April 2021 with the research subjects were taken with consecutive sampling technique. The study population was all patients diagnosed with sepsis and treated with one hour sepsis bundle. After obtaining approval from the Ethics Committee, Faculty of Medicine, University of North Sumatra, based on inclusion and exclusion criteria 30 research samples were collected. All research subject's identity were recorded, history taking either auto-anamnesis or alloanamnesis and physical examination was carried out on research subjects. Based on the results of the examination, an assessment of the calculation of the qSOFA score, the recording of blood pressure, heart rate and rSO2 was done. All the subjects identified as having sepsis in the ED were given a one hour bundle treatment which consisted of measuring lactate levels, taking blood cultures, giving broad-spectrum antibiotics (Ceftriaxone 2gr), crystalloids (Ringer Lactat) 30 ml/kg for hypotension or lactate levels 4 mmol/L and administration of a vasopressor (Norephinephrine) if the patient is hypotensive during or after fluid resuscitation to maintain a MAP 65mmHg. Monitoring and recording of blood pressure, heart rate and rSO2 immediately after the one hour bundle (T1). All data obtained were analyzed statistically

III. RESULTS

This study is an interventional analytic study to determine the description of cerebral oxygenation after the one hour bundle procedure in septic patients. This research was conducted in the emergency department (ED) and ICU H. Adam Malik Hospital, Medan. The study was conducted from April 2021 until the sample was sufficient. The sample of this study consisted of 30 samples obtained from all patients diagnosed with sepsis and managed with one hour bundle sepsis and met the inclusion and exclusion criteria.

Table 3.1 Overview of the Research Sample Characteristics

Characteristics	N (%)	Mean ± SD
Age		46.7±12.09
Gender		
Man	18 (60)	
Woman	12 (40)	
Work		
Laborer	4 (13.3)	
Teacher	9 (30)	
Employee	4 (13.3)	
Trader	8 (26.7)	
Farmer	4 (13.3)	
Government employees	1 (3,3)	
Ethnic group		
Aceh	5 (16.7)	
Batak	10 (33.3)	
Java	6 (20)	
Malay	8 (26.7)	
Sunda	1 (3,3)	
Religion		
Islam	12 (40.0)	
Catholic	1 (3,3)	
Protestant	14 (46.7)	
Buddha	3 (10)	
Diagnosis		
Pulmonary Sepsis	20 (66.7)	
SSTI	2 (6.7)	
Gastrointestinal sepsis	1 (3,3)	
Urosepsis	7 (23.3)	
BMI		24.67 ± 2.55
TOTAL	30 (100)	

Based on table 3.1, the sample of this study were 30 samples with the mean age of 46.7 ± 12 years. Based on gender, 18 samples (60%) were male and 12 samples (40%) were female. Most of the samples are teachers as many as 9 samples (30%), followed by the trade profession as many as 8 samples (26.7%). The professions of laborers, employees, and farmers have a same sample size, which is as many as 4 samples (13.3%) in each profession. One sample (3.3%) was found to be a Civil Servant. Based on ethnicity, there were 10 samples of Batak tribes (33.3%), 8 samples of Malays (26.7%), 6 samples of Javanese (20%), 5 samples of Acehnese (16.7%), and Sundanese as much as 1 sample (3.3%). Distribution of samples based on religion found 12 samples of Islam (40%), Protestant Christians 14 samples (46.7%), Buddhists 3 samples (10%), and catholic 1 sample (3.3%). Based on the diagnosis, there were 20 samples of pneumonia sepsis (66.7%), urosepsis and sepsis with acute kidney injury as many as 7 samples (23.3%) in each group, 2 samples of skin and soft tissue infection cases (6.67%) and cases of gastrointestinal sepsis were found in 1 sample (3.3%). Based on the average BMI in this study was 24.67 ± 2.55.

Table 3.2 Overview of SBP, DBP and HR characteristics at T0 and T1

Characteristics	Mean	SD
SBP Value		
T0	88.03	7.21
T1	103	4.63
DBP value		
T0	55.27	3.22
T1	59.27	6.17
Heart Rate		
T0	117.57	7.40
T1	110.87	8.67

Based on Table 3.2, the mean value of SBP at SBP T0 was 88.03 with an SD value of 7.21. The mean value of SBP T1 is 103 with an SD value of 4.63. The mean value of DBP on DBP T0 was 55.27 with an SD value of 3.22. The mean value of DBP T1 was 59.27 with an SD value of 6.17. The mean Heart Rate at T0 is 117.57 with an SD value of 7.40, while the average Heart Rate at T1 is 110.87 with an SD value of 8.67.

Table 3.3 Overview of Right RSO2 and Left RSO2 Comparison in T0 and T1 Observation

RS02 Value Mean			p value
Right RSO2 Value			
RSO2 T0 : RSO2 T1	46.50	49.76	0.004
Left RS02 Value			
RSO2 T0 : RSO2 T1	46.76	50.32	0.009

Based on table 3.3, the mean value of right cerebral oxygenation before and 1 hour after the one hour bundle procedure was 46.5 and 49.76, respectively. The mean value of left cerebral oxygenation before and 1 hour after the one hour bundle procedure was found to be 46.76 and 50.32, respectively. There is a significant difference in the right RSO2 value T0-T1 with a p value of 0.004 <0.05. Likewise, the left RSO2 mean value with a T0-T1 ratio has a significant difference with a p value of 0.009 <0.05.

IV. CONCLUSIONS

From the results of this research conducted to see the description of cerebral oxygenation after the one hour bundle procedure in septic patients at the Emergency Department and Intensive Care Unit of Haji Adam Mlik General Hospital, it can be concluded that:

1. The average age of the sample in this study was 46.7 ± 12 years with 18 (60%) male samples and 12 (40%) female samples. Most of the jobs found were teachers, as many as 9 (30%) samples, The most common ethnic groups found were the Batak, with 10 (33.3%) samples. The most samples are Protestant with 14 (46.7%) samples. The diagnosis of pulmonary sepsis was the most common, with 20 (66.7%) samples. The mean value of BMI in this study was 24.67 ± 2.55.

2. The mean value of right cerebral oxygenation before the one hour bundle procedure was 46.5. The mean value of left cerebral oxygenation before the one hour bundle procedure was 46.76.

3. The mean value of right cerebral oxygenation 1 hour after the one hour bundle procedure was 49.76. The mean value of left cerebral oxygenation 1 hour after the one hour bundle procedure was 50.32.

4. There is a significant difference in the comparison of the right rSO2 value in the observation before the one hour bundle action and 1 hour after the one hour bundle action with $p = 0.004 < 0.05$. The similar result was also found in the comparison of left rSO2 values in observations before the one hour bundle action and 1 hour after the one hour bundle action with $p = 0.009 < 0.05$.

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