INDONESIAN JOURNAL OF ANESTHESIOLOGY AND REANIMATION
Volume 5 (1), January 2023: 11-17

Original Research Article

PEDIATRIC SHOCK PROFILE IN THE PEDIATRIC INTENSIVE CARE UNIT (PICU) OF DR. SOETOMO GENERAL ACADEMIC HOSPITAL

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ABSTRACT

Introduction: Shock is a life-threatening condition caused by circulatory failure which increases morbidity and mortality rate. According to the western literature, about 2% of children are admitted to hospitals worldwide due to shock. **Objective:** This study aimed to describe the pediatric shock profile of patients in the Pediatric Intensive Care Unit (PICU) of Dr. Soetomo General Academic Hospital between 1 January to 1 December 2019. **Methods:** A total of 60 patients were selected as the participants using a descriptive method. Data collection was carried out by recording the exact time the participants first entered the PICU. Furthermore, data were collected based on gender, age, physical and laboratory examination, diagnosis of shock, patients' outcomes, as well as PRISM III score. **Results:** The results of this study that the males and children are 51.7% and 53.3%, respectively. At an infant age, the distribution of the highest average pulse and breathing frequency was 135 and 32.2, respectively. The highest average body temperature at the age of adolescents was 37.19°C. Furthermore, the patients' diagnoses were dominated by distributive shock with the highest PRISM III score ≥8 and deaths recorded of 76.6%, 60%, and 61.7%, respectively. The diagnosis results showed that distributive shock leads to the highest mortality with a PRISM III score of 51.7% and 53.3%. **Conclusion**: Distributive shock contributes to the patient's diagnoses and mortality rate with the highest score of PRISM III being ≥8. From this conclusion, the PICU needs to be more responsive to detect distributive shock in children.

Keywords: Demographics of Pediatric Shock; Distributive Shock; Pediatric Intensive Care Unit; Pediatric Shock Profile

ABSTRAK

Pendahuluan: Syok merupakan kondisi gagal sirkulasi yang mengancam jiwa yang meningkatkan morbiditas dan mortalitas. Syok menyumbang tingkat 2% dari anak-anak yang dirawat di seluruh dunia menurut sebagian besar literatur barat. **Tujuan:** Untuk menentukan dan mendeskripsikan profil pasien syok pediatri di PICU RSUD Dr. Soetomo tahun periode 1 Januari – 1 Desember 2019. **Metode:** Penelitian dilakukan secara retrospektif menggunakan metode deskriptif dengan jumlah sampel 60 pasien. Pengumpulan data dilakukan dengan pencatatan saat pasien pertama kali masuk PICU dengan kondisi stabil. Data mencangkupi jenis kelamin, usia, pemeriksaan fisik, pemeriksaan laboratorium, diagnosis syok, luaran pasien, dan skor PRISM III. **Hasil:** Hasil penelitian ini didominasi oleh laki-laki (51,7%) dan anak-anak (53,3%). Distribusi rata-rata frekuensi nadi dan frekuensi pernapasan tertinggi pada usia bayi (135) (32,2) dan rata-rata suhu tubuh tertinggi pada usia remaja (37,19). Diagnosis syok pasien didominasi oleh syok distributif (76,6%) dengan skor PRISM III tertinggi ≥8 (60%) dan persentase tertinggi adalah pasien meninggal (61,7%). Distribusi luaran pasien berdasarkan hasil diagnosis syok menunjukkan bahwa syok distributif memiliki mortalitas tertinggi (51,7%) dengan skor PRISM III ≥8 (53,3%). **Kesimpulan:** Hasil diagnosis syok dan mortalitas pasien tertinggi didominasi oleh syok distributif dengan skor mortalitas tertinggi pada PRISM III adalah ≥8. Dari kesimpulan tersebut, PICU harus lebih tanggap dalam mendeteksi syok distributif pada anak.

Kata Kunci : Demografi Syok Pediatrik; Syok Distributif; Unit Perawatan Intensif Anak; Profil Syok Pediatrik

Article info: Received: September, 28th 2022; Revised: October, 8th 2022; Accepted: December, 27th 2022; Published: January, 20th 2023

Available at https://e-journal.unair.ac.id/IJAR | **DOI:** https://doi.org/10.20473/ijar.V5I12023.11-17

INTRODUCTION

Shock is a life-threatening condition caused by circulatory failure that increases morbidity and mortality rates (1). Therefore, pediatric shock is a general emergency that highly contributes to morbidity and mortality. About 400,000–500,000 reported cases of the septic life-threatening condition occur yearly. In 2000, there was an improvement in childhood shock from 50% to 20% (2).

Several studies reported that the mortality rate is between 40% to 80% in the case of septic, while it is 60% in cardiogenic shock. However, delays in recognizing and treating the clinical symptoms can lead to high mortality rates. The rate of spreading this life-threatening condition at Dr. Soetomo General Academic Hospital Surabaya is 14.58% (3).

Shock occurs in various forms including hypovolemic, cardiogenic, distributed, and obstructive. Hypovolemic is a condition with inadequate organ perfusion caused by loss of intravascular volume (4). Meanwhile, cardiogenic often occurs due to acute myocardial infarction and disorders of adequate cardiac filling such as pericardial tamponade or valve stenosis (5). Distributive shock is also caused by sepsis, vasoplegia, or anaphylaxis (6).

Fluid resuscitation is considered the cornerstone of management while implementing immediate care to identify pediatrics with shock (7). Furthermore, hemodynamic monitoring is one of the pillars of establishing shock diagnosis and determining its treatment. Early identification through physical examination, vital signs, urine output, central venous pressure, and transthoracic echocardiography is often used to evaluate preload and afterload status as well as cardiac function in response to fluid resuscitation (8).

It is only a few studies that examined the clinical and demographic profiles in the Pediatric Intensive Care Unit of Dr. Soetomo General Academic Hospital. Therefore, this study becomes a pilot and helps in establishing the essential clinical and demographic profile of the shock patients.

METHODS

This descriptive study examines the patient's medical records using a retrospective method. Data were collected by recording the exact time the participants first entered the PICU. Also, it was analyzed using consecutive sampling with inclusion criteria being pediatric patients aged 1 month – 18 years. The inclusion criteria were pediatric patients listed in the medical records at the PICU of Dr. Soetomo General Academic Hospital, while those with a diagnosis of shock were excluded. This study obtained ethical feasibility from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital (Ref No. 0500/LOE/301.42/VI/2021).

The data extracted from the medical records included gender, age, physical examination in the form of heart rate, respiratory rate, body temperature, laboratory tests in the form of hemoglobin, white blood cells, platelets, shock diagnosis results, patients' outcomes from the PICU, and PRISM III score. Furthermore, the data were proceeded into the statistical program for social science software program and presented in tables.

RESULTS AND DISCUSSION

Demographics of Pediatric Shock Patients

From January to December 2019, about 60 patients diagnosed with shock were treated in the PICU of Dr. Soetomo General Academic Hospital. A total of 31 or 51.7% out of the 60 participants were male and the remaining were female. In the case of age, about 53.3% were

Available at https://e-journal.unair.ac.id/IJAR | **DOI:** https://doi.org/10.20473/ijar.V5I12023.11-17

children between the age of 2-10 years. The following table shows the percentages of gender and ages of the patients.

Table 1. Demographics of Pediatric Shock Patients

Variable	Frequency (n=100)	Percentage (n=100)
Gender		
Male	31	51.7%
Female	29	48.3%
Age Categories		
Infant (<1 year)	10	16.7%
Children	32	53.3%
Adolescents	18	30%

Patients' Clinical Profile Based on Age with Physical Examination Results

In the HR, RR, and temperature categories, the chi-square p-value was 0.025, 0.181, and 0.043, respectively, which are less than the alpha of 5% or 0.05. Table 2 below shows the demographic data on the patients' age with the results of the physical examination.

Table 2. The relation of Age Categories and Patients' Physical Examination Results

Physical Examination	Infant (x̄±SD)	Children (x̄±SD)	Adolescents (x̄±SD)	p-value
HR	133.142± 10.558	119.823± 21.153	119.526± 24.132	0.025
RR	30± 8.082	28.352± 8.337	28.210± 9.997	0.181
Temperature	36.942± 0.427	36.785± 0.494	37.152± 0.968	0.043

Shock Patients' Profile Based on Laboratory Examination (Hemoglobin, Leukocyte Count, and Platelet)

In the PICU, the lowest, highest, and average levels of hemoglobin are 3.3 g/dL, 18.5 g/dL, and 10.46 g/dL, respectively. The lowest, highest, and average leukocyte count was 1280/µL, 580000/µL, and 47632.68/µL, respectively. Furthermore, the lowest and the highest platelet count was 4550/µL and 744000/µL with an average of 158153.83 ± 168353.15. Table 3 below shows the patients' hemoglobin levels, leukocyte counts, and platelet counts.

Table 3. Shock Patients' Profile Based on Laboratory Examination

Indicator	Mean
Hb (g/dL)	10.46
WBC (/µL)	47632.68
PLT (/µL)	158153.83 ± 168353.15

Patients' Profile Based on Shock Diagnosis Results, PRISM III Score, and Patients' Outcomes

Based on the diagnosis results in the PICU, distributive shock, particularly septic, has the highest medical records of 76.6%, followed by hypovolemic, cardiogenic, and obstructive with 20%, 3.3%, and 0%, respectively. The results on the PRISM III showed that the score ≥ 8 and < 8 are 60% and 40%, respectively. In this study, the condition of shock patients was divided into two where 61.7% and 38.3% of them died and lived, respectively. Table 4 below shows the percentage of shock diagnosis results, PRISM III score, and patients' outcomes.

Table 4. Profile of Shock Diagnosis Results, PRISM III Score, and Patients' Outcomes

Variable	Frequency	Percentage (n=100)
Diagnosis Results of Shock		
Hypovolemic Shock	12	20%
Cardiogenic Shock	2	3.3%
Distributive Shock	46	76.6%
Obstructive Shock	0	0%
PRISM III Score		
≥8	36	60%
<8	24	40%
Patients' Outcomes		
Survived	23	38.3%
Died	37	61.7%

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Profile of Patients' Outcomes Distribution based on Shock Diagnosis Results and PRISM III Score

Based on the diagnosis results, the record of patients that died through distributive, hypovolemic, cardiogenic, and obstructive shock is 51.7%, 8.3%, 1.7%, and 0% with about 25%, 11.7%, 1.7%, and 0% of them that were alive. The distribution of patients' outcomes showed that the mortality rate for PRISM III ≥8 and < 8 are 53.3% and 8.3% with about 6.7% and 31.7% that survive. Furthermore, the p-value was 0.027 and 0.001 which is less than alpha 5% or 0.05. Table 5 below shows the profile of patients' outcomes and PRISM III score.

Table 5. Profile of Patients' Outcomes Distribution Based on Shock Diagnosis Results and PRISM III Score

Variable	Output%		Total	p-value
	Life	Died		
Diagnosis Results of Shock				
Hypovolemic Shock	5 (8.3%)	7(11.7%)	12(20%)	0.027
Cardiogenic Shock	1(1.7%)	1(1.7%)	2(3.3%)	
Distributive Shock	31(51.7%)	15(25%)	46(76.6%)	
Obstructive Shock	0(0%)	0(0%)	0(0%)	
PRISM III Score				
≥ 8	32(53.3%)	4(6.7%)	36(60%)	0.001
< 8	5(8.3%)	19(31.7)	26(40%)	

Based on the demographic profile, patients experiencing shock in the PICU at Dr. Soetomo General Academic Hospital Surabaya were dominated by males with a total of 51.7% compared to females with 43.3%. This was in line with the data of Gadappa and Behera (2019) (11), where male pediatric patients were more susceptible to shock.

The prevalence is high in males due to decreased humoral and cellular immune responses to infection. However, the increase in an age not only causes the immune system to be mature but also gender differences underlying the formation of immunity in early life. There is a gradual spike in sex steroid hormones during infancy and this is known as "mini puberty". Additionally, sex steroid hormones affect the immune system (9). Male is at higher risk of contracting infection because the antibodies genetically and hormonally in female are better for producing immunoglobulins (10).

Moreover, the number of patients with age differed since children had the highest score with a total of 53.3%. The result is in line with Gadappa & Behera (2019) (11) that children critically affected by shock also have several co-morbidities such as leukocytosis, anemia, positive CRP, and hyponatremia. This is because they are susceptible to infection and have a higher incidence of anemia.

At the age of baby and adolescence, the highest average pulse is 135 and 37 with a breathing frequency of 32.2 and 19, respectively. The p-value in the HR, RR, and temperature categories are 0.025, 0.181, and 0.043, respectively, indicating less than the alpha of 5% or 0.05. This showed that there is a relationship between age and the patients' examination results. The results are also in line with Paary *et al*. (2016) (12) because the patients have a history of hypertension, type II diabetes mellitus, and chronic kidney disease.

Several studies showed that comorbid conditions including diabetes mellitus, hypertension, and chronic kidney disease are risk factors for infant mortality (13). The lowest, highest, and average level of the patients' hemoglobin was 3.3 g/dL, 18.5 g/dL, and 10.46 g/dL, respectively. These data were in line with Biban *et al*, (2021) (13) that the average hemoglobin level in septic shock is 10.5 g/dL. In this study, patients experiencing

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shock in the PICU suffer from leukocytosis. The majority of them experience an increase in leukocytes due to infectious conditions (14).

These results were in line with Jeevan *et al*. (2017) (15) that the average mortality of leukocyte levels is 47632.68/µL. Also, the average number of platelet was still at normal levels with an average value of 158153.83 ± 168353.15/µL. This is because data collection was carried out by recording the exact time the patients' first entered the PICU.

Distributive shock is the most common diagnosis in medical records with 46 patients or 76.6%. This is caused by complications from ventilator-related pneumonia, atelectasis, pneumothorax, laryngeal edema, and extubating events (16).

Based on the patients' outcomes, the rate of mortality and the patients who are alive are 61.7% and 38.3%, respectively. The high death rate can be caused by patients who have immature immune systems. Additionally, the participants' condition tends to worsen septic shock which increases the mortality rate (17).

Based on the diagnosis result, about 51.7% and 25% of patients with distributive shock, particularly septic, died and lived respectively. This is caused by the respiratory tract being the most common site of infection (9).

The distribution of patients' outcomes showed that the mortality rate for PRISM III ≥8 is 53.3%, while those that were alive with a PRISM III score <8 is 31.7%. This high death is caused by the patients' who died before reaching the PICU (18). The p-value is 0.027 and this is less than the alpha of 5% or 0.05. This indicates that there is a relationship between the shock diagnosis and patients' outcomes. Also, the p-value is 0.001 and this is less than the alpha of 5% or 0.05. This shows that there is a relationship between the PRISM III score and patients' outcomes.

CONCLUSION

The majority of the shock patients were dominated by males and children aged 2-10 years. In the demographic distribution of age, the average value of the highest pulse frequency of 135 was from 1 month to 1 year. The highest average respiratory frequency and body temperature were at the age of infants and adolescents, respectively. Moreover, the diagnosis results showed that distributive shock had the highest mortality with the PRISM III score ≥8.

Acknowledgment

The authors are grateful to the doctors and staff in the Faculty of Medicine, Universitas Airlangga, and Dr. Soetomo General Hospital, Surabaya, Indonesia, for the assistance and advice provided in conducting this study.

Conflict of Interest

There is no conflict expressed by all the authors.

Funding

This study did not receive any funding.

Authors' Contributor

All authors have contributed to several processes in this study.

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