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Study on Clinical, Subclinical Characteristics and Results of Treatment of Sepsis in Children at The Pediatric Intensive Care Unit and Neonatal Vung Tay Nguyen Regional General Hospital, Dak Lak Province, Vietnam

Nguyen Thi Hong Van[1], Dang Thi Ha[2], Nguyen Thi Kim Oanh[3]

[1,2,3]Buon Ma Thuot Medical University, 298 Ha Huy Tap Str, Dak Lak, 630000,Vietnam

Abstract: Pediatric patients exhibit a higher incidence of sepsis compared to adults, with the risk inversely correlated with age. **Objectives:** To determine the ratio clinical, subclinical characteristics and results of treatment of sepsis in children at the pediatric intensive care unit and neonatal Tay Nguyen Regional general hospital. **Materials and methods:** A descriptive case series was conducted on 73 children aged 2 months to 15 years who were diagnosed with sepsis and admitted to the pediatric intensive care unit and neonatal Tay Nguyen Regional general hospital between September 2024 and April 2025. **Results:** Among 73 pediatric patients with sepsis, 2 to <12 months accounted for the highest proportion 42,5%. Male-female distribution was 50,7% and 49,3%, 86,3% of patients resided in rural areas. The most common clinical signs were fever 93,2% and tachypnea 65,8%. Respiratory tract infections represented the most frequent focus 57,5%. Non-shock sepsis constituted 64.4% of cases. Blood cultures were positive in 31,5%. The recovery rate was 58,9%, referral to higher-level hospitals was 30,1% and mortality was 11,0%. All patients received antimicrobial therapy, fluid resuscitation was administered in 82,2% and vasopressors were not required in 65,7%.

Keywords: Sepsis, multiple organ dysfunction, systemic inflammatory response syndrome.

INTRODUCTION

Sepsis represents a significant global health burden across all countries. The incidence of sepsis in children is higher than in adults, with younger age groups exhibiting higher rates of infection [World Health Organization, 2020]. The predominant etiological agents are bacteria [Yogaraj, J. S. *et al.*, 2002]. Sepsis can progress to septic shock and multiple organ dysfunction syndrome (MODS). It is a severe clinical condition characterized by a complex course and high mortality.

Early-stage pediatric sepsis often presents with nonspecific manifestations, posing considerable challenges for clinicians in making timely diagnoses and initiating appropriate management within the critical therapeutic window.

To investigate the epidemiological characteristics, clinical and paraclinical features, as well as the causative pathogens of pediatric sepsis in Dak Lak Province, we conducted this study with the following objectives: (1) To determine the prevalence of selected clinical and paraclinical characteristics of pediatric sepsis at the Pediatric Intensive Care Unit and Neonatal Intensive Care Unit of Tay Nguyen Regional General Hospital. (2) To evaluate treatment outcomes of pediatric sepsis at the Pediatric Intensive Care Unit and Neonatal Intensive Care Unit of Tay Nguyen Regional General Hospital.

SUBJECTS AND METHODS

Study Population

Inclusion criteria: Patients aged from 2 months to 15 years who met the diagnostic criteria for sepsis according to the 2005 International Pediatric Sepsis Consensus Conference [Pomerantz, W. J. *et al.*, 2023; Goldstein, B. *et al.*, 2005]: systemic inflammatory response syndrome (SIRS), in which at least one criterion must be abnormal temperature or leukocyte count, in the presence of suspected or confirmed infection.

Exclusion criteria: Patients with pre-existing multiple organ dysfunction prior to the diagnosis of sepsis; hematologic disorders affecting leukocyte counts (e.g., leukemia, bone marrow failure); patients receiving corticosteroid therapy; and cases in which parents or legal guardians did not consent to participate in the study.

Study setting and duration: The study was conducted at the Pediatric Intensive Care Unit and Neonatal Intensive Care Unit of Tay Nguyen Regional General Hospital, Dak Lak Province, from September 2024 to April 2025.

Study Methods

Study design: Descriptive case series.

Sample size: A total of 73 eligible patients were recruited using a convenience sampling method.

***Corresponding Author:** Nguyen Thi Hong Van

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Study variables:
Clinical and paraclinical characteristics of pediatric sepsis: general characteristics, systemic inflammatory response syndrome, source of infection, clinical classification, blood culture results, and organ function.

Treatment outcomes: recovery, referral to higher-level facilities, mortality, duration of treatment, and therapeutic interventions.

Data analysis: Data were analyzed using SPSS version 20.0.

Ethical Considerations
The study was conducted following approval from the Institutional Review Board of Buon Ma Thuot Medical University and Tay Nguyen Regional General Hospital. All procedures complied with ethical standards for biomedical research, ensuring no harm to pediatric patients, maintaining confidentiality of personal information, and guaranteeing objectivity and fairness in data collection.

RESULTS

Clinical and Paraclinical Characteristics of Pediatric Sepsis

General Characteristics of Pediatric Patients with Sepsis

Table 1. General Characteristics

Characteristics	n = 73	Percentage (%)
Age		
2 months – < 12 months	31	42.4
1 – 5 years	21	28.8
6 – 15 years	21	28.8
Sex		
Male	37	50.7
Female	36	49.3
Residence		
Urban	10	13.7
Rural	63	86.3
Ethnicity		
Kinh	27	37.0
Others	46	63.0

Comment: The most commonly affected age group was 2 months to under 12 months (42.4%). The male-to-female ratio was nearly equal. The majority of patients resided in rural areas (86.3%), and the ethnic distribution was diverse.

Clinical Characteristics of Pediatric Sepsis

Table 2. Characteristics of Systemic Inflammatory Response Syndrome and Blood Pressure

Characteristics	n = 73	Percentage (%)
Fever	**68**	**93.2**
Tachycardia/Bradycardia	**42**	**57.5**
Tachypnea	**48**	**65.8**
Leukocytosis	**37**	**50.7**
Hypotension	**26**	**35.6**

Comment: Fever was present in nearly all cases (93.2%). Tachypnea, tachycardia/bradycardia, and leukocytosis were each observed in more than 50.0% of patients. Hypotension was noted in 35.6% of cases.

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Table 3. Sites of Infection in Pediatric Sepsis

Site of Infection	n = 73	Percentage (%)
Respiratory tract	42	57.5
Gastrointestinal tract	16	22.0
Urinary tract	1	1.4
Central nervous system	12	16.3
Others	1	1.4
Unknown	1	1.4

Comment: The respiratory tract was the most common source of infection (57.5%), followed by the gastrointestinal tract (22.0%) and central nervous system (16.3%). Urinary tract infections, soft tissue infections, and cases with unidentified sources each accounted for 1.4%.

Table 4. Clinical Forms of Pediatric Sepsis

Clinical Form	n	Percentage (%)
Non-shock	47	64.4
Septic shock	26	35.6

Comment: A total of 47 patients (64.4%) had sepsis without shock, while 26 patients (35.6%) presented with septic shock.

Paraclinical Characteristics of Pediatric Sepsis

Table 5. Hematological Findings and Organ Function Parameters

Characteristics	n = 73	Percentage (%)
Anemia	Present	50
Thrombocytopenia	Present	9
INR > 2	Present	8
Elevated creatinine	Present	13
Elevated SGPT	>100 U/L	19
CRP	>10 mg/dL	47

Comment: The prevalence of anemia and elevated CRP exceeded 50.0%. Elevated SGPT accounted for 26.0%, increased creatinine for 17.8%, while thrombocytopenia and INR > 2 were observed at similar rates.

Table 6: Blood Culture Results

Results	n = 73	Percentage (%)
Positive	23	31.5
Negative	50	68.5

Comment: Among 73 patients, 23 (31.5%) had positive blood cultures.

Table 7: Bacterial Etiology of Pediatric Sepsis

Group	Bacterial Species	n	Percentage (%)
Gram (+)	*Staphylococcus aureus*	6	30.0
	Streptococcus pneumoniae	1	5.0
	Staphylococcus haemolyticus	1	5.0
	Coagulase-negative *Staphylococcus*	1	5.0
Gram (-)	*Acinetobacter* spp.	2	10.0
	Klebsiella pneumoniae	2	10.0
	Burkholderia cepacia complex	2	10.0
	Pseudomonas spp.	1	5.0
	Haemophilus influenzae	1	5.0
	Enterobacter cloacae	1	5.0
	Achromobacter xylosoxidans	1	5.0
	Stenotrophomonas maltophilia	1	5.0

Comment: *Staphylococcus aureus* was the most predominant pathogen, accounting for 30.0% of positive isolates.

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Treatment Outcomes of Pediatric Sepsis

Table 8: Overall Treatment Outcomes

Outcomes	n	Percentage (%)
Recovered	43	58.9
Referred to higher-level facility	22	30.1
Death	8	11.0

Comment: The recovery rate was 58.9%, referral rate was 30.1%, and mortality accounted for 11.0%.

Table 9: Duration of Treatment

Duration (days)	**Minimum**	**Maximum**	**Mean**
Length of stay	2	56	16.85

Comment: The shortest treatment duration was 2 days (2 cases, including 1 referral and 1 death). The longest duration was 56 days. The mean length of stay was 16.85 days.

Table 10. Treatment Modalities

Treatment	**Category**	**n**	**Percentage (%)**
Antibiotic therapy	No change	27	37.0
	First modification	24	32.9
	Second modification	22	30.1
Fluid resuscitation	Yes	60	82.2
	No	13	17.8
Vasopressor use	None	48	65.7
	One agent	18	24.7
	Two agents	3	4.1
	Three agents	4	5.5

Comment: All patients received antibiotic therapy (100%). Fluid resuscitation was required in 82.2% of cases. The majority of patients (65.7%) did not require vasopressors.

DISCUSSION

Clinical and Paraclinical Characteristics of Pediatric Sepsis

General Characteristics

Sepsis was most commonly observed in children aged 2 to <12 months, accounting for 42.5%. A study by Nguyen Huu Chau Duc reported similar findings, with the 1–5-year age group having the highest proportion (47.2%) [Nguyen, H. C. D. *et al*., 2023]. The male-to-female ratio in our study was nearly equal (50.7% vs. 49.3%). Similarly, Ha Thanh Hieu reported a slight male predominance (54.5% vs. 45.5%). Most patients were from rural areas (86.3%), which is consistent with findings by Dung Luu, where rural residence accounted for 57.2% [Liu, R. *et al*., 2024].

Clinical Characteristics of Pediatric Sepsis

Among the four SIRS criteria, fever was present in nearly all cases (93.2%). Tachypnea was observed in 65.8%, while abnormal heart rate and leukocytosis accounted for 57.5% and 50.7%, respectively. Hypotension (or narrowed pulse pressure) was noted in 35.6% of cases. These findings differ from those reported by Bui Binh Bao Son, where fever was less common (72.6%), tachypnea was more frequent (80.2%), abnormal heart rate was 56.2%, and hypotension was significantly higher (69.8%) [Son, B. B. B. *et al*., 2023].

The respiratory tract was the most common source of infection (57.5%), followed by the gastrointestinal tract (22.0%) and central nervous system (16.3%). These results are comparable to those of Ying Zhang, in which respiratory infections accounted for 29.2% and gastrointestinal infections for 32.3% [Ying, Z. *et al*., 2020].

In our study, non-shock sepsis accounted for 64.4%, while septic shock was observed in 35.6% of cases. This is relatively comparable to the findings of Ying Zhang, where septic shock accounted for 52.3% and non-shock cases 47.7% [Ying, Z. *et al*., 2020].

Paraclinical Characteristics of Pediatric Sepsis

The prevalence of anemia and elevated CRP was 65.5% and 64.4%, respectively. Elevated SGPT was observed in 26.0%, increased creatinine in 17.8%, while thrombocytopenia and INR >2 were found at similar rates (12.3% and 11.0%). These findings are broadly consistent with those reported by Ha Thanh Hieu, where elevated CRP was

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55.3%, thrombocytopenia 15.6%, elevated creatinine 5.2%, and SGPT ≥100 U/L was 22.1% [Hieu, H. T. *et al*., 2020].

The blood culture positivity rate was 31.5%, while 68.5% were negative. Gram-negative bacteria were slightly more prevalent (52.6%) than Gram-positive bacteria (47.4%). *Staphylococcus aureus* was the most common pathogen (30.0%). In contrast, a study by Dinh Duong Tung Anh *et al*. reported a higher proportion of Gram-positive bacteria (58.8%) compared to Gram-negative bacteria (40.3%), with *Staphylococcus aureus* also being the most frequently isolated organism (20.8%) [Anh, D. D. T. *et al*., 2020]. Factors affecting blood culture results may include prior antibiotic use before sample collection.

Treatment Outcomes of Pediatric Sepsis

Overall Treatment Outcomes

The recovery rate was 58.9%, referral rate was 30.1%, and mortality rate was 11.0%. These findings are comparable to those reported by Ha Thanh Hieu, where treatment success was 63.6% and failure was 36.4% [Hieu, H. T. *et al*., 2020].

The shortest treatment duration was 2 days, the longest was 56 days, and the mean duration was 16.85 days. These results are consistent with those of Ha Thanh Hieu, who reported a mean treatment duration of 16.92 ± 15.01 days, with a range from 1 to 75 days [Hieu, H. T. *et al*., 2020].

Treatment Modalities

All patients received antibiotic therapy. Fluid resuscitation was administered in 82.2% of cases, while the majority of patients (65.7%) did not require vasopressors. Among those requiring vasopressors, the use of a single agent was most common (24.7%), with adrenaline being the most frequently used agent. These findings are comparable to those reported by Ha Thanh Hieu, where 100% of pediatric sepsis patients received antibiotics, 74.0% received fluid therapy, and vasopressor use was higher at 81.1% [Hieu, H. T. *et al*., 2020].

CONCLUSION

This study, conducted from September 2024 to April 2025 on 73 eligible pediatric patients admitted to the Pediatric Intensive Care Unit and Neonatal Intensive Care Unit of Tay Nguyen Regional General Hospital, yielded the following conclusions:

Children aged 2 to <12 months accounted for the majority of cases. Fever was present in 93.2% of patients, and the respiratory tract was the most common source of infection. The blood culture positivity rate was 31.5%, with Gram-negative bacteria accounting for 52.6% of isolates. *Staphylococcus aureus* was the most frequently identified pathogen (30%).

Regarding treatment outcomes, the recovery rate was 59%, the referral rate was 30%, and the mortality rate was 11%.

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