

# Clinical Characteristics of 163 Cases of Childhood Sepsis and Analysis of Risk Factors

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## Abstract

**Objective:** To analyze the clinical characteristics and risk factors of children with sepsis diagnosed using the Phoenix Sepsis Score in the pediatric emergency room of Guangzhou Women's and Children's Medical Center, and to provide clinical evidence for early intervention and reliable treatment. **Methods:** A total of 163 pediatric sepsis cases admitted from November 2019 to November 2024 were studied. Patients were divided into normal lactate (<2 mmol/L) and high-lactate ( $\geq 2$  mmol/L) groups. Data were analyzed using chi-square tests and Mann-Whitney U tests. Univariate and multivariate logistic regression analyses were performed to identify risk factors for the high-lactate group. **Results:** Among the 163 children (97 males, 66 females; age range 1 month to 14 years, median 1 year), 93 were in the normal lactate group and 70 in the high-lactate group. Clinical features included fever (98.2%), cough (17.2%), vomiting (9.2%), abdominal pain (12.9%), convulsions (7.4%), urinary tract infections (13.9%), and surgical diseases (6.7%). Vomiting and abdominal pain rates were significantly lower in the high-lactate group compared to the normal-lactate group ( $P < 0.05$ ), while the rate of urinary tract infections was higher ( $P < 0.05$ ). Risk factors for the high-lactate group included age < 1 year, PICU admission, oxygenation index (P/F) < 100 mmHg, and multiple organ dysfunction (all  $P < 0.05$ ). Age < 1 year was an independent risk factor (adjusted OR = 4.946, 95% CI 2.439 - 10.027,  $P < 0.05$ ). **Conclusions:** Early intervention is crucial for high-lactate sepsis patients under 1 year of age, aiding in disease severity and prognosis assessment.

## Keywords

Sepsis, Clinical Characteristics, High-Lactate, Risk Factors

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## 1. Introduction

Sepsis is an important cause of morbidity and mortality in children [1]. Although the standardized criteria for defining sepsis are in flux, the general concept of sepsis is a severe infection that results in organ dysfunction [2]. The clinical presentations of sepsis in children are varied and may include fever, shortness of breath, rapid heart rate, hypotension, and impaired consciousness [3]. The clinical presentation may be more insidious and atypical in children than in other age groups. Serum lactate is an important tool for assessing the efficacy of sepsis treatment and predicting its severity, and knowledge of the clinical features of sepsis can help in the early diagnosis, treatment and prognosis of patients [4]. The 2024 International Consensus updated the diagnostic criteria for sepsis and septic shock in children, introducing the Phoenix Sepsis Score (PSS) criteria as a diagnostic tool [5]. The data of 163 cases of childhood sepsis admitted to the Emergency Department of Guangzhou Women and Children's Medical Centre from November 2019 to November 2024 were retrospectively analyzed and summarized to explore the clinical features of sepsis and the high-risk factors of the high-lactate group, and to provide a basis for early diagnosis and treatment.

## 2. Objects and Methods

### 2.1. Objects

A total of 163 pediatric patients with confirmed sepsis diagnosed in our emergency stay were selected for the study (Time: 2019.11-2024.11), and their clinical history, laboratory investigations, and treatment were retrospectively collected. The male to female ratio was 1.47:1 (97/66). Age of high-lactate group was 1 month to 11 years (median age 3 years); age of normal lactate group was 1 month to 14 years (median 8 months).

Diagnostic criteria for patients with sepsis: Referring to the "2024 International Consensus Criteria: Sepsis and Septic Shock in Children" diagnostic criteria, sepsis is considered to be diagnosed as suspected infection with a Phoenix score  $> 2$ ; sepsis with cardiovascular score  $> 1$  is diagnosed as septic shock.

### 2.2. Methods

#### 2.2.1. Ethical Approval and Consent to Participate

This study was approved by the Ethics Committee of Guangzhou Women and Children's Medical Center (Approval No. 2025069A01). Informed consent was obtained from the parents and guardians upon admission. All procedures involving human participants were performed in accordance with the ethical standards of the institutional and/or National Research Committee and the Declaration of Helsinki 1964.

#### 2.2.2. Data Management

Through the electronic medical record management system of Guangzhou Women's and Children's Medical Centre, we retrieved the clinical medical record data of

the children who were kept under observation for the diagnosis of sepsis in the emergency department in the past 5 years, and analyzed the clinical characteristics of the children, including gender, age, clinical manifestations, laboratory tests, pathogens, complications and therapeutic measures.

### 2.3. Statistical Analyses

Data were processed by SPSS 26.0 statistical software, and count data were expressed as cases (%), and the  $\chi^2$  test was used for intergroup comparisons. Comparisons between groups were made using the Mann-Whitney rank sum test. Risk factors in the high-lactate group were analyzed by one-way logistic regression, and risk factors with  $P < 0.05$  were entered into two-way logistic regression analysis, with  $P < 0.05$  being a statistically significant difference.

## 3. Results

General data and distribution feature: A total of 163 patients with sepsis were included, aged from 1 month to 14 years (median 1 year). There were 70 cases (43%) in the high-lactate group and 93 cases (57%) in the normal lactate group; there were 97 cases (59.5%) of males and 66 cases (40.5%) of females, with a male-to-female ratio of 1.47:1. The age of the patients was 1 month to 6 months in 42 cases (25.8%), 6 months to 12 months in 18 cases (11%); 1 to <3 years in 33 cases (20.2%); 3 to 7 years in 57 cases (34.9%); >7 years in 13 cases (8%). There were 70 cases (45 males and 25 females) in the high-lactate group and 93 cases (52 males and 42 females) in the normal lactate group. The time of onset was from November 2019 to November 2020. There were 23 cases (14.1%) in total, 41 cases (25.2%), 25 cases (15.3%), 32 cases (19.6%) and 42 cases (25.8%) in that order. The season of onset was autumn and winter.

Clinical features: 160 of the 163 children had fever, most of them were auditory fever or flaccid fever, with a fever peak of 38.5°C - 40.5°C. The patients in the male high-lactate group had 45 cases of fever. There were 45 cases in the male high-lactate group and 52 cases in the normal lactate group. The duration of fever was <7 d in 142 cases and >7 d in 21 cases. 38 children had cough and wet rales in the lungs. 36 (22.1%) had gastrointestinal symptoms, including vomiting in 15, abdominal pain in 21, convulsions in 11, urinary tract infections in 22, coagulation disorders in 49, and sepsis with surgical disease in 11, and sepsis in 97 males (59.5%). It was found that: vomiting and abdominal pain were lower in the high-lactate group than in the normal lactate group [2/13,  $\chi^2 = 5.912$ ,  $P < 0.05$ ; 4/17,  $\chi^2 = 5.618$ ,  $P < 0.05$ ]; whereas, the proportion of urinary tract infections in the high-lactate group was higher than that in the normal lactate group [16/6,  $\chi^2 = 9.207$ ,  $P < 0.05$ ] (see **Table 1**).

Laboratory tests: oxygenation index (P/F) decreased in the majority of children. P/F less than 400 in 149 cases (91.4%), less than 300 in 106 cases (65%), less than 200 in 46 cases (28.2%), less than 100 in 10 cases (16.3%). 107 cases (65.6%) had elevated WBC of 16.7 (8.9, 26.3) \* 10<sup>9</sup>/L; C-reactive protein (CRP) was elevated in

**Table 1.** Comparison of clinical characteristics of children with sepsis in two groups.

Clinical characteristics	High lactate group (n = 70)	Normal lactate group (n = 93)	Total cases (%)	$\chi^2$	P
Fever	92	68	160 (92.4%)	3.602	0.058
Cough	10	18	28 (17.2%)	0.721	0.396
Vomit	2	13	15 (9.2%)	5.912	0.015
Stomach ache	4	17	21 (12.9%)	5.616	0.018
Seizure	3	9	12 (7.4%)	1.702	0.192
Urinary tract infection	16	6	22 (13.5%)	9.207	0.002
Surgical diseases	4	7	11 (6.7%)	0.209	0.648
Coagulation disorders	22	27	49 (30.1%)	0.109	0.741
Sex: male	45	52	97 (59.5%)	1.162	0.281

155 cases (95.1%), at 135.7 (89, 100) mg/L; PCT was elevated in 98 cases (89%) at 4.22 (0.98, 12.57) mg/L; Platelet decline in 13 cases (8%) was  $328 (236, 446) \times 10^9/L$ ; FIB decreased in 43 cases (26.4%) to 6.11 (4.627, 7.27) g/L; 45 cases (27.6%) with D-dimer more than 2 mg/L. Of these, only P/F < 100, the ratio of children with sepsis in the high-lactate group to those in the normal-lactate group was 7/3 (OR = 3.833, 95% CI 0.83 - 13.387, P = 0.014).

Pathological examination: Positive throat swab, blood culture or cerebrospinal fluid or bone marrow culture tests 22.7% (37/163) and positive throat swab viral nucleic acid tests 19 % (31/163). Positive blood cultures, cerebrospinal fluid and its bone marrow cultures were 3.7% (6/163). The viruses detected in 37 children with viral infection sepsis were ADV, RSV, EV, FA, FB, MP, EB, RV and others. There was no statistically significant positive pathogenesis in the high-lactate and normal lactate groups.

Serious illnesses and their complications: During the course of the disease, 17 (10.4%) of the 163 children with sepsis were transferred to the PICU for further treatment, 10 were diagnosed with septic shock (6.1%) and 11 (6.7%) were complicated by multiple organ dysfunction. Among children transferred to PICU, the ratio of high-lactate group to normal lactate group was 12/5 (OR = 3.641, 95% CI 1.219 - 10.881, P = 0.021); among children with combined multiple organ dysfunction, the ratio of high-lactate group to normal lactate group was 8/3 (OR = 3.971, 95% CI 0.988 - 15.169, P = 0.048) (See **Table 2**).

Analysis of high-risk factors for critical illness: One-way logistic regression analysis identified risk factors for critical illness including age < 1 year, transferred to PICU, P/F < 100 mmHg, and multiple organ dysfunction (**Table 2**). The above statistically different risk factors were included in a two-factor logistic regression analysis, and it was found that age < 1 year was an independent risk factor for the occurrence of critical illness (corrected OR = 4.946, 95% CI 2.439 - 10.027, P < 0.01) (See **Table 3**).

**Table 2.** One-way logistic regression analysis of risk factors in the hyperlactate group of children with sepsis.

Groups	High lactate group (n = 70)	Normal lactate group (n = 93)	OR	P	(95% CI)
Age < 1 year old	39	21	4.313	<0.01	2.191 - 8.491
WBC > 12 * 10 <sup>9</sup> /L	46	58	1.291	0.442	0.674 - 2.473
CRP > 100 mg/L	50	57	1.579	0.179	0.812 - 3.072
PCT > 10 ng/L	14	14	1.411	0.409	0.624 - 3.191
PLT < 100 * 10 <sup>9</sup> /L	4	9	0.566	0.36	0.167 - 1.918
Fib < 100 mg/dl	15	28	1.212	0.741	0.571 - 2.2
P/F < 100	7	3	3.833	0.04	0.83 - 13.387
D-dimer > 2 mg/L	21	24	1.12	0.741	0.571 - 2.2
Aetiology (+)	4	9	1.579	0.215	0.767 - 3.254
Transferred to PICU	12	5	3.641	0.021	1.219 - 10.881
MODS	8	3	3.971	0.048	0.988 - 15.169

**Table 3.** One-way logistic regression analysis of the hyper-lactate group in children with sepsis.

Group	Age < 1 year old	Transferred to PICU	P/F < 100	MODS
High lactate group	39	12	7	8
Normal lactate group	21	5	3	3
P	<0.01	0.146	0.263	0.075
OR	4.946	2.478	2.424	3.94
(95% CI)	(2.439 - 10.027)	(0.728 - 8.431)	(0.515 - 11.412)	(0.871 - 17.84)

#### 4. Discussion

Sepsis is by far one of the most common problems faced by pediatric emergency department and intensive care unit physicians [6]. Sepsis is a syndrome of systemic inflammatory response caused by bacteria, viruses, and fungi, which can progress to septic shock and MODS, and become the leading cause of non-cardiac deaths [7]. It has been reported in the literature that lactate is an independent risk factor for prognosis in children with sepsis [8]. The 2024 International Consensus updated the diagnostic criteria for sepsis and septic shock in children, introducing the Phoenix Sepsis Score (PSS) criteria as a diagnostic tool. Therefore, lactic acid was used as the basis for grouping in this paper. This study finding that vomiting and abdominal pain rates were significantly lower in the high-lactate group is

counterintuitive. The Discussion should briefly address this unexpected result and speculate on potential clinical reasons, maybe altered consciousness affecting symptom reporting. The study identifies a higher rate of urinary tract infections in the high-lactate group, This finding aligns with the research conducted by Purkerson, Jeffrey M [9]. The conclusion that infants under 1 year are at high risk is well-supported. That is because younger children with underlying diseases, such as congenital heart disease and immunodeficiencies. These children may have relatively weakened immune systems and organ function and are less resistant to infections, and therefore require more aggressive treatment and monitoring [10]. It has been reported that platelets and blood lactate are closely related to the body's inflammatory response in patients with sepsis [11].

Multiple organ failure due to septic infections has been previously reported in the literature as the main reason for admission to the ICU [12]. Potential Racial Differences in Timeliness of Antibiotic Treatment for Patients with Severe Sepsis or Infectious Shock Presenting to the Office of the Visiting Clinic [13]. Early use of antibiotics in children with sepsis is the key to treatment, and in this study it was found that antibiotics were used in 96.9% of cases of sepsis diagnosed in the emergency room of our hospital (158/163), which suggests that the emergency physicians of our hospital have a lot of experience in the early identification of sepsis, and that the early use of antibiotics greatly reduces the probability of admission to the PICU of patients in our department(17/163 10.4%). Differences in initial site of infection, admission PICU inflammatory markers, and co-infecting pathogens during hospitalisation in children with sepsis have been reported in the literature [14]. Clinical manifestations of neonatal septicaemia may include lethargy, shortness of breath, feeding difficulties, delayed CRT, gastric haemorrhage [15]. In contrast, high fever and shortness of breath are the two most common clinical signs of sepsis in children [4], This is consistent with the research in this paper.

In this study, 163 children with sepsis were included and divided into a normal lactate group (93) and a hyper-lactate group (70) according to their lactate levels. The clinical characteristics of the two groups were analyzed using the chi-square test. It was found that 98.2% of the patients were febrile, 17.2% of the patients were coughing, 30% of the patients had coagulation dysfunction, 7.4% of the patients had haemorrhagic convulsions, 6.7% of the patients had co-infections of the urinary tract, 6.7% of the patients required surgical intervention (11/163 6.7%). One of them died on the next day of transfer to ICU with complication of intracranial haemorrhage. In this study, 10.4% of children were admitted to PICU and 6.7% of them had multi-organ dysfunction. The study showed that children in the normal lactate group had more vomiting and abdominal pain, but the incidence of urinary tract infections was more in the hyper-lactate group than in the normal lactate group.

It has been reported in the literature that PCT, CRP and neutrophil counts in children with sepsis can show rapid elevation [16]. Platelets play an important role

in inflammation and coagulation dysfunction leading to organ damage in sepsis [17]. Fibrinogen levels as a predictor of mortality in patients with sepsis or infectious shock [18]. The D-dimer-albumin ratio has also been reported in the literature as an independent predictor of critically ill patients with sepsis [19]. In this paper, it was found that there was no statistically significant difference between the two groups of children with sepsis in terms of gender, CRP, PCT, FIB, D-dimer and pathogenesis. Whereas, there were significant differences between the two groups in age less than 1 year, P/F less than 100 mg/dl, transfer to PICU and multiple organ dysfunction. Binary Logistic regression analysis of these four factors showed that age less than 1 year was only found to be an independent risk factor for children with sepsis in the high lactate group.

## 5. Conclusion

In summary, patients with sepsis in small infants require a high degree of vigilance on the part of the clinician, and early intervention and aggressive treatment can improve the patient's prognosis. Hyper-lactate group sepsis in patients younger than 1 year old is informative in determining the criticality of the disease, the effectiveness of treatment and prognosis.

## Author Contribution

Nianhui Deng contributed to drafting of the manuscript. Yongling Song carried out statistical analysis. Guangming Liu and Peiqing Li contributed to edit of the manuscript, study design and review the manuscript. All authors read and approved the final manuscript.

## Data Availability Statement

All data generated or analyzed during this study are included in this published article.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- [1] Lestari, I.N., Yoel, C. and Lubis, M. (2019) The Association between the Level of Antithrombin III and Mortality in Children with Sepsis. *Open Access Macedonian Journal of Medical Sciences*, **7**, 959-961. <https://doi.org/10.3889/oamjms.2019.211>
- [2] Weiss, S.L., Nicolson, S.C. and Naim, M.Y. (2020) Clinical Update in Pediatric Sepsis: Focus on Children with Pre-Existing Heart Disease. *Journal of Cardiothoracic and Vascular Anesthesia*, **34**, 1324-1332. <https://doi.org/10.1053/j.jvca.2019.10.029>

- [3] Vo, H.H. and Bui, B.B.S. (2018) Clinical Features and Coagulation Abnormalities in Children with Sepsis at Danang Hospital for Women and Children. *Journal of Medicine and Pharmacy*, 97-103.
- [4] Bui, B. (2024) Đặc điểm lâm sàng và nồng độ lactate huyết thanh trong nhiễm khuẩn huyết ở trẻ em jcmhch. No. 96, 65-72.
- [5] Schlapbach, L.J., Watson, R.S., Sorce, L.R., Argent, A.C., Menon, K., Hall, M.W., *et al.* (2024) International Consensus Criteria for Pediatric Sepsis and Septic Shock. *JAMA*, **331**, 665-674. <https://doi.org/10.1001/jama.2024.0179>
- [6] Yuniar, I. (2017) Lactate Profiles of Pediatric Shock Patients in Cipto Mangunkusumo General Hospital 2015: A Pilot Study. *Paediatrica Indonesiana*, **57**, Article 12. <https://doi.org/10.14238/pi57.1.2017.12-7>
- [7] Zhang, Y., Cao, B., Cao, W., Miao, H. and Wu, L. (2022) Clinical Characteristics and Death Risk Factors of Severe Sepsis in Children. *Computational and Mathematical Methods in Medicine*, **2022**, Article ID: 4200605. <https://doi.org/10.1155/2022/4200605>
- [8] Wang, Y., Zhang, H., Tang, X., *et al.* (2020) A Retrospective Study on Risk Factors for Prognosis of Children with Sepsis. *Chinese Critical Care Medicine*, **32**, 707-710.
- [9] Purkerson, J.M., Corley, J.L. and Schwartz, G.J. (2020) Metabolic Acidosis Exacerbates Pyelonephritis in Mice Prone to Vesicoureteral Reflux. *Physiological Reports*, **8**, e14525. <https://doi.org/10.14814/phy2.14525>
- [10] Hall, M. (2019) Immune Modulation in Pediatric Sepsis. *Journal of Pediatric Intensive Care*, **8**, 42-50. <https://doi.org/10.1055/s-0038-1676607>
- [11] Biyikli, E., Kayipmaz, A.E. and Kavalci, C. (2017) Effect of Platelet-Lymphocyte Ratio and Lactate Levels Obtained on Mortality with Sepsis and Septic Shock. *The American Journal of Emergency Medicine*, **36**, 647-650. <https://doi.org/10.1016/j.ajem.2017.12.010>
- [12] Arbous, S.M., Termorshuizen, F., Brinkman, S., de Lange, D.W., Bosman, R.J., Dekkers, O.M., *et al.* (2024) Three-Year Mortality of ICU Survivors with Sepsis, an Infection or an Inflammatory Illness: An Individually Matched Cohort Study of ICU Patients in the Netherlands from 2007 to 2019. *Critical Care*, **28**, Article No. 374. <https://doi.org/10.1186/s13054-024-05165-x>
- [13] Madsen, T.E. and Napoli, A.M. (2016) Analysis of Race and Time to Antibiotics among Patients with Severe Sepsis or Septic Shock. *Journal of Racial and Ethnic Health Disparities*, **4**, 680-686. <https://doi.org/10.1007/s40615-016-0271-7>
- [14] Zhou, T.L., Zhou, Y.P., Zhang, Y.C., *et al.* (2020) Clinical Features and Outcomes of Cancer-Related versus Non-Cancer-Related Sepsis in Pediatric Intensive Care Unit. *Chinese Journal of Pediatrics*, **58**, 482-487.
- [15] Sonawane, S., Suryawanshi, M., Patil, P., Sonawane, R. and Tolani, M.K. (2014) To Study the Clinical Profile of Neonatal Sepsis and the Sensitivity of Various Markers of Sepsis Screen. *MVP Journal of Medical Sciences*, **1**, Article 19. <https://doi.org/10.18311/mvpjms/2014/v1/i1/808>
- [16] Casado-Flores, J., Blanco-Quirós, A., Asensio, J., Arranz, E., Garrote, J.A. and Nieto, M. (2003) Serum Procalcitonin in Children with Suspected Sepsis: A Comparison with C-Reactive Protein and Neutrophil Count. *Pediatric Critical Care Medicine*, **4**, 190-195. <https://doi.org/10.1097/01.pcc.0000059420.15811.2d>
- [17] Shannon, O. (2020) The Role of Platelets in Sepsis. *Research and Practice in Thrombosis and Haemostasis*, **5**, 27-37. <https://doi.org/10.1002/rth2.12465>
- [18] Chalodiya, K., Bahulikar, A., Khadke, V. and Phalgune, D. (2020) Correlation of Plasma

Fibrinogen and Mean Platelet Volume in Patients of Sepsis to the Severity of Sepsis and Its Outcome. *International Journal of Advances in Medicine*, **7**, Article 1830. <https://doi.org/10.18203/2349-3933.ijam20205043>

- [19] Zhang, J., Song, C. and Hu, Z. (2024) The Value of D-Dimer-Albumin Ratio as a Prognostic Biomarker in Critically Ill Patients with Sepsis: A Retrospective Single-Center Study. *Heliyon*, **10**, e39057. <https://doi.org/10.1016/j.heliyon.2024.e39057>