

Procalcitonin-to-Albumin Ratio vs. C-reactive Protein-to-Albumin Ratio in Predicting Sepsis and Its Severity in Children: A Prospective Observational Study

Received 01/09/2025
Review began 02/28/2025
Review ended 04/04/2025
Published 04/09/2025

© Copyright 2025

Hasa et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.81935

Vetsa Snigdha Hasa¹, Bandya Sahoo², Mukesh K. Jain², Manas R. Behera², Sibabratta Patnaik³

1. Pediatrics, Kalinga Institute of Medical Sciences, Bhubaneswar, IND 2. Pediatric Medicine, Kalinga Institute of Medical Sciences, Bhubaneswar, IND 3. Pediatric Intensive Care Unit, Kalinga Institute of Medical Sciences, Bhubaneswar, IND

Corresponding author: Mukesh K. Jain, mukesh26.jain@gmail.com

Abstract

Background: Sepsis is one of the leading causes of morbidity and mortality in children. The aim of our study was to compare the procalcitonin-to-albumin ratio (PAR) and C-reactive protein(CRP)-to-albumin ratio (CAR) in predicting sepsis and its severity in children and to know which one is better.

Methods: This prospective observational study was conducted in a tertiary care hospital from July 2022 to January 2024. Procalcitonin, CRP, and albumin, along with baseline investigations, were sent on the day of admission (day 0), day 2 of admission, and day 7 of admission for all the children with suspected sepsis.

Results: This study included 118 children diagnosed with sepsis who were analyzed. Among them, 83 (70%) were male. The median age was 11 years, with a range of two months to 17 years. The median duration of fever prior to hospitalization was four days. The mortality and morbidity distribution included total septic shock in 22 (19%), multiple organ dysfunction (MODS) in 12 (9%), and death in 13 (11%). In total, 22 (19 %) patients required inotropic support, and 15 (13 %) required respiratory support. The cut-off value for predicting sepsis obtained for PAR was 13.5 with sensitivity 49.47% and specificity 95.61% on the day of admission, whereas the cut-off value for CAR was 0.31 with sensitivity 67.36% and specificity 64.21% on the day of admission. Receiver-operating characteristic (ROC) curve analysis was done for the diagnostic value of PAR and CAR, and the area under the curve (AUC) for detecting sepsis were 0.73 (95%CI=0.634-0.827) and 0.67 (95% CI=0.544-0.796), respectively.

Conclusion: The study demonstrates that the PAR and CAR are valuable diagnostic markers for predicting sepsis in children. On the day of admission, PAR showed a higher specificity (95.61%) compared to CAR (64.21%), making it a reliable marker for ruling in sepsis, while CAR exhibited greater sensitivity (67.36%) for detecting cases. The ROC curve analysis revealed AUC values of 0.73 for PAR and 0.67 for CAR, indicating moderate diagnostic accuracy for both. These findings suggest that PAR and CAR can complement traditional markers in diagnosing pediatric sepsis and its severity, with PAR being particularly useful in identifying more severe cases. Further research is warranted to validate these markers and explore their prognostic utility over time.

Categories: Emergency Medicine, Pediatrics, Infectious Disease

Keywords: c-reactive protein, c-reactive protein to albumin ratio and pediatric sepsis, multi organ dysfunction syndrome, procalcitonin, procalcitonin to albumin ratio, serum albumin

Introduction

Pediatric sepsis is one of the challenging and serious illnesses among the pediatric population. There are around 7.5 million deaths annually worldwide due to pediatric sepsis [1]. With prompt diagnosis and treatment, mortality can be reduced, and outcomes can be enhanced. Screening, diagnosis, judicious administration of antibiotics, and monitoring of response to antibiotics are made feasible by the existence of certain biomarkers. Further biomarkers can be useful in distinguishing between bacterial and viral infections [2]. While C-reactive protein (CRP) and procalcitonin (PCT) are the most commonly used biomarkers for diagnosing bacterial infections, both have several limitations. Although both have variable sensitivity and specificity, CRP has low accuracy as compared to PCT, which is a more specific biomarker of infection/inflammation and hence can aid clinicians in diagnosing sepsis [3].

Considering the fact that both PCT and serum albumin (ALB) are closely related to infection and inflammation, the PCT-to-ALB ratio (PAR) has been found to strongly correlate with mortality in adults with sepsis-induced acute kidney injury [4]. PAR is also an early diagnostic predictor in discriminating urosepsis from febrile urinary tract infections [5].

How to cite this article

Hasa V, Sahoo B, Jain M K, et al. (April 09, 2025) Procalcitonin-to-Albumin Ratio vs. C-reactive Protein-to-Albumin Ratio in Predicting Sepsis and Its Severity in Children: A Prospective Observational Study. Cureus 17(4): e81935. DOI 10.7759/cureus.81935

CRP and ALB are acute-phase proteins produced by the liver. In sepsis, CRP increases and positively correlates with the degree of infection [6], while ALB is often decreased. Wang et al. found the CRP-to-ALB ratio (CAR) serves as an effective indicator for early diagnosis of pediatric sepsis and had a higher value in combined diagnosis [7]. The presence of a standardized biomarker that is specific, sensitive, and effective assessment tool for early identification of sepsis in children would improve the outcome of pediatric sepsis [8]. It has been observed that a combination of biomarkers increases the sensitivity and specificity of tests rather than an individual biomarker [9,10]. Recent research studies show that higher PAR and CAR are independent predictors for neonatal sepsis [9,11]. There is much evidence to prove CRP and procalcitonin as independent markers for the diagnosis of sepsis in children [12-14]. However, there is no study combining PAR and CAR to increase the diagnostic accuracy for detecting pediatric sepsis and its severity. The common practice of using independent biomarkers for detecting sepsis has to be given a thought. In recent studies, PAR and CAR have been studied in different scenarios [5,9-11,15,16], but there are no studies regarding the CAR and PAR in correlation with pediatric sepsis in children. The main aim of our study was to analyze the role of PAR and CAR in predicting sepsis and its severity in the pediatric population.

Materials And Methods

This was a prospective observational study conducted in the Department of Paediatrics at a tertiary care hospital, Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar, Odisha, India, over 18 months, from July 1, 2022, to January 1, 2024. The study aimed to evaluate the diagnostic and prognostic utility of biomarkers, specifically the PAR and CAR, in children with suspected sepsis. The study protocol was approved by the Institutional Ethical Committee of KIMS (approval number: KIMS/SLRC/PG/2022/79, dated June 24, 2022). Written informed consent was obtained from parents or guardians, and assent was taken from children aged ≥ 7 years who were capable of understanding the study. The study adhered to ethical guidelines, ensuring confidentiality and the rights of participants.

Inclusion and exclusion criteria

Inclusion Criteria

Children aged >1 month to 18 years admitted to the Pediatric Intensive Care Unit (PICU) with suspected clinical sepsis, as defined by the International Consensus on Pediatric Sepsis (2005), were included. According to this definition, sepsis is a systemic inflammatory response to infection that results in clinical signs and symptoms of infection along with the presence of Systemic Inflammatory Response Syndrome (SIRS).

Exclusion Criteria

Children with severe acute malnutrition, recent surgical interventions, primary liver diseases, nephrotic syndrome, or malabsorption syndromes were excluded to minimize confounding factors.

Sample size calculation

The sample size of 118 was determined based on a previous study by Li et al. [10], considering a 5% level of significance, 95% confidence interval, and 80% power.

Definitions

Criteria for Sepsis

Infection: There must be clinical evidence of an infection. This can be confirmed through either microbiological evidence (positive cultures), clinical signs (e.g., fever, chills, signs of pneumonia, meningitis, or urinary tract infection), or infectious focus (e.g., a documented source of infection).

SIRS: Two or more of the following must be present: Fever (temperature $>38.0^{\circ}\text{C}/100.4^{\circ}\text{F}$) or hypothermia (temperature $<36.0^{\circ}\text{C}/96.8^{\circ}\text{F}$), tachycardia (age-specific increased heart rate), tachypnea (age-specific increased respiratory rate) or need for mechanical ventilation, leukocytosis (WBC $>12,000/\mu\text{L}$), leukopenia (WBC $<4,000/\mu\text{L}$), or an increased band count (immature neutrophils $>10\%$)

Severe Sepsis

Severe sepsis is sepsis complicated by organ dysfunction or tissue hypoperfusion. Evidence of organ dysfunction, which can include: (i) cardiovascular dysfunction: hypotension (low blood pressure), despite adequate fluid resuscitation, tachycardia (abnormally high heart rate), (ii) respiratory dysfunction: hypoxemia (low oxygen levels in blood), acute respiratory failure (need for mechanical ventilation), (iii) renal dysfunction: oliguria (urine output $<1\text{ mL/kg/hour}$) or anuria (no urine output), elevated serum creatinine or blood urea nitrogen (BUN), (iv) hematologic dysfunction: thrombocytopenia (low platelet count), disseminated intravascular coagulation (DIC), where blood clots form throughout the body, (v) metabolic acidosis: Lactic acidosis or elevated lactate levels indicating tissue hypo perfusion, and (vi)

neurological dysfunction: altered mental status, confusion, or coma.

Septic Shock

Septic shock is severe sepsis with persistent hypotension despite adequate fluid resuscitation, leading to inadequate tissue perfusion and oxygenation, which can result in multi-organ failure and death.

Data collection

Data were collected at three time points: on the day of admission (day 0), day 2 of admission, and day 7 of admission. Clinicodemographic information, including age, sex, and clinical parameters such as heart rate, respiratory rate, blood pressure, oxygen saturation, and temperature, were recorded. The need for respiratory support (e.g., nasal prongs, high-flow heated humidified nasal cannula, non-invasive ventilation, or mechanical ventilation) and circulatory support (e.g., inotropes) was documented. Sensorium was assessed using the Glasgow Coma Scale (GCS), and the pediatric Sequential Organ Failure Assessment (pSOFA) score was calculated to evaluate disease severity.

Baseline investigations included complete blood count (CBC), renal function tests, and liver function tests. Biomarkers such as CRP, PCT, and serum albumin were measured on day 0, day 2, and day 7. Blood cultures were collected at admission to confirm sepsis. PAR and CAR were calculated to assess their diagnostic and prognostic relevance in sepsis.

Statistical analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 28.0 (Released 2021; IBM Corp., Armonk, New York, United States). Continuous variables were expressed as median and range, while categorical variables were presented as frequencies and percentages. Receiver operating characteristic (ROC) curve analysis was performed to evaluate the diagnostic accuracy of PAR and CAR in predicting sepsis and disease severity. Youden's index (sensitivity + specificity – 1) was used to determine the optimal cut-off values for PAR and CAR, balancing sensitivity and specificity for clinical utility. The area under the ROC curve (AUC) for both biomarkers was compared using Delong's test. Diagnostic cut-off values, sensitivity, specificity, and 95% confidence intervals (CI) were calculated at a 5% significance level.

Youden's index provided a statistically robust method to identify optimal cut-off values, ensuring a balance between sensitivity and specificity for clinical decision-making. These biomarkers, along with ROC curve analysis, offered insights into their diagnostic and prognostic potential in pediatric sepsis.

Results

This study included 118 children diagnosed with sepsis. Among them, 83 (70%) were male and 35 (30%) were female. The median age was 11 years, with a range of two months to 17 years. The median duration of fever prior to hospitalisation was four days (Table 1). The mortality and morbidity distribution included total septic shock in 22 (19%), multiple organ dysfunction (MODS) in 12 (9%), and death in 13 (11%). In total, 22 (19%) patients required inotropic support, and 15 (13%) required respiratory support.

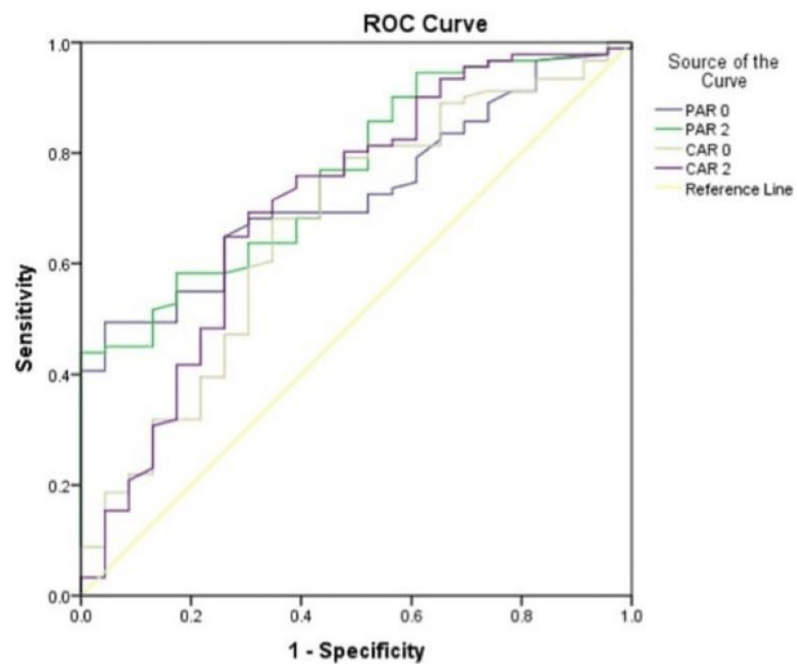
Variables		Median (IQR)	Range
Age (years)		11 (10-14)	0.2-17
Duration of fever (in days) prior to hospitalization		4 (2-6)	1-30
Hemoglobin (g/dL)		9.6 (9-11.3)	4.5-21
TLC ($10^3/\mu\text{L}$)		7 (4.5-19)	0.7-44
Total Bilirubin (mg/dL)		0.72 (0.6-0.9)	0.15-9.36
Creatinine (mg/dL)		0.64 (0.5-0.88)	0.1-3.9
CRP (mg/L)	Day		
	0	121 (35-220)	1.2-365
	2	120 (40-220)	0.5-402
	7	10 (10-50)	0.1-312
PCT (ng/ml)	Day		
	0	25 (3.2-45)	0.1-123
	2	27 (10-36.5)	0.2-125
	7	0.7 (0.5-5)	0.01-70
Albumin (g/dL)	Day		
	0	3.0 (2.7-3.3)	0.8-4.2
	2	3.0 (2.7-3.2)	1-4.0
	7	3.2 (3.2-3.5)	1.9-4.2
CRP/ALB ratio	Day		
	0	0.41 (0.17-0.85)	0.04-2.78
	2	0.37 (0.17-0.79)	0 -2.0
	7	0.03 (0.03-0.13)	0 -1.25
PCT/ALB ratio	Day		
	0	9.06 (5.63-18.33)	0.03-121.2
	2	8.77 (5.7-17)	0 -90
	7	0.21 (0.17-3.3)	0 -21.8

TABLE 1: Demographic and laboratory values

IQR: interquartile range; TLC: total leucocyte count; CRP: C-reactive protein; PCT: procalcitonin; ALB: albumin

Diagnostic value of PAR and CAR in predicting sepsis

PCT, CRP, and ALB tests were done on the day of admission, day 2, and day 7 of admission. The cut-off values taken for PCT and CRP were $> 0.5 \text{ ng/mL}$ and 5 mg/L , respectively. The normal value of ALB is $3.5\text{--}5 \text{ g/dL}$. The ROC curve analysis was done for the diagnostic value of PAR and CAR. As shown in Figure 1, AUC for detecting sepsis were 0.730 (95%CI: 0.634-0.827) and 0.670 (95%CI: 0.544-0.796), respectively, for PAR and CAR. The cut-off value obtained for PAR was 13.5, with a sensitivity of 49.47% and a specificity of 95.61% on the day of admission. The cut-off value for CAR was 0.31, with a sensitivity of 67.36% and a specificity of 64.21% on the day of admission. The diagnostic values of day 2 are described in Table 2.

**FIGURE 1: ROC curve analysis of CAR and PAR in predicting sepsis**

ROC: receiver operating characteristics; PAR: procalcitonin-to-albumin ratio; CAR: C-reactive protein-to-albumin ratio

Test Result Variable(s)	AUC (95% CI)	Standard Error ^s	P Value	Cut-off	Sensitivity	Specificity	Youden Index
PAR Day 0	0.730 (.634-.827)	.049	.001	13.5	49.47	95.61	0.4508
PAR Day 2	0.764 (.666-.862)	.050	.000	13.22	44.21	100	0.4421
CAR Day 0	0.670 (.544-.796)	.064	.012	0.31	67.36	65.21	0.3257
CAR Day 2	0.709 (.582-.837)	.065	.002	0.33	64.21	73.91	0.3812

TABLE 2: Diagnostic value of PAR and CAR in predicting sepsis

PAR: procalcitonin-to-albumin ratio; CAR: C-reactive protein-to-albumin ratio

Day 0: day of admission, Day 2: second hospital day

Predictive value of PAR and CAR in predicting severe sepsis

The cut-off value obtained for PAR was 16.37, with a sensitivity of 50% and a specificity of 78.8% on the day of admission. The cut-off value for CAR was 0.403, with a sensitivity of 69% and a specificity of 54.3% on the day of admission. The values of day 2 and day 7 of admission are given in Table 3.

Variables	AUC (95% CI)	P Value	Sensitivity	Specificity	Youden index	Cut off value
PAR -0	0.602 (0.473-0.731)	0.114	50	78.8	28.8	16.3
PAR -2	0.642 (0.519-0.764)	0.028	46.2	80.4	26.6	16.9
PAR -7	0.701 (0.588-0.813)	0.002	53.8	80.4	34.2	1.3
CAR- 0	0.606 (0.483-0.730)	0.098	69.200	54.3	23.5	0.403
CAR -2	0.701 (0.582-0.821)	0.002	57.700	80.4	38.1	0.632
CAR -7	0.599 (0.475-0.724)	0.123	80.800	40.2	21.0	0.028

TABLE 3: Diagnostic value of PAR and CAR for predicting severe sepsis

PAR: procalcitonin-to-albumin ratio; CAR: C-reactive protein-to-albumin ratio

PAR 0: PAR on the day of admission; PAR 2: PAR on day 2 of admission; PAR 7: PAR on day 7 of admission; CAR 0: CAR on the day of admission; CAR 2: CAR on day 2 of admission; CAR 7: CAR on day 7 of admission

The prediction of severe sepsis was assessed using AUC. As shown in Figures 2, 3, the AUC of PAR and CAR for predicting severe sepsis are 0.602 (95%CI: 0.473-0.731) and 0.606 (95%CI: 0.483-0.730), respectively.

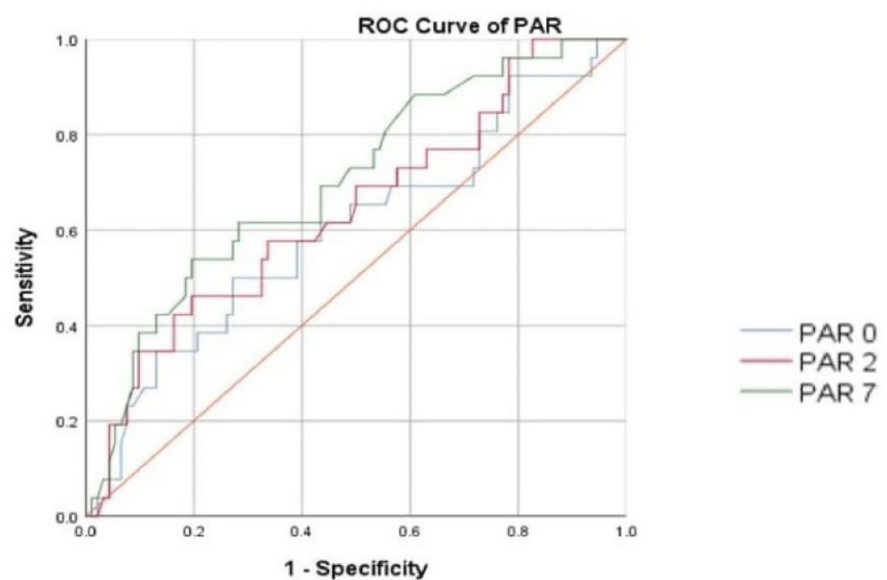


FIGURE 2: ROC of PAR in predicting severe sepsis

PAR: procalcitonin-to-albumin ratio

0: day of admission; 2: day 2 of admission; 7: day 7 of admission

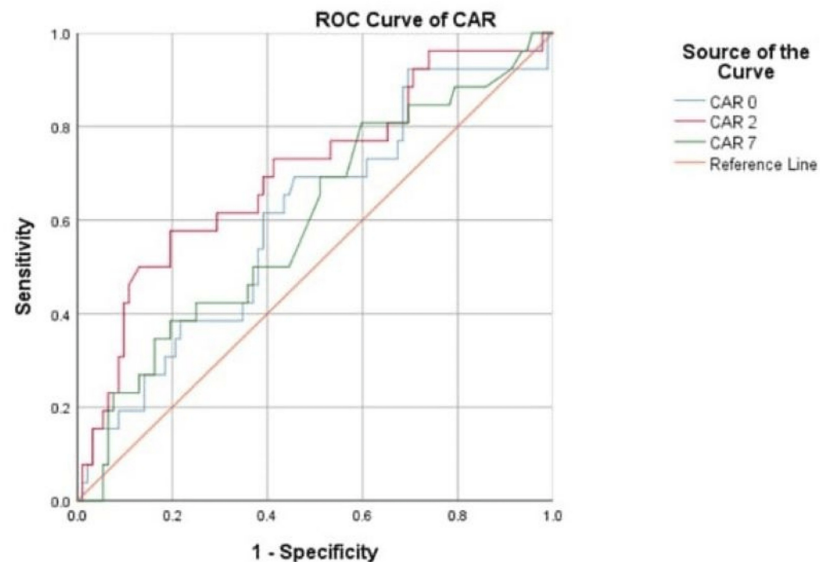


FIGURE 3: ROC of CAR in predicting severe sepsis

CAR: C-reactive protein-to-albumin ratio

0: day of admission; 2: day 2 of admission; 7: day 7 of admission

Discussion

Early diagnosis of pediatric sepsis is of utmost importance for timely management and good outcome. In this cohort, we have studied the role of combined biomarkers like PAR and CAR for detecting sepsis and its severity in the pediatric population.

In our study, CAR was significant in predicting sepsis and also the severity of sepsis on day 2 of admission. The optimal cut-off value for CAR on admission was 0.31 (sensitivity 67.3% and specificity 65.2%), and day 2 of admission was 0.33 (sensitivity 64.2% and specificity 73.9%). According to a study by Wang et al., the clinical value of CAR in diagnosing pediatric sepsis revealed AUC of 0.809, sensitivity of 68% and specificity of 95% with cut-off of 0.41 [17], which is similar to our study.

In our study, the ROC curve analysis of CAR showed an AUC of 0.709 (p -value < 0.05) for predicting sepsis and an AUC of 0.701 (p -value < 0.05) for severe sepsis on day 2 of admission, which shows a good discriminatory ability in predicting pediatric sepsis. A similar finding was established by Li et al. in predicting neonatal sepsis (AUC=0.74, p -value < 0.01) and its severity (AUC=0.70, p -value < 0.001) [10].

The diagnostic efficacy of PCT in sepsis is well established; hence, we have combined ALB with PCT to recognize the superior diagnostic performance between the two. In our study, the diagnostic performance of PAR showed a cut-off value of 13.5 on the day of admission (sensitivity 49.4% and specificity 95.6%) and 13.22 on day 2 of admission (sensitivity 44.7% and specificity 100%). According to Li et al., there was a strong correlation between PAR with neonatal SOFA score and prolonged length of hospital stay in neonatal sepsis [11]. The cut-off value in their study was more than equal to 0.065 with sensitivity 64%, specificity 72%, AUC 0.72, and p -value < 0.001 for predicting neonatal sepsis. However, in our study, the ROC curve analysis of PAR in predicting sepsis shows an AUC of 0.730 on the day of admission and an AUC of 0.764 on day 2 of admission.

We have also derived a correlation of PAR with sepsis severity. PAR was significant in detecting sepsis severity on day 2 and day 7 of admission. The cut-off value for predicting sepsis severity on day 2 of admission was 16.97 with sensitivity of 46% and specificity 80%, which is statistically significant with a p -value of 0.02; hence, our study shows higher PAR value is associated with the presence of sepsis and its severity.

There is no study of PAR in correlation with pediatric sepsis and its severity. However, a study by Ho et al. analyzes the 28-day mortality prediction in pediatric sepsis [18]. This was a retrospective study comparing the usefulness of lactate/ALB ratio, CAR and PAR in which the ROC curve analysis for 28-day mortality showed an AUC of 0.533 and cut-off value of 4.15 (sensitivity 60%, specificity 46%).

The novelty of this study lies in the analysis of the role of CAR and PAR in pediatric sepsis and also the comparison between them to find out which has a superior diagnostic value. This dual approach allowed us to assess not only the individual contributions of biomarkers but also their combined diagnostic efficacy, shedding light on their potential clinical utility.

We determined the optimal cut-off values specific to this study population, which is one of the limitations of our study. Moreover, our study was constrained by a small sample size, and the cost burden was heightened due to the necessity of conducting tests three times. Furthermore, our study was conducted at a single center, potentially limiting the generalizability of our findings to the specific geographical area.

Conclusions

The study demonstrates that the PAR and CAR are valuable diagnostic markers for predicting sepsis in children. On the day of admission, PAR showed a higher specificity compared to CAR, making it a reliable marker for ruling in sepsis, while CAR exhibited greater sensitivity for detecting cases. The ROC curve analysis indicated moderate diagnostic accuracy for both. These findings suggest that PAR and CAR can complement traditional markers in diagnosing pediatric sepsis and its severity and help in reducing sepsis-related mortality with PAR being particularly useful in identifying more severe cases. Further research is warranted to validate these markers and explore their prognostic utility over time.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mukesh K. Jain, Vetsa Snigdha Hasa, Bandya Sahoo, Manas R. Behera, Sibabratta Patnaik

Acquisition, analysis, or interpretation of data: Mukesh K. Jain, Vetsa Snigdha Hasa, Bandya Sahoo, Manas R. Behera, Sibabratta Patnaik

Drafting of the manuscript: Mukesh K. Jain, Vetsa Snigdha Hasa, Bandya Sahoo, Manas R. Behera, Sibabratta Patnaik

Critical review of the manuscript for important intellectual content: Mukesh K. Jain, Vetsa Snigdha Hasa, Bandya Sahoo, Manas R. Behera, Sibabratta Patnaik

Supervision: Mukesh K. Jain, Vetsa Snigdha Hasa, Bandya Sahoo, Manas R. Behera, Sibabratta Patnaik

Disclosures

Human subjects: Consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee of Kalinga Institute of Medical Sciences issued approval KIMS/SLRC/PG/2022/79, dated June 24, 2022. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Miranda M, Nadel S: Pediatric sepsis: a summary of current definitions and management recommendations . *Curr Pediatr Rep.* 2023, 11:29-39. [10.1007/s40124-023-00286-3](https://doi.org/10.1007/s40124-023-00286-3)
2. Lanziotti VS, Póvoa P, Soares M, Silva JR, Barbosa AP, Salluh JI: Use of biomarkers in pediatric sepsis: literature review. *Rev Bras Ter Intensiva.* 2016, 28:472-82. [10.5935/0103-507X.20160080](https://doi.org/10.5935/0103-507X.20160080)
3. Vijayan AL, Vanimaya, Ravindran S, Saikant R, Lakshmi S, Kartik R, G M: Procalcitonin: a promising diagnostic marker for sepsis and antibiotic therapy. *J Intensive Care.* 2017, 5:51. [10.1186/s40560-017-0246-8](https://doi.org/10.1186/s40560-017-0246-8)
4. Chen L, Wu X, Qin H, Zhu H: The PCT to albumin ratio predicts mortality in patients with acute kidney injury caused by abdominal infection-evoked sepsis. *Front Nutr.* 2021, 8:584461. [10.3389/fnut.2021.584461](https://doi.org/10.3389/fnut.2021.584461)
5. Luo X, Yang X, Li J, et al.: The procalcitonin/albumin ratio as an early diagnostic predictor in discriminating urosepsis from patients with febrile urinary tract infection. *Medicine (Baltimore).* 2018, 97:e11078. [10.1097/MD.00000000000011078](https://doi.org/10.1097/MD.00000000000011078)
6. Wang S, Chen D: The correlation between procalcitonin, C-reactive protein and severity scores in patients with sepsis and their value in assessment of prognosis [Article in Chinese]. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue.* 2015, 27:97-101. [10.3760/cma.j.issn.2095-4352.2015.02.004](https://doi.org/10.3760/cma.j.issn.2095-4352.2015.02.004)

7. Wang QY, Lu F, Li AM: The clinical value of high mobility group box-1 and CRP/Alb ratio in the diagnosis and evaluation of sepsis in children. *Eur Rev Med Pharmacol Sci.* 2022, 26:6361-6. [10.26355/eurrev_202209_29662](https://doi.org/10.26355/eurrev_202209_29662)
8. Jacobs L, Wong HR: Emerging infection and sepsis biomarkers: will they change current therapies? . *Expert Rev Anti Infect Ther.* 2016, 14:929-41. [10.1080/14787210.2016.1222272](https://doi.org/10.1080/14787210.2016.1222272)
9. Park JE, Chung KS, Song JH, et al.: The C-reactive protein/albumin ratio as a predictor of mortality in critically ill patients. *J Clin Med.* 2018, 7:333. [10.3390/jcm7100333](https://doi.org/10.3390/jcm7100333)
10. Li T, Li X, Wei Y, et al.: Predictive value of c-reactive protein-to-albumin ratio for neonatal sepsis . *J Inflamm Res.* 2021, 14:3207-15. [10.2147/JIR.S321074](https://doi.org/10.2147/JIR.S321074)
11. Li T, Li X, Liu X, et al.: Association of procalcitonin to albumin ratio with the presence and severity of sepsis in neonates. *J Inflamm Res.* 2022, 15:2313-21. [10.2147/JIR.S358067](https://doi.org/10.2147/JIR.S358067)
12. Sanders S, Barnett A, Correa-Velez I, Coulthard M, Doust J: Systematic review of the diagnostic accuracy of C-reactive protein to detect bacterial infection in nonhospitalized infants and children with fever. *J Pediatr.* 2008, 153:570-4. [10.1016/j.jpeds.2008.04.023](https://doi.org/10.1016/j.jpeds.2008.04.023)
13. Hu R, Gong Y, Wang Y: Relationship of Serum Procalcitonin Levels to Severity and Prognosis in Pediatric Bacterial Meningitis. *Clin Pediatr (Phila).* 2015, 54:1141-4. [10.1177/0009922815569203](https://doi.org/10.1177/0009922815569203)
14. Downes KJ: Procalcitonin in pediatric sepsis: what is it good for? . *J Pediatric Infect Dis Soc.* 2021, 10:1108-10. [10.1093/jpids/piab066](https://doi.org/10.1093/jpids/piab066)
15. Mohd Amin AT, Zaki RA, Friedmacher F, Sharif SP: C-reactive protein/albumin ratio is a prognostic indicator for predicting surgical intervention and mortality in neonates with necrotizing enterocolitis. *Pediatr Surg Int.* 2021, 37:881-6. [10.1007/s00383-021-04879-1](https://doi.org/10.1007/s00383-021-04879-1)
16. Ranzani OT, Zampieri FG, Forte DN, Azevedo LC, Park M: C-reactive protein/albumin ratio predicts 90-day mortality of septic patients. *PLoS One.* 2013, 8:e59321. [10.1371/journal.pone.0059321](https://doi.org/10.1371/journal.pone.0059321)
17. Wang J, Zhao K, Mao X, Zhang Y, Shao J, Fan W, Wang Y: Relationship between CRP albumin ratio and the mortality in critically ill patients with aki: a retrospective observational study. *Biomed Res Int.* 2021, 2021:9957563. [10.1155/2021/9957563](https://doi.org/10.1155/2021/9957563)
18. Yoo KH, Choi SH, Suh GJ, et al.: The usefulness of lactate/albumin ratio, C-reactive protein/albumin ratio, procalcitonin/albumin ratio, SOFA, and qSOFA in predicting the prognosis of patients with sepsis who presented to EDs. *Am J Emerg Med.* 2024, 78:1-7. [10.1016/j.ajem.2023.12.028](https://doi.org/10.1016/j.ajem.2023.12.028)