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ORIGINAL RESEARCH

PCT/ALB Ratio in Initial Three days for the Prediction of Secondary Infection in Septic Patients

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Background: Procalcitonin (PCT) to albumin (ALB) ratio (PAR) in initial three days is a rapidly available indicator to assess the prognosis of patients with sepsis. This study aims to explore the correlation between changes in PAR during the initial 72 hours and the incidence of secondary infections.

Methods: A total of 147 patients with sepsis were included in this study. Patients divided into secondary infection and without secondary infection group, according to whether they had secondary infection. PAR was calculated as serum PCT (ng/mL)/ALB (mg/mL). All statistical analyses were performed using the statistical package SPSS 20.0.

Results: Compared with the without secondary infection group, the median APACHE II (22[17–30] vs 16[11–25]; p=0.009) were significantly higher in the secondary infection group. And the median ΔPCT/ALB adm-72h (0.10[0.02–0.48] vs 0.17[0.03–0.65]; p=0.011) were significantly lower in the secondary infection group. On multiple logistic regression, lower ΔPCT/ALB adm-72h was independently associated with the secondary infection. Decreasing quartile of ΔPCT/ALB adm-72h was statistically significantly associated with secondary infection, particularly among survivors.

Conclusion: The decline in the PCT/ALB ratio over the initial 72 hours of the acute phase of sepsis serves as an association for the onset of secondary infections during a septic patient's hospitalization.

Keywords: sepsis, PCT, secondary infection, biomarker

Introduction

Sepsis is life-threatening organ dysfunction due to a dysregulated host response to infection. In 2017, approximately 48·9 million incident cases of sepsis were recorded worldwide and 11·0 million sepsis-related deaths were reported, accounting for 19.7% of all global fatalities.[1] Patients with sepsis frequently undergo treatment with broad-spectrum antibiotics, are subjected to invasive procedures, and receive immune-modulating therapies while in the intensive care unit (ICU), which may weaken their immune systems and elevate the risk of subsequent infections. In addition to extending ICU stays, these infections also lead to considerable financial burdens.[2] Therefore, it is crucial to identify and stratify treatment for this patient group.

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Emerging techniques such as flow cytometry can assess immune cell function to predict secondary infections.[3] However, this method is complex and costly. Multiple studies have showed that Procalcitonin (PCT) is a valuable biomarker for diagnosing sepsis and guiding antibiotic therapy, but relying on a single indicator to predict secondary infection is challenging.[4] Deng et al proposed using the albumin/procalcitonin (ALB/PCT) ratio to predict bloodstream infections in patients with cerebral hemorrhage, demonstrating that combining markers can enhance predictive value.[5]

During inflammation and sepsis, the production of PCT follows an entirely different pathway, details of which are not fully understood. Several studies have shown the production of PCT in response to bacterial Lipopolysaccharide (LPS) or other endotoxins and to inflammatory markers like IL-6, IL-2, etc.[6] Albumin (ALB) is a protein synthesized by the liver hepatocytes and makes up 40~60% of the total proteins in plasma protein. ALB is the main protein responsible for maintaining the colloid-osmotic pressure and can act as a transporter of several endogenous and exogenous compounds. Moreover, as a nutritional indicator, ALB is closely associated with immunocompromised conditions.[7]

In recent years, multiple studies have demonstrated that the PCT/ALB ratio (PAR) is a rapidly available indicator to assess the prognosis of patients with sepsis.[8] PCT is an infection indicator that usually represents the inflammatory response of the body, while ALB has been reported in literature to be possibly related to immune dysfunction. Studies have found that treatment with albumin reduces systemic inflammation and circulatory dysfunction in patients with decompensated cirrhosis.[9] These two indicators reflect two different aspects of the body's immunity and inflammation, and their ratio may amplify the effect of reflecting the body's immunity and inflammation.[5] This synergistic approach significantly improves the precision of prognostic predictions and clinical utility. It facilitates the early detection of sepsis, enables accurate assessment of patient severity and prognosis, and informs clinical decision-making processes. However, there is a lack of studies on the detection of secondary infection through PCT/ALB ratio in initial 3 days. This study will investigate the effect of initial 72 hours changes (ΔPCT/ALB adm-72h) in PAR on sepsis prognosis and active secondary infection.

Materials and Methods

Data Collection

The present prospective observational study was conducted with approval from Guangdong Provincial People's Hospital Ethics Committee in a general intensive care unit (ICU) of Guangdong Provincial People's Hospital. Written informed consent was provided by the patient or legal proxy before enrollment. The study was performed during the period from July 2016 to February 2021. This study meets the requirements of medical ethics and has been reviewed by the Ethics Review Committee of Guangdong Provincial People's Hospital (Ethics Number: 2015374H). This study adheres to the ethical principles of the Declaration of Helsinki.

Baseline characteristics included demographic characteristics, laboratory results, vital signs, the primary source of infections, and disease severity. They were recorded within 24 hours after admission of patients satisfying the criteria of sepsis-3 including those with confirmed or suspected infection who had an increase in sequential organ failure assessment (SOFA) score by 2points or more from baseline.[10] Meanwhile, patients were enrolled based on the inclusion and exclusion criteria within 5 days of sepsis onset. The severity of illness was evaluated using the Acute Physiology and Chronic Health Evaluation II (APACHE II), and SOFA scores. The patients were followed for at least 28 days after enrollment. Based on the mortality within 28 days and occurrence of secondary infection, participants were divided into 2 groups: the without secondary infection group and secondary infection group. The primary outcome was without secondary infection. Secondary outcomes were mortality within 28 days, length ICU stay and length hospital stay.

Population Selection Criteria and Definitions

The inclusion criteria comprised adult sepsis patients with community-acquired infection (≥18-years-old) who met the sepsis 3.0 criteria. Patients were excluded if any of the following criteria were fulfilled: end-stage of chronic disease, with autoimmune disease, cancer, or long-term use of immune suppressants, the onset time was >5 days, or if consent could not be obtained. These conditions may influence the immune status and prognosis of patients, potentially interacting with sepsis treatments and outcomes. Consequently, they can impact the precision of research methodologies and the

assessment of therapeutic efficacy. All patients were evaluated in the ICU on day 1 (within 24 h after admission) and administered conventional therapy according to the 2016 international guidelines for the management of severe sepsis and septic shock.[9]

Secondary infection is defined as follows: (1) an infection acquired after 48 hours of patient admission to a given hospital resulting from delivering healthcare services to patients; there must be no evidence that the infection was present or incubating at the time of admission;[11] (2) a direct connection with the previous hospitalization; (3) a new infection showed up in other parts that based on the original infections (except for septic foci transfer elsewhere) or other pathogens were isolated from the primary source of infection (eliminate contamination and original mixed bacteria); and (4) potential infections activated by diagnostic and therapeutic measures, such as herpes virus and tuberculosis infection. The most common intent infections are pulmonary infection, urinary tract infection, bloodstream infection, and catheter-related infections.

Statistical Analysis

We reported the number and percentage of patients as categorical variables, and the median (first quartile [Q1]; third quartile [Q3]) as continuous variables. Categorical variables were compared using the chi-squared test or Fisher's exact test, whereas continuous variables were compared using the nonparametric Mann–Whitney *U*-test.

We assessed the association of quartile of ΔPCT/ALB adm-72h with primary and secondary outcomes using multivariate logistic regression, and we report the odds ratios (ORs) and 95% confidence intervals (CIs). We used the Bonferroni method to perform post hoc multiple comparison correction among four groups. SPSS (version 20.0) was used for the collected data analyses. An α level of 0.05 was used for all analyses. To ensure the accuracy and completeness of the data, we remove outliers through data cleaning and use median filling to fill in the missing data.

Result

Baseline Characteristics and PCT/ALB Ratio in Initial 3 days

In total, the Intensive Care Unit of Guangdong Provincial People's Hospital admitted a total of 366 adult patients with sepsis. According to pre-specified criteria, 208 patients were excluded for having an onset time greater than 5 days, or for having autoimmune diseases, immunodeficiency, or long-term use of immunosuppressants, or having cancer, or for being unable to obtain consent. Ultimately, 158 participants were included in the study. One participant was lost to follow-up, and 10 patients were excluded from the final analysis due to the diagnosis of cancer and autoimmune disease (Figure 1). This yielded a study cohort of 147 participants: 104 in the without secondary infection group and 43 in the secondary infection group. The median age of the patients was 66 years, ranging from 18 to 86 years. Of these, 38 died within 28 days. The median APACHE II (22[17–30] vs 16[11–25]; p=0.009) were significantly higher in the secondary infection group. And the median ΔPCT/ALB adm-72h (0.10[0.02–0.48] vs 0.17[0.03–0.65]; p=0.011) were significantly lower in the secondary infection group. The secondary infection patients were more likely to indwelling the endotracheal intubation (90.69% vs 67.31%; p=0.002). The baseline characteristics of the study patients are summarized in Table 1. The primary source of infection was shown in supplementary material: Table S1. The critical laboratory date in survivors and without survivors was presented in supplementary material: Table S2.

ΔPCT/ALB Adm-72h as an Independent Predictor of Secondary Infection in Patients With Sepsis

Multivariable logistic analysis revealed that the ΔPCT/ALB adm-72h (odds ratio [OR] 2.370; 95% confidence interval [CI] 1.138–4.935; p = 0.02] and mechanical ventilation (OR 6.639; 95% CI 1.888–23.351; p = 0.003) were independent predictors of secondary infection, allowing differentiation of patients with such infection from those without, these results are presented in supplementary material: Table S3.

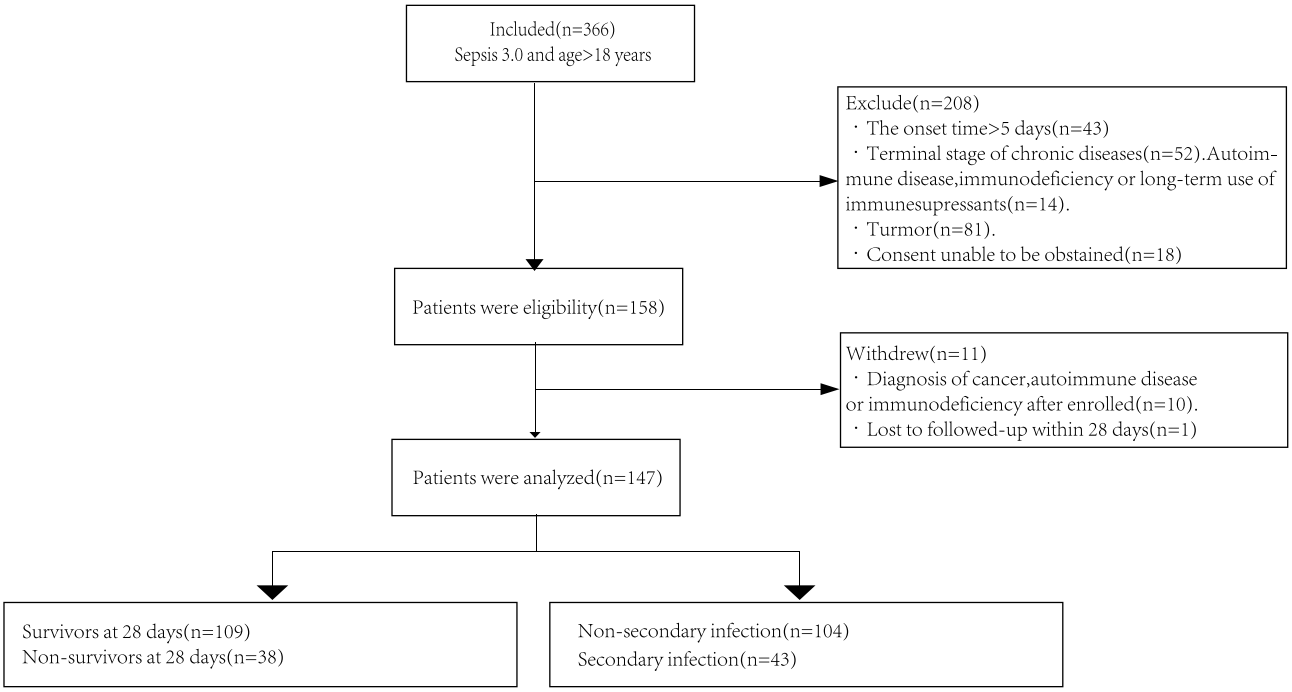


Figure 1 Schematic of the study.

Associations Between ΔPCT/ALB Adm-72h and the Secondary Infection

According to the quartile of ΔPCT/ALB adm-72h, patients were divided into four groups: group 1 (>0.49), group 2 (0.15–0.48), group 3 (0.02–0.14) and group 4(<0.02). The clinical and laboratory data of the study patients based on quartile of ΔPCT/ALB adm-72h are presented in Table 2. There was a statistically significant increase in secondary infection rate in group 3 and group 4. We conducted post hoc multiple comparisons and found differences between the first group, second group, and fourth group through Fisher's exact test; There are differences between the second, third, and fourth groups, while there is no difference between the first and third groups. Given that some patients died early before secondary infection could be detected, further analysis was performed to avoid bias. The further analysis showed that surviving patients had a significant increasing trend for secondary infection rate in surviving patients, length of hospital stay and length of ICU with increasing quartile of ΔPCT/ALB adm-72h. These results are presented in Figure 2 and supplementary materials: Figure S1. The 28-day mortality rates for various groups are detailed in supplementary materials: Table S4.

Discussion

In this study, we investigated the potential of ΔPCT/ALB adm-72h as a distinguishing marker for septic patients with secondary infections. Our results suggest a correlation between ΔPCT/ALB adm-72h and secondary infections, but not with 28-day mortality in sepsis patients. Notably, the ΔPCT/ALB adm-72h stratification effectively recognizes septic patients with secondary infections, particularly among survivors.

Secondary infections are often challenging to predict, especially in septic patients. C-reactive protein (CRP), another acute inflammatory protein, has not shown a correlation with hospitalization when considering the PCT/ALB ratio in initial 3 days. Firstly, the elevation of CRP levels in response to inflammation typically occurs over an extended period. Secondly, CRP's low sensitivity to infection and its responsiveness to early noninfectious inflammation. This lack of correlation may be attributed to changes in initial CRP levels in septic patients, which can result from trauma, surgical tissue damage, subsequent thrombosis, and ventilator-related lung injury, among other factors.[11] Luo et al also reported that CRP/ALB was not a reliable indicator, failing to discriminate between urosepsis and febrile urinary tract infection.[12]

Table 1 Baseline Characteristics and PCT/ALB Ratio in Initial 3 days

Demographic Characteristics	All (n=147)	Secondary Infection (n=43)	Without Secondary Infection (n=104)	*p*
Female, n (%)	51(34.7)	12(27.9)	39(37.5)	0.342
Age (years)	66(55–78)	64(57–77)	68(55–78)	0.703
Vital signs				
T (°C)	36.7(36.5–37.1)	36.5(36.5–37.1)	36.8(36.5–37.1)	0.184
Heart rate (bpm)	96(83–110)	90(82–105)	98(83–112)	0.218
MAP (mmHg)	88(81–97)	88(82–99)	87(80–97)	0.584
Laboratory data				
WBC ($\times10^9$/L)	14.31(9.04–20.90)	12.24(9.41–17.12)	14.60(8.90–22.02)	0.181
Neutrophil ($\times10^9$/L)	12.24(7.79–18.91)	10.95(8.13–15.00)	12.63(7.21–20.28)	0.171
PLT ($\times10^9$/L)	116.0(69.5–186.0)	116.0(63.8–181.8)	116.0(71.0–193.0)	0.683
PCT (ng/mL)	18.8(6.1–50.9)	14.4(6.3–30.5)	21.2(5.8–73.6)	0.061
PCT 72 h(ng/mL)	8.52(3.02–25.9)	8.52(2.5–27.38)	8.68(3.25–25.25)	0.959
ALB at adm (g/L)	35.3(31.6–40)	35.8(31.58–39.93)	34.9(31.6–40.1)	0.816
ALB 72h (g/L)	36.5(33.05–39.5)	37(33.58–39.43)	36.2(32.6–39.5)	0.326
PCT/ALB adm	0.55(0.17–1.4)	0.46(0.19–0.83)	0.63(0.16–1.85)	0.066
PCT/ALB 72 h	0.24(0.08–0.71)	0.25(0.07–0.71)	0.24(0.09–0.71)	0.898
ΔPCT/ALB adm-72h	0.14(0.02–0.48)	0.10(0.01–0.24)	0.17(0.03–0.65)	0.011
CRP (mg/L)	144.8(77.1–200)	140.7(73.5–200.0)	144.8(78.9–200.0)	0.504
CRP72h (mg/L)	112.5(62.36–174.46)	122.1(68.76–173.88)	111.75(61.57–174.53)	0.550
CRP/ALB adm	4.14(2.25–5.29)	4.05(1.96–5.32)	4.26(2.30–5.27)	0.748
CRP/ALB 72h	3.07(1.75–4.59)	3.15(1.75–4.68)	3.02(1.74–4.47)	0.568
ΔCRP/ALB adm-72h	0.50(0.04–1.16)	0.56(0.42–1.53)	0.49(0.06–1.42)	0.822
LAC (mol/L)	1.8(1.2–3.3)	1.8(1.1–2.8)	1.7(1.2–3.5)	0.578
Indwelling urinary catheters, n (%)	147(100)	43(100)	104(100)	1.000
Indwelling the central venous catheter, n (%)	144(97.96)	43(100)	101(97.12)	0.868
Indwelling the endotracheal intubation[a], n (%)	110(74.83)	39(90.69)	70(67.31)	0.002
Severity of illness				
SOFA scores	7(5–9)	8(6–10)	7(4–9)	0.067
APACHE II score	20(12–26)	22(17–30)	16(11–25)	0.009
Outcomes				
Length of ICU stay (days)	8.5(5.0–15.4)	13.5(7.6–31.0)	7.0(4.0–11.0)	<0.001
Length of hospital stay (days)	15.0(9.0–22.0)	19.9(12.8–29.9)	13.0(8.0–20.0)	0.002
28 days mortality	38(25.9)	11(25.6)	27(26)	0.962

Note: [a]All patients received mechanical ventilation.
Abbreviations: APACHE, acute physiology and chronic health evaluation; SOFA, sequential organ failure assessment; ICU, ICU intensive care unit.

The prognostic utility of the ALB/PCT ratio in neonatal sepsis was demonstrated by Tiewei Li et al.[8] Deng et al proposed using the albumin/procalcitonin (ALB/PCT) ratio to predict bloodstream infections in patients with cerebral hemorrhage, demonstrating that combining markers can enhance predictive value.[5] These studies underscore the reliability of changes in the PCT to albumin ratio as a predictor of sepsis progression. To date, the predictive value of the temporal fluctuations in the PCT/ALB ratio for secondary infections among patients with sepsis remains unclear.

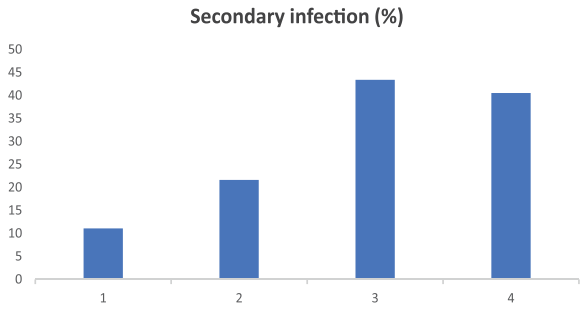
Our studies have shown the feasibility of using PCT/ALB or ALB/PCT to improve the accuracy of biomarker prediction. The application of ΔPCT/ALB adm-72h is an association with secondary infections could be attributed to several factors. Firstly, patients exhibiting significant changes in the ΔPCT/ALB adm-72h often presented with higher initial PCT values, implying the likelihood of bacterial infections, especially in gram-negative bacilli. These patients may benefit more from antibiotic therapy. In contrast, patients in groups 3 and 4 showed lower initial PCT values with no difference in disease severity, suggesting infections with opportunistic pathogens.[13] A smaller change in PCT could indicate ineffective anti-infective treatment, potentially prolonging hospital stay and increasing the risk of secondary infection.

Table 2 Clinical Features, Severity of Illness and Prognosis across Quartiles of ΔPCT/ALB Adm-72h

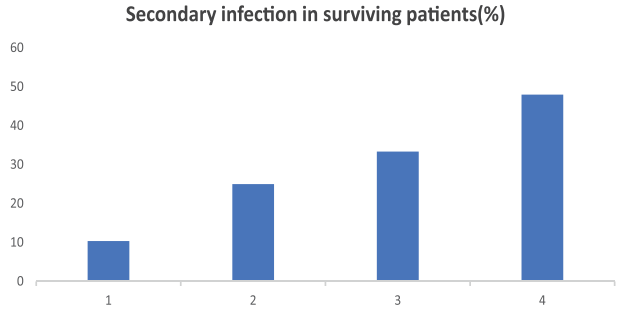
	All Patients (n=147)	Groups Based on ΔPCT/ALB adm-72h			
		Group 1 (n=36)	Group 2 (n=37)	Group 3 (n=37)	Group 4 (n=37)
Laboratory date					
PCT (ng/mL)	18.8(6.1–50.9)	34.5(72.32–150.18)	18.27(13.08–29.31)	6.43(4.02–18.8)	5.8(2.20–33.80)
PCT 72 h(ng/mL)	8.52(3.02–25.9)	15.09(6.13–48.07)	8.33(5.68–20.58)	3.24(2.10–12.80)	10.48(1.87–34.70)
ALB at adm (g/L)	35.3(31.6–40)	33.6(31.0–39.6)	33.8(31.4–37.0)	35.4(32.2–38.1)	38.7(34.8–41.1)
ALB 72h (g/L)	36.5(33.05–39.5)	36.6(33.1–38.9)	36.6(34.8–39.2)	37.0(32.2–40.4)	35.2(33.0–39.5)
PCT/ALB adm	0.55(0.17–1.4)	1.845(1.045–4.125)	0.55(0.41–0.80)	0.20(0.11–0.48)	0.17(0.06–0.86)
PCT/ALB 72 h	0.24(0.08–0.71)	0.496(0.190–1.266)	0.2118(0.167–0.556)	0.084(0.53–0.355)	0.244(0.055–1.123)
Severity of illness					
SOFA scores	7(5–9)	7 (5–10)	7.00 (5–10)	6 (4–9)	7 (5–10)
APACHE II scores	19.5(12–26)	15.00 (10.5–21.5)	17.00 (12.5–22.5)	21 (9.75–30.25)	22 (15–27)
Outcomes					
Length ICU stay (days)	8.54(5–15.42)	6.00 (4–14)	7.15 (4–12.1)	9.50 (6–19.88)	10.00 (5–23.5)
Length of hospital stay (days)	15(9–22)	13 (8–22)	14 (10–19)	17 (9–22)	18 (7–30)
28 days mortality (%)	38 (25.9)	8(22.2)	9(24.3)	10(26.3)	11(30.6)
Secondary infection (%)	43(29.25)	4(11.11)	8(21.62)	16(43.42)	15(40.54)
Secondary infection in surviving patients (%)	31(28.44)	3(10.34)	7(25)	9(33.33)	12(48)

Abbreviations: APACHE, acute physiology and chronic health evaluation; SOFA, sequential organ failure assessment; ICU, ICU intensive care unit.

Moreover, changes in albumin significantly influence ΔPCT/ALB adm-72h. Albumin, is produced by the liver and traditionally serves as a nutritional index reflecting the body's nutritional status. The exact mechanism of its elevation is unclear, but it could include several actions.[14] Albumin can cause elevated serum oncotic pressure, thereby attracting interstitial fluid and improving organ perfusion. Recent literature has shown a strong relationship between serum albumin concentration, disease severity, and mortality.[15] Hypoalbuminemia may be considered an independent risk factor for disease morbidity and mortality. Albumin levels are also indicative of an inflammatory state. Sepsis-induced capillary leakage and impaired lymphatic reflux contribute to albumin decline, leading to immune dysfunction and increased risk of secondary infections.[16] Lower albumin levels also impact antibiotic effectiveness due to specific pharmacokinetic (PK) and pharmacodynamic (PD) properties, potentially leading to underdosage, extended hospitalization, and increased risk of secondary infections.[17]



Group	Secondary infection(%)	Adjust OR(95% CI)	p
1	4(11.11)	Ref.	Ref.
2	8(21.62)	2.21(0.60-8.11)	0.233
3	16(43.42)	6.09(1.79-20.77)	0.004
4	15(40.54)	5.46(1.59-18.65)	0.007



Group	Secondary infection in surviving patients(%)	Adjust OR(95%CI)	p
1	3(10.34)	Ref.	Ref.
2	7(25)	1.61(0.95-2.72)	0.121
3	9(33.33)	1.96(1.26-3.02)	0.009
4	12(48)	2.40(1.44-4.00)	0.003

Figure 2 Secondary infection rate across quartiles of ΔPCT/ALB adm-72h (all patients and survivors).
Notes: According to the quartile of ΔPCT/ALB adm-72h, patients were divided into four groups: group 1 (< −0.48), group 2 (−0.49–0.14), group 3 (−0.15–0.02) and group 4 (>-0.02). Adjusted for variables including age, sex, SOFA score, APACHE-II score, the primary source of infection, indwelling catheters and mechanical ventilation at ICU admission.

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The ΔPCT/ALB adm-72h ratio may outperform PCT or ALB alone in assessing inflammation due to the amplifying effect of ALB on PCT's role. Serum albumin concentration is traditionally viewed as an indicator of nutritional status; however, it is also correlated with disease severity and mortality.[18] Albumin serves as a robust predictor of clinical outcomes because its levels typically decline during acute infections, a phenomenon often resulting from capillary leakage, which may also indicate inflammation.[19] Thus, albumin is utilized both to assess prognosis and to guide treatment decisions in a variety of diseases. Moreover, albumin exhibits notable antioxidant properties,[9] which can enhance microcirculatory blood flow and reduce albumin adhesion, contributing to its anti-inflammatory effects. Hypoalbuminemia may indicate immune dysfunction during sepsis, and studies have shown that albumin therapy reduces systemic inflammation and circulatory dysfunction in patients with decompensated cirrhosis.[20] The concentration of ALB may reflect the immune function status of patients, providing context for why the ΔPCT/ALB adm-72h ratio enhances the assessment of inflammation by PCT.[21] The ΔPCT/ALB adm-72h ratio is particularly sensitive to changes in the dynamic balance between inflammation and immune function, thereby offering a more precise prediction of the risk of secondary infections following sepsis. We conducted ROC analysis and found that PCT or ALB alone did not have predictive power, while the Δ PCT/ALB adm-72h ratio had (Figure S2).

Several reasons may explain why the changes in the ΔPCT/ALB adm-72h outperforms the static PCT/ALB index in predicting secondary infections following sepsis. Firstly, substantial individual variability exists among the patients studied, suggesting that a single absolute value at a specific point in time does not solely determine a patient's prognosis. Secondly, the specific treatment protocols implemented for each patient pre-hospitalization and post-hospitalization can significantly influence the PCT and ALB results. As a result, the change in initial ΔPCT/ALB adm-72h can effectively mirror the disease's progression and the patient's response to treatment, thereby serving as a more reliable index for gauging disease regression. Despite the robust predictive power of the PCT/ALB ratio for secondary infections post-sepsis, no existing research has proposed an appropriate threshold for this ratio. Given that most studies focus on different outcome indicators, the critical value of PCT/ALB will inevitably vary. To enhance its clinical utility, it is crucial to broaden the sample size in future research and establish the corresponding PCT/ALB thresholds for different outcome variables.

The Δ PCT/ALB adm-72h ratio's potential as a predictive tool for sepsis could be attributed to several mechanisms. Procalcitonin (PCT) serves as a biomarker for the inflammatory response during bacterial infections and sepsis, with elevated levels in sepsis patients indicating an inflammatory reaction to infection. Albumin (ALB) is essential for evaluating both the nutritional status and immune function of patients; in cases of sepsis, patients frequently exhibit hypoalbuminemia, which results from enhanced protein catabolism and reduced synthesis due to inflammatory processes. This ratio effectively captures the extent of both inflammation and nutritional deficit in septic patients, reflecting the severity of the associated pathophysiological alterations and multi-organ damage. Consequently, it serves as a conveniently valuable tool for predicting and assessing the prognosis of secondary infections in sepsis.

Limitations

Firstly, the data was sourced from patients admitted to both individual central and intensive care units, which resulted in a relatively small sample size. We are preparing to expand the queue and validate the research findings in the next step Secondly, due to the constraints of our study, we did not perform in vitro experiments to explore the relationship between PCT/ALB and systemic inflammation and immune function, which may affect the generalizability of our study's conclusions. Additionally, our analysis did not encompass factors such as patients' medical histories, potential comorbidities, glucocorticoids use, and invasive procedures, which may limit the comprehensiveness of our conclusions. Lastly, there is considerable heterogeneity among different infection sites and pathogens; however, we did not conduct subgroup analyses for these variations, potentially impacting the individualization of our research findings.

Conclusions

The decline in the PCT/ALB ratio in the initial 72 hours of the acute phase of sepsis serves as an association for the onset of secondary infections during a septic patient's hospitalization. The PCT/ALB ratio in the initial 72 hours could potentially be a practical and convenient marker for predicting secondary infections.

https://doi.org/10.2147/IDR.S502537

Abbreviations

ALB, Albumin; APACHE II, Acute Physiology and Chronic Health Evaluation II; CI, Confidence Interval; CRP, C-reactive protein; ICU, Intensive Care Unit; OR, Odds Ratio; PAR, Procalcitonin/Albumin Ratio; PD, Pharmacodynamic; PCT, Procalcitonin; PK, Pharmacokinetic; Q1, First Quartile; Q3, Third Quartile; SOFA, Sequential Organ Failure Assessment.

Data Sharing Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

The present prospective observational study was conducted with approval from Guangdong Provincial People's Hospital Ethics Committee (2018-424H-2). Informed consent was obtained from all patients or their legal proxy before enrollment.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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