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Comorbidity Patterns And Source Of Infection Among Sepsis And Septic Shock Patients: A Cross-Sectional Analysis

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Background: Sepsis and septic shock remain major contributors to intensive care unit (ICU) mortality worldwide. Comorbidities and infection sources significantly influence outcomes and diagnostic marker performance.

Aim and Objectives: To assess comorbidity distribution, infection sources, and diagnostic performance of procalcitonin (PCT) and C-reactive protein (CRP) in patients with sepsis and septic shock.

Material and Methods: A cross-sectional study was conducted on 80 participants (40 sepsis patients, 40 controls). Demographics, comorbidities, infection sources, and biomarker levels were recorded. ROC curve analysis evaluated diagnostic performance.

Results: Hypertension (22.5%), diabetes mellitus (25%), chronic lung disease (25%), and anemia (30%) were common comorbidities in sepsis. Septic shock occurred in 25% of patients. Pneumonia (30%), urinary tract infections (20%), and abdominal abscess (25%) were the most frequent infection sources. PCT demonstrated high diagnostic accuracy (AUC=0.93 for control vs sepsis), outperforming CRP (AUC=0.85).

Conclusion: Certain comorbidities, especially diabetes and chronic lung disease, were significantly more prevalent in sepsis. PCT showed superior diagnostic accuracy over CRP, particularly for differentiating sepsis from healthy controls.

Keywords: Sepsis, Septic Shock, Procalcitonin, C-Reactive Protein, Comorbidities, Infection Source.

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection and is a leading cause of death in ICUs globally【1】. Despite advances in critical care, sepsis mortality remains high, particularly when complicated by septic shock【2】. Early

diagnosis and risk stratification are essential for improved outcomes【3】. Comorbidities play a crucial role in sepsis susceptibility and prognosis【4】, with conditions like diabetes mellitus, chronic lung disease, and chronic kidney disease significantly increasing infection risk【5,6】.

Sources of infection vary geographically and influence sepsis severity【7】. Pneumonia, urinary tract infections, abdominal sepsis, and meningitis are common causes【8,9】. Identification of infection sources is vital for targeted therapy and antibiotic stewardship【10】.

Biomarkers such as procalcitonin (PCT) and C-reactive protein (CRP) have been widely studied for sepsis diagnosis【11】. PCT levels rise in response to bacterial infections and are associated with disease severity【12,13】, whereas CRP, an acute-phase reactant, increases in inflammatory states but is less specific for bacterial infection【14,15】. Previous studies have demonstrated the utility of PCT in differentiating bacterial sepsis from non-infectious causes of systemic inflammation【16】.

Several studies have compared PCT and CRP in ICU populations【17】, but limited data exist on their diagnostic performance alongside detailed comorbidity and infection source profiling in sepsis and septic shock patients in resource-limited settings【18】. This study aims to address this gap by evaluating comorbidities, infection sources, and biomarker performance in a cohort of ICU patients with sepsis and septic shock【19,20】.

MATERIAL AND METHODS

A cross-sectional study was conducted in the ICU of a tertiary care hospital over 12 months in the Department of Microbiology.

Study Population:

Eighty participants were enrolled—40 patients with sepsis and 40 healthy controls.

Inclusion Criteria:

1. Adults (≥18 years)
2. Diagnosis of sepsis according to Sepsis-3 criteria
3. Informed consent provided

Exclusion Criteria:

1. Immunosuppressive therapy
2. HIV/AIDS
3. Recent surgery within 4 weeks
4. Chronic inflammatory or autoimmune disorders

Data Collection:

Demographic data, comorbidities, infection sources, PCT, and CRP levels were recorded. Microbiological confirmation was performed using culture methods. PCT was measured via electrochemiluminescence immunoassay and CRP via immunoturbidimetry.

Statistical Analysis:

Data were analyzed using SPSS v25. ROC analysis determined biomarker diagnostic

performance. A p-value <0.05 was considered significant.

RESULTS

Among sepsis patients, hypertension (22.5%), diabetes mellitus (25%), chronic lung disease (25%), and anemia (30%) were most prevalent. Septic shock was diagnosed in 25% of cases. Pneumonia was the leading infection source (30%), followed by urinary tract infection (20%) and abdominal abscess (25%). PCT levels were significantly higher in culture-positive sepsis (15.39±14.53 ng/ml) compared to controls (0.17±0.23 ng/ml). CRP was elevated in sepsis but less discriminatory between culture-positive and culture-negative cases. ROC analysis showed PCT had superior accuracy for distinguishing sepsis from controls (AUC=0.93) compared to CRP (AUC=0.85).

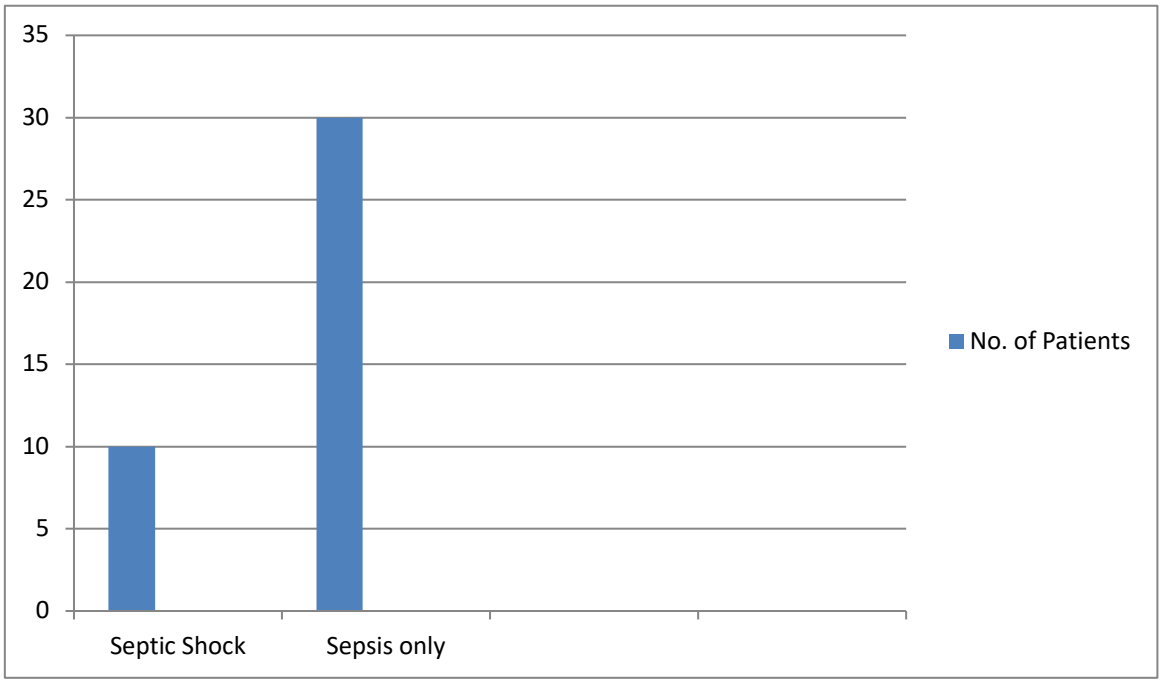
Table 1. Comorbidities Distribution

Comorbidity	**Sepsis (n=40)**	**Controls (n=40)**	**p-value (approx)**
Hypertension	9 (22.5%)	14 (35%)	0.10
Diabetes Mellitus	10 (25%)	0	<0.001
Chronic Lung Disease	10 (25%)	0	<0.001
Chronic Kidney Disease	4 (10%)	2 (5%)	0.35
Anaemia	12 (30%)	4 (10%)	<0.01
Acute Kidney Failure	13 (32.5%)	3 (7.5%)	<0.01
Chronic Liver Disease	6 (15%)	0	<0.01
Cancer	0	10 (25%)	<0.01
Epilepsy	1 (2.5%)	5 (12.5%)	0.04

Table 2. Septic Shock Distribution

Condition	**No. of Patients**	**Percentage**
Septic Shock	10	25%
Sepsis only	30	75%

Table 3. Source of Infection



Graph No. 1: Graphical representation of Source of Infection

Source	Sepsis (n=30)	Septic Shock (n=10)	p-value (approx)
Pneumonia	10 (33.3%)	2 (20%)	0.41
Urinary Tract Infection	6 (20%)	2 (20%)	1.0
Abdominal Abscess	6 (20%)	4 (40%)	0.09
Meningitis	5 (16.7%)	1 (10%)	0.63
Skin Wound	3 (10%)	2 (20%)	0.38

Table 4. Biomarkers Across Groups

Group	Mean PCT (ng/ml) (mg/L)	Median (IQR)	Mean CRP	Median (IQR)
Culture Positive	15.39 ± 14.53	8.96 (4.68–26.62)	40.22 ± 18.54	36.12 (26.38–54.33)

Culture Negative	4.84 ± 7.16	1.99 (0.41–6.16)	38.21 ± 18.84	34.53 (25.65–40.90)
Control	0.17 ± 0.23	0.049 (0.04–0.13)	14.80 ± 15.32	8.61 (2.64–20.62)

Table 5. ROC Diagnostic Performance of PCT

Comparison	AUC	Sensitivity	Specificity	Cut-off (ng/ml)
Control vs Sepsis	0.93	86.3%	86.3%	>0.393
Culture +ve vs Culture –ve	0.79	80.8%	72.2%	>3.53
Sepsis vs Septic Shock	0.76	100%	60.7%	>2.42

Table 6. ROC Diagnostic Performance of CRP

Comparison	AUC	Sensitivity	Specificity	Cut-off (mg/L)
Control vs Sepsis	0.85	100%	66.3%	>15.70
Culture +ve vs Culture -ve	0.53	46.2%	72.2%	>38.08
Sepsis vs Septic Shock	0.88	84.2%	85.2%	>39.43

DISCUSSION

The present study analyzed comorbidity patterns, infection sources, and biomarker performance among patients with sepsis and septic shock, revealing significant differences between the groups. Diabetes mellitus, chronic lung disease, anemia, acute kidney failure, and chronic liver disease were more prevalent among sepsis patients compared to controls, consistent with earlier studies highlighting these conditions as major predisposing factors for sepsis development [21-23]. Diabetes is known to impair immune function through alterations in neutrophil activity and cytokine production, predisposing individuals to severe infections [24]. Similarly, chronic lung disease increases susceptibility to pneumonia, which remains a common cause of sepsis worldwide [25].

Acute kidney injury was significantly more common in sepsis cases, in line with findings from

Hoste et al. [26] and Bagshaw et al. [27], who reported that renal dysfunction not only complicates sepsis but also increases mortality risk. Interestingly, cancer was more prevalent in the control group, possibly reflecting a different hospital admission profile or exclusion of patients with immunosuppressive chemotherapy from the sepsis cohort.

Regarding infection sources, pneumonia was the most frequent, followed by urinary tract infections, abdominal abscesses, and meningitis. This aligns with a global systematic review indicating that respiratory tract infections are the predominant source of sepsis, particularly in ICU settings [28,29]. The observed rate of abdominal abscesses was higher in septic shock patients, suggesting that intra-abdominal infections may contribute to more severe clinical deterioration, as noted in studies by Mazuski et al. [30].

Biomarker analysis revealed that procalcitonin (PCT) was significantly elevated in sepsis and septic shock compared to controls, with a high diagnostic accuracy (AUC 0.93) for distinguishing sepsis from controls. These results corroborate prior studies that identified PCT as a sensitive and specific marker for bacterial sepsis [31–33]. CRP levels were also elevated in sepsis but demonstrated lower specificity compared to PCT, consistent with the work of Pierrakos and Vincent [34] and Meisner [35]. The cut-off value of >0.393 ng/ml for PCT provided optimal sensitivity and specificity, aligning with findings from Assicot et al. [36] and Becker et al. [37].

Interestingly, PCT demonstrated better discrimination between culture-positive and culture-negative sepsis cases than CRP, reinforcing its utility in guiding antibiotic initiation, as supported by Schuetz et al. [38]. ROC analysis showed that both PCT and CRP could differentiate sepsis from septic shock, though PCT sensitivity was higher. This supports recommendations from recent sepsis management guidelines advocating for PCT as an adjunct diagnostic tool in critically ill patients [39, 40].

Overall, our findings emphasize the importance of comorbidity screening, early infection source identification, and biomarker-based diagnostic strategies in improving sepsis outcomes. The higher prevalence of chronic illnesses among sepsis patients highlights the need for targeted preventive interventions in high-risk populations.

CONCLUSION

Diabetes, chronic lung disease, and anemia were significant comorbidities among sepsis patients, with pneumonia and abdominal abscess as leading infection sources. PCT was superior to CRP in diagnosing sepsis, emphasizing its role in early detection and management.

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study
Consent to participate: There is consent to participate.
Consent for publication: There is consent for the publication of this paper.
Authorscontributions: Author equally contributed the work.

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