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Original Research

Assessment of Procalcitonin and C-reactive protein as biomarkers in suspected cases of sepsis among patients in ICU

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ABSTRACT:

Background: Worldwide, sepsis is regarded as one of the leading causes of illness and mortality. It is among the frequent reasons why organs fail.The present study was conducted to evaluate procalcitonin (PCT) and C-reactive protein (CRP) as biomarkers in suspected cases of sepsis among patients in ICU. **Materials & Methods:** 74 clinically suspected cases of sepsis of both genders admitted in ICU were selected. Five milliliters of venous blood were collected simultaneously for the detection of PCT and CRP, and aseptically bedside inoculated aerobic blood culture flasks were used for culture and antibiotic sensitivity. **Results:** Out of 74 cases, there were 40 males and 34 females. Blood culture was positive in 32 and negative in 42 cases. Among 32 positive blood culture cases, 5 isolates identified were of staphylococcus aureus, E. coli 12, klebsiella pneumoniae 7 isolates, Acinetobacter baumannii in 2 and Pseudomonas aeruginosa in 6 cases. The difference was significant (P< 0.05). The median PCT concentrations in Gram-positive bacteria was 4.08 ng/ml and the median PCT concentrations in Gram-negative bacteria was found to be 9.51 ng/ml. The respective median levels among the Gram-negative bacteria were as follows: E. coli 18.27 ng/ml followed by K. pneumoniae17.78 ng/ml. CRPconcentrations of Gram-positive bacteria was found to be 38.9 mg/L and for Gram-negative bacteria 35.5mg/L. **Conclusion:** In individuals with a positive blood culture, PCT is more pertinent than CRP and has been shown to be a valid marker for diagnosing sepsis. When blood culture findings are unavailable or the illness site is unknown, PCT levels might offer helpful information for choosing the best antimicrobial treatment.

Key words: blood culture, CRP, Procalcitonin

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INTRODUCTION

According to the Third International Consensus Definitions for sepsis and septic shock, sepsis has lately been reinterpreted and reexamined as "a life-threatening organ dysfunction caused by dysregulated host-response to systemic infection." Worldwide, sepsis is regarded as one of the leading causes of illness and mortality.[1] It is among the frequent reasons why organs fail. According to a recent worldwide study, sepsis causes an estimated 48.9 million cases and 11 million deaths annually, or 20% of all deaths worldwide. One of the leading causes of hospital-related deaths and a significant global health issue, sepsis costs the United States more than $24 billion a year.[2,3]

Numerous scoring systems have been studied for the degree of organ failure. These methods quantify abnormalities based on clinical observations, laboratory results, or therapy outcomes. Additionally, there have been differences in how these score systems have been reported.[4] The frequency of sepsis is increased by population growth, such as in the elderly population, the lengthening of life cycles in patients with chronic illnesses, the frequent use of immunosuppressive medications, and the widespread use of invasive procedures for diagnosis or treatment. Significant chronic comorbidities have been linked to the most basic causes of mortality, and it has been doubtful that improved hospital care could prevent the majority of sepsis-related deaths.[5]Procalcitonin has the traits of a biomarker since it distinguishes between infectious and non-infectious causes of sepsis and increases sepsis quickly and specifically. CRP is a non-specific acute-phase protein of sepsis and another biomarker of inflammation; nevertheless, there is conflicting data on its diagnostic accuracy in distinguishing infection from non-infection.[6]The present study was conducted to evaluate procalcitonin (PCT) and C-reactive protein (CRP) as biomarkers in suspected cases of sepsis among patients in ICU.

MATERIALS & METHODS

The study was conducted on 74 clinically suspected cases of sepsis of both genders admitted in ICU. All agreed to participate in the study.

Data such as name, age, gender etc. was recorded. Five milliliters of venous blood were collected simultaneously for the detection of PCT and CRP, and aseptically bedside inoculated aerobic blood culture flasks were used for culture and antibiotic sensitivity. Gram's staining and blood culture were carried out. Following initial characterization by colony morphology and Gram's stain, all of the bacteria that were cultivated and separated from the blood culture-positive cases were then subjected to species identification and AST determination using the VITEK® 2 COMPACT automated identification method. Data were analyzed and statistically evaluated. P value less than 0.05 was considered significant (P< 0.05).

RESULTS

Table I Distribution of patients

Total- 74		
Gender	**Male**	**Female**
Total	40	34

Table I shows that out of 74 cases, there were 40 males and 34 females.

Table II Blood culture profile

Blood culture	Number	P value
Positive	32	0.51
Negative	42	

Table II shows that blood culture was positive in 32 and negative in 42cases.

Table III Organism isolated in blood culture positive subjects with sepsis

Type of bacteria	Number	P value
Staphylococcus aureus	5	0.01
E. Coli	12	
KlebsiellaPneumoniae	7	
Acinetobacter baumannii	2	
Pseudomonas aeruginosa	6	

Table III, graph I shows that among 32 positive blood culture cases, 5 isolates identified were of staphylococcus aureus, E. coli 12, klebsiella pneumoniae 7 isolates, Acinetobacter baumannii in 2 and Pseudomonas aeruginosa in 6 cases. The difference was significant (P< 0.05).

Graph I Organism isolated in blood culture positive subjects with sepsis

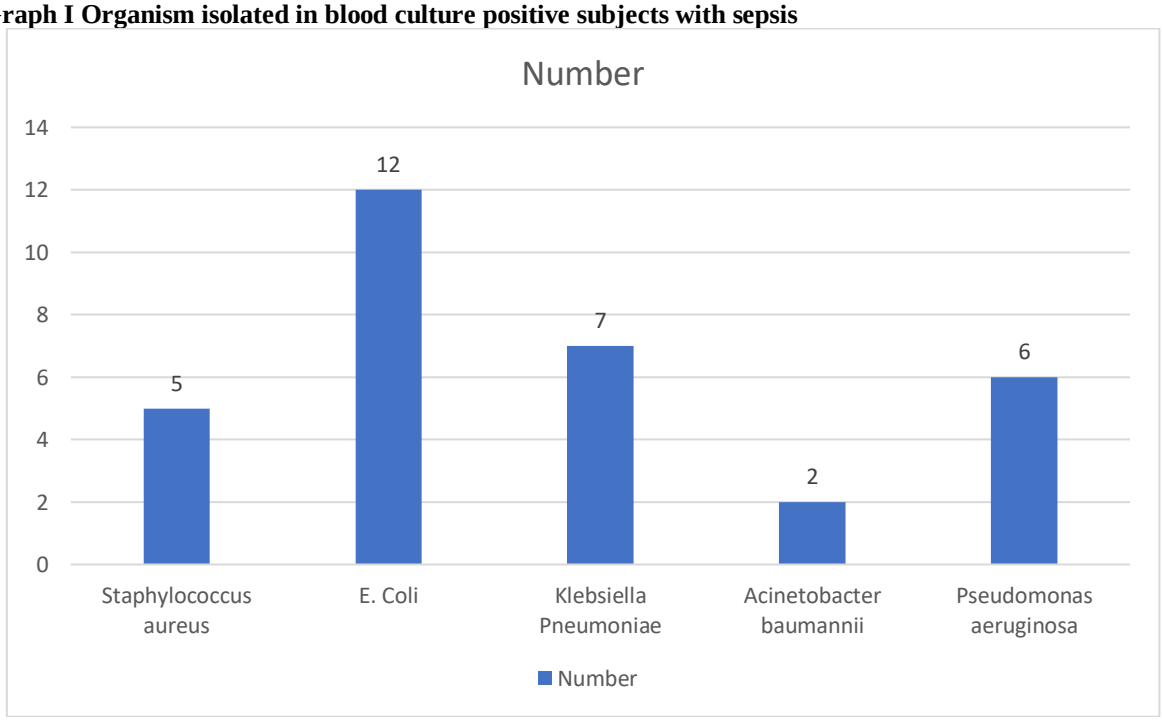

Table IV Distribution of serum PCT and CRP concentrations corresponding to different causative pathogens in culture positive cases

Type of bacteria		PCT	CRP
Gram+ve(n=5)		4.08	38.9
Staphylococcusaureus		4.08	38.5
Gram-ve(n=27)		9.51	35.4
bacteriaceae(n=19)	E.Coli	18.27	31.7
	KlebsiellaPneumonia	17.78	33.1
NFGNB(n=8)	Acinetobacterbaumannii	11.9	56.3
	Pseudomonas Aeruginosa	5.85	37.5

Table IV shows that the median PCT concentrations in Gram-positive bacteria was 4.08 ng/ml and the median PCT concentrations in Gram-negative bacteria was found to be 9.51 ng/ml. The respective median levels among the Gram-negative bacteria were as follows: E. coli 18.27 ng/ml followed by K. pneumoniae17.78 ng/ml. CRPconcentrations of Gram-positive bacteria was found to be 38.9 mg/L and for Gram-negative bacteria 35.5mg/L.

DISCUSSION

It's not always easy to diagnose bacterial infections in critically unwell people. Unlike colonization, infection requires some level of host reaction. We assume a patient has an infection based on the host response's symptoms, after which we look for the infection focus and start treating the patient with antimicrobial medicines.[7] However, the symptoms may not be present in some elderly, neonatal, and immunocompromised patients, who end up being the most susceptible to the complex infection courses.[8] On the other hand, factors other than bacterial infection (such as trauma, pancreatitis, burn, etc.) may cause similar signs.[9]The present study was conducted to evaluate procalcitonin (PCT) and C-reactive protein (CRP) as biomarkers in suspected cases of sepsis among patients in ICU.

We found that out of 74 cases, there were 40 males and 34 females. Blood culture was positive in 32 and negative in 42 cases. Simon et al[10]evaluated the accuracy of determination of procalcitonin (PCT) and C-reactive protein (CRP) levels for the diagnosis of bacterial infection. PCT level was more sensitive (88% [95% confidence interval {CI}, 80%–93%] vs. 75% [95% CI, 62%–84%]) and more specific (81% [95% CI, 67%–90%] vs. 67% [95% CI, 56%–77%]) than CRP level for differentiating bacterial from noninfective causes of inflammation. The Q value for PCT markers was higher (0.82 vs. 0.73). The sensitivity for differentiating bacterial from viral infections was also higher for PCT markers (92% [95% CI, 86%–95%] vs. 86% [95% CI, 65%–95%]); the specificities were comparable (73% [95% CI, 42%–91%] vs. 70% [95% CI, 19%–96%]). The Q value was higher for PCT markers (0.89 vs. 0.83). PCT markers also had a higher positive likelihood ratio and lower negative likelihood ratio than did CRP markers in both groups. On the basis of this analysis, the diagnostic accuracy of PCT markers was higher than that of CRP markers among patients hospitalized for suspected bacterial infections.

We found that among 32 positive blood culture cases, 5 isolates identified were of staphylococcus aureus, E. coli 12, klebsiella pneumoniae 7 isolates, Acinetobacter baumannii in 2 and Pseudomonas aeruginosa in 6 cases. Chan et al[11]evaluated the value of PCT as a marker of bacterial infection for emergency department patients.Fifty-eight patients were infected and 49 patients were not infected. The white blood cell counts, the serum C-reactive protein (CRP) level (mg/l), and the PCT level (ng/ml) were compared between the infected and noninfected groups of patients.A white blood cell count >12,000/mm3 or <4000/mm3 was present in 36.2% of the infected patients and in 18.4% of the noninfected patients. The best cut-off serum levels for PCT and CRP, identified using the Youden's Index, were 0.6 ng/ml and 60 mg/l, respectively. Compared with CRP, PCT had a comparable sensitivity (69.5% versus 67.2%), a lower specificity (64.6% versus 93.9%), and a lower area under the receiver operating characteristic curve (0.689 versus 0.879). PCT levels, but not CRP levels, were significantly higher in bacteremic and septic shock patients. Multivariate logistic regression identified that a PCT level >/= 2.6 ng/ml was independently associated with the development of septic shock.

We observed that median PCT concentrations in Gram-positive bacteria was 4.08 ng/ml and the median PCT concentrations in Gram-negative bacteria was found to be 9.51 ng/ml. The respective median levels among the Gram-negative bacteria were as follows: E. coli 18.27 ng/ml followed by K. pneumoniae17.78 ng/ml. CRP concentrations of Gram-positive bacteria was found to be 38.9 mg/L and for Gram-negative bacteria35.5mg/L. Matson A et al[12] in their study, changes in the plasma concentration of C-reactive protein were assessed as a diagnostic test for sepsis in critically ill patients. Forty-nine episodes of secondary sepsis were identified in 31 patients. In 43 out of the 49 episodes there was a 25% or greater change in the concentration of C-reactive protein on the day that sepsis was diagnosed but in six episodes of sepsis the change was less than 25%. A 25% rise in the plasma concentration of C-reactive protein in the absence of other non-infective causes of a raised C-reactive protein, such as inflammation, tissue injury or

surgery, is highly suggestive of infection, but failure of the C-reactive protein to rise does not eliminate a diagnosis of sepsis.

CONCLUSION

In individuals with a positive blood culture, PCT is more pertinent than CRP and has been shown to be a valid marker for diagnosing sepsis. When blood culture findings are unavailable or the illness site is unknown, PCT levels might offer helpful information for choosing the best antimicrobial treatment.

REFERENCES

1. ReinhartK,BauerM,RiedemannNC,HartogCS.Newapproachestosepsis:moleculardiagnosticsandbiomarkers.ClinicalMicrobiologyReviews.2012;25(4):609-34.
2. Jawad I, Lukšić I, Rafnsson SB. Assessing available information on the burdenof sepsis: global estimates of incidence, prevalence and mortality. J GlobHealth.2012;2(1):010404.
3. Vincent JL, Marshall JC, Ñamendys-Silva SA, François B, Martin-Loeches I, Lipman J, et al. Assessment of the worldwide burden of critical illness: the intensive care over nations (ICON) audit. Lancet Respir Med. 2014;2(5):380-6.
4. Kwan A, Hubank M, Rashid A, Klein N, Peters MJ. Transcriptional instability during evolving sepsis may limit biomarkerbased risk stratification. PLoS ONE. 2013;8(3):e60501.
5. Prakash KP, Arora V, Geethanjali PP. Bloodstream bacterial pathogens and their antibiotic resistance pattern in Dhahira Region, Oman. Oman Med J. 2011;26(4):240-79.
6. Povoa P, Almeida E, Moreira P, Fernades A, Mealha R, Aragao A, Sabino H. C-reactive protein as an indicator of sepsis. Intensive Care Med. 1998;24:1052–1056.
7. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29:1303–1310.
8. Ugarte H, Silva E, Mercan D, De Mendonca A, Vincent JL. Procalcitonin used as a marker of infection in the intensive care unit. Crit Care Med. 1999;27:498–504.
9. Vigushin DM, Pepys MB, Hawkins PN. Metabolic and scintigraphic studies of radioiodinated human C-reactive protein in health and disease. J Clin Invest. 1993;90:1351–1357.
10. Simon L, Gauvin F, Amre DK, Saint-Louis P, Lacroix J. Serum procalcitonin and C-reactive protein levels as markers of bacterial infection: a systematic review and meta-analysis. Clinical infectious diseases. 2004 Jul 15;39(2):206-17.
11. ChanYL,TsengCP,TsayPK,ChangSS,ChiuTF,ChenJC.Procalcitoninasamarkerofbacterialinfectioninthee mergencydepartment:anobservationalstudy.CritCare. 2004;8(1):12-20.
12. Matson A, Soni N, Sheldon J. C-reactive protein as a diagnostic test of sepsis in the critically ill. Anaesth Intensive Care. 1991;19:182–186.