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ORIGINAL ARTICLE

Prognostic values of blood Procalcitonin in cases of septicaemia

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ABSTRACT:

Background: Sepsis is a potentially deadly medical condition that is characterized by a whole-body inflammatory state which is called the systemic inflammatory response syndrome (SIRS) and the presence of a known or suspected infection. The present study was conducted to evaluate the diagnostic and the prognostic values of blood Procalcitonin (PCT) in cases of bacterial septicaemia. **Materials & Methods:** 78 patients of sepsis who were admitted to intensive care unit of both genders were selected. Group I comprised of patients with history of an acute or chronic infection and group II were controls. PCT value was measured at 24 hours (T24) and at 96 hours. **Results:** There were 38 cases of bacterial infection, 24 of viral infection and in 16 cases etiology was not established. Maximum cases were seen in age group 41-60 years in group I and II respectively. Maximum patients of bacterial infection (37%), viral (79%), in etiology not established group (80%) and group II (97%) had PCT ranged between 0.0 - 0.5 ng/ml. The difference was significant (P< 0.05). The mean PCT value in patients with bacterial infection at 24 hours was 4.71 and at 96 hours was 1.31. In patients with viral infection at 24 hours and at 96 hours was 0.36 and 0.27 and in patients in with no established etiology was 0.95 and 0.28 at 24 hours and 96 hours respectively. The difference was significant (P< 0.05). **Conclusion:** This study demonstrates the value of PCT in establishing sepsis early diagnosis. Patients who are very ill and may have sepsis may benefit from using the PCT measurements as a guide for antibiotic treatment.

Keywords: Sepsis, PCT, systemic inflammatory response syndrome

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INTRODUCTION

Sepsis is a potentially deadly medical condition that is characterized by a whole-body inflammatory state which is called the systemic inflammatory response syndrome (SIRS) and the presence of a known or suspected infection.[1]In the emergency department and medical intensive care unit, identifying and treating sepsis early is a daily problem. Consequently, increasing the survival percentage of patients—especially children—requires a prompt and precise diagnosis.[2]

It is crucial to identify sepsis in a sick patient as soon as possible so that the right antibiotic treatment can be administered.[3] Numerous indicators of inflammation have been examined, including IL-1β, TNF-α, IL-6, and IL-8. It is commonly known that these cytokines correlate with the severity of sepsis.[4] However, they take a lot of time and money to complete, and they are neither sensitive nor specific enough. As a precursor of calcitonin, procalcitonin (PCT) is a 13 kDa protein consisting of 116 amino acids. In the thyroid, lung, and pancreatic neuroendocrine cells, it is successively cleaved to produce three different molecules: calcitonin (32 amino acids), katacalcin (21 amino acids), and an N-terminal fragment known as aminoprocalcitonin (57).[5]While Procalcitonin (PCT) performs quite well as a diagnostic biomarker, it excels when it is called upon as a monitoring or prognostic bio-marker.[6]The present study was conducted to evaluate the diagnostic and the prognostic values of blood Procalcitonin (PCT) in cases of bacterial septicaemia.

MATERIALS & METHODS

The study was carried out on 78 patients of sepsis who were admitted to intensive care unit of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Group I comprised of patients with history of an acute or chronic infection and group II were controls. 5 ml blood sample was collected from all at the time of admission (T0), at 24 hours (T24) and the final sample was collected 96 hours after the admission (T96). Procalcitonin was estimated and a value of ≥0.5 ng/ml was accepted as pathologically significant. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Age group (years)	Group I			Group II
	Bacterial	Viral	Etiology not established	
21-40	7	4	6	26
41-60	17	12	5	30
>60	14	8	5	22
Total	38	24	16	78

Table I shows that there were 38 cases of bacterial infection, 24 of viral infection and in 16 cases etiology was not established. Maximum cases were seen in age group 41-60 years in group I and II respectively.

Table II PCT values obtained in respect to etiology of infection

PCT	Group I			Group II	P value
	Bacterial	Viral	Etiology not established		
0.0 - 0.5 ng/ml	37%	79%	80%	97%	0.04
0.5 - 2.0 ng/ml	20%	18%	12%	3%	
2.0 - 10.0 ng/ml	19%	3%	3%	0%	
>10.0 ng/ml	24%	0%	5%	0%	

Table II, graph I shows that maximum patients of bacterial infection (37%), viral (79%), in etiology not established group (80%) and group II (97%) had PCT ranged between 0.0 - 0.5 ng/ml. The difference was significant (P< 0.05).

Graph I PCT values obtained in respect to etiology of infection

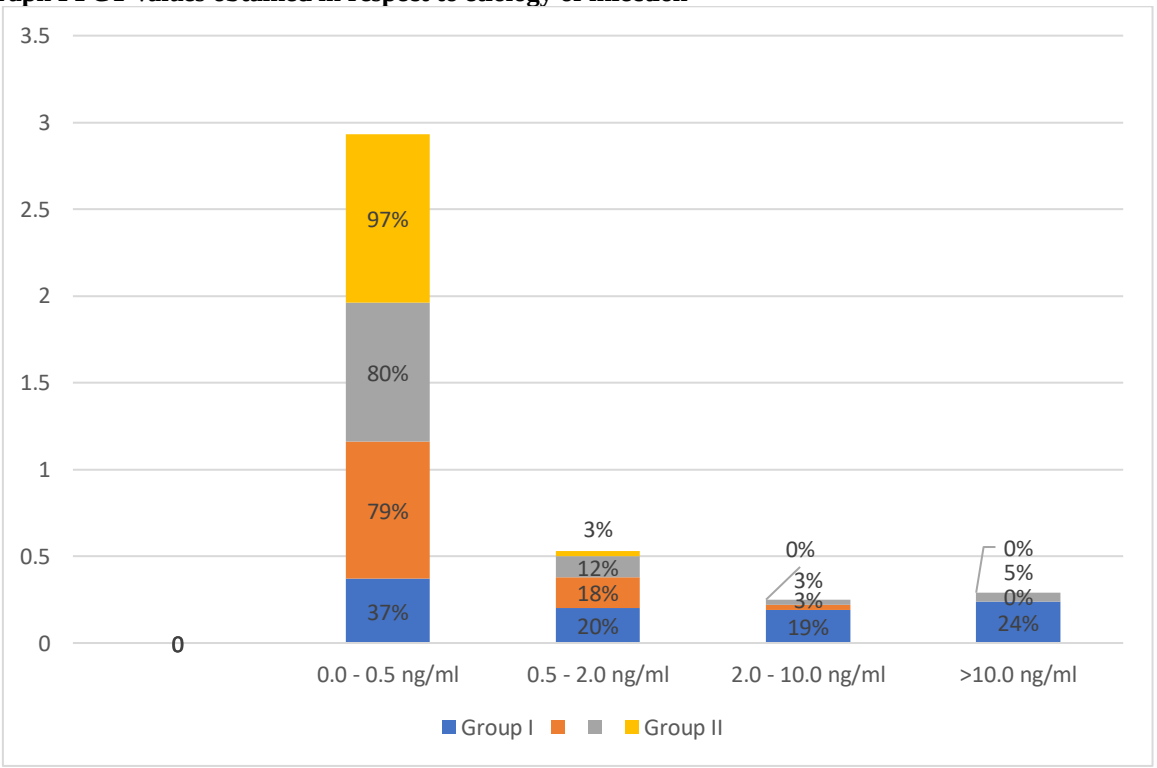

Table III Comparison of mean PCT values after 24 hours and 96 hours

Group	24 hours	96 hours	P value
Bacterial infection	4.71	1.31	0.01
Viral infection	0.36	0.27	0.95
Etiology not established	0.95	0.28	0.04

Table III shows that mean PCT value in patients with bacterial infection at 24 hours was 4.71 and at 96 hours was 1.31. In patients with viral infection at 24 hours and at 96 hours was 0.36 and 0.27 and in patients in with no established etiology was 0.95 and 0.28 at 24 hours and 96 hours respectively. The difference was significant (P< 0.05).

DISCUSSION

Bacterial lipopolysaccharide (LPS) has been shown to be a potent inducer of PCT release into the systemic circulation. This release is not associated with an increase in calcitonin. PCT levels increase from 3 to 4 hours, peak at about 6 h and then plateau for up to 24 hours. It is degraded by specific protease and has a half-life of between 25 and 30 h. In contrast, C-reactive protein (CRP) levels rise between 12 and 18 hours after bacterial challenge.[7]In healthy individuals circulating levels of PCT are very low, usually below 0.1 ng/ml. In viral infections and inflammatory states, PCT concentrations are slightly elevated up to 1.5 ng/ml, but in bacterial infection levels may exceed 1000 ng/ml.[8] This 3–5 log-fold increase makes it an ideal marker of bacterial sepsis.The exact sites of PCT production are unknown but it is thought that the liver is a major site. The evidence for this comes from a study that showed that hepatocytes produced large quantities of PCT following stimulation with TNF-α and IL-6.[9]The present study was conducted to evaluate the diagnostic and the prognostic values of blood Procalcitonin (PCT) in cases of bacterial septicaemia.

We found that there were 38 cases of bacterial infection, 24 of viral infection and in 16 cases etiology was not established. Maximum cases were seen in age group 41-60 years in group I and II respectively. Mathew B et al[10]evaluated the diagnostic and the prognostic values of blood Procalcitonin (PCT) in cases of bacterial septicaemia in children. The total sample comprised of 150 subjects who were admitted to the ICU with septicaemia and 50 normal, healthy, age and sex matched children. The first sample was collected at the time of admission, before the start of the antibiotic therapy (T0). A second sample was collected at 24 hours (T24) and a final sample was collected at 96 hours (T96). A PCT value of > 0.5ng/ml was accepted as positive. 63% of the children who were diagnosed with a bacterial aetiology showed detectable blood PCT levels with higher concentrations, while in the children who were diagnosed with a viral aetiology, only 22.2 % had detectable PCT levels, but in lower concentrations. The mean percentage reduction in the PCT value among the bacterial infection subjects was 44.39 ± 41.82 as compared to that in the viral infection subjects (5.71 ± 26.68) and in the subjects where the aetiology was not established (5.71 ± 26.68).

We found that maximum patients of bacterial infection (37%), viral (79%), in etiology not established group (80%) and group II (97%) had PCT ranged between 0.0 - 0.5 ng/ml. We found that mean PCT value in patients with bacterial infection at 24 hours was 4.71 and at 96 hours was 1.31. In patients with viral infection at 24 hours and at 96 hours was 0.36 and 0.27 and in patients in with no established etiology was 0.95 and 0.28 at 24 hours and 96 hours respectively. Rey C et al[11]analysed the clinical value of procalcitonin (PCT), C-reactive protein (CRP) and leucocyte count in the diagnosis of paediatric sepsis and in the stratification of patients according to severity.Leucocyte count, PCT and CRP were measured when considered necessary during the PICU stay. Patients were classified, when PCT and CRP were measured, into one of six categories (negative, SIRS, localized infection, sepsis, severe sepsis, and septic shock). Median plasma PCT concentrations were 0.17, 0.43, 0.79, 1.80, 15.40 and 19.13 ng/ml in negative, systemic inflammatory response syndrome (SIRS), localized infection, sepsis, severe sepsis, and septic shock groups, respectively, whereas median plasma CRP concentrations were 1.35, 3.80, 6.45, 5.70, 7.60 and 16.2 mg/dl, respectively. The area under the ROC curve for the diagnosis of septic patients was 0.532 for leucocyte count (95% CI, 0.462-0.602), 0.750 for CRP (95% CI, 0.699-0.802) and 0.912 for PCT (95% CI, 0.882-0.943). We obtained four groups using CRP values and five groups using PCT values that classified a significant percentage of patients according to the severity of the different SIRS groups.

The shortcoming of the study is small sample size.

CONCLUSION

This study demonstrates the value of PCT in establishing sepsis early diagnosis. Patients who are very ill and may have sepsis may benefit from using the PCT measurements as a guide for antibiotic treatment.

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