



STUDY OF PROCALCITONIN AS A BIOMARKER FOR EARLY DIAGNOSIS OF SEPSIS PATIENTS IN A TERTIARY CARE HOSPITAL

Emergency Medicine

**Dr. Osama
Ashfaque**

Department of Emergency Medicine, Peerless Hospital

**Dr. Indraneel
Dasgupta***

Clinical Director, Department of Emergency Medicine, Peerless Hospital*Corresponding Author

Dr. Sambit Maiti

Assistant Consultant, Department of Emergency Medicine, Peerless Hospital

ABSTRACT

Introduction: Sepsis is a life-threatening condition that arises when the body's response to infection causes injury to its own tissues and organs. Common signs and symptoms include fever, increased heart rate, increased breathing rate, and confusion. To guide treatment, a central venous catheter and an arterial catheter may be placed for access to the bloodstream. Other measurements such as cardiac output and superior vena cava oxygen saturation may be used. **Aims:** This study was aimed to assess the diagnostic value of procalcitonin (PCT) for sepsis patients and to study the values of procalcitonin (PCT) with multiple organ dysfunctions, death and culture positive patients for sepsis patients. **Materials and Methods:** A Descriptive, cross-sectional and Prospective Study was conducted in Department of Emergency Medicine in a Tertiary Care Hospital, Kolkata, West Bengal from October 2020 - September 2021. 182 patients were taken in our study. **Result:** We examined that LOS was significantly more in patients with Culture [8.5246 ± 2.6433] compared to without Culture patients [6.9752 ± 1.8729]. ($p < 0.001$) and more patients had Culture with Died patients [22 (91.7%)] but this was statistically significant ($p < 0.0001$). **Conclusion:** We examined that LOS was significantly more in patients with Culture compared to without Culture patients and age was not significantly less in patients with MOD compared to without MOD patients.

KEYWORDS

critical care, Sepsis, procalcitonin and PCT.

INTRODUCTION

Sepsis is a life-threatening condition that arises when the body's response to infection causes injury to its own tissues and organs. Common signs and symptoms include fever, increased heart rate, increased breathing rate, and confusion.¹ There also may be symptoms related to a specific infection, such as a cough with pneumonia, or painful urination with a kidney infection. In the very young, old, and people with a weakened immune system, there may be no symptoms of a specific infection and the body temperature may be low or normal, rather than high. Severe sepsis is sepsis causing poor organ function or insufficient blood flow. Insufficient blood flow may be evident by low blood pressure, high blood lactate, or low urine output. Septic shock is low blood pressure due to sepsis that does not improve after reasonable amounts of intravenous fluids are given.²

Sepsis usually is treated with intravenous fluids and antibiotics. Typically, antibiotics are given as soon as possible. Often, ongoing care is performed in an intensive care unit. If fluid replacement is not enough to maintain blood pressure, medications that raise blood pressure may be used. Mechanical ventilation and dialysis may be needed to support the function of the lungs and kidneys; respectively.³ To guide treatment, a central venous catheter and an arterial catheter may be placed for access to the bloodstream. Other measurements such as cardiac output and superior vena cava oxygen saturation may be used. People with sepsis need preventive measures for deep vein thrombosis, stress ulcers and pressure ulcers, unless other conditions prevent such interventions. Some might benefit from tight control of blood sugar levels with insulin. The use of corticosteroids is controversial. Activated drotrecogin alfa, originally marketed for severe sepsis, has not been found to be helpful, and was withdrawn from sale in 2011.⁴

Disease severity partly determines the outcome. The risk of death from sepsis is as high as 30%, from severe sepsis as high as 50%, and from septic shock as high as 80%. The number of cases worldwide is unknown as there is little data from the developing world. Estimates suggest sepsis affects millions of people a year. In the developed world approximately 0.2 to 3 people per 1000 are affected by sepsis yearly, resulting in about a million cases per year in the United States. Rates of disease have been increasing. Sepsis is more common among males than females. The medical condition has been described since the time of Hippocrates. The two terms, "septicemia" and "blood poisoning", refer to the microorganisms or their toxins in the blood and are no longer commonly used.⁵

In addition to symptoms related to the provoking cause, sepsis is frequently associated with fever, low body temperature, rapid breathing, elevated heart rate, confusion, and edema. Early signs are a rapid heart rate, decreased urination, and high blood sugar. Signs of established sepsis include confusion, metabolic acidosis (which may be accompanied by faster breathing and lead to a respiratory alkalosis), low blood pressure due to decreased systemic vascular resistance, higher cardiac output, and dysfunctions of blood coagulation (where clotting may lead to organ failure).⁶

AIMS AND OBJECTIVES

AIM

This study was aimed to assess the diagnostic value of procalcitonin (PCT) for sepsis patients.

OBJECTIVES

To study the values of procalcitonin (PCT) with multiple organ dysfunctions, death and culture positive patients for sepsis patients.

MATERIALS AND METHODS

STUDY AREA

Department of Emergency Medicine in a Tertiary Care Hospital, Kolkata, West Bengal.

STUDY PERIOD

This study was carried for October 2020 - September 2021

STUDY POPULATION

This study was on the patients presenting with sepsis in tertiary care Hospital, Kolkata during the study period.

Study group:

182 patients were taken in our study.

INCLUSION CRITERIA

- Patients presenting with features of sepsis age >18 years were included in our study.

EXCLUSION CRITERIA

- Out of all the adult patients (>18 years of age) consecutively admitted to the hospital through emergency department, Neurosurgical, traumatized, and elective surgical patients without complications were excluded.
- Paediatric age group was excluded in our study.

- Deaths occurring after discharge from hospital was excluded.

STUDY DESIGN

A Descriptive, cross-sectional and Prospective Study

RESULT AND DISCUSSION

This study was carried for October 2020 - September 2021 were the patients presenting with sepsis in tertiary care Hospital, Kolkata during the study period. Patients presenting with features of sepsis age 003E18 years were included in our study were included in this study.

Hicks CW et al ⁷(2014) observed that in the critical care setting, increasing levels of midregional proadrenomedullin (MRproADM), midregional proatrial natriuretic peptide (MRproANP), procalcitonin (PCT), copeptin, and proendothelin-1 (proET-1) have been shown to be correlated with increasing severity of sepsis. Data were analyzed using nonparametric Mann-Whitney U-tests, χ^2 -tests, and receiver operating characteristic curves. Of the 66 patients enrolled in this study, 37 (56.1%) were men, with a median age of 58 years [interquartile range (IQR) 39-69 years], and 19 (28.8%) had a final diagnosis of early sepsis.

In our study, out of 182 patients, most of the patients were 61-70 years old [44 (24.2%)]. Rest of 36 (19.8%) patients were 71-80 years of age, 33 (18.1%) patients were 51-60 years of age, 21 (11.5%) patients were 41-50 years of age, 17 (9.3%) patients were 21-30 years of age, 16 (8.8%) patients were 81-90 years of age and 15 (8.2%) patients were 31-40 years of age but this was not statistically significant. (p=.3125).

CULTURE

We found that in culture, male [50(82.0%)] population was higher than the female population [11(18.0%)] but this was not statistically significant. (p=.3125).

Sridharan P et al ⁸(2013) examined that a comprehensive search of all published studies of the use of serum concentrations of PCT to guide the treatment of sepsis in adult patients (1996 to 2011) was conducted with PubMed and Google Scholar. Wanner et al. published the largest study (n=405) demonstrating that peak PCT concentrations occur early after injury in both patients with sepsis and those with multiple organ dysfunction syndrome (MODS).

It was found that most of patients had MOD with culture [42(68.9%)] but this was statistically significant. (p<0.0001).

Present study showed that in Culture, [22(36.1%)] patients were Died but this was statistically significant. (p<0.0001).

In our study Age was not significantly high in patients with Culture [62.0984±14.9027] compared to without Culture patients [57.6694±18.3682]. (p=0.1046).

Gupta S et al ⁹(2019) found that despite the advancement in diagnostic modalities of sepsis, it is still a leading cause of morbidity and mortality. Differentiation between sepsis and non-infectious disease states remains a diagnostic challenge. Procalcitonin (PCT) is useful for the diagnosis of sepsis but it varies in cut-off ranges at different clinical settings Procalcitonin can accurately differentiate culture-negative and culture-positive sepsis from non-infectious diseases, thus making it a promising biomarker in diagnosis of bacterial sepsis.

We observed that Procal Within 7 Day was significantly more in patients with Culture [25.8847±26.9801] compared to without Culture patients [7.7217±13.6857]. (p=<0.001).

Vijayan AL et al ¹⁰(2017) observed that sepsis is a global healthcare problem, characterized by whole body inflammation in response to microbial infection, which leads to organ dysfunction. Procalcitonin (PCT), a member of the calcitonin super family could be a critical tool for the diagnosis of sepsis. But to distinguish between bacterial versus viral infections, procalcitonin alone may not be effective. Rapid elevation in the concentration of procalcitonin and other newly emerging biomarkers during an infection and its correlation with severity of illness makes it an ideal biomarker for bacterial infection. Beside this, the procalcitonin levels can be used for monitoring response to antimicrobial therapy, diagnosis of secondary inflammations, diagnosis of renal involvement in paediatric urinary tract infection, etc. The present article summarizes the relevance of

procalcitonin in the diagnosis of sepsis and how it can be useful in determining the therapeutic approaches.

Our study showed that Procal After 7 Day was significantly less in patients without Culture patients [1.5977±8.1078] compared to with Culture [41.8125±39.4946]. (p=<0.001).

Present study showed that TLC was significantly high in patients with Culture [15172.1311 ± 2713.9842] compared to without Culture patients [13272.7273 ± 1897.3666]. (p=<0.001).

We examined that LOS was significantly more in patients with Culture [8.5246 ± 2.6433] compared to without Culture patients [6.9752±1.8729]. (p=<0.001).

MOD

Data of our study showed that male [55 (90.2%)] population was higher than the female population with Mod patients [6 (9.8%)] but this was statistically significant (p<0.0001).

In our study only Culture was significantly more with Mod patients [42(68.9%)]. (p=<0.0001)

We examined that only [19 (31.1%)] patients had Died with MOD patients but this was statistically significant (p<0.0001).

In our study Age was not significantly less in patients with MOD [57.8852±19.6724] compared to without MOD patients [59.7934±16.1348]. (p=0.4857).

Wacker C et al ¹¹(2013) found that procalcitonin is a promising marker for identification of bacterial infections. We assessed the accuracy and clinical value of procalcitonin for diagnosis of sepsis in critically ill patients. We searched Medline, Embase, ISI Web of Knowledge, the Cochrane Library, Scopus, BioMed Central, and Science Direct, from inception to Feb 21, 2012, and reference lists of identified primary studies. We included articles written in English, German, or French that investigated procalcitonin for differentiation of septic patients--those with sepsis, severe sepsis, or septic shock--from those with a systemic inflammatory response syndrome of non-infectious origin. Procalcitonin is a helpful biomarker for early diagnosis of sepsis in critically ill patients. Nevertheless, the results of the test must be interpreted carefully in the context of medical history, physical examination, and microbiological assessment.

We observed that Procal Within 7 Day was significantly more in patients with MOD [33.1727±22.0948] compared to without MOD patients [4.0476±11.4884]. (p=<0.001).

Our study showed that Procal After 7 Day was significantly reduced in patients without MOD patients [3.1163±12.1770] with MOD compared to [41.8125±39.4946]. (p=<0.001).

Present study showed that TLC was significantly high in patients with MOD [15614.7541 ± 2271.9181] compared to without MOD patients [13049.5868 ± 1922.8938]. (p=<0.001).

We examined that LOS was significantly more in patients with MOD [9.5410 ± 2.2403] compared to without MOD patients [6.4628±1.4494]. (p=<0.001).

DEATH

Our study showed that male [22 (91.7%)] population was higher than the female population with Died patients [2 (8.3%)] but this was not statistically significant (p=0.0356).

Gupta S et al ¹²(2019) found that despite the advancement in diagnostic modalities of sepsis, it is still a leading cause of morbidity and mortality. Differentiation between sepsis and non-infectious disease states remains a diagnostic challenge. This prospective study included 305 patients from different medical wards; the patients were classified into group I: controls (n=46), group II: culture-negative sepsis (n=76) and group III: culture-positive sepsis (n=196). Mean p value <0.05 was considered significant. Procalcitonin can accurately differentiate culture-negative and culture-positive sepsis from non-infectious diseases, thus making it a promising biomarker in diagnosis of bacterial sepsis.

It was found that more patients had Culture with Died patients [22 (91.7%)] but this was statistically significant ($p<0.0001$).

Sridharan P et al¹³ (2013) examined that a comprehensive search of all published studies of the use of serum concentrations of PCT to guide the treatment of sepsis in adult patients (1996 to 2011) was conducted with PubMed and Google Scholar. Wanner et al. published the largest study ($n=405$) demonstrating that peak PCT concentrations occur early after injury in both patients with sepsis and those with multiple organ dysfunction syndrome (MODS).

We found that only [19 (79.2%)] patients had MOD with died patients but this was statistically significant ($p<0.0001$).

In our study Age was significantly high in patients with Died [69.4583 $\pm$ 16.5082] compared to without Died patients [57.5886 $\pm$ 17.0059]. ($p=0.0016$).

We observed that Procal Within 7 Day was significantly more in patients with Died [58.1792 $\pm$ 11.4430] compared to without Died patients [7.0696 $\pm$ 11.8626]. ($p<0.001$).

Our study showed that Procal After 7 Day was significantly reduced in patients without Died patients [4.2347 $\pm$ 11.5894] with Died compared to [86.4500 $\pm$ 14.9560]. ($p<0.001$).

Present study showed that TLC was significantly high in patients with Died [17208.3333 $\pm$ 1977.6835] compared to without Died patients [13408.2278 $\pm$ 2002.2588]. ($p<0.001$).

We examined that LOS was significantly more in patients with Died [10.6667 $\pm$ 2.4789] compared to without Died patients [7.0127 $\pm$ 1.8164]. ($p<0.001$).

CONCLUSION

In our study, out of 182 patients, most of the patients were 61-70 years old but this was not statistically significant.

We found that in culture, male population was higher than the female population but this was not statistically significant.

It was found that most of patients had MOD with culture but this was statistically significant.

Our study showed that Procal After 7 Day was significantly less in patients without Culture patients compared to with Culture.

Present study showed that TLC was significantly high in patients with Culture compared to without Culture patients.

We examined that LOS was significantly more in patients with Culture compared to without Culture patients.

We examined that only patients had died with MOD patients but this was statistically significant.

In our study Age was not significantly less in patients with MOD compared to without MOD patients.

We observed that Procal within 7 Day was significantly more in patients with MOD compared to without MOD patients.

We examined that LOS was significantly more in patients with MOD compared to without MOD patients.

Our study showed that male population was higher than the female population with Died patients but this was not statistically significant. It was found that more patients had Culture with Died patients but this was statistically significant.

We found that only patients had MOD with died patients but this was statistically significant.

In our study Age was significantly high in patients with Died compared to without Died patients.

We observed that Procal within 7 Day was significantly more in patients with Died compared to without Died patients.

Our study showed that Procal after 7 Day was significantly reduced in patients without Died patients compared to with Died.

Table: Association between MOD: Culture CULTURE

CULTURE					
MOD	No	Yes	TOTAL	Chi-square value	
No	102	19	121	0.4040	<0.0001
Row %	84.3	15.7	100.0		
Col %	84.3	31.1	66.5		
Yes	19	42	61		
Row %	31.1	68.9	100.0		
Col %	15.7	68.9	33.5		
TOTAL	121	61	182		
Row %	66.5	33.5	100.0		
Col %	100.0	100.0	100.0		

Table: Association between Culture: MOD

MOD					
Culture	No	Yes	TOTAL	Chi-square value	
No	102	19	121	51.4136	<0.0001
Row %	84.3	15.7	100.0		
Col %	84.3	31.1	66.5		
Yes	19	42	61		
Row %	31.1	68.9	100.0		
Col %	15.7	68.9	33.5		
TOTAL	121	61	182		
Row %	66.5	33.5	100.0		
Col %	100.0	100.0	100.0		

Table: Association between Culture: Death DEATH

DEATH					
Culture	No	Yes	TOTAL	Chi-square value	p-value
No	119	2	121	4.4153	<0.0001
Row %	98.3	1.7	100.0		
Col %	75.3	8.3	66.5		
Yes	39	22	61		
Row %	63.9	36.1	100.0		
Col %	24.7	91.7	33.5		
TOTAL	158	24	182		
Row %	86.8	13.2	100.0		
Col %	100.0	100.0	100.0		

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