DIAGNOSTIC SIGNIFICANCE OF PROCALCITONIN IN SEPSIS

Dr. Molugu Divya Reddy, Dr. Sreenivas Reddy

¹MD(General Medicine), Assistant Professor, Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh, India.

²MD(General Medicine), Assistant Professor, Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh, India.

Article Info: Received 5 August 2019; Accepted 30 August. 2019

DOI: <https://doi.org/10.32553/ijmbs.v3i8.510>

Corresponding author: Dr. Sreenivas Reddy

Conflict of interest: No conflict of interest.

Abstract

Background: Sepsis is a global healthcare problem, characterized by whole body inflammation in response to microbial infection, which leads to organ dysfunction. It is a frequent complication in hospitalized patients. Despite the use of available treatment modalities mortality in sepsis remains high, often due to delayed diagnosis and treatment.

Objective: To study the efficacy of procalcitonin as a diagnostic marker for sepsis.

Design: This was a cross-sectional study.

Duration: One year i.e. from January 2017 to January 2018.

Setting: Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh, India.

Participants: 100 Patients aged above 18 years presenting with acute sepsis to the Department Of Medicine, Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh, India.

Methods: Sepsis was confirmed clinically and/or by positive blood culture. Serum PCT was assayed semi-quantitatively by rapid immunochromatographic technique (within 2 hours of sample receipt). The patients were classified into groups. PCT and various other relevant factors were measured in all study subjects. PCT levels of less than 0.1 ng/ml were considered negative; all other levels were considered positive. Data were presented in the form of statistical Tables and charts. SPSS software version 20 was used for statistical analysis.

Results: PCT proved to be an excellent indicator of sepsis. Serum PCT levels predicts mortality in the present study.

Conclusion: The PCT assay was found to be a useful biomarker of sepsis in this study. The assay could be performed and reported rapidly and provided valuable information before availability of culture results. This might assist in avoiding unwarranted antibiotic usage.

Keywords: Sepsis, Procalcitonin, Marker, Diagnosis.

INTRODUCTION

Procalcitonin (PCT) is a peptide precursor of the hormone calcitonin, the latter being involved with calcium homeostasis. PCT is a member of the calcitonin (CT) superfamily of peptides. It is peptide of 116 amino acid with an approximate molecular weight of 14.5 kDa, and its structure can be divided into three sections : amino terminus , immature calcitonin and calcitonin carboxyl-terminus peptide. Under normal physiological conditions, active CT is produced and secreted in the C-cells of the thyroid gland after proteolytic cleavage of PCT, meaning, in a healthy individual, that PCT levels in circulation are very low (<.05 ng/mL). Procalcitonin is part of the inflammatory cascade in sepsis. Procalcitonin levels tend to be elevated in bacterial infections whereas they are

depressed in viral infections, and high PCT has been known to predict bacteremia. Procalcitonin is detectable in the serum within 4 hours and has a half-life of 22–26 hours. Peak levels occur between 12 and 48 hours. However, PCT levels may be elevated in patients who do not have sepsis, with levels between 2–10 ng/mL seen in patients with conditions such as autoimmune disorders, trauma, cardiac arrest, surgery, burns and pancreatitis. The present research aims to study the efficacy of procalcitonin as a diagnostic marker for sepsis.

MATERIALS AND METHODS

Place of Study: Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh, India.

Type of Study: This was a cross-sectional study.

Sample Collection: Sample size: 100.

Sampling Methods: Consecutive patients.

Inclusion Criteria: Patients aged above 18 years presenting with acute sepsis.

Exclusion Criteria: Patients with history of recent surgery or transplant, malignancy, suspected or documented non-bacterial infections and those managed on immunosuppressant agents were excluded.

Statistical Methods: Data were presented in the form of statistical Tables and charts. SPSS software version 20 was used for statistical analysis.

Ethical Approval: Approval was taken from the Institutional Ethics Committee prior to commencement of the study.

OBSERVATIONS AND RESULTS

AGE AND SEX DISTRIBUTION

Table 1: Age and Sex Distribution

Age range (years)	Male		Female	
	No.	%	No.	%
20-40	22	22%	20	20%
41-60	20	20%	16	16%
61-80	20	20%	14	14%
Total	62	62%	38	38%

A total of 100 patients with age ranging from 20 to 80 years were undertaken for the study and majority of them belonged to age group of 20 – 40 years.

SYMPTOMATOLOGY

Table 2: Symptomatology

Symptoms	No. of Patients	Percentage
Fever	96	96%
Breathlessness	32	32%
Cough	20	20%
Burning Micturition	18	18%
Headache	22	22%
Vomiting	22	22%
Pain abdomen	14	14%

Of all the patients undertaken for study majority were having fever around 96% and 1/3rd of them showed breathlessness symptoms, around 20% of the patients exhibited symptoms of cough, headache and vomiting and lesser number with burning micturition and pain abdomen.

SERUM PROCALCITONIN CONCENTRATION

Table 3: Serum Procalcitonin Concentration

Serum PCT concentrations (ng / ml)						
n = 100	<0.5	0.5 – 2	2 – 10	10 – 30	30 – 60	50 – 100 & above
No Sepsis	32	0	0	0	0	0
Sepsis	0	0	21	0	0	0
Severe Sepsis	0	0	0	16	12	19
Total	32	0	21	16	12	19

The study included 100 ICU patients with suspected sepsis. Patients age ranged 20 to 80 years. Out of 100, 62 patients were male & 38 female. Among these, patients PCT above 100 ng/ml were seen in 19 patients, 30- 60 ng/ml in 12 patients, 10- 30 ng/ml in 16 patients, 2- 10 ng/ml in 21 patients & less than 0.5 ng/ml in 32 patients. There was a statistically significant correlation with the presence of sepsis determined using either PCT ≥ 0.5 ng/ml or ≥ 2 ng/ml ($p < 0.001$).

DISCUSSION

The aim of this study was to identify sepsis using serum PCT as a marker in critically ill patients present at the duration of our study in the hospital. Its an uphill task for clinicians in diagnosing infection & sepsis in critically ill patients. Serum PCT has been found to be a very good and to an extent reliable marker of sepsis. During assessment combined role of serum PCT & other clinical signs of inflammation as predictors of sepsis, we found out that the prevalence was much higher in patients over 60 yrs of age. The other studies reported a higher prevalence of sepsis in patients aged 57 years¹². We found out incidence of sepsis was considerably high in males compared to females in the present study. Fever was the most common symptom in our study followed by breathlessness, cough, burning micturition, headache, vomiting and pain abdomen. We observed in present study Serum PCT has 96% sensitivity. Serum PCT cannot be used as a marker for localized infections or infections having no systemic manifestations. Elevated serum PCT values during rigorous infections may decrease considerably to very low levels with appropriate therapy, It does not always designate complete control of the infection but only that generalization of the infection or the systemic response is under control¹⁴. Patients after undergoing major trauma or surgery may also have increased serum PCT levels without any clearcut evidence of severe infection. However, the median values under these conditions are usually lesser than those found during severe sepsis and septic shock^{4,15}.

Our study has various outcomes for clinicians. One it definitely indicates that serum PCT as marker is helpful in managing sepsis in critical care. Its used to diagnose sepsis on ICU admission, serum PCT offers a reasonable higher level of precision than other tests. It is very helpful in decision making by physicians and their stepwise approach to the complex management of critically ill patients with sepsis requiring several interventions in a short period of time. The test can be performed within 45 minutes and gives valuable information long before cultural results are available.

CONCLUSIONS

The PCT assay was found to be a useful biomarker of sepsis in this study. The assay could be performed and reported rapidly and provided valuable information before availability of culture results. This might assist in avoiding unwarranted antibiotic usage.

REFERENCES

1. Kaukonen KM, Bailey M, Pilcher D, Cooper DJ, Bellomo R. Systemic inflammatory response syndrome criteria in defining severe sepsis. *N Engl J Med*. 2015 Apr;372(17):1629–38
2. Wacker C, Prnko A, Brunkhorst FM, Schlattmann P. Procalcitonin as a diagnostic marker for sepsis: a systematic review and meta-analysis, *Lancet Infect Dis*. 2013;13:426–435
3. Bloos F, Marshall JC, Dellinger RP, Vincent JL, Gutierrez G, Rivers E, et al. Multinational, observational study of procalcitonin in ICU patients with pneumonia requiring mechanical ventilation: a multicenter observational study. *Critical Care* 2011; 15:R88.<https://doi.org/10.1186/cc10087>
4. Sinha M, Desai S, Mantri S, Kulkarni A. Procalcitonin as an adjunctive biomarker in sepsis. *Indian J Anaesth*. 2011;55:266-70
5. Terregnio CA, Lopez BL, Karras DJ. Endogenous mediators in emergency department patients with sepsis: Are levels associated with progression to severe sepsis and death? *Ann Emerg Med*. 2000;35:26-34.
6. Matson A, Soni N, Sheldon J. C- reactive protein as a diagnostic test of sepsis in critically ill patients. *Anaesth Intens Care*. 1991;19:182-6.
7. Poova P, Almeida E, Moreira P, Fernandes A. C-reactive protein as an indicator of sepsis. *Intens care med*. 1998;24:1052-6.
8. Ugerte 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. Muller B, Becker KL, Schachinger H, Rickenbacher PR. Calcitonin precursors are reliable marker of sepsis in a medical intensive care unit. *Crit Care Med*. 2000;28:977-83.
10. De Werra I, Jaccard C, Corradin SB, Chioleo R. Procalcitonin as a diagnostic tool in lower respiratory tract infections and tuberculosis. *Eur Respir J*. 2003;21:939-43.
11. Assicot M, Nylen ES, Jordan MH. High serum procalcitonin concentrations in patients with sepsis and infection. *Lancet*. 1993;347:518-9.
12. Sand KE, Bates DW, Lanken PN, Graman PS, Hibberd PL, Kahn KL. Epidemiology of sepsis syndrome in 8 academic medical centres. *JAMA*. 1997;278:234-40.
13. Todi S, Chatterjee S, Bhattacharyya M. Epidemiology of severe sepsis in India. *Crit Care Med*. 2007;11:65.
14. Calandra T, Cohen J. International sepsis forum definition of infection in the ICU consensus conference. *Crit Care Med*. 2005;33:1538-48.
15. Sudhir U, Venkatachalaiah RK, Thimmaiah AK, Rao MY, Kempegowda P. Significance of serum Procalcitonin in sepsis. *Indian Journal of Critical Care Medicine*. 2011;15(1):1-5.