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Original Research Article

Procalcitonin as a Marker for Early Diagnosis of Sepsis

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Abstract

Background: Procalcitonin (PCT) has been newly proposed indicator of presence of infection and as a useful marker of the severity of sepsis.

Methods: This hospital based cross sectional study was conducted at Department of Medicine, JNUIMSRC, Jaipur, Rajasthan. The study was conducted on 50 ICU patients of suspected or established sepsis who were admitted in the hospital. The study samples included all patients aged above 15 years presenting with acute sepsis as diagnosed by clinical presentation.

Results: The study included 50 ICU patients with suspected sepsis. Patients age ranged 15 to 75 years. Out of 50, 32 patients were male & 18 were female. Among these, patients PCT above 30 ng/ml were seen in 3 patients, 10-30 ng/ml in 3 patients, 2-10 ng/ml in 19 patients, 0.5-2 ng/ml in 1 patients & less than 0.5 ng/ml in 24 patients. There was a statistically significant correlation with the presence of sepsis determined using either PCT ≥05 ng/ml or ≥2 ng/ml.

Conclusions: PCT is among the most promising sepsis markers capable of completing clinical signs and routine lab parameters suggestive of severe infection.

Keywords: Procalcitonin, Sepsis, ICU.

Introduction

During the course of evolution, our immune system has eventually developed to deal with infectious pathogen invasions by various host defence mechanisms. Inflammatory response is one of the primary responses to a microbial invasion, [1] which leads to the systemic illness which is referred to as sepsis. Its severity correlates with mortality [2-5]. It may occur as a result of infections acquired from community, hospitals or other healthcare facilities. There are an alarming number of 18 million new sepsis cases reported each year worldwide with mortality rate ranging from 30–50% [6]. Intensive care case pattern study reported frequent prevalence of sepsis in India, with 28.3% of patients contact sepsis during ICU stay and have 34% mortality rate [7].

All types of microbes like bacteria, virus, fungi and parasites can cause sepsis, but bacteria cause the most common pathogenic invasion [8-10]. During sepsis, the microorganisms invade to the blood stream and directly proliferate locally and release various virulent factors into the bloodstream [11]. These products can stimulate the release of endogenous mediators of sepsis from endothelial cells, monocytes, macrophages neutrophils and plasma cell precursors [12]. Sepsis-related inflammatory response arise when the body

attempts to neutralize pathogenic infection which in turn leads to the activation of various mechanism with the immune cells to secrete inflammatory protein which in turn damage tissues and organs of the host [13-14]. Clinical symptoms of sepsis include tachycardia, tachypnea, fever, leucocytosis, etc. Usually severe sepsis is accompanied with hypoperfusion or dysfunction of at least one organ. Sepsis associated with multiple organ dysfunction syndrome (MODS) or hypotension is known as septic shock. [15]

Procalcitonin (PCT) has been newly proposed indicator of presence of infection and as a useful marker of the severity sepsis. Procalcitonin is a precursor of the hormone Calcitonin and it is synthesized physiologically by thyroid 'C' cells. In normal physiological condition, PCT levels in the serum are low (<0.1 ng/ml). However in bacterial infection PCT is synthesized in various extra thyroidal neuroendocrine tissues. Systemic PCT secretion is a component of the inflammatory response that appears to be relatively specific to systemic bacterial infections. Bacteraemic infection appears to cause the highest rises of PCT and with lower or negligible rises in localized viral and intracellular bacterial infection. This study was done to evaluate the diagnostic value of serum PCT and its prognostic value in sepsis. [16]

Material and Methods

The study was conducted on 50 ICU patients of suspected or established sepsis who were admitted in the hospital. The study samples included all patients aged above 15 years presenting with acute sepsis as diagnosed by clinical presentation.

Patients with history of anaphylaxis, adrenal insufficiency, low blood volume, congestive cardiac failure, and pulmonary embolism, history of malignancy and trauma or recent surgery were excluded from the study.

Blood samples were drawn from all patients within 24 hrs of admission to the ICU for complete blood count, ESR, PT, APTT, LFT,RFT, Blood culture and estimation of PCT, X- ray and ultrasound were done for all patients. Serum PCT was measured by using chemiluminiscence technique, Maglumi 600. The kit has been designed for the quantitative determination of PCT in human serum. 17] The method can be used for samples over the range of 0.01- 100 ng / ml. The test has to be performed on the fully- auto chemiluminiscence immune assay (CLIA) analyzer Maglumi 600.

Statistical analysis was performed using statistical software EPI-INFO. 'P' values below 0.05 were considered significant.

Results

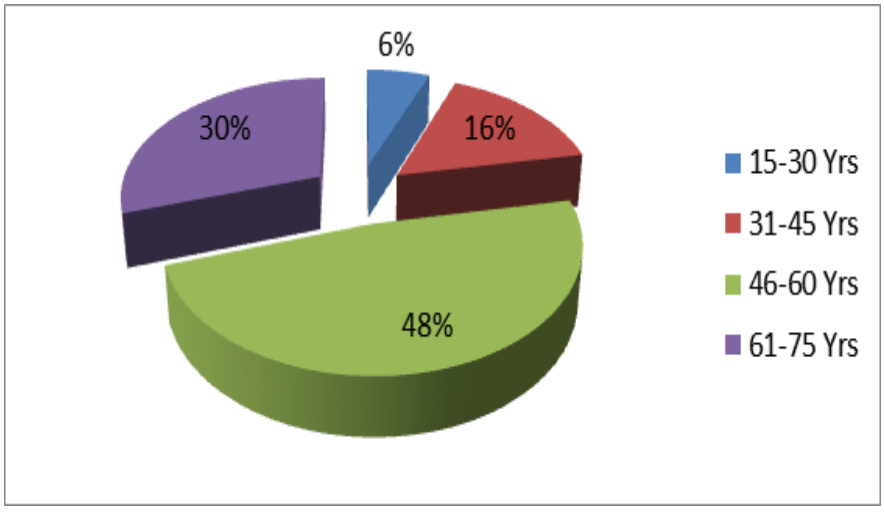

Figure 1: Age wise distribution

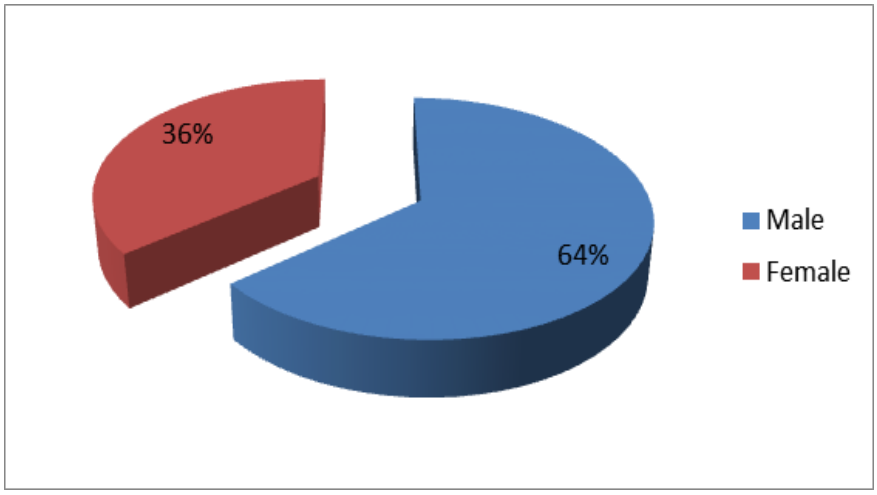

Figure 2: Sex wise distribution

Table 1: Serum procalcitonin in no sepsis, sepsis and severe sepsis patients

Sepsis	Serum PCT level (ng/dl)					Total
	<0.5	0.5-2	2-10	10-30	>30	
No sepsis	24	0	0	0	0	24
Sepsis	0	1	15	0	0	16
Severe sepsis	0	0	4	3	3	10
Total	24	1	19	3	3	50

The study included 50 ICU patients with suspected sepsis. Patients age ranged 15 to 75 years. Out of 50, 32 patients were male & 18 female. Among these, patients PCT above 30 ng/ml were seen in 3 patients, 10-30 ng/ml in 3 patients, 2-10 ng/ml in 19 patients, 0.5-2 ng/ml in 1 patients & less than 0.5 ng/ml in 24patients . There was a statistically significant correlation with the presence of sepsis determined using either PCT ≥05 ng/ml or ≥2 ng/ml ($p<0.001$).

Discussion

The purpose of this study was to evaluate the utility of serum PCT as a marker of sepsis in critically ill patients in our hospital. Early diagnosis of infection & sepsis in critically ill patients is a difficult task for clinician. Serum PCT has been found to be a very good marker of sepsis. The prevalence of sepsis was more in patients aged over 60 yrs. The other studies reported a higher prevalence of sepsis in patients aged 57 years. [18] In our study male more affected with sepsis compared to females. Other studies also indicated a higher incidence in male. [19]

Serum PCT is not a marker of localized infections or infections with no systemic manifestations. Although elevated serum PCT values during rigorous infections may decrease to very low levels with appropriate therapy, does not always designate complete control of the infection but only that generalization of the infection or the systemic response is under control. [20]

Patients after major trauma or surgery may present with increased serum PCT levels without any evidence of severe infection. However, the median values under these conditions are usually lesser than those found during severe sepsis and septic shock. [21]

In our study have several outcomes for clinicians. It definitely indicates that serum PCT may be help in the management of sepsis in critical care. First as, a new test to diagnose sepsis on ICU admission, serum PCT offers a high level of precision that other tests cannot provide. It may direct physicians in their clinical decision making 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.

Conclusion

PCT evaluation seems to be better predictor to differentiate patients with sepsis and patients without sepsis. The addition of serum PCT to the standard work up of critically ill patients with suspected sepsis might assist in avoiding unwanted antibiotic usage in patients who presents with symptoms similar to those in infective conditions. It may increase diagnostic certainty & improve patient management.

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