PCT as a Prognostic Marker in Cardiac Patients with Neutropenic Sepsis: Two Case Reports

Neelima Verma · Shaloo Kapoor · Deepa Rao ·
Siddhartha Sharma · Anita Arora

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Abstract Procalcitonin (PCT) is an innovative and highly specific marker for diagnosis of clinically relevant bacterial infection and sepsis. PCT supports early diagnosis and Clinical decision making. A retrospective study of two classical cases of neutropenic sepsis with elevated PCT levels in cardiac ICU was done. PCT was analyzed using Elecsys Brahms PCT kit. Serum PCT levels <0.5 ng/ml and ANC $<1,000/\text{mm}^3$ was taken as cutoff. The first patient had initial high levels of PCT 100 ng/ml, TLC $13,600/\text{mm}^3$ and ANC $12,250/\text{mm}^3$. It was followed by drop with subsequent rise in PCT levels and drop in TLC $1,000/\text{mm}^3$ and ANC $70/\text{mm}^3$. The second patient had normal PCT 0.116 ng/ml, TLC $5,600/\text{mm}^3$ and ANC $4,420/\text{mm}^3$ levels followed with sharp increase in all the values with subsequent drop in TLC $2,000/\text{mm}^3$ and ANC 880 cells/ mm^3 . Both the patients died of neutropenic sepsis with multiorgan failure. The case reports showed the correlation of PCT with TLC and ANC levels in predicting the mortality of patients with neutropenic sepsis in cardiac ICU.

Keywords Procalcitonin · Neutropenic sepsis · Total leucocyte count · Cardiac patients · Absolute eosinophil count

Introduction

Procalcitonin (PCT) is a polypeptide consisting of 116 amino acids, the precursor of calcitonin normally produced by C cells of thyroid gland [1] and secreted to some extent by leukocytes [2]. Serum PCT elevation was first reported in patients with bacterial sepsis [3]. Increasingly over the last decade PCT has become popular as a novel marker of infection in the intensive care unit [4, 5]. The association between serum PCT levels and the severity of neutropenic sepsis has created interest in the possible prognostic value of PCT levels. We hypothesize that elevated PCT levels predict the outcome of patients with neutropenic sepsis in cardiac set up. To the best of our knowledge very limited data is available on PCT and neutropenic sepsis in cardiac ICU.

Materials and Methods

A retrospective study of two patients admitted in the ICU of FEHI between July 2011 and September 2011 was done. PCT levels were processed as per standard protocol during their stay in the hospital and was compared with other laboratory parameters. PCT was done on Cobas e 411 based on electrochemiluminescence immunoassay “EC-LIA” using Elecsys Brahms PCT kit [6].

Case Report

Case 1

A 66 years old female with history of hypertension, coronary artery disease and hemorrhoids was admitted to Fortis

N. Verma (✉)
Department of Clinical Biochemistry, Fortis Escorts Heart
Institute, Okhla Road, New Delhi, India
e-mail: drnilimaverma@gmail.com

S. Kapoor · D. Rao · S. Sharma · A. Arora
Super Religare Laboratories, Fortis Escorts Heart Institute,
New Delhi, India

Table 1 Patient outcomes (case 1)

Analyte	Biological reference interval	22/07/2011	26/07/2011	29/07/2011	14/08/2011	25/08/2011	26/08/2011	28/08/2011
CPK (U/L)	0–238	262						
CK-MB (U/L)	0–24	55						
TROP T (ng/ml)	<0.010	0.23						
NT PROBNP (pg/ml)	<135	>35,000						
BUN (mg/dl)	3–18	89	18	56	24	48	28	48
CREAT (mg/dl)	0–1.3	6.5	1.8	4.1	3.2	3.3	2.3	3.9

Graph 1 Depicting correlation of TLC, ANC and PCT (case 1) **Graph 2** Depicting correlation of TLC, ANC, PT and APTT (case 1)

Table 2 Patient outcomes (case 2)

Analyte	Biological reference interval	02/09	07/09	10/09	13/09	18/09
CPK (U/L)	0–238	86		236		
CK-MB (U/L)	0–24					
TROP T (ng/ml)	0.010	0.02				
NT PROBNP (pg/ml)	135	4451				
BUN (mg/dl)	3–18	25	88	136	83	64
CREAT (mg/dl)	0–1.3	1.5	3.1	3.7	2.3	1.7

Graph 3 Depicting correlation of TLC, ANC and PCT (case 2)

Escorts Heart Institute on 22 July 2011. She was transferred from ICU of other hospital and was on mechanical ventilation with high ionotropic support. On examination she was afebrile, normotensive with heart rate of 102/min. The significant abnormalities at the time of admission (Table 1) were: TLC $13,600/\text{mm}^3$, ANC $11,200/\text{mm}^3$ and procalcitonin 100 ng/ml. Coagulation parameters were also impaired. Results of TLC, ANC and PCT are shown in Graph 1. Results of PT, APTT with TLC and ANC are shown in Graph 2. Blood, urine and ET secretion cultures were negative at the time of admission. The patient was stable for few days with the treatment and later started deteriorating. On 22 August 2011 she became febrile with abrupt decrease in TLC and ANC and sharp rise in PCT, PT and APTT. 2 days later her TLC and ANC count further reduced to 1,000 and $70/\text{mm}^3$ respectively with drastic rise in PCT from 62.1 to 125 ng/ml leading to her death due to severe sepsis with multi organ failure. Blood culture sent just before her death showed *Pseudomonas aeruginosa* and multiorganism growth in ET secretion.

Case 2

77 years old female patient with history of diabetes mellitus, hypertension, arterial septal defect with Eisenmenger's syndrome was admitted in the hospital on 2 September 2011 with difficulty in breathing since 1 day. At the time of admission she was afebrile with normal PCT, TLC and ANC. Results of blood parameters are depicted in Table 2. Blood and urine cultures were negative. Despite the patient being afebrile her TLC and ANC count increased followed by sharp fall of counts and rise in PCT as shown in Graph 3. PT and APTT values deranged as shown in Graph 4. ET secretion was positive for *Klebsiella pneumonia* and her blood culture showed *Acinetobacter* and *Enterococcus* just before death.

Discussion

PCT is an established marker produced to some extent by leucocytes [2] used for specific and rapid diagnosis of

Graph 4 Depicting correlation of TLC, ANC, PT and APTT (case 2)

neutropenic sepsis which is a medical emergency demanding active medical intervention [7, 8]. The prognostic significance of PCT has already been established in studies with immunocompetent adult patients in ICU [9, 10] and in children with febrile neutropenia [11, 12]. Presumably in our patients high levels of PCT could have been due to stimulus from infecting organism which release high levels of cytokine [13] as evident from sepsis and positive blood culture reports. The utility of monitoring serum PCT in febrile neutropenic episodes for initial diagnosis of infection was evaluated. Delayed PCT peak higher than 500 pg/ml contributes to the early diagnosis of invasive fungal disease. PCT decrease in follow up promptly reflects response to anti fungal therapy when compared with the slow resolution of fever [14]. Massaro et al. [15] have shown that PCT was significantly higher in the 26 out of 52 patients with neutropenia and is a better marker than CRP. Sinning et al. [16], states that PCT concentration correlates well with the extent of atherosclerosis and prognosis in patients with coronary heart disease. In our study ANC values for both the patients dropped to $<1,000/\text{mm}^3$ indicating neutropenic sepsis as per GONG cancer care guidelines (patients with ANC $<1,000/\text{mm}^3$ have been defined undergoing neutropenic sepsis) [17]. Both patients had developed bacterial infections with rising trend of PCT along with neutropenia ($<1,000/\text{mm}^3$). Serum PCT proves to be an excellent indicator of neutropenic sepsis in critically ill patients [18] with multiorgan failure. The test done in our laboratory with PCT BRAHMS, Hennigsdorf, Germany kit using a time resolved amplified cryptate emission (TRACE) technology assay on Cobas e 411 takes only 30 min and gives valuable information much before the availability of culture results. In our study blood cultures

were positive in the samples taken just before death but final results were available after 1 week of death. Correlation of rise in PCT with mortality is similar to studies published earlier [19, 20]. The highlighting feature of our study is increase in PCT levels with neutropenic sepsis in adult patients of cardiac ICU.

Conclusion

The present study concludes that PCT might be a useful diagnostic tool for early detection of systemic infection and correlates well with morbidity and mortality in cardiac ICU patients with neutropenic sepsis. In both the cases very high PCT values were observed even before decrease in ANC. Hence PCT might be considered as the earliest marker for predicting mortality in both the patients.

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