Short Report

The status of serum procalcitonin in pulmonary tuberculosis and nontuberculosis pulmonary disease

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Abstract

Procalcitonin (PCT) is a marker of the inflammatory response to infection. In the present study the serum PCT of 46 pulmonary tuberculosis patients, 46 non-tuberculosis pulmonary disease and 46 healthy subjects were analyzed using semiquantitative PCT-Q kit. All healthy individuals (100%) were negative regarding PCT. Using cut-off value of 0.5 ng/ml, The sensitivity, specificity positive predictive value and negative predictive value for serum PCT in distinguishing tuberculous from nontuberculous pulmonary disease were 36.9%, 63.1%, 50% and 50%, respectively. According to our results the serum PCT is not a reliable marker for diagnosis of pulmonary tuberculosis due to low sensitivity and specificity.

Introduction

Pulmonary tuberculosis (PTB) is still a major health problem in both developed and developing countries and it remains a leading infectious cause of death. The world health organization (WHO) estimates that there are more than 8 million new cases of tuberculosis (TB) each year. It is estimated that about one-third of the world population are infected with TB (2 billion people) and about 10% of this figure will progress to disease state.[1] The alarming increase in number of tuberculosis patients indicates the need to strengthen the control measures. Control of the disease depends largely on early detection and treatment of active cases. Diagnosis of tuberculosis is based on clinical symptoms, chest x-ray, skin tuberculin test and finally on the detection of the causative agent by direct microscopy of biological specimens and culture on solid and in liquid media.[2] Smear examination and in-vitro culture of mycobacterium tuberculosis bacilli has remained the golden standard. However the sensitivity of the direct smear examination of sputum is low and culture and microbiological tests are also time-consuming and laborious.

Procalcitonin (PCT) is an acute phase reactant protein and consists of 116 amino acids with 13 KDa[3] has been reported as a sensitive marker of severe bacterial infection.[4,5]

The usefulness of PCT in diagnosis, and particularly the differential diagnosis of pulmonary tuberculosis from nonpulmonary tuberculosis diseases, is still the matter of some controversy. The aim of the present study was to determine the sensitivity and specificity of serum PCT test in distinguishing pulmonary tuberculosis from nontuberculosis pulmonary diease.

Patients, Methods and Results

This case-control study was performed from March 2007 to June 2008 in Research Center for Infectious Diseases and Tropical Medicine, Bou-Ali Hospital, Zahedan University of Medical Sciences, Zahedan, Iran. The project was approved by ethical committee of Zahedan University of Medical Sciences and informed consent was taken from all patients and healthy individuals. Blood samples were obtained from TB (n=46), non-PTB disease (n=46) and healthy subjects (n=46). The diagnosis of PTB was based on clinical, radiological, sputum Acid Fast Bacillus (AFB) smear positivity, culture and response to antituberculosis chemotherapy. Cases of lung infections other than tuberculosis were patients who had symptoms and signs of acute pneumonia, bronchitis and broncho-pneumonia confirmed by chest X-ray in whom three consecutive sputum smears were negative for AFB and they had also been cured on follow-up clinically and radiologically

The serum PCT concentration ranges ($\geq$ 0.5 ng/ml, 0.5-2 ng/ml, 2-10 ng/ml and $\geq$ 10 ng/ml) were determined using semiquantitative PCT-Q kit (B.R.A.H.M.S. Diagnostica GmbH, Berlin, Germany) based on the manufacturer's procedure.

Statistical analysis was performed by commercial software (SPSS for Windows, V 11.5). Using fisher's exact test, the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined.

Of 46 PTB patients included in the study, 19 were male (41.3%) and 27 (58.7%), female with mean age of 58 ± 13.4 years (35-87 years). Among non-PTB, 19 (41.3%) were male, 27 (58.7%) female with mean age of 58 ± 15.8 years (19-85 years); in normal subject group, 22 were male (47.8%), 24 (52.2%) were female, and mean age was 43 ± 11.3 years (27-70 years).

As shown in Table-1 all healthy individuals (100%), 63% (29/46) of pulmonary tuberculosis patients and 63% (29/46) of nontuberculosis pulmonary disease had PCT levels less than 0.5 ng/ml. The PCT level at different ranges was different between pulmonary tuberculosis and nontuberculosis

Table-1: Status of procalcitonin (PCT) in pulmonary tuberculosis (PTB), nonpulmaonary tuberculosis (Non-PTB) and healthy subjects.

	Procalcitonin concentration (ng/ml)			
	<0.5	0.5-2	2-10	>10
PTB	29(63.1%)	12(26.1%)	4(8.6%)	1(2.2%)
Non-PTB	29(63.1%)	14(30.4%)	2(4.3%)	1(2.2%)
Normal subjects	46(100%)	0(0%)	0(0%)	0(0%)

pulmonary disease (Table-1). We determined the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPPV) of PCT for distinguishing tuberculosis from nontuberculosis pulmonary disease. Using cut-off value of 0.5 ng/ml, the sensitivity, specificity, PPV and NPV for serum PCT in distinguishing tuberculous from nontuberculous pulmonary disease were 36.9%, 63.1%, 50% and 50%, respectively. The sensitivity of 10.86%, specificity of 93.48%, PPV of 62.5% and NPV of 50.5% were obtained at 2 ng/ml cut-off values (Table-2).

Table-2: The sensitivity, specificity, positive predictive value (PPV), negative predictive value and accuracy of PCT levels at different cut-off point for distinguishing PTB from non-PTB.

PCT Cut-off values	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
0.5 ng/ml	36.9	63.1	50	50	47.9
2 ng/ml	10.86	93.48	62.5	50.5	52.17

Discussion

In the presenty study it was found that although serum PCT-Q semi-quantitative test kit could detect PCT level at different ranges, using the cut-off level 0.5 ng/ml or 2 ng/ml is not a reliable test in distinguishing pulmonary tuberculosis from nontuberculosis pulmonary disease. Kandemir et al.[3] determined the level of PCT in active pulmonary tuberculosis, medical staff and healthy controls. They found that the levels of PCT were not significantly different between active pulmonary tuberculosis patients (0.764 ± 0.204 ng/ml) and medical staff (0.687 ± 0.249 ng/ml). However, differences between active tuberculosis patients and control group (0.308 ± 0.114 ng/ml) were significant. We found that all of the control group and 63.1% of tuberculosis and nontuberculosis pulmonary disease were PCT negative (PCT<0.5 ng/ml). Polzin et al.[6] determined the levels of PCT in patients with acute exacerbation of chronic bronchitis (AECB), community-acquired pneumonia (CAP), hospital-acquired pneumonia (HAP), tuberculosis and healthy subjects. They found that PCT levels in all groups were below the recommended cut-off level of 0.5 ng/ml. Cakir et al.[7] found that serum PCT concentration was statistically different between tuberculous and nontuberculous pleurisy groups, even though PCT levels were below cut off level of 0.5 ng/ml. Specificity and sensitivity values for serum PCT in discriminating tuberculous from nontuberculous pleurisy were 80% and 72.2% at the 0.081 ng/ml cut-off values.

Baylan et al.[8] observed that the PCT levels of most cases with PTB (58.7%) were below the usual cut-off level (0.5 ng/mL). They reported that serum PCT was not a reliable test for diagnosis of active PTB due to its low sensitivity (41.3%). Our results are in agreement with these findings.

In conclusion according to the present study, the PCT levels at different ranges (<0.5 ng/ml, 0.5-2 ng/ml, 2-10 ng/ml and >10 ng/ml) were not different between pulmonary tuberculosis and nontuberculosis pulmonary disease and the serum PCT is not a reliable marker for diagnosis of pulmonary tuberculosis due to low sensitivity and specificity.

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