Research Article

The role of serum procalcitonin level measuring in Patients with acute exacerbation COPD

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Abstract

Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) are important cause of morbidity and motality. Bacterial infection plays the most important cause of AECOPD.**Aim of the work:** the aim of this work is to evaluate possible use of procalcitonin in the prediction and the severity of AECOPD. **Patient and Methods:** 50 COPD patients with acute exacerbation, 30 stable COPD patients and 18 healthy control subjects. Serum procalcitonin levels were measured in all subjects. **Results:** serum procalcitonin levels were significantly higher in COPD patients group (0.82±0.5 ng/ml) than healthy control group (0.3±0.07 ng/ml). Also serum procalcitonin levels were significantly higher in AECOPD patients group (1.12±0.4 ng/ml) than stable COPD patients group (0.31±0.14 ng/ml). The causative microbes among AECOPD patients: Gram positive bacteria caused exacerbation in 72% of the patients while Gram negative bacteria in 22% of them and candidiasis (6%). Streptococcus species was the most common organism (36%) , followed by MRSA(18%), staphylococc species (18%), pseudomonas (12%), klebsiella (10%). the levels of systemic inflammatory markers (PCT, CRP, ESR, WBCs count and Neutrophils count) were significantly higher in the AECOPD group than in the stable COPD group.there was significant negative correlation between procalcitonin serum levels and post bronchodilator FEV1 among AECOPD patients. **Conclusion:** This study found increased serum PCT levels among AECOPD patients and suggests a role for PCT in the predicting of bacterial infections, discrimination between them and non- bacterial ones.

Keyword: COPD, acute exacerbation, procalcitonin.

Introduction

Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) have considerable impact on morbidity, mortality, and quality of life[1]. Common triggers for AECOPD include viral and/or bacterial infection of the tracheobronchial tree and air pollution, but the cause of approximately one-third of severe exacerbations cannot be identified[2]. Calcitonin, being the precursor of procalcitonin (PCT), is secreted from thyroid medullary cells and is related with calcium metabolism[3]. PCT is a protein having a molecular weight of 13 kD and it consists of 116 amino acid residues[4]. The exact regions of its secretion are not yet clear. Some literature suggests that PCT is secreted from neuroendocrine cells of the liver, small intestine and thyroid cells[5]. In healthy humans, its normal serum level is 0.1 ng/ml[3]. PCT, C-reactive protein (CRP) and white blood cells (WBCs) are examples of biomarkers that could assist in selecting patients who will benefit most from antibiotic therapy. It appears that PCT is a more sensitive marker of bacterial infections in general[6]. PCT was prospectively studied as a marker to guide antibiotic therapy in AECOPD[7].

Aim of work

Evaluate possible use of PCT in the prediction and the severity of AECOPD

Patients and methods

This case control study has been carried out on 98 subjects at chest department,Minia university hospital, during the period from october 2016 to May 2017. eighteen of them were involved as healthy

control,while eighty patients diagnosed as COPD based on Global Initiative for Chronic obstructive Lung Disease (GOLD) guidelines[8], fifty of them were in acute exacerbation while thirty patients were stable COPD.

Inclusion criteria: patients over 40 years old with clinical and functional diagnosis of COPD (either stable disease or acute exacerbation).

Exclusion criteria: patients congestive heart failure, patients with obvious pneumonia without COPD on a chest radiograph, patients with pulmonary diseases other than COPD (bronchial asthma,congenital bronchiectasis, pneumonia, tuberculosis,other chronic pulmonary disease), sepsis, pulmonary and extra pulmonary malignancies and any diseases which cause an increase in serum PCT levels.patients received antibiotics within 10 days of admission.

All subjects were subjected to the following: history taking from patients or their relatives, detailed general and local chest examination, plain chest X-ray (PA view) to confirm inclusion criteria, arterial blood gas analysis (ABG), spirometry, Routine laboratory investigations including: (CBC, Renal and liver function tests, C-Reactive Protein, ESR), sputum culture for gram bacteria, Serum procalcitonin: Procalcitonin was measured in patient serum by using ELISA according to the human procalcitonin (PCT) ELISA kit (Glory science co,Ltd) protocol. COPD severity was defined as mild when post-bronchodilator FEV1 ≥ 80% predicted, moderate when post-bronchodilator FEV1 from 50-79% predicted, severe when post-bronchodilator FEV1 from 30-49% predicted, very severe when post-bronchodilator FEV1 < 30 % predicted[8]. For evaluating the type of exacerbation , Anthonisen criteria were used Accordingly, the presence of all of the following criteria such as an increase in the severity of dyspnea (where grade of dyspnea based on mMRC), intensity of the purulency, and amount of the sputum were defined as type1 exacerbation, while Type 2 exacerbation requires the presence of two of these symptoms. The presence of one of the symptoms described previously and upper respiratory tract infection ,fever, and an increase in the severity of wheezing and cough ,20% increase in the respiratory/heart rate within the previous 5 days was defined as Type 3 AECOPD(9).

Results

Table (1): Shows demographic and laboratory differences among total studied subjects

	Control health (n = 18)	COPD patients (n = 80)	P value
Age	50.1±4.7	63.15±9.1	0.098
Sex			
Male	7(38.9%)	65(81.2%)	0.231
Female	11(61.1%)	15(18.8%)	
Smoking history			
Smokers	2(11.1%)	62(77.5%)	<0.001*
Nonsmokers	16(88.9%)	18(22.5%)	
Smoking index (pack per year)	2.78±8.2	36.50±23.1	<0.001*
Laboratory investigation:			
WBCs (×10³/µL)	5.98±1.8	11.7±3.1	<0.001*
Neutrophils %	56.17±12.8	76.59±8.7	<0.001*
ESR first hour mm	11.28±6.01	43.45±28.06	<0.001*
ESR second hour mm	23±10.6	68.55±31.1	<0.001*
CRP	2.33±4.1	35.85±42.8	0.001*
Procalcitonin ng/ml	0.3±0.07	0.82±0.5	<0.001*

Table (2): Shows functional, gasometric and laboratory differences in COPD patient groups:

	Stable COPD (n = 30)	AE-COPD (n =50)	p value
PFT:			
Post-FEV1 (% pred)	59.03±4.6	32.5±9.7	<0.001*
Post-FVC (% pred)	72.5±5.5	48.1±10.7	<0.001*
Post-FEF25-75 (% pred)	43.3±11.4	16.6±8.4	<0.001*
Post-FEV1/FVC %	63.3±4.4	53.6±9.8	<0.001*
Post PEFR %	48.8±6.6	41.8±4.4	<0.001*
ABG:			
pH	7.38±0.02	7.33±0.06	<0.001*
PaO_2 mmHg	62.2±4.6	44.08±13.6	<0.001*
SaO_2 %	91.9±2.1	73.4±16.1	<0.001*
$PaCO_2$ mmHg	47.5±6.4	57.1±14.4	<0.001*
HCO_3 mmol/L	27.4±3.3	29.3±4.9	0.051
WBCs ($\times 10^3/\mu L$)	8.46±1.8	13.72±1.8	<0.001*
Neutrophils %	70.87±10.6	80.02±4.9	<0.001*
ESR first hour mm	14.8±8.6	60.64±20.5	<0.001*
ESR second hour mm	34.3±16.4	89.10±16.07	<0.001*
CRP	4.4±6.8	54.72±44.2	<0.001*
Procalcitonin ng/ml	0.31±0.14	1.12±0.4	<0.001*

Table (3): PCT level based on GOLD classification type, severity of exacerbation:

		N	PCT	P-value
Severity according to GOLD classification	**FEV1≥80% of predicted**	0	-	<0.001*
	FEV1≥50% & < 80%	30	0.31±0.14	
	FEV1≥30% & <50%	24	0.77±0.37	
	FEV1<30% of predicted	26	1.4±0.26	
Type of exacerbation according to Anthonisen criteria	**Type 3**	10	0.6±0.47	0.03*
	Type 2	16	1.08±0.39	
	Type 1	24	1.3±0.4	

Table (4): Level of serum procalcitonin among cultures of different microorganisms in AECOPD:

Microbes	PCT (ng/ml)	P value
Staphylococcus species (n=9(18%))	0.84±0.4	0.096
MRSA (n=9(18%))	1.16±0.5	
Streptcoccus species (n=18(36%))	1.27±0.3	
Pseudomonas (n=6(12%))	0.78±0.6	
Klebsiella (n=5(10%))	1.26±0.2	
Candida (n=3(6%))	1.24±0.2	

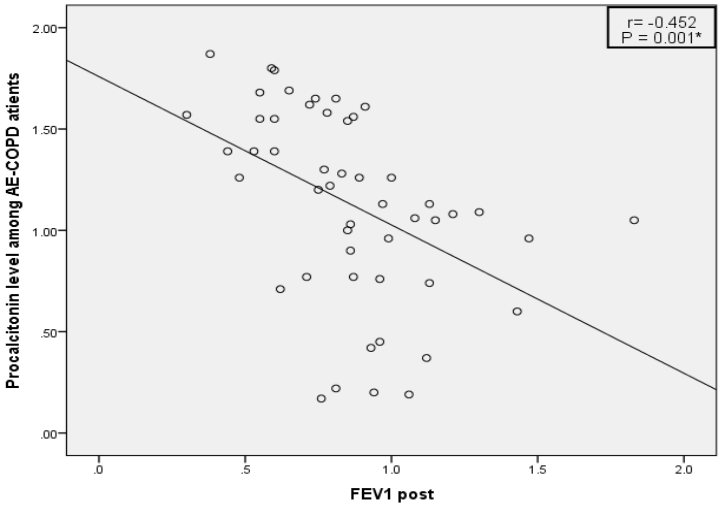

Figure (1): Bivariate correlation between procalcitonin level and post FEV1 among AECOPD

Discussion

In our study, serum procalcitonin levels were significantly higher in COPD patients group (0.82±0.5 ng/ml) than healthy control group (0.3±0.07 ng/ml), this is similar to results of Mohamed et al.,[10]. Also we found that serum procalcitonin levels were significantly higher in AECOPD patients group (1.12±0.4 ng/ml) than stable COPD patients group (0.31±0.14 ng/ml).This result is in agreement with a study by Pazarli et al., reported that sreum procal-citonin level has significant differences between AECOPD patients in comparison with stable COPD patients and healthy control subjects[11]. In the current study, the majority of our patients with AECOPD had bacterial infection (94%) while fungal infection was presented in 6% of them. The causative microbes among AECOPD patients: Gram positive bacteria caused exacerbation in 72% of the patients while Gram negative bacteria in 22% of them and candidiasis (6%). Streptococcus species was the most common organism (36%), followed by MRSA (18%), staphylococc species (18%), pseudomonas (12%), klebsiella (10%). A study by Soler et al., found that the microbial patterns among COPD exacerbation corresponded to community-acquired pathogens (S. pneumoniae, H. influenzae, and moraxella catar-rhalis) in (56%) and to Gram-negative enteric bacilli (GNEB), pseudomonas, and Stenotrophomonas spp. in (44%) of isolates. Clostridium pneu-moniae and respiratory viruses were found in 18% and 16% of investigations, respectively [12]. In the present work, it was found that the levels of systemic inflame-matory markers (PCT, CRP, ESR, WBCs count and Neutrophils count) were significantly higher in the AECOPD group than in the stable COPD group. Similar to this study, also Zhang and his colleague showed that the levels of CRP, PCT, WBC and Neutrophils in the infective COPD group were significantly higher than that in the non infective group[13]. In the present study, procalcitonin level increased with increased severity of AE-COPD as graded by Anthonisen criteria. Also Pazarli et al., reported that mean procalcitonin levels differed significantly in terms of type and severity of AE-COPD and highest level was determined in severe exacerbation [11]. In the present study, procalcitonin level increased with increased airflow limitation as graded by GOLD severity. Also, our study found negative correlation between procalcitonin and post-bronchodilator FEV1 among AECOPD patients. this is in agreement with Daubin et al., recorded higher serum procalcitonin levels in patients with very severe[14].

Conclusion

This study found increased serum PCT levels among AECOPD patients and suggests a role for PCT in the predicting of

bacterial infections, discrimination between them and non- bacterial ones. There is highly significant difference between GOLD classification as regard PCT level, On the other hand, a significant difference between Types of exacerbation and mean procalcitonin level.

Recommendation

It is known that our study had limited numbers of patients so, we recommend making studies on larger scale. Serum PCT level is recommended to be followed after course of anibiotics. Studies of serum PCT level should be performed on patients with non-bacterial AECOPD. We recommend more studied to support our findings

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