

Evaluation of serum procalcitonin level as a biomarker for disease severity in Covid-19 patients: The experience of Mohammed VI University Hospital in Oujda.

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World Journal of Biology Pharmacy and Health Sciences, 2023, 16(01), 106–110

Publication history: Received on 07 August 2023; revised on 06 October 2023; accepted on 09 October 2023

Article DOI: <https://doi.org/10.30574/wjbphs.2023.16.1.0420>

Abstract

The pandemic of coronavirus disease (Covid-19) has infected millions of individuals around the globe. The current study was aimed to evaluate the serum procalcitonin (PCT) level as a biomarker for bacterial co-infection and disease severity in Covid-19 patients. A total of 319 Covid-19 positive patients were examined in this study. Among the total individuals, 169 (53%) were male while 150 (47%) were female. Among the examined samples, 142 (44.5%) were hospitalized in Covid services, and 177(55.5%) were admitted in the intensive care unit (ICU). The mean PCT level for Covid-19 services patients was 0.58 ng/mL and for ICU patients was 7.84 ng/mL. The statistical analysis revealed that there was a significant association of PCT value and age ($P<0,0001$) while there was no association of gender and PCT value in COVID-19 patients ($P=0.2745$). Most Covid-19 patients have low PCT levels but elevated markers of inflammation such as C-reactive protein (CRP) on admission. It can be concluded that the serial PCT measurement could determine the prognosis of disease and presence of bacterial co-infection in Covid-19 patients. The main objective of our study is to determine the role of serum procalcitonin in the diagnosis and clinical management of patients with COVID-19 from Oriental Region of Morocco, also we evaluate the correlation between Procalcitonin and disease severity in COVID-19. We report the experience of the Moroccan Mohammed VI University Hospital of Oujda.

Keywords: Procalcitonin; COVID-19; Diagnosis; Severity; Prognosis.

1. Introduction

Among the greatest public health challenges of the 21st century are emerging viral infections. In December 2019, a new severe respiratory disease spread in Wuhan City, Hubei Province, China. The symptoms that were described were: fever, dry cough, shortness of breath, chills, myalgia, nasal congestion and muscle aches. On 7th January, the causative agent of pneumonia was isolated and the whole genome sequence was released in early January, 2020. It was recognized that the deadly pneumonia was caused by a virus that belongs to the coronaviridae family [1, 2, 3, 4]. The world health organization (WHO) named it severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease it caused as coronavirus diseases 2019 (Covid-19) on February 11, 2020 [5]. WHO first declared it a public health emergency of international concern and then as a pandemic [6]. The disease severity could be evaluated by various laboratory markers including serum procalcitonin [7]. Recently, several findings revealed that a greater level of serum PCT is associated with Covid-19 severity [8]. PCT has also been included in the recommended laboratory work-up for the better prediction of prognosis [9]. In the present work, we focus on the role of serum procalcitonin in the diagnosis and clinical management of patients with COVID-19 from Oriental Region of Morocco, also we evaluate the correlation between Procalcitonin and disease severity in COVID-19. We report the experience of the Moroccan Mohammed VI University Hospital of Oujda.

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2. Material and methods

The current study was conducted at the Central Laboratory of the Mohammed VI University Hospital of Oujda in Morocco. A total of 319 Covid-19 positive patients were examined in this study. Among the total individuals, 169 (53%) were male while 150 (47%) were female. About 3 ml blood sample was obtained from each individual in a red-cap collecting tube. All those individuals who were tested positive for the SARS-CoV-2 according to the WHO and CDC guidelines for the detection and diagnosis of COVID-19 in the period of 2021 were included in this study. The collected samples were centrifuged at 4,000 rpm for 10 minutes to obtain a clear supernatant serum. The samples were analyzed through the ARCHITECT ci8200 integrated system by microparticle chemiluminescence immunoassay (CMIA) and Cobas e 411 analyzer by electrochemiluminescence. The comparison of the two methods was made according to the Cofrac SH-GTA-04 Human Health Accreditation Technical Guide and no significant difference was noticed. The Procalcitonin assay was carried out by verified methods with a very satisfactory coefficient of variation. The net result is in the unit of ng/mL.

The statistical analysis of the data was performed using MedCalc software Version 14.8.1. The correlation between different variables was examined.

3. Results

A total of 319 Covid-19 positive individuals were examined in this study. The Covid-19 patients were previously screened through RT-PCR in the PCR unit of our laboratory which follows global standards. Among the total individuals (n=319), 169 were male individuals while 150 were female individuals. 142 (44.5%) were hospitalized in Covid services, and 177(55.5%) were admitted in the intensive care unit (ICU). The overall mean age observed was 64 years. The mean age in Covid-19 services was 61 and 66 in ICU (Table 1). The mean PCT level for Covid-19 services patients was 0.58 ng/mL and for ICU patients was 7.84 ng/mL. (Table 1).

Table 1 Different services of COVID-19 patients along with their age and mean PCT level

Service:	No. of patients	Mean age	Mean PCT level
Covid-19 Services	142	61	0.58
ICU	177	66	7.84

Among the patients hospitalized in COVID-19 services, only 17 patients were transferred to ICU. Among them, the average PCT was 0.6 ng/mL versus 0.58 ng/mL in patients who have not been transferred to ICU . There was no significant difference. A total of 108 patients died, of which 106 were hospitalized in ICU (Figure 1).

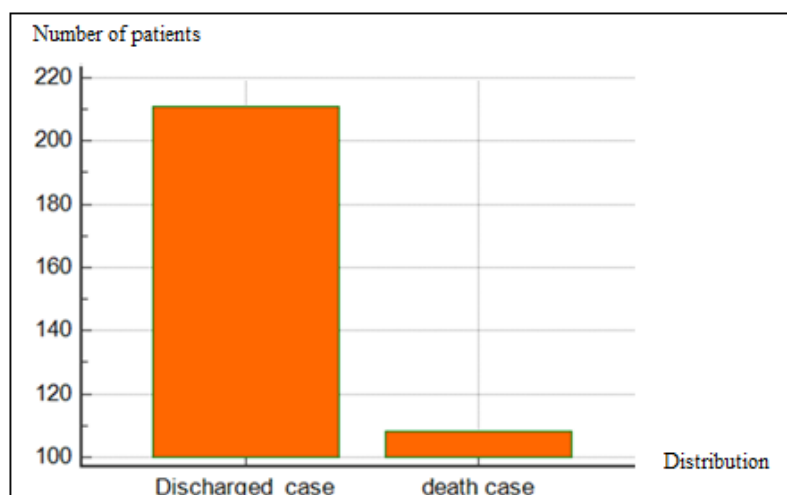


Figure 1 Distribution of discharged cases and death cases

On admission the mean serum procalcitonin level was 0.9 ng/ml in COVID-19 services and 5.5 ng/ml in ICU. While at the end of hospitalization the average serum procalcitonin level was 0.6 ng/ml in the COVID-19 services while it was 63 ng/ml in ICU (figure 2).

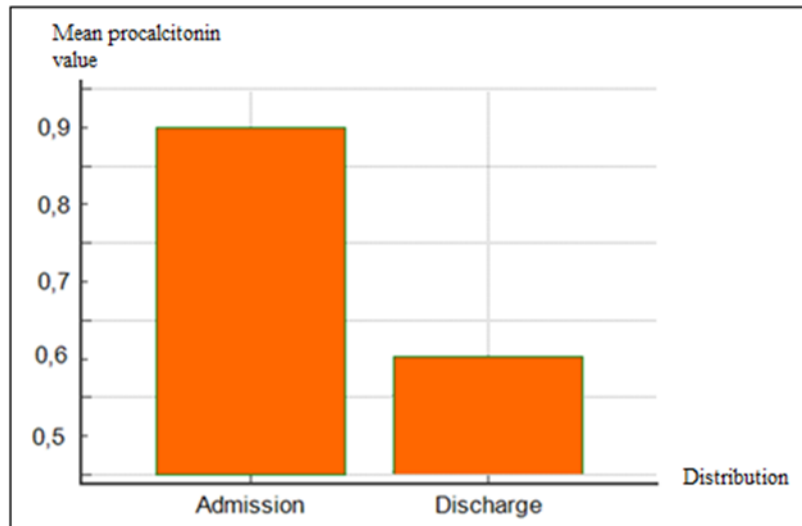


Figure 2 Mean measured procalcitonin value at admission and discharge of patients infected with COVID-19 from discharged cases

The statistical analysis revealed that there was a significant association of PCT value and age ($P < 0.0001$) while there was no association of gender and PCT value in COVID-19 patients ($P = 0.2745$). Most Covid-19 patients have low PCT levels but elevated markers of inflammation such as C-reactive protein (CRP) on admission. There was no correlation between PCT and CRP value in COVID-19 patients ($r = 0.18$). There was a significant association between PCT and D-dimers in one hand ($P < 0.0001$) and PCT and lymphopenia in the other hand.

4. Discussion

Procalcitonin, which is the 116-amino acid precursor of the hormone calcitonin, is normally synthesized and released by thyroid parafollicular C cells. However, it can also be synthesized in many extra thyroid tissues during bacterial infections, which is mediated by increased concentrations of tumor necrosis factor alpha and interleukin 6.

Comparing to other molecules produce during infection, PCT has high value for bacterial infections [10,11,12]. In previous studies, the PCT value has been observed to be elevated and are directly related with the Covid-19 severity [12,13].

Previously researchers reported that the PCT level were higher in critical group than in moderate group [14]. In our study we also observed the similar findings concerning patients hospitalized in intensive care units compared to those in covid-19 departments and we observed that the elevation in PCT level increases with the increase in age of the patients. In discharged patients, we found in our study that the average PCT was high on admission compared to discharge, unlike patients hospitalized in intensive care unit where the average PCT increased from admission to discharge. The fluctuation in PCT level could be associated with the prognosis of the diseases [14]. Most Covid-19 patients have low PCT levels at the time of admission, but elevated markers of inflammation such as C-reactive protein (CRP) indicate that they have inflammation in the lungs [15,16,17]. However, the PCT levels increases during the course of disease which could be linked to the presence of bacterial infections. The bacterial co-infection with the viral infection could result in the development of secondary bacterial pneumonia in these patients [18]. Therefore, when the bacterial co-infection is confirmed, the patients should be treated with antibiotics [19]. However, the bacterial co-infections could increase prognosis and mortality risk if early antibiotic treatment is not initiated [20].

Therefore, the examination of PCT as a biomarker is essential in Covid-19 patients. For identification of bacterial infections, PCT is a better biomarker as it has specificity towards bacterial infections.

PCT as effective biomarkers and prognostic tool for lungs infection and other respiratory tract infections has been reported previously. Several studies have reported its significant prognostics implication and detection of bacterial co-

infections [21]. In addition to other prognostic tools as infection bio-markers for monitoring of Covid-19 patients, PCT could also be used as important biomarkers. Our results demonstrated that the serial PCT measurement could predict the prognosis of Covid-19 patients.

5. Conclusion

In conclusion, our study demonstrates that PCT may be an indicator of severity and may contribute to determining the severity of patients infected with COVID-19. In addition, serial procalcitonin measurements may be useful in predicting prognosis. Additional investigation is needed to further illustrate the mechanisms by which increased PCT is synthesized and released in patients infected with COVID-19.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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