CORRELATION BETWEEN PROCALCITONIN AND OTHER INDICATORS OF INFLAMMATION IN PATIENTS WITH VENTILATOR ASSOCIATED PNEUMONIA

GIUSEPPA LA CAMERA, *GIOVANNI CANTARELLA, **MARIA DI VITA, DANILO CARMELO GRASSO, CHRISTIAN BONSIGNORE, PIERFILIPPO DI MARCO, DARIO AKHSHIK
*Department of Medical Sciences and Pediatric Cardiology - **Department of Surgery, Department of Anesthesiology and Intensive Care, Universiy of Catania, Italy

ABSTRACT

***Introduction**: A patient hospitalized in Intensive Care with an initial diagnosis of cardiac-respiratory insufficiency is described. Several clinical and laboratory parameters are analyzed, including procalcitonin (PCT), highlighting how they quickly correlate with episodes of ventilator associated pneumonia (VAP) which this patient repeatedly suffered, thus revealing a useful biomarker for timely diagnosis and therapy.*

***Key words**: Ventilator associated pneumonia, procalcitonin, inflammatory parameters, trachea-stoma, biomarker.*

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Introduction

VAP refers to a pathological condition characterized by the presence of an infiltrate of inflammatory origin at the level of pulmonary parenchyma. It appears about 48 hours after beginning mechanical respiration, and clinically exhibits fever, leukocytosis, and production of a pulmonary infiltrate visible on chest x-ray. In recent years the literature has provided several new biomarkers that can be used in the clinical diagnosis of VAP. An important role is played by PCT, along with other indicators of inflammation such as C-Reactive Protein (CRP), white blood cell count (WBC), and body temperature.

PCT is an innovative diagnostic parameter used to identify the presence of infectious bacteria, sepsis and septic shock[1]. The concentration of PCT in the plasma strictly correlates with the severity of inflammatory activation[2], and its sensitivity and specificity are superior to CRP, WBC, or body temperature, which are fairly sensitive indicators of inflammatory stimuli but have limited specificity[4]. PCT is already present in the circulation 2-6 hours after the stimulus, with peak values after 12-48 hours. In healthy individuals PCT values are usually less than 0.05ng/ml[3], while values higher than 10ng/ml are found in severe bacterial sepsis or septic shock.

Material and methods

In June 2013 the patient B.L. was admitted to the I.C.U. of Vittorio Emanuele Polyclinic Hospital in Catania. B.L. is a Caucasian male age 61, height 170cm, weight 110kg. The patient's distant pathological history included obesity, arterial hypertension, dyslipidemia treated pharmacologically, but no significant family pathology. The initial diagnosis was cardio-respiratory insufficiency and recent AMI. The patient was apyretic, intubated via oral-tracheal tube connected to a mechanical respirator, hemodynamically stabile, with diuresis but stimulated pharmacologically, Once admitted we measured his PCT daily using the immunometric method (Mini-Vidas, Biomerieux). Routine hemodynamic tests were also performed including renal function, liver, complete hemichrome with formula,

and RCP. We also measured body temperature and bacteriological exams in the sputum and in the blood when fever appeared. After the first week spontaneous respiration was not expected in the near future, so a surgical trachea-soma was performed. The patient's condition during the following two months remained serious. On the 61st day of hospitalization a very high increase of PCT (112ng/ml) was observed, along with an increase in WBC.

During the following days both values decreased but not to normal, and peaked again on the 68th day. The body temperature was fluctuating compared to the PCT and the other two measures, with an increase on the 65th day and an episode of hypothermia on the 70th day. At the same time we isolated Escherichia coli in the blood culture, a gram negative bacterium notorious in the pathogenesis of VAP, especially in the late-onset form. Consequently we administered therapeutic doses of meropenem. The antibiotic therapy normalized the WBC and PCT values (Figure 1). (Corrections to Figure 1: White cells, Procalcitonin, Temperature, Day of Hospitalization).

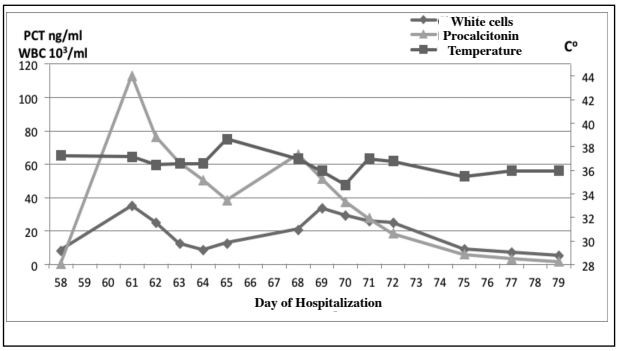

Figure 1: Changes in PCT, temperature, and white cells from the 58th to 79th day of hospitalization.

On the 80th day we observed a new peak in PCT values, and over the following days they remained high, uncorrelated to WBC or body temperature. A slight increase was observed on the 91st day, loosely correlated to a slight increase in PCT the day before. A nasal swab, throat swab and bronchial aspirate performed afterwards were positive for Aeruginosa Pseudomonas, and the patient was treated with a combination of rifampicin and colimicin (Figure 2).

During the following day we observed a large increase in PCT values, followed by a gradual decrease. The WBC was very high on the 98th day, while CRP and body temperature were normal. At the same time urine culture revealed a high load of Klebsiella pnaeumoniae bacteria, sensitive to colistin, which was administered to the patient (Figure 3).

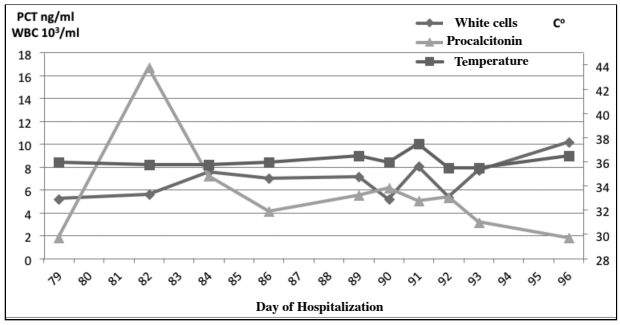

Figure 2: Changes in PCT, temperature, and white cells from the 79th to 96th day of hospitalization.

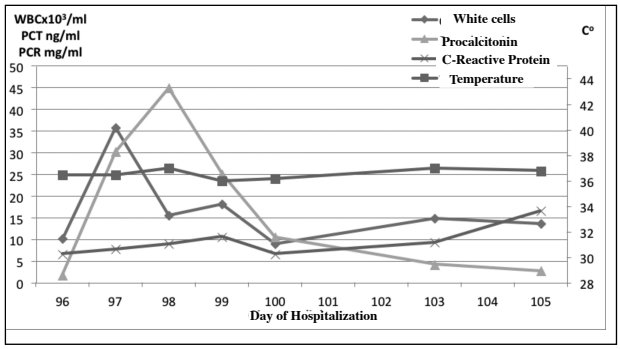

Figure 3: Changes in PCT, body temperature, WBC and CRP from the 96th to 105th day of hospitalization.

Discussion

Clinical signs, x-rays, intensive hemodynamic and microbiology monitoring during hospitalization in I.C.U. aided in the diagnosis of the patient's repeated episodes of ventilator associated pneumonia. The diagnosis was supported by isolating the bacteria notorious in the pathogenesis of VAP pneumonia such as E. coli, Pseudomonas Aeruginosa, and Klebsiella pnaeumoniae, during the long period of mechanical respiration and pharmacological sedation the patient underwent. Other risk factors included obesity and chronic respiratory insufficiency. Routine monitoring of PCT showed a correlation between the infection process and increasing PCT values. Compared to WBC, PCT has quicker and more precise peaks that accompany the infection[5], allowing a fast and appropriate therapeutic response. VAP is a variable disease whose duration depends on the virulence of the pathogen and the defenses of the host[6].

Conclusions

VAP is still a frequent cause of morbidity and mortality despite the complex and expensive attempts at prevention and treatment. The essentially clinical diagnosis is often problematic due to the low sensitivity and specificity of clinical and radiographic signs[7]. Daily monitoring of PCT is an important method to quickly diagnose VAP, considering the ease of use due to new technology. PCT also offers other encouraging features: high sensitivity and specificity for infections, the rise appears early in the infection and declines early on resolution of the infection, which makes the monitoring and identification of episodes possible[8]. These considerations confirm that PCT is a promising biomarker to improve diagnostic efficiency and manage progression and treatment of VAP[9].

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