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Procalcitonin as a diagnostic and prognostic marker for sepsis caused by intestinal infection: a case report

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Abstract. – BACKGROUND: In recent years, procalcitonin has emerged as a promising marker for bacterial infection, with the high sensitivity and specificity.

CASE PRESENTATION: This report presents a 76-year-old woman with fever, vomiting and diarrhea. The clinical and laboratory examination revealed that the patient had a suspected serious intestinal infection and sepsis. The extremely high level of procalcitonin and positive blood culture result confirmed our diagnosis.

CONCLUSIONS: Early identification of severe sepsis sometimes is very difficult. Procalcitonin is a useful tool in the early diagnosis of sepsis, differentiating from other inflammatory syndrome. The high PCT level (10 ng/ml) in this case could suggest serious bacterial infection and sepsis, and also predicts mortality and worse outcome.

Key Words:
Procalcitonin, Intestinal infections, Diagnosis, Sepsis.

Introduction

Procalcitonin (PCT), a 13-kDa 116-amino acid precursor molecule of calcitonin, is usually released from the c-cells of thyroid gland. The complete sequence of PCT has been known since 1984[1], and its encoding was characterized in 1989[2]. In health people, the PCT levels in the blood are very low, typically less than 0.05 ng/ml. However, the levels are markedly increased upon response to bacterial endotoxins and proinflanmatory cytokines and strongly correlates with extent and severity of infection. Conversely, PCT levels are attenuated by interferon (INF)-γ, a cytokines typically releases in response to viral infection. Therefore, PCT is more specific for bacterial infections and may help to distinguish bacterial infections from viral illness and other non-infectious inflammatory conditions[3].

Current interest in PCT in critical care medicine stems from the original report in 1993 that elevations in the serum concentration were associated with bacterial sepsis in children[4]. Moreover, PCT shows a favorable kinetic profile for use as a clinical marker: its serum levels rise in 3 hours and reach the maximum within 6-12 hours from onset of bacterial infection. Serum half-life of PCT is about 20-24 hours and PCT has a high stability in serum and plasma *ex vivo* which making it particularly suitable for routine laboratory parameters of infection[5]. Furthermore, circulating serum PCT levels halve daily when the infection is controlled by host immune system or antibiotic therapy, PCT also had been recommended for monitoring disease course and response to treatment[6].

To our knowledge, there are very few reports about the usefulness of PCT in intestinal infection. Therefore, we reported here a case of a 76-year-old woman with serious intestinal infection and sepsis who had an extremely high level of procalcitonnin.

Case Presentation

A 76 year-old woman presented in the Emergency Department complaining of a 2 day history of fever, vomiting and watery diarrhea after taking suspected diet. She had undergone a left lung resection 28 years previously.

On admission, physical examination revealed the patient was in a bad general condition. Her axillary temperature was 37°C, blood pressure 70/40 mmHg, heart rate 140 bpm, and respiratory rate 32 bpm. Lung auscultation revealed decreased breath sounds over the left lower lung field and wheezing sound over the lower part of right lung. Abdomen examination showed slight tenderness. No lymphadenopathy was found and examination of other systems was unremarkable.

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Results of laboratory investigation were as follows: white blood cell count, 8.4×10^9/L with 72.54% neutrophils; red blood cell count, 4.24×10^{12}/L, haemoglobin, 120 g/L, platelet count 36×10^9/L, serum C-reative protein (CRP) level, 175.15 mg/L, alanine aminotransferase (ALT) level, 73U/L, aspartate aminotransferase (AST) level 49U/L, total protein 54.10 g/L, albumin 31.30 g/L, blood urea nitrogen, 14.75 mmol/L, creatinine, 121.10 μmol/L, erythrocyte sedimentation rate of 25 mm/h, and the level of procalcitonin was more than 10 ng/ml. The patient was in respiratory insufficiency with an arterial pH of 7.107, PCO_2 of 54.8 mmHg, PO_2 of 88 mmHg, HCO_3 of 17.3 mmol/L and SaO_2 92% on room air. Her chest radiograph and CT scan showed post operation of left lung, and echocardiogram or electrocardiogram showed nodal tachycardia. The initial prominent diagnosis for her was serious intestinal infection and subsequent sepsis, based on the history, physical examination and extremely high PCT level. The patient was treated with antibiotic (ciprofloxacin) and standard care for shock. After admission, her general condition became worse, and dyspnoea and hypotension developed. The laboratory data showed the white blood cells increased (from 15.34×10^9/L with 97.94% neutrophils to 31.12×10^9/L 96.74% neutrophils), the level of blood ALT (591U/L), AST (390U/L), creatinine (286.10 μmol/L) and urea nitrogen (19.19 mmol/L) increased significantly. Her condition rapidly deteriorated and had been in rapid progression to circulatory collapse, progressive dyspnea and multiple organ failure. On the same day, blood culture result came out and was positive for Escherichia coli, susceptible to imipenem, meropenem, however, resistant to ciprofloxacin, which confirmed our initial diagnosis.

Discussion

Sepsis, defined as systemic inflammatory response syndrome (SIRS), mainly is induced by serious bacterial infection. Delay in diagnosis and treatment often results in rapid progression to circulatory collapse, multiple organ failure, and finally, death. Early identification significantly reduces mortality from sepsis-related multiple organ dysfunction[7-8]. However, sepsis can sometimes be difficult to substantiate, and its distinction from non-infectious conditions in critically ill patients is often a challenge. Definitive an etiological diagnosis requires isolation of the microorganism from the blood or the site of infection, but positive bacteriological cultures, including blood cultures may not be promptly available. And in many cases, blood culture is negative, which can reflect previous antibiotic administration, the presence of slow-growing or fastidious organisms or the absence of microbial invasion of the bloodstream. It has been estimated that blood cultures are positive in only 5-20% of sepsis cases. Changes in body temperature, heart and respiratory rates, and white blood cell counts are unspecific. CRP is one of the most commonly used laboratory tests in the emergency department. It is cheap and widely used for the detection of infection and inflammation, however, CRP positivity often lacks specificity for the detection of infections due to frequent elevation in various non-infectious complications, and it is not sufficiently specific for an accurate diagnosis of severe sepsis[9]. The better diagnostic tests for sepsis have long been sought, and among the most prominent candidates in this respect are PCT, as a novel biomarker of infection, which has become increasingly popular and several studies have highlighted the usefulness of monitoring PCT levels for identifying infectious processes[10]. Several earlier studies have demonstrated that PCT is the best parameter for identifying sepsis compared with 15 other clinical, biochemical, and bacteriologic variables tested in the ER setting, including IL-6 and CRP. PCT was found to be significantly higher in patients with bacteraemia and septic shock than in other patients[11-13].

New analytical methods have made PCT measurement more easily accessible for round-the-clock use. In our case, we used a semi-quantitative method with immunochromatography (Wuhan Easy Diagnosis Biomedicine Company, Wuhan, China) for the PCT assay, which gave a rapid result in 15 minutes.

In the case presented here, the patient complained of a 2-day history of fever, vomiting and watery diarrhea after taking suspected diet and on admission the laboratory investigation showed white blood cell count was in normal range. Based on history, physical examination and conventional laboratory examination (i.e. white blood count) it was very difficult to identify serious infection and sepsis in early stage and distinct it from simple acute gastroenteritis. However, the PCT level in this case significantly increased (> 10 ng/ml), even when blood cells was in normal range, Later, the positive blood culture results (*Escherichia coli*) confirmed the patient

has a serious systemic infection. It suggested that PCT may have a value an early biomarker for bacterial infection.

PCT levels are characteristically high in patients with severe bacterial infections or with sepsis. It also had been recommended for monitoring disease course and predicting outcome which was used as a new marker of systemic infection for screening and determination of the prognosis of severely ill patients. The procalcitonin level at admission can be a prognostic indicator for sepsis and mortality. Several studies showed that procalcitonin concentrations within the first 48 hours, especially between 14 and 24 hours could serve as a useful prognostic indicator for sepsis and mortality in patients with serious infection[14-15]. When PCT is positive and at a high level (> 2 ng/ml), a patient is likely to develop severe sepsis or septic shock. In addition, it is important to closely monitor patients whose procalcitonin concentration is ≥ 2 ng/ml, and administration of prophylactic antibiotics should be considered. In this case we presented here the patient had an extremely high PCT level (> 10 ng/ml) and died in the end. It suggested a significant high PCT that might be associated with septic shock and multiple organ failure and worse outcome.

Conclusions

Procalcitonin is useful in the early diagnosis of sepsis, differentiating bacterial infection, sepsis from viral infection and other non-infectious inflammatory syndrome. The high PCT level (10 ng/ml) in this case could suggest serious bacterial infection and sepsis, and also predicts mortality and worse outcome.

Conflict of Interest

None.

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