



Serum procalcitonin in Egyptian patients with acute meningitis and a negative direct cerebrospinal fluid examination

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Received 25 March 2013; received in revised form 4 June 2013; accepted 2 July 2013

KEYWORDS

Acute meningitis;
Negative gram stain;
Procalcitonin

Summary

Background: To reduce the morbidity and mortality related to bacterial meningitis, it is important to discriminate bacterial meningitis from aseptic meningitis during the acute phase of the disease, when the clinical symptoms are often similar.

Objectives: To test the reliability of serum procalcitonin (PCT) to discriminate bacterial meningitis from aseptic meningitis in patients who have a negative direct cerebrospinal fluid (CSF) examination, and to evaluate the role of serum PCT to assess treatment efficacy compared with the total leukocyte count (TLC), erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP).

Materials and methods: Forty patients with suspected acute meningitis and negative gram stains were included, and ten healthy persons were included as controls. According to the clinical examination and the CSF cytochemical analysis and cultures, the patients were divided into bacterial and aseptic groups. The measurements of serum PCT, ESR, CRP and TLC were performed.

Results: Patients in the bacterial group had a higher value of serum PCT at admission and at 3 days post-treatment than those in the aseptic group, with a highly significant difference between them.

Conclusion: Serum PCT and, to a lesser extent, TLC had prognostic value in patients with acute meningitis, and PCT is more useful because it can be frequently measured for the diagnosis and follow-up of bacterial meningitis.

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Abbreviations: PCT, procalcitonin; TLC, total leukocytic count; ESR, erythrocyte sedimentation rate; CSF, cerebrospinal fluid (CSF); ELISA, enzyme linked immunosorbent assay; ROC, receiver operating characteristic; WBC, white blood cell count; CRP, C-reactive protein; N, number.

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Introduction

Meningitis is an extremely severe and life threatening infection that necessitates immediate diagnosis and prompt therapy. Bacterial meningitis is endemic in Egypt, and sporadic cases occur throughout the year [1].

Because the consequences of the delayed diagnosis of bacterial meningitis can be severe, any proposed diagnostic tool must achieve near 100% sensitivity. When used alone, clinical criteria, gram staining, bacterial antigen testing of the cerebrospinal fluid (CSF) and classic tests of biological markers in the blood (C-reactive protein [CRP] level, white blood cell [WBC] count and neutrophil count) or CSF (protein level, glucose level, WBC count and neutrophil count) do not offer 100% sensitivity with a high specificity for distinguishing bacterial and aseptic meningitis [2].

CSF analysis is the cornerstone and diagnostic test of choice for suspected meningitis [3]. Gram staining of the sample may demonstrate bacteria in bacterial meningitis, but the absence of bacteria does not exclude bacterial meningitis as they are only observed in 60% of cases; this figure is reduced by a further 20% if antibiotics were administered before the sample was taken [4]. Procalcitonin (PCT), a calcitonin propeptide, is believed to be synthesized in the C cells of the thyroid gland and secreted from leukocytes of the peripheral blood. The secretion of PCT was found to increase in the presence of bacterial lipopolysaccharides and cytokines that are associated with sepsis [5]. Among the new markers, the serum PCT level appears to be one of the most sensitive and specific predictors to discriminate between bacterial and aseptic infections [6]. Recently, its role in distinguishing between children with aseptic meningitis and those with life-threatening bacterial meningitis has been reported [7]. Moreover, Viallon et al. [8] reported the value of determining the serum PCT concentrations for the differential diagnosis of bacterial and viral meningitis in the absence of microbiologic pointers at the time of a patient's emergency admission to the hospital. In our study, we will evaluate the potential role of serum PCT in the differential diagnosis of meningitis cases that have a negative direct CSF examination. We will also evaluate the role of serum PCT in determining the treatment efficacy at an earlier stage of acute bacterial meningitis to reduce the need for lumbar puncture performed 48–72 h after admission to assess the treatment efficacy.

Materials and methods

Study site

This prospective study was performed in the Tropical Medicine Department, Ain Shams University Hospital, and at Embaba Fever Hospital in collaboration with the central microbiology unit, Ain Shams University Hospital, during the period from January 2012 to September 2012.

Study population

Forty patients presenting at the emergency unit of Embaba Fever Hospital with suspected acute meningitis were enrolled in this study. According to the results of the cerebrospinal fluid (CSF) cytochemical profile and bacterial cultures, our patients were classified into two groups: Group 1 included 16 patients with acute bacterial meningitis, and Group 2 included 24 patients with acute aseptic meningitis. The control group (Group 3) included 10 healthy subjects with no clinical or laboratory evidence of infection and who were matched according to age and sex. Meningitis was defined as bacterial according to both the CSF laboratory findings (increased protein ≥ 2 g/l, decreased glucose ratio ≤ 0.4 , and leukocyte count $\geq 1500 \times 10^6$ /l with polymorph nuclear leukocyte domination) and a positive bacterial culture [9].

Inclusion criteria

Patients who presented for the first time at Embaba Fever Hospital with the following conditions were included in this study: (a) clinical picture and CSF analysis suggestive of acute meningitis and (b) negative direct CSF examination.

Exclusion criteria

Patients with the following conditions were excluded:

- Clinical, radiological and/or laboratory findings suggestive of tuberculosis, cryptococcal meningitis, cerebrovascular disease, brain tumors or other causes of coma.
- Antibiotic treatment for 2 days before admission.
- Positive organism in a direct gram-stained film.
- Other causes of fever (presence of another site of infection in addition to meningitis).
- Drug-induced meningeal irritation.

Ethical considerations

Informed consent was obtained from the patients' relatives and the control subjects before

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