ORIGINAL RESEARCH

Cytokine levels in community-acquired pneumonia

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ABSTRACT

Background: This study was conducted to assess cytokine levels in subjects having community-acquired pneumonia.
Material and methods: Pneumonia sufferers had been involved in the investigation. During the hospital stay, serum cytokine concentrations had been assessed, genotyping was carried out, the responsible bacteria were determined, and subjects were watched closely.
Results: Individuals having pneumococcal pneumonia had considerably higher blood cytokine concentrations. The beginning of corticosteroid therapy had an independent impact on the decline in cytokine concentrations.
Conclusion: Acute phase proteins, such as IL-1RA, IL-6, IL-8, and IL-10, are not genotype-dependent. The type of the causing microbe and the beginning of corticosteroid therapy have an impact on their levels
Keywords: cytokine, pneumonia

Introduction

Community-acquired pneumonia is a leading cause of hospitalization, mortality, and incurs significant health care costs. As disease presentation varies from a mild illness that can be managed as an outpatient to a severe illness requiring treatment in the intensive care unit (ICU), determining the appropriate level of care is important for improving outcomes in addition to early diagnosis and appropriate and timely treatment.[1-4]

CAP encompasses a clinical spectrum from walking pneumonia in an otherwise healthy patient to necrotizing or multilobar disease with septic shock. Pneumonia is the third leading reason for hospital admission, accounting for 544,000 hospitalizations from the ED annually.[5] Despite advances in medicine, the mortality rate from CAP has remained stable over the past 4 decades[6] In the United States, CAP is the leading cause of sepsis and death from infection. Given the prevalence of CAP and its potential to cause severe illness, emergency providers must have a thorough understanding of this multifaceted condition and be able to take a nuanced approach to management.

The role of each specific cytokine in the inflammatory response to CAP is still a subject of ongoing research. In general, tumour necrosis factor (TNF)-α and interleukin (IL)-6 are considered essential pro-inflammatory proteins and IL-10 is considered the most important cytokine with anti-inflammatory properties.[7,8]

Hence, this study was conducted to assess cytokine levels in subjects having community-acquired pneumonia.

Material and methods

This study was conducted to assess cytokine levels in subjects having community-acquired pneumonia. Overall, 100 subjects were involved in this study. 70 out of 100 subjects were males whereas 30 were females. A new infiltration on a chest radiograph along with at least two of the following criteria were used to establish pneumonia: C-reactive protein (CRP) >15 mg/L1, cough, sputum production, temperature >38°C or 35°C, auscultatory signs associated with pneumonia, leukocytosis or leukopenia, and/or leukopenia. Patients with specific immunodeficiencies were excluded, including those with known congenital or acquired immunodeficiencies, those who had recently

undergone chemotherapy, taken corticosteroids (prednisone equivalent >20 mg/day for >3 days), or been hospitalized recently (30 days). Clinical and laboratory data were collected at inclusion, and the Pneumonia Severity Index (PSI) was computed. To use multiplex immunoassays to determine cytokine profiles, blood was drawn and serum samples were preserved. The following factors were evaluated: mortality, intensive care unit (ICU) admission, hospital stay duration, and the etiologic microbe. All patients provided their written, voluntarily informed consent. All statistical analyses were performed using statistics software SPSS version 13.0

Results

Table 1: Gender-wise distribution of subjects

Gender	Number of subjects	Percentage
Males	70	70%
Females	30	30%
Total	100	100%

70 out of 100 subjects were males and 30 were females.

Table 2: Concentrations of IL-1RA, IL-6, IL-8, and IL-10 at admission and after 3 days

Cytokines	Concentration at admission (pg/ml)	Concentration after 3days (pg/ml)
IL-1RA	101.3	49.2
IL-6	33.5	7.6
IL-8	13.7	5.8
IL-10	17.1	9.0

The concentrations of the cytokines were high at admission and reduced after 3 days of treatment.

Discussion

Community-acquired pneumonia (CAP) is an acute inflammatory condition of the lung acquired outside of the health care system. It affects people of all ages. The disease is characterised by a risk of rapid deterioration with high mortality, which is difficult to predict. Thus, hospitalisation and narrow surveillance of patients is often required.[9]

Reports suggest nearly 2.4 million deaths occur among all ages due to lower respiratory tract infections (LRTIs).[10] Among these, sub-Saharan Africa, Southeast Asia and South Asia have documented higher fatality. In 2016, 197.05 million episodes (112.83-287.64) of pneumococcal pneumonia were reported worldwide and thus represented the leading cause of LRTI morbidity and mortality. Globally, mortality due to LRTI remained unchanged from 2005 to 2015 although age standardized death rates fell by 19.5 percent. In recent years, there has been a steady increase in the hospitalization rates including intensive care units (ICU) due to CAP, especially in the older population.[11] The case fatality rate ranges from 2 to 20 per cent reaching up to 50 per cent in patients admitted to ICUs and varies between healthcare settings, geographical region, patient categories and age.[12]

Hence, this study was conducted to assess the cytokines levels in subjects having community-acquired pneumonia.

In this study, it was seen that the cytokine concentrations were raised at the time of hospitalization and after three days pf corticosteroid therapy, there was reduction in cytokine levels.

Siljan et al[13]examined the association of multiple cytokines and the terminal complement complex (TCC) with microbial aetiology, disease severity and short-term outcome. Plasma levels of 27 cytokines and TCC were analysed in blood samples obtained at hospital admission, clinical stabilization and 6-week follow-up from 247 hospitalized adults with CAP. Fourteen mediators were included in final analyses. Adverse short-term outcome was defined as intensive care unit (ICU) admission and 30-day mortality. Cytokine and TCC levels were dynamic in the clinical course of CAP, with highest levels seen at admission for most mediators. Admission levels of cytokines and TCC did not differ between groups of microbial aetiology. High admission levels of IL-6 (odds ratio [OR] 1.47, 95% confidence interval [CI] 1.18-1.84, P = .001), IL-8 (OR 1.79, 95% CI 1.26-2.55, P = .001) and MIP-1β (OR 2.28, 95% CI 1.36-3.81, P = .002) were associated with a CURB-65 severity score of ≥3, while IL-6 (OR 1.37, 95% CI 1.07-1.74, P = .011) and MIP-1β (OR 1.86, 95% CI 1.03-3.36, P = .040) were associated with a high risk of an adverse short-term outcome. In this CAP cohort, admission levels of IL-6, IL-8 and MIP-1β were associated with disease severity and/or adverse short-term outcome. Still, for most mediators, only non-significant variations in inflammatory responses were observed for groups of microbial aetiology, disease severity and short-term outcome.

Kapanadze et al[14]evaluated the potential association serum cytokine levels with complications and severity of pneumonia and identification marker for earlier diagnosis of pneumonia complications. For this purpose, 62 children admitted to Iashvili Central Children Hospital during 2013-2014, Tbilisi, Georgia,

were investigated. The study was approved by the Ethics Committee of the Tbilisi State Medical University and written informed consent was obtained from the parents/legal guardians of all study participants. Control group consisted of 10 healthy age matched individuals. All samples (serum, urine, sputum, nasopharyngeal swabs) were analyzed for the presence of respiratory viruses and/or bacterial pathogens. The serum cytokines (IFN-gamma, TNF-alfa, IL-8, IL-10) levels were determined by enzyme-linked immunosorbent assay (ELISA) on the first and fifth day of hospitalization. The patients with community-acquired pneumonia on the first and fifth day of the treatment had significantly higher cytokine concentrations (IFN-g, TNF-a, IL-8, IL-10) than age matched individuals ($p<0.01$). Moreover, IL-10 and TNF-a ($p<0.05$) levels were statistical differ between groups with high and low saturation, However, patients with pleural effusion have significantly lower circulating IL- 8, than without effusion. Based on their results, circulatory cytokines (IL-10, TNF, IL-8) were elevated in CAP patient and can be used as markers of pneumonia severity signs (saturation, pleural effusion etc).

Conclusion

Based on the results of this study, it can be concluded that cytokines are an essential biomarker for the diagnosis of community-acquired pneumonia.

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