Low Opsonic Activity in Sera from HIV-Infected Patients against *Streptococcus pneumoniae*

Yasuo Ono1,3), Satoshi KIMURA2), Shin-ichi OKA2), Kaoru SHIMADA2), Otohiko KUNII3) and Shiro KANEGASAKI1)
1)Department of Bacterial Infection and 2)Internal Medicine, Institute of Medical Science, University of Tokyo
3)Department of Internal Medicine, Division 2, Teikyo University School of Medicine
(Received: June 8, 1993)
(Accepted: July 26, 1993)

Key words: opsonic activity, HIV, *S. pneumoniae*, chemiluminescence

Patients infected with human immunodeficiency virus (HIV) are highly susceptible to various bacterial infections, especially, *Streptococcus pneumoniae*1,2). Encapsulated bacteria such as *S. pneumoniae*, *Hemophilus influenzae* and *Klebsiella pneumoniae* are known to be resistant to phagocytosis by neutrophils and macrophages unless cell-wall-specific antibodies are present. It is suggested, therefore, that the serum of HIV-infected patients is deficient in opsonic activity against these bacteria. In this study, we compared the serum opsonic activity of the patients with that of healthy normal persons by using the luminol-enhanced chemiluminescence (CL) method. As CL assay is a very sensitive and reliable way for determining the opsonic activity of serum3,4,5), the method can be used to quantify the opsonic activity of sera from HIV-infected patients.

**Materials and Methods**

This study included 23 HIV-infected patients (21 males, 2 females), aged from 9 to 56 years (average ± SD, 29 ± 12) who had CD4+ T cell counts in peripheral blood ranging from 3 to 606/µl (average ± SD, 177 ± 214). Controls were 12 healthy donors aged from 20 to 39 years (30 ± 5 years). Sera from both groups were collected under sterile conditions, and stored in small quantities at −80°C before assay. Neutrophils were isolated from a healthy blood donor by the Ficoll-Hypaque gradient method as described before). Neutrophils were washed twice in minimum essential medium (MEM) and resuspended at 5 × 10⁵ cells/ml in MEM. The opsonic activity of the serum against a strain of *S. pneumoniae* type 3 was determined in comparison with that of pooled normal serum (blood type AB stored at −80°C) by incubation at 37°C for 10 min. CL was that emitted by 5 × 10⁵ neutrophils in 1 ml of MEM, stimulated by 20 µl of *S. pneumoniae* suspension (2 × 10⁷ cfu) opsonized by 20 µl of patient’s serum, healthy person’s serum or pooled normal serum in the presence of 20 µl (11.2 m mol) of luminol. The assay was performed with a Biolumat LB9505 device (Berthold Co., Germany) and recorded for 20 min. The integral CL count for 20 min obtained was used and the results are expressed as the percentage of the control (blood type AB).

The statistical significance of differences between results was calculated by Student’s *t*-test.

**Results and Discussion**

Figure 1 shows the opsonic activity in sera from HIV-infected patients and normal individuals against *S. pneumoniae*. Sera from the patients exhibited lower opsonic activity than pooled normal serum. The mean value of the activity in sera from patients was 84 ± 16% of that of pooled serum. In contrast, sera
from healthy adults showed higher opsonic activity and gave a mean value of 115 ± 16%. The low opsonic activity was found in both asymptomatic HIV-seropositive individuals and patients with acquired immunodeficiency syndrome (AIDS) (data not shown).

Susceptibility to invasive pneumococcal diseases is known to be different in HIV-infected patients and healthy persons\(^1\). One of the reasons for this difference may be the low opsonic activity intervening in the process of bacterial phagocytosis in HIV-infected patients. The low activity seems to be due to a decreased level of capsule-specific antibody against surface polysaccharides of *S. pneumoniae*, since the levels of IgG to pneumococcal capsular polysaccharides were reported to be significantly lower in both asymptomatic HIV-seropositive individuals and patients with AIDS than in healthy control subjects\(^6\). Complement activity (CH50, C3, C4) was normal or low\(^7,8\). Increased levels of immune complexes and of C3 degradation products in patient’s serum\(^8\) may reflect abnormal complement activation, which may inhibit phagocytosis of opsonized bacteria.

In conclusion, opsonophagocytic dysfunction in host defense, particularly low opsonic activity of sera, may predispose patients with HIV to high rates of invasion by pneumococci. CL methods may be useful for clinically monitoring opsonic activity in sera of HIV-infected patients and evaluating the efficacy of a pneumococcal vaccine.

References


肺炎球菌に対する HIV 感染患者血清の低オブソニン活性

1)東京大学医学研究所細菌感染研究部, 2)同 内科, 3)帝京大学医学部第 2 内科

平成 5年11月20日