IgG Response to Pneumococcal Polysaccharide–Protein Conjugate Appears Similar to IgG Response to Polysaccharide in Bone Marrow Transplant Recipients and Healthy Adults

Bone marrow transplant recipients mount inadequate antibody responses to polysaccharide antigens for at least 2 years after transplantation [1]. In the case of *Haemophilus influenzae*, vaccines composed of capsular polysaccharide conjugated to a protein have demonstrated greater immunogenicity than those composed of pure capsular polysaccharide [2]. We undertook this study to determine whether the same principle applies for *Streptococcus pneumoniae*.

*H. influenzae* polysaccharide–protein conjugate vaccine, Hib-TITER (Wyeth, Philadelphia) and either PNEUMOVAX 23 (Merck, West Point, PA) or heptavalent pneumococcal polysaccharide–protein conjugate vaccine (PPCV) (Merck), which contains serotypes 4, 6B, 9V, 14, 18C, 19F, and 23F, each conjugated to the outer membrane protein of *Neisseria meningitidis* [3], were injected intramuscularly ~ 1 year after transplantation. Fifteen of the 27 patients randomized to the two vaccine groups were evaluable (nine received PPCV, and six received PNEUMOVAX 23). The two most common reasons that patients could not be evaluated were the administration of intravenous immunoglobulin and lack of a 1-month post-immunization blood sample.

The two vaccine groups were comparable with respect to age, gender, history of splenectomy, original disease, donor type, pretransplantation cytomegalovirus (CMV) serostatus, conditioning...
Table 1. Pneumococcal serotype–specific IgG levels in bone marrow transplant recipients and healthy volunteers injected with either polysaccharide-protein conjugate vaccine or polysaccharide vaccine.

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Polysaccharide-protein conjugate vaccine*</th>
<th>Polysaccharide vaccine†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pneumococcal serotype</td>
<td>Level before immunization</td>
</tr>
<tr>
<td>Patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>1.8</td>
<td>(0.1–35.8)</td>
</tr>
<tr>
<td>14</td>
<td>1.1</td>
<td>(0.1–4.1)</td>
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<tr>
<td>19F</td>
<td>1.6</td>
<td>(0.1–27.5)</td>
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<tr>
<td>23F</td>
<td>1.1</td>
<td>(0.1–28.4)</td>
</tr>
<tr>
<td>18C</td>
<td>1.6</td>
<td>(0.8–29.8)</td>
</tr>
<tr>
<td>4</td>
<td>1.9</td>
<td>(0.8–20.9)</td>
</tr>
<tr>
<td>Healthy volunteers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>2.4</td>
<td>(1.2–38.2)</td>
</tr>
<tr>
<td>14</td>
<td>1.8</td>
<td>(0.6–17.3)</td>
</tr>
<tr>
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<tr>
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<td>(1.7–30.2)</td>
</tr>
<tr>
<td>9V</td>
<td>1.5</td>
<td>(0.8–50.8)</td>
</tr>
</tbody>
</table>

NOTE. IgG levels in mg/L, presented as median (range).

* This group consisted of 9 patients and 10 healthy volunteers.
† This group consisted of 6 patients and 19 healthy volunteers.
‡ The vaccine was PNEUMOVAX 23 (Merck, West Point, PA).

regimen, acute graft-versus-host disease (GVHD) prophylaxis, the
time of immunization (posttransplantation day), original disease
status at the time of vaccination, and the incidence of chronic
GVHD at the time of vaccination; the groups were dissimilar
with respect to number of patients treated with immunosuppressive
drugs at the time of vaccination (2 of 9 in the PPCV vs. 4 of 6 in
the PNEUMOVAX 23 group; P = .14 [Fisher’s exact test]). In
addition, 29 healthy volunteers (aged 18-50 years) were random-
ized to receive either PNEUMOVAX 23 (n = 19) or PPCV (n = 10);
all were evaluable.

Pneumococcal serotype–specific IgG levels were determined by
use of ELISA, as previously described [4]. Levels of H. influenzae
IgG was determined with use of ELISA, the Bindazyme kit (Bind-
ing Site, Birmingham, U.K.). The fold increase in specific IgG
concentration was calculated by dividing the 1-month postimmuni-
ization level by the preimmunization level. Differences in the fold
increases between the two vaccine groups were tested with a two-
tailed Mann-Whitney-Wilcoxon rank-sum test.

The fold increases in pneumococcal serotype–specific IgG con-
centration in the PPCV and PNEUMOVAX 23 groups did not differ statistically, in either the patients or the healthy volunteers
table 1). The patients who received PPCV did not have a greater
degree of humoral immunodeficiency than those who received
PNEUMOVAX 23, because the former patients had equal or
greater IgG responses to the H. influenzae conjugate vaccine: the
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Ocular Toxoplasmosis After Autologous Peripheral-Blood Stem-Cell Transplantation

*Toxoplasma gondii* is an opportunistic pathogen that is uncommon in immunocompromised hosts after bone marrow transplantation (BMT). The risk for reactivation of *T. gondii* infection is greatest from 2 to 6 months after transplantation [1, 2]. Toxoplasmosis is extremely rare after autologous BMT, as demonstrated in two recent series in which none of 509 patients and 1 of 250 patients developed the disease [1, 3]. Moreover, there are no previous reports of toxoplasmosis in recipients of autologous peripheral-blood stem-cell transplants. Similarly, reports of ocular toxoplasmosis after allogeneic [4, 5] or autologous [6] BMT are rare, and there are no previous reports of the condition after autologous peripheral-blood stem-cell transplantation (PBSCT). We describe a patient with advanced ovarian carcinoma who developed ocular toxoplasmosis after an autologous PBSCT.

A 60-year-old female with recurrent endometrioid carcinoma of the right ovary underwent autologous PBSCT (day 0) after receiving a myeloablative regimen of busulfan, thiotepa, and carboplatin. She did not have a history of visual disturbances before transplantation. On posttransplantation day 45, she began to experience a decrease in visual acuity in her right eye, and by day 70, the visual acuity in the eye deteriorated to the extent that she could only count fingers. Funduscopic examination of the right eye demonstrated inflammatory cells and haziness in the posterior portion of the vitreous humor. In addition, a white infiltrate was noted in the macular region of the retina. However, there was no evidence of atrophic retinitis or retinal vascular changes, and the optic disk was normal as well (figure 1). Findings on examination of the left eye were unremarkable.

A biopsy specimen of the right vitreous was obtained on posttransplantation day 72. Although bacterial, viral, and fungal cultures of the vitreous fluid remained negative, PCR analysis of the fluid by amplification of the repetitive B1 gene of *T. gondii* was positive. Moreover, the serum titer of IgG antibodies to *T. gondii* was high (1:36,000) (ELISA-kit; Incstar Science, Technology and Research, Stillwater, MN). A Sabin-Feldman dye test was positive. The IgM antibody titer was within normal limits. An ELISA for IgM antibodies was negative, and the titer of IgA antibodies, as determined by ELISA, was >22. An ELISA for IgE antibodies was positive, and an AC/HS test, a differential agglutination test, demonstrated an acute pattern.

The patient received intravenous clindamycin (600 mg three times daily) and oral pyrimethamine (25 mg daily) for 6 weeks. A follow-up funduscopic examination demonstrated partial resolution of the abnormalities described previously, and there was no

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