Prognostically Significant Classification of Immune Changes in AIDS With Kaposis’s Sarcoma

By Jeremy Taylor, Rahmat Afraziabi, John L. Fahey, Elizabeth Korns, Michael Weaver, and Ronald Mitsuyasu

Sixteen immunological parameters were assessed quantitatively for their value in providing an immunologically-based and prognostically significant classification of the immune alteration in 97 patients with AIDS and Kaposis’s sarcoma (AIDS-KS). The dimensions of reductions in the T4 (T helper/inducer cells) subpopulation of lymphoid cells in the T4/T8 ratio were found to correlate most closely with prognosis. Most other immunological changes did not relate to clinical course. T4 lymphocyte levels >300/μL and a T4-T8 ratio >0.5 indicated a relatively good prognosis, eg. 85% to 95% survival at 12 months. T4 levels <100/μL and/or a T4-T8 ratio <0.2 had a very poor prognosis, eg. <25% survival at 12 months. Intermediate T4 levels and T4-T8 ratios had intermediate prognosis.

These immunological findings were found to have independent prognostic value for survival when compared with disease classifications based on tumor stage (I through IV) or on clinical status A (without) or B (with fever, night sweats, or weight loss). Reduced proliferative capacity, increased OKT10 antigen expression, elevated levels of serum IgA, and immune complexes also correlated with prognosis. Elevated levels of serum IgG, cellular HLA-DR expression, and skin test anergy occurred frequently in AIDS-KS but did not have prognostic significance. Variations in level of total lymphocyte, T8 (T suppressor/cytotoxic) cell, gamma FcR receptor-positive cell number, NK activity, or level of serum IgM were less common in AIDS-KS and did not correlate with prognosis.

MATERIALS AND METHODS

Patients. The study group consisted of 97 consecutive patients with biopsy-proven epidemic KS seen at the UCLA Kaposis’s Sarcoma Clinic between January 1982 and February 1984 whose clinical and immunological status could be clearly determined. Sixteen patients were excluded from the study because of inadequate histologic documentation of KS or because of incomplete clinical information. Three patients with proven KS were excluded because their immunological status was within normal limits and because they showed no antibodies to HTLV-III. This group will be reported separately. All of the remaining patients from whom serum was available were found to have antibodies to HTLV-III virus. All patients were male homosexuals whose median age was 36 years with a range of 27 to 64 years. There were no Haitians, Africans, or blood transfusion recipients among these patients. Patients were followed after their initial visit with clinical and immunological assessment at three-month intervals whenever possible.

In April 1985, 37 patients were still alive, 55 patients had died, and 5 were lost to follow-up. By June 1984, 56 patients had received treatment with α-interferon, 36 had received chemotherapy, and 3 were bone marrow transplant recipients, with many patients receiving more than one form of treatment; 25 patients had received no therapy. The results of these therapeutic trials have been reported and are not considered in the scope of this study.

Fifteen patients had developed an opportunistic infection prior to, or at the time of initial presentation with KS (eg. Pneumocystis carinii pneumonia, Candida esophagitis, or Toxoplasmata gondii encephalitis). Three patients had a history of lymphadenopathy prior to the diagnosis of KS. One patient had B cell non-Hodgkin’s lymphoma diagnosed at the same time as KS.

The tumor stage (I through IV) and clinical subtypes A and B were established for each patient by a modification of the criteria of Kriegl et al10 on each date of immunological testing. Tumor Stage I had limited cutaneous (one anatomic area) involvement and less than five cutaneous lesions; Stage II had disseminated cutaneous locations (more than one anatomic area) and more than five cutaneous lesions; Stage III had visceral involvement (gastrointestinal, lymph node, etc.); and Stage IV had both cutaneous and visceral...
involvement. Clinical subtypes were either: (A) asymptomatic; or (B) exhibiting fever of >100 °F, lasting more than two weeks and unrelated to an identifiable source of infection; night sweats; or weight loss of ≥10% of body weight.

If no immunological testing had been done over an interval of more than three months but the patient had been seen clinically during that period, tumor stage and clinical subtypes were still noted. Follow-up of patients who had left the Los Angeles area was accomplished by telephone interview whenever feasible. The median time of follow-up was 12 months, with a range of 1 to 33 months.

**Immunological testing.** Total T4 cell number, total T8 cell number, T4-T8 ratio, and HLA DR and OKT10 antigen expression were performed on peripheral blood of all patients at the time of their routine clinical assessments approximately every three months. Tests for phytohemagglutinin (PHA) proliferative response, natural killer (NK) activity, and FcR cell tests were usually done at initial presentation and then periodically on most patients. Skin testing was conducted on 51 patients at their initial visit only. The serum immunoglobulins IgG, IgA, and IgM, and immune complexes were measured at the initial clinical evaluation and were not generally repeated.

Peripheral blood monoclonal cells (PBMCs) were obtained as either heparinized (functional assays) or EDTA-treated (phenotype assays) venous blood. Total lymphocyte count and T cell subsets determination were accomplished by surface phenotype analysis using fluorescent monoclonal anti-T cell antibodies.

In brief, 50 μL of whole blood was treated with a RBC lysing reagent. The residual PBMCs were studied with stained fluorescent-conjugated monoclonal antibodies. T cell subpopulations were determined using an Ortho Spectrum III fluorescent-cell analyzer (Raritan, NJ). The monoclonal antibodies used and the respective monoclonal cell subpopulations are as follows: Leu4 (pan-T cell marker); Leu3a (T helper/inducer, T4); Leu2a (T suppressor/cytotoxic, T8) (Becton Dickenson, Mountain View, Calif); and HLA DR and OKT10 (Ortho) as markers of early T cell differentiation antigens. Total numbers of these subpopulations were derived from measurements of total WBC count and differential count (for lymphocytes) by standard methods. The NK activity was assayed using radiolabeled (51Cr) K562 target cells and lymphocyte effector cells at an effector-target cell (ET) ratio of 10:1 as described by Spina et al.15

Mitogen-induced proliferation to PHA was tested in a microassay as previously described.15 PBMCs were cultured with a 1:100 dilution of PHA (Burroughs Wellcome) for 48 hours at 37 °C. Tritiated thymidine was added to the cultures, and cells were harvested 24 hours later and counted on a Beckman scintillation counter. Data are expressed as cpm × 10−1. Skin tests to recall antigens including mumps, intermediate-strength purified protein derivative of tuberculin (PPD), and Candida were performed; induration of ≥5 mm after 48 hours was considered positive.

Total serum immunoglobulins including IgG, IgA, and IgM were measured in the clinical chemistry laboratory at UCLA Medical Center by the laser nephelometry method (PDQ Laser Nephelometry, Hyland Laboratory, Deerfield, III). Circulating immunocomplexes (CIC) were measured using polyethylene glycol precipitation techniques.16

**Statistical methods.** Wilcoxon rank-sum tests were used for comparisons of groups and subpopulations. Survival analyses were performed using Kaplan-Meier plots14 and Cox proportional hazard models.15 Because levels of many immunologic parameters are being simultaneously compared, it is necessary to correct for multiple comparisons. This is done using the conservative Bonferroni approach, in which the Bonferroni significance level is .05 divided by the number of comparisons. In Tables I through 3, P values of <.05 are marked with a single asterisk (*); this indicates a probable relationship, but should be viewed with some skepticism. Parameters marked with double asterisks (**) indicate P values that are less than the Bonferroni significance level; these should be regarded as strongly indicative of a relationship.

**RESULTS**

The immunologic changes observed at presentation in the 97 patients with AIDS-KS showed increases of some param-

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**Table 1. Immunological Parameters by Tumor Stage at Initial Presentation**

<table>
<thead>
<tr>
<th>Immune Parameter</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 23</td>
<td>n = 40</td>
<td>n = 10</td>
<td>n = 24</td>
</tr>
<tr>
<td>Total WBC</td>
<td>4,741 (1,726)</td>
<td>4,992 (2,248)</td>
<td>5,000 (1,700)</td>
<td>4,300 (1,600)</td>
</tr>
<tr>
<td>Total LYM</td>
<td>1,195 (559)†</td>
<td>1,434 (890)†</td>
<td>1,265 (527)†</td>
<td>915 (395)†</td>
</tr>
<tr>
<td>Total T cells</td>
<td>917 (433)</td>
<td>961 (629)</td>
<td>934 (472)</td>
<td>617 (377)</td>
</tr>
<tr>
<td>Total T4 (Th)</td>
<td>298 (260)</td>
<td>202 (116)</td>
<td>292 (242)</td>
<td>124 (115)</td>
</tr>
<tr>
<td>Total T8 (Ts)</td>
<td>555 (266)</td>
<td>744 (487)</td>
<td>594 (257)</td>
<td>472 (278)</td>
</tr>
<tr>
<td>T4-T8 ratio</td>
<td>0.58 (0.58)</td>
<td>0.33 (0.22)</td>
<td>0.54 (0.32)</td>
<td>0.28 (0.21)</td>
</tr>
<tr>
<td>HLA-DR (%)</td>
<td>32 (14)</td>
<td>29 (12)</td>
<td>22 (10)</td>
<td>27 (13)</td>
</tr>
<tr>
<td>OKT10 (%)</td>
<td>22 (18)</td>
<td>27 (19)</td>
<td>23 (19)</td>
<td>40 (26)</td>
</tr>
<tr>
<td>FcR (%)</td>
<td>16 (9)</td>
<td>14 (7)</td>
<td>13 (6)</td>
<td>12 (4)</td>
</tr>
<tr>
<td>NK</td>
<td>17 (10)</td>
<td>4 (—)</td>
<td>11 (5)</td>
<td></td>
</tr>
<tr>
<td>PHA</td>
<td>31 (22)</td>
<td>35 (24)</td>
<td>36 (16)</td>
<td>25 (24)</td>
</tr>
<tr>
<td>IgG</td>
<td>2,083 (1,047)</td>
<td>1,951 (624)</td>
<td>1,766 (1267)</td>
<td>2,284 (1,048)</td>
</tr>
<tr>
<td>IgA</td>
<td>314 (188)</td>
<td>353 (151)</td>
<td>263 (85)</td>
<td>550 (413)</td>
</tr>
<tr>
<td>IgM</td>
<td>168 (82)</td>
<td>195 (72)</td>
<td>146 (40)</td>
<td>171 (74)</td>
</tr>
<tr>
<td>Immune complexes</td>
<td>95 (78)</td>
<td>73 (44)</td>
<td>258 (250)</td>
<td>304 (557)</td>
</tr>
</tbody>
</table>

Several values are underlined in columns II and IV to facilitate comparison of I and III stages with stages II and IV.

*Values for each parameter used in this and subsequent tables are expressed as follows: WBC/μL; Total blood LYM (lymphocytes) (μL/L); Total T cells (μL/L); Total T4 (T helper/inducer cells, Leu4, CD4+) (μL/L); Total T8 (T suppressor/cytotoxic cells, Leu2, CD8+) (μL/L); HLA DR antigen expression (% of peripheral blood mononuclear cells [PBMCs]); T10 antigen expression (% of PBMCs); Gamma FcR+ cells (% of PBMCs); Natural killer cell (NK) ET ratio 10:1 (% of radiolabeled released in control lysis); Phytohemagglutinin-induced (PHA) proliferation (Tdr cpm × 10−3); IgG (mg/dL); IgA (mg/dL); IgM (mg/dL); Circulating immune complexes (μg/mL) Delayed hypersensitivity skin tests (negative for three antigens).

†Mean ± SD.
decreased total T4 cells ($P < 10^{-4}$), decreased PHA proliferative response ($P < 10^{-4}$), immune complexes ($P < 10^{-2}$), increased OKT10 antigen expression ($P < 10^{-4}$), and increased serum IgA level ($P < 10^{-2}$). No statistically significant correlations with survival were found for WBC count, total lymphocytes, total T cells, total T8 cells, HLA DR antigen expression, FcR$^+$ cells, NK activity, serum IgG, or IgM.

The Kaplan-Meier survival curves for T4–T8 ratio, total T4 cell numbers, PHA proliferative response, and total T8 cells are shown in Fig 1. The T8 level does not correlate with survival, although the other immune parameters do.

A comparison of the immunologic parameter at initial examination between those who received no treatment and those who received some form of therapy showed no significant differences. Therefore, even if the treatments prolonged life, the above survival analysis is still valid.

**Relationship of immune parameters to tumor stage.**

The immunologic status of the patients at presentation with KS tumor stages I, II, III, and IV were compared (Table 1). Differences in the mean values of total T4 cells, T4–T8 ratio, and T10 expression are seen between the four subpopulations. These findings were confirmed on repeat analysis at the last time a blood specimen was tested for each patient. The values in Table 1 show that the order of the tumor stages that gives the closest correspondence to the seriousness of the immunologic abnormality with increasing order of severity is (I and III), II, and IV.

The importance of the immunologic parameters to patient survival was assessed by univariate proportional hazards survival analyses on two patient subpopulations: those presenting with Stage I and III tumors and those presenting with Stage II and IV (Table 2). The immunologic parameters, particularly T4–T8 ratio, total T4 cells, and PHA proliferative response have important prognostic value within the subpopulations. These immunologic measurements clearly provide independent prognostic information.

### Table 1. Relationship of Immunological Parameters to Survival of AIDS-Kaposi’s Sarcoma Patients with Tumor Stages I + III and II + IV and in Clinical Categories A and B

<table>
<thead>
<tr>
<th>Immune Parameter</th>
<th>Tumor Stage</th>
<th>Clinical Subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I + III</td>
<td>II + IV</td>
</tr>
<tr>
<td>Total LYM</td>
<td>.78†</td>
<td>.13</td>
</tr>
<tr>
<td>Total T cells</td>
<td>.71</td>
<td>.16</td>
</tr>
<tr>
<td>Total T4</td>
<td>.05</td>
<td>.0001§</td>
</tr>
<tr>
<td>Total T8</td>
<td>.51</td>
<td>.56</td>
</tr>
<tr>
<td>T4–T8 ratio</td>
<td>.007‡</td>
<td>.0001§</td>
</tr>
<tr>
<td>HLA DR (%)</td>
<td>.49</td>
<td>.40</td>
</tr>
<tr>
<td>OKT10 (%)</td>
<td>.05</td>
<td>.002§</td>
</tr>
<tr>
<td>PHA</td>
<td>.04†</td>
<td>.0001§</td>
</tr>
<tr>
<td>IgG level</td>
<td>.81</td>
<td>.05</td>
</tr>
<tr>
<td>IgA level</td>
<td>.67</td>
<td>.03‡</td>
</tr>
<tr>
<td>lgM level</td>
<td>.82</td>
<td>.29</td>
</tr>
<tr>
<td>Immune complexes</td>
<td>.35</td>
<td>.0003§</td>
</tr>
</tbody>
</table>

*Parameters for these tests are same as in Table 1.
†P value < .05.
§P value less than Bonferroni significance level.

### Table 2. Immunologic Parameters by Clinical Level at Presentation

<table>
<thead>
<tr>
<th>Immune Parameter</th>
<th>Clinical Level</th>
<th>A (n = 64)</th>
<th>B (n = 33)</th>
<th>Difference Between A and B Levels (P Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total WBC</td>
<td>4,668 (1,637)*</td>
<td>4,969 (2,423)</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>Total LYM</td>
<td>1,199 (593)</td>
<td>1,313 (909)</td>
<td>.99</td>
<td></td>
</tr>
<tr>
<td>Total T cells</td>
<td>849 (415)</td>
<td>914 (701)</td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>Total T4</td>
<td>259 (198)</td>
<td>136 (127)</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Total T8</td>
<td>570 (302)</td>
<td>715 (508)</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>T4–T8 ratio</td>
<td>0.49 (0.39)</td>
<td>0.23 (0.23)</td>
<td>.0001</td>
<td></td>
</tr>
<tr>
<td>HLA-DR (%)</td>
<td>28 (13)</td>
<td>31 (12)</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>OKT10 (%)</td>
<td>22 (17)</td>
<td>38 (24)</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>FcR (%)</td>
<td>14 (8)</td>
<td>13 (4)</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>NK</td>
<td>15 (10)</td>
<td>13 (10)</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>PHA</td>
<td>36 (23)</td>
<td>20 (19)</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>lgG</td>
<td>1,997 (737)</td>
<td>2,406 (1,024)</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>lgA</td>
<td>374 (277)</td>
<td>468 (298)</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>lgM</td>
<td>174 (81)</td>
<td>183 (50)</td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td>Immune complexes</td>
<td>80 (66)</td>
<td>281 (465)</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

*Mean (SD). Values are expressed as in Table 1.
†P value < .05.
‡P value < .05.
that is distinct from prognostic information based on tumor stage.

Relationship of immune parameters to clinical level. Clinical subtypes A and B differed in initial total T4 cells, T4–T8 ratio, and PHA proliferative response (all decreased), and in T10 antigen expression and serum immune complexes (both increased) (Table 3). No significant differences existed for total lymphocytes, total T cells, total T8 cells, HLA DR expression, or serum immunoglobulins. When the analysis was performed for the last time and a blood specimen was taken from the patient, the same differences between A and B clinical subtypes were seen.

The relationships of the immunologic parameters to patient survival within each clinical group were analyzed separately and found to add significant information (Table 2). Total T4 cells, T4–T8 ratio, T10 expression, and PHA proliferative response provide prognostic information for patients within clinical subtype A, indicating that an immunologic evaluation of clinical subtype A patients is useful. Survival in patients with clinical subtype B, however, did not correlate with immunologic parameters. When both clinical subtype and tumor stage were combined to determine prognosis, a multivariate survival analysis revealed that total T4, T4–T8 ratio, and PHA proliferative response each gave additional survival information (data not shown) at P < .002.

Skin tests were performed in 51 patients; 12 were positive responders. In tumor Stages I and III, there were 6 responders in 12 patients; in Stages II and IV there were only 6 responders in 39 patients tested. In clinical subtype classifications A and B there were 9 in 31 and 3 in 20 responders, respectively. Skin test anergy was found not to be of prognostic significance for survival (P = .27). The positive and negative responders did not show statistically significant differences in any of the immunological parameters considered.

Opportunistic infection. Fifteen patients had a prior or concurrent opportunistic infection (OI) at the time of diagnosis with KS. We investigated the immunologic characteristics of this group and the relationship between the immunologic parameters and the development of OI. The OI group was found to have lower T4–T8 ratios (P < .01), total T4 cells (P < .01), WBCs (P < .01), and total lymphocytes (P < .05). There were no statistically significant differences in total T8 cells, total T cells, T10 and HLA-DR antigens, PHA proliferative response, FcR cell number, NK activity, serum IgG, IgA, and IgM, or immune complexes between those with and without prior OI. The findings with respect to lower T4–T8 ratio and total T4 cell number agree with the observation that OI generally occurs with more serious immunologic impairment than does KS alone.

The relationships between the immunologic parameters at initial examination with the time to future occurrence of opportunistic infections were also investigated. A univariate analysis on the time to occurrence of OI revealed that patients with lower T4–T8 ratios, total T4 cells, and PHA proliferation tended to get OIs sooner than did patients with higher ratios (P < 0.04 for each parameter). Similarly, parameters such as T10 antigen expression (P < 0.01), serum immune complexes (P < 0.05), and IgA (P < 0.05) related (although less well) to development of subsequent OIs. Other parameters were found not to be significant.

The above analysis shows that the occurrence of OIs is strongly related to the immunologic condition of the patient. It also indicates that immunologic abnormalities precede the development of OIs; they are not the result of OIs. The immunologic variables which are significant to OI occurrence also relate to survival; of the patients who died nearly all died as a result of OIs rather than from complications related solely to KS.

Critical immunological values. The findings noted above give strong evidence that several immunologic parameters provide valuable information in predicting the course of patients’ disease. Thus, an immunologic staging of KS...
patients should be valuable. Figures 2 and 3 show the strong relationship between T4 cell numbers and T4–T8 ratio and survival; they also show that prognosis changes rapidly as the immunologic values decrease.

By comparing survival curves for various levels of total T4 cell numbers and of T4–T8 ratio at initial examination, values indicating good, intermediate, and poor prognosis were obtained (Table 4). Eighty-five percent of patients with T4 values >300/μL and 95% of patients with T4–T8 ratio >0.5 survived 12 months, respectively. In contrast, only 35% of patients with T4 levels <100/μL and 25% of patients with T4–T8 ratio <0.2 survived 12 months. In the intermediate range of immunologic values, the prognosis changes rapidly as the values decrease. Two critical values were chosen as compromise numbers. One value would have been simpler; however, it would not have represented the large differences in survival rates accurately.

DISCUSSION

Immunologic changes relevant to prognosis are restricted to only a few parameters. Decreased T4 cell numbers and T4–T8 ratio are shown to be the most significant immunologic changes in relation to prognosis and to OI development. The T4 lymphoid cell subpopulation and its reduction appears to be the central feature of AIDS. The evidence that HTLV-III is preferentially cytopathic for T4 cells indicates that direct damage by the virus to T4 cells undermines the immune system; the present data point to T4 cell reduction as the key factor leading to the life-threatening complications which make AIDS such a serious disease.

Most patients with AIDS-KS are reported to have antibodies to HTLV-III which is consistent with the view that HTLV-III is the etiologic agent for AIDS. Currently, available data indicate that the presence of antibodies to HTLV-III is not the key prognostic factor in AIDS-KS. Rather, the cellular immune parameters (represented in the range of T4 cell levels and T4–T8 ratios found in AIDS-KS) reflect the central pathogenic effects of HTLV-III infection and correlate with prognosis.

Immune deficiency in AIDS is manifested primarily by a deficiency of the T4 (T helper) subpopulation of lymphoid cells. Direct measurement of T4 cell numbers may provide the best prediction of prognosis. The major limitation in T4 cell quantitation is the dependence on WBC counts and differential leukocyte determinations to provide an absolute number of lymphocytes per microliter. This essential step in quantitation has far more variabilities than does the actual measurement of the percentage of T4 antigen-bearing lymphoid cells (the CD4 and T4 subpopulation).

Measurement of T4–T8 ratio avoids the problems associated with quantitation of lymphocytes by means of WBC and differential counts since it can be determined directly from measurements of the percentages of cells with T4 and with T8 antigens. This measurement, however, is subject to biologic variability in the level of T8 cells. The T8 cells can be changed by infections and, probably, by various circumstances that have no relation to prognosis in AIDS. Our data confirm that T8 cell levels do not relate to prognosis in AIDS-KS patients. However, variation in T8 levels affects the T4–T8 ratio and reduces the precision of applying ratio measurements to AIDS prognosis.

Despite the limitations on T4 cell enumeration and T4–T8 ratio measurements, they correlate well (and better than any other parameter) with prognosis. Both measurements are recommended and can be easily made simultaneously. A repetition of the tests will also increase the value of the measurements.

These quantitative extrapolations are based on the premise documented here—that susceptibility, or lack of susceptibility, to infection is related to the quantity of T4 cells. Another immune parameter evaluated in conjunction with T4 cell numbers (or T4–T8 ratio) may improve prognostic capacity further. Such an association may also point to functional cooperation within the immune system and provide clues for better understanding of the immune system’s protective functions and its potential for failure.

Measurements of T4 levels and/or T4–T8 ratio were found to have a significance that was independent of clinical status or KS tumor stage. In patients with AIDS-related complex and oral candidiasis, the presence of T4–T8 ratio <0.51 has been reported to be associated with a high likelihood of developing advanced AIDS. A T4–T8 ratio >0.6 indicated a much better prognosis in these patients.

The T4 lymphoid subpopulation numbers appear normally to provide a considerable margin of protection before OIs occur. Reduction in T4 cell levels to below normal range was characteristic of AIDS-KS but was not sufficient to establish prognosis. The 5th percentile value for a normal population is more than three times greater than the critical value seen for poor prognosis in this study. Estimates of protective margin

### Table 4. Critical Values of T4–T8 Ratio and T4 Cell Numbers to Prognosis

<table>
<thead>
<tr>
<th>Immunologically Defined Prognosis</th>
<th>Better</th>
<th>Intermediate</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4–T8 ratio</td>
<td>&gt;0.5</td>
<td>0.5–0.2</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Surviving 12 months</td>
<td>&gt;95%</td>
<td>(Intermediate)</td>
<td>25%</td>
</tr>
<tr>
<td>T4 cell numbers/μL</td>
<td>&gt;300</td>
<td>300–100</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Surviving 12 months</td>
<td>85%</td>
<td>(Intermediate)</td>
<td>35%</td>
</tr>
</tbody>
</table>
will have to be refined when the subpopulation of the T4 lymphoid cells most relevant in protection against viral, fungal, protozoal, and other infections occurring in AIDS patients has been identified.

Classical KS occurs without evidence of immune deficiency.\(^1\)\(^-\)\(^2\)\(^1\)\(^1\) Thus, resistance or susceptibility to KS relates with less exactness than do OIs to T4 cell levels. Perhaps circumstances of host resistance or other co-factors play large roles in the initiation and development of KS.

Increases of B cell activity such as the elevated serum IgG and IgA and immune complex levels, B cell numbers in lymphoid tissues,\(^2\)\(^2\)\(^2\)\(^2\)\(^2\) and spontaneous Ig-secreting cells,\(^2\)\(^3\) are seen in many phases of AIDS. These B cell changes contrast less exactness than do lymphoid cell deficiency in epidemic KS will be of prime therapeutic importance.

REFERENCES

5. Seigel FP: Immune dysfunction in AIDS. Semin Oncol 11:29, 1984
Prognostically significant classification of immune changes in AIDS with Kaposi’s sarcoma

J Taylor, R Afrasiabi, JL Fahey, E Korns, M Weaver and R Mitsuysau