Cardiac Manifestations of Human Immunodeficiency Virus Infection: A Two-Dimensional Echocardiographic Study

RONALD B. HIMELMAN, MD, WILLIAM S. CHUNG, MD, DAVID N. CHERNOFF, MD, NELSON B. SCHILLER, MD, FACC, HARRY HOLLANDER, MD
San Francisco, California

To determine the prevalence of cardiac abnormalities in patients with human immunodeficiency virus (HIV) infection, two-dimensional Doppler echocardiography was performed on 70 consecutive patients with HIV infection, including 51 with acquired immunodeficiency syndrome (AIDS), 13 with AIDS-related complex and 6 with asymptomatic HIV infection. Of the 70 patients, 36% were hospitalized and 64% were ambulatory at the time of evaluation. The average age was 37 years; 93% were homosexual men.

Echocardiographic findings included dilated cardiomyopathy in eight patients (11%), pericardial effusions in seven patients (10%) (one with impending tamponade), pleural effusion in four patients (6%) and mediastinal mass in one patient (1%). Among the 25 hospitalized patients, echocardiographic abnormalities were noted in 16 (64%), whereas among the 45 ambulatory patients, the only abnormality noted was mitral valve prolapse in 3 patients (7%) (p < 0.0001). Dilated cardiomyopathy was the only echocardiographic lesion more common in the 25 hospitalized patients than in 20 hospitalized control patients with acute leukemia. Symptoms of congestive heart failure responded to conventional therapy. Cardiac lesions were associated with active Pneumocystis carinii pneumonia and low T helper lymphocyte counts.

Dilated cardiomyopathy of unknown origin may be more common than was previously recognized in hospitalized, acutely ill patients with AIDS, but is uncommon in ambulatory patients with HIV infection. Echocardiography should be considered in the evaluation of dyspnea in hospitalized patients with HIV infection, especially those with dyspnea that is out of proportion to the degree of pulmonary disease.

(J Am Coll Cardiol 1989;13:1030–6)

With the increasing prevalence of acquired immunodeficiency syndrome (AIDS) and human immunodeficiency virus (HIV) infection, varied clinical manifestations of disease, including cardiac involvement, have been noted (1–11). Although pathologic studies and case reports of AIDS patients with dilated cardiomyopathy (1–7), pericardial effusion (7,8), Kaposi’s sarcoma (9) and opportunistic infections (10,11) involving the heart have been described, the prevalence of cardiac abnormalities in living adults with HIV infection is unknown. To better define this prevalence, relate cardiac abnormalities to other manifestations of HIV-associated disease and compare the prevalence of cardiac abnormalities in hospitalized and ambulatory patients, we performed two-dimensional echocardiography with Doppler ultrasound studies on a series of consecutive patients with HIV infection.

Methods

Patient selection (Table 1). The study protocol was approved by the Committee for Human Research at the University of California, San Francisco. From September 1987 to September 1988, 82 consecutive patients from the AIDS clinic with known HIV infection were asked to participate in the study; of these patients, 70 (85%) were evaluated. Of the 70 study patients, 25 (36%) were hospitalized and 45 (64%) were ambulatory at the time of evaluation. There was no clinical or radiographic suspicion of cardiac disease in the ambulatory patients, all of whom were examined by one of the authors (D.N.C., H.H.). One patient with left ventricular...
Their mean age was 36 years, and 15 patients were male. Patients who met these criteria served as control patients.

Table 1. Clinical Manifestations of Human Immunodeficiency Virus (HIV) Infection in 70 Patients

<table>
<thead>
<tr>
<th></th>
<th>Hospitalized HIV</th>
<th>Ambulatory HIV</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>25</td>
<td>45</td>
<td>20</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>35 ± 5</td>
<td>37 ± 7</td>
<td>36 ± 10</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64 ± 8</td>
<td>73 ± 9*</td>
<td>69 ± 12</td>
</tr>
<tr>
<td>IBW (%)</td>
<td>96 ± 14</td>
<td>102 ± 16</td>
<td>103 ± 13</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>99 ± 12</td>
<td>113 ± 11*</td>
<td>117 ± 19*</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>63 ± 11</td>
<td>73 ± 8*</td>
<td>70 ± 10</td>
</tr>
<tr>
<td>Serum albumin (g/liter)</td>
<td>23 ± 4</td>
<td>35 ± 8*</td>
<td>27 ± 5</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>0.31 ± 0.6</td>
<td>0.37 ± 0.6*</td>
<td>0.39 ± 0.6*</td>
</tr>
<tr>
<td>T4 cell count (×10³/liter)</td>
<td>131 ± 186</td>
<td>333 ± 217*</td>
<td>NA</td>
</tr>
</tbody>
</table>

Major infections
- Pneumocystis carinii
- Cytomegalovirus
- Mycobacterial disease
- Bacterial sepsis
- Disseminated fungal disease
- Neoplasms
  - Kaposi's sarcoma
  - Lymphoma
- Zidovudine (AZT) therapy

<table>
<thead>
<tr>
<th></th>
<th>HIV HIV Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumocystis carinii</td>
<td>18</td>
</tr>
<tr>
<td>Cytomegalovirus</td>
<td>2</td>
</tr>
<tr>
<td>Mycobacterial disease</td>
<td>3</td>
</tr>
<tr>
<td>Bacterial sepsis</td>
<td>1</td>
</tr>
<tr>
<td>Disseminated fungal disease</td>
<td>1</td>
</tr>
<tr>
<td>Neoplasms</td>
<td></td>
</tr>
<tr>
<td>Kaposi's sarcoma</td>
<td>6</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>1</td>
</tr>
<tr>
<td>Zidovudine (AZT) therapy</td>
<td>11</td>
</tr>
</tbody>
</table>

* p < 0.05 versus hospitalized patients with HIV; *conversion factor to mg/dl is 0.1. AIDS = acquired immunodeficiency syndrome; BP = blood pressure; IBW = predicted ideal body weight; NA = not available.

Echocardiography

Imaging technique. Quantitative M-mode, two-dimensional and Doppler echocardiograms were performed on a phantom-calibrated IREX Meridian ultrasound machine. The subjects were placed in the 90° left lateral decubitus position, left ventricular chamber sizes were maximized in standard views and respiration was suspended before recording (14). Blood pressure was determined by sphygmomanometer at the end of the echocardiographic study with the patient seated.

Measurements and tracing. Echocardiographic measurements were made on a phantom-calibrated Diasonics computer-guided light-pen digitizing system. End-diastolic areas were traced on video frames at the peak of the R wave on the ECG or just after mitral valve closure; end-systolic areas were traced at the frame immediately preceding mitral valve opening.

Morphology. Mitral-septal separation was defined by M-mode echocardiography as the perpendicular distance between the E point of the anterior mitral leaflet and a tangent drawn to the most posterior point reached by the interventricular septum within the same cycle (15). Mitral-septal separation was measured at a level in which both mitral leaflets were well seen.

Average diastolic left ventricular wall thickness and left ventricular mass were calculated with use of a truncated ellipsoid formula (16). Previous work (17) indicates that mean left ventricular mass index by this technique in a normal adult man is 71 g/m²; the upper limit of normal is 94 g/m².

Left ventricular volumes and ejection fraction were measured using a modification of Simpson’s rule (18-20). End-systolic and end-diastolic endocardial areas were traced in the apical two and four chamber views to generate left
ventricular end-diastolic volume, end-systolic volume and ejection fraction. According to previous work (20), mean left ventricular end-diastolic volume index by this technique in a normal adult man is 58 ml/m²; the upper limit of normal is 80 ml/m².

Dilated cardiomyopathy was defined as the presence of diffuse left ventricular hypokinesia (ejection fraction ≤45%) and left ventricular dilation (left ventricular end-diastolic volume index >80 ml/m²).

Doppler evaluation. Standard Doppler evaluations of all four cardiac valves in pulsed wave and continuous wave modes were performed. The presence and severity of valvular regurgitation were determined by standard methods (21).

Doppler localization of tricuspid insufficiency was performed in the pulsed mode, then maximized and measured in the continuous wave mode. By a modification of the Bernoulli formula (22), the peak pressure gradient (in mm Hg) between the right atrium and ventricle was estimated as the product of 4 and maximal tricuspid insufficiency velocity squared (ΔP = 4V²). Right ventricular systolic pressure was computed as the sum of this pressure gradient and right atrial pressure (right ventricular systolic pressure = 4V² + right atrial pressure) (23). Subcostal views in all but four patients demonstrated >50% collapse of the diameter of the proximal inferior vena cava during deep inspiration. Right atrial pressure was assumed to be 5 mm Hg for these patients and 15 mm Hg for the four patients with <50% collapse of the inferior vena cava (24,25). By this method, the upper limit of normal for right ventricular systolic pressure in this laboratory is 30 mm Hg.

Statistical analysis. Data were evaluated by chi-square analysis and factorial analysis of variance. Upper limits of normal for left ventricular mass index and end-diastolic volume index in normal men determined in this laboratory (listed earlier) have previously been computed and reported (17,20) as the 90% upper confidence bounds for the 95th percentile. Comparisons were made between hospitalized and ambulatory patients with HIV infection and between hospitalized patients with HIV infection and control patients. Values are listed as mean ± standard deviation (SD). The null hypothesis was rejected at the 5% level.

Results

Clinical Data (Table 1)

Among the 70 patients with HIV infection, 25 were hospitalized and 45 were ambulatory at the time of evaluation.

Ambulatory versus hospitalized with HIV infection. Compared with the ambulatory patients, the hospitalized patients more frequently had a history of Pneumocystis carinii pneumonia and had significantly lower mean values for body weight, systolic and diastolic blood pressure, serum albumin, hematocrit and T4 lymphocyte count.

Table 2. Echocardiographic Findings in 70 HIV-Infected Patients

<table>
<thead>
<tr>
<th>Condition</th>
<th>Hospitalized HIV</th>
<th>Ambulatory HIV</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>25 (24)</td>
<td>45 (27)</td>
<td>20</td>
</tr>
<tr>
<td>Dilated cardiomyopathy</td>
<td>8 (7)</td>
<td>0*</td>
<td>0*</td>
</tr>
<tr>
<td>Pericardial effusion</td>
<td>7 (7)</td>
<td>0*</td>
<td>6</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>4 (3)</td>
<td>0*</td>
<td>2</td>
</tr>
<tr>
<td>Mediastinal mass</td>
<td>1 (1)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mitral valve prolapse</td>
<td>0</td>
<td>3 (1)</td>
<td>1</td>
</tr>
</tbody>
</table>

*p < 0.05 versus hospitalized patients with HIV; numbers in parentheses indicate patients with AIDS as opposed to AIDS-related complex or asymptomatic HIV infection. HIV = human immunodeficiency virus.

Hospitalized patients with HIV infection versus control patients. The control patients with acute leukemia and the hospitalized patients with HIV infection were similar in mean age, body weight, percent of ideal body weight, diastolic blood pressure, serum albumin and hematocrit. However, control patients had significantly higher values for systolic blood pressure. Compared with control patients, hospitalized patients with HIV infection also more frequently had a history of Pneumocystis carinii pneumonia, Kaposi’s sarcoma and treatment with AZT.

Two-Dimensional Echocardiographic Findings (Table 2)

Echocardiographic lesions. Two-dimensional echocardiography demonstrated dilated cardiomyopathy, pericardial effusion, pleural effusion or mediastinal mass in 16 (64%) of the 25 hospitalized patients with HIV infection. In comparison, mitral valve prolapse was the only abnormality noted in 3 (7%) of the 45 ambulatory patients (p < 0.0001). Of the echocardiographic lesions, only dilated cardiomyopathy was significantly more common in hospitalized patients with HIV infection than in control patients with acute leukemia. Dilated cardiomyopathy was demonstrated in eight study patients with HIV infection versus no control patient (p < 0.05), pericardial effusion in seven study patients versus six control patients (p = NS), pleural effusion in four study patients versus two control patients (p = NS) and mediastinal mass in one study patient versus no control patients (p = NS). All of these echocardiographic lesions were limited to patients with AIDS, except for one patient with AIDS-related complex who had dilated cardiomyopathy and a pleural effusion.

Dilated cardiomyopathy. Among the eight hospitalized patients with HIV infection and dilated cardiomyopathy, four were detected from the clinical evaluation and four were first recognized at the time of the echocardiogram. All eight patients had four chamber enlargement and diffuse left ventricular hypokinesia, with a mean ejection fraction of 33 ± 13% (range 10 to 45%), end-diastolic volume index of 96 ± 40 ml/m² and left ventricular mass index of 108 ± 23 g/m².
end-diastolic volume indexes by two-dimensional echocardiography

0.05 versus hospitalized patients with HIV infection. NS = no

patients with HIV infection and 20 control patients with acute

Figure 1. Comparison of left ventricular (LV) ejection fractions and
end-diastolic volume indexes by two-dimensional echocardiography
in 25 hospitalized patients with HIV infection, 45 ambulatory
patients with HIV infection and 20 control patients with acute
leukemia. The eight patients with dilated cardiomyopathy are indi-
cated by black circles in the first column; the other 17 hospitalized
patients by open circles. Horizontal bars indicate mean values. "p <
0.05 versus hospitalized patients with HIV infection. NS = no
significant difference versus the same group.

(Fig. 1). Two patients presented with congestive heart failure
at the time of a first AIDS-defining opportunistic infection:
five other patients had previously known AIDS and one had
previously known AIDS-related complex.

None of the patients with cardiomyopathy had had prior
administration of cardiotoxic medications or a history of
alcohol abuse, hypertension, diabetes or coronary disease;
however, two patients did have a history of intravenous drug
abuse and one had concomitant hepatic and renal failure.
Two patients with AIDS who did not have cardiomyopathy
were treated with anthracycline derivatives for Kaposi’s
sarcoma. Among the eight patients with cardiomyopathy,
five had active Pneumocystis carinii pneumonia, one had
Kaposi’s sarcoma, one had tuberculosis and one had non-Hodgkin’s lymphoma; three of
the patients also had dilated cardiomyopathy. The mean
serum albumin concentration in these seven patients was 25
g/liter (2.5 g/dl); the lower limit of normal in this laboratory
is 33 g/liter (3.3 g/dl).

Pleural effusion. In the four patients with pleural effusion
by echocardiography (two with a large left pleural effusion,
one with a small right effusion and one with a small bilateral
effusion), the effusion had been previously documented by
chest radiograph with decubitus films. Manifestations of
AIDS in these four patients included Pneumocystis carinii
pneumonia in three, mycobacterial infection in two, cardio-
myopathy in two and Kaposi’s sarcoma in one. In the two
patients with a large effusion and dyspnea, thoracentesis was
performed, with symptomatic benefit.

Mediastinal mass. One patient who had lymphadenopa-
thetic Kaposi’s sarcoma presented with dyspnea and de-
creased exercise tolerance. Echocardiography showed an 8
cm anterior mediastinal mass that compressed the right
ventricle. Computed tomography confirmed the presence of
a water density mass and also revealed diffuse mediastinal
and axillary lymphadenopathy. Biopsy of the mediastinal
mass was declined.

Doppler findings. Comparison of the hospitalized and
ambulatory patients with HIV infection revealed no signifi-
cant differences in the incidence of regurgitation of the mitral
(52% versus 45%), tricuspid (74% versus 67%) or aortic (4%
versus 0%) valve, respectively (all p = NS). Although no
patient in the study had severe mitral or tricuspid insuffi-
cyency, the eight patients with dilated cardiomyopathy usu-
ally had mild to moderate valvular regurgitation by Doppler
study that was associated with a murmur on physical exam-
ination. whereas the other patients had absent, trivial or mild
regurgitation that was usually not associated with a murmur.
Peak pulmonary systolic pressure was significantly higher in
Table 3. Echocardiographic Measurements in 70 HIV-infected Patients

<table>
<thead>
<tr>
<th></th>
<th>Hospitalized HIV (n = 25)</th>
<th>Ambulatory HIV (n = 45)</th>
<th>Control (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E point (cm)</td>
<td>0.9 ± 0.6</td>
<td>0.4 ± 0.1*</td>
<td>0.5 ± 0.2*</td>
</tr>
<tr>
<td>LVEDVI (ml/m²)</td>
<td>67 ± 29</td>
<td>50 ± 16*</td>
<td>51 ± 15*</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>54 ± 18</td>
<td>60 ± 8</td>
<td>61 ± 10</td>
</tr>
<tr>
<td>LVMI (g/m²)</td>
<td>78 ± 24</td>
<td>67 ± 21</td>
<td>72 ± 25</td>
</tr>
<tr>
<td>AWT (cm)</td>
<td>1.1 ± 0.2</td>
<td>0.9 ± 0.3*</td>
<td>1.1 ± 0.2</td>
</tr>
<tr>
<td>LAVI (ml/m²)</td>
<td>43 ± 21</td>
<td>34 ± 10*</td>
<td>34 ± 9*</td>
</tr>
</tbody>
</table>

*p < 0.05 versus patients hospitalized with HIV. AWT = average diastolic left ventricular wall thickness; E point = mitral-septal separation; HIV = human immunodeficiency virus; LAVI = left atrial volume index; LVEDVI = left ventricular end-diastolic volume index; LVEF = left ventricular ejection fraction; LVESVI = left ventricular end-systolic volume index; LVMI = left ventricular mass index.

hospitalized than in ambulatory patients with HIV infection (37 ± 11 versus 22 ± 4 mm Hg, respectively, p < 0.05).

Quantitative Planimetry (Table 3)

Hospitaled versus ambulatory patients with HIV infection (Fig. 1). Compared with the ambulatory patients with HIV infection, hospitalized patients with HIV infection had significantly higher echocardiographic values for mean mitral-septal separation, left ventricular end-diastolic and end-systolic volume indexes, average wall thickness and left atrial volume index (Fig. 1). There were no significant group differences for mean left ventricular ejection fraction or mass index.

Hospitalized patients with HIV infection versus control patients (Fig. 1). Compared with control patients, hospitalized patients with HIV infection also had significantly higher values for mitral-septal separation, left ventricular end-diastolic and end-systolic volume indexes and left atrial volume index. Mean left ventricular ejection fraction, mass index and average wall thickness were not significantly different between these two groups.

Discussion

To determine the prevalence of cardiac lesions, we evaluated a series of HIV-infected patients by two-dimensional echocardiography with Doppler ultrasound. The patients in the study were mainly symptomatic homosexual men. Of the 70 study patients with HIV infection, eight (11%) were found to have dilated cardiomyopathy, seven (10%) had pericardial effusion, four (6%) had pleural effusion and one (2%) had a mediastinal mass.

Selection of control patients. Although it is difficult to select an appropriate control group for adults hospitalized with AIDS, we chose young patients with acute leukemia who had baseline echocardiography before the administration of anthracycline derivatives. Like the hospitalized HIV-infected patients, the control patients were relatively young and systemically ill. Of the echocardiographic lesions demonstrated, only dilated cardiomyopathy was statistically more common in hospitalized patients with HIV infection than in control patients. These results in consecutively studied patients, plus the diagnosis of dilated cardiomyopathy in four other patients with AIDS in this laboratory over the years before this study, suggest an association between dilated cardiomyopathy and AIDS.

Comparison with previous reports. The prevalence of dilated cardiomyopathy in this study was nearly identical to that in a recent necropsy series of patients with AIDS (2). Pericardial tamponade has also been reported previously in patients with AIDS (7). One of our seven patients with pericardial effusion had incipient tamponade that improved after therapy with a nonsteroid anti-inflammatory drug; the remaining six patients had a small, hemodynamically insignificant effusion. The origin of the pericardial effusion in this study was not clear; however, hypoalbuminemia and contiguous pneumonitis may have been contributing factors. We have previously described (27) a patient with AIDS with a large mediastinal mass.

Findings in hospitalized versus ambulatory patients. We observed a striking difference in the incidence and severity of echocardiographic findings between hospitalized and ambulatory patients with HIV infection. Among the 25 hospitalized HIV-infected patients, cardiac and thoracic abnormalities were noted in 16; in contrast, among the 45 ambulatory patients, the only abnormality noted was mitral valve prolapse in three patients. Our data in living subjects confirm previous pathologic reports (1–5) that dilated cardiomyopathy and other cardiac abnormalities are fairly common in hospitalized, acutely ill patients with AIDS. However, we have also shown that cardiac lesions are uncommon in ambulatory patients with HIV infection, despite prior major opportunistic infections in one-third of patients.

Comparing the hospitalized with the ambulatory patients with HIV infection, the former had larger, thicker hearts and higher peak pulmonary systolic pressures. The differences between these groups were mainly due to the hospitalized patients with dilated cardiomyopathy. Although hospitalized patients had a lower hematocrit than ambulatory patients, cardiac enlargement has been reported (28) to develop only in association with severe anemia. Left ventricular hypertrophy could not be attributed to hypertension because hospitalized patients had significantly lower values for systolic and diastolic blood pressure than did outpatients with HIV infection or control patients.

In the ambulatory HIV-infected study patients, values for mean left ventricular mass and end-diastolic volume were lower than normal, but still in the normal range reported for healthy adult men (17,20). After correction for body surface
area, these variables were closer to mean normal values; thus, we attributed this difference in cardiac size to cachectic habitus. Mild or moderate pulmonary hypertension was noted in the patients with dilated cardiomyopathy and in two additional hospitalized patients who had active *Pneumocystis carinii* pneumonia.

**Prognosis of dilated cardiomyopathy.** Among the eight HIV-infected patients with dilated cardiomyopathy, four had a rapidly fatal acute course. Despite this poor outcome, symptoms of congestive heart failure due to dilated cardiomyopathy often initially responded to conventional treatment. Therapy with AZT did not appear to prevent the development of cardiomyopathy because four of the eight patients had been given this drug.

**Pathogenesis of dilated cardiomyopathy.** The history of each patient with cardiomyopathy was negative for exposure to known cardiotoxins. AZT and trimethoprim-sulfamethoxazole, the two most commonly administered drugs in this study, have not been reported to cause myocarditis or congestive heart failure in AIDS or non-AIDS patients (29,30). Although many of the hospitalized patients with AIDS were underweight or even cachectic at the time of evaluation, nutritional deficiency seems unlikely as an etiologic factor, since hospitalized patients with HIV infection and control patients were comparably abnormal in percent of predicted ideal body weight and serum albumin. Similar to previous studies (1–7), the patients studied were nearly all homosexual men without a history of intravenous drug abuse. Thus, cardiac abnormalities associated with addiction, such as valve vegetations, valvular sclerosis and cardiac abscesses, were not demonstrated. It is unknown whether patients with AIDS secondary to intravenous drug abuse have a greater or lesser incidence of cardiac lesions, including dilated cardiomyopathy.

We found an association between the presence of active *Pneumocystis carinii* pneumonia infection and cardiac abnormalities. Neither the organism nor the drugs employed in treatment have been reported to cause myocarditis or myocardial depression. There was no correlation with other active opportunistic infections such as cytomegalovirus. We speculate that the most immunocompromised patients with AIDS may be predisposed to develop multiple complications of immunocompromise, including myocarditis. Although this concept is supported by significantly lower T4 cell counts in hospitalized than in ambulatory study patients with HIV infection (31), T4 counts did not differ between patients with dilated cardiomyopathy and other hospitalized patients with HIV infection.

Recent reports (1–7) suggest that the most likely origin of dilated cardiomyopathy in patients with HIV infection is infectious myocarditis. Several autopsy studies in adult and pediatric patients with AIDS (1–5) have demonstrated that focal myocarditis is a common and often asymptomatic cardiac lesion. Although various cardiac pathogens have been identified by necropsy in patients with AIDS (including cytomegalovirus, *Toxoplasma gondii*, *Cryptococcus neoformans*, *Candida albicans*, *Mycobacterium tuberculosis* and *Histoplasma capsulatum*), there is no clear relation between the presence of an opportunistic pathogen and the severity of myocarditis (3). Alternatively, myocardial dysfunction may be caused by direct myocyte infection by HIV. In one report (32), HIV was cultured from an endomyocardial biopsy sample in a living patient with myocarditis. Our findings in patients with dilated cardiomyopathy are limited by the lack of myocardial tissue by either endomyocardial biopsy or autopsy. Further clinicopathologic research is required to confirm the diagnosis and provide information about the pathogenesis of the disease.

**Clinical implications.** Many patients with AIDS develop multiple opportunistic pulmonary infections, so that dyspnea is often assumed to be of pulmonary origin. Our findings suggest that cardiac abnormalities should also be considered in the evaluation of dyspnea in these patients. Palliative therapy for dyspnea due to congestive heart failure or pericardial effusion in this setting is efficacious, and differs from therapy for pulmonary processes. In addition, the detection of occult cardiomyopathy in AIDS may have relevance for the choice of antibiotic and tumor therapy. For example, intravenous trimethoprim-sulfamethoxazole must be administered in a large volume of fluid to avoid crystallization of drug in the renal tubules (33); this fluid load might not be well tolerated by a patient with cardiac compromise. Likewise, anthracycline derivatives, which are used as chemotherapeutic agents for Kaposi’s sarcoma, could lead to further deterioration of cardiac function if administered to a patient with cardiomyopathy. The use of echocardiography should be considered in the evaluation of dyspnea in hospitalized patients with AIDS, especially those who have shortness of breath that is out of proportion to their diagnosed pulmonary disease.

We are indebted to Salvatore Geraci, RDMS for performing most of the echocardiographic studies, and to Melvin Cheitlin, MD and Robert Wachter, MD for reviewing the manuscript.

**References**


