

# Prevalence and Clinical Characteristics of HIV Type 1-Infected Patients Receiving Dialysis in Spain: Results of a Spanish Survey in 2006: GESIDA 48/05 Study

J.-C. Trullàs,<sup>1</sup> G. Barril,<sup>2</sup> F. Cofan,<sup>3</sup> A. Moreno,<sup>1</sup> A. Cases,<sup>3</sup> M. Fernandez-Lucas,<sup>4</sup> J. Martinez-Ara,<sup>5</sup>  
M. Ceballos,<sup>6</sup> J. Garcia-de-Diego,<sup>7</sup> M.-L. Muñoz,<sup>8</sup> J. Molina,<sup>9</sup> A. Martínez-Castelao,<sup>10</sup> J. González-García,<sup>11</sup>  
J.-M. Miró,<sup>1</sup> and the Spanish HIV Infection in Dialysis Study Group\*

## Abstract

End-stage renal diseases (ESRD) are becoming more frequent in HIV-infected patients. In Europe there is little information about HIV-infected patients on dialysis. A cross-sectional multicenter survey in 328 Spanish dialysis units was conducted in 2006. Information from 14,876 patients in dialysis was obtained (81.6% of the Spanish dialysis population). Eighty-one were HIV infected (0.54%; 95% CI, 0.43–0.67), 60 were on hemodialysis, and 21 were on peritoneal dialysis. The mean (range) age was 45 (28–73) years. Seventy-two percent were men and 33% were former drug users. The mean (range) time of HIV infection was 11 (1–27) years and time on dialysis was 4.6 (0.4–25) years. ESRD was due to glomerulonephritis (36%) and diabetes (15%). HIV-associated nephropathy was not reported. Eighty-five percent were on HAART, 76.5% had a CD4 T cell count above 200 cells, and 73% had undetectable viral load. Thirty-nine percent of patients met criteria for inclusion on the renal transplant (RT) waiting list but only 12% were included. Sixty-one percent had HCV coinfection. HCV-coinfected patients had a longer history of HIV, more previous AIDS events, parenteral transmission as the most common risk factor for acquiring HIV infection, and less access to the RT waiting list ( $p < 0.05$ ). The prevalence of HIV infection in Spanish dialysis units in 2006 was 0.54% HCV coinfection was very frequent (61%) and the percentage of patients included on the Spanish RT waiting list was low (12%).

## Introduction

WITH THE INTRODUCTION of highly active antiretroviral therapy (HAART) in 1996, HIV-related morbidity and mortality have decreased dramatically. Nevertheless, HIV-infected patients develop chronic end-stage liver and kidney diseases.<sup>1,2</sup> In this setting, interest in end-stage renal diseases (ESRD) and renal transplantation in the HIV-infected population has increased in the past few years.

HIV-infected patients can develop ESRD for reasons not related to HIV infection (diabetes mellitus, hypertension,

polycystic kidney disease, injecting drug use, etc.), related to HIV infection [HIV-associated nephropathy (HIVAN), immune-complex-mediated glomerulonephritis, and thrombotic microangiopathy], or related to coinfection by hepatitis B virus (HBV) and hepatitis C virus (HCV). In the United States, HIVAN is a common cause of ESRD in African-Americans aged between 24 and 60 years. In Europe, the prevalence of HIVAN is lower, and it mainly affects blacks.<sup>3–5</sup>

The prevalence of HIV infection in dialysis units varies widely between different countries and even within the same country. This depends on the geographic location of the dial-

<sup>1</sup>Infectious Diseases Service, Hospital Clinic-IDIBAPS, University of Barcelona, Barcelona, Spain.

<sup>2</sup>Nephrology Service, La Princesa University Hospital, Madrid, Spain.

<sup>3</sup>Renal Transplant and Nephrology Service, Hospital Clinic-IDIBAPS, Barcelona, Spain.

<sup>4</sup>Nephrology Service, Hospital Ramon y Cajal, Madrid, Spain.

<sup>5</sup>Nephrology Service, La Paz University Hospital, Madrid, Spain.

<sup>6</sup>Nephrology Service, Puerta del Mar University Hospital, Cadiz, Spain.

<sup>7</sup>Nephrology Service, Hospital General de Elche, Elche, Spain.

<sup>8</sup>Nephrology Service, Hospital de Cruces, Baracaldo, Spain.

<sup>9</sup>Nephrology Service, Hospital de Donostia, San Sebastian, Spain.

<sup>10</sup>Nephrology Service, Bellvitge University Hospital, Hospitalet del Llobregat, Barcelona, Spain.

<sup>11</sup>AEC-GESIDA, Madrid, Spain.

\*The investigators of the Spanish HIV Infection in Dialysis Study Group are listed in the Appendix.

ysis unit and the demographic characteristics of the patients attended in each unit. In the late 1980s, the estimated prevalence in Europe was 0–5%.<sup>6</sup> In the United States, a prevalence study using the United States Renal Data System (USRDS) database evidenced an increase of the prevalence of HIV infection in the U.S. ESRD population from 0.90% in 1995 to 1.16% in 2000.<sup>7</sup> In 2002, the Centers for Disease Control and Prevention (CDC) estimated a prevalence of 1.5% in the United States.<sup>8</sup> There is little information about the prevalence of HIV infection in dialysis units in Europe during the HAART era with the exception of two previous studies in France (prevalence of 0.38% and 0.67% in 1997 and 2002, respectively)<sup>9,10</sup> and one in Spain (prevalence of 1.15% in 2004).<sup>11</sup>

In the early 1980s, survival of patients with AIDS and ESRD was poor and, consequently, the value of providing maintenance dialysis to this group was questioned.<sup>12</sup> Over the past two decades, with the appearance of effective treatments and improved survival, experience in the management of HIV-infected patients with ESRD has been accumulating, and both hemodialysis (HD) and peritoneal dialysis (PD) have proven effective in these patients.<sup>13</sup> Furthermore, in recent years many centers in the United States<sup>14–16</sup> and in Spain<sup>17,18</sup> have been performing renal transplantation in HIV-infected patients with encouraging results. HIV-specific inclusion criteria have been defined in Spanish<sup>19</sup> and British guidelines for kidney transplantation.<sup>20</sup>

The aim of this survey was to investigate the prevalence and characteristics of HIV-infected patients receiving dialysis in Spain in 2006 and to identify potential candidates for renal transplantation.

## Materials and Methods

### Study population

During the second trimester of 2006 a cross-sectional multicenter survey was carried out under the coordination of the Spanish HIV Infection in Dialysis Study Group [from the Spanish Nephrology Society (SEN) and the Spanish Society of Infectious Diseases and Clinical Microbiology (SEIMC)]. Serum screening for HIV, HCV, and HBV was performed in all patients who started dialysis in Spain.<sup>21</sup> The study population was obtained from 328 dialysis centers (HD and PD units) from public and private hospitals and outpatient clinics. A questionnaire was sent to all centers requesting the following information: total number of patients and number of HIV-infected patients under the different modalities of renal replacement therapy [HD, PD, and home hemodialysis (HHD)]. During the third trimester of 2006, nonresponding centers were contacted again via electronic mail or telephone. For every HIV-infected patient, a separate questionnaire was sent to obtain the following variables: demographic data, renal diagnosis (either clinical or by biopsy), modality of and time on dialysis, duration of HIV infection, risk factors for HIV transmission, previous AIDS-defining events, last or current HIV-RNA plasma viral load determination, last or current CD4<sup>+</sup> T cell count (cells/mm<sup>3</sup>), HAART regimen, HBV and HCV coinfections, psychological and psychiatric situation, history of drug abuse, diabetes mellitus, and cardiovascular comorbidity. We also asked about HIV-infected transplant recipients or whether they were on the renal transplant waiting list.

The causes of ESRD were classified according to the criteria of the European Dialysis and Transplant Association (ERA-EDTA).

The Spanish criteria for HIV status when selecting renal transplantation candidates were as follows: no history of opportunistic infections (except tuberculosis, esophageal candidiasis, or *Pneumocystis jiroveci* pneumonia), CD4<sup>+</sup> T cell count above 200 cells/mm<sup>3</sup>, and an undetectable HIV-RNA plasma viral load or a viral load that was suppressible with HAART. In Spain, where most of these patients are former injecting drug users, a 2-year period of abstinence from cocaine and heroin abuse is also required, although patients can be participating in the methadone program.<sup>19</sup>

### Statistical analysis

Collected data were analyzed using the SPSS statistical package (version 14.0; SPSS, Inc., Chicago, IL). Quantitative variables are expressed as the mean and standard deviation and qualitative variables as the number of patients and percentages. The Chi-square test or Fisher's exact test was used to compare qualitative variables. The *t* test was used to compare quantitative variables. The significance level was set at 0.05.

## Results

In January 2007, the questionnaire was completed by 200 out of 328 dialysis centers representing a response rate of 61% of the centers and 81.6% of the total Spanish dialysis population. Of the responding centers, 91 (45.5%) were hospital units and 109 (54.5%) were outpatient clinics. Of the 128 nonresponding centers, 116 (90%) were outpatient clinics. Thirty-five (17.5%) of the responding centers had HIV-infected patients under dialysis.

The total number of patients in renal replacement therapy was 14,876 (13,537 in HD, 1,317 in PD, and 22 in HHD). The total number of HIV-infected patients was 81, representing an estimated prevalence of 0.54% (95% CI, 0.43–0.67). All had HIV-1 infection. Sixty HIV patients were receiving HD (prevalence, 0.44%; 95% CI, 0.33–0.57) and 21 were receiving PD (prevalence 1.59%; 95% CI, 0.99–2.42). There were no HIV-infected patients on HHD (Table 1).

Data from the 81 HIV-1-infected patients on dialysis were analyzed (Table 2). The mean age was 45.5 ± 8.7 years and 72% were men. The mean duration of dialysis was 4.6 ± 4.5 years, being longer in the HD group (*p* < 0.01). The most frequently used modality of renal replacement therapy was HD (74%). The main causes of ESRD were different types of glomerulonephritis (36%) followed by diabetic nephropathy (15%). No HIVAN or thrombotic microangiopathy was reported. However, only 23% of patients had a biopsy-proven diagnosis.

The mean time from HIV infection was 11.9 ± 6.9 years. The most frequent risk factor for HIV was parenteral exposure in the HD group and high-risk sexual behavior (heterosexuality and men who have sex with men) in the PD group. The mean CD4<sup>+</sup> T cell count was 358 ± 191 cells/mm<sup>3</sup> (range: 16–845) and 62 patients (76.5%) had a CD4<sup>+</sup> T cell count above 200 cells/mm<sup>3</sup>. Fifty-nine patients (73%) had an undetectable plasma HIV-RNA viral load with no difference between the two groups. Previous AIDS-defining events were more frequent in patients under PD (*p* <

TABLE 1. PREVALENCE OF HIV, HCV, AND HBV IN DIALYSIS UNITS IN SPAIN<sup>a</sup>

	HD <sup>b</sup> (n = 13,537)	PD <sup>b</sup> (n = 1,317)	Total (n = 14,876)
HIV infection [number (%; 95% CI)]	60 (0.44%; 0.33–0.57%)	21 (1.59%; 0.99–2.42%)	81 (0.54%; 0.43–0.67%)
Coinfections [number (%)]			
HCV	35	10	45 (55%)
HBV	1	1	2 (2.4%)
HCV + HBV	2	3	5 (6%)

<sup>a</sup>HCV, hepatitis C virus; HBV, hepatitis B virus; HD, hemodialysis; PD, peritoneal dialysis; CI, confidence interval.

<sup>b</sup>There were no HIV-infected patients in home hemodialysis.

0.05), the most frequent being infection by *Mycobacterium tuberculosis*. Eighty-five percent of patients were under different antiretroviral treatments and the most frequent regimen was the combination of two nucleoside and/or nucleotide reverse transcriptase inhibitors with either one nonnucleoside reverse transcriptase inhibitor or one protease inhibitor. Information about HAART dosage was not collected.

When the Spanish criteria for renal transplantation in HIV-infected patients were applied,<sup>19</sup> we found that 32 patients (39.5%) fulfilled the criteria to be included on the renal transplant waiting list. The remaining 49 patients had at least one exclusion criterion for kidney transplantation, the most frequent being an unfavorable psychological and psychiatric status (32 cases). Other exclusion criteria were previous op-

TABLE 2. DEMOGRAPHIC CHARACTERISTICS OF 81 HIV-INFECTED PATIENTS IN DIALYSIS<sup>a</sup>

Characteristic	Total	HD	PD	p
Number of patients (%)	81	60 (74%)	21 (26%)	
Male gender, N (%)	58 (72%)	42 (70%)	16 (76%)	0.74
Mean age (years)	45.5 ± 8.7	45 ± 8.8	46.7 ± 8.3	0.35
Diabetes mellitus, N (%)	19 (23%)	14 (23%)	5 (23%)	0.66
Cardiovascular events, N (%)	21 (26%)	17 (28%)	4 (19%)	0.32
Duration of dialysis (years)	4.6 ± 4.5	5.1 ± 5.0	2.8 ± 1.7	<.01
Causes of ESRD, N (%)				
Glomerulonephritis	29 (36%)	19 (31%)	10 (47.5%)	
Diabetic nephropathy	12 (15%)	10 (16.5%)	2 (9.5%)	0.74
Unknown/Unavailable	20 (24%)	15 (26%)	5 (24.5%)	
Other causes <sup>b</sup>	20 (25%)	16 (26.5%)	4 (18.5%)	
Biopsy proven, N (%)	19 (23%)	10 (16.5%)	9 (43%)	<.05
Duration of HIV infection (years)	11.9 ± 6.9	11.5 ± 6.8	13.1 ± 7.3	0.27
Risk factor for HIV infection, N (%)				
Parenteral	29 (36%)	22 (36%)	7 (33%)	0.90
Former injecting drug user	27	20	7	
Blood transfusion	2	2	—	
Sexual	27 (33%)	19 (31%)	8 (38%)	
MSM	9	6	3	
Heterosexuality	18	13	5	
Multiple	19 (23.5%)	14 (23%)	5 (24%)	
Unknown/unavailable	6 (7.5%)	5 (10%)	1 (5%)	
CD4 <sup>+</sup> T cells > 200, N (%)	62 (76.5%)	46 (76.5%)	16 (76%)	0.53
Undetectable VL, N (%)	59 (73%)	46 (76.5%)	13 (62%)	0.96
AIDS-defining events, N (%)	36 (44%)	23 (38%)	13 (62%)	<0.05
Receiving HAART, N (%)	69 (85%)	53 (88%)	16 (76%)	0.84
2 NRTIs + 1 NNRTI	31 (45%)	26 (49%)	5 (31%)	
2 NRTIs + 1 PI	23 (33%)	15 (28%)	8 (50%)	0.80
Other regimen	15 (22%)	12 (23%)	3 (19%)	
RT waiting list, N (%)	10 (12%)	8 (13%)	2 (9.5%)	0.95
Transplant recipients, N (%)	3 (3.7%)	3 (5%)	0	—
Meeting criteria for RT	32 (39.5%)	22 (36.5%)	10 (47.5%)	0.18
HCV coinfection	19 (59%)	14 (63%)	5 (50%)	0.17

<sup>a</sup>HD, hemodialysis; PD, peritoneal dialysis; P, statistical significance; N, number; %, percentage; ESRD, end-stage renal disease; MSM, men who have sex with men; VL, viral load; HAART, highly active antiretroviral therapy; NRTIs, nucleoside and nucleotide reverse transcriptase inhibitors; NNRTIs, nonnucleoside reverse transcriptase inhibitors; PIs, protease inhibitors; RT, renal transplantation; HCV, hepatitis C virus.

<sup>b</sup>Other causes includes interstitial nephropathy, polycystic kidney disease, hereditary/genetic, vascular, and systemic diseases. HIVAN and thrombotic microangiopathies were not found.

portunistic infections (other than tuberculosis, *Pneumocystis jirovecii* pneumonia, or esophageal candidiasis) in 15 cases, a CD4<sup>+</sup> T cell count below 200 cells/mm<sup>3</sup> in 19 cases, and detectable plasma HIV-1 RNA viral load in 22 cases. At the time of the survey, only 10 patients (12% of global patients and 31% of patients with eligibility criteria) were included on the Spanish renal transplant waiting list. Three patients had previously received a renal transplant but were again on dialysis because of graft loss.

Fifty patients (61%) had HCV coinfection, seven patients (8.4%) had HBV coinfection, and five (6%) had coinfection with both viruses. Most of the coinfecting patients were asymptomatic, but 10% had clinically diagnosed cirrhosis (Child A). Only three patients had been previously treated for HCV infection, but only one achieved a sustained virologic response (Table 1).

Differences between patients who were coinfecting and noncoinfecting with hepatitis C and/or B viruses are listed in Table 3. In comparison with noncoinfecting patients, we

found that coinfecting patients had a longer history of HIV infection ( $p < 0.01$ ) and previous AIDS-defining events ( $p < 0.01$ ). We also found significant differences in the risk factors for acquiring HIV infection ( $p < 0.01$ ). The main risk factor for acquiring HIV infection in coinfecting patients was parenteral drug use, as most patients were former injecting drug users. In comparison, noncoinfecting patients acquired HIV infection more frequently by sexual transmission. Finally, we did not find differences in the number of patients who met the HIV criteria to be included on the renal transplant waiting list, but there were more noncoinfecting patients on the renal transplant waiting list (24% vs. 6%,  $p < 0.05$ ).

Differences between patients receiving and not receiving HAART are listed in Table 4. Fifty-eight (84%) patients receiving HAART had an undetectable viral load in comparison with only one (8.3%) not receiving HAART ( $p < 0.001$ ). The CD4<sup>+</sup> T cell count was above 200 cells/mm<sup>3</sup> in 78% and 66% of patients receiving and not receiving HAART, re-

TABLE 3. HIV-INFECTED PATIENTS IN DIALYSIS: DIFFERENCES BETWEEN COINFECTED (HEPATITIS B AND C VIRUSES) AND NONCOINFECTED PATIENTS<sup>a</sup>

	Total (n = 81)	No coinfection (n = 29)	Hepatitis coinfection <sup>b</sup> (n = 52)	p
Male gender, N (%)	58 (72%)	19 (65.5%)	39 (75%)	0.36
Mean age (years)	45.5 ± 8.7	46 ± 12	45 ± 6	0.42
Diabetes mellitus, N (%)	19 (23%)	9 (31%)	10 (19%)	0.22
Cardiovascular events, N (%)	21 (26%)	8 (27%)	13 (25%)	0.79
Duration of dialysis (years)	4.6 ± 4.5	4.1 ± 3.9	4.8 ± 4.9	0.47
Hemodialysis-peritoneal (%)	74%-26%	76%-24%	73%-27%	0.78
Causes of ESRD, N (%)				
Glomerulonephritis	36%	28%	40.5%	
Diabetic nephropathy	15%	27.5%	8%	0.26
Unknown/unavailable	24%	24%	23.5%	
Other causes <sup>c</sup>	25%	20.5%	28%	
Biopsy proven, N (%)	19 (23%)	4 (13%)	15 (29%)	0.06
Duration of HIV infection (years)	11.9 ± 6.9	7.3 ± 5.0	14.4 ± 6.6	<0.01
Risk factor for HIV infection (%)				
Parenteral	36%	10%	50%	<0.01
Former injecting drug user	33%	10%	46%	
Blood transfusion	3%	—	4%	
Sexual	33%	69%	14%	
MSM	11%	17%	8%	
Heterosexuality	22%	52%	6%	
Multiple	23.5%	7%	33%	
Unknown/unavailable	7.5%	14%	3%	
CD4 <sup>+</sup> T cells > 200, N (%)	62 (76.5%)	21 (72%)	41 (79%)	0.37
Undetectable VL, N (%)	59 (73%)	19 (65.5%)	40 (77%)	0.53
AIDS events, N (%)	36 (44%)	7 (24%)	29 (56%)	<0.01
Receiving HAART, N (%)	69 (85%)	24 (82%)	45 (86.5%)	0.64
2 NRTIs + 1 NNRTI	31 (45%)	11 (45.5%)	20 (44.5%)	
2 NRTIs + 1 IP	12 (33%)	9 (37.5%)	14 (31%)	0.89
Other regimen	26 (22%)	4 (17%)	11 (24.5%)	
RT waiting list, N (%)	10 (12%)	7 (24%)	3 (6%)	<0.05
Transplant recipients, N (%)	3 (3.7%)	2 (7%)	1 (2%)	0.40
Meet criteria for RT, N (%)	32 (39.5%)	12 (41%)	20 (38.5%)	0.74

<sup>a</sup>N, number; %, percentage; p, statistical significance; ESRD, end-stage renal disease; MSM, men who have sex with men; VL, viral load; HAART, highly active antiretroviral therapy; NRTIs, nucleoside and nucleotide reverse transcriptase inhibitors; NNRTIs, nonnucleoside reverse transcriptase inhibitors; PIs, protease inhibitors; RT, renal transplantation.

<sup>b</sup>Hepatitis coinfection (52 patients): 45 HCV, 2 HBV, 5 HCV and HBV.

<sup>c</sup>Other causes includes interstitial nephropathy, polycystic kidney disease, hereditary/genetic, vascular, and systemic disease.

TABLE 4. HIV-INFECTED PATIENTS IN DIALYSIS: DIFFERENCES BETWEEN PATIENTS RECEIVING AND NOT RECEIVING HAART

Total population (n = 81)	Receiving HAART (68/81 = 85%)	Not receiving HAART (12/81 = 15%)	p
Duration of HIV (years), mean $\pm$ SD	12.3 $\pm$ 7.1	9.9 $\pm$ 6	0.32
AIDS events, N (%)	30 (43.5%)	6 (50%)	0.67
CD4 <sup>+</sup> T cell count/mm <sup>3</sup> , mean $\pm$ SD	354 $\pm$ 180	382 $\pm$ 263	0.66
CD4 <sup>+</sup> T cells > 200, N (%)	54 (78%)	8 (66%)	0.05
Undetectable VL, N (%)	58 (84%)	1 (8.3%)	<0.001
HCV and/or HBV coinfections, N (%)	45 (65%)	7 (58%)	0.64
Duration of dialysis (years), mean $\pm$ SD	4.8 $\pm$ 4.8	2.9 $\pm$ 2.1	0.19
Hemodialysis–peritoneal dialysis (%)	77%–23%	58%–42%	0.17
Meet criteria for RT, N (%)	29 (42%)	3 (25%)	0.46

HAART, highly active antiretroviral therapy; *p*, statistical significance; SD, standard deviation; N, number; %, percentage; VL, HIV-RNA viral load; HCV, hepatitis C virus; HBV, hepatitis B virus; RT, renal transplantation.

spectively ( $p = 0.05$ ). It seems that the modality of renal replacement therapy used (HD vs. PD) did not substantially affect these results. No other significant differences between receiving and not receiving HAART patients were found.

## Discussion

We present the data from the second cross-sectional multicenter survey conducted in Spain on ESRD among HIV-infected patients on dialysis. At the end of 2006, the Spanish Nephrology Society (SEN) reported a total of 18,222 patients under renal replacement therapies in Spain; of these 16,161 were on HD and 2061 were on PD.<sup>22</sup> In this study we obtained information from 14,876 dialysis patients, which represents 81.6% of the total Spanish dialysis population.<sup>22</sup>

Prevalence estimates in Spain, including those from the 2004 study (1.15%; 95% CI 0.85–1.45%) and the current study at the end of 2006 (0.54%; 95% CI 0.43–0.67%), are likely overestimated. In the 2004 study, prevalence was overestimated because the study population was only 4962 dialysis patients (27% of the Spanish dialysis population). Another reason was that most of the nonresponding centers were outpatient units that do not usually treat HIV-infected patients.<sup>11</sup> In the present survey, the majority (90%) of nonresponding centers were outpatient dialysis units and HIV-infected patients usually receive dialysis in hospital dialysis units. Therefore, we believe that the real prevalence is probably lower than 0.5%. For the same reason, we considered that the prevalence of HIV infection in patients receiving PD is also overestimated.

A similar prevalence was reported in France in 1997 (0.38%)<sup>9</sup> and 2002 (0.67%).<sup>10</sup> To our knowledge, these are the only available data on the prevalence of HIV infection in dialysis units in Europe during the HAART era. A pre-HAART (1995) Italian study reported a prevalence of 0.13% in dialysis units in Italy.<sup>23</sup> With regard to the prevalence of HIV infection in dialysis units in Europe, there is little information and more cooperative studies are needed. According to these results, we assume that the prevalence of HIV infection in dialysis units in European countries in the HAART era is lower than the prevalence reported in the United States (prevalence of 1.5% in 2002).<sup>6</sup>

The SEN report in 2006 showed that 1457 out of 18,222 patients in the Spanish dialysis population had HCV infection (8% prevalence).<sup>22</sup> We found a higher prevalence (61%) of

HCV coinfection in our patients probably because most of these patients were former injecting drug users (risk factors for HIV infection are listed in Tables 2 and 3). Treating HCV in patients with HIV coinfection and/or on dialysis is more complex and requires continuous adjustment of antiviral drug dose. This may be the reason why only three patients had previously received treatment for HCV.

As reported in other series,<sup>10,24</sup> the renal replacement therapy most frequently used was HD and we found no patients in HHD. As for the causes of ESRD, some epidemiologic differences between the Spanish population and the French and American populations were found. HIVAN is the cause of ESRD in more than 60% of the American population<sup>24,25</sup> and 39.9% in France<sup>10</sup> compared with no reported cases in Spain. Thrombotic microangiopathy (traditionally associated with HIV infection) was not found in the study population. The most frequent causes of ESRD were different types of glomerulonephritis. Diabetic nephropathy was the second leading cause of ESRD (15%). Glomerulonephritis and diabetic nephropathy were also the most frequent causes of ESRD in the Spanish dialysis population in 2006.<sup>22</sup> The differences in ESRD etiology between countries may be due to ethnic differences (HIVAN almost exclusively affects African-American or Caribbean patients) but also to renal biopsy policies (23% of biopsy-proven diagnoses in our survey compared with 45.9% in the United States<sup>3</sup> and 57% in the French surveys).<sup>10</sup>

As described above, a high prevalence of HCV coinfection was found and coinfecting patients acquired HIV infection intravenously as most of them were former injecting drug users. These patients had a longer history of HIV infection with previous AIDS-defining events. This may be one of the reasons why glomerulonephritis is the main cause of ESRD in this group, compared with diabetic nephropathy in noncoinfecting patients (Table 3).

A higher CD4<sup>+</sup> T cell count and receiving HAART while on dialysis are strongly associated with improved survival in HIV-infected dialysis patients,<sup>24</sup> but over- or underprescription of antiretroviral medication can result in suboptimal use of HAART in ESRD patients.<sup>26</sup> Eighty-five percent of patients were under different HAART regimens including three or more drugs, but information about dosing was not collected. Sixty-two patients (76%) had a CD4<sup>+</sup> T cell count above 200 cell/mm<sup>3</sup>, and most of these patients were

receiving HAART. Almost all patients with an undetectable viral load were taking antiretroviral medication and only one of them was not receiving antiretroviral therapy (Table 4). The differences in viral load and CD4<sup>+</sup> T cell count between patients receiving and not receiving HAART were statistically significant ( $p < 0.01$  and  $p = 0.05$ , respectively). Despite the fact that this is not a survival study, it seems clear that HIV-infected patients with ESRD must receive appropriate antiretroviral therapy. As HIV dialysis patients under stable HAART regimens can achieve higher CD4<sup>+</sup> T cell counts and lower HIV-RNA viral load, more patients could potentially meet the criteria to be on the renal transplant waiting list.

As described above, 32 patients (39.5%) met the Spanish HIV criteria to be on the renal transplant waiting list. We did not find differences between coinfecting and noncoinfecting patients according to the number of patients who met the HIV criteria for renal transplantation. Nevertheless, noncoinfecting patients were more frequently placed on the renal transplant waiting list than coinfecting patients at the time of the survey (24% vs. 6%,  $p < 0.05$ ). The management of hepatitis B and C infection is more difficult both in dialysis patients and in HIV-coinfecting patients. In addition, immunosuppressive treatment after renal transplant increases the risk of hepatitis virus reactivation. Inclusion of coinfecting patients on the renal transplant waiting list may be limited for these reasons.

The present study has some limitations. First, the rate of biopsy-proven renal disease is low and this may be one of the reasons for the low rate of HIV-related causes of ESRD found. Second, information about antiretroviral dosage was not collected. This information could be very valuable in order to determine how many patients were under- or overprescribed. And finally, although the black population is much smaller in Spain than in the United States and other European countries, such as France, we do not have information regarding the race of the Spanish HIV-infected dialysis patients. However, in a recent study published by the Spanish cohort of naive HIV-infected patients (CoRIS),<sup>27</sup> only 5% of the 1591 HIV-infected patients in the 17 participating centers from January 2004 to October 2005 who were there for the first time were from sub-Saharan Africa.

Despite these limitations, the focus of this study is on epidemiologic data regarding HIV infection in dialysis patients in the HAART era, with detailed information about clinical situation, risk factors, virologic and immunologic status, HAART regimens, and impact of these variables on the RT waiting list.

In summary, we found a low prevalence of HIV infection in the Spanish dialysis population in the HAART era. The percentage of HCV-coinfecting patients was very high. Two-thirds of these patients can achieve adequate virologic and immunologic status under different HAART regimens, and almost half of them could be suitable candidates for renal transplantation. At the time of the survey only 12% of patients were included on the RT waiting list. HIV infection is no longer considered an absolute contraindication for renal transplantation and encouraging patient and graft survival rates have been reported in the United States and Spain. The high prevalence of HCV coinfection makes it difficult to manage these patients in dialysis and after renal transplantation. In Spain and in the rest of Europe, more epidemiologic studies on ESRD in HIV-infected patients are needed. A Spanish

cohort study to analyze the survival of the HIV-infected population on dialysis is ongoing. We hope this study and future studies will be able to answer some of the remaining questions about survival and prognosis factors in this population and also help physicians (nephrologists and HIV infection specialists) provide optimal care and improve their management of the multidisciplinary issues of the "HIV infection with ESRD population."<sup>28</sup>

## Appendix

Steering Committee: J.M. Miró, A. Moreno, J.C. Trullàs, G. Barril, F. Cofan, A. Mazuecos, J. Burgos, and J. González-García. Coordinating Center: B. Moyano, H. Esteban, and J. González-García from the Clinical Trials Agency (AEC) of the AIDS Study Group of the Spanish Society of Infectious Diseases and Clinical Microbiology (GESIDA/SEIMC).

List of Investigators of the Spanish HIV-Infection in Dialysis Study Group: J.M. Miró, F. Cofan, J.C. Trullàs, A. Moreno, C. Cervera, A. Cases, F. Agüero, F. Torres, F. Oppeheimer, J.M. Campistol, and J.M. Gatell, Hospital Clínic-IDIBAPS, Universitat de Barcelona, Barcelona; J. Martínez-Ara, Hospital Universitario La Paz, Madrid; M. Fernández-Lucas and M. Rivera-Gorrín, Hospital Universitario Ramón y Cajal, Madrid; A. Martínez-Castelao and X. Fulladosa, Hospital Universitari de Bellvitge, Hospitalet del Llobregat, Barcelona; J. Molina, Hospital de Donosti, San Sebastián; O. González-Peña, Hospital de Basurto, Bilbao; M. Muñiz, Hospital de Cruces, Baracaldo; J. García de Diego, Hospital General Universitario de Elche; P. Vidau, Hospital Central de Asturias, Oviedo; R. Jofre-Ibáñez, Hospital General Universitario Gregorio Marañón, Madrid; M. Ceballos and A. Mazuecos, Hospital Universitario Puerta del Mar, Cádiz; E. Gruss, Fundación Hospital de Alcorcón; J.L. Pizarro, Hospital Infanta Cristina, Badajoz; F. Sarró-Sobrín, Hospital Arnau de Vilanova, Lleida; G. Barril, Hospital Universitario La Princesa, Madrid; J.M. Núñez-García, Hospital Clínic Universitario de Valladolid; R. Álvarez, Hospital Clínic Universitario Lozano Blesa, Zaragoza; A. Solís-Padrones, Hospital Can Misses, Ibiza; P. de Sequera-Ortiz, Hospital Universitario Príncipe de Asturias, Alcalá de Henares; J. Martín-Navarro, Centro de Diálisis La Luz, Madrid; J. Modol-Gort, Centro Hospitalario Althaia, Manresa; R.M. Muñoz-González, Hospital de Galdakao; J. de Juan-Ribera, Centro de Diálisis ASHDO, Elche; M.D. Albero, Hospital Virgen de Los Lirios, Alcoy; M.J. Navarro-Parreño, Hospital Santa Maria del Rosell, Cartagena; E. Lucas-Guillén, Hospital Dr. Rafael Méndez, Murcia; A. Martín-Malo, Hospital Universitario Reina Sofía, Córdoba; R. Mouzo, Hospital General Juan Cardona, El Ferrol; A. Gilo, Policlínico La Rosaleta, Santiago de Compostela; C. Asensio-Peinado, J.M. Osorio-Moratalla, and E. Martínez-Benavides, Hospital Universitario Virgen de las Nieves, Granada; J.A. Gutiérrez-Colon, Hospital Universitario Miguel Servet, Zaragoza; J.M. Lamas-Barreiro, Hospital do Meixoeiro, Vigo; F. Viana-Apraiz, Hospital Santiago Apóstol, Vitoria; L. Pallardó-Mateu, Hospital Dr. Peset, Valencia; J.A. Miguel-Carrasco, Hospital Clínic Universitario, Valencia.

## Acknowledgments

We are indebted to Thomas O'Boyle for his assistance with the English version of the manuscript and to Ferran Torres for his help with the statistical analysis. The study was partially supported by a research grant from the "Grupo de Estudio del Sida (GESIDA), Madrid, Spain." The "Agencia de

Ensayos Clínicos del Grupo de Estudio de Sida (AEC-GESIDA) de la Sociedad Española de Enfermedades Infecciosas y Microbiología Clínica" (SEIMC) is supported in part by "Plan Nacional sobre el SIDA" of the Spanish Health Ministry. Dr. J.M. Miró received a Research Grant from the "Institut d'Investigacions Biomèdiques August Pi I Sunyer (IDIBAPS)" and the "Conselleria de Salut de la Generalitat de Catalunya, Barcelona (Spain)." The results of this study were presented at the XLIV Congress of the European Renal Association-European Dialysis and Transplantation Association (ERA-EDTA), June 21–24, 2007, Barcelona, Spain. Abstract number FP193.

#### Disclosure Statement

No competing financial interests exist.

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Address reprint requests to:

Jose M. Miró  
 Infectious Diseases Service  
 Hospital Clinic  
 Villarroel, 170  
 08036 Barcelona, Spain

E-mail: jmmiro@ub.edu

