

Tropical Diseases Screening in Immigrant Patients with Human Immunodeficiency Virus Infection in Spain

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Abstract. Latent parasitic infections can reactivate because of immunosuppression. We conducted a prospective observational study of all human immunodeficiency virus (HIV)-infected immigrants who visited the Infectious Diseases Department of the Hospital Universitari Vall d'Hebron, Barcelona, Spain, during June 2010–May 2011. Screening of the most prevalent tropical diseases (intestinal parasitosis, Chagas disease, leishmaniasis, malaria, schistosomiasis, and strongyloidiasis) was performed according to geographic origin. A total of 190 patients were included: 141 (74.2%) from Latin America, 41 (21.6%) from sub-Saharan Africa, and 8 (4.2%) from northern Africa. Overall, 36.8% (70 of 190) of the patients had at least one positive result for any parasitic disease: 5 patients with positive *Trypanosoma cruzi* serology, 11 patients with positive *Schistosoma mansoni* serology, 35 patients with positive *Strongyloides stercoralis* serology, 7 patients with positive *Leishmania infantum* serology, intestinal parasitosis were detected in 37 patients, malaria was diagnosed in one symptomatic patient. We propose a screening and management strategy of latent parasitic infections in immigrant patients infected with HIV.

INTRODUCTION

In recent years, the immigrant population in Spain has increased significantly, and in 2011 represented 12.2% of the total population (approximately 5.7 million persons).¹ Conversely, in 2010 there were 34 million persons with human immunodeficiency virus (HIV) infection worldwide, and nearly 70% were concentrated in Africa and South America.² These factors have changed the demographic profile of HIV-infected patients treated in hospitals in Spain, with higher proportion of immigrants, mainly from sub-Saharan Africa and Latin America.

Screening of latent infections is recommended in the initial approach for all HIV-infected patients because of the capability to reactivate when immunosuppression is established. A tuberculin skin test (TST), chest radiograph, and serologic tests (for *Toxoplasma gondii*, *Treponema pallidum*, and hepatitis A, B and C viruses) should be performed.^{3–5} However, immigrant patients may have other endemic infections in their countries, such as *Strongyloides stercoralis* hyperinfection syndrome, or myocarditis and meningoencephalitis caused by *Trypanosoma cruzi*,^{6,7} that can be reactivated or manifested as severe forms because of the immunosuppression. Immune reconstitution inflammatory syndrome has also been related to some parasitic infections, such as leishmaniasis, schistosomiasis, and strongyloidiasis.⁸

The aim of this study was to perform a screening for prevalent tropical diseases in immigrants with HIV infection in Spain according to their geographic origin. With these results, we will suggest a screening, treatment and follow-up strategy.

PATIENTS AND METHODS

Study population and data collection. A prospective observational study was conducted at the Infectious Diseases Department of the Hospital Universitari Vall d'Hebron, a University hospital in Barcelona, Spain. All HIV-infected

patients from Latin America, sub-Saharan Africa, and northern Africa who visited the Infectious Diseases Department during June 2010–May 2011 were included. The study protocol was approved by the institutional review board of the hospital and informed consent was obtained from all patients.

The following data were collected: epidemiologic data (age, sex, country and district of origin, time since arrival in Spain, time since last travel to their country of origin, living in a rural environment); HIV infection-related data (CD4+ cell count, HIV plasma virus RNA, HIV acquisition risk factor, current antiretroviral therapy, previous opportunistic infections), eosinophil count, chest radiograph, TST and serologic data (*Toxoplasma gondii*, hepatitis B virus [HBV] surface antigen, antibodies against HBV core antigen and antibodies against hepatitis C virus [HCV]). Eosinophilia was defined as eosinophil count $\geq 500/\text{mm}^3$ or a percentage $\geq 7\%$. The TST (Mantoux method) result was considered positive when the transversal diameter of induration was ≥ 5 mm, according to international recommendations.⁵ Latent tuberculosis was diagnosed in patients with a positive TST result and a normal chest radiograph.

Screening for tropical diseases. For infections with intestinal parasites, stool samples were collected on two days from all patients and placed in 10% formol saline. Microscopic examination was performed by using direct techniques (saline and iodine wet mounts) and after concentration techniques by using the formol-ether method or Ritchie's technique. Auramine staining for *Cryptosporidium* and *Iso spor a* detection was also performed. Specific treatment was offered to all patients with a parasite infection considered pathogenic.

For Chagas disease, all patients from Latin America were tested for this disease (unless they came from the Caribbean islands). Serologic diagnosis of Chagas disease was performed by using two enzyme-linked immunosorbent assays (ELISAs) in parallel, one with recombinant antigen (Bioelisa Chagas; Biokit, Barcelona, Spain) and the other with crude antigen (Ortho *T. cruzi* ELISA; Johnson and Johnson, Piscataway, NJ) according to diagnostic criteria of the World Health Organization. Both ELISAs were performed according to the manufacturers' instructions. We considered results positive or negative if results of both tests were concordant. All discordant serum samples were tested by using an in-house

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Western blotting method with a lysate from *Trypanosoma cruzi* epimastigotes.⁹ When a positive result was obtained, chest radiograph, electrocardiogram, echocardiogram, esophagogram, and barium enema were performed and specific treatment was offered.

For leishmaniasis, all patients were tested for this disease by detection of IgG against *Leishmania infantum* by using an ELISA (Novagnost Leishmania IgG; Siemens Diagnostics, Marburg, Germany) according to the manufacturer's instructions. Bone marrow aspiration was performed in patients with positive serologic results and pancytopenia or hepatosplenomegaly to diagnose visceral leishmaniasis (VL). Specific treatment was offered.

For malaria, patients from malaria-endemic areas (sub-Saharan Africa and some Latin American regions) were tested for this disease by using a real-time polymerase chain reaction (PCR) with peripheral blood samples. This PCR could identify four species of *Plasmodium*. DNA extraction was conducted by using automatic silica-membrane technology (NucliSENS EasyMag; bioMerieux, Marcy l'Etoile, France). Primers and probe for a satellite sequence were selected and used in a TaqMan-based assay as described by Rougemont and others.¹⁰ Positive results for the PCR were considered diagnostic for malaria, and specific treatment was administered.

For schistosomiasis, patients coming from schistosomiasis-endemic areas (sub-Saharan Africa and some Latin American regions) were tested for this disease by detection of IgG against *Schistosoma mansoni* by using an ELISA (Novagnost Schistosoma mansoni IgG; Siemens Diagnostics) according to the manufacturer's instructions. When results were positive, stool and urine samples were test for parasite ova and abdominal ultrasonography was performed. Specific treatment was offered when schistosomiasis was confirmed (ova detection) or suspected (positive serologic results and

characteristic manifestations, such as eosinophilia, hematuria, or periportal fibrosis).

For strongyloidiasis, all patients were tested for this disease by detection of IgG against *Strongyloides stercoralis* by using an ELISA (Strongyloides IgG; DRG Diagnostics, Marburg, Germany). When results were positive, three additional stool samples were collected and specific fecal culture for *S. stercoralis* larvae (charcoal culture) was performed. Specific treatment was offered when strongyloidiasis was confirmed (larvae detection) or suspected (positive serologic results and characteristic manifestations, such as eosinophilia, skin lesions, or intestinal disorders).

Statistical analysis. Categorical data are presented as absolute numbers and proportions, and continuous variables are expressed as medians and interquartile ranges (IQRs). The chi-square test or Fisher exact test, when appropriate, was used to compare the distribution of categorical variables, and the Mann-Whitney U test was used for continuous variables. Univariate and multivariate analyses using a forward stepwise multiple regression model were conducted to identify variables independently associated with a specific parasitosis. Adjusted odds ratios and 95% confidence intervals were calculated. Results were considered statistically significant if the two-tailed *P* value was < 0.05. SPSS software for Windows version 15.0 (SPSS Inc., Chicago, IL) was used for statistical analyses.

RESULTS

Demographic and HIV infection data. Overall, 190 patients were included in the study. Countries of origin are shown in Figure 1. There were 141 (74.2%) patients from Latin America, 41 (21.6%) patients from sub-Saharan Africa, and 8 (4.2%) patients from northern Africa (the third group was excluded from statistical analysis because of low numbers of patients and was considered unrepresentative of the

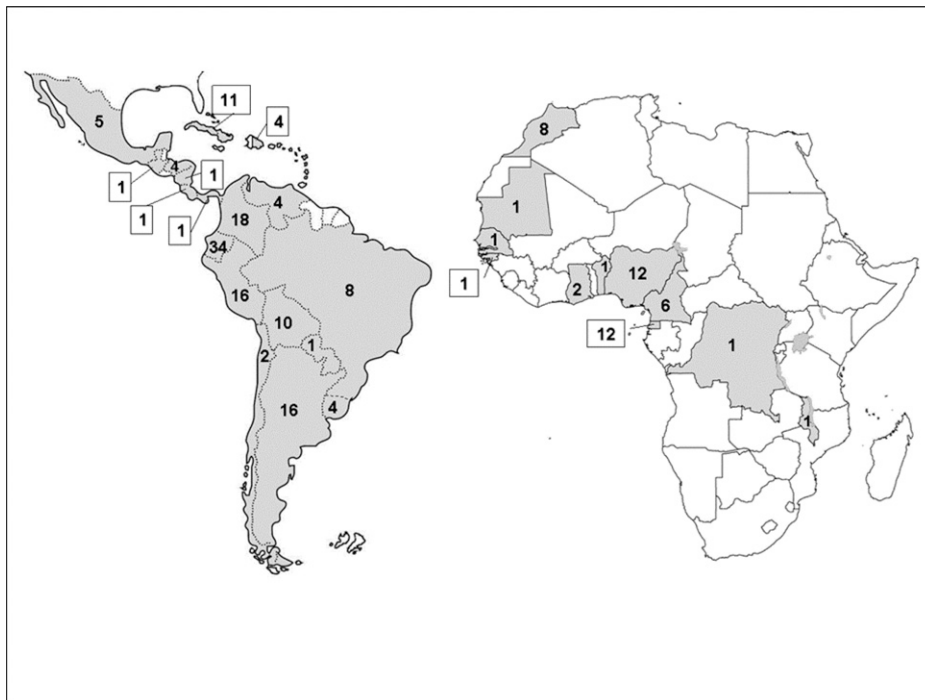


FIGURE 1. Geographic origin of patients in the study in Spain. Numbers represent number of patients coming from each country.

TABLE 1
Epidemiologic and HIV-related data, Spain*

Characteristic	Overall (n = 190)	Latin America (n = 141)	Sub-Saharan Africa (n = 41)	Northern Africa (n = 8)	P†
Male sex	129 (67.9)	108 (76.6)	15 (36.6)	6 (75)	< 0.001
Age, years	37 (32–43)	37 (32–43)	36 (30–42)	39 (35–40)	0.358
Time since arrival, months	96 (60–123)	96 (60–126)	84 (60–120)	102 (43–216)	0.226
Time since last travel, months	36 (12–60)	36 (12–60)	36 (10–72)	18 (3–42)	0.809
Living in a rural environment	60 (31.6)	37 (26.2)	19 (46.3)	4 (50)	0.014
Minimum CD4+ cell count/mm ³	223 (118–341)	223 (123–336)	224 (60–344)	262 (188–417)	0.501
Current CD4+ cell count/mm ³	459 (358–625)	458 (369–658)	386 (274–565)	502 (453–767)	0.030
HIV RNA < 50 copies/mL	124 (65.3)	97 (68.8)	24 (58.5)	3 (37.5)	0.221
HIV acquisition risk factor					
Heterosexual	112 (58.9)	65 (46.1)	40 (97.6)	7 (87.5)	< 0.001
Homosexual/bisexual	76 (40)	75 (53.2)	1 (2.4)	0 (0)	< 0.001
Intravenous drug user	1 (0.5)	0 (0)	0 (0)	1 (12.5)	–
Unknown	1 (0.5)	1 (0.7)	0 (0)	0 (0)	–
Immunologically naive patients	42 (22.1)	32 (22.7)	8 (19.5)	2 (25)	0.665
Previous opportunistic infection	37 (19.5)	30 (21.3)	6 (14.6)	1 (12.5)	0.347

*HIV = human immunodeficiency virus. Values are no. (%) patients or median (interquartile range).

†For comparison between Latin America and sub-Saharan Africa groups.

population in this region). Epidemiologic and HIV-related data are shown in Table 1. The median age of the patients was 37 (IQR = 32–43) years and 129 (68%) were male. The median time since arrival in Spain was 96 (IQR = 60–123) months.

Regarding HIV infection, the median current and minimum CD4+ cell counts were 459 (IQR = 358–625) cells/mm³ and 223 (IQR = 118–341) cells/mm³, respectively. At the time of study enrollment, 159 (77.9%) patients were receiving antiretroviral therapy, and 124 (83%) of them had undetectable HIV RNA virus load (< 50 copies/mL). Patients from sub-Saharan Africa had a significantly higher proportion of women and living in rural environments and a lower current CD4+ cell count than patients from Latin America.

Screening of latent infections. Data for screening of latent infections are shown in Table 2. Nine (4.7%) patients were positive for antibodies against HCV, 15 (7.9%) patients were infected with HBV, and 68 (35.8%) patients had a previous infection with HBV (positive for antibodies against HBV core antigen but negative for HBV surface antigen). Eosinophilia was detected in 29 (15.3%) patients. The TST result was positive in 18 (10%) of 179 patients. Of these 18 patients, 6 reported previous tuberculosis, and 12 reported a latent infection (6.7% of the overall population). When geographic areas were compared, we found that the prevalence of eosinophilia and HBV and HCV infections was significantly higher among patients from sub-Saharan Africa than those from

Latin America. Overall, 36.8% (70 of 190) of the patients had at least one positive result for any parasitic disease.

Intestinal parasitosis. Two stool samples from each patient were collected from 139 (72%) patients. A total of 37 (26.6%) of these samples showed positive results and 64 parasites were isolated (Table 3); Twenty-one patients had one parasite and 16 patients had ≥ 2 parasites.

Chagas disease. Five (3.9%) of 126 patients were positive for Chagas disease: four from Bolivia and one from Ecuador. All were in the indeterminate phase of Chagas disease. Treatment with benznidazole, 100 mg every 8 hours (5 mg/kg/day) for 60 days was prescribed for all five patients and no adverse reaction was reported.

Leishmaniasis. A serologic test result for *L. infantum* was positive for 7 (3.7%) of 187 patients. None of them had clinical or analytical signs of VL and no further studies were conducted.

Malaria. A real-time PCR for *Plasmodium* DNA was performed for 62 patients from malaria-endemic countries. Only one patient was positive for *Plasmodium falciparum*: a 32-year-old woman from Equatorial Guinea, who had arrived in Spain one month earlier. She was asymptomatic when screening was performed, but two days later she had a fever. Thin and thick blood films were positive for *P. falciparum* and specific treatment was offered.

Schistosomiasis. Eleven (18.9%) of 58 patients were positive for *S. mansoni* serology: nine from sub-Saharan Africa and

TABLE 2
Infectious diseases screening, Spain*

Characteristic	Overall	Latin America	Sub-Saharan Africa	Northern Africa	P†
Eosinophilia	29/190 (15.3)	15/141 (10.6)	13/41 (31.7)	1/8 (12.5)	0.001
Latent tuberculosis infection	12/179 (6.7)	9/135 (6.6)	3/37 (8.1)	0/7 (0)	0.760
Positive for <i>Toxoplasma gondii</i> serology	103/190 (54.2)	73/141 (52.5)	27/41 (65.9)	2/8 (25)	0.129
Positive for antibody against HCV	9/190 (4.7)	2/141 (1.4)	5/41 (12.2)	2/8 (25)	0.002
Positive for HBs	15/190 (7.9)	9/141 (6.4)	6/41 (14.6)	0/8 (0)	0.091
Past hepatitis B infection	68/190 (35.8)	44/141 (31.2)	22/41 (53.7)	2/8 (25)	0.008
Past or present HBV infection	83/190 (43.7)	53/141 (37.6)	28/41 (68.3)	2/8 (25)	< 0.001
Intestinal parasitosis	37/139 (26.6)	32/102 (31.4)	4/32 (12.5)	1/5 (20)	0.036
Positive for <i>Leishmania infantum</i> serology	7/187 (3.7)	6/138 (4.3)	1/41 (2.4)	0/8 (0)	0.580
Positive for <i>Strongyloides stercoralis</i> serology	35/190 (18.4)	22/141 (15.6)	11/41 (26.8)	2/8 (25)	0.101
Positive for <i>Trypanosoma cruzi</i> serology	5/126 (3.9)	5/126 (3.9)	0/0 (0)	0/0 (0)	–
Positive for <i>Schistosoma mansoni</i> serology	11/58 (18.9)	2/17 (11.8)	9/41 (22)	0/0 (0)	0.368
Positive PCR result for <i>Plasmodium</i>	1/62 (1.6)	0/21 (0)	1/41 (2.4)	0/0 (0)	1.000
Any parasitologic diagnosis	70/190 (36.8)	52/141 (36.9)	16/41 (39)	2/8 (25)	0.803

*Values are number (%) of patients. HCV = hepatitis C virus; HBs = hepatitis B surface antigen; HBV = hepatitis B virus; PCR, polymerase chain reaction.

†For comparison between Latin America and sub-Saharan Africa groups.

TABLE 3
Intestinal parasites isolated, Spain

Intestinal parasite	No. isolates
Pathogenic parasites	
<i>Entamoeba histolytica/dispar</i>	4
<i>Giardia lamblia</i>	4
<i>Strongyloides stercoralis</i>	2
<i>Trichuris trichiura</i>	2
<i>Ascaris lumbricoides</i>	1
<i>Hymenolepis nana</i>	1
Parasites of minor medical importance	
<i>Blastocystis hominis</i>	24
<i>Dientamoeba fragilis</i>	9
Non-pathogenic parasites	
<i>Entamoeba coli</i>	9
<i>Endolimax nana</i>	8
Total	64

two from Latin America. None of the patients had previously received specific treatment for schistosomiasis or had classic symptoms and signs, and seven of them had eosinophilia when screening was performed. Abdominal ultrasonography was performed and urine samples were collected from five patients for detection of parasite ova; all patients had negative results. Praziquantel, 40 mg/kg/day for 2 days, was administered to patients with eosinophilia and positive serologic results.

Strongyloidiasis. Thirty-five (18.4%) of 190 patients were positive for *S. stercoralis* serology. *Strongyloides stercoralis* larvae were detected by stool examination in one patient. Three stool samples were obtained from eight other patients, and specific fecal culture showed positive results for larvae detection for one additional patient. Only nine (25.7%) patients had eosinophilia when screening was performed. Ivermectin, 200 µg/kg/day for 2 days, was administered to patients with eosinophilia or a confirmed diagnosis by larvae demonstration.

Multivariate analysis showed that eosinophilia was significantly associated with strongyloidiasis and schistosomiasis. Patients from Latin America and those who arrived in Spain within the past five years had an increased risk of having intestinal parasitosis. Results are shown in Table 4.

DISCUSSION

Since the relationship between HIV and some neglected tropical diseases has been described, screening for tropical diseases among HIV-infected patients from disease-endemic areas is becoming more relevant.^{11,12} We treated 5 patients with Chagas disease, 1 with malaria, 7 with schistosomiasis, 9 with strongyloidiasis, and 14 with intestinal parasitosis.

Immunocompromised patients may show reactivation of Chagas disease with severe acute clinical manifestations (meningoencephalitis and myocarditis) and high parasitemia, especially when CD4+ cell counts are $\leq 200/\text{mm}^3$.^{13,14} Thus, active research involving patients from disease-endemic areas must be conducted to avoid additional reactivations of Chagas disease, as has been reported in some hospitals in Spain.¹⁵ Two serologic tests must be performed for all HIV-infected patients from Latin America (except from the Caribbean islands) to screen persons for Chagas disease, and persons should be treated with benznidazole when positive results are obtained.

Co-infection with *Leishmania* and HIV is currently reported in 2–9% of all patients with VL in some disease-endemic countries. Infection with HIV increases the risk for developing VL in disease-endemic areas, reduces the therapeutic response, and increases the risk of relapse. Conversely, VL promotes the clinical progression of HIV disease.¹⁶ Different serologic tests are available for the diagnosis of leishmaniasis; unfortunately, more than 50% of co-infected patients have negative serologic

TABLE 4
Univariate and multivariate analysis, Spain*

Characteristic	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P
Strongyloidiasis				
Living in a rural environment	1.15 (0.51–2.58)	0.724	–	–
Eosinophilia	2.56 (1.04–6.34)	0.036	2.56 (1.03–6.34)	0.041
Current CD4+ cell count < 200/mm ³	3.45 (1.13–10.5)	0.022	–	–
HIV RNA ≥ 50 copies/mL	1.36 (0.62–2.97)	0.429	–	–
No ART	0.75 (0.28–1.97)	0.561	–	–
Previous opportunistic infection	0.88 (0.33–2.32)	0.799	–	–
Latin American origin	0.50 (0.22–1.15)	0.799	–	–
Schistosomiasis				
Living in a rural environment	4.70 (1.09–20.14)	0.028	–	–
Eosinophilia	10 (2.30–43.39)	0.001	8.74 (1.73–43.98)	0.009
Current CD4+ cell count < 200/mm ³	12.2 (2.31–64.68)	0.001	10.3 (1.57–67.54)	0.015
HIV RNA ≥ 50 copies/mL	4.29 (1.01–18.34)	0.039	–	–
No ART	2.72 (0.69–10.68)	0.141	–	–
Previous opportunistic infection	1.82 (0.39–8.43)	0.435	–	–
Latin American origin	0.47 (0.09–2.47)	0.368	–	–
Intestinal parasitosis				
Time since arrival < 5 years	4.16 (1.71–10.11)	0.001	4.64 (1.83–11.75)	0.001
Living in a rural environment	1.70 (0.77–3.75)	0.187	–	–
Eosinophilia	1.84 (0.72–4.69)	0.195	–	–
Current CD4+ cell count < 200/mm ³	1.23 (0.35–4.29)	0.738	–	–
HIV RNA ≥ 50 copies/mL	0.72 (0.31–1.67)	0.450	–	–
No ART	0.59 (0.20–1.70)	0.328	–	–
Previous opportunistic infection	1.71 (0.65–4.51)	0.272	–	–
Latin American origin	3.2 (1.03–9.88)	0.036	3.72 (1.14–12.17)	0.001

*OR = odds ratio; CI = confidence interval; HIV = human immunodeficiency virus; ART = antiretroviral therapy.

results, and there is serologic cross-reactivity between *Leishmania* and other microorganisms, such as *Trypanosoma* or mycobacteria.¹⁷ In our study, none of the seven patients with positive serologic results had clinical or analytical abnormalities, and Chagas disease was concurrently diagnosed in four of these patients. Therefore, positive results were most probably false-positive results caused by cross-reactivity. On the basis of our results, serologic testing is not useful for VL screening of VL HIV-infected persons.

HIV infection and malaria are two of the most important health problems in developing countries, mainly in sub-Saharan Africa. Studies about the impact of HIV infection on the risk for severe malaria differ in their findings.¹⁸ Although real-time PCR is more sensitive than thick or thin blood films in post-arrival screening for malaria in asymptomatic patients from disease-endemic areas, PCR did not provide any advantage in our HIV population.¹⁹ In our experience, screening asymptomatic HIV-infected patients for malaria was not useful. This finding was probably caused by the fact that most analyzed patients were living in Spain for more than five years at the time of screening, which reduced the risk for malaria.

Chronic schistosomiasis results from the immune response of the host to schistosome eggs and the granulomatous reaction produced by the antigens they secrete.²⁰ Diminished egg excretion efficiency has been found in HIV-infected patients with schistosomiasis, which complicates diagnosis.²¹ The lack of sensitivity of classical methods and reduced egg excretion in HIV-infected patients make serologic analysis an interesting tool for schistosomiasis screening in this population. In our study, 11 patients had positive serologic results for *S. mansoni*, but results of screening for ova were negative.

Patients infected with HIV from area to which schistosomiasis is endemic should be screened by serologic testing, and stool and urine sample must be collected and tested when a positive result is obtained to confirm the diagnosis. On the basis of its efficacy and safety, praziquantel should be offered to patients with a confirmed diagnosis and those with positive serologic results and indirect signs of infection (eosinophilia, hematuria, periportal fibrosis, urine bladder calcification). We do not have any explanation for the association between schistosomiasis and low CD4+ cell counts, but it was probably caused by the small number of patients.

Strongyloides stercoralis infection is asymptomatic in most infected patients, but a fulminant presentation that can be fatal (*S. stercoralis* hyperinfection syndrome and disseminated strongyloidiasis) may occur in situations of compromised host immunity, as in HIV infection.²² Definitive diagnosis of strongyloidiasis is made on the basis of detection of larvae in stool samples. However, low parasite load and irregular larval output in chronic infections (especially in immunocompromised patients) make a diagnosis challenging.²³ Currently, serologic tests are sensitive and specific and are useful for screening of asymptomatic patients and follow-up after specific treatment.^{24,25} Therefore, serologic testing for *S. stercoralis* infection in an HIV-infected population seems to be the best strategy. Stool samples must be collected for larvae detection in persons with positive results to confirm the diagnosis. Specific treatment with ivermectin should be offered to patients with a confirmed diagnosis and patients with positive serologic results and other signs of infection (eosinophilia, pruritus, skin lesions, or gastrointestinal disorders).

Higher prevalence of intestinal parasites in an HIV-infected population has been reported.²⁶ *Cryptosporidium*,

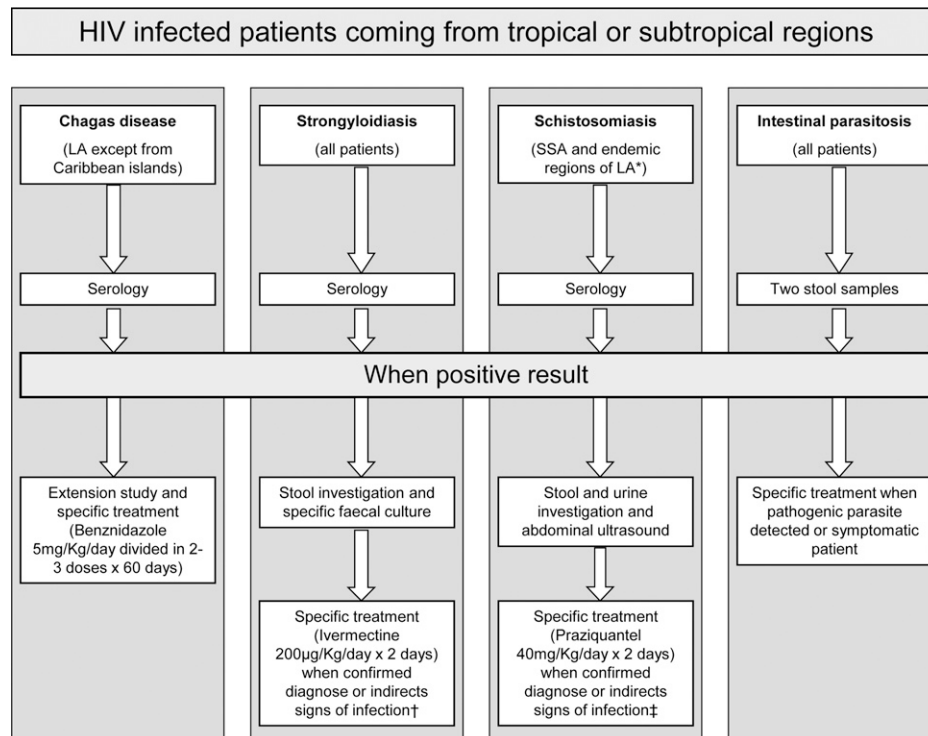


FIGURE 2. Screening and management strategy of latent parasitic infections in human immunodeficiency virus–infected patients in Spain. LA = Latin America; SSA = sub-Saharan Africa. *Patients from Brazil, Venezuela, Surinam, and Caribbean islands.³⁰ †Eosinophilia, pruritus, suggestive skin lesions, and gastrointestinal disorders. ‡Eosinophilia, hematuria, and suggestive ultrasound disorders.

Isospora, and other protozoan parasites have been related to advanced HIV infection, and other protozoa and helminths are increasingly recognized as a significant problem in immunocompromised persons.^{27,28} The higher prevalence of intestinal parasitosis among immigrants living in Spain for less than five years can be explained by the fact that most intestinal parasites interrupt their life cycle two or three years after leaving a favorable epidemiologic environment. We have found no explanation for the higher prevalence of intestinal parasitosis among patients from Latin America in our study. Two stool samples should be collected from all HIV-infected patients from tropical and subtropical regions to screen for intestinal parasitosis, even if these patients are asymptomatic (all patients with intestinal parasitosis were asymptomatic in our study). Specific treatment must be offered when pathogenic parasites are detected or in symptomatic patients.

The low prevalence (4.7%) of HCV and HIV co-infection compared with the entire HIV-infected population in Spain (approximately one third of the population) could be explained by the main HIV acquisition risk factor in our study, the sexual transmission; only one patient was an intravenous drug user. As it was expected, the prevalence of HBV infection is higher in the group from sub-Saharan Africa than in the group from Latin America.⁴

As suspected, parasitic infections among HIV-infected patients from tropical and subtropical regions are highly prevalent, and screening programs for HIV populations from disease-endemic areas are highly recommended. In a similar study conducted in the United States,²⁹ 128 immigrants infected with HIV were screened by stool sample investigation and serologic tests. Prevalence of antibodies against *Strongyloides* (26%) and *Schistosoma* (29%) antigens were higher than in our study (18.4% and 18.9%, respectively). Conversely, no patient in that study was positive for *T. cruzi*, whereas 3.9% of our patients had a positive test result. These differences were likely caused by differences in proportions of patients from sub-Saharan Africa and Latin America in both studies. As in our study, eosinophilia was strongly associated with strongyloidiasis and schistosomiasis, highlighting the importance of testing for parasitic infections in patients with high eosinophil counts.

This study involved patients born in areas to which some tropical diseases were endemic. Nevertheless, patients who travel for long periods through the tropics are also at risk for acquiring these endemic tropical diseases and should be screened similar to patients born in these areas, especially when they are symptomatic. Specific recommendations for screening in returning travelers should be made on the basis of travel destination, duration of travel, and risky activities.

One of the limitations of our study is the use of a screening method based on serologic tests. Immunosuppression caused by HIV infection may decrease the sensitivity of serologic tests, and positive results may not differentiate between latent and past infections. Nevertheless, given the potential risk of reactivation and safety of most of the specific treatments, treating parasitic infections based on serologic diagnosis in immunocompromised patients seems to be beneficial. Another limitation is that we used serologic tests for *L. infantum* and *S. mansoni* to screen for leishmaniasis and schistosomiasis, respectively, on the basis of cross-reactivity with other species, which could decrease test specificity. Finally, the study

population had specific social characteristics, which made it difficult to follow-up these patients. A greater effort had to be made by physicians; only 139 (72%) of 190 patients provided stool samples and further studies after positive serologic results were obtained were difficult to perform.

In summary, parasitic infections are prevalent in HIV-infected patients from tropical and sub-tropical areas. Because of the risk of reactivation and severe forms of diseases, screening for parasitic infections is highly recommended in this population. On the basis of our results and other reported results, we propose screening for parasitic infections by testing stool samples and using serologic tests for Chagas disease, strongyloidiasis, and schistosomiasis in all HIV-infected patients according to their geographic origin. Malaria screening should be individualized according to risk (recent immigrants from malaria-endemic areas). Screening and management strategy is summarized in Figure 2.

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