

# Prognosis and Clinical Evaluation of Infection Caused by *Rhodococcus equi* in HIV-Infected Patients\*

## A Multicenter Study of 67 Cases

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**Objective:** To assess the clinical characteristics and the factors that influenced the prognosis of patients with HIV and infection caused by *Rhodococcus equi*.

**Design:** Observational, multicenter study in 29 Spanish general hospitals.

**Setting:** These hospitals comprised a total of 20,250 beds for acute patients and served a population of 9,716,880 inhabitants.

**Patients:** All patients with HIV and diagnosed *R equi* infection until September 1998.

**Results:** During the study period, 19,374 cases of AIDS were diagnosed. Sixty-seven patients were included (55 male patients; mean  $\pm$  SD age, 31.7  $\pm$  5.8 years). At the time of diagnosis of *R equi* infection, the mean CD4+ lymphocyte count was 35/ $\mu$ L (range, 1 to 183/ $\mu$ L) and the stage of HIV infection was A3 in 10.4% of patients, B3 in 31.3%, C3 in 56.7%, and unknown in 1.5%. *R equi* was most commonly isolated in sputum (52.2%), blood cultures (50.7%), and samples from bronchoscopy (31.3%). Chest radiographic findings were abnormal in 65 patients (97%). Infiltrates were observed in all of them, with cavitations in 45 patients. The most active antibiotics against the strains isolated were vancomycin, amikacin, rifampicin, imipenem, ciprofloxacin, and erythromycin. After a mean follow-up of 10.7  $\pm$  12.8 months, 23 patients (34.3%) died due to causes related to *R equi* infection and 6 other patients showed evidence of progression of the infection. The absence of highly active antiretroviral therapy (HAART) was independently associated with mortality related to *R equi* infection (relative risk, 53.4; 95% confidence interval, 1.7 to 1,699). Survival of patients treated with HAART was much higher than that of patients who did not receive this therapy.

**Conclusions:** Infection by *R equi* is an infrequent, opportunistic complication of HIV infection and occurs during advanced stages of immunodepression. In these patients, it leads to a severe illness that usually causes a bacteremic, cavitory pneumonia, although HAART can improve the prognosis.

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**Key words:** AIDS; bacteremia; HIV; pneumonia; *Rhodococcus equi*

**Abbreviations:** CI = confidence interval; HAART = highly active antiretroviral therapy; RR = relative risk

*Rhodococcus equi*, previously known as *Corynebacterium equi*, is a weak, acid-fast, Gram-positive rod. It is currently classified among the

nocardiform actinomycetes.<sup>1</sup> The ability of *R equi* to remain inside macrophages and even destroy them is considered to be the basis for its pathogenicity.<sup>1–3</sup> It produces a necrotizing granulomatous lesion rich in

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macrophages with periodic acid-Schiff-positive granular cytoplasm. Occasionally, a peculiar histopathologic lesion is observed, known as malakoplakia, which is characterized by histiocytes with cytoplasmic inclusions laminated with iron and calcium (Michaelis-Gutmann bodies<sup>2,4-6</sup>). It grows well in ordinary culture media and forms salmon-pink colored colonies.<sup>1,2,6</sup>

*R equi* is a common pathogen of pneumonia in foals and sometimes produces infections in other mammals.<sup>1,2</sup> Although natural exposure to *R equi* is frequent,<sup>7</sup> the first infection by this organism in humans was described in 1967.<sup>8</sup> It mainly affects immunocompromised patients, especially those with HIV infection.<sup>9,10</sup> Although it could be underdiagnosed in the past,<sup>2,11</sup> and despite some reports that have detected an increasing incidence,<sup>9</sup> it is a very uncommon illness, both in general population and in patients with HIV infection. It has been reported only in isolated cases or in short series with revision of cases previously published.<sup>10,12,13</sup> This study reports the clinical characteristics and factors that influenced the prognosis of 67 patients with HIV and diagnosed *R equi* infection.

## MATERIALS AND METHODS

An observational, multicenter study was performed in 29 general hospitals from several regions in Spain. These hospitals comprised a total of 20,250 beds for acute patients and served a population of 9,716,880 inhabitants. All of the patients with HIV and *R equi* infection from the beginning of the AIDS epidemic until September 1998 were included. Information from every patient was collected by a previously designed form. The follow-up of each patient was carried out for as long as possible, and it was finished in December 1998. In those cases diagnosed before the beginning of this study, this information was collected retrospectively.

Isolation, identification, and susceptibility tests of the *R equi* strains were performed in the microbiology laboratory of each hospital. AIDS was diagnosed using the diagnostic criteria in force in Europe at the time of diagnosis of the *R equi* infection.<sup>14-16</sup>

### Definitions

**Outcome of *R equi* Infection:** This was assessed at the end of the follow-up period using three categories: cure, disappearance of the initial lesions and absence of manifestations of infection 1 month after withdrawing antimicrobial treatment; regression, reduction of the initial lesions and/or improvement of symptoms attributable to *R equi* infection during the course of antimicrobial therapy; and progression, increase of the lesions or exacerbation of symptoms attributable to *R equi* infection during the course of treatment, as well as the recurrence of infection after withdrawing treatment.

**Survival:** Survival was evaluated using the following categories: (1) death associated with *R equi* infection (related mortality), when the patient's death occurred due to causes directly attributable to the infection, to complications of the infection or to the therapy used; (2) death not associated with the infection, when

death occurred with evidence of regression or cure of the infection and due to a cause not associated with the infection or its treatment; (3) and alive, when the patient was still alive at the last evaluation after the diagnosis of *R equi* infection.

**Antibiotic Therapy:** Antibiotic therapy was defined as appropriate when at least two active drugs were used against the causal agent and both during a period > 90 days. Treatment was considered as inappropriate in any other case.

**Highly Active Antiretroviral Therapy (HAART):** HAART was defined as the combination of two reverse transcriptase inhibitors with protease inhibitors for a period of > 30 days.

### Statistical Analysis

A descriptive analysis of all the clinical characteristics collected from each patient was performed. Related mortality with *R equi* infection was considered to be the dependent variable for the analysis of the prognosis. The following variables were analyzed to know their possible association with related death: diagnosis of *R equi* infection before 1997, bacteremia, extrapulmonary location of the infection, multilobar pneumonia, previous or concomitant diagnosis of AIDS, CD4+ lymphocytes count, inappropriate antibiotic therapy, surgery, and absence of HAART. A statistically significant association was considered to exist when the p value was < 0.05. First, a univariate analysis was performed by means of the Cox proportional hazards method. Relative risks (RRs) and 95% confidence intervals (CIs) were calculated. Then, all the variables associated with related death in the univariate analysis were included in a multivariate Cox regression model, by means of a forward stepwise method, and contrasted by the likelihood ratio. Survival of patients with and without HAART was analyzed using the Kaplan-Meier method, and its statistical significance was assessed using the log-rank test.

## RESULTS

During the study period, 19,374 new patients received a diagnosis of AIDS in the participant hospitals. Sixty-seven patients with HIV received a diagnosis of *R equi* infection during 9 years (Fig 1). Previous exposure to *R equi* was suspected in 10 patients. Mean  $\pm$  SD age was  $31.7 \pm 5.8$  years (range, 20 to 60 years), and most were male (55 patients, 82%). Risk activities for HIV infection were as follows: IV drug use, 48 patients (71.6%); heterosexual lifestyle, 11 patients (16.4%); bisexual or homosexual lifestyle, 3 patients (4.5%); transfusions, 2 patients (3%); blood derivatives, 1 patient (1.5%); and unknown, 2 patients (3%). Only eight of the patients who used IV drugs were still using IV drugs at the time of diagnosis of *R equi* infection.

The stage of HIV infection at the time of diagnosis of *R equi* infection was A3 in 7 patients (10.4%), B3 in 21 patients (31.3%), C3 in 38 patients (56.7%), and not clear in 1 patient (1.5%). The average CD4+ lymphocyte count was  $35/\mu\text{L}$  (range, 1 to  $183/\mu\text{L}$ ). The most common symptoms attributable to *R equi* infection were fever (91%) and respiratory symptoms: cough (88.1%), expectoration (85.1%), and chest pain (44.8%) [Table 1]. The average duration

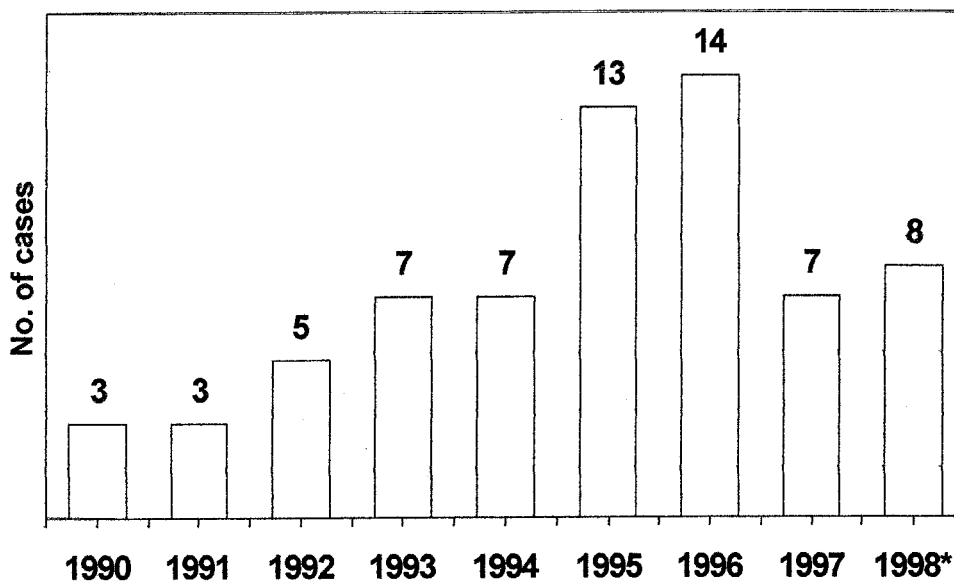


FIGURE 1. Annual distribution of diagnosis of infections caused by *R equi*. \*Cases were included until September 1998.

of symptoms before hospital admission was  $47.7 \pm 48.6$  days (range, 4 to 223 days). Most samples from which *R equi* was isolated were sputum (52.2%), blood cultures (50.7%), and samples from bronchoscopy (31.3%) [Table 2]. Chest radiographic findings were abnormal in 65 patients (97%). Infiltrates were observed in all of them, and cavitations were observed in 45 patients. There was multilobar involvement in 13 patients, pleural effusions in 11 patients, and mediastinal lymphadenopathies in 2 patients. In patients in whom *R equi* infection was located in the lungs, the area involved was the upper right lobe in 20 patients, the middle lobe in 5 patients, the lower right lobe in 19 patients, the upper left lobe in 21 patients, and the lower left lobe

in 18 patients. There was evidence of malakoplakia in tissue samples from five patients.

The mean follow-up period of patients after diagnosis of *R equi* infection was  $10.7 \pm 12.8$  months. Organs affected by *R equi* infection are shown in Table 3. The lung was involved in 95.5% of episodes, and bacteremia was observed in 59.8%.

Table 4 shows the antimicrobial susceptibility of strains that established the diagnosis of *R equi* infection. The most active antibiotics were vancomycin, amikacin, rifampicin, imipenem, ciprofloxacin, and erythromycin.

All but three patients received antibiotics for *R equi* infection. Eleven patients underwent surgery:

**Table 1—Symptoms Attributable to Infection Caused by *R equi***

Symptoms	No. (%)
Fever	61 (91)
Cough	59 (88.1)
Expectoration	57 (85.1)
Chest pain	30 (44.8)
Hemoptysis	21 (31.3)
Dyspnea	20 (29.8)
Asthenia	17 (25.4)
Weight loss	16 (23.9)
Anorexia	12 (17.9)
Diarrhea	4 (6)
Headache	2 (3)
Tumor	2 (3)
Dysarthria	1 (1.5)

**Table 2—Samples in Which *R equi* Was Isolated**

Samples	No. (%)*
Sputum	35 (52.2)
Blood culture	34 (50.7)
Bronchoscopy (total)†	21 (31.3)
Bronchoaspirate	12 (17.9)
BAL	12 (17.9)
Telescopic brush catheter	5 (7.5)
Fine-needle aspiration	12 (17.9)
Pleural liquid	6 (9)
Tissue culture	4 (6)
Stool	2 (3)
Transtracheal puncture	1 (1.5)
Abscess drainage	1 (1.5)

\*The total No. of positive samples is > 67 because in some patients, *R equi* was isolated in several opportunities.

†Expresses the total No. of patients with a sample obtained by bronchoscopy.

**Table 3—Location of *R equi* Infection by Organ**

Affected Organs	No. (%)
Lung	64 (95.5)
Pleura	10 (14.9)
CNS	3 (4.5)
Skin and soft tissue	3 (4.5)
Mediastinum	1 (1.5)
Thyroid	1 (1.5)
Liver	1 (1.5)
Heart	1 (1.5)
Blood*	40 (59.8)

\*No. of patients with isolation of *R equi* in blood culture throughout the follow-up period.

lung resection (n = 4) and drainage techniques (n = 7). Twenty-four patients received HAART (35.8%), 42 patients (62.7%) did not receive HAART, and this information was unknown in 1 patient.

The mean follow-up was 10.7 months. Regarding the outcome of *R equi* infection, 10 patients (14.9%) fulfilled the criteria for cure, and there was regression in 28 patients (41.8%) and progression in 29 patients (42.3%). Furthermore, after this period, 30 patients (44.8%) were still alive, 23 patients (34.3%) died due to causes related to *R equi* infection, and 14 patients (20.9%) died due to causes not related to the infection. Thus, 29 patients (43.3%) died in relation to *R equi* infection or presented evidence of progression.

Table 5 shows the univariate analysis of the variables that were associated with the worst prognosis. These were multilobar involvement, absence of HAART, and inappropriate antimicrobial therapy for

**Table 4—Antimicrobial Susceptibility of Initial Isolates of *R equi*\***

Antibiotics	Sensitives/ Tested, No.	Sensitives, %
Vancomycin	60/60	100
Amikacin	22/22	100
Rifampin	47/48	97.9
Imipenem	41/42	97.6
Ciprofloxacin	47/50	94
Erythromycin	53/58	91.4
Gentamicin	40/47	85.1
Tetracycline	15/22	68.2
Chloramphenicol	12/18	66.7
Cotrimoxazole	17/38	44.7
Cefotaxime	13/32	40.6
Amoxicillin-clavulanate	12/33	36.4
Clindamycin	6/33	18.2
Ampicillin	7/41	17.1
Penicillin	2/40	5

\*Intermediate susceptibility has been interpreted as resistance.

*R equi* infection. However, only the absence of HAART was independently associated with related mortality in the multivariate analysis (RR, 53.4; 95% CI, 1.7 to 1669). Figure 2 shows that the probability of death related to *R equi* infection among the 42 patients who did not receive HAART was much higher than that of the 24 patients who did. In fact, all the deaths for this reason occurred in patients who did not receive HAART.

## DISCUSSION

To our knowledge, this study describes the most extensive series published to date of *R equi* infection in patients with HIV. As this is a retrospective study, the data presented should be interpreted with caution and do not allow conclusions to be drawn on aspects that would require a previous homogeneous definition for all patients (for example, treatment used). However, we believe that this study furnishes information of interest, as it is a multicenter study carried out over a wide geographic area with a large population of patients with HIV infection. During the enrollment period of the 67 patients included in this study, 19,374 new cases of AIDS were diagnosed in the participant hospitals. This shows how uncommon this infection is, as well as the usefulness of a wide collection of cases in order to increase our knowledge about this process.

At the time of diagnosis of *R equi* infection, the average CD4+ lymphocyte count was very low. This fact shows that *R equi* induces disease in patients with HIV infection with advanced immunologic impairment and supports the opinion that *R equi* infection is considered an AIDS-defining event.<sup>17</sup>

The most frequently involved organ was the lung, and this fact is a constant in the human infection. Thus, in two series of *R equi* infection with a total of 36 patients with HIV infection, the lung was involved in 91.7%.<sup>12,13</sup> Furthermore, in a review of cases of patients without HIV infection, there was respiratory involvement in 27 of the 54 cases reported.<sup>10</sup> This justifies the fact that the clinical expression of the disease is mainly respiratory. In the present series, the lobes were involved with a similar frequency. Imaging techniques revealed pulmonary cavitations in two thirds of cases. In a series of 78 patients with HIV infection with pulmonary cavitations evaluated over a 7-year period, *R equi* was the causal agent in 7.7% of cases.<sup>18</sup> Therefore, *R equi* should form part of the differential diagnosis of cavitory pneumonia in patients with HIV infection.<sup>19</sup>

As has already been pointed out,<sup>12,13</sup> blood and sputum cultures were the samples with the best yield for the diagnosis of this infection. The pattern of

**Table 5—Univariate Analysis of the Variables Associated With Mortality Related to *R equi* Infection**

Variables	Death/Episodes, No. (%)	RR (95% CI)	p Value
Diagnosis before 1997	22/52 (42.3)	3.4 (0.4–25.5)	0.24
Bacteremia	18/40 (45)	2.3 (0.8–6.1)	0.1
Extrapulmonary disease	19/42 (45.2)	2.4 (0.8–7.2)	0.1
Multilobar pneumonia	7/12 (58.3)	3.1 (1.2–7.9)	0.02
Absence of HAART	23/42 (54.8)	53.4 (1.7–1,669)	0.02
AIDS	15/38 (39.5)	1.8 (0.7–4.2)	0.19
Surgery	5/11 (45.4)	1 (0.3–2.8)	0.95
Inappropriate antibiotic therapy	14/39 (35.9)	2.6 (1–6)	0.03
CD4+ lymphocyte count*		0.99 (0.98–1.003)	0.13

\*Risk reduction of related mortality for each CD4+ lymphocyte per microliter.

antimicrobial susceptibility of the isolated strains is similar to that described in other studies,<sup>13,20</sup> although this can vary in specific geographic areas<sup>21</sup> or in isolations with previous antibiotic therapy.<sup>22,23</sup>

Infection caused by *R equi* was a severe illness given that, after the follow-up period, more than one third of the patients died due to causes attributable to the infection and in a further 9% there were evidences of progression of the infection despite the prescribed treatment. When variables that influenced the prognosis of the patients were evaluated, only the absence of HAART was associated with *R equi*-related mortality. Moreover, no patients receiving HAART died in relation to the infection caused by *R equi*. It has been pointed out that the infection caused by *R equi* has a worse prognosis in patients with HIV than in patients without HIV,<sup>24</sup> and that they need a lifetime of antimicrobial therapy.<sup>2,24</sup> However, a great change happened since HAART was introduced as standard therapy for HIV infection: there was a decrease in the incidence of

opportunistic infections,<sup>25</sup> its prognosis improved,<sup>26,27</sup> and secondary chemoprophylaxis could be suspended with no recurrences.<sup>28,29</sup> It is likely that HAART can allow us to withdraw the antibiotic therapy at some time in patients with HIV and *R equi* infections, as well as to reduce the incidence of this opportunistic infection and, as could be observed in this study, to improve its prognosis. In fact, the outcome of patients included in this study was more favorable than that observed in other series with similar patients but which were carried out before HAART was available in clinical practice.<sup>12,13</sup>

The peculiar pathogenicity of *R equi* infection determines the treatment of this process. Due to the high frequency of bacteremia and high bacterial loads, it may be appropriate to indicate a combination of IV antibiotics with bactericidal effect such as imipenem plus vancomycin or imipenem plus teicoplanin.<sup>30,31</sup> Lipophilic antibiotics with good intracellular penetration must then be administered, and combinations based on macrolides and rifampin have proven to be optimal.<sup>1,2,13</sup> Azithromycin seems to be an appropriate drug for the treatment of this infection in combination with others, as reaches high levels in tissues.<sup>32</sup>

Appropriate antibiotic treatment did not influence outcomes in this study. This could be explained as the drugs that the patients received were very different from each other. This important issue could only be clarified by means of prospective studies, where homogeneous regimens are previously established. Drainage of abscesses must be carried out when possible; however, we think that resection surgery should be limited to selected patients who do not respond to medical treatment.

In summary, *R equi* infection is an uncommon opportunistic complication of HIV infection that occurs in advanced stages of immunodepression. It usually appears as a subacute pneumonia that is usually cavitary and bacteremic. Although the most effective antimicrobial therapy is unknown, taking

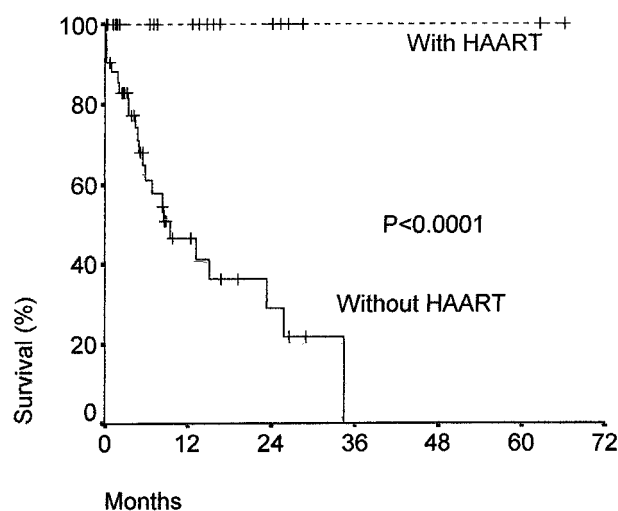


FIGURE 2. Cumulative survival curves of the 24 patients with *R equi* infection who received HAART and the 42 patients who did not.

into account the pathogenic and biological features of this organism, antimicrobial therapy should be based on a combination of drugs with a good intracellular penetration, and administered over a long period. Infection by *R equi* in patients with HIV is a severe illness although, as this study shows, HAART can improve its prognosis.

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## APPENDIX

Other members of Grupo Andaluz para el estudio de las Enfermedades Infecciosas and/or Grupo de estudio de SIDA of the Sociedad Española de Enfermedades Infecciosas y Microbiología Clínica who participated in the study were Koldo Aguirrebengoa, MD, hospital de Cruces, Baracaldo; Antonio Bascuñana, MD, hospital Puerta del Mar, Cádiz; Félix Gutiérrez, MD, hospital General, Elche; Manuel Javaloyas, MD, hospital Sant Llorenç, Viladecans; Fernando Lozano, MD, hospital de Valme, Sevilla; Patricia Muñoz, MD, hospital Gregorio Marañón, Madrid; Antonio Payerás, MD, Complex Hospitalari, Palma de Mallorca; Jesús Rodríguez-Baños, MD, hospital Virgen de la Macarena, Sevilla; Jesús Santos, MD, hospital Virgen de la Victoria, Málaga; Josu Baraia, MD, hospital de Basurto, Bilbao; Marino Blanes, MD, hospital La Fe, Valencia; Mercedes González-Serrano, MD, hospital del Servicio Andaluz de Salud, La Línea de la Concepción; Pablo Labarga, MD, hospital San Millán, Logroño; Jaime Locutura, MD, hospital General Yagüe, Burgos; Rafael Luque, MD, hospital de Motril; Juan Pascual, MD, hospital Virgen de la Nieves, Granada; Ignacio Suárez, MD, hospital Infanta Elena, Huelva; Mauricio Telenti, MD, hospital General de Asturias, Oviedo; and Antonio Vergara, MD, hospital de Puerto Real; Spain.

## REFERENCES

- 1 Prescott JF. *Rhodococcus equi*: an animal and human pathogen. Clin Microbiol Rev 1991; 4:20–34
- 2 Verville TD, Huycke MM, Greenfield RA, et al. *Rhodococcus equi* infections of humans: 12 cases and a review of the literature. Medicine (Baltimore) 1994; 73:119–132
- 3 Hondalus MK, Mosser DM. Survival and replication of *Rhodococcus equi* in macrophages. Infect Immun 1994; 62:4167–4175
- 4 Kwon KY, Colby TV. *Rhodococcus equi* pneumonia and pulmonary malakoplakia in acquired immunodeficiency syndrome: pathologic features. Arch Pathol Lab Med 1994; 118:744–748
- 5 Guerrero MF, Ramos JM, Renedo G, et al. Pulmonary malakoplakia associated with *Rhodococcus equi* infection in patients with AIDS: case report and review. Clin Infect Dis 1999; 28:1334–1336
- 6 Scott MA, Graham BS, Verrall R, et al. *Rhodococcus equi*: an increasingly recognized opportunistic pathogen; report of 12 cases and review of 65 cases in the literature. Am J Clin Pathol 1995; 103:649–655
- 7 Vullo V, Mastroianni CM, Lichtner M, et al. Serologic responses to *Rhodococcus equi* in individuals with and with-

- out human immunodeficiency virus infection. Eur J Clin Microbiol Infect Dis 1996; 15:588–594
- 8 Golub B, Falk G, Spink WW. Lung abscess due to *Corynebacterium equi*: report of first human infection. Ann Intern Med 1967; 66:1174–1177
- 9 Linder R. *Rhodococcus equi* and *Arcanobacterium haemolyticum*: two “coryneform” bacteria increasingly recognized as agents of human infection. Emerg Infect Dis 1997; 3:145–153
- 10 Farina C, Ferruzzi S, Mamprin F, et al. *Rhodococcus equi* infection in non-HIV-infected patients: two case reports and review. Clin Microbiol Infect 1997; 3:12–18
- 11 Doig C, Gill MJ, Church DL. *Rhodococcus equi*: an easily missed opportunistic pathogen. Scand J Infect Dis 1991; 23:1–6
- 12 Donisi A, Suardi MG, Casari S, et al. *Rhodococcus equi* infection in HIV-infected patients. AIDS 1996; 10:359–362
- 13 Arlotti M, Zoboli G, Moscatelli GL, et al. *Rhodococcus equi* infection in HIV-positive subjects: a retrospective analysis of 24 cases. Scand J Infect Dis 1996; 28:463–467
- 14 Centers for Disease Control. Revision of the CDC surveillance case definition of acquired immunodeficiency syndrome. MMWR Morb Mortal Wkly Rep 1987; 36(suppl 1):3s–15s
- 15 European Centre for the Epidemiological Monitoring of AIDS. 1993 revision of the European AIDS surveillance case definition. AIDS Surveillance in Europe Quarterly Report 1993; 37:23–28
- 16 Ancelle-Park R. Expanded European AIDS case definition [letter]. Lancet 1993; 341:441
- 17 Albrecht H. Redefining AIDS: towards a modification of the current AIDS case definition. Clin Infect Dis 1997; 24:64–74
- 18 Rodríguez-Arrondo F, von-Wichmann MA, Arrizabalaga J, et al. Lesiones pulmonares cavitadas en los pacientes infectados por el virus de la inmunodeficiencia humana: análisis de una serie de 78 casos. Med Clin (Barc) 1998; 111:725–730
- 19 Gallant JE, Ko AH. Cavitory pulmonary lesions in patients infected with human immunodeficiency virus. Clin Infect Dis 1996; 22:671–682
- 20 McNeil MM, Brown JM. Distribution and antimicrobial susceptibility of *Rhodococcus equi* from clinical specimens. Eur J Epidemiol 1992; 8:437–443
- 21 Hsueh PR, Hung CC, Teng LJ, et al. Report of invasive *Rhodococcus equi* infections in Taiwan, with an emphasis on the emergence of multidrug-resistant strains. Clin Infect Dis 1998; 27:370–375
- 22 Nordmann P, Chavanet P, Caillon J, et al. Recurrent pneumonia due to rifampicin-resistant *Rhodococcus equi* in a patient infected with HIV. J Infect 1992; 24:104–107
- 23 Van Etta LL, Filice GA, Ferguson RM, et al. *Corynebacterium equi*: a review of 12 cases of human infection. Rev Infect Dis 1983; 5:1012–1018
- 24 Harvey RL, Sunstrum JC. *Rhodococcus equi* infection in patients with and without human immunodeficiency virus infection. Rev Infect Dis 1991; 13:139–145
- 25 Palella FJ Jr, Delaney KM, Moorman AC. Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. N Engl J Med 1998; 338:853–860
- 26 Sepkowitz KA. Effect of HAART on natural history of AIDS-related opportunistic disorders. Lancet 1998; 351:228–230
- 27 Carr A, Marriott D, Field A, et al. Treatment of HIV-1-associated microsporidiosis and cryptosporidiosis with combination antiretroviral therapy. Lancet 1998; 351:256–261

- 28 López Bernaldo de Quiros JC, Miro JM, Peña JM, et al. A randomized trial of the discontinuation of primary and secondary prophylaxis against *Pneumocystis carinii* pneumonia after highly active antiretroviral therapy in patients with HIV infection. *N Engl J Med* 2001; 344:159–167
- 29 Ledergerber B, Mocroft A, Reiss P, et al. Discontinuation of secondary prophylaxis against *Pneumocystis carinii* pneumonia in patients with HIV infection who have a response to antiretroviral therapy. *N Engl J Med* 2001; 344:168–174
- 30 Rouquet RM, Clave D, Massip P, et al. Imipenem/vancomycin for *Rhodococcus equi* pulmonary infection in HIV-positive patient [letter]. *Lancet* 1991; 337:375
- 31 Chavanet P, Bonnotte B, Caillot D, et al. Imipenem/teicoplanin for *Rhodococcus equi* pulmonary infection in AIDS patients. *Lancet* 1991; 337:794–795
- 32 Reese RE, Betts RF. Antibiotic use: M. Erythromycin, azithromycin, clarithromycin and dirithromycin. In: Reese RE, Betts RF. *A practical approach to infectious diseases*. 4th ed. Boston, MA: Little, Brown and Company, 1996; 1288–1310



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2. Registered users...if prompted, enter your user name and password to proceed to the search screen. *New users*...Click the link that reads, "New Users sign-up here!" Follow the directions to register as a user. When done, you will see the search screen.
3. Search for your name in the database. If you need help with your search, click the "help" link.
4. Locate your entry, and review the information. If corrections or additions need to be made, click the link, "Contact ACCP to update entry," to send your revisions to ACCP via e-mail. Please make sure that we have an e-mail address listed for you.
5. Should you need to speak to someone, contact ACCP Member Services to update your listing: 800-343-2227 or 847-498-1400.