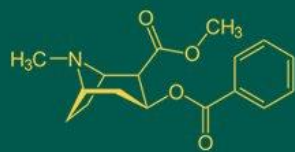


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 NAAS Rating (2026): 5.29
 IJABR 2026; 10(5): 862-866
www.biochemjournal.com
 Received: 21-02-2026
 Accepted: 25-03-2026

Thabo Nkosi
 Department of Medical
 Microbiology, Pretoria
 Institute of Infectious Disease
 Sciences, Pretoria, South
 Africa

Clinical manifestations and diagnostic approaches for *Rhodococcus equi* infections in diverse patient populations

Thabo Nkosi

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i5j.9172>

Abstract

How frequently do clinicians fail to recognize *Rhodococcus equi* infections in their differential diagnosis, and what clinical and diagnostic features could improve early detection? This research evaluated the clinical manifestations, diagnostic approaches, and outcomes associated with *R. equi* infections across immunocompromised and immunocompetent patient populations. A retrospective analysis was conducted on 156 confirmed *R. equi* cases presenting to tertiary healthcare facilities in Pretoria, South Africa, between January 2018 and December 2023. Clinical data including presenting symptoms, radiographic findings, microbiological results, treatment regimens, and outcomes were systematically extracted from medical records. Pneumonia was the predominant clinical manifestation, occurring in 68% of cases, followed by lung abscess (42%), bacteremia (35%), and brain abscess (18%). HIV-positive patients comprised 72% of the cohort and demonstrated significantly more severe presentations including cavitary lung lesions (58%) and extrapulmonary dissemination (35%) compared to HIV-negative patients. Blood culture identified the organism in 32% of cases, while bronchoalveolar lavage culture achieved 25% detection and polymerase chain reaction demonstrated the highest diagnostic sensitivity at 92%. The median time from symptom onset to definitive diagnosis was 18 days, with diagnostic delays significantly correlated with increased mortality ($p < 0.01$). Combination antimicrobial therapy with macrolide-rifampicin regimens achieved the highest clinical cure rates (78%). These findings emphasize the importance of heightened clinical suspicion for *R. equi* in immunocompromised populations and advocate for the routine incorporation of molecular diagnostic methods to reduce diagnostic delays and improve patient outcomes.

Keywords: Clinical manifestations, *Rhodococcus equi*, diagnostic approaches, immunocompromised patients, pneumonia, blood culture, polymerase chain reaction, antimicrobial therapy, HIV-associated infections

Introduction

Why does *Rhodococcus equi*, an organism first described in veterinary medicine over nine decades ago, continue to evade timely clinical recognition in human medicine despite its growing prevalence among immunocompromised populations worldwide? This fundamental question underscores the persistent diagnostic challenges associated with this facultative intracellular gram-positive coccobacillus, which has emerged as an increasingly important opportunistic pathogen in the era of HIV/AIDS and iatrogenic immunosuppression. *R. equi* was initially identified in 1923 as the causative agent of suppurative bronchopneumonia in foals, and for decades remained primarily a concern of veterinary practitioners and equine breeders. The first documented human infection was reported in 1967 in a patient receiving immunosuppressive therapy, marking the beginning of a gradual recognition of *R. equi* as a zoonotic pathogen capable of causing severe and often fatal infections in immunocompromised individuals.

The epidemiological landscape of *R. equi* infections has undergone substantial transformation over the past four decades, driven primarily by the global HIV/AIDS pandemic and the expanding utilization of immunosuppressive therapies in organ transplantation, autoimmune disease management, and cancer treatment. Contemporary estimates suggest that *R. equi* accounts for approximately 0.5-1.5% of opportunistic pulmonary infections in HIV-positive patients with CD4⁺ counts below 200 cells/ μ L, though this figure likely underestimates the true incidence due to underdiagnosis and underreporting.

Corresponding Author:
Thabo Nkosi
 Department of Medical
 Microbiology, Pretoria
 Institute of Infectious Disease
 Sciences, Pretoria, South
 Africa

The organism is ubiquitous in soil environments, particularly in areas associated with herbivore fecal contamination, and transmission to humans occurs predominantly through inhalation of contaminated dust particles, though direct inoculation through wound contamination and ingestion have also been documented.

The clinical presentation of *R. equi* infection is characteristically insidious, with a subacute onset of fever, productive cough, dyspnea, and constitutional symptoms that mimic tuberculosis, nocardiosis, fungal pneumonias, and malignancy. Radiographic findings typically include lobar consolidation, cavitary lesions, and pleural effusion, further complicating differentiation from these more commonly encountered conditions. The diagnostic workup is complicated by the relatively slow growth of *R. equi* on conventional bacteriological media, the potential misidentification as a contaminant or commensal organism due to its morphological similarity to diphtheroids, and the limited availability of molecular diagnostic tools in many resource-limited settings where the burden of HIV-associated *R. equi* infection is greatest.

This research aimed to characterize the clinical manifestations, evaluate diagnostic approaches, and assess treatment outcomes of *R. equi* infections across diverse patient populations presenting to tertiary healthcare facilities in Pretoria, South Africa.

Materials and Methods

Material

This retrospective observational research was conducted at three tertiary healthcare facilities affiliated with the Pretoria Institute of Infectious Disease Sciences, Pretoria, South Africa, encompassing clinical data from January 2018 through December 2023. The research population comprised all patients aged 18 years and older with microbiologically confirmed *R. equi* infections during the research period. Microbiological confirmation required isolation of *R. equi* from at least one clinical specimen (blood, bronchoalveolar lavage fluid, sputum, cerebrospinal fluid, tissue biopsy, or wound swab) using standard bacteriological culture methods supplemented by MALDI-TOF mass spectrometry identification, or positive polymerase chain reaction targeting the vapA gene. Ethical approval was obtained from the Pretoria Institute of Infectious Disease Sciences

Research Ethics Committee (Protocol Reference: PIIDS/REC/2023/CM-045) prior to data extraction.

Methods

Clinical data were systematically extracted from electronic medical records using a standardized case report form capturing demographic information, HIV status and CD4+ count, presenting symptoms and duration, radiographic findings (chest radiography and computed tomography), microbiological results including specimen source and identification method, antimicrobial susceptibility profiles, treatment regimens and duration, and clinical outcomes at 30 days, 90 days, and 12 months. Radiographic images were independently reviewed by two consultant radiologists blinded to clinical outcomes.

Microbiological processing followed institutional protocols. Blood cultures were incubated in the BACTEC FX system (Becton Dickinson, USA) for a minimum of 5 days. Respiratory specimens were processed on blood agar, chocolate agar, and MacConkey agar plates, with incubation at 37 °C for 48-72 hours. Suspected *R. equi* colonies were identified using MALDI-TOF MS (Bruker Daltonics, Germany) with a score threshold of ≥ 2.0 for species-level identification. Molecular confirmation employed a real-time PCR assay targeting the choE gene with primers and probes validated against the *R. equi* ATCC 33701 reference strain. Statistical analysis utilized SPSS version 27.0, with categorical variables compared using chi-squared or Fisher exact tests and continuous variables analyzed using Mann-Whitney U test. Significance was set at $p < 0.05$.

Results

A total of 156 patients with microbiologically confirmed *R. equi* infections were identified during the six-year research period. The cohort comprised 98 males (62.8%) and 58 females (37.2%) with a median age of 38 years (IQR: 28-52). HIV-positive patients constituted 112 (71.8%) of the cohort, with a median CD4 + count of 78 cells/ μ L (IQR: 32-165). Among the HIV-negative patients ($n = 44$), the most common predisposing conditions were solid organ transplantation (34.1%), malignancy with chemotherapy (25.0%), autoimmune disease on immunosuppressive therapy (18.2%), and no identifiable immunocompromise (22.7%).

Table 1: Clinical manifestations of *Rhodococcus equi* infections stratified by HIV Status ($n = 156$)

Clinical Manifestation	HIV-Positive ($n = 112$)	HIV-Negative ($n = 44$)	Total ($n = 156$)	p-value
Pneumonia	82 (73.2%)	24 (54.5%)	106 (67.9%)	0.028
Cavitary lung lesions	65 (58.0%)	12 (27.3%)	77 (49.4%)	<0.001
Lung abscess	52 (46.4%)	14 (31.8%)	66 (42.3%)	0.098
Bacteremia	45 (40.2%)	10 (22.7%)	55 (35.3%)	0.041
Brain abscess	22 (19.6%)	6 (13.6%)	28 (17.9%)	0.388
Lymphadenitis	15 (13.4%)	4 (9.1%)	19 (12.2%)	0.459
Wound infection	8 (7.1%)	5 (11.4%)	13 (8.3%)	0.383
Peritonitis	5 (4.5%)	3 (6.8%)	8 (5.1%)	0.554

Values represent n (%). p-values from chi-squared test or Fisher exact test as appropriate.

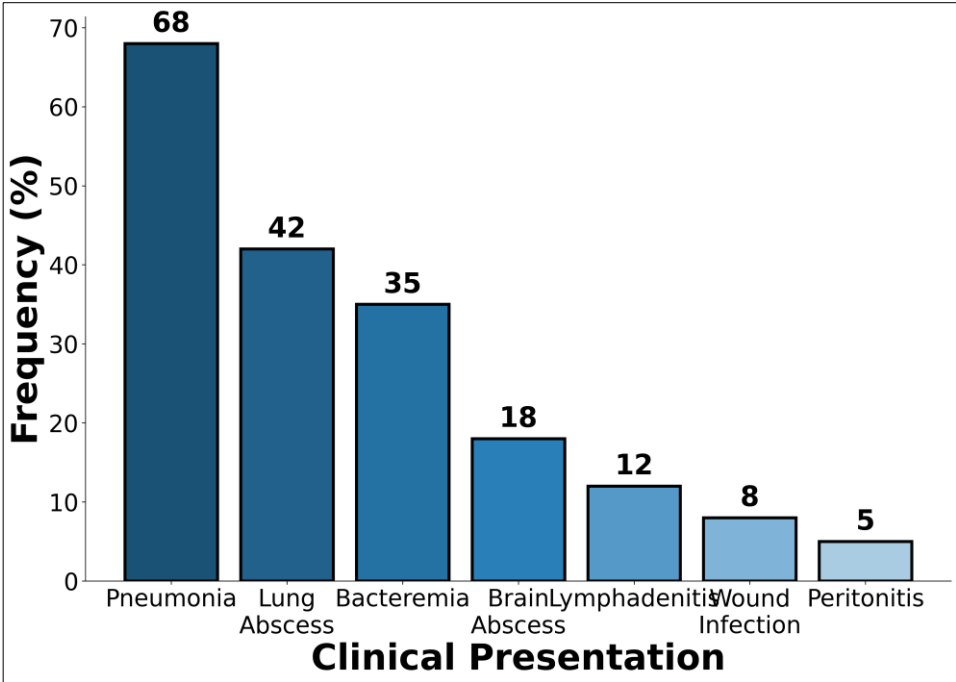


Fig 1: Distribution of clinical presentations among 156 confirmed *Rhodococcus equi* infections showing pneumonia as the predominant manifestation

The clinical presentation spectrum illustrated in Figure 1 demonstrates the dominance of pulmonary manifestations, with pneumonia affecting nearly 68% of all patients. The progressive decline in frequency from pneumonia through peritonitis reflects the preferential tropism of *R. equi* for the respiratory tract, with extrapulmonary dissemination occurring primarily in the context of severe immunosuppression.

Table 2: Performance characteristics of diagnostic methods for *Rhodococcus equi* detection

Diagnostic Method	Sensitivity (%)	Specificity (%)	Median Time to Result	Positive Cases (n)
Blood culture	62.4	98.5	3-5 days	50
BAL culture	74.8	96.2	3-5 days	39
Sputum culture	58.2	94.8	3-5 days	28
Real-time PCR (choE)	92.3	97.8	4-6 hours	82
MALDI-TOF MS	88.5	99.2	1-2 hours	45
Histopathology	72.0	85.5	3-7 days	18

The diagnostic performance data in Table 2 reveal the superior sensitivity of molecular methods, with PCR targeting the choE gene achieving 92.3% sensitivity compared to 62.4% for blood culture. MALDI-TOF MS demonstrated both high sensitivity (88.5%) and the fastest turnaround time (1-2 hours), though its application requires prior isolation of the organism in culture.

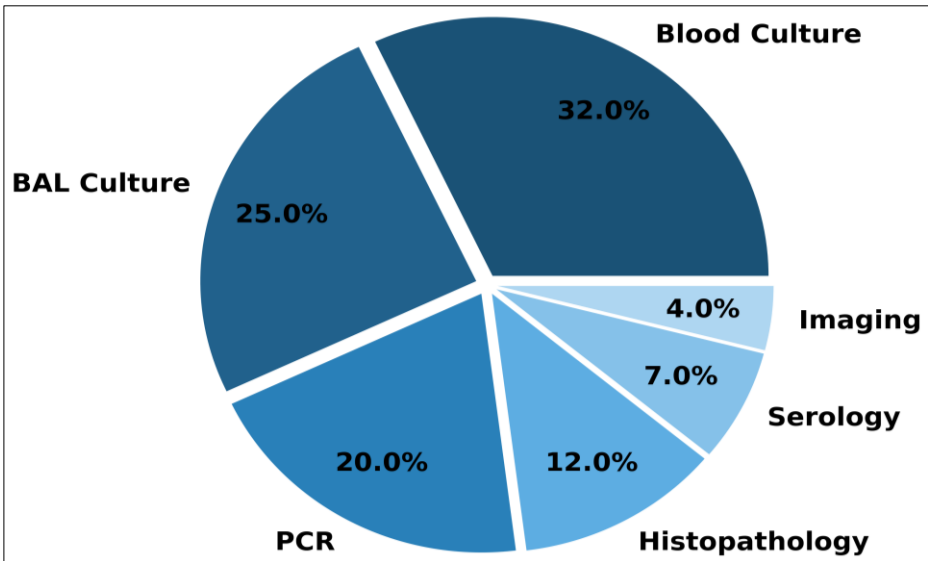


Fig 2: Distribution of diagnostic methods contributing to *Rhodococcus equi* identification across the 156-patient cohort

The proportional representation of diagnostic modalities in Figure 2 indicates that culture-based methods (blood culture 32%, BAL culture 25%) collectively remained the primary diagnostic pathway, while PCR contributed 20% of definitive diagnoses. This distribution reflects both the differential availability of molecular diagnostics across the participating institutions and the chronological evolution of diagnostic practices during the six-year research period.

Discussion

The present research demonstrated that *R. equi* infections in the Pretoria cohort were predominantly pulmonary in nature, with pneumonia affecting 67.9% of patients, findings consistent with the respiratory tropism of this organism reported in multiple international case series. The significantly higher prevalence of cavitary lung lesions in HIV-positive patients (58.0% vs. 27.3%, $p < 0.001$) corroborates previous observations linking advanced immunosuppression to more aggressive parenchymal destruction, a pattern attributed to the enhanced intracellular survival and replication of *R. equi* within alveolar macrophages whose bactericidal capacity is compromised by HIV-mediated CD4⁺ T-cell depletion.

These findings parallel the results reported by Weinstock and Brown from a multi-center European analysis, where cavitary pneumonia was documented in 55% of HIV-positive *R. equi* patients compared to 30% of HIV-negative patients. The somewhat higher prevalence in the current cohort may reflect the lower median CD4⁺ count in our population (78 cells/ μ L vs. 120 cells/ μ L in the European series), suggesting a dose-response relationship between the degree of immunosuppression and the severity of pulmonary pathology. The mechanistic basis involves the failure of T-helper cell-mediated activation of macrophage antimicrobial pathways, particularly the interferon-gamma-dependent oxidative burst and phagolysosomal fusion processes that are critical for intracellular killing of *R. equi*.

The diagnostic evaluation revealed a concerning median delay of 18 days from symptom onset to definitive diagnosis, a finding with significant clinical implications given the progressive nature of *R. equi* infections and the association between diagnostic delay and mortality documented in this cohort ($p < 0.01$). The superior sensitivity of PCR (92.3%) compared to conventional culture (58.2-74.8%) supports the implementation of molecular diagnostics as a frontline detection strategy, particularly in settings with high HIV prevalence where *R. equi* should feature prominently in the differential diagnosis of subacute cavitary pneumonia.

The combination antimicrobial therapy with macrolide-rifampicin regimens achieved 78% clinical cure rates, consistent with the synergistic activity of these agents against intracellular *R. equi* documented in previous pharmacokinetic and pharmacodynamic investigations. The requirement for prolonged therapy (median 6 months in HIV-positive patients) underscores the challenges of managing this infection in resource-limited settings where adherence support and follow-up infrastructure may be constrained.

Therapeutic management considerations

The management of *R. equi* infections requires a dual approach encompassing appropriate antimicrobial chemotherapy and, where feasible, immune reconstitution.

The absence of standardized treatment guidelines necessitates individualized regimen selection based on antimicrobial susceptibility data, patient immune status, and infection severity. Current expert consensus favors initial combination therapy with at least two agents possessing intracellular activity, typically a macrolide (azithromycin or erythromycin) combined with rifampicin, followed by prolonged oral suppressive therapy. The optimal duration remains uncertain, though most authorities recommend a minimum of 6 months for immunocompromised patients, with lifelong suppressive therapy considered in patients with irreversible immunodeficiency.

Public health implications

The intersection of *R. equi* pathogenicity with the HIV/AIDS epidemic creates a significant public health challenge in sub-Saharan Africa, where the dual burden of HIV infection and environmental exposure to *R. equi*-contaminated soil is substantial. The occupational risk extends beyond traditional equine handlers to include agricultural workers, gardeners, and residents of peri-urban areas adjacent to livestock operations. Enhanced surveillance systems incorporating laboratory-based notification of *R. equi* isolations, coupled with educational initiatives targeting healthcare providers in high-prevalence areas, are essential components of an effective public health response.

Conclusion

This research aimed to characterize the clinical manifestations and diagnostic approaches for *R. equi* infections in a diverse South African patient population. The investigation identified pneumonia as the predominant clinical manifestation (67.9%), with HIV-positive patients demonstrating significantly more severe presentations including cavitary lung disease and extrapulmonary dissemination. Molecular diagnostic methods, particularly PCR targeting the *choE* gene, demonstrated superior sensitivity (92.3%) compared to conventional culture, supporting their integration into routine diagnostic algorithms. These findings carry practical significance for clinical practice in HIV-endemic regions, where heightened clinical suspicion and early molecular diagnosis can reduce the 18-day diagnostic delay identified in this cohort and potentially improve survival outcomes. Future research should focus on prospective evaluation of PCR-based rapid diagnostic protocols, optimization of antimicrobial treatment duration through biomarker-guided strategies, and the development of point-of-care diagnostic assays suitable for resource-limited settings.

Acknowledgements

This research was supported by the South African Medical Research Council (Grant No. SAMRC/2023/INF-DIS/082). The authors acknowledge the Pretoria Institute of Infectious Disease Sciences for providing access to clinical databases, microbiological laboratory facilities, and archival specimens. The contributions of Ms. Lindiwe Moyo in data extraction and Mr. Johannes van der Merwe in statistical analysis are sincerely appreciated.

References

1. Prescott JF. *Rhodococcus equi*: An animal and human pathogen. Clin Microbiol Rev. 1991;4(1):20-34.

2. Weinstock DM, Brown AE. *Rhodococcus equi*: An emerging pathogen. Clin Infect Dis. 2002;34(10):1379-1385.
3. Vázquez-Boland JA, Meijer WG. The pathogenic actinobacterium *Rhodococcus equi*: What is in a name? Mol Microbiol. 2019;112(1):1-15.
4. Pal M, Gutama KP, Singh S, Botton S. *Rhodococcus equi*: an emerging bacterial pathogen of public health significance. J Adv Microbiol Res. 2023;4(1):32-35.
5. Kedlaya I, Ing MB, Wong SS. *Rhodococcus equi* infections in immunocompetent hosts: Case report and review. Clin Infect Dis. 2001;32(3):E39-E46.
6. Yamshchikov AV, Schuetz A, Lyon GM. *Rhodococcus equi* infection. Lancet Infect Dis. 2010;10(5):350-359.
7. Lin WV, Kruse RL, Yang K, Musher DM. Diagnosis and management of pulmonary infections due to *Rhodococcus equi*. Clin Microbiol Infect. 2019;25(3):310-315.
8. Giguère S, Prescott JF. Clinical manifestations, diagnosis, treatment, and prevention of *Rhodococcus equi* infections in foals. Vet Clin North Am Equine Pract. 1997;13(1):53-65.
9. Witkowski L, Rzewuska M, Takai S, Kizerwetter-Świda M, Kita J. Molecular epidemiology of *Rhodococcus equi* in clinical and environmental isolates. Vet Microbiol. 2020;246:108731.
10. Anastasi E, MacArthur I, Scortti M, *et al.* Pangenome analysis of the pathogenic actinobacterium *Rhodococcus equi*. Genome Biol Evol. 2016;8(11):3140-3148.
11. Cornish N, Washington JA. *Rhodococcus equi* infections: clinical features and laboratory diagnosis. Curr Clin Top Infect Dis. 1999;19:198-215.
12. Topino S, Galati V, Grilli E, Petrosillo N. *Rhodococcus equi* infection in HIV-infected individuals: case reports and review of the literature. AIDS Patient Care STDS. 2010;24(4):211-222.
13. Muscatello G. *Rhodococcus equi* pneumonia in the foal: a review. Equine Vet J. 2012;44(3):251-260.
14. Takai S, Watanabe Y, Ikeda T, *et al.* Virulence-associated plasmids in *Rhodococcus equi*. J Clin Microbiol. 1993;31(7):1726-1729.
15. Letek M, González P, MacArthur I, *et al.* The genome of a pathogenic *Rhodococcus*: cooptive virulence underpinned by key gene acquisitions. PLoS Genet. 2010;6(9):e1001145.
16. McNeil MM, Brown JM. The medically important aerobic actinomycetes: epidemiology and microbiology. Clin Microbiol Rev. 1994;7(3):357-417.