

Histoplasmosis Epidemiological, Clinical and Diagnostic Perspectives in Vietnam: Case Report

Nguyen Tat Thanh^{1*} and Le Duc Vinh²

¹Department of Infectious Diseases, Mai Khoi Clinic, Vietnam

²Department of Parasitology, Pham Ngoc Thach University of Medicine, Ho Chi Minh City (700000), Vietnam

*Corresponding author: Nguyen Tat Thanh, Department of Infectious Diseases, Mai Khoi Clinic, Ho Chi Minh City (700000), Vietnam

ARTICLE INFO

Received: 📅 May 05, 2025

Published: 📅 May 09, 2025

Citation: Nguyen Tat Thanh and Le Duc Vinh. Histoplasmosis Epidemiological, Clinical and Diagnostic Perspectives in Vietnam: Case Report. Biomed J Sci & Tech Res 61(5)-2025. BJSTR. MS.ID.009657.

ABSTRACT

Histoplasmosis, a systemic mycosis caused by *Histoplasma capsulatum*, poses a fatal threat in endemic regions, yet remains rare in Vietnam and other regions in Asia due to ecological preferences for other fungi such as *Talaromyces marneffe*. This study aimed to characterize the epidemiological, clinical, and diagnostic aspects of histoplasmosis in Vietnam, compared with talaromycosis. Histoplasmosis presents a varied clinical spectrum that affects multiple organ systems ranging from mild to fatal cases. The clinical, laboratory, and radiologic similarities between histoplasmosis and talaromycosis complicate the clinical diagnosis. Distinct features in microscopy and culture can aid fungal differentiation. This study highlights the diagnostic challenges of histoplasmosis, advocating for the integration of epidemiological, clinical and laboratory data, suggesting advanced diagnostic methods using fungal antigen-based and molecular tests.

Keywords: Histoplasmosis; *Histoplasma Capsulatum*; Talaromycosis; *Talaromyces Marneffe*; Vietnam

Abbreviations: ART: Antiretroviral Therapy; TB: Tuberculosis; PCR: Polymerase Chain Reaction; PCP: Pneumocystis Pneumonia; AFB: Acid-Fast Bacilli; OD: Optical Density; ESBL: Extended-Spectrum Beta-Lactamase; BAL: Bronchoalveolar lavage; AST: Aspartate Aminotransferase; ALT: Aminotransferase

Introduction

Histoplasmosis is a systemic mycosis caused by the dimorphic fungus, *Histoplasma capsulatum*. Although it is highly endemic in North, Central, and Latin America, the fungus can also be found in globally diverse regions such as Central Africa, East Asia, and Europe [1,2]. This disease primarily affects immunocompromised individuals, especially those with advanced HIV infection, typically when the CD4+ T cell count falls below 100 cells/ μ L [3]. Exposures to contaminated soil, bird droppings, and bat guano in caves or old buildings within endemic areas are significant risk factors for contracting histoplasmosis. However, the epidemiology of *Histoplasma capsulatum* in non-endemic regions remains poorly understood [4-6]. The prevalence of disseminated histoplasmosis among HIV/AIDS patients in endemic areas ranges from 4.4% to 10.3% [7,8]. Histoplasmosis presents with a diverse spectrum of symptoms, ranging from acute and fatal presentations with pulmonary infiltrates and central nervous system involvement, to subacute contexts featuring manifestations of

reticuloendothelial system invasion [9]. The mortality rates of histoplasmosis varies significantly, from 10% to 50%, as reported in various case series [1,9-11]. Notably, histoplasmosis can be misdiagnosed with other invasive mycoses, such as talaromycosis, highly endemic in Southeast Asia and southern China, which can mimic the clinical presentations of *Histoplasma capsulatum* infection [12,13].

Additionally, tuberculosis is another important differential diagnosis [14]. Conventional diagnostic methods for histoplasmosis include routine peripheral blood smears, skin and blood cultures. Additionally, immunoassays and polymerase chain reaction (PCR) methods for *Histoplasma capsulatum*, have variable sensitivity and false-positive rates due to cross-reactivity with other systemic fungal infections [15,16]. Given the unavailability of specific *H. capsulatum* antigen-based enzyme immunoassays in most Asian regions, the serum Mp1p antigen detection enzyme immunoassay and PCR tests for *Talaromyces marneffe* may be employed to distinguish between these fungal infections [17]. This study describes the various clinical

manifestations and disease complications in adult patients with histoplasmosis, aiming to contribute to the limited epidemiological and clinical data, diagnostic and therapeutic challenges of histoplasmosis in Vietnam as well as in the Southeast Asia.

Case Reports

Patient 1

A 22-year-old male from the Southeast region of Ho Chi Minh City presented on June 18, 2013, with a history of two weeks of high, persistent fever, substantial jaundice, and fatigue. The development of disseminated papular skin lesions on his face and body (Figure 1A), prompted him to seek clinic and hospital care, where he was diagnosed with HIV infection using three different enzyme-linked immunosorbent assays (ELISA). He had no history of injection drug use; however, he reported same-sex intercourse with the classmate several times before admission. His CD4+ T cell count was 03 cells/ μ L. Laboratory tests revealed severe anemia, significant thrombocytopenia, and highly elevated levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (Table 1). Skin microscopy revealed yeast-like organisms, initially suspected to be *Talaromyces marneffe*, due to its endemicity in this region. Skin and blood cultures were pending. Chest radiography showed patchy alveolar infiltrates in both lungs. He was treated with oral itraconazole (400 mg/day) for talaromycosis and intravenous ceftriaxone for community-acquired pneu-

monia for two weeks. Hemoculture later returned negative result; nevertheless, his skin culture was positive for *Histoplasma capsulatum*. Multiple acid-fast bacilli (AFB) smears of sputum were negative; however, a follow-up chest radiography revealed no improvement. After consultation with doctors from the tertiary Tuberculosis Center, antituberculous therapy was initiated with rifampicin, isoniazid, ethambutol, and pyrazinamide by day 14 (D+14). Two days after starting antituberculous treatment, the patient further developed severe respiratory failure requiring mechanical ventilation. A repeated chest radiography revealed diffuse alveolar infiltrates and pleural effusion in both lungs. Hospital-acquired pneumonia coinfection with tuberculosis was considered; thus, intravenous imipenem and vancomycin were administered. Bronchoalveolar lavage (BAL) culture revealed *Acinetobacter spp.*, that was positive for extended-spectrum beta-lactamase (ESBL). Considering the progression of his histoplasmosis status, by day 14, his fever and skin lesions did not improve. Hence, the treatment doctor determined a switch from itraconazole by oral route to intravenous amphotericin B deoxycholate (0.7 mg/kg/day). Two weeks after receiving the above treatments (D+28), the patient showed marked improvement and was weaned off mechanical ventilation. The patient was discharged on day 46 (D+46) and showed clinical resolution within three months after discharge. At the last follow-up visit in December 2013, the patient was completely well, and his CD4+ T cell count increased to 182 cells/ μ L.

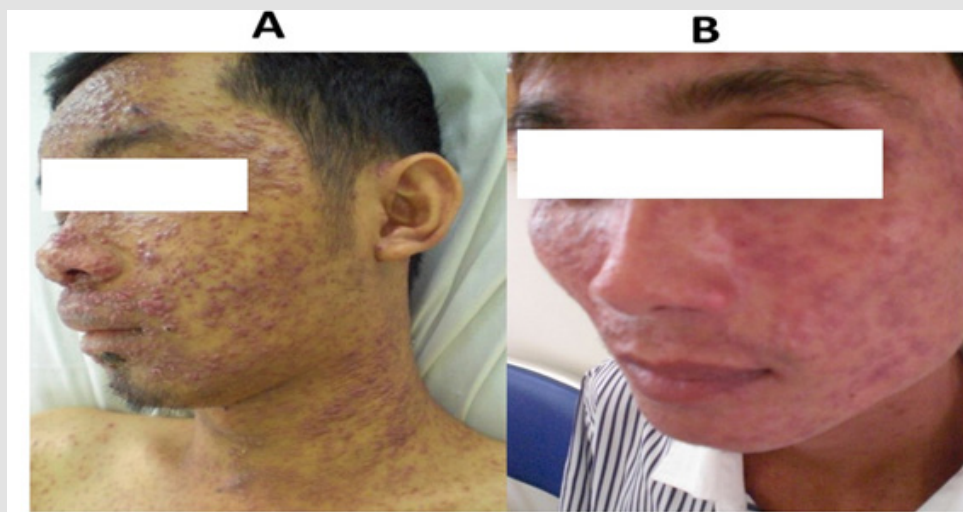


Figure 1: The characteristic papular skin lesions in one patient with histoplasmosis (Figure 1A), and dermatitis-like skin lesions in another patient with histoplasmosis-associated immune reconstitution inflammatory syndrome (IRIS) (Figure 1B).

Table 1: Clinical features, treatment, and outcomes of HIV-infected patients with histoplasmosis in Vietnam.

Case	Age and sex	Province / Area of residence	Month of onset	Possible exposure and occupation	Clinical manifestations and laboratory of <i>H.capsulatum</i> cases	CD4 cell counts (cells/ μ L)	Serum <i>T. marneffei</i> Mp1p antigen	Microbiology of <i>H.capsulatum</i>	Treatments	Response and outcome
1	22-year-old, male	Dong Nai / Southeast, Vietnam	June, 2013	Cave camping, student No history of travelling outside Vietnam	Prolonged, high fever, multiple papular skin lesions, pneumonia and respiratory failure, mechanical ventilation Hemoglobin = 7.3 g/dL; Platelet = 20 K/ μ L; AST = 834 U/L; ALT = 279 U/L	03	NA	Postive skin microscopy and culture Negative hemoculture	Amphotericin B deoxycholate 0.7 mg/kg/day for 2 weeks then itraconazole 400 mg/day for 10 weeks Anti-tuberculous therapy for pulmonary TB with negative AFB: rifampicin, isoniazid, ethambutol, pyrazinamide	Complete resolution of symptoms after one month in hospital and two months after discharge, alive
2	31 year-old, male	Bac Lieu / Mekong River Delta, Vietnam	October, 2014	Farmer, soil exposure No history of travelling outside Vietnam	Afebrile, multiple maculopapular skin lesions, severe anemia Hemoglobin = 5.5 g/dL; Platelet = 446 K/ μ L; AST = 88 U/L; ALT = 17 U/L	08	NA	Postive skin microscopy and culture Negative hemoculture	Amphotericin B deoxycholate 0.7 mg/kg/day for 2 weeks then itraconazole 400 mg/day for 10 weeks Intravenous oxacillin plus oral clindamycin for skin super-infection	Clinical improvement over one month, alive
3	34 year-old, male	Ho Chi Minh City, Vietnam	September, 2017	Office worker, Traveling history to Thailand	Febrile, malaise, papular skin lesions, diarrhea, mild anemia Hemoglobin = 10.7 g/dL; Platelet = 146 K/ μ L; AST = 86 U/L; ALT = 64 U/L	55	Negative (OD= 0.037)	Negative skin microscopy and hemoculture Positive skin culture	Amphotericin B deoxycholate 0.7 mg/kg/day for a week, then itraconazole 400 mg/day for 10 weeks	Clinical improvement over two months, alive
4	48-year-old, male	Khanh Hoa / South Central Coast	November, 2017	Electronic engineer, No history of travelling outside Vietnam	High fever, malaise, wasting, oral ulcers, maculopapular skin lesions, gastrointestinal symptoms, jaundice, chronic hepatitis B Critical hepatic, renal and respiratory failure Hemoglobin = 11.6 g/dL; Platelet = 162 K/ μ L; AST = 902 U/L; ALT = 443 U/L; Total bilirubin = 17.7 μ mol/L; Serum creatinine = 900 μ mol/L	NA	Negative (OD = 0.026)	Negative skin microscopy, Negative skin and blood cultures Cervical lymph node microscopy and culture revealed positive results	Amphotericin B deoxycholate 0.7 mg/kg/day for 2 days in-hospital	Clinical deterioration, died in-hospital

Notes: AFB, acid fast bacilli; AST, aspartate aminotransferase; ALT, alanine transaminase; K = 1,000 units; NA, not available; OD, optical density, cut-off point > 0.45 defined as positive antigen test for the serum Mp1p antigen test for diagnosing *Talaromyces marneffei* infection.

Patient 2

A 31-year-old male from the Mekong River Delta, southern Ho Chi Minh City, Vietnam presented in October 2014 with a one-month history of fatigue, scaly and pustular skin lesions on his face and body, without fever. He reported no history of injection drug use. The patient had been diagnosed with HIV infection and started the first-line antiretroviral therapy (ART) four months before admission, at which time his CD4+ T cell count was 8 cells/ μ L. A month before this admission, he had developed papular skin lesions and was diagnosed with *Histoplasma capsulatum* infection based on positive results from skin microscopy and culture at the hospital, and was treated itraconazole (400 mg/day) by oral route. He reported well adherence to ART and antifungal treatments. Upon this readmission, repeated skin microscopy results were positive for *H. capsulatum* and methicillin-resistant *Staphylococcus aureus* (MRSA); however, hemoculture still revealed negative result. Other laboratory test results are presented in the Table 1. He was administered intravenous amphotericin B deoxycholate and oxacillin combined with oral clindamycin for MRSA superinfection of the skin for a treatment course of two weeks. His skin lesions improved significantly after 10 days of receiving therapeutics, and he was discharged after 14 days of in-hospital treatment. He showed rapid clinical resolution within one month after discharge. At the follow-up visit in November 2014, the patient was completely well, and his CD4+ T cell count increased to 64 cells/ μ L.

Patient 3

A 34-year-old male from Ho Chi Minh City presented in September 2017 with a week history of high fever, diarrhea with loose stools, fatigue, and sparse papular skin lesions on his face and arms. He was diagnosed with HIV infection and started on the first-line ART a month prior to his hospital presentation, at which time his CD4+ T cell count was 19 cells/ μ L. The laboratory test results are listed in the Table 1. Skin microscopy revealed negative result while the skin and blood culture results were pending. The serum Mp1p antigen detection enzyme immunoassay for *Talaromyces marneffe* was performed, based on test availability and higher epidemiological prevalence of *Talaromyces marneffe* infection (than *H. capsulatum*) in Vietnam. The Mp1p antigen test showed an optical density (OD) value of 0.037, indicating a negative result for *Talaromyces marneffe* infection. Therefore, the patient was clinically diagnosed with histoplasmosis. The treatment doctor administered itraconazole 400 mg/day by oral route; nevertheless, minimal improvement was observed after three weeks of the oral itraconazole regimen. The blood culture yielded negative result. Hence, the patient was referred to the Tuberculosis

Center for further investigation of suspected tuberculosis. One week later, the patient's clinical status worsened, with increased malaise and exacerbation of dense papular skin lesions (Figure 1B), enlarged cervical lymph nodes and joint swelling. He was indicated for repeated microscopic examination and culture for systemic mycoses. Upon this readmission, his skin culture was positive for *Histoplasma capsulatum*, and the hemoculture result was still negative. His CD4+ T cell count markedly increased to 55 cells/ μ L, liver enzymes and hemoglobin levels were within the normal range. He was retreated with intravenous amphotericin B deoxycholate for a week, leading to significant clinical improvement, and was discharged. The patient continued a consolidation antifungal therapy with itraconazole 400 mg/day by oral route for a 10-week course. At the last follow-up visit in April 2018, the patient was clinically well, with a rapidly increasing CD4+ T cell count of 121 cells/ μ L.

Patient 4

A 48-year-old male from the South-Central Coast region of Vietnam presented in November 2017 with a two-week history of high fever, severe jaundice, macular and papular skin lesions on his face and body, cough, oral ulcers, and fatigue. He had enlarged cervical lymph nodes and was newly HIV diagnosed. His CD4+ T cell count had not yet been tested. The patient reported a 10-year history of chronic hepatitis B infection without any specific antiviral treatment. On admission, the laboratory tests revealed highly elevated liver enzyme and serum bilirubin levels (Table 1). Acid-fast bacilli (AFB) smears of sputum were negative, and his chest radiography revealed diffuse interstitial infiltrates in both lung fields. Skin microscopy as well as skin and blood culture results were negative. Considering the endemicity of talaromycosis, the serum Mp1p antigen detection enzyme immunoassay was conducted because of clinically suspected *Talaromyces marneffe* infection. The serum Mp1p antigen revealed a negative result (optical density value of 0.026). Fine-needle aspiration of his cervical lymph nodes showed positive results for *Histoplasma capsulatum* based on microscopy and culture (Figures 2A & 3A). The patient was treated with intravenous amphotericin B deoxycholate (0.7 mg/kg/day). Two days after receiving the treatment, he developed severe acute renal failure (glomerular filtration rate [GFR] < 15 mL/min); hence, he was indicated to switch from amphotericin B deoxycholate to itraconazole 400 mg/day (orally). Additionally, high-dose cotrimoxazole was used for clinically suspected pneumocystis pneumonia (PCP). On day 4 (D+4) after admission, he further developed severe respiratory failure requiring mechanical ventilation. The patient's clinical status deteriorated due to critical hepatic, renal and respiratory failure, eventually leading to in-hospital death.

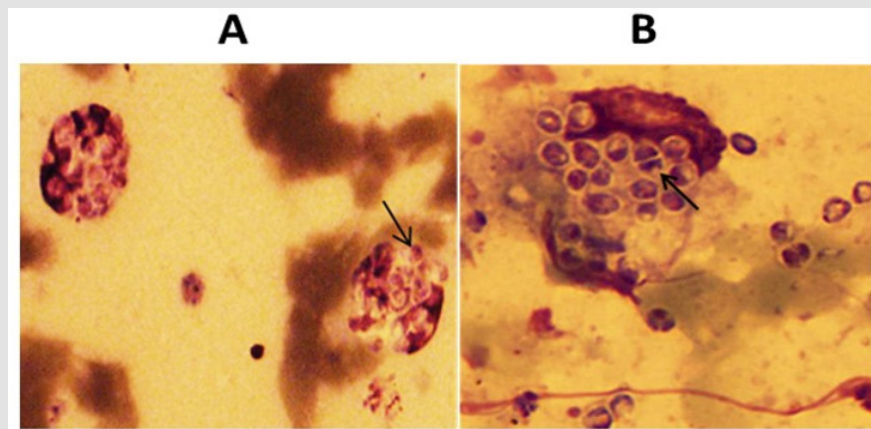


Figure 2: Microscopy of skin smear in a patient with *Histoplasma capsulatum* infection (Figure 2A), compared with the bone marrow smear of another patient with *Talaromyces marneffeii* infection (Figure 2B) [23]. The distinct feature of the septum from *Talaromyces marneffeii* was used to differentiate it from *Histoplasma capsulatum* (see arrows).

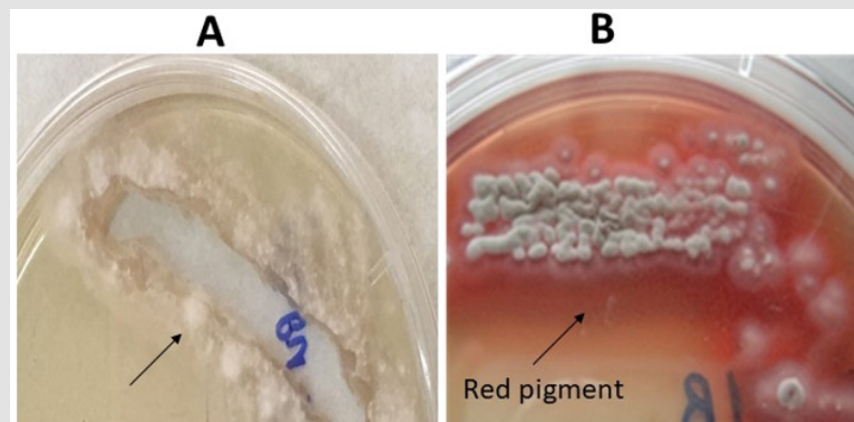


Figure 3: Skin culture colonies in a patient with *Histoplasma capsulatum* infection (Figure 3A), compared with the bone marrow culture of another patient with *Talaromyces marneffeii* infection (Figure 3B) [23]. Notably, *T. marneffeii* produced red pigments at environment temperatures (indicated by arrows in Figure 3B-*T. marneffeii* versus in Figure 3A-*H. capsulatum*).

Discussion

This study illustrates several adult cases of histoplasmosis in Vietnam, where this disease is rarely seen, compared with the more frequently reported endemic talaromycosis. This study aimed to expand the limited data reported on histoplasmosis in Southeast Asia and discuss the diagnostic and therapeutic challenges of differentiating between talaromycosis and histoplasmosis, characterizing immune reconstitution inflammatory syndrome (IRIS) in patients with histoplasmosis, and comparing it with talaromycosis-associated IRIS.

Epidemiologically, *Histoplasma capsulatum* is highly endemic in the American regions but has also been reported in other regions such as Central Africa, East Asia, and Europe, in contrast to its rarity in Southeast Asian regions [1,2]. Exposure to contaminated envi-

ronments, such as caves, old buildings, soil, bird droppings, and bat guano, increases the risk of contracting histoplasmosis in endemic areas [4,5]. Nevertheless, *Talaromyces marneffeii* is predominantly endemic in Southeast Asia and southern China, where risk factors such as soil exposure, high humidity, and rainy seasons contribute to its high prevalence [12,18,19]. *T. marneffeii* is commonly found in bamboo rats and their burrows, and its geographical distribution matches that of the bamboo rats [20]. The ecological niche distinction has been supposed to account for the rare occurrence of *H. capsulatum* infections in Southeast Asia and southern China, where *T. marneffeii* is more prevalent [4,12]. Both diseases primarily affect advanced HIV patients with CD4+ T cell counts below 100 cells/ μ L [3,18], with the prevalence of disseminated histoplasmosis among HIV/AIDS patients ranging from 4.4% to 10.3% [7,8], which is closely equivalent to ta-

laromycosis (4.4% to 11%) [18,20]. Histoplasmosis has a mortality rate between 10% and 50% [1,9-11], higher than that of talaromycosis, which ranges from 10% to 30% [18,21]. Histoplasmosis has a wide clinical spectrum, ranging from mild to severe disease, with disseminated forms affecting the pulmonary system, gastrointestinal tract, reticuloendothelial system, and central nervous system [7,9-11].

Symptoms often include fever, skin lesions, nausea, vomiting, oral ulcers, anemia, lymphadenopathy, and hepatosplenomegaly, with laboratory findings revealing anemia, neutropenia, thrombocytopenia, elevated liver enzymes, and interstitial infiltrates on chest radiography. These presentations closely resemble those of talaromycosis, making clinical differentiation challenging [9,13,18]. Identification relies on the microbiological examination of patient samples, such as the skin, blood, and lymph nodes [18,22]. Both *Histoplasma capsulatum* and *Talaromyces marneffe* are intracellular and extracellular dimorphic fungi, but *T. marneffe* has a clear central septum (Figure 2B) and produces a red pigment (Figure 3B) at environment temperatures, unlike *H. capsulatum* (Figures 2A & 3A) [12,13,22]. Despite positive culture detection rates of 90% among HIV patients, bone marrow investigations can help identify fungi in patients with negative skin smears and cultures, albeit this invasive procedure requires skilled hematologists [15,16,18,22]. In non-endemic areas such as Vietnam, rapid and accurate diagnosis of histoplasmosis is challenging owing to its clinical similarity to talaromycosis, other systemic mycoses and tuberculosis [13,14]. Therefore, the clinical scenarios presented in this study underscore the need for diagnostic tests that are less invasive, more sensitive, and specific to detect *Histoplasma capsulatum* and differentiate it from *Talaromyces marneffe*. Currently, antigen-based enzyme-linked immunosorbent assay tests for diagnosing *H. capsulatum* are not available in Vietnam and other Asian countries.

However, it may cross-react with other fungal species such as *Aspergillus spp.* Significantly, real-time polymerase chain reaction (PCR) for the identification and confirmation of *Histoplasma capsulatum* demonstrates good diagnostic values with sensitivities up to 100% and specificities ranging from 92% to 95%, but the high cost and unavailability limit its practical use in Southeast Asian regions [8,16]. Additionally, the serum Mp1p antigen detection enzyme immunoassays for *Talaromyces marneffe* have been developed with a sensitivity of approximately 90% and specificity of 100% reported [17,23]. In terms of the clinical homogeneity between histoplasmosis and talaromycosis, conventional microbiological methods have limitations, considering the relative positive results from skin microscopy and prolonged time (up to three weeks or more) to await *H. capsulatum* skin and blood culture results. Hence, the serum Mp1p antigen detection enzyme immunoassay for *Talaromyces marneffe* may be an alternative choice for differentiating talaromycosis patients from those with histoplasmosis upon hospital admission, considering better survival associated with timely antifungal treatments. Tuberculosis (TB) has

been reported the most common coinfection (approximately 22%) among HIV-infected patients [24]. In clinical practice, we found that patients with subclinical tuberculosis may present with non-specific symptoms, similar to those of systemic mycoses including histoplasmosis and talaromycosis. Therefore, fungal antigen-specific ELISA tests and molecular diagnostic methods are useful for differentiating between tuberculosis and invasive mycoses. In terms of treating patients with co-infected tuberculosis and systemic mycoses (as seen in the patient 1), rifampicin is the backbone of the first-line antituberculous therapies; however, it is also a potent CYP3A4 inducer potentially decreasing the concentration of azole antifungals such as itraconazole by 60% [25].

Thus, intravenous amphotericin B is recommended to avoid significant drug-drug interactions between rifampicin and azole antifungals during the in-hospital intensive treatment phase [25]. Another major concern in managing TB and systemic mycosis coinfections is the increased risk of the immune reconstitution inflammatory syndrome (IRIS) and relapse of invasive mycoses in patients co-administered rifampicin and azole antifungal drugs [24]. To date, there are limited data on immune reconstitution inflammatory syndrome (IRIS) associated with both histoplasmosis and talaromycosis in Vietnam and Southeast Asia, aside from a few case reports [26-28]. Severely immunosuppressed HIV-infected patients are prone to develop IRIS upon starting antiretroviral therapy (ART). This can lead to exaggerated or dysregulated T-cell responses triggered by pathogens or persistent antigens, coupled with genetic susceptibility [29]. Histoplasmosis- and talaromycosis-associated IRIS can manifest as either worsening of treated fungal infections (paradoxical IRIS) or emergence of previously untreated infections (unmasking IRIS).

Risk factors have been reported, including ART-naïve status, CD4 T cell count below 50 cells/ μ L, early ART initiation following opportunistic infection therapies, and high residual pathogen burden [26,29]. In this study, the patient 3 was likely to present with a clinical scenario of paradoxical histoplasmosis-associated IRIS with worsening skin lesions and cervical lymphadenopathy, slightly elevated liver enzymes and markedly increasing CD4+ T cell count. Notably, the definitions of IRIS often require evidence of immune restoration, such as a significant decrease in plasma HIV RNA levels or an increase in CD4 cell count [26]. However, HIV-RNA viral load was not tested on this patient at the study time point. A previous case series of three HIV-positive patients showed paradoxical talaromycosis-associated IRIS with inflammatory symptoms such as dermatitis-like skin lesions, lymphadenopathy, painful synovitis, and erythema nodosa [26]. The average time to develop talaromycosis-IRIS after ART initiation ranges from 3 to 6 months [29]. Similarities between histoplasmosis and talaromycosis-associated IRIS include dermatitis-like skin lesions, lymph node enlargement, painful joint swelling, markedly elevated CD4+ T cell counts, normalized liver enzyme and hemoglobin levels. The IRIS-experienced patients required hospitalization for intravenous ampho-

tericin B deoxycholate treatment. Better survival outcomes have been reported in patients with talaromycosis-associated IRIS [26], as well as observed in the patient 3 with histoplasmosis-associated IRIS in this study. Lastly, in clinical practice, distinguishing patients with invasive mycoses-associated IRIS from those with disease relapse is challenging, given the high mortality associated with relapse [30].

Accurate identification is critical because patients with relapse require immediate and early in-hospital treatment for the reinduction antifungal and concurrent coinfection treatments. Standard laboratory tests including hemoglobin, platelet counts, liver transaminases, and CD4+ T cell counts have been reported to be useful for differentiating between these conditions [26,30].

Conclusion

This study highlights similar clinical presentations, laboratory values, and radiological findings in disseminated histoplasmosis and talaromycosis. Microscopy and sample culture are the standard methods for the confirmed diagnosis. Serological and molecular tests offer good diagnostic values; however, limitations include test unavailability and costs, and cross-reactivity among fungi.

Acknowledgements

We express our gratitude to the patients for giving their permission to write this case report and to present (masked) pictures of patients' skin lesions and microbiology results. Patients' informed consents are available in the submission. We also thank all administrative staffs at Mai Khoi Clinic, Ho Chi Minh City (700000), Vietnam for their assistance in monitoring the patients.

Conflict of Interest

The authors declare no competing interests.

Funding

This study was self-funded.

References

- Baddley JW, Winthrop KL, Patkar NM, Delzell E, Beukelman T, et al. (2011) Geographic distribution of endemic fungal infections among older persons, United States. *Emerg Infect Dis* 17(9): 1664-1669.
- Wheat LJ, Azar MM, Bahr NC, Spec A, Relich RF, et al. (2016) Histoplasmosis. *Infect Dis Clin North Am* 30(1): 207-227.
- Gutierrez ME, Canton A, Sosa N, Puga E, Talavera L (2005) Disseminated histoplasmosis in patients with AIDS in Panama: a review of 104 cases. *Clin Infect Dis* 40(8): 1199-1202.
- Maiga AW, Deppen S, Scaffidi BK, Baddley J, Aldrich MC, et al. (2018) Mapping *Histoplasma capsulatum* Exposure, United States. *Emerg Infect Dis* 24(10): 1835-1839.
- (2013) Centers for Disease Control and Prevention. Histoplasmosis in a state where it is not known to be endemic--Montana, 2012-2013. *MMWR Morb Mortal Wkly Rep* 62(42): 834-837.
- Buddha NK, Jadon RS, Mondal S, Vikram NK, Sood R (2018) Progressive disseminated histoplasmosis in an immunocompetent adult: A case report. *Intractable Rare Dis Res* 7(2): 126-129.
- Silva TC, Treméa CM, Zara AL, Mendonça AF, Godoy CS, et al. (2017) Prevalence and lethality among patients with histoplasmosis and AIDS in the Midwest Region of Brazil. *Mycoses* 60(1): 59-65.
- Hoffmann ER, Daboit TC, Paskulin DD, Monteiro AA, Falci DR, et al. (2017) Disseminated histoplasmosis and AIDS: a prospective and multicentre study to evaluate the performance of different diagnostic tests. *Mycoses* 60(1): 20-24.
- Kauffman CA (2007) Histoplasmosis: a clinical and laboratory update. *Clin Microbiol Rev* 20(1): 115-132.
- Damasceno LS, Ramos AN Jr, Alencar CH, Gonçalves MV, de Mesquita JR, et al. (2014) Disseminated histoplasmosis in HIV-infected patients: determinants of relapse and mortality in a north-eastern area of Brazil. *Mycoses* 57(7): 406-413.
- Samayoa B, Roy M, Cleveland AA, Medina N, Lau Bonilla D, et al. (2017) High Mortality and Coinfection in a Prospective Cohort of Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome Patients with Histoplasmosis in Guatemala. *Am J Trop Med Hyg* 97(1): 42-48.
- Vanittanakom N, Cooper CR Jr, Fisher MC, Sirisanthana T (2006) *Penicillium marneffei* infection and recent advances in the epidemiology and molecular biology aspects. *Clin Microbiol Rev* 19(1): 95-110.
- Mootsikapun P, Srikulbutr S (2006) Histoplasmosis and penicilliosis: comparison of clinical features, laboratory findings and outcome. *Int J Infect Dis* 10(1): 66-71.
- Adenis A, Nacher M, Hanf M, Basurko C, Dufour J, et al. (2014) Tuberculosis and histoplasmosis among human immunodeficiency virus-infected patients: a comparative study. *Am J Trop Med Hyg* 90(2): 216-223.
- Hage CA, Ribes JA, Wengenack NL, Baddour LM, Assi M, et al. (2011) A multicenter evaluation of tests for diagnosis of histoplasmosis. *Clin Infect Dis* 53(5): 448-454.
- Dantas KC, Freitas RS, da Silva MV, Criado PR, Luiz ODC, et al. (2018) Comparison of diagnostic methods to detect *Histoplasma capsulatum* in serum and blood samples from AIDS patients. *PLoS One* 13(1): e0190408.
- Prakit K, Nosanchuk JD, Pruksaphon K, Vanittanakom N, Youngchim S (2016) A novel inhibition ELISA for the detection and monitoring of *Penicillium marneffei* antigen in human serum. *Eur J Clin Microbiol Infect Dis* 35(4): 647-656.
- Le T, Thanh NT, Thwaites GE (2020) Talaromycosis (Penicilliosis). In *Hunter's Tropical Medicine and Emerging Infectious Diseases* Elsevier, pp. 682-685.
- Ning C, Wei W, Xu B, Thanh N, et al. (2020) The global distribution, drivers, and burden of talaromycosis 1964–2018. In *Conference of Retrovirus and Opportunistic Infections*, p. 8-11.
- Huang X, He G, Lu S, Liang Y, Xi L (2015) Role of *Rhizomys pruinosus* as a natural animal host of *Penicillium marneffei* in Guangdong, China. *Microb Biotechnol* 8(4): 659-664.
- Thanh NT, Dat NT (2022) Predicting the risk of in-hospital mortality in patients with HIV-associated *Talaromyces marneffei* infection. *Texila International Journal of Academic Research* 9(3).
- Wong SY, Wong KF (2011) *Penicillium marneffei* Infection in AIDS. *Patholog Res Int* 2011: 764293.
- Ly VT, Thanh NT, Thu NT, Chan J, Day JN, et al. (2020) Occult *Talaromyces marneffei* infection unveiled by the novel Mp1p antigen detection assay. In *Open forum infectious diseases* 7(11): ofaa502.

24. Thanh NT, Dat NT (2020) Prevalence of HIV-associated Co-infections and Clinical Characteristics among HIV/AIDS Outpatients in the Context of Dolutegravir Roll-out Program in Vietnam. *Texila International Journal of Public Health* 10(22).
25. Grant SM, Clissold SP (1989) Itraconazole. A review of its pharmacodynamic and pharmacokinetic properties, and therapeutic use in superficial and systemic mycoses. *Drugs* 37(3): 310-344.
26. Thanh NT, Liem NT, Shikuma C, Day JN, Thwaites G, et al. (2016) Clinical features of three patients with paradoxical immune reconstitution inflammatory syndrome associated with *Talaromyces marneffe* infection. *Medical Mycology Case Reports* 19: 33-37.
27. Kiggundu R, Nabeta HW, Okia R, Rhein J, Lukande R (2017) Unmasking histoplasmosis immune reconstitution inflammatory syndrome in a patient recently started on antiretroviral therapy. *Autops Case Rep* 6(4): 27-33.
28. Chaisuwannarak K, Chularojanamontri L, Junsuwan N, Eimpunth S (2022) Cutaneous manifestations and dermoscopic findings are important clues to the diagnosis of *Talaromyces marneffe* in HIV patients with immune reconstitution inflammatory syndrome: A case report and literature review. *J Dermatol* 49(1): 168-172.
29. Sharma SK, Soneja M (2011) HIV & immune reconstitution inflammatory syndrome (IRIS). *Indian J Med Res* 134(6): 866-877.
30. Tat TN, Tat DN, Krishnamurthy PT (2023) The Impacts of Antiretroviral and Antifungal Treatments, and Tuberculosis Co-infection on Mortality and Relapse in Patients with *Talaromyces Marneffe* Infection 10(4).

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.61.009657

Nguyen Tat Thanh. Biomed J Sci & Tech Res



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