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Pulmonary Scedosporiosis in Non-Immunocompromised Hosts: A Case Series and Literature Review

Xianhong Chi [1,2,†], Mianluan Pan [1,2,†], Jiehua Deng [1,2,†], Yuhao Lin [1,2], Yaqin Wei [1,2], Kaiduan Xie [1,2], Xinyan Chen [1,2], Jinxin Zheng [1,2], Linqian Wu [1,2], Yifan Wu [1,2] and Jianquan Zhang [1,2,*]

[1] Department of Respiratory and Critical Care Medicine, The Eighth Affiliated Hospital, Sun Yat-sen University, Shenzhen 518000, China; sammurize@163.com (X.C.); panmianluan@163.com (M.P.); dengjh120@126.com (J.D.)
[2] Biological Laboratory of Hetao Cooperation Zone, The Eighth Affiliated Hospital, Sun Yat-sen University, Shenzhen 518000, China
* Correspondence: jqzhang2002@126.com
† These authors contributed equally to this work.

Abstract

Background: Pulmonary scedosporiosis can occur without recognized immunosuppression, particularly in patients with structural lung disease. We characterized its clinical features, diagnostic approaches, treatment, and outcomes. **Methods**: We retrospectively analyzed 10 patients with *Scedosporium* detected in respiratory specimens during 2023–2025, and conducted a narrative review of 37 published adult cases with non-immunocompromised status. **Findings**: Among the 10 institutional patients, chronic structural or airway disease was present in 8/10, most commonly bronchiectasis (6/10). Cough (8/10) and sputum production (7/10) were common institutionally; hemoptysis occurred in 3/10 institutional patients and 27/37 published cases. Patchy opacities occurred in 7/10 and bronchiectasis occurred in 6/10 institutional patients, whereas cavities (20/37) and fungal balls (17/37) were common in published cases. Bronchoalveolar lavage fluid (BALF)-tNGS detected *Scedosporium* in all 10 institutional patients, whereas BALF culture was positive in 8/10. Species-level identifications were concordant in all eight culture-positive cases. All 37 published cases were culture-confirmed, with NGS additionally used in 3/37. The median interval from symptom onset to first detection was 17 days (IQR, 7–32.5) in the institutional cohort; among the 30/37 published cases with available data, the median interval from symptom onset to diagnosis was 5 months. All institutional patients initially received voriconazole. Eight of the 10 institutional patients were clinically diagnosed with infection, whereas two had insufficient evidence to distinguish infection from colonization. Three institutional patients were cured, five improved, and two were lost to follow-up after 3–5 days. Among the published cases, 29/37 were cured or improved, 3/37 died, and 5/37 were lost to follow-up. **Interpretation**: Pulmonary scedosporiosis should be considered in patients with structural lung disease and persistent or progressive pulmonary lesions. Diagnosis should integrate clinical, radiological, bronchoscopic, and microbiological findings. tNGS may complement fungal culture. Voriconazole remains first-line treatment, and surgery may be considered in patients with localized progressive cavitary disease or hemoptysis.

Keywords: *Scedosporium*; structural lung disease; tNGS; non-immunocompromised

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1. Introduction

Scedosporiosis is an opportunistic fungal infection caused by *Scedosporium* spp., including members of the *Scedosporium apiospermum* complex, including *S. apiospermum* and

S. boydii [1]. Older reports used *Pseudallescheria boydii* or *Petriellidium boydii* for organisms now classified within *Scedosporium* spp. [2]. Although the respiratory tract is the primary site of involvement, disseminated disease can affect the central nervous system, skin, and osteoarticular structures [3]. Management remains clinically challenging because *S. apiospermum* exhibits reduced and variable susceptibility to several antifungal agents, particularly amphotericin B [4].

Historically, this infection was linked to specific events like near-drowning, trauma, or severe immunosuppression [1,3]. However, pulmonary infection also occurs in non-immunocompromised patients, particularly those with chronic airway disease. Pulmonary scedosporiosis can resemble pulmonary aspergillosis or tuberculosis/nontubercular mycobacteria (NTM) pulmonary disease clinically and radiologically [5]. Mycological identification may avoid delayed or inappropriate treatment.

We analyzed all 10 non-immunocompromised patients with *Scedosporium* detected in respiratory specimens at our center during 2023–2025 and conducted a narrative review of published adult cases in non-immunocompromised hosts to further characterize disease in this population. We describe the clinical features, diagnostic approaches, treatment, and outcomes of the institutional series and published cases separately.

2. Methods

2.1. Patient Cohort and Ethics

Patients with *Scedosporium* detected in respiratory specimens at the Eighth Affiliated Hospital, Sun Yat-sen University, between 1 January 2023 and 31 December 2025, were identified from electronic medical records. Data on demographics, medical history, laboratory examinations, chest imaging, treatment, and outcomes were collected. This retrospective study was approved by the Ethics Committee of the Eighth Affiliated Hospital, Sun Yat-sen University (No. 2026-154-01), and all data were accessed and analyzed only after approval was obtained. Because this was a retrospective analysis of routinely collected clinical data, the requirement for individual informed consent was waived by the Ethics Committee.

2.2. Definition of Pulmonary Scedosporiosis, Disseminated Scedosporiosis with Pulmonary Involvement and Non-Immunocompromised Status

The definition of pulmonary scedosporiosis is as follows: (1) "Proven infection" required compatible symptoms and imaging and isolation of *Scedosporium* from aseptically obtained lesional lung tissue. (2) "Clinical diagnosis" required respiratory symptoms, compatible imaging, and at least one positive bronchoalveolar lavage fluid (BALF) or twice positive sputum culture for *Scedosporium*. Treatment response served as an auxiliary role in establishing "Clinical diagnosis". (3) "Colonization" was defined as respiratory detection of *Scedosporium* without related symptoms or radiographic evidence of active infection. (4) "Unclassified airway detection" was defined as respiratory detection of *Scedosporium* without meeting the criteria for any of the above three categories. Disseminated scedosporiosis with pulmonary involvement was defined by the fulfillment of either of the following criteria: 1. Identification of the same *Scedosporium* spp. from two or more non-contiguous anatomical organs by microbial culture or molecular biological testing. 2. In the presence of definite respiratory clinical symptoms and characteristic chest imaging findings, *Scedosporium* is isolated from an extrapulmonary sterile sample and other pathogens have been excluded as the cause of the pulmonary lesions. The above criteria were applied only to institutional cases. Diagnostic classifications of cases included in the literature review were based on those reported in the original publications.

Non-immunocompromised status required no known ongoing primary or acquired immunodeficiency. Patients with previous immunocompromising conditions were eligible

when these conditions were clinically stable or inactive and they had received no systemic immunosuppressive treatment during the preceding 12 months.

2.3. Targeted Next Generation Sequencing (tNGS)

BALF was collected from segmental bronchi corresponding to the identified lesions. Immediately after collection, 5 mL of BALF was stored aseptically at −20 °C and transported to Guangzhou KingMed Diagnostics Laboratory (Guangzhou, China) within 4 h. Samples were centrifuged and mechanically disrupted before total nucleic acid extraction. Libraries were prepared by reverse transcription, target amplification, purification, and adapter ligation, followed by sequencing on the KM MiniSeqDx-CN platform(KingCreate Biotechnology, Guangzhou, China). The targeted panel covered 225 predefined respiratory pathogens. After quality filtering, sequence reads were aligned against a reference database compiled from GenBank, the Reference Sequence (RefSeq) database, and the nucleotide collection maintained by the National Center for Biotechnology Information (NCBI). *S. apiospermum* and *S. boydii* were differentiated based on matches to their respective species-level reference sequences; results without sufficient species-level resolution were reported at the genus level. Taxonomic abundance was normalized as reads per 100,000 input reads (RPhK), with RPhK ≥ 10 defined as positive. *Bacillus subtilis* was used as a positive control, and nuclease-free water served as a no-template negative control to monitor assay performance and potential contamination.

tNGS was performed contemporaneously during the index hospitalization as part of routine diagnostic care. Testing was ordered at the treating physician's discretion when the infectious etiology remained unclear after the initial clinical and microbiological evaluation. Laboratory turnaround time was defined as the interval from specimen receipt by the testing laboratory to report release.

2.4. Outcomes and Prognosis of Pulmonary Scedosporiosis

Treatment outcomes were stratified into six categories based on a composite of clinical, radiological, and microbiological data: (1) Cure: complete resolution of clinical symptoms, radiographic improvement compared with prior findings, and absence of *Scedosporium* spp. on repeat fungal culture or next-generation sequencing (NGS) after ≥3 months of continuous antifungal therapy. (2) Improvement: clinical or radiographic improvement only, but with an insufficient duration of antifungal therapy or without evidence of mycological clearance. (3) Stable: neither clinical nor radiographic improvement, and no evidence of mycological clearance. (4) Progression: worsening of clinical symptoms and radiographic evidence of enlarging or newly appearing lesions. (5) Death: attributable when pulmonary scedosporiosis directly caused or substantially contributed to death; non-attributable when death resulted from an unrelated cause; and indeterminate when evidence was insufficient. (6) Lost to follow-up: no clinical, radiological, or microbiological outcome data were available after discharge and patients' subsequent status could not be ascertained. Follow-up time was defined as the interval from hospital discharge to the last documented clinical assessment.

2.5. Literature Review

We searched PubMed, Web of Science, and Scopus to identify reports of pulmonary scedosporiosis in non-immunocompromised adults published between 1948 and 2025. The final search was conducted on 24 October 2026. Detailed database-specific search strategies are provided in the Supplementary Materials. Reference lists of retrieved reports were also examined for additional relevant publications.

Eligibility regarding non-immunocompromised status was assessed at the patient level using the definition in Section 2.2. The original authors' classification as non-immunocompromised was accepted when no immunocompromising condition, systemic immunosuppressive treatment, or contradictory information was reported. When a potentially immunocompromising condition or systemic immunosuppressive treatment was reported, eligibility was assessed according to Section 2.2, considering disease activity and the interval since treatment discontinuation. Cases were excluded when the available information was insufficient to establish that these eligibility criteria were met.

After duplicate removal, titles and abstracts were screened to identify potentially eligible case reports or case series. Publications of other types and reports describing exclusively extrapulmonary infection without pulmonary involvement or patients with immunocompromised status were excluded. Full texts were then assessed, and individual cases were excluded if they involved patients younger than 18 years, *Lomentospora prolificans* (formerly *Scedosporium prolificans*), colonization, near-drowning, trauma, or immunocompromised status identified during full-text assessment. Disseminated infection with documented pulmonary involvement remained eligible.

2.6. Statistical Analysis

All statistical analyses were descriptive. The institutional cohort and the published cases were analyzed separately. Continuous variables are summarized as medians and interquartile ranges (IQRs). Quartiles were calculated using the exclusive percentile method with linear interpolation (QUARTILE.EXC, WPS Office). PCT values reported as <0.02 ng/mL were treated as 0.02 ng/mL. Categorical variables are summarized as numbers and percentages. For the published cases, percentages were calculated using all 37 cases as the denominator unless otherwise specified. Descriptive statistics were calculated using WPS Office (version 12.1.0.28043; Kingsoft Office Software, Inc., Beijing, China)).

3. Results

3.1. Demographic Characteristics and Clinical Profiles

A total of 10 patients with *Scedosporium* detected in respiratory specimens at our center between 1 January 2023 and 31 December 2025 were included. The cohort included seven women (7/10, 70%) and three men (3/10, 30%), with a median age of 50 years. Baseline body mass index was 18.5–24 kg/m^2 in 7/10 patients (70%). At least one comorbidity was documented in 9/10 patients (90%). Chronic structural or airway disease was present in 8/10 patients (80%). The conditions included bronchiectasis (6/10, 60%), asthma (2/10, 20%), chronic obstructive pulmonary disease (1/10, 10%), and sequelae of pulmonary tuberculosis (1/10, 10%). The most common presenting symptoms were cough (8/10, 80%) and sputum production (7/10, 70%). Fever, hemoptysis, and moist rales were each documented in 3/10 patients (30%), chest pain in 2/10 patients (20%), and dyspnea and wheezing in 1/10 patient each (10%). Detailed demographic and clinical characteristics are provided in Table 1.

P4 and P7 had a history of systemic immunosuppressive treatment, which had been discontinued more than one year before the diagnosis of pulmonary scedosporiosis. P4 had a 12-year history of rheumatoid arthritis and ankylosing spondylitis that was clinically stable at diagnosis. She had previously used corticosteroids and immunosuppressants intermittently but had discontinued both more than one year earlier. P7 had lymphoma that had been in sustained remission and was not receiving chemotherapy for 22 months. Both patients were classified as non-immunocompromised according to the study definition and were included in the study. Although P4 and P7 met the study definition of non-immunocompromised status, we performed an additional descriptive analysis after ex-

cluding these two patients. The characteristics of the remaining eight patients are presented in the Supplementary Materials.

3.2. Laboratory Examinations

Among the 10 patients, white blood cell (WBC) and absolute neutrophil counts (ANC) were elevated in P5 (1/10, 10%), whereas P4 had a decreased ANC (1/10, 10%). The absolute lymphocyte count was decreased in P7 (1/10, 10%), and hemoglobin was below the reference range in P4 and P9 (2/10, 20%). Albumin was decreased in P1 (1/10, 10%), and aspartate aminotransferase (AST) was elevated in P2 (1/10, 10%). Platelet counts, globulin, alanine aminotransferase (ALT), and creatinine were within their respective reference ranges in all patients. High-sensitivity C-reactive protein (hs-CRP) and procalcitonin (PCT) were each elevated in P5, P7, and P9 (3/10, 30%). The erythrocyte sedimentation rate (ESR) was elevated in 6 of the 7 patients tested (6/7, 85.7%). BALF-(1,3)-β-D-glucan (BDG) was negative in all five patients tested (5/5), and BALF-Galactomannan (GM) was negative in all six patients tested (6/6). Results for the remaining patients were unavailable. Among the six patients who underwent lymphocyte immunophenotyping, absolute CD4+ and CD8+ T-cell counts were decreased in 4/6 (66.7%) and 3/6 (50.0%), respectively. Serum IgG and IgA concentrations were within the reference ranges in all four patients tested (4/4, 100%), and IgM concentrations were normal in all three patients tested (3/3, 100%). Total IgE was elevated in 3/6 patients (50.0%), including P9, whose level exceeded 1000 kU/L. Comprehensive laboratory and immunological data are summarized in Table 2.

3.3. Radiological Findings

Radiological evaluation revealed heterogeneous airway, parenchymal, and structural abnormalities. Patchy opacities were the most frequent finding, occurring in 7/10 patients (70%; P2–P6, P8, and P10; Figure 1A,B,D). Bronchiectasis was identified on CT in 6/10 patients (60%; P2, P4, and P6–P9). Four had concomitant intraluminal hyperdense material or mucus impaction (4/6, 66.7%; P4, P6, P8, and P9). P6 showed bilateral bronchiectasis with focal mucus plugging and peripheral patchy opacities (Figure 1A). Segmental atelectasis occurred in P1 and P7 (2/10, 20%), accompanied by right main bronchus occlusion in P1 (1/10, 10%). A tree-in-bud pattern was observed only in P3 (1/10, 10%; Figure 1C). Detailed imaging findings are summarized in Table 1 and Figure 1.

3.4. Bronchoscopic Findings

Bronchoscopic examination revealed abnormalities in 8/10 patients (80%), whereas P4 and P5 had normal findings (2/10, 20%). Extensive white viscous secretions involving the bilateral bronchi were observed in P3 and P7 (2/10, 20%), and bilateral white secretions were reported in P8 (1/10, 10%). Purulent secretions localized to the left upper lobe were observed in P2 (1/10, 10%), localized secretions in the basal segment of the left lower lobe in P6 (1/10, 10%), and minor secretions in P9 and P10 (2/10, 20%). P1 exhibited right main bronchus occlusion accompanied by segmental narrowing of the left upper- and lower-lobe bronchi, together with white foamy secretions and mottled mucosa (1/10, 10%). Detailed bronchoscopic findings are provided in Table 1.

Table 1. Demographic and Clinical Characteristics of 10 Institutional Patients.

ID	Age/ Sex	BMI	Comorbidities	Time to Detection	Symptom/ Sign	Radiological Findings	Bronchoscopy	BALF Culture	tNGS	Treatment (Duration)	Outcome (Follow-Up Time)
1	48/F	23.4	COPD Asthma	49 d	Cough, sputum	Right main bronchus occlusion and segmental atelectasis; left ground-glass nodules	Right main bronchus occlusion; left upper and lower lobe segmental narrowing with white foamy secretions and mottled mucosa	*S. boydii*	*S. boydii*; Influenza A virus	Voriconazole (365 days) + Oseltamivir (14 days)	Cure (730 days)
2	49/M	23.4	Bronchiectasis	26 d	Cough, sputum, fever, left chest pain	Patchy opacities in bilateral lower lobes; bronchiectasis with inflammation in the left lung.	purulent secretions in left upper lobe	*S. apiospermum*	*S. apiospermum*; *P. jirovecii*; *F. nucleatum*; HHV-7; *S. anginosus*	Voriconazole (90 days)	Cure (210 days)
3	45/F	27.5	None	27 d	Cough, sputum, bilateral moist rales	Patchy opacities and tree-in-bud sign in right lower lobe	Extensive white viscous secretions in bilateral bronchi	*S. boydii* *N. abscessus*	*S. boydii*; *N. abscessus*; *C. parapsilosis*; *F. nucleatum*	Voriconazole + SMZ (7 days)	Improve (7 days)
4	37/F	14.7	AS RA Bronchiectasis	16 d	Fever, right chest pain	Patchy opacities in right middle and left lower lobes; bronchiectasis with hyperdense impaction in right lower lobe	Normal	*S. apiospermum*	*S. apiospermum*; *S. pneumoniae*; *A. fumigatus*	Voriconazole (5 days)	Lost to follow-up (5 days)
5	51/F	25.0	Asthma	14 d	Cough, sputum, dyspnea, wheezing	Patchy opacities and solid nodules in bilateral upper lobes	Normal	None	*S. apiospermum*; *C. albicans*; hMPV	Voriconazole (60 days)	Improve (60 days)
6	44/F	20.3	Bronchiectasis	7 d	Hemoptysis	Bilateral bronchiectasis, focal mucus plugging, and peripheral patchy opacities	Secretion in basal segment of the left lower lobe	*S. apiospermum*; *M. abscessus*	*S. apiospermum*; *M. abscessus*; EBV	Voriconazole + moxifloxacin + inhaled amikacin + clarithromycin (60 days)	Improve (60 days)
7	77/M	22.8	Lymphoma DM GERD	18 d	Fever, cough, sputum, bilateral moist rales	bronchiectasis in left lower lobe; segmental atelectasis	Extensive white viscous secretions in bilateral bronchi	*S. apiospermum*	*S. apiospermum*; *Acinetobacter baumannii*	Voriconazole (90 days)	Cure (270 days)

Table 1. *Cont.*

ID	Age/ Sex	BMI	Comorbidities	Time to Detection	Symptom/ Sign	Radiological Findings	Bronchoscopy	BALF Culture	tNGS	Treatment (Duration)	Outcome (Follow-Up Time)
8	55/F	22.3	Bronchiectasis	7 d	Cough, hemoptysis	Bronchiectasis with intraluminal hyperdense spots and patchy opacities in bilateral lower lobes	white secretions in bilateral lung	*S. apiospermum*	*S. apiospermum*	Voriconazole (60 days)	Improve (60 days)
9	71/M	19.1	Bronchiectasis Sequelae of PTB	92 d	Cough, sputum	Bronchiectasis with hyperdense impaction in right lower lobe	Minor secretions in right lower lobe	None	*Scedosporium* spp.; *A. fumigatus* *M. intracellulare*; *Streptococcus mitis*	Voriconazole and Isaconazol (90 days)	Improve (90 days)
10	55/F	21.5	GERD Bronchiectasis	6 d	Cough, sputum, hemoptysis, left lower lung moist rales	Patchy opacities in left lung	Minor white viscous secretions in left lung	*S. apiospermum*	*S. apiospermum*; *T. whipplei*; *P. aeruginosa*;	Voriconazole (3 days)	Lost to follow-up (3 days)

Abbreviations: *A. fumigatus*, *Aspergillus fumigatus*; AS, ankylosing spondylitis; BALF, bronchoalveolar lavage fluid; BMI, body mass index; *C. albicans*, *Candida albicans*; *C. parapsilosis*, *Candida parapsilosis*; COPD, chronic obstructive pulmonary disease; d, days; DM, diabetes mellitus; F, female; *F. nucleatum*, *Fusobacterium nucleatum*; GERD, gastroesophageal reflux disease; HHV-7, human herpesvirus 7; hMPV, human metapneumovirus; M, male; *M. abscessus*, *Mycobacterium abscessus*; *M. intracellulare*, *Mycobacterium intracellulare*; *N. abscessus*, *Nocardia abscessus*; *P. jirovecii*, *Pneumocystis jirovecii*; PTB, pulmonary tuberculosis; RA, rheumatoid arthritis; *S. anginosus*, *Streptococcus anginosus*; *S. apiospermum*, *Scedosporium apiospermum*; *S. boydii*, *Scedosporium boydii*; *S. pneumoniae*, *Streptococcus pneumoniae*; spp., species not identified to the species level; *T. whipplei*, *Tropheryma whipplei*; tNGS, targeted next-generation sequencing; EBV, Epstein–Barr virus; *P. aeruginosa*, *Pseudomonas aeruginosa*; SMZ: trimethoprim-sulfamethoxazole.

Table 2. Laboratory Results of 10 Institutional Patients.

Laboratory Examination	Reference	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Median	IQR (Q1–Q3)
WBC ($\times 10^9$/L)	3.5–9.5	5.01	5.7	4.77	3.69	13.33	6.38	4.98	4.69	4.33	4.39	4.88	4.38–5.87
ANC ($\times 10^9$/L)	1.8–6.3	2.57	3.91	2.25	1.26	9.85	4.06	3.43	2.18	2.4	2.55	2.56	2.23–3.95
ALC ($\times 10^9$/L)	1.1–3.2	2.84	1.5	2.03	2	2.93	1.88	0.89	2.16	1.2	1.46	1.94	1.40–2.33
HGB (g/L)	115–175	127	130	122	101	124	122	131	131	108	122	123	118.50–130.25
PLT ($\times 10^9$/L)	125–350	315	239	210	270	269	240	164	162	182	301	239.5	177.50–277.75
Albumin (g/L)	35–55	34.2	43.1	36.3	35.2	35.7	39.8	41.9	43.1	37.2	38.9	38.1	35.58–42.20
Globulin (g/L)	20–40	27.4	35.3	28.5	29.5	29.6	25.8	30.3	32	27.7	24.9	29	27.00–30.73
ALT (U/L)	7–50	21	41	14	14	24	12	26	23	18	21	21	14.00–24.50
AST (U/L)	13–40	23	59	21	21	20	17	23	27	22	25	22.5	20.75–25.50
Creatinine (μmol/L)	44–106	52	54.1	56.2	59.1	64.6	54.9	67.1	44.9	85.3	51.3	55.6	51.83–65.23
hs-CRP (mg/L)	0–10	0.88	1.68	0.92	0.37	15.84	0.73	14.42	0.2	18.43	1.19	1.06	0.64–14.78
ESR (mm/h)	0–20	22	63	-	17	-	23	25	-	54	32	25	22–54
PCT (ng/mL)	0–0.046	0.021	<0.02	0.022	<0.02	0.062	0.042	0.131	0.026	0.061	<0.02	0.024	0.020–0.061
IgG (g/L)	8.6–17.4	10.5	-	-	-	-	11.16	11.8	-	-	10.42	10.83	10.44–11.64
IgA (g/L)	1.0–4.2	1.76	-	-	-	-	3.94	3.96	-	-	2.11	3.03	1.85–3.96
IgM (g/L)	0.5–2.8	1.25	-	-	-	-	1.46	-	-	-	1.2	1.25	1.20–1.46
IgE (kU/L)	0–120	189.8	32.28	-	7.12	209.1	-	-	-	1129.09	109.43	149.62	25.99–439.10
BDG		Negative	-	-	-	-	Negative	-	Negative	Negative	Negative		
GM test		-	-	Negative	-	Negative	Negative	-	Negative	Negative	Negative		
$CD4^+$ T cell count (cells/μL)	550–1400	433	265	-	-	-	709	248	-	301	674	367	260.75–682.75
$CD8^+$ T cell count (cells/μL)	320–1250	355	299	-	-	-	668	85	-	105	529	327	100.00–563.75
CD4%	28–58	35.8	28.3	-	-	-	40	58	-	43.8	44.5	41.9	33.93–47.88
CD8%	19–48	27.6	31.6	-	-	-	38	19.9	-	15.3	34.9	29.6	18.75–35.68

Abbreviation: WBC: White Blood Cell; ANC: Absolute Neutrophil Count; ALC: Absolute Lymphocyte Count; HGB: Hemoglobin; PLT: Platelet; ALT: Alanine Aminotransferase; AST: Aspartate Aminotransferase; hs-CRP: high-sensitivity C-Reactive Protein; ESR: Erythrocyte Sedimentation Rate; PCT: Procalcitonin; BDG: (1,3)-β-D-glucan; GM: Galactomannan.

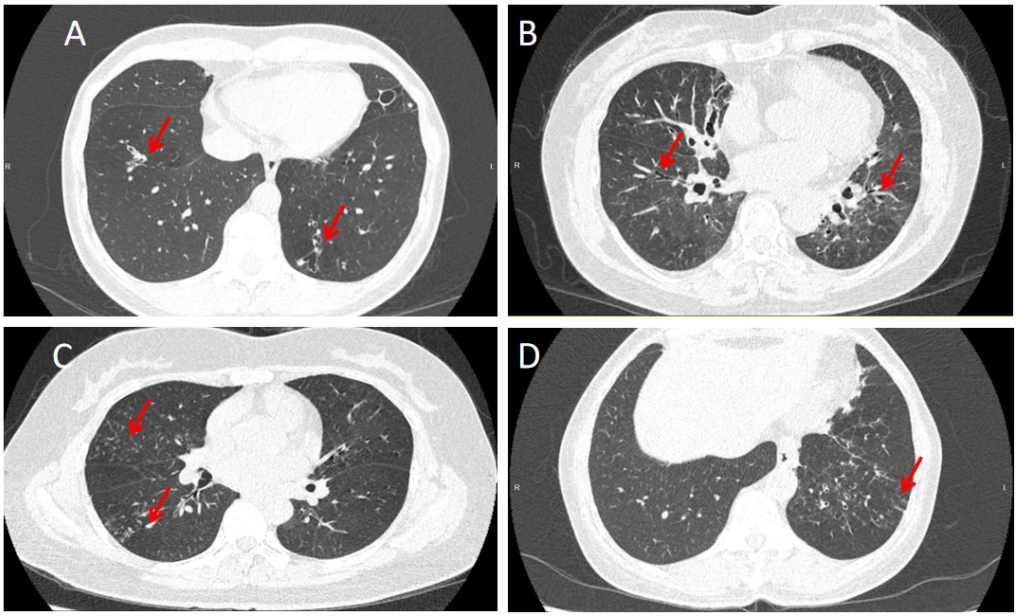


Figure 1. Chest imaging of patients infected by *Scedosporium* spp. (**A**): bilateral bronchiectasis, focal mucus plugging, and peripheral patchy opacities in P6; (**B**): bronchiectasis with intraluminal hyperdense spots and patchy opacities in bilateral lower lobes in P8; (**C**): patchy opacities and tree-in-bud sign in right lower lobe in P3; (**D**): patchy opacities in left lung in P10. Red arrows indicate the lesions.

3.5. Microbiological and Diagnostic Outcomes

In all 10 patients, tNGS results were reported 1 day after specimen receipt. Among the eight culture-positive patients, the culture reporting turnaround times were 9.0, 15.2, 11.3, 4.0, 5.2, 4.2, 6.1, and 5.2 days for P1, P2, P3, P4, P6, P7, P8, and P10, respectively, with a median of 5.7 days (range, 4.0–15.2 days). BALF tNGS detected *Scedosporium* in all patients (10/10, 100%), whereas BALF culture was positive in eight (8/10, 80%). Culture identified *S. apiospermum* in six patients (6/10, 60%) and *S. boydii* in two (2/10, 20%). All eight culture-positive patients also had positive tNGS results. Among the two culture-negative patients, tNGS identified *S. apiospermum* in P5 and *Scedosporium* spp. in P9 (without species-level identification). Eight patients were classified as having clinically diagnosed infection, whereas P5 and P9 had insufficient evidence to distinguish infection from colonization. The tNGS reads, classifications and supporting evidence are summarized in Supplementary Table S4. The median interval from symptom onset to the first detection of *Scedosporium* was 17 days (IQR, 7–32.5 days).

Additional organisms recovered from BALF cultures included *Nocardia abscessus* in P3 and *Mycobacterium abscessus* in P6 (2/10, 20%). All three organisms were also detected by tNGS. Additional microbial targets were detected by tNGS in 9/10 patients (90%). These included bacteria such as *Streptococcus pneumoniae*, fungi such as *Pneumocystis jirovecii* and *Aspergillus fumigatus*, and viruses including influenza virus, hMPV, HHV-7, and EBV.

Scedosporium was not recovered from follow-up cultures in P1 and P6. Follow-up tNGS did not detect *Scedosporium* in P2, P6, or P7. No follow-up microbiological results were documented for P3, P4, P5, P8, P9, or P10 (Table 1).

3.6. Treatment and Clinical Outcomes

All 10 patients, including eight with clinically diagnosed infection and two with insufficient diagnostic evidence, initially received voriconazole (200 mg every 12 h). Most patients subsequently transitioned to oral voriconazole for sequential step-down therapy after hospital discharge. Voriconazole-based therapy was generally well tolerated. P6 developed

tongue discoloration and was subsequently switched to isavuconazole. P3 experienced transient visual disturbances and gastrointestinal discomfort, but these adverse reactions were tolerable and did not require treatment modification. In addition to voriconazole, P1 received oseltamivir for influenza A infection. P3 received trimethoprim-sulfamethoxazole for culture-confirmed *N. abscessus*, and P6 received clarithromycin, moxifloxacin, and inhaled amikacin for culture-confirmed *M. abscessus*. These three patients were considered to have co-infections. Although tNGS detected other organisms in the remaining patients, these findings were considered to represent airway colonization based on the overall clinical presentation, and no corresponding treatment was administered. At the last documented follow-up, P1, P2 and P7 were classified as cured (3/10, 30%), whereas P3, P5, P6, P8 and P9 were classified as improved (5/10, 50%). P4 and P10 were lost to follow-up after only 3–5 days of documented treatment (2/10, 20%) and were therefore not evaluable for clinical outcome. Among the eight patients with evaluable outcomes, the median documented antifungal treatment duration was 75 days (range, 7–365 days). Treatment durations and outcome classifications are provided in Table 1.

3.7. Narrative Literature Review of Published Cases

Figure 2 summarizes the screening and inclusion of 37 adult cases of pulmonary scedosporiosis in non-immunocompromised hosts, and Table 3 summarizes the clinical characteristics of these cases [6–41].

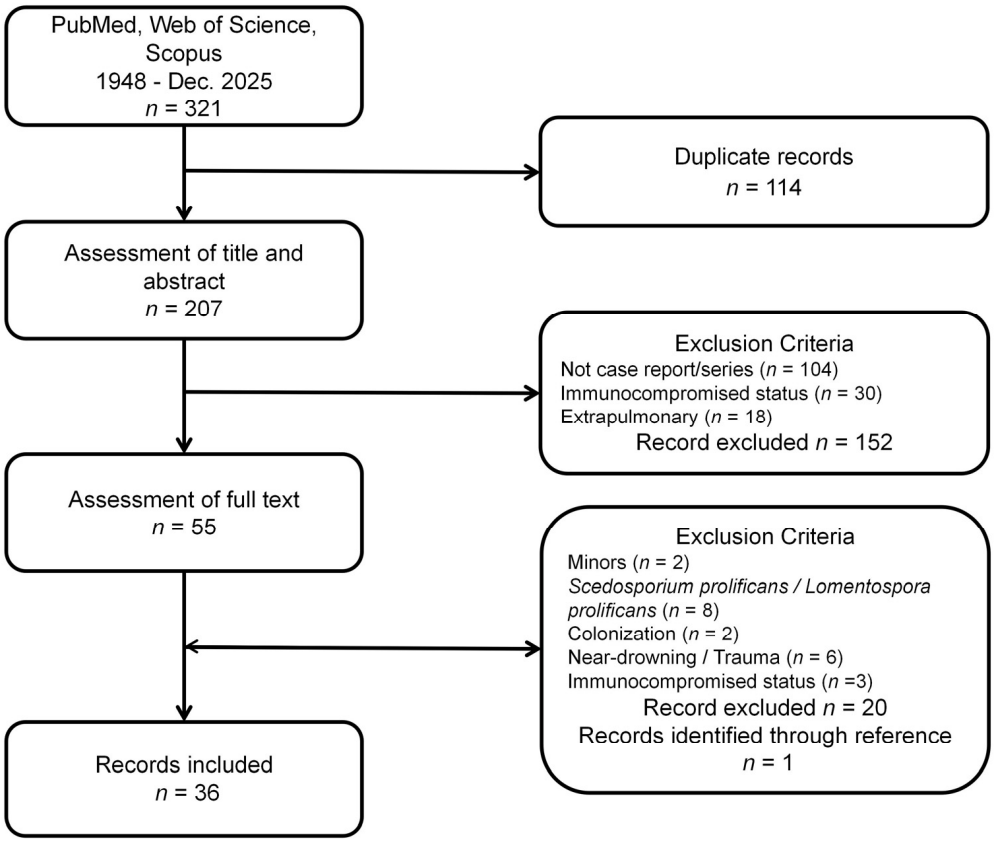


Figure 2. Flow diagram of study identification and selection for the narrative literature review. **Note:** The literature search and screening were conducted on 24 October 2026. The exclusion criteria were not mutually exclusive. Each record represented a unique publication.

Table 3. Characteristics of 37 Published Cases Included in the Literature Review.

Variable	Total (n = 37)	Percentage (%)
Age, median (IQR)	61 years (46–70 years)	
Sex		
Male	17	45.9
Female	20	54.1
Underlying conditions		
Pulmonary TB	15	40.5
COPD/bronchitis/emphysema	4	10.8
Bronchiectasis	8	21.6
GERD	1	2.7
Pulmonary NTM	4	10.8
Pulmonary Hypertension	1	2.7
Symptoms		
Cough	26	70.3
Hemoptysis	27	73.0
Fever	14	37.8
Radiological findings		
Infiltrates/opacities	13	35.1
Cavities	20	54.1
Fungal balls	17	45.9
Bronchiectasis	12	32.4
Anatomical location		
Upper lobe	14	37.8
Lower lobe	10	27.0
Left lung	28	75.7
Right lung	24	64.9
Middle lobe	4	10.8
Scedosporium spp.		
S. apiospermum	24	64.9
S. boydii	2	5.4
Pseudallescheria boydii	8	21.6
Not identified to species level	3	8.1
Disease extent		
Pulmonary disease	34	91.9
Disseminated disease	3	8.1
Co-infection		
NTM	3	8.1
TB	1	2.7
Aspergillus	1	2.7

Table 3. *Cont.*

Variable		Total (n = 37)	Percentage (%)
	Pseudomonas aeruginosa	1	2.7
	Haemophilus influenzae	1	2.7
	Staphylococcus aureus	1	2.7
Diagnostic method			
	BALF culture	27	73.0
	Pulmonary tissue fungal culture	16	43.2
	Sputum culture	7	18.9
	NGS	3	8.1
	Blood culture	1	2.7
Treatment			
	Voriconazole	19	51.4
	Itraconazole	5	13.5
	Miconazole	2	5.4
	Ketoconazole	1	2.7
	Isavuconazole	1	2.7
	Amphotericin B	4	10.8
	Posaconazole	1	2.7
	Terbinafine	1	2.7
	Surgery	14	37.8
	No antifungal treatment	5	13.5
Outcome			
	Cure	15	40.5
	Improved	14	37.8
	Death	3	8.1
	Lost to follow-up	5	13.5
Time to diagnosis, median		5 months (n = 30)	
Antifungal treatment duration, median		5.25 months (n = 22)	
Culture turnaround time, median		12 days (n = 9)	

Note: Pulmonary tissue fungal culture included specimens obtained by percutaneous or bronchoscopic biopsy or surgical resection, as applicable. Organism names were retained as reported in the source publications; historical names such as *Pseudallescheria boydii* were retained when contemporary species-level reassignment could not be verified. Qualitative or nonconvertible time descriptions were excluded, and missing data were not imputed. Outcomes reflect the terminology used in the source publications. Percentages were calculated using all 37 cases unless otherwise specified. Underlying conditions, symptoms, co-infections, radiological findings, anatomical location, diagnostic method and treatments were non-mutually exclusive. **Abbreviations:** BALF, bronchoalveolar lavage fluid; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; n, number of cases; NGS, next-generation sequencing; *S. apiospermum*, *Scedosporium apiospermum*; *S. boydii*, *Scedosporium boydii*; TB, tuberculosis; GERD, Gastroesophageal Reflux Disease. NTM, nontuberculous mycobacteria.

The 37 published cases had a median age of 61 years (IQR, 46–70 years) and included 17/37 men (45.9%) and 20/37 women (54.1%). At least one underlying condition was reported in 26/37 cases (70.3%). The most frequently reported conditions were pulmonary

tuberculosis (15/37, 40.5%), bronchiectasis (8/37, 21.6%), COPD, chronic bronchitis, or emphysema (4/37, 10.8%). Cough, hemoptysis, and fever were reported in 26/37 (70.3%), 27/37 (73.0%), and 14/37 cases (37.8%), respectively.

Laboratory findings were available for 24/37 cases (64.9%). At least one reported WBC, CRP, or ESR was elevated in 11/24 cases (45.8%). The reported inflammatory-marker values were within reference limits in the other 10/24 cases (41.7%). Serum (1,3)-β-D-glucan (BDG) results were reported only for Cases 23 and 25 and were positive in both (2/2). GM results were reported for two cases: BALF-GM was negative in Case 32, whereas the serum GM index was 0.585 in Case 37.

Radiologically, cavities were reported in 20/37 cases (54.1%), followed by fungal balls in 17/37 (45.9%), infiltrates or opacities in 13/37 (35.1%), and bronchiectasis in 12/37 (32.4%). Left- and right-lung involvement was reported in 28/37 (75.7%) and 24/37 cases (64.9%), respectively. Upper-, lower-, and middle-lobe involvement was reported in 14/37 (37.8%), 10/37 (27.0%), and 4/37 cases (10.8%), respectively (Supplementary Material, Table S1).

All 37 cases were microbiologically confirmed by culture. The reported identifications were *S. apiospermum* in 24/37 cases (64.9%) and *S. boydii* in 2/37 (5.4%). A total of 8/37 cases (21.6%) were reported as *Pseudallescheria boydii* (a historical designation retained from the original articles). The culture specimen sources included BALF in 27/37 cases (73.0%), pulmonary tissue in 16/37 (43.2%), sputum in 7/37 (18.9%), and blood in 1/37 (2.7%). NGS was additionally used in 3/37 cases (8.1%), all of which were also culture-confirmed. Disseminated disease occurred in 3/37 patients (8.1%). Co-infections were reported in 8/37 cases (21.6%), most commonly with NTM (3/37, 8.1%). Tuberculosis, *Aspergillus*, *Pseudomonas aeruginosa*, *Haemophilus influenzae*, and *Staphylococcus aureus* were each reported in 1/37 cases (2.7%). Among the 30 cases with quantifiable data, the median interval from symptom onset to definitive microbiological diagnosis was 5 months. Among the nine cases reporting culture turnaround time, the median was 12 days.

Voriconazole was administered in 19/37 cases (51.4%). Surgery was performed in 14/37 cases (37.8%); 4/37 patients (10.8%) underwent surgery without antifungal therapy, whereas 10/37 (27.0%) received combined antifungal and surgical treatment. The median antifungal treatment duration was 5.25 months among 22 cases with convertible duration data. Surgery was performed in Cases 1, 3, 10, 12, 15, 16, 18–20, 22, 26, 27, 33 and 34. Their indications, procedures, pathological findings, and perioperative antifungal treatments are summarized in Supplementary Material (Table S3). According to the outcomes reported in the source articles, 15/37 patients (40.5%) were cured, 14/37 (37.8%) improved, 3/37 (8.1%) died, and 5/37 (13.5%) were lost to follow-up. Of the three deaths, two were considered attributable to pulmonary scedosporiosis or related complications, whereas one was indeterminate because the cause of death was not reported. Detailed information on the reported treatments and outcomes is provided in the Supplementary Materials (Tables S1–S3).

4. Discussion

All 10 patients in the institutional series were classified as non-immunocompromised according to the study definition. To characterize pulmonary scedosporiosis in this population, we additionally reviewed 37 published cases in non-immunocompromised hosts. Whereas scedosporiosis following near-drowning or in profoundly immunocompromised hosts is associated with invasive disease and poor outcomes [42,43], disease in non-immunocompromised hosts predominantly affected patients with chronic structural lung disease and generally followed a subacute or chronic course. Common manifestations included cough, sputum production, and hemoptysis. Radiological findings included focal

opacities, cavities, fungal balls, and endobronchial mucus impaction. Treatment was primarily triazole-based, particularly with voriconazole, and most reported outcomes were favorable. Surgical resection may be considered as adjunctive therapy for localized disease, recurrent symptoms, or an inadequate response to antifungal treatment.

Scedosporium spp. are ubiquitous in environmental reservoirs, including soil and sewage. In healthy hosts, inhaled conidia are usually removed by mucociliary clearance. However, structural lung disease may provide an anatomical niche for persistent airway colonization or invasion by *Scedosporium* spp. [1,33]. In our analysis, chronic structural or airway disease affected 8/10 institutional patients, most commonly bronchiectasis, while pulmonary tuberculosis was the most common underlying condition in published cases. Post-tuberculosis cavities, impaired mucus clearance associated with bronchiectasis, and repeated antibiotic exposure may weaken airway defenses, disrupt the local microbiota, and increase susceptibility to fungal infection [35].

Reduced CD4+ T-cell counts were observed in 4/6 tested patients, including P7 (Table 2). Single measurements obtained during active pulmonary illness cannot determine whether these abnormalities were transient changes associated with acute infection or persistent cellular immune impairment, and repeat testing after clinical stabilization may clarify their significance. Systemic inflammation was generally mild, and BDG and GM results were negative in all patients tested. Although this small series cannot establish biomarker sensitivity, respiratory fungal culture or molecular testing remains appropriate when symptoms and imaging suggest pulmonary scedosporiosis, despite unremarkable blood markers.

tNGS identifies microorganisms by enriching and sequencing predefined microbial nucleic acid targets and comparing the resulting sequences with reference databases. It does not require viable microbial growth and can provide etiological clues within 1–2 days of laboratory receipt. However, tNGS is costly, and its detection performance depends on specimen quality, microbial nucleic acid abundance, and target coverage. Results must therefore be interpreted alongside symptoms, imaging, conventional microbiological findings, and the clinical course. In this case series, species-level identifications by tNGS and culture were concordant in all eight culture-positive cases. Two patients (P5 and P9) had *Scedosporium* detected only by tNGS, without culture confirmation, resulting in lower diagnostic certainty than in culture-positive cases. Both experienced symptomatic improvement following antifungal treatment, supporting clinical suspicion of infection but not excluding colonization or contributions from other causes. These cases illustrate the interpretation of molecular findings and treatment decisions in routine clinical practice and suggest that tNGS may provide etiological clues. They may also offer practical insights for clinicians to discuss the role of NGS in managing rare pathogen infection.

Pulmonary Scedosporiosis may present with nonspecific cavitary lesions or fungal balls, while its hyaline, septate, branching hyphae may be difficult to distinguish morphologically from those of *Aspergillus*. In the institutional cohort, *Aspergillus fumigatus* and nontuberculous mycobacteria (NTM) were each detected alongside *Scedosporium*. These environmentally acquired opportunistic pathogens share several host susceptibility factors, including impaired airway clearance and structural lung damage (especially bronchiectasis). *Scedosporium* and *Aspergillus* may both present radiologically as cavities or fungal balls and microscopically as hyaline, septate, branching hyphae, making differentiation based solely on imaging or morphology difficult [3,5]. Culture and molecular methods such as NGS should therefore be used to establish species-level identification. Because *S. apiospermum* complex commonly exhibits high amphotericin B MICs, its misidentification as *Aspergillus* or another mold followed by empirical amphotericin B therapy may result in suboptimal treatment and delay effective therapy [1,4,44,45]. Both NTM and *Scedosporium* occur in

soil and aquatic environments and may colonize or cause disease in structurally abnormal airways. In institutional cases, NTM and *Scedosporium* were simultaneously detected in P6 and P9. The pulmonary abnormalities could have been attributable to either organism or both, and their relative contributions could not be determined from the available data. Simultaneous detection alone did not establish coinfection. The pathogenic significance of each organism should be assessed separately by integrating symptoms, serial imaging, repeated isolation or culture results, and longitudinal treatment response before therapy is initiated. Because rifampicin-containing NTM regimens can markedly reduce voriconazole exposure and thereby compromise the treatment of pulmonary scedosporiosis [29], treatment priority, drug interactions, regimen modification, and alternative agents should be assessed in advance when both diseases require therapy.

Antifungal susceptibility varies considerably among *Scedosporium* spp., making species-level identification clinically relevant [45]. Both tNGS and culture-based methods can support species-level identification. In our institutional cohort, tNGS results were reported within 1–2 days, whereas final positive fungal culture reports were issued after a median of 5.7 days (range, 4.0–15.2 days). These complementary roles support the combined use of tNGS and fungal culture to provide timely species-level information while retaining cultured isolates for conventional confirmation and antifungal susceptibility testing. Current guidelines recommend voriconazole as first-line therapy for scedosporiosis, but the optimal treatment timing and duration for localized pulmonary disease in non-immunocompromised hosts remain unclear [4,44]. Given the heterogeneity among cases, treatment should be individualized according to clinical characteristics, and the optimal duration requires further investigation. Voriconazole-associated adverse effects, particularly hepatotoxicity, visual disturbances, phototoxicity, and periostitis, warrant monitoring. Renal concerns primarily relate to the sulfobutylether-β-cyclodextrin vehicle used in the intravenous formulation in patients with renal impairment. Adverse reactions were recorded in P3 and P6. P6 developed tongue discoloration, which resolved after switching to isavuconazole while clinical improvement was maintained. Isavuconazole may be considered when voriconazole is not tolerated, although evidence supporting its use in scedosporiosis remains limited. Given the limited susceptibility of *Scedosporium* to available monotherapies and their adverse effects, combination therapy also merits further exploration. A case report suggested that terbinafine has limited in vitro activity when used alone but may act synergistically with voriconazole [28]. Other emerging antifungal strategies may provide future therapeutic options for drug-resistant molds such as *Scedosporium*, although their clinical value requires further investigation [46].

The ESCMID/ECMM guideline recommends surgical intervention for a single cavitary lung lesion causing hemoptysis or for a progressive cavitary lung lesion, although the supporting evidence is primarily based on case reports and expert opinion [4]. All 14 surgical patients in this study were identified from published case reports (Supplementary Material, Tables S1 and S3). The main indications were disease progression, relapse, and persistent complications despite medical therapy. Most patients were cured or improved, while only one died of severe pulmonary scedosporiosis. Given potential publication bias, variable follow-up, and the small sample size, the optimal timing and extent of resection, perioperative antifungal regimens, surgical safety and recurrence risk in non-immunocompromised patients require further investigation.

Several limitations should be considered. First, the small cohort precluded reliable assessment of risk and prognostic factors. Second, neither antifungal susceptibility testing nor therapeutic drug monitoring was performed, limiting individualized assessment of antifungal selection, drug exposure, efficacy, and toxicity. Third, the single-center retrospective design was susceptible to regional variation and referral bias. The use of tNGS in

clinically selected patients may also have introduced testing-selection bias and favored the identification of diagnostically complex cases. Fourth, differences in treatment duration and outcomes between the institutional and literature cohorts should not be interpreted as comparative effectiveness because of heterogeneity in case selection, follow-up, and outcome definitions. Fifth, in patients with polymicrobial detection, our diagnostic framework could not definitively distinguish mixed infection from infection with concomitant airway colonization, and concurrent organism-directed treatment prevented attribution of clinical improvement to a single pathogen or treatment. The absence of an independent reference standard also precluded assessment of tNGS diagnostic accuracy. Finally, the literature review was dominated by case reports and therefore subject to publication bias.

5. Conclusions

Pulmonary scedosporiosis in non-immunocompromised hosts often accompanies a structural lung disease, particularly bronchiectasis and post-tuberculosis sequelae. Its clinical and radiological features overlap with aspergillosis and nontuberculous mycobacterial disease, requiring integrated clinical, radiological, bronchoscopic, and microbiological assessment. In this cohort, tNGS provided results in the early stage, while co-detected airway organisms required clinical interpretation. Bronchoscopy may facilitate fungal culture and molecular testing in patients with persistent or progressive pulmonary lesions. Surgical intervention may be considered for a single cavitary lung lesion causing hemoptysis or for a progressive cavitary lung lesion. Voriconazole remains the mainstay of treatment, with regimens individualized according to species, disease extent, clinical response, drug interactions, and toxicity.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/jof12110819/s1, Table S1: Clinical characteristics, diagnostic approaches, treatment, and outcomes of published pulmonary scedosporiosis cases in non-immunocompromised patients; Table S2: Laboratory findings, BDG/GM assay results, and bronchoscopic findings in the included cases; Table S3: Surgical management of published pulmonary scedosporiosis cases in non-immunocompromised patients; Table S4. Diagnostic Classification and Supporting Evidence for Each Patient in Institutional Cohort.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of The Eighth Affiliated Hospital, Sun Yat-sen University (19 August 2026).

Informed Consent Statement: Informed consent for participation is not required as per Article 32 of "the Measures for Ethical Review of Life Science and Medical Research Involving Humans" in China, as this study uses data generated through observation without interfering with public behavior and

anonymized information data, does not cause harm to the human body, and does not involve sensitive personal information or commercial interests.

Data Availability Statement: The raw data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to patient privacy and institutional ethics regulations, clinical datasets (including sequencing data and high-resolution imaging) are not publicly available.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

ALC	Absolute lymphocyte count
ALT	Alanine aminotransferase
ANC	Absolute neutrophil count
AS	Ankylosing spondylitis
AST	Aspartate aminotransferase
BALF	Bronchoalveolar lavage fluid
BMI	Body mass index
COPD	Chronic obstructive pulmonary disease
DM	Diabetes mellitus
hs-CRP	high-sensitivity C-reactive protein
EBV	Epstein–Barr virus
ESR	Erythrocyte sedimentation rate
GERD	Gastroesophageal reflux disease
GM	Galactomannan
HGB	Hemoglobin
HHV-7	Human herpesvirus 7
hMPV	Human metapneumovirus
BDG	(1,3)-β-D-glucan
NTM	Nontuberculous mycobacteria
PCT	procalcitonin
tNGS	Targeted next-generation sequencing
WBC	White blood cell
PLT	Platelet
PTB	Pulmonary tuberculosis

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