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Pulmonary Non-Tuberculous Mycobacterial Infection Mimicking Tuberculosis: A Case Series Diagnosed by Bronchoalveolar Lavage Culture

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Abstract: ***Pulmonary non-tuberculous mycobacteria (NTM) can mimic pulmonary tuberculosis, particularly in TB-endemic regions, leading to delayed diagnosis and inappropriate therapy. This prospective case series describes six adults presenting with chronic respiratory symptoms and radiological findings suggestive of tuberculosis who showed poor response to empirical anti-TB therapy or conventional therapy. All patients underwent bronchoscopy with bronchoalveolar lavage (BAL) for microbiological evaluation following inconclusive sputum investigations. BAL culture identified NTM, including Mycobacterium abscessus and Mycobacterium avium complex. High-resolution computed tomography demonstrated bronchiectatic and fibrocavitary patterns consistent with pulmonary NTM disease. Species-directed treatment resulted in early clinical improvement. These findings emphasize the importance of considering pulmonary NTM in patients with presumed tuberculosis who fail conventional treatment and support BAL culture as a valuable diagnostic tool for microbiological confirmation.***

Keywords: Non tuberculous mycobacteria, pulmonary NTM disease, bronchoscopy, tuberculosis mimic, bronchiectasis, and BAL culture

1. Introduction

This study aimed to describe the clinical presentation, radiological features, microbiological diagnosis, and early treatment outcomes of patients with pulmonary NTM infection diagnosed through BAL culture after presumed tuberculosis treatment failure.

Non-tuberculous mycobacteria (NTM) encompass more than 190 species of mycobacteria other than Mycobacterium tuberculosis complex and Mycobacterium leprae [1]. NTM are aerobic, non-spore-forming, Gram-positive rods that are ubiquitous in the environment. Endorsed by the American Thoracic Society (ATS) and Infectious Diseases Society of America (IDSA) as clinically significant pathogens, NTM are capable of causing progressive pulmonary disease, particularly in immunocompromised hosts or those with pre-existing structural lung disease [1,2].

Pulmonary NTM disease poses a substantial diagnostic challenge because its clinical presentation closely overlaps with pulmonary tuberculosis. Patients typically present with chronic respiratory symptoms, including cough, haemoptysis, weight loss, low-grade fever, night sweats, and dyspnoea, symptoms indistinguishable from TB. Radiological features, including fibrocavitary lesions, nodular infiltrates, and bronchiectasis, further compound the diagnostic confusion [1,2].

In TB-endemic settings such as India, empirical anti-TB therapy is frequently commenced without microbiological confirmation, resulting in delayed NTM diagnosis, inappropriate treatment, and progressive lung destruction. A key clinical clue is persistent or worsening symptoms despite an adequate course of standard anti-TB or antibiotic therapy [3].

The global burden of pulmonary NTM disease is increasing. Prevots and Marras reported rising NTM prevalence across North America, Europe, and Asia-Pacific, with Mycobacterium avium complex (MAC) and rapidly growing mycobacteria (M. abscessus, M. chelonae) being the predominant species [4]. In India, Gupta et al. reported 18 cases of NTM from a tertiary centre, with MAC and M. abscessus being the most common isolates [3].

The ATS/IDSA 2007 diagnostic criteria require: (i) compatible clinical and radiological features, (ii) exclusion of other diagnoses, and (iii) microbiological confirmation — either two or more positive sputum cultures, or one positive BAL culture, or a compatible lung biopsy with mycobacterial histopathology [1]. The 2020 ATS/ERS/ESCMID/IDSA guidelines updated treatment recommendations, particularly for MAC and M. abscessus [2].

Fibreoptic bronchoscopy with BAL culture is especially valuable when sputum cultures are negative or inconclusive a common scenario in NTM disease due to the intermittent shedding of organisms [1,2]. HRCT chest is the imaging modality of choice and demonstrates two dominant phenotypes: fibrocavitary disease and the nodular bronchiectatic phenotype [1].

Pulmonary NTM infection remains underdiagnosed in TB-endemic countries due to: (i) clinical and radiological overlap

with TB; (ii) routine initiation of empirical anti-TB therapy without microbiological confirmation; (iii) slow growth of NTM on conventional culture media; and (iv) low clinical suspicion among practitioners. The consequence is prolonged inappropriate therapy, progressive lung destruction, and significant patient morbidity. This case series addresses the diagnostic gap by systematically documenting six confirmed cases of pulmonary NTM diagnosed via BAL culture.

2. Methodology / Approach

A prospective observational case series was conducted in the Department of Respiratory Medicine, MGM Medical College and Hospital, Navi Mumbai. Patients were recruited over a defined window from January 2024 to December 2025. Screened several patients with tb like symptoms, Six patients presenting with chronic respiratory symptoms persisting beyond six weeks and failure to respond to at least one course of empirical anti-TB therapy or antibiotic therapy defined as no clinical improvement after a minimum of four weeks of treatment were enrolled. Institutional Ethics Committee approval and informed patient consent were obtained.

A standardized data collection proforma was used for all patients, capturing demographics, symptom duration, prior treatment history, microbiological results, imaging findings, treatment administered, and 8–24 week clinical outcome.

All patients underwent: (i) detailed clinical history and physical examination; (ii) baseline sputum AFB smear and MGIT culture; (iii) chest X-ray (posteroanterior view); (iv) high-resolution computed tomography (HRCT) of the chest; and (v) fibreoptic bronchoscopy with bronchoalveolar lavage (BAL). BAL specimens were processed for AFB smear, mycobacterial culture (Lowenstein-Jensen medium and MGIT 960), and species identification by line probe assay or MALDI-TOF where available.

DST was performed where available using CLSI methodology; results were used to guide therapy selection. In cases where DST was not obtained, treatment was initiated based on species-directed empirical regimens per 2020 ATS guidelines.

DST was available in three out of the six patients.

Inclusion criteria:
- Adults (≥18 years)
- Chronic respiratory symptoms for ≥6 weeks
- Failure to respond to ≥1 course of empirical anti-TB or antibiotic therapy (defined as no clinical improvement after 4 weeks)
- At least one positive BAL mycobacterial culture
- HRCT chest findings compatible with NTM disease

Exclusion criteria:
- Confirmed M. tuberculosis on culture/GeneXpert
- Patients who refused bronchoscopy
- Incomplete clinical data

Follow-up duration:
Clinical follow-up ranged from 8 to 24 weeks, with symptomatic improvement documented in all six patients at the most recent available assessment

Limitations: Follow-up duration was variable and relatively short; long-term microbiological clearance and relapse rates were yet to be assessed.

Standardized treatment protocol:
Treatment was guided by species identification and current ATS/ERS/ESCMID/IDSA recommendations. Rapidly growing NTM, particularly *Mycobacterium abscessus*, was treated with a multidrug regimen including amikacin, imipenem/cefoxitin, and Tigecycline, with additional agents such as clofazimine or linezolid used based on susceptibility patterns and clinical response. MAC was treated with a macrolide (azithromycin/clarithromycin), rifampicin, and ethambutol. Treatment duration and regimen modifications were individualized according to culture conversion, radiological response, and drug tolerability.

Diagnosis of pulmonary NTM disease was established per ATS/IDSA 2007 criteria: compatible clinical and radiological findings with at least one positive BAL mycobacterial culture. Patients with confirmed M. tuberculosis were excluded.

Table 1: Summary of six cases of pulmonary NTM infection diagnosed via BAL culture

Case	Age/Sex	Clinical History	BAL Culture	Radiology	Outcome
1	56/F	Chronic cough, weight loss, appetite loss; empirical anti-TB therapy twice; multiple hospitalizations	M. abscessus (rapidly growing NTM)	Fibrocavitary changes (CXR); bronchiectasis (HRCT)	Improved on targeted therapy
2	61/M	Cough, exertional breathlessness, prior inhaler use, fever, appetite loss	MAC (M. avium complex)	Nodular pattern; bronchiectasis (HRCT)	Improved on macrolide-based regimen
3	37/M	Cough, fever, multiple hospitalizations, prior inhaler use	MAC (M. avium complex)	Bronchiectasis (CT)	Symptomatic improvement
4	61/F	Exertional breathlessness, recurrent infections, weight loss, prior anti-TB therapy	M. abscessus (rapidly growing NTM; species confirmed)	Fibrocavitary changes; bronchiectasis; nodular pattern (CT)	Improved on targeted therapy
5	80/F	On empirical anti-TB therapy ; chronic cough, appetite loss, pleuritic chest pain	M. abscessus (rapidly growing NTM; species confirmed)	Fibrocavitary changes; bronchiectasis (CT)	Symptomatic and radiological improvement
6	65/F	Exertional breathlessness, chronic cough, prior empirical anti-TB therapy	M. abscessus (rapidly growing NTM)	Bronchiectasis (CT)	Symptomatic improvement

BAL: Bronchoalveolar lavage; MAC: Mycobacterium avium complex; HRCT: High-resolution CT; NTM: Non-tuberculous mycobacteria.

3. Results & Discussion

All six patients were adults (age range 37–80 years; mean age was approximately 63 years), comprising four females and two males. All presented with chronic cough, weight loss, and low-grade fever, with exertional breathlessness in four. A consistent and clinically significant finding was prior receipt of empirical anti-TB therapy in at least one patient twice, without microbiological confirmation and without meaningful clinical improvement.

Sputum AFB smears were negative or inconclusive in all six cases, highlighting the inadequacy of sputum-based evaluation for NTM disease. Chest X-ray demonstrated fibrocavitary changes in four patients; HRCT showed bronchiectasis in all six, with a nodular-bronchiectatic phenotypes in two and fibrocavitary changes in four consistent with the two dominant HRCT phenotypes of pulmonary NTM disease described in literature [1].

BAL culture confirmed M. abscessus in four patients and MAC in two. M. abscessus, a rapidly growing mycobacterium, is associated with a more challenging clinical course and requires intensive multi-drug regimens including amikacin, imipenem, and macrolides [2]. MAC requires a macrolide-based regimen combined with rifampicin and ethambutol [1,2]. Following species-directed therapy, all six patients demonstrated improvement within 2–3 months.

These findings are consistent with published Indian literature. Gupta et al. [3] reported MAC and rapidly growing NTM as the predominant species from a tertiary centre, mirroring our cohort. The importance of bronchoscopy with BAL culture as the diagnostic cornerstone — particularly when sputum cultures are negative — is well established [1,5]. A single positive BAL culture meets the ATS/IDSA microbiological criterion for NTM pulmonary disease [1].

Future research should focus on: (i) epidemiological prevalence studies of pulmonary NTM disease in India across different geographic regions; (ii) molecular typing and drug susceptibility testing to guide optimal treatment regimens, particularly for M. abscessus; (iii) assessment of outcomes with newer agents such as amikacin liposome inhalation suspension (ALIS) for MAC and clofazimine-containing regimens for M. abscessus; and (iv) development of rapid diagnostic assays to reduce diagnostic delay in resource-limited settings.

4. Conclusion

This case series highlights that pulmonary non-tuberculous mycobacterial infection may clinically and radiologically mimic pulmonary tuberculosis, particularly in TB-endemic settings. In patients with persistent symptoms despite empirical anti-tubercular treatment and inconclusive sputum investigations, bronchoscopy with BAL culture may facilitate microbiological diagnosis and species identification. Early recognition of pulmonary NTM may reduce inappropriate therapy and support more appropriate disease-specific management. Fibreoptic bronchoscopy with BAL culture serves as a valuable diagnostic tool enabling species-specific identification and targeted treatment. HRCT chest characterises disease pattern and extent.

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