Brief Report

Mycobacterium gordonae: the canary in the coal mine?

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Abstract: *Mycobacterium gordonae* (*M. gordonae*) is a species of nontuberculous mycobacteria (NTM) that rarely causes infection. It has previously been labeled the most common NTM contaminant. Bronchiectasis is a disease characterized by abnormal airway dilation leading to chronic cough, sputum production and pulmonary infections. Patients with bronchiectasis are at higher risk of NTM-lung disease with more pathogenic NTM species including *Mycobacterium avium* complex (MAC) and *Mycobacterium abscessus* (*M. abscessus*). The relationship between bronchiectasis and less-pathogenic NTM species such as *M. gordonae* is less well understood. We performed a retrospective study on patients who had *M. gordonae* isolated from respiratory specimens at UConn Health between May 2nd, 2010 and October 18th, 2022. *M. gordonae* was isolated 74 times from 56 patients. It was isolated 35 (47.3%) times from 31 patients with bronchiectasis and 39 (52.7%) times from 26 patients without bronchiectasis. Data was available on all mycobacterial cultures sent from May 2nd 2018 to October 18th 2022. Mycobacterial cultures sent from patients with bronchiectasis were significantly more likely to grow *M. gordonae* than patients without bronchiectasis (4.3% *vs.* 1.6%, P=0.007). Furthermore, when considered at the patient level, there remained a significant increased rate of *M. gordonae* isolation among patients with bronchiectasis (7.1% *vs.* 2.2%, P<0.001). We then looked at past and future isolation of more pathogenic NTM species and found a non-statistically increased rate of isolation of more pathogenic NTM species including MAC and *M. abscessus* in patients with bronchiectasis (45.2% *vs.* 29%, P=0.09). Based on our results, isolation of *M. gordonae* should raise suspicion of chronic airway disease and defects in host immune response, such as those seen in bronchiectasis. Furthermore, isolation of *M. gordonae* may suggest increased risk of infection with more pathogenic NTM species such as MAC and *M. abscessus*.

Keywords: Bronchiectasis; nontuberculous mycobacteria (NTM); *Mycobacterium gordonae* (*M. gordonae*); *Mycobacterium avium* complex (MAC)

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Introduction

Several nontuberculous mycobacteria (NTM) species are rarely associated with clinical disease, despite being isolated from respiratory samples. The most common of these less pathogenic NTM is *Mycobacterium gordonae* (*M. gordonae*), often considered a contaminant (1) as it is frequently recovered from laboratory faucets, pipelines and freshwater (2). Pseudo-outbreaks have been reported, implicating contaminated tap water or ice, topical anesthetics, and medications (3). Symptomatic infection is quite rare, usually occurring in severely immunocompromised patients.

Patients with bronchiectasis are at greater risk of infection by pathogenic NTM species including *Mycobacterium avium* complex (MAC) and *Mycobacterium abscessus* (*M. abscessus*) than the general population (4). We theorized that isolation of less pathogenic NTM, such as *M. gordonae*, would also be associated with bronchiectasis,

reasoning that defects in airway host defense (5) that increase risk for pathogenic NTM might also increase the likelihood of colonization with less pathogenic NTM. We further theorized that colonization with a less pathogenic NTM might indicate a degree of host defense impairment that could be a marker for increased risk of developing infection by more pathogenic NTM. Accordingly, we performed a retrospective study to investigate these questions.

Methods

We used records from the University of Connecticut mycobacteriology laboratory to identify isolates of *M. gordonae* between May 2nd, 2010 and October 18th, 2022. We then performed a retrospective chart review to delineate characteristics, comorbid medical conditions of patients from whom *M. gordonae* was isolated, and past and future isolation of any other NTM.

Further analysis was conducted on patients with *M. gordonae* from May 2nd, 2018 to October 18th 2022, the period during which we had access to diagnosis codes (an electronic health record was implemented on May 2, 2018), to assess for an association between isolation of *M. gordonae* and the presence of bronchiectasis. ICD-10 codes identifying patients with bronchiectasis included J47.0, J47.1 and J47.9. Fisher's exact test was utilized to determine the association of *M. gordonae* with the presence of bronchiectasis. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review board of UConn Health (IRB No. 22X-243-1) on March 8th, 2022. Individual consent for this retrospective analysis was waived.

Results

M. gordonae was isolated 35 times from 31 patients with bronchiectasis and 39 times from 26 patients without bronchiectasis. Baseline patient characteristics, the respiratory specimen type and indication for mycobacterial culture are shown in *Table 1*.

Among the 31 bronchiectasis patients who grew *M. gordonae*, 11 (35.5%) had previously grown a pathogenic NTM and 5 (16.1%) subsequently grew a pathogenic NTM. Overall, 14 (45.2%) grew one or more pathogenic NTM either before or after growing *M. gordonae* (23 total positive isolates; 20 MAC and 3 *M. abscessus* or "*M. chelonae/abscessus*"). Among 155 patients with bronchiectasis who never had isolation of *M. gordonae*, 45 (29.0%) grew pathogenic NTM at some point during their course (P=0.09 compared to patients who grew *M. gordonae*). Six patients (19.4%) of those who grew *M. gordonae* grew MAC at least twice, therefore meeting American Thoracic Society criteria for MAC lung disease (6), while 25 patients among the 155 (16.1%) non-*M. gordonae* cohort met ATS criteria for NTM lung disease. Among the 26 patients without bronchiectasis who grew *M. gordonae*, 1 (4%) had previous isolation of MAC and 1 (4%) subsequently grew MAC. *Table 2* summarizes prior and subsequent growth of pathogenic NTM from patients who grew *M. gordonae*.

Between May 2nd, 2018 and October 18th 2022, among 1,346 mycobacterial cultures, 394 (29.3%) were from patients with bronchiectasis and 952 (70.7%) from patients without bronchiectasis. Among the 394 cultures from patients with bronchiectasis, 17 (4.3%) grew *M. gordonae*. Among the 952 cultures from patients without bronchiectasis, 16 (1.7%) grew *M. gordonae* (P=0.007). When considered at the patient level, there remained a statistically significant increased rate of *M. gordonae* isolation among patients with bronchiectasis. Among 754 unique patients who had mycobacterial cultures sent, 168 patients had bronchiectasis and 586 patients did not have bronchiectasis. Of the 168 patients with bronchiectasis, 12 (7.1%) had at least one mycobacterial culture that grew *M. gordonae*. Of the 586 patients without bronchiectasis, 13 (2.2%) had at least one mycobacterial culture that grew *M. gordonae* (P<0.001).

One of the 57 patients who grew *M. gordonae* was felt to have infection necessitating treatment. This patient was a 39-year-old male with history of psoriatic arthritis and sarcoidosis on adalimumab who presented with chronic productive cough found to have bilateral pulmonary nodules and thoracic lymphadenopathy. Expectorated mycobacterial culture on July 11th, 2016 grew *M. gordonae*. He was treated for approximately 5 months with rifampin and ethambutol but failed to follow-up to complete treatment.

Discussion

The link between bronchiectasis and pathogenic NTM species including MAC and *M. abscessus* is well established. United States Medicare data demonstrated NTM pulmonary disease being 50 to 75 times more prevalent in patients with bronchiectasis than those without (7). An association between less pathogenic NTM including *M. gordonae* and bronchiectasis has not previously been

Table 1 Baseline patient characteristics, respiratory specimen type, and reason for mycobacterial cultures among patients who had *M. gordonae*

Patient data	Patients with bronchiectasis (n=31)	Patients without bronchiectasis (n=26)
Age (years)	73.5 (11.9)	59 (16.6)
Female	18 (58.1)	9 (34.6)
Smoker, current or former	16 (51.6)	17 (65.4)
COPD	8 (25.8)	8 (30.8)
Asthma	10 (32.3)	4 (15.4)
Cardiac disease	8 (25.8)	7 (26.9)
End stage renal disease	0 (0.0)	1 (3.8)
Diabetes mellitus	1 (3.2)	2 (7.7)
Active malignancy	3 (9.7)	9 (34.6)
History of tuberculosis	2 (6.5)	2 (7.7)
Immunocompromised[†]	5 (16.1)	7 (26.9)
Number and type of specimens		
Number of specimens	35	39
Expectorated sputum	33 (94.3)	30 (76.9)
Bronchoscopy	2 (5.7)	6 (15.4)
Tracheal aspirate	0 (0.0)	3 (7.7)
Indication for mycobacterial culture		
Tuberculosis suspected	3 (8.6)	10 (25.6)
Non-tuberculous mycobacterial infection suspected	1 (2.9)	1 (2.6)
Prior *M. avium* complex infection	4 (11.4)	1 (2.6)
Routine surveillance culture in bronchiectasis patients	22 (62.9)	0 (0.0)
Evaluation for acute illness or abnormal imaging	3 (8.6)	26 (66.7)
Unknown	2 (5.7)	1 (2.6)
Smear positive	4 (11.4)	1 (2.6)

Data are shown as mean (SD) or n (%). [†], includes patients with human immunodeficiency virus, chronic oral glucocorticoid or disease modifying anti-rheumatic agent use, or with underlying immunodeficiency. COPD, chronic obstructive pulmonary disease; *M. avium*, *Mycobacterium avium*; SD, standard deviation.

investigated.

Our study describes the largest cohort of patients with isolation *M. gordonae* from respiratory specimens to date. There are limited data to which our results can be compared to, as literature regarding *M. gordonae* is largely limited to rare case reports or case series of infection mostly in immunocompromised patients, although case reports of infection in immunocompetent patients do exist (8).

While isolation of *M. gordonae* has previously been thought to almost always represent specimen or solution contamination, or oropharyngeal exposure to contaminated water without pulmonary relevance (6,9), our finding of a higher likelihood of isolating *M. gordonae* in patients with bronchiectasis than other types of lung disease suggest that it could be a marker for underlying impaired local airway host defense such as seen in bronchiectasis (5), even when not pathogenic.

We also found a high rate (45.2%) of positive cultures for more pathogenic NTM among the patients who grew *M. gordonae*. This prevalence is much higher than the 10%

Table 2 Prior and subsequent isolation of pathogenic non-tuberculous mycobacteria from patients who grew *M. gordonae*

Subject No.	Bronchiectasis (yes/no)	Date of isolation of *M. gordonae*	Prior pathogenic NTM isolation	Subsequent pathogenic NTM isolation
10	Yes	12/2/2019	MAC (11/28/2018)	MAC (12/20/2022)
			MAC (1/24/2019)	
14	Yes	3/5/2020	MAC (10/11/2019)	None
16	Yes	1/20/2020	None	MAC (1/21/2020)
				MAC (1/22/2020)
17	Yes	8/3/2020	*M. chelonae/abscessus* (11/4/2019)	None
24	Yes	4/12/2011	MAC (2/11/2011)	None
27	Yes	7/6/2012	MAC (11/28/2011)	None
			MAC (11/17/2011)	
30	No	12/20/2012	None	MAC (1/30/2013)
36	Yes	5/6/2014	None	MAC (2/13/2015)
				MAC (12/31/2015)
35	Yes	1/14/2014	*M. abscessus* (11/14/2011)	None
37	Yes	9/2/2014	MAC (2004)	None
41	Yes	1/8/2016	MAC (1/7/2016)	None
44	Yes	10/5/2016	MAC (4/16/2009)	*M. chelonae/abscessus* (12/11/2018)
			MAC (4/14/2015)	MAC (6/14/2019)
47	No	11/25/2012	MAC (11/23/2012)	None
56	Yes	7/15/2022	MAC (2/17/2011)	None
			MAC (7/29/2011)	

M. gordonae, *Mycobacterium gordonae*; NTM, nontuberculous mycobacteria; MAC, *Mycobacterium avium* complex; *M. chelonae*, *Mycobacterium chelonae*; *M. abscessus*, *Mycobacterium abscessus*.

reported in a meta-analysis of the prevalence of NTM in bronchiectasis (10). We had limited statistical power to detect an increased risk of isolation of pathogenic NTM in patients who had *M. gordonae* versus those who did not have *M. gordonae*, therefore an increased risk of isolating pathogenic NTM in these patients cannot be ruled out, given the P value approaching significance for this outcome (P=0.09).

Our study has some limitations. It is a single center study. Patients with bronchiectasis were probably more likely to have mycobacterial cultures given its association with NTM lung disease, but this would not explain the rate of *M. gordonae* isolation in our culture-level analysis (as opposed to a patient-level analysis). While the association of *M. gordonae* with other NTM could be subject to confounding by indication (mycobacterial cultures more likely to be sent in patients with suspected NTM disease), most of the *M. gordonae* isolates were from samples sent for routine bronchiectasis surveillance.

Conclusions

In summary, isolation of *M. gordonae* occurs more commonly in patients with bronchiectasis, and therefore, in many cases is likely not the result of specimen contamination or solely oropharyngeal exposure; rather its isolation likely reflects the impaired local airway host defenses seen in patients with bronchiectasis. Although the difference did not reach statistical significance, we cannot rule out the possibility that

isolation of *M. gordonae* in patients with bronchiectasis is a marker of increased risk of isolation of pathogenic NTM.

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Footnote

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1648/coif). C.L.D. reports institutional contracts from AN2, Bugworks, Insmed, Iuvabis, Paratek, Cystic Fibrosis Foundation, FDA, PCORI, and NIH; reports consulting fees from Genentech, and Pfizer; reports participation in the data safety monitoring committees of Otsuka, Bill and Melinda Gates Foundation, and Lilly; reports participation in the advisory boards of AN2, Astrazeneca, Hyfe, Insmed, MannKind, Matinas Biopharma, Nob Hill, Paratek, Spero, and Zambon. These activities are outside of the submitted work. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review board of UConn Health (IRB No. 22X-243-1). Individual consent for this retrospective analysis was waived.

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