

Approaches for Rarely Isolated Non- Tuberculous Mycobacteria Infections

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Severance

Less common NTM

❖ F/58, health check-up abnormality 2012

- RML, lingular bronchiectasis 2012
- Mild cough and sputum 2014

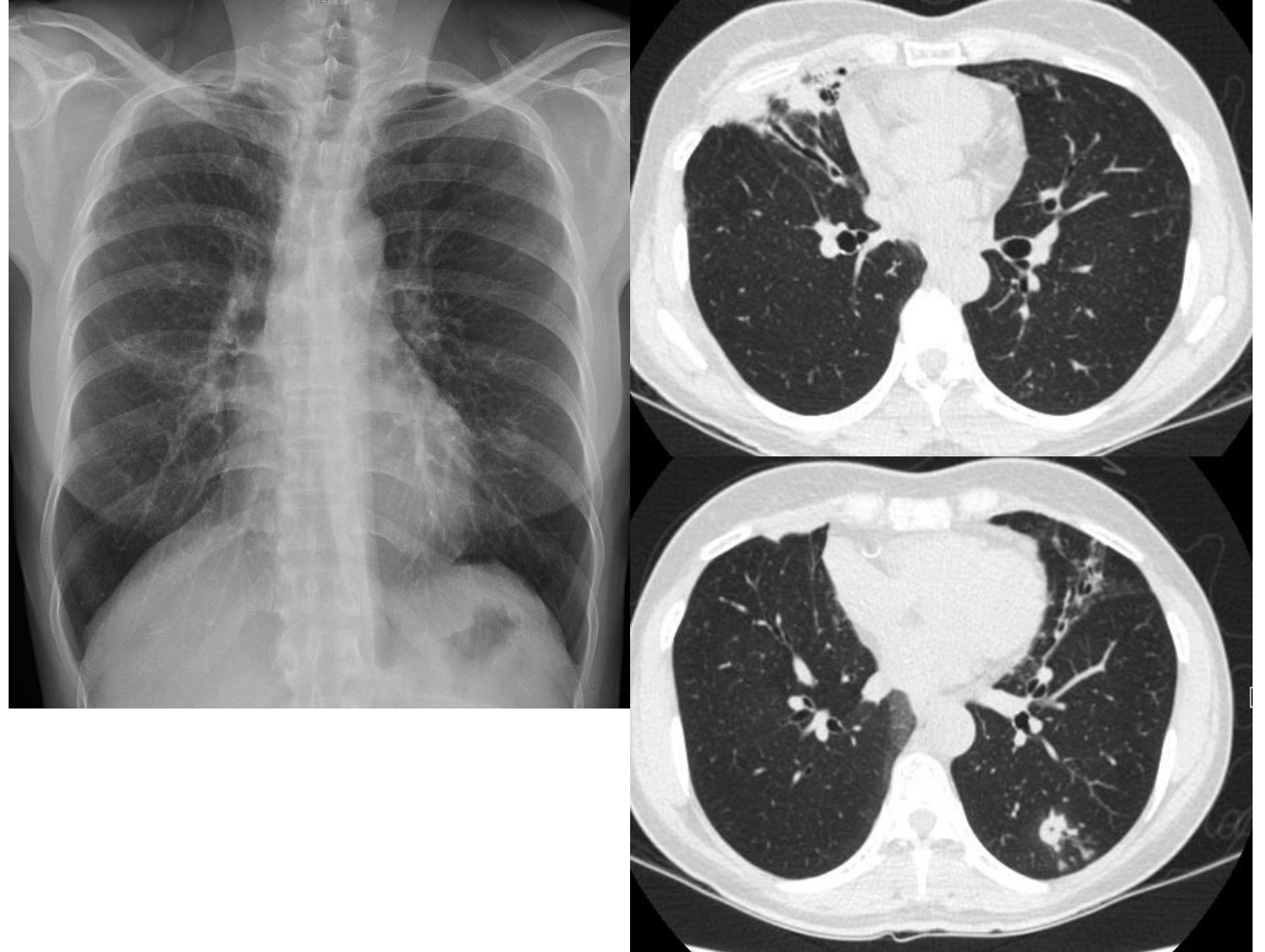
❖ Microbiologic test

- Bronchial washing AFB s/c: NTM (*M.avium*) 2012
- Sputum AFB s/c : NTM (*M.avium*) *3 times 2014
 - Clarithromycin/ethambutol/rifampin 2014~2016 (18m)

➢ Sputum AFB s/c: NTM (*M.chelonae*)

비결핵 마이코박테리아 동정	1 Mycobacterium chelonae
비결핵 마이코박테리아 동정	1 Mycobacterium avium

- Sputum AFB s/c : NTM (*M.avium*) *3 times 2018



Diagnosis of NTM pulmonary disease

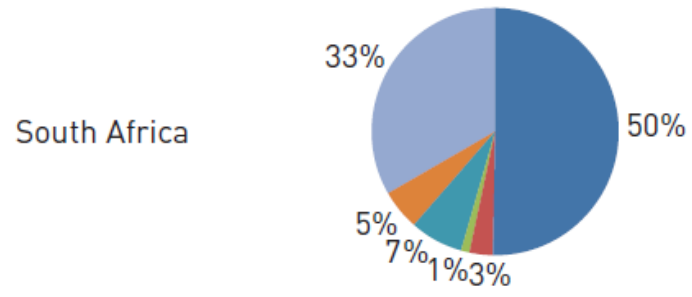
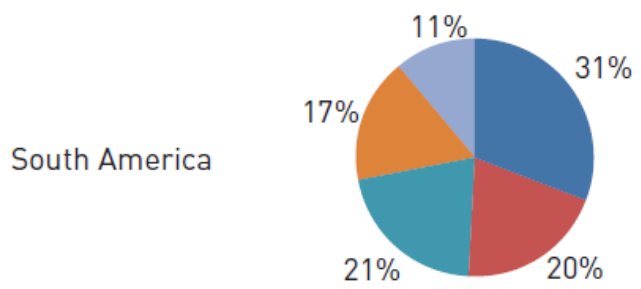
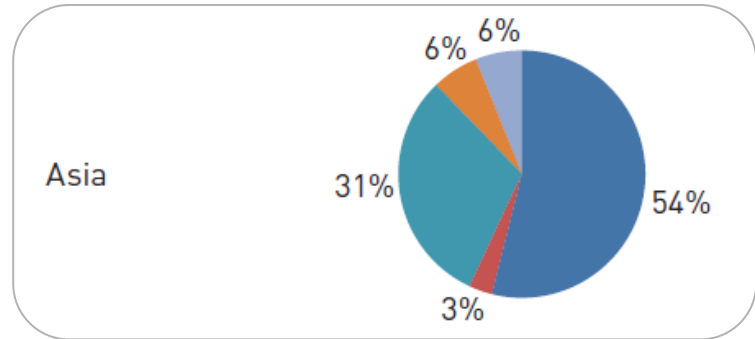
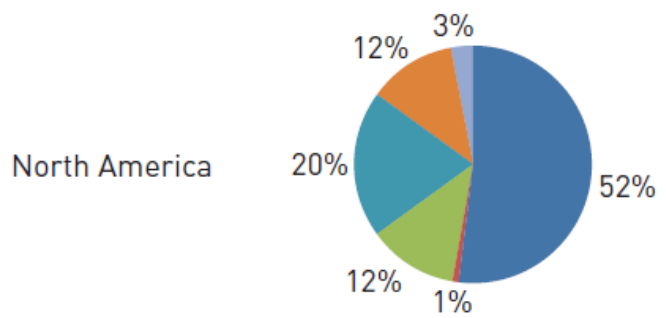
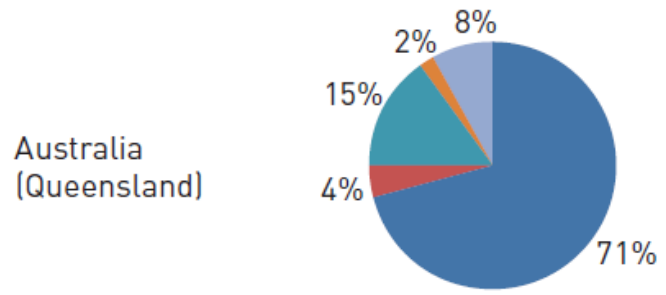
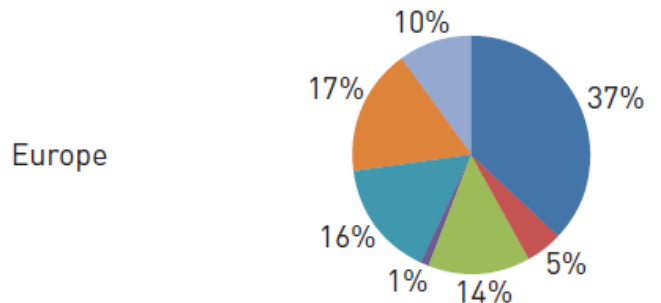
TABLE 2 Clinical and microbiologic criteria for diagnosis of nontuberculous mycobacterial pulmonary disease[#]

Clinical	Pulmonary or systemic symptoms	<i>Both clinical and radiologic criteria required</i>
Radiologic	Nodular or cavitary opacities on chest radiograph, or a high-resolution computed tomography scan that shows bronchiectasis with multiple small nodules	
And	Appropriate exclusion of other diagnoses	
Microbiologic [¶]	1) Positive culture results from at least two separate expectorated sputum samples. If the results are nondiagnostic, consider repeat sputum AFB smears and cultures <i>or</i> 2) Positive culture results from at least one bronchial wash or lavage <i>or</i> 3) Transbronchial or other lung biopsy with mycobacterial histologic features (granulomatous inflammation or AFB) and positive culture for NTM or biopsy showing mycobacterial histologic features (granulomatous inflammation or AFB) and one or more sputum or bronchial washings that are culture positive for NTM	

¶ when 2 positive cultures are obtained, the isolates should be the same NTM species (or subspecies in the case of *M. abscessus*) in order to meet disease criteria

➔ Repeated FU culture and species identification !!

Global distribution of NTM species



Distribution of NTM

MAC	31 – 71%
<i>M. kansasii</i>	3 – 20%
<i>M. xenopi</i>	1 – 14%
<i>M. malmoense</i>	0 – 1%
RGM	7 – 31%
<i>M. gordonae</i>	2 – 17%
other SGM	3 – 33%

- ❖ Geographical variation of NTM isolation from patients
- ❖ Geographical variation of environmental mycobacteria
- ❖ *M.gordonae* : relatively frequent isolation

Epidemiology of NTM Isolation and Disease in East Asia

East Asia						
China (2008–2012) ¹⁵⁵	I: 616	<i>M kansasii</i> (45)	<i>M avium</i> (3.6) <i>M intracellulare</i> (20.8)	<i>M chelonae-abscessus</i> complex (14.9)	<i>M fortuitum</i> (4.5)	
China (2009–2019) ¹⁵⁶	I: 1102	<i>M avium</i> (13.2) <i>M intracellulare</i> (54.8)	<i>M chelonae-abscessus</i> complex (16.5)	<i>M kansasii</i> (8.2)	<i>M gordonae</i> (3.3)	<i>M fortuitum</i> (<1)
China (2010–2015) ¹²⁰	I: 232 D: 72 ^a	<i>M avium</i> (4.7) <i>M intracellulare</i> (40.5) <i>M avium</i> (2.8) <i>M intracellulare</i> (52.8)	<i>M abscessus</i> (28.4) <i>M abscessus</i> (33.3)	<i>M kansasii</i> (9.9) <i>M kansasii</i> (9.7)	<i>M fortuitum</i> (8.6)	<i>M gordonae</i> (4.3) -
China (2013–2016) ¹⁵⁷	D: 607	<i>M avium</i> (16.3) <i>M intracellulare</i> (78.7)	<i>M abscessus</i> subsp. <i>abscessus</i> (23.9) <i>M abscessus</i> subsp. <i>abscessus</i>	<i>M kansasii</i> (10)	<i>M fortuitum</i> (2.8)	<i>M gordonae</i> (1)
Japan (2000–2013) ¹⁰⁸	D: 592 ^f	<i>M avium</i> (70.6) <i>M intracellulare</i> (22.3)	-	-	-	-
Japan (2001–2009) ¹³²	D: 975	<i>M avium</i> (42.6) <i>M intracellulare</i> (44.3)	<i>M abscessus</i> (3.1) <i>M chelonae</i> (<1)	<i>M gordonae</i> (2.1); <i>M kansasii</i> (2.1)	-	-
Japan (2006–2016) ¹⁰⁹	I: 3620 D: 2155 ^f	MAC (82.2) MAC (87.2)	<i>M abscessus</i> complex (4.5) <i>M chelonae</i> (<1) <i>M abscessus</i> complex (5.5) <i>M chelonae</i> (<1)	<i>M kansasii</i> (3.7) <i>M kansasii</i> (3.9)	<i>M fortuitum</i> (2.1)	<i>M peregrinum</i> (<1) <i>M fortuitum</i> (1.3) <i>M. lentiflavum</i> (<1); <i>M. szulgai</i> (<1)
Japan (2009–2015) ¹⁶⁰	I: 416 D: 114	<i>M abscessus</i> (31) <i>M chelonae</i> (11) <i>M abscessus</i> (36) <i>M chelonae</i> (10)	<i>M avium</i> (5) <i>M intracellulare</i> (20) <i>M avium</i> (6) <i>M intracellulare</i> (27)	<i>M gordonae</i> (18) <i>M fortuitum</i> (10)	<i>M fortuitum</i> (11)	- - <i>M gordonae</i> (6)
Japan (2012–2013) ¹⁰⁵	I: 26059 D: 7167 ^f	<i>M avium</i> (61.8) <i>M intracellulare</i> (31.1) <i>M avium</i> (65.1) <i>M intracellulare</i> (22.4)	<i>M kansasii</i> (2.1) <i>M kansasii</i> (3.4)	<i>M abscessus</i> (2) <i>M chelonae</i> (<1) <i>M abscessus</i> (2.7)	<i>M fortuitum</i> (1.1)	<i>M terrae</i> (<1) -

Epidemiology of NTM Isolation and Disease in East Asia

South Korea (2001–2015) ¹⁰⁴	D: 2329	MAC (75)	<i>M abscessus</i> (22)	<i>M kansasii</i> (3)	-	-
South Korea (2006–2016) ¹⁰⁰	D: 1017	MAC (63.6)	<i>M abscessus</i> complex (10.8)	<i>M fortuitum</i> (2.1); <i>M kansasii</i> (2.1)	-	-
South Korea (2007–2019) ¹⁰²	I: 2807	<i>M avium</i> (19.2) <i>M intracellulare</i> (50)	<i>M fortuitum</i> complex (4.7)	<i>M abscessus</i> (4.6) <i>M chelonae</i> (1)	<i>M gordonae</i> (3.5)	<i>M kansasii</i> (1.1)
South Korea (2009–2015) ¹⁰³	I: 5558	<i>M avium</i> (23.1) <i>M intracellulare</i> (38.9)	<i>M abscessus</i> (8.4)	<i>M kansasii</i> (7.7)	-	-
South Korea (2014–2019) ¹⁰¹	I: 4962	<i>M avium</i> (17.5) <i>M intracellulare</i> (42.3)	<i>M abscessus</i> (7) <i>M chelonae</i> (3.3)	<i>M fortuitum</i> (5.5)	<i>M kansasii</i> (3.6)	<i>M mucogenicum</i> (2.7)
Taiwan (2000–2012) ¹¹⁵	D: 3317	MAC (41.5)	<i>M abscessus</i> (21.4) <i>M chelonae</i> (9.4)	<i>M fortuitum</i> (13.4)	<i>M kansasii</i> (7.1)	<i>M gordonae</i> (5)
Taiwan (2007–2010) ¹¹⁴	I: 894	MAC (32.4)	<i>M abscessus</i> complex (9.2) <i>M chelonae</i> complex (17.6)	<i>M fortuitum</i> complex (17)	<i>M kansasii</i> (9.8)	<i>M gordonae</i> (7)
Taiwan (2010–2014) ¹¹⁶	D: 1674	MAC (34.4)	<i>M abscessus</i> (24.3)	<i>M kansasii</i> (11)	<i>M fortuitum</i> (9.8)	<i>M gordonae</i> (4.7)

Frequency of NTM isolation

2010-2012, 803 NTM isolates

Table 1 NTM commonly isolated from respiratory specimens during the study period

Species	N (%)
<i>Mycobacterium avium complex</i>	
<i>Mycobacterium avium</i>	250 (34.2)
<i>Mycobacterium intracellulare</i>	252 (34.5)
<i>Mycobacterium abscessus complex</i>	
<i>Mycobacterium abscessus</i>	93 (12.7)
<i>Mycobacterium massiliense</i>	53 (7.3)
<i>Mycobacterium fortuitum</i>	28 (3.8)
<i>Mycobacterium gordonae</i>	19 (2.6)
<i>Mycobacterium kansasii</i>	18 (2.5)
<i>Mycobacterium peregrinum</i>	17 (2.4)
Total	730 (100.0)

Table 2 Rare NTM species isolated from respiratory specimens during the study period

Species	N (%)
<i>Mycobacterium conceptionense</i>	9 (12.3)
<i>Mycobacterium chelonae</i>	7 (9.6)
<i>Mycobacterium lentiflavum</i>	7 (9.6)
<i>Mycobacterium mageritense*</i>	7 (9.6)
<i>Mycobacterium chimaera†</i>	6 (8.2)
<i>Mycobacterium terrae</i>	5 (6.8)
<i>Mycobacterium kumamotoense</i>	4 (5.5)
<i>Mycobacterium porcinum</i>	3 (4.1)
<i>Mycobacterium goodii</i>	2 (2.7)
<i>Mycobacterium nebraskense</i>	2 (2.7)
<i>Mycobacterium phocaicum*</i>	2 (2.7)
<i>Mycobacterium septicum</i>	2 (2.7)
<i>Mycobacterium celatum</i>	1 (1.4)
<i>Mycobacterium holsaticum</i>	1 (1.4)
<i>Mycobacterium sensuense</i>	1 (1.4)
<i>Mycobacterium arupense</i>	1 (1.4)
<i>Mycobacterium kubicae</i>	1 (1.4)
<i>Mycobacterium neoaurum</i>	1 (1.4)
<i>Mycobacterium xenopi</i>	1 (1.4)
Failed species identification‡	10 (13.7)
Total	73 (100.0)

Less common NTM and rare NTM

❖ Less common NTM

- SGM : *M.genevense*, *M.gordonae*, *M.malmomense*, *M.simiae*, *M.szulgai*
- RGM : *M.chelonae*, *M.fortuitum*

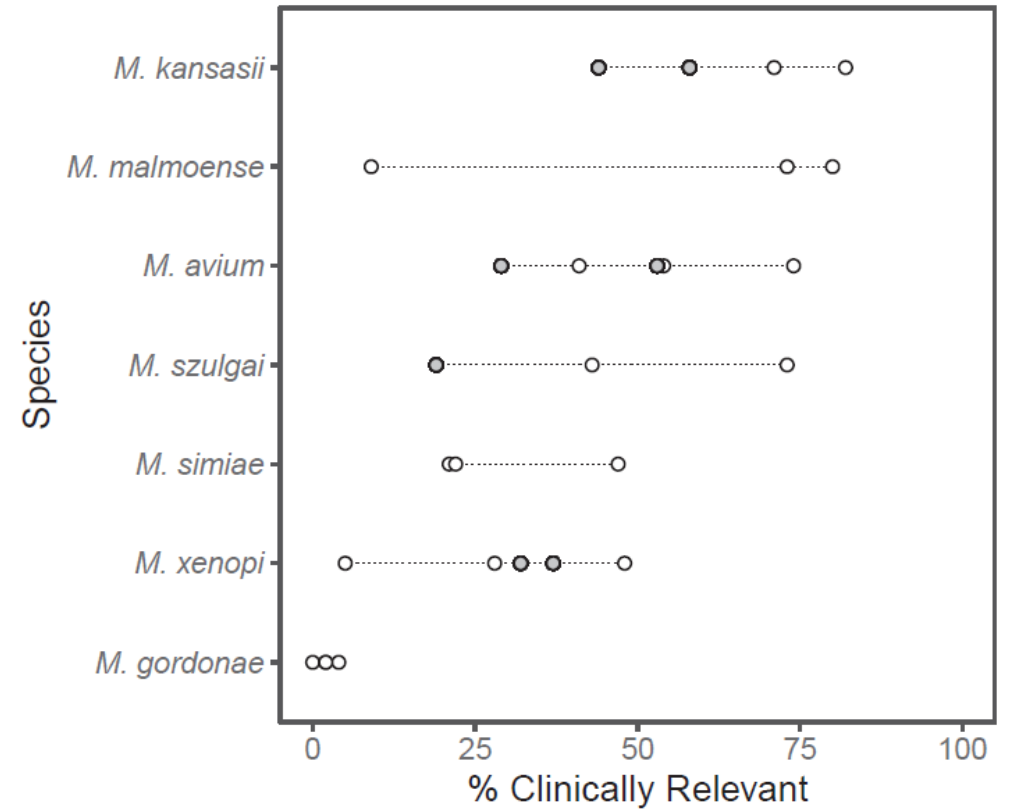
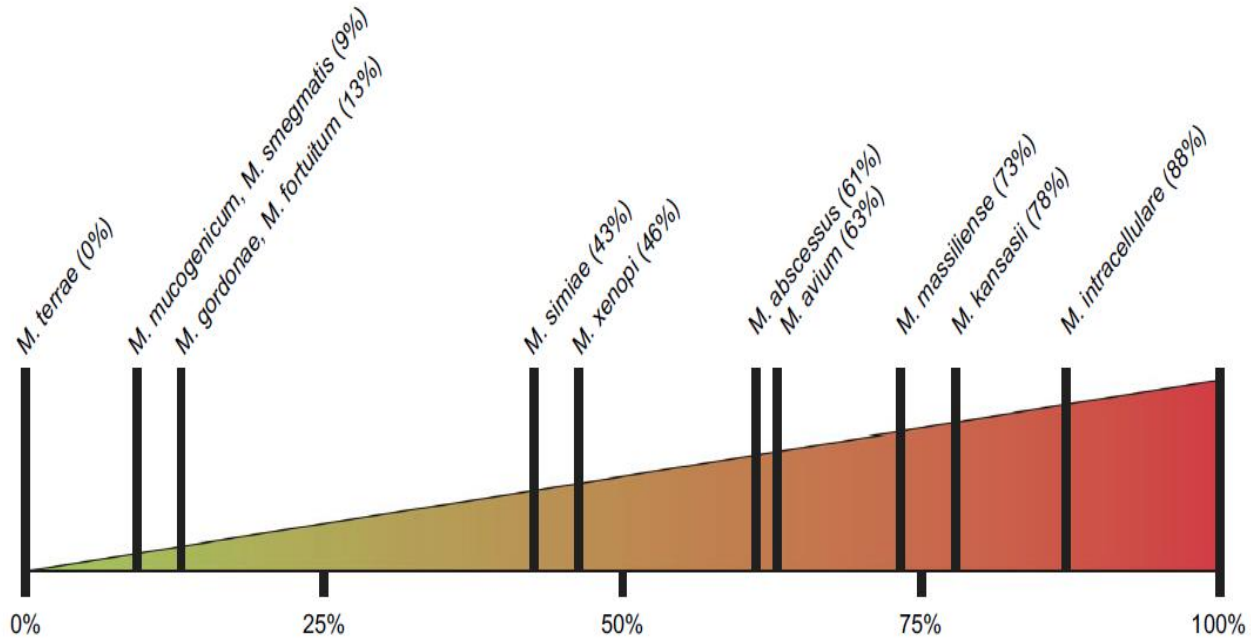
❖ Rare NTM

- Could not be identified by the most popular and globally dominating NTM identification assays
 - GenoType Mycobacterium (Hain Lifescience, Nehren, Germany), INNOLiPA V2 (Fujirebio, Ghent, Belgium) and Accuoprobew (Hologic Genprobe, Tucson, AZ, USA)
 - Need sequencing

General Recommendation

- ❖ Confirm the clinical, radiological and microbiological criteria for diagnosis of NTM-PD.
- ❖ Carefully assess for other causes of the patients symptoms and verify fulfillment of disease criteria before embarking on a course of treatment.
- ❖ The choice of treatment regimen should be guided by the results of the antimycobacterial drug susceptibility testing, although for some species causing NTM-PD the correlation of anti mycobacterial drug susceptibility testing and clinical outcome can be poor.
- ❖ To monitor treatment, sputum samples should be collected for culture every 1–2 months after initiation of therapy until there is sputum conversion to culture negative and then every 2–3 months until therapy is completed, defined as 12 months of negative mycobacterial sputum cultures (while on therapy) from the date of the first negative culture.

Clinical relevance of isolated NTM



Final diagnosis of patients with less common NTM

Table 2 Rare NTM species isolated from respiratory specimens during the study period

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<i>Mycobacterium phocaicum</i> *	2 (2.7)
<i>Mycobacterium septicum</i>	2 (2.7)
<i>Mycobacterium celatum</i>	1 (1.4)
<i>Mycobacterium holsaticum</i>	1 (1.4)
<i>Mycobacterium senense</i>	1 (1.4)
<i>Mycobacterium arupense</i>	1 (1.4)
<i>Mycobacterium kubicae</i>	1 (1.4)
<i>Mycobacterium neoaurum</i>	1 (1.4)
<i>Mycobacterium xenopi</i>	1 (1.4)
Failed species identification‡	10 (13.7)
Total	73 (100.0)

73 isolates in 68 patients

Only 4 patients with two more isolation

Table II Final diagnosis of 30 patients with positive cultures for *Mycobacterium szulgai* from respiratory specimens.

Final diagnosis	No. of patients (%)
M. szulgai lung disease	13 (43)
Pulmonary TB	8 (27)
Bacterial pneumonia	3 (10)
Other NTM lung disease ^a	2 (7)
Bronchiectasis	1 (3)
Lung cancer	2 (7)
Chronic airway disease	1 (3)

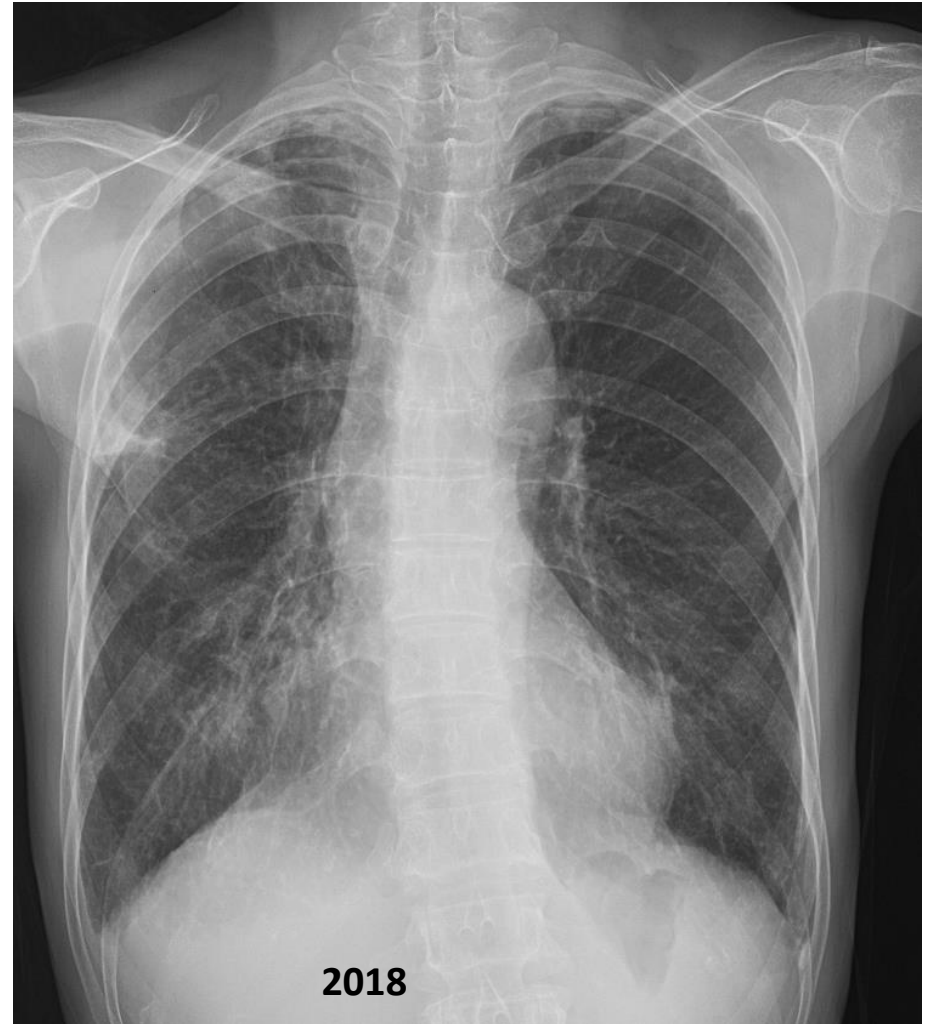
Diagnosis of NTM-PD with less common NTM

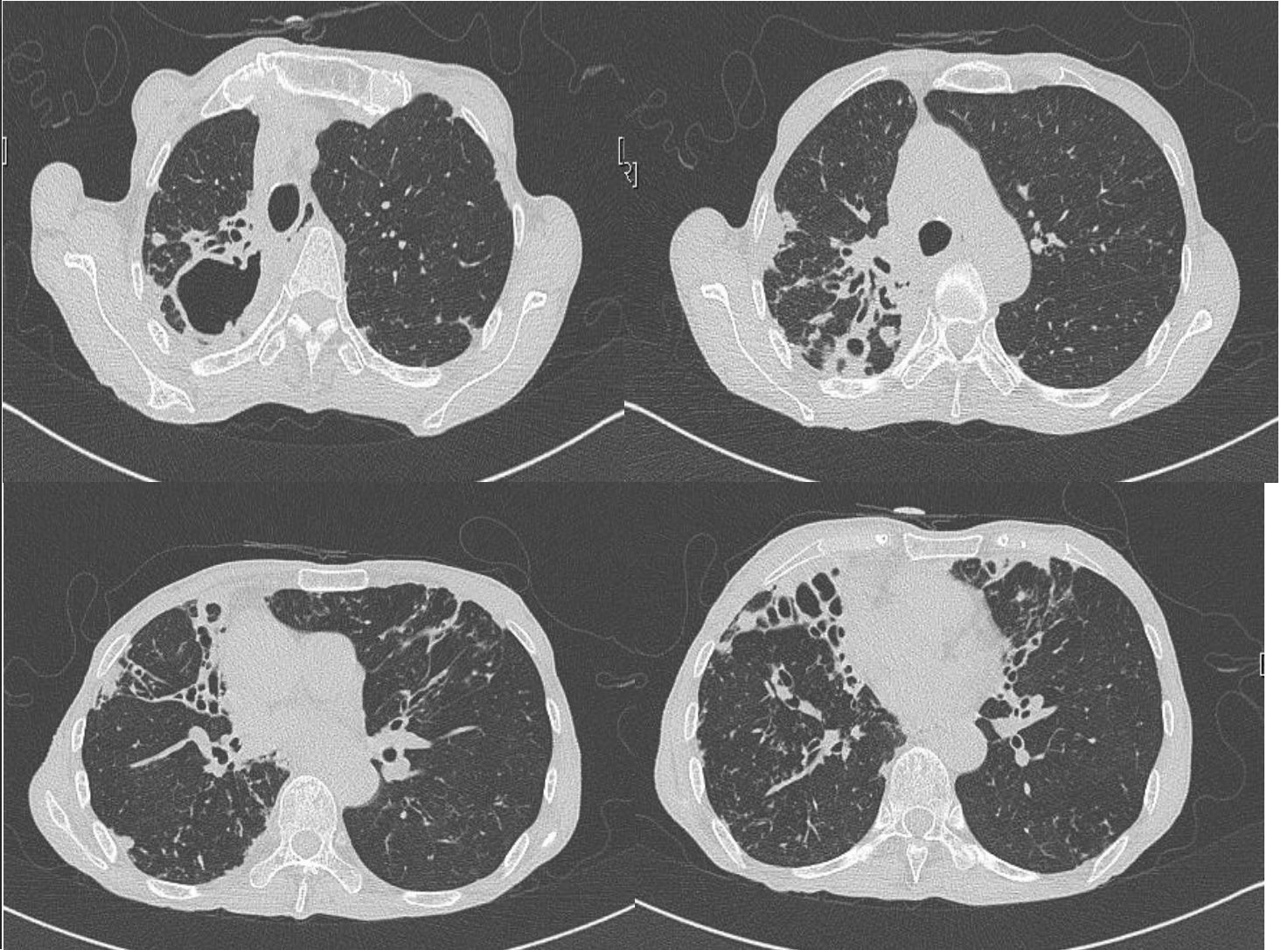
- ❖ Same diagnostic criteria for other common NTM isolates like *MAC* or *M.absessus*?

Although the same criteria are applied in the diagnosis of NTMPD, clinicians should **calibrate their diagnostic threshold** based on the pathogenicity of each species.

Calibrate diagnostic threshold, *M.kansasii*

- ❖ F/72, chronic cough and sputum since 2018 (local clinic)
 - Cough, sputum, hemoptysis
 - Exertional dyspnea
 - Multiple cavitory consolidation and bronchiectasis 2023
- ❖ Microbiologic test
 - Sputum AFB s/c :*M.kansasii* , single culture 2018 (local clinic)
 - Sputum AFB s/c :*M.kansasii* , multiple culture 2021 (local clinic)
 - Sputum AFB s/c :*M.kansasii* , Sm+ ,multiple cultures 2023





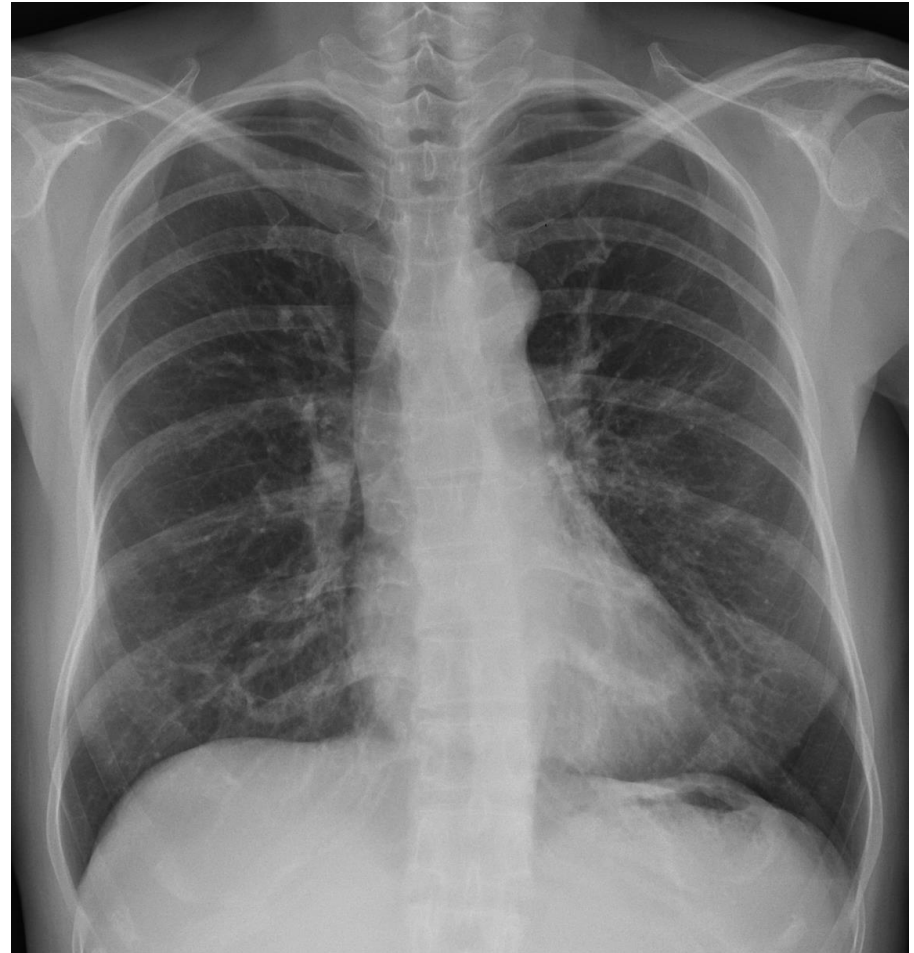
Calibrate diagnostic threshold, *M.gordonae*

❖ F/54, health check-up abnormality 2018

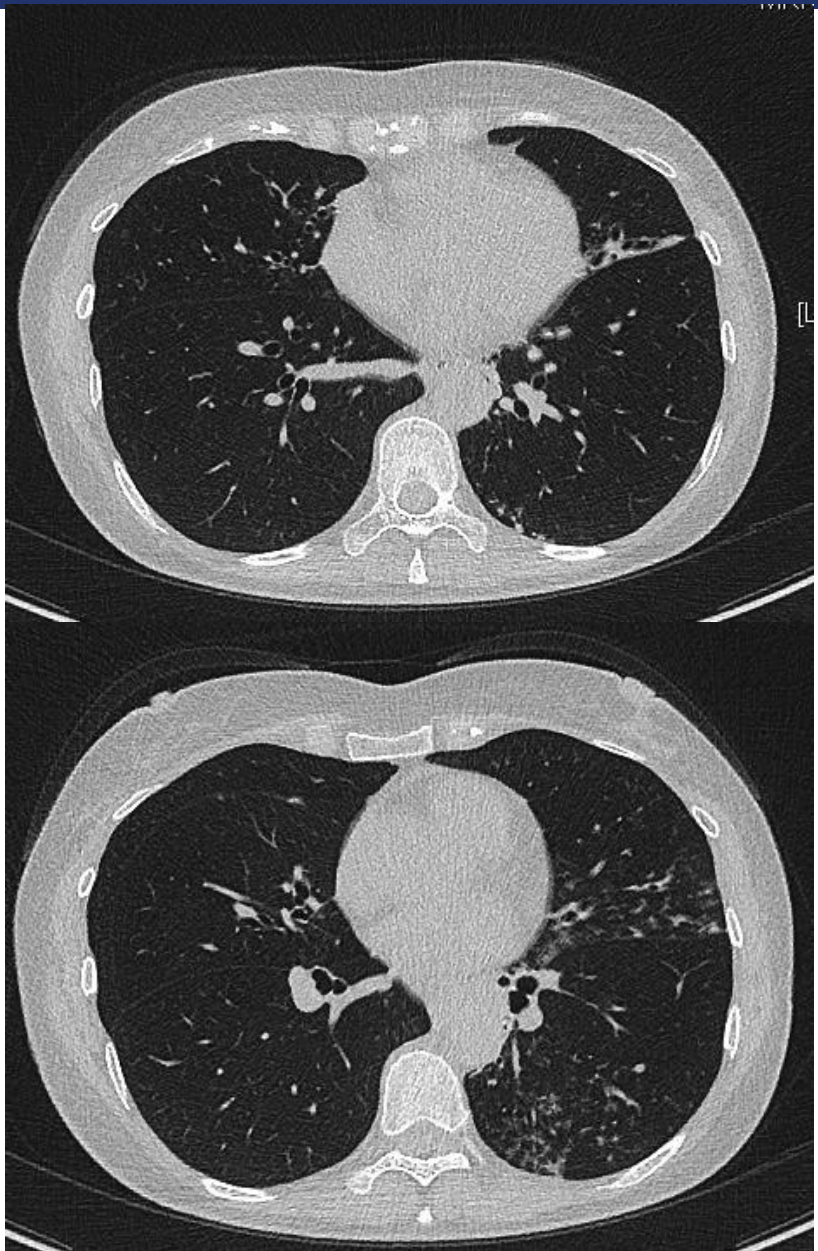
- RML, lingular bronchiectasis 2018
- Mild cough and sputum 2021
- Sputum aggravation 2023

❖ Microbiologic test

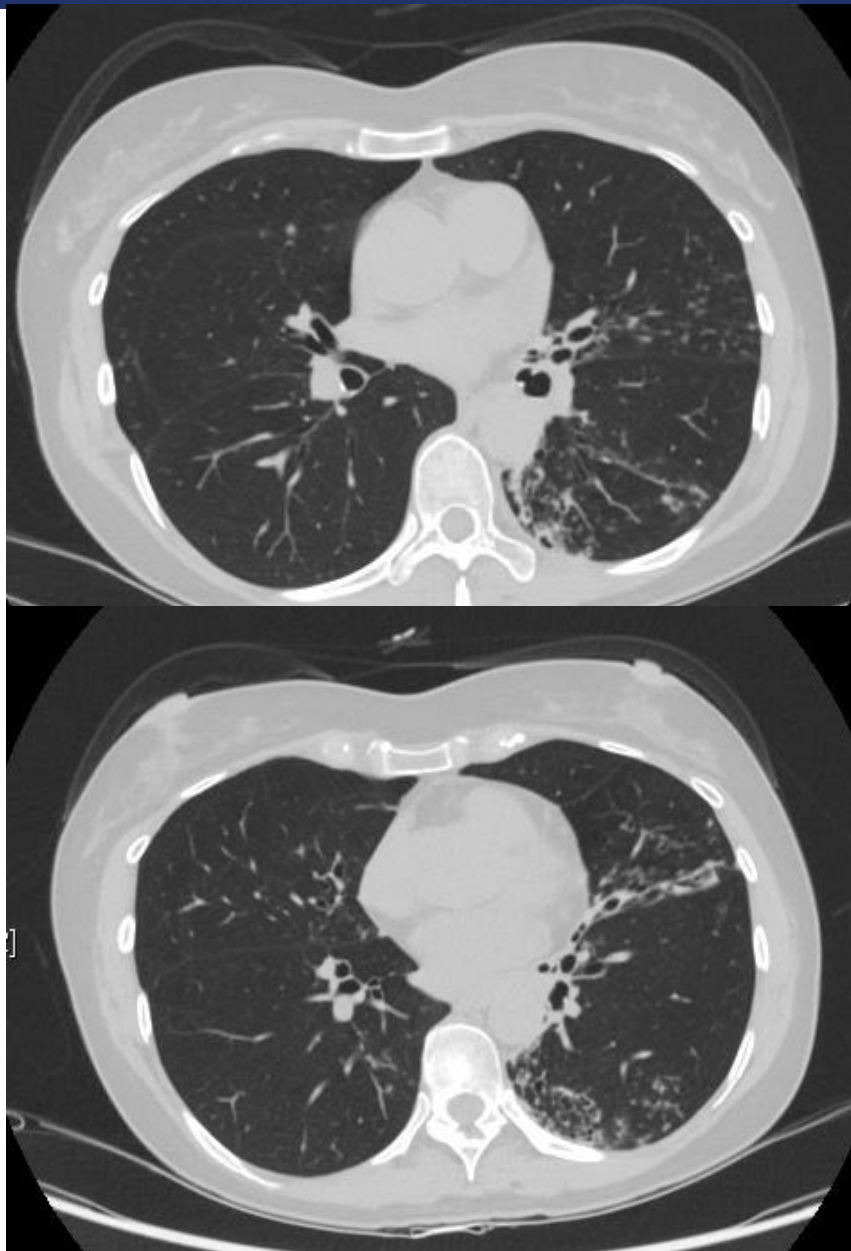
- Sputum AFB s/c : NTM (*M.gordonae*) *4 times 2021
- Sputum AFB s/c : NTM (*M.gordonae*) *2 times 2023
- No pathogenic ordinary bacteria in sputum culture



2018



2022



2023

Approach to less common NTM

❖ Rapidly growing NTM

- *M. chelonae*
- *M. fortuitum*

❖ Slowly growing NTM

- *M. genavense*
- *M. simiae*
- *M. szulgai*
- *M. gordonae*

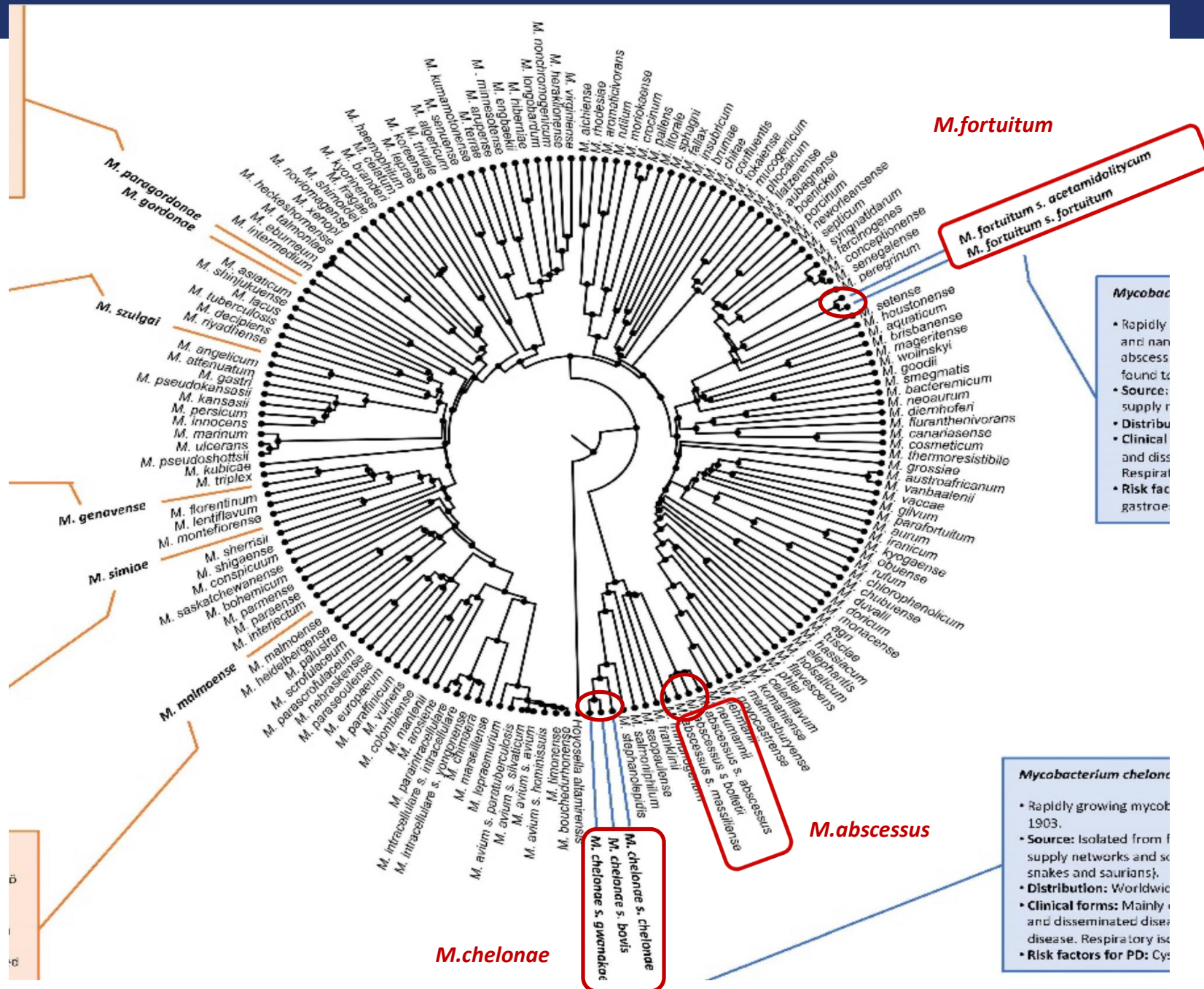
Approach to less common NTM

❖ Rapidly growing NTM

- *M. chelonae*
- *M. fortuitum*

❖ Slowly growing NTM

- *M. genavense*
- *M. simiae*
- *M. szulgai*
- *M. gordonae*



M.chelonae

❖ Source

- Isolated from fresh water (river, lakes, ponds), water supply networks and soil
- Isolated from captive reptiles (turtles, snakes)

❖ Distribution : worldwide

❖ Clinical forms

- Mainly **extrapulmonary** infection (skin and soft tissues) and disseminated disease
- Unusual cause of NTM-PD
- Respiratory isolates mostly represent contamination

M.chelonae

❖ Diagnosis

- Unusual cause of NTM-PD
- Clinicians should carefully assess for other causes of the patients symptoms and **verify fulfillment of disease criteria** before embarking on a course of treatment
- **Antimycobacterial drug susceptibility testing** should be done

❖ Treatment

- Treatment for *M. chelonae* pulmonary disease initially includes **at least two drugs** for mild to moderate disease or **three drugs** in more severe disease that the organism **shows in-vitro susceptibility** to.
- 20% of patients with *M. chelonae* pulmonary disease received adjunctive surgical resection

M. fortuitum

❖ Source

- Isolated from fresh water (river, lakes, ponds), water supply networks and soil

❖ Distribution : worldwide

❖ Clinical forms

- Mainly **extrapulmonary** infection (skin and soft tissues) and disseminated disease
- Unusual cause of NTM-PD
- Respiratory isolates mostly represent contamination

M. fortuitum

❖ Diagnosis

- *M. fortuitum* is a relatively common NTM species isolated from respiratory specimens, it is a relatively uncommon cause of NTM-PD.
- Clinicians should maintain a high-diagnostic threshold for identifying *M. fortuitum* pulmonary disease, and they should carefully assess for other causes of the patients symptoms and radiological abnormalities.
- Antimycobacterial drug susceptibility testing should be done
- *erm (39) gene* which confers inducible resistance to macrolide

❖ *M. fortuitum* complex

- *M. peregrinum*, *M. septicum*, *M. porcinum*, and *M. conceptionense*
- Different antibiotic susceptibilities, including macrolide susceptibility

M. fortuitum

❖ Underlying condition

- Esophageal and gastrointestinal motility disorder (eg. Achalasia)
- Post-TB change, sever COPD and cancer

❖ Treatment

- Management of underlying condition
- **At least two drugs** for mild-to-moderate disease or **three drugs** in more severe disease that the organism shows in-vitro susceptibility to.
- **Fluoroquinolones** may contribute the favorable response

Regimen for *M.chelonae* and *M.fortuitum*

	Number of drugs	Drugs	Duration	Comments
<i>M.chelonae</i>	Initial phase (≥ 3) Continuation phase (≥ 2)	<ul style="list-style-type: none"> - Azithromycin/CLR - Tobramycin IV - Imipenem-cilastin IV - MFX/LFX/CPX - LZD - CFZ 	12 months beyond culture conversion	<ul style="list-style-type: none"> - Drugs based on DST result - Oral two-drug regimen for mild ~ moderate disease
<i>M.fortuitum</i>	Initial phase (≥ 3) Continuation phase (≥ 2)	<ul style="list-style-type: none"> - MFX/LFX/CPX - Amikacin IV - Imipenem-cilastin IV - Cefoxitin IV - LZD - CFZ - Co-trimoxazole - Doxycycline 	12 months beyond culture conversion	<ul style="list-style-type: none"> - Drugs based on DST result - Oral two-drug regimen for mild ~ moderate disease - FQ may be effective

Approach to less common NTM

❖ Rapidly growing NTM

- *M. chelonae*
- *M. fortuitum*

❖ Slowly growing NTM

- *M. genavense*
- *M. simiae*
- *M. szulgai*
- *M. gordonae*

M. genavense

- ❖ *M. genavense* is a rare cause of NTM-PD.
- ❖ *M. genavense* was first described in the setting of severe immunosuppression with disseminated disease.
- ❖ *M. genavense* does not grow on solid media, thus antimycobacterial drug susceptibility testing is challenging.
- ❖ Most isolates are susceptible in vitro to fluoroquinolones, clofazimine, and amikacin.
- ❖ Macrolide containing multi-drug regimens that typically include ethambutol plus one or two other drugs such as a rifamycin, amikacin, or a fluoroquinolone

M.simiae

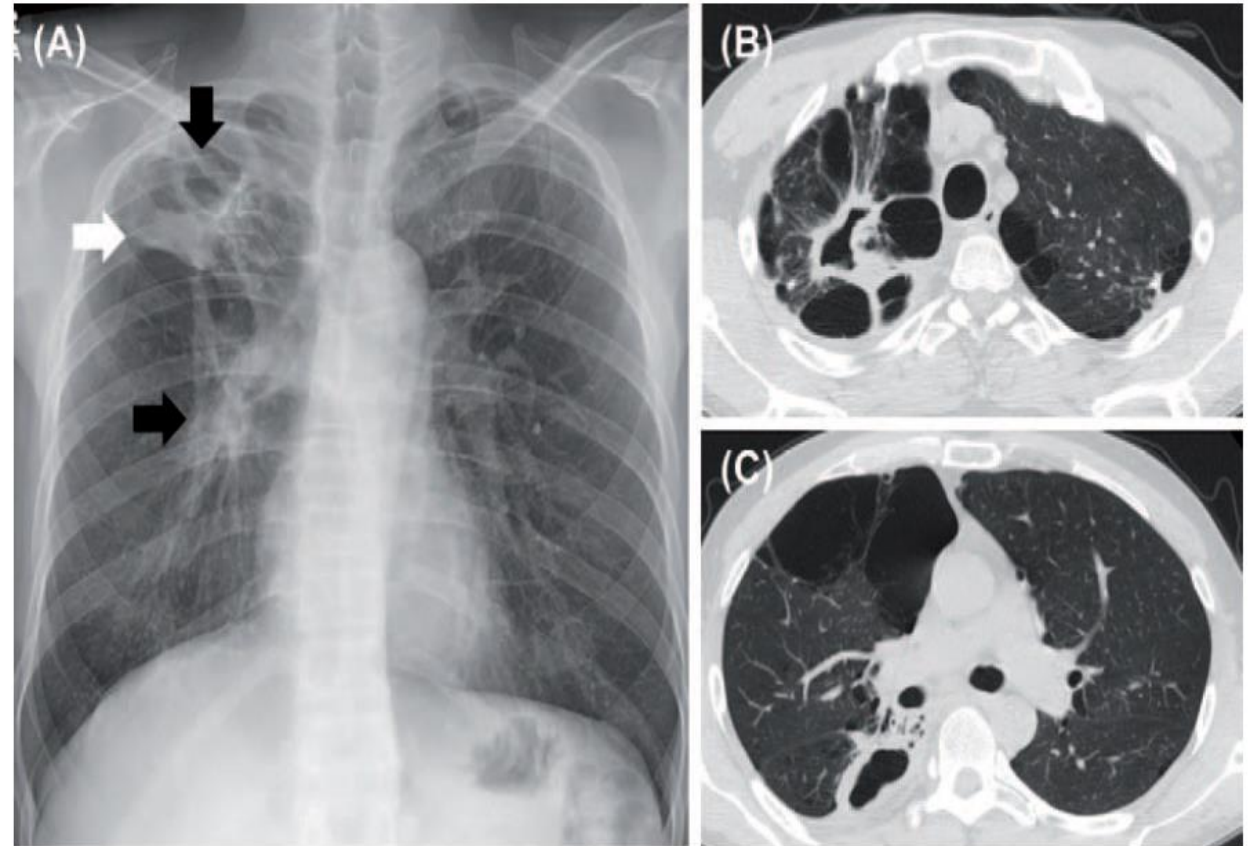
- ❖ Source : water and soil
- ❖ Distribution : worldwide, rarely reported in Asia, mainly in Middle-East (Israel, Lebanon, Iran)
- ❖ Respiratory isolates of *M.simiae* are most often contaminants
- ❖ Clinicians should maintain a **high threshold to diagnose** *M. simiae* pulmonary disease and carefully assess for other causes of a patient's symptoms or radiological abnormalities.
- ❖ Natural drug resistance : hard to treat
 - *M.simiae* strain ATCC 25275 : only susceptible to macrolides, clofazimine, and sulfamethoxazole
 - Clinical isolates : can be susceptible to MFX, aminoglycosides and cycloserine
- ❖ Treatment with at least 3 drugs
 - Azithromycin, clofazimine, amikacin / azithromycin, moxifloxacin, co-trimoxazole

M.szulgai

- ❖ Source : water and soil
- ❖ *M.szulgai* is an unusual cause of pulmonary disease
 - Less than 1% of human respiratory isolates of NTM
 - The isolation of *M.szulgai* appears to be clinically relevant in most cases
 - Mainly cause pulmonary disease
- ❖ Treatment with at least 3 drugs
 - Azithromycin/CLR, rifampicin, ethambutol for 12 months
 - Clofazimine and amikacin are alternative

13 patients with *M.szulgai* pulmonary disease

	No. of patients (%), or median (IQR)
Age, y	63 (53–72)
Gender, male	12 (92)
Body mass index, kg/m ²	21.7 (18.7–23.2)
History of previous TB	7 (54)
Co-morbidity	
COPD	3 (23)
Cardiovascular disease	3 (23)
Diabetes mellitus	3 (23)
Malignancy	2 (15)
Chronic kidney disease	1 (8)
Smoking	
Current smoker	7 (54)
Ex-smoker	2 (15)
Heavy alcoholic	2 (15)
Type of respiratory sample	
Bronchial washing specimen	7 (54)
Expectorated sputum specimen	6 (46)
Positive AFB smear	12 (92)
CT findings	
Cavity	9 (69)
Nodules	6 (46)
Consolidation	6 (46)
Bronchiectasis	7 (54)
Emphysema	6 (46)
Anti-mycobacterial treatment	9 (69)
Treatment duration, months	8 (6–13)
Follow-up duration, months	41.3 (6.1–66.5)



M. gordonae

- ❖ Source : water (widely distributed in water supply) and soil
- ❖ Distribution: worldwide
- ❖ Essentially considered a non-pathogenic species (colonization or contamination)
- ❖ When *M.gordonae* is cultured in respiratory samples, other causes of lung disease should be carefully considered.
- ❖ Multiple sputum samples should be collected over several weeks or months to identify the presence of any other NTM known to be more pathogenic.

Calibrate diagnostic criteria for low virulence mycobacteria



Table 1. The *Mycobacterium gordonae* culture from the observed respiratory samples over an 8-year period

	Positive culture (cases)	Positive smear (cases)	Median positive culture detection time (days)
Total cases over the 8 years	209	23	24
Positive culture ≥ 2 times	27	8	17.5
Positive culture > 3 times	11	5	19.5
Definitive cases	3	3	9

- The number of culture
- Smear grade
- Time to culture positivity

19 cases with $\geq 2+$ cx *RpoB* gene sequencing subtype

2 Subtype A

5 Subtype B

7 Subtype C

4 Subtype D

- *RpoB* gene sequencing subtype

M.gordonae

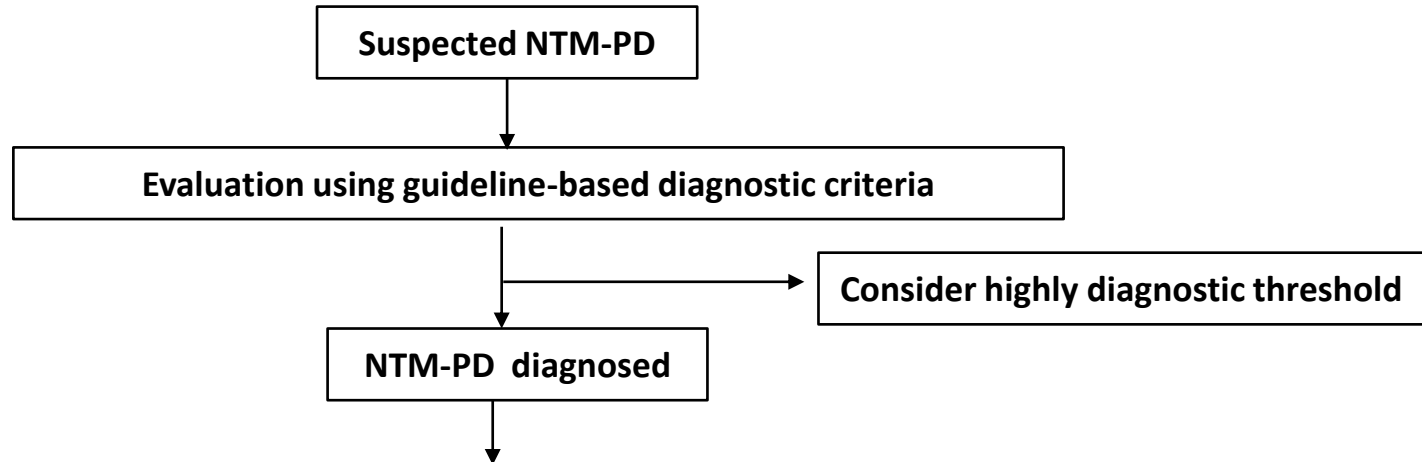
- ❖ Treatment is seldom necessary.
- ❖ No standard treatment can be recommended, a combination of a macrolide, rifampicin, and ethambutol has been described as successful in some cases.

Table 2. Summary of the five cases of definitive *Mycobacterium gordonae* pulmonary disease cases

Case	Age	Gender	Disease type	Number of smears/ culture positive	Median positive culture detection time	Treatment
1	57	Female	NB	2/7	12.5 days	RFP + EB + CAM
2	62	Male	FC	4/7	NA	RFP + EB + CAM
3	67	Female	NB	3/4	22.5 days ^a	INH + RFP → CFX + CAM → Surgery
4	72	Male	FC	2/3	7 days	No treatment
5	63	Female	NB	1/4	9 days	RFP + EB + CAM

Regimen for SGM

	Number of drugs	Drugs	Duration	Comments
<i>M.genavense</i>	≥ 3	<ul style="list-style-type: none"> - Azithromycin/CLR - Rifampicin - Moxifloxacin - Clofazimine - Amikacin IV 	12 months beyond culture conversion	<ul style="list-style-type: none"> - Drugs based on DST result
<i>M.simiae</i>	≥ 3	<ul style="list-style-type: none"> - Azithromycin/CLR - Moxifloxacin - Co-trimoxazole - Clofazimine - Amikacin IV 	12 months beyond culture conversion	<ul style="list-style-type: none"> - Drugs based on DST result - Amikacin in cavitary and severe disease
<i>M.szulgai</i>	≥ 3	<ul style="list-style-type: none"> - Azithromycin/CLR - Rifampicin - Ethambutol - Moxifloxacin - Clofazimine - Amikacin IV 	12 months or 12 months beyond culture conversion if treatment with a macrolide, a rifamycin, or ethambutol cannot be used	<ul style="list-style-type: none"> - Drugs based on DST result - FQ,CFZ, AMK in case of intolerance or resistance to macrolide, rifamycin and ethambutol



General management
Evaluate for and address predisposing conditions (e.g. immunocompromising conditions, structural lung disease, reflux)
Management of underlying bronchiectasis and co-infections , including airway clearance and judicious antimicrobial therapy of other potential pathogens
Monitor for progression with periodic clinical assessments and investigations
Minimize concentrated exposure to environmental sources of NTM

Factors to consider in evaluating need for antimicrobial therapy against NTM
Patient preference and values, severity and progression of symptoms, immunocompromising conditions, comorbidities/contraindications, age and frailty
Extent and severity of abnormalities, presence of cavities, progression over time
Bacterial burden based on smear positivity and frequency of isolation, pathogenicity of species

Summary

- ❖ Frequency of less common NTM shows geographical differences.
- ❖ Confirm the clinical, radiological and microbiological criteria for diagnosis of NTM-PD.
- ❖ However, we need to consider different (high threshold) diagnostic criteria for low-virulent less common NTM for NTM-PD.
- ❖ Whenever possible, regimen selection should be guided, but not dictated, by DST, recognizing that the correlation between in vitro activity and clinical response is uncertain.
- ❖ There is insufficient data to recommend the evidence based treatment for less common NTM pulmonary disease.

Thank you for your attention!



Diagnosis of NTM pulmonary disease

TABLE 2 Clinical and microbiologic criteria for diagnosis of nontuberculous mycobacterial pulmonary disease[#]

Clinical	Pulmonary or systemic symptoms	Both clinical and radiologic criteria required
Radiologic	Nodular or cavitary opacities on chest radiograph, or a high-resolution computed tomography scan that shows bronchiectasis with multiple small nodules	
And	Appropriate exclusion of other diagnoses	
Microbiologic [¶]	1) Positive culture results from at least two separate expectorated sputum samples. If the results are nondiagnostic, consider repeat sputum AFB smears and cultures <i>or</i> 2) Positive culture results from at least one bronchial wash or lavage <i>or</i> 3) Transbronchial or other lung biopsy with mycobacterial histologic features (granulomatous inflammation or AFB) and positive culture for NTM or biopsy showing mycobacterial histologic features (granulomatous inflammation or AFB) and one or more sputum or bronchial washings that are culture positive for NTM	

[#] **expert consultation** should be obtained when NTM are recovered that are either **infrequently encountered** or that usually represent **environmental contamination**