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Comparison of the Spectrum of Radiologic and Clinical Manifestations of Pulmonary Disease Caused by *Mycobacterium avium* Complex and *Mycobacterium xenopi*

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Abstract

Aim: *Mycobacterium xenopi* is described with upper lobe cavitation (''fibrocavitary'' pattern), whereas the *Mycobacterium avium* complex (MAC) is described with bronchiectasis and centrilobular nodules (''nodular bronchiectasis''). We retrospectively described and compared computed tomography (CT) chest manifestations of disease caused by MAC and *M xenopi*.

Materials and Methods: We reviewed patients who had either MAC or *M xenopi* lung disease and who had CTs between January 2002 and December 2003. Clinical data were recorded, and the patterns on chest CTs were categorized as ''fibrocavitary,'' ''nodular bronchiectatic,'' and ''unclassified.''

Results: There were 74 patients; 50 with MAC and 24 with *M xenopi*. The patients with MAC were older (mean 69 vs 58 years; $P = .007$). Patients with *M xenopi* more often had emphysema (50% vs 20%; $P = .02$), cavities (46% vs 16%; $P = .01$), and nodules $\leq$5 mm (88% vs 58%; $P = .02$). *M xenopi* cases more commonly had a fibrocavitary radiologic pattern (33% vs 18%), with no statistically significant difference ($P = .24$). MA*C* was more often associated with a nodular bronchiectatic pattern (68% MAC vs 4% *M xenopi*; $P < .0001$). Sixty-three percent of patients with *M xenopi* had a pattern that was predominantly randomly distributed nodules (11/15 [73%]) or consolidation and/or ground-glass opacities (4/15 [27%]).

Conclusion: Compared with MAC, patients with *M xenopi* infection develop more cavities and more nodules, and they less often have a predominant nodular bronchiectatic pattern. Although a predominantly cavitary pattern appears to be more common with *M xenopi*, the majority of patients with *M xenopi* had CT patterns of random nodules or consolidation and/or ground-glass opacities rather than classically described findings.

Résumé

Objectif: La description de *Mycobacterium xenopi* est fonction de la formation de cavernes dans le lobe supérieur (« forme fibrocavitaire »), alors que celle du complexe *Mycobacterium avium* (MAC) est fonction de la présence de bronchectasies et de nodules centrolobulaires (« forme nodulaire bronchectasique »). De façon rétrospective, nous avons décrit, puis comparé les manifestations pulmonaires d'affections causées par le MAC et par *M. xenopi*.

Matériel et méthodes: Nous avons passé en revue le dossier de patients présentant une maladie pulmonaire attribuable à une infection par le MAC ou par *M. xenopi* et ayant subi un examen de tomodensitométrie entre janvier 2002 et décembre 2003. Les données cliniques ont été enregistrées et les formes observées par tomodensitométrie thoracique ont été classifiées comme étant « fibrocavitaires », « nodulaires bronchectasiques » et « non classifiées ».

Résultats: Sur un total de 74 patients, 50 présentaient une infection par le MAC et 24, une infection par *M. xenopi*. Les patients infectés par le MAC étaient plus âgés que les patients infectés par *M. xenopi* (âge moyen de 69 ans contre 58 ans; $P = 0{,}007$). Comparativement à l'autre groupe, les patients infectés par *M. xenopi* étaient plus souvent atteints d'emphysème (50 % contre 20 %; $P = 0{,}02$) et présentaient plus souvent

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des cavernes (46 % contre 16 %; $P = 0{,}01$) et des nodules d'une taille égale ou inférieure à 5 mm (88 % contre 58 %; $P = 0{,}02$). Les cas de *M. xenopi* ont par ailleurs révélé des formes fibrocavitaires plus souvent que les cas de MAC (33 % contre 18 %), mais sans afficher d'écart statistiquement significatif ($P = 0{,}24$). Les infections par le MAC ont été davantage associées à des formes nodulaires bronchectasiques que les infections par *M. xenopi* (68 % contre 4 %*i*; $P < 0{,}0001$). Soixante-trois pour cent des patients infectés par *M. xenopi* ont présenté une répartition aléatoire de nodules prédominante (11/15 [73 %]), ou bien une consolidation ou des opacités en verre dépoli (4/15 [27 %]).

Conclusion: Les patients infectés par *M. xenopi* présentent davantage de cavernes et de nodules et moins de formes nodulaires bronchectasiques prédominantes que les patients infectés par le MAC. Même si la présence d'une forme essentiellement cavitaire semble plus courante chez les patients infectés par *M. xenopi*, les résultats de tomodensitométrie ont dans la plupart des cas indiqué des nodules répartis de façon aléatoire, ou encore une consolidation ou des opacités en verre dépoli, plutôt que les résultats habituellement décrits.

Key Words: Computed tomography; *Mycobacterium avium* complex; *Mycobacterium xenopi*

Nontuberculous mycobacteria (NTM) are in an emerging group of infectious pathogens that most often cause pulmonary infection. *Mycobacterium avium* complex (MAC) is the most common cause of NTM lung disease in most parts of the world, followed variably by *Mycobacterium kansasii*, *Mycobacterium xenopi*, *Mycobacterium abscessus*, *Mycobacterium fortuitum*, and others, depending especially upon geographic location [1]. *M xenopi* is the second most common cause of NTM lung disease in Ontario, Canada, and is also common in France and the United Kingdom [1–4]. Pulmonary NTM infection is probably acquired through inhalation from an environmental source [5] because NTMs are widespread in the environment [6], and human-to-human transmission appears to be exceedingly rare [5]. Although immune deficiency is a risk factor, such patients comprise only a small minority of patients with pulmonary NTM disease [5,7].

Radiologic assessment of pulmonary NTM comprises an integral component of the diagnostic criteria, which also include microbiologic and clinical aspects, to help distinguish true disease from colonization or specimen contamination [5]. There are 2 commonly described radiographic presentations of NTM disease. The first is cavitation with architectural distortion, very often in the setting of significant emphysema and in the upper lobes (“fibrocavitary”), and the second is bronchiectasis and bronchiolar nodules, often predominantly in the middle lobe and/or lingula (“nodular bronchiectasis”) [5,8]. The radiographic manifestations of MAC and *M xenopi* have been studied [9–13]. *M xenopi* is described as presenting with upper lobe cavitation most commonly, whereas MAC is more often described as presenting with nodular bronchiectasis [9–13]. However, there have been no large studies of consecutive patients that directly compared the radiologic features of patients with pulmonary MAC vs *M xenopi*. The aims of our study were to describe and compare computed tomography (CT) chest manifestations of pulmonary disease caused by MAC and *M xenopi* in a consecutive series of patients from a single institution.

Materials and Methods

Study Population

The study was approved by the research ethics board of our institution. Given the retrospective study design, the requirement for informed consent was waived. To be eligible for inclusion, patients had to have fulfilled American Thoracic Society diagnostic criteria for pulmonary NTM disease for either MAC or *M xenopi* [5]. The diagnostic criteria include clinical and microbiologic components. The clinical criteria are the presence of pulmonary symptoms and nodules or cavities in the chest radiograph or bronchiectasis and small nodules on CT. The microbiologic criteria are fulfilled with $\geq$2 positive sputum cultures, or a positive culture from a bronchial wash or lavage, or a lung biopsy with histologic features sugestive of mycobacterial infection in the presence of a positive culture [5]. The patients had a chest CT performed within 6 months of the NTM isolation within the period January 2002 to December 2003. Records and images were retrospectively reviewed and analysed. Clinical information regarding smoking history, asthma and other chronic lung disorders, and the presence of of pulmonary and nonpulmonary neoplasm was also recorded.

Imaging Technique

Patients underwent CT evaluation of the chest by using 4-row helical CT scanner (LightSpeed QX/i; GE Medical Systems, Milwaukee, WI) and 64-detector row scanner (Aquilion 64; Toshiba Medical Systems Corp, Shimoishigami, Otawara-shi, Tochigi, Japan). Volumetric helical images were acquired in the supine position by using 150-320 mA and 120 kV, 5-mm collimation, and a reconstruction interval of 2.5 mm. The images were reconstructed in a low- and high-spatial resolution algorithms and were viewed in lung window settings (W1500, Level - 600 H.U).

Imaging Analysis

One thoracic radiologist with 8 years of experience (D. P.) and 2 thoracic imaging fellows with 2 years of experience independently reviewed the chest CT (M. C. and U. W.). Measurable disease was recorded for each patient. The recorded abnormal findings on the CT included ground-glass opacities, consolidation, cavitation, tree-in-bud configuration, bronchiectasis, random pulmonary nodules (recorded as $\leq$ 5 mm or $>$ 5 mm in diameter), enlarged lymph nodes, emphysema, pleural