

# Moraxella catarrhalis – An underestimated culprit for community-acquired lower respiratory tract infections in diseased adult lungs

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## ABSTRACT

In four months, five cases of *Moraxella* causing lower respiratory tract infection were encountered among patients with underlying lung disease in the Pulmonary medicine outpatient department of a tertiary care center in rural West Bengal. The patients exhibited a spectrum of clinical presentations, ranging from mild to severe respiratory symptoms along with shortness of breath as the most consistent symptom. Diagnostic workup revealed *Moraxella catarrhalis* as the causative agent of lower respiratory tract infections in all cases, highlighting its emerging role as a significant respiratory pathogen. Treatment strategies varied based on disease severity, but all the patients improved with treatment. These cases underscore the importance of considering *Moraxella* as a causative organism for community-acquired lower respiratory tract infection and emphasize the need for continued surveillance and research to better understand its epidemiology and clinical management.

**Keywords:** COPD, LRTI, lung disease

## Introduction

*Moraxella catarrhalis*, once doubted as a pathogen, has been associated with acute otitis media in children, its frequency rising post-pneumococcal vaccine introduction.<sup>[1]</sup> Though typically milder than pneumococcal disease, it induces mucosal inflammation via identified virulence factors. In adults with chronic obstructive pulmonary disease (COPD), it triggers roughly 10% of exacerbations. *M. catarrhalis*, exclusive to humans, has its niche in the nasopharynx and middle ear cavity. Its increasing isolation suggests a shifting microbial landscape.<sup>[2]</sup> *M. catarrhalis* can independently cause sinusitis, otitis media,

tracheitis, bronchitis, pneumonia, and, less frequently, ocular infections and bacteremia in pediatric patients.<sup>[3]</sup> In adults, it may cause laryngitis, bronchitis, and pneumonia in COPD patients, nosocomial infections, and infections among elderly patients. In most cases, there are mixed agents showing isolation of *Streptococcus pneumoniae* or *Haemophilus influenzae* along with *Moraxella catarrhalis* from respiratory specimens.<sup>[4]</sup>

Though *Moraxella* is a known cause of respiratory infections, very few cases of *M. catarrhalis* as a respiratory pathogen have been reported from India. Here, we report 5 cases of *Moraxella* causing lower respiratory tract infection over 4 months (January to April 2024). For all patients' informed consent was taken. All the patients had yielded good quality sputum or bronchoalveolar lavage samples according to the standard microscopic criteria, and all the samples were negative on screening for tuberculosis by cartridge-based nucleic acid amplification test (CBNAAT)

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Received: 29-07-2024

Revised: 21-10-2024

Accepted: 23-10-2024

Published: 25-04-2025

### Access this article online

#### Quick Response Code:



**Website:**  
<http://journals.lww.com/JFMPC>

**DOI:**  
10.4103/jfmprc.jfmprc\_1294\_24

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**How to cite this article:** Sengupta M, Sharma P, Ghosh S, Banerjee S. *Moraxella catarrhalis* – An underestimated culprit for community-acquired lower respiratory tract infections in diseased adult lungs. J Family Med Prim Care 2025;14:1557-60.

and microscopy for tubercle bacilli and had no other significant bacterial or fungal isolate from their lower respiratory tract samples.

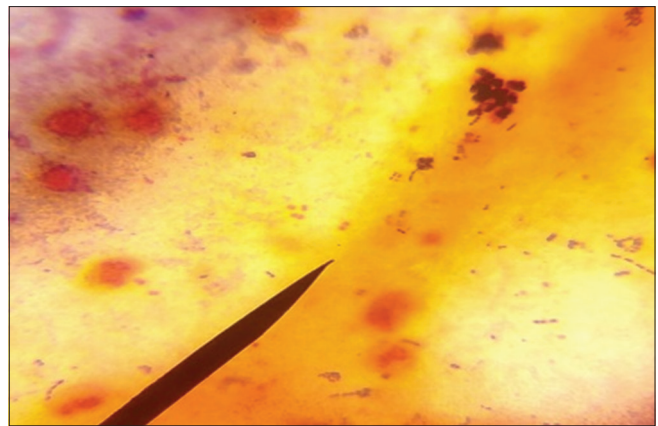
### Case 1

A 77-year-old male smoker from rural West Bengal was a frequent visitor of the Pulmonary Medicine outpatient department (OPD) of our center for the last 1 year due to shortness of breath (SOB) and cough with scanty expectoration. SOB was more marked in the morning after waking up and was aggravated in a dusty environment. For the last two weeks before the culture was collected, he started developing low-grade fever and marked weakness. Cough and expectoration increased; sputum was rusty white in color, thick and purulent in consistency, and devoid of blood. He was a consistent cigarette smoker for more than 50 years with more than 1 pack per day. He did not have any history of tuberculosis, diabetes, hypertension, alcohol intake, history of ear or paranasal sinus, or dental infection. On Chest X-ray, bilateral nonhomogenous opacities in both upper zones were seen. On the high-resolution computed tomographic (HRCT) scan of the lungs, mild fibrosis with bronchiectasis in bilateral upper lobes with multiple multicentric nodules was seen.

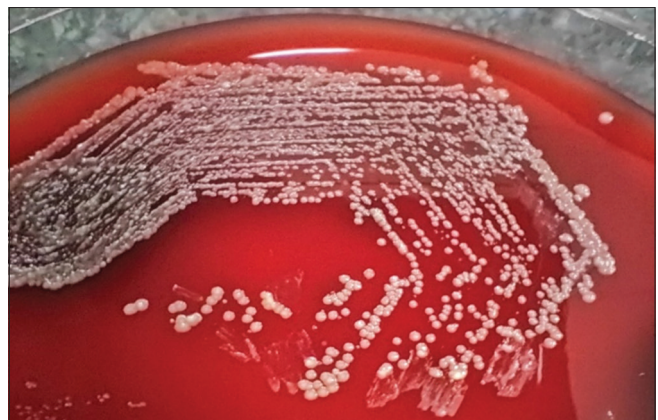
Sputum samples were sent for Gram stain and culture sensitivity. Gram stain finding was pus cells >25/Low power field (LPF), epithelial cells <10/LPF (Bartlett score = +2) along with the presence of Gram-negative cocci and few Gram-positive cocci [Figure 1]. On culture in blood agar, there was a heavy growth of non-hemolytic, small, round, opaque glistening colonies that moved when pushed [Figure 2]. On biochemical identification and Vitek 2 compact system (Biomerieux Inc) the organism was identified as *Moraxella catarrhalis* which was subsequently confirmed by matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS). The isolate was sensitive to ampicillin, ceftriaxone, cefixime, cefazolin, amoxicillin-clavulanate, piperacillin-tazobactam, ciprofloxacin, levofloxacin, amikacin, meropenem, doxycycline, and resistant to cotrimoxazole [Figure 3]. The patient was diagnosed as a case of acute exacerbation of COPD with an acute lower respiratory tract infection caused by *M. catarrhalis*. The patient was started on empirical intravenous ceftriaxone and oral azithromycin. Antimicrobials were not changed after culture reports were available. The patient improved within the next 1 week and was discharged from the hospital.

### Case 2

A 35-year-old homemaker lady has been visiting the Pulmonary Medicine OPD for the last six months with a history of asthma and atopy. For the last three weeks, she has had a history of intermittent fever, wet cough with expectoration of purulent sputum, and streaky hemoptysis. She was not a smoker and had no history of any addiction, diabetes, hypertension, or tuberculosis. On HRCT thorax she had right middle lobe and bilateral lower lobe bronchiectasis. A bronchoalveolar lavage sample was obtained from the patient, which showed many pus



**Figure 1:** Shows Gram stain of sputum with pus cells and Gram-negative diplococci



**Figure 2:** Shows colonies of *Moraxella catarrhalis*



**Figure 3:** Shows antimicrobial susceptibility of *Moraxella catarrhalis*

cells with few Gram-negative cocci. On bacterial culture there was a pure and heavy growth of *Moraxella catarrhalis* as identified by biochemical tests, Vitek 2 compact system (Biomerieux Inc), and confirmed by MALDI-TOF MS. The isolate was sensitive to ampicillin, ceftriaxone, cefixime, cefazolin, amoxycillin clavulanate, piperacillin tazobactam, ciprofloxacin, levofloxacin, amikacin, meropenem, doxycycline, and cotrimoxazole. The

patient was diagnosed as a case of bronchial asthma and bronchiectasis with superadded infection by *M. catarrhalis*. She was treated with oral ciprofloxacin 750 mg 1 tab twice daily for 2 weeks and recovered.

### Case 3

A 37-year-old male schoolteacher presented to the Pulmonary Medicine OPD with complaints of SOB, cough, and recurrent hemoptysis for the last 3 months. He also complained of occasional pain on the left upper back of his chest for the same duration. He had pulmonary tuberculosis diagnosed 3 years back for which he completed his treatment. There was no history of diabetes, hypertension, or any other comorbidities. On chest X-ray there were increased broncho-vascular markings. The sputum sample was of good quality with Bartlett score +2. Sputum Gram stain revealed predominant Gram-negative cocci and few Gram-positive cocci in chains resembling salivary viridans streptococci. On culture in blood agar, the sputum sample yielded heavy growth of *Moraxella catarrhalis* identified by biochemical test, Vitek 2 compact system and subsequently confirmed by MALDI-TOF MS. The isolate was sensitive to ampicillin, ceftriaxone, cefixime, cefazolin, amoxicillin-clavulanate, piperacillin-tazobactam, ciprofloxacin, levofloxacin, amikacin, meropenem, doxycycline and cotrimoxazole. The patient was diagnosed as a case of lower respiratory tract infection caused by *M. catarrhalis*. He was successfully treated with oral ciprofloxacin for 5 days.

### Case 4

A 33-year-old farmer presented to the Pulmonary Medicine OPD with complaints of low-grade fever and anorexia for the last six weeks, with cough and expectoration of mucopurulent yellow musty sputum. He had a history of SOB and cough with scanty expectorations for the last five years. He is a nonsmoker and denied any other addiction. There was no history of hypertension, diabetes, or tuberculosis in self or close contact. On HRCT thorax there was diffuse cystic bronchiectasis with increased bronchial wall thickness and tracheal dilatation. His total serum IgE was found to be 371 IU/ml. On screening for tuberculosis, both CBNAAT and Ziehl Neelsen staining were negative. The bronchoalveolar lavage sample showed many pus cells with few Gram-negative cocci. On bacterial culture there was a pure and heavy growth of *Moraxella catarrhalis* as identified by biochemical reactions, Vitek 2 compact system, and confirmed by MALDI-TOF MS. The isolate was sensitive to ampicillin, ceftriaxone, cefixime, cefazolin, amoxicillin-clavulanate, piperacillin-tazobactam, ciprofloxacin, levofloxacin, amikacin, meropenem, doxycycline, and cotrimoxazole. He was successfully treated with oral ciprofloxacin for 5 days.

### Case 5

A 46-year-old homemaker lady presented to the Pulmonary Medicine OPD with complaints of fever and cough for six weeks. She has a history of atopy and asthma, with intermittent SOB, associated with sneezing, lacrimation, and cough with musty

yellowish expectoration. She had a history of microbiologically confirmed pulmonary tuberculosis four years back, for which she had taken a full course of antitubercular therapy and was declared cured. For the last ten years, she has been a known diabetic, hypothyroid, and dyslipidemia. Sputum, which was a good quality sample, on culture yielded a heavy growth of *Moraxella catarrhalis* identified by biochemical tests, Vitek 2 compact system, and subsequently confirmed by MALDI-TOF MS. The isolate was sensitive to ampicillin, ceftriaxone, cefixime, cefazolin, amoxicillin-clavulanate, piperacillin-tazobactam, ciprofloxacin, levofloxacin, amikacin, meropenem, doxycycline and cotrimoxazole. She was treated successfully with oral levofloxacin for 10 days.

## Discussion

*Moraxella catarrhalis*, was once considered a commensal organism of the upper respiratory tract, with 53% colonization rate in the nasopharynx of infants above six months of age.<sup>[5]</sup> It has emerged as a significant pathogen causing respiratory infections. In the Indian subcontinent, studies from Pakistan showed a prevalence of *Moraxella* in lower respiratory tract infection between 5 to 20%.<sup>[6,7]</sup> But very few studies from India have reported *Moraxella catarrhalis* as a pathogen of LRTI. In a study done in Kerala, it was found that *M. catarrhalis* was present in 6.45% of culture-positive sputum samples. It was considered as significant lower respiratory tract pathogen, especially in elderly patients with underlying risk factors.<sup>[8]</sup> Here we report five cases of LRTI caused by *M. catarrhalis*. Among the five cases, two patients had allergic asthma with central bronchiectasis, two patients had a previous history of tuberculosis and one patient had acute exacerbation of COPD. All these patients developed lower respiratory tract infections caused by *M. catarrhalis*. In a study done in Japan, it was found that nearly half of the pneumonia cases caused by *M. catarrhalis* occurred during winter. These patients were typically older and more likely to have underlying pulmonary conditions like asthma and bronchiectasis.<sup>[9]</sup> In all the cases of our study, the disease onset was between December to March, which is winter and early spring in India, and had affected a diseased lung. In a study done in Nepal among 716 samples, 50.41% yielded respiratory pathogens, with *H. influenzae* being the most common, followed by *S. pneumoniae* and *M. catarrhalis* (6.90%) with the highest prevalence of *Moraxella* in males of the 61-70 age group, during winter. Amoxicillin-clavulanate and ceftriaxone were the most effective antibiotics, while ampicillin showed the least efficacy.<sup>[10]</sup>

In a tertiary care hospital in Northern India, 63 clinically significant *M. catarrhalis* isolates demonstrated a high prevalence of resistance to cotrimoxazole, penicillin, and ampicillin while showing maximum susceptibility to cefotaxime, tetracycline, and ciprofloxacin, with 34.9% of cases exhibiting multidrug resistance to more than three antimicrobials.<sup>[11]</sup> In a study involving 10 *Moraxella* isolates, 8 were  $\beta$ -lactamase producers and exhibited multidrug resistance (MDR) with 100% resistance to both ampicillin and ceftazidime.<sup>[12]</sup> However, in our study, all



the *Moraxella* isolates were fairly sensitive, and all five patients improved with treatment. This may be because all the patients were treatment naïve and presented to the OPD from rural parts of West Bengal without any history of recent antibiotic intake.

The implications of this case series of *Moraxella* infections causing pneumonia in individuals with diseased lung conditions are significant, especially considering the scarcity of reports from India. While *Moraxella* pneumonia cases are documented globally, the lack of attention to these pathogens in India suggests potential underdiagnosis or oversight in clinical practice. The findings underscore the importance of vigilance and proactive screening for *Moraxella* infections, particularly in patients with pre-existing lung conditions. By recognizing and promptly treating *Moraxella* pneumonia, healthcare providers can improve patient outcomes, prevent complications, and contribute to better management of respiratory infections in India. Increased awareness and inclusion of *Moraxella* in diagnostic protocols can lead to more accurate identification and targeted treatment strategies, ultimately reducing the burden of pneumonia-related morbidity and mortality in the country.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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