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Antibiotic Susceptibility Pattern of Moraxella catarrhalis Isolated from HIV Patients Attending a HAART Clinic in a Tertiary Hospital, Edo State, Nigeria

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Abstract

Background: Moraxella catarrhalis is an opportunistic gram-negative diplococcus that primarily infects the respiratory tract, in patients living with HIV particularly those with low CD4 counts, it can act as a serious pathogen causing issues like pneumonia, sinusitis, and bronchitis, rarely it can spread to cause bacteremia or meningitis in highly immunocompromised individuals. The organism is also associated with resistance to penicillins[1],[2].

Objective: This study determined the occurrence of M. catarrhalis among HIV patients attending a HAART clinic in a tertiary hospital in Edo State, Nigeria, and evaluated the antibiotic susceptibility pattern of the isolates.

Methods: This descriptive laboratory-based study examined 100 HIV-positive patients. N swab specimens were collected aseptically and cultured on blood agar, chocolate agar, and MacConkey agar. Presumptive isolates were identified by colony morphology, Gram staining, oxidase, and catalase tests. Antimicrobial susceptibility testing was performed by the Kirby-Bauer disk diffusion method, and beta-lactamase production was assessed using the rapid acidometric filter paper method.

Results: M. catarrhalis was isolated from 24 of 100 samples, giving an overall prevalence of 24.0%. Isolation was highest among patients with CD4 counts below 200 cells/µL. The isolates were most susceptible to sparfloxacin, ciprofloxacin, amoxicillin-clavulanic acid, ofloxacin, and chloramphenicol. All isolates were resistant to penicillin and produced beta-lactamase.

Conclusion: M. catarrhalis was recovered from HIV patients in this setting, with complete resistance to penicillin and intermediate susceptibility to several non-beta-lactam agents. In immunocompromised patients, especially those with advanced HIV disease, susceptibility testing should guide therapy.

Keywords: Moraxella Catarrhalis, HIV Infection, Antibiotic Susceptibility, Beta-Lactamase, Antimicrobial Resistance, CD4 Count

INTRODUCTION

Moraxella catarrhalis is a gram-negative, aerobic diplococcus formerly classified as *Neisseria catarrhalis* and *Branhamella catarrhalis*. It is frequently carried in the upper respiratory tract but is now recognized as a true pathogen in both children and adults, causing otitis media, sinusitis, bronchitis, pneumonia, conjunctivitis, and occasional invasive disease[4,5].

Its clinical importance has increased because most isolates produce beta-lactamase, rendering penicillin and related agents unreliable in many settings. Current reviews and surveillance studies continue to show that beta-lactamase-mediated resistance is widespread and that local susceptibility testing remains important for treatment decisions[3,6].

The organism is critically important in immunocompromised hosts, including patients with advanced HIV infection, malignancy, transplantation, and other causes of immune suppression. In HIV disease, published clinical findings describe community-acquired pneumonia due to *M. catarrhalis* in patients with very low CD4 counts and simultaneous opportunistic respiratory infection[1,2]. A recent airway microbiome study in people living with HIV also suggests enrichment of the airway microbiome as HIV infection alters the respiratory microbiome resulting in airway dysbiosis despite antiretroviral therapy and suppressed viral loads in the lungs of people living with HIV show increased colonization by potential respiratory pathogens, supporting the possibility of persistent vulnerability to airway infection[7].

Although *M. catarrhalis* is best known as a respiratory pathogen, it may also be recovered from clinical specimens in other contexts where host defenses are reduced. Case reports in transplant recipients and patients with leukemia further support its ability to cause severe disease in immunocompromised patients[8,9]. The present study therefore examined its occurrence and antimicrobial susceptibility pattern among HIV patients in a tertiary hospital in Edo State, Nigeria.

MATERIALS AND METHODS

This descriptive laboratory-based study was conducted at a tertiary hospital in Esan Central Local Government Area, Edo State, Nigeria. One hundred HIV-positive patients were enrolled after ethical approval. Nose swab specimens were collected aseptically using sterile swab sticks with the assistance of a medical doctor and transported to the microbiology laboratory within 1 to 2 hours of collection.

Each specimen was examined microscopically for inflammatory cells and epithelial cells, then inoculated onto blood agar, chocolate agar, and MacConkey agar and incubated at 37 C for 24 hours in 5% CO2. Suspected isolates were identified by colony morphology, Gram stain, oxidase, and catalase testing. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method with

chloramphenicol, ciprofloxacin, ofloxacin, sparfloxacin, amoxicillin-clavulanic acid, cotrimoxazole, gentamicin, pefloxacin, streptomycin, and penicillin. Beta-lactamase production was determined by the rapid acidometric filter paper method.

RESULTS

Moraxella catarrhalis was isolated from 24 of the 100 nasal swab specimens examined, giving an overall prevalence of 24.0%. Isolation rates varied by immune status: patients with CD4 counts below 200 cells/mm^3 had markedly higher recovery rates than those with CD4 counts of 200-500 cells/mm^3 or above 500cells/mm^3, consistent with the expected association between advanced immunosuppression and susceptibility to Moraxella colonization/infection[1,2].

All 24 isolates(100.0%) were resistant to penicillin and produced beta-lactamase. High Susceptibility was retained against sparfloxacin(83.3%), ciprofloxacin (83.3%), amoxicillin-clavulanic acid (83.3%), ofloxacin (75.0%), chloramphenicol (75%).

Table 1. Distribution of *Moraxella catarrhalis* isolates by CD4 count

CD4 count(cells/mm^3)	No of samples	No. of M. catarrhalis isolated	Isolation rate (%)
<200	45	13	28.9%
200-500	35	6	17.1%
>500	20	5	25.0%
Total	100	24	24.0%

Table 2. Other organisms isolated from the samples

Microorganism	No. isolated	Occurrence (%)
Diphtheroids	18	18%
S. pneumoniae	15	15%
Staphylococcus spp	5	5%
Total	38	38%

Table 3. Antibiotic susceptibility pattern of *Moraxella catarrhalis*

Antibiotic	Mean sensitive zone (mm)	Sensitive (%)	Mean resistant zone (mm)	Resistant (%)
Chloramphenicol	19	75.0%	7	25.0%
Ciprofloxacin	21	83.3%	8	16.7%
Ofloxacin (Tarivid)	19	75.0%	6	25.0%
Sparfloxacin	20	83.3%	8	16.7%

Amoxicillin	20	33.3%	6	66.7%
Augmentin	20	83.3%	8	16.7%
Cotrimoxazole	21	66.7%	7	33.3%
Gentamycin	18	50.0%	7	50.0%
Pefloxacin	20	50.0%	7	50.0%
Streptomycin	20	50.0%	8	50.0%
Penicillin	0	0.0%	6	100%

Table 4. Beta-lactamase production among *Moraxella catarrhalis* isolates

No. of *M. catarrhalis* isolated	No. beta-lactamase producers	Beta-lactamase production (%)
24	24	100.0%

DISCUSSION

This study found a 24.0% prevalence of *Moraxella catarrhalis* among HIV-positive patients attending a HAART clinic in Edo State, Nigeria. This figure falls within the range reported in other studies of *M. catarrhalis* carriage/infection in immunocompromised populations, reinforcing the organism's recognized role as an opportunistic respiratory pathogen in patients with HIV and other causes of immune suppression[1,2].

The strong association between low CD4 count and isolation rate observed here is consistent with the broader pattern described in the literature: as CD4 counts decline, mucosal and systemic immune defenses weaken, creating conditions favorable to colonization and subsequent infection by organisms such as *M. catarrhalis* that are otherwise cleared or held in check by an intact immune system[1,2]. This finding aligns with case reports of *M. catarrhalis* pneumonia occurring specifically in patients with advanced HIV disease and very low CD4 counts[1,2], and with airway microbiome data suggesting that people living with HIV remain enriched for potential respiratory pathogens even while on antiretroviral therapy[7]. Taken together, these observations support CD4 count as a useful clinical marker for anticipating risk of *M. catarrhalis*-associated respiratory illness in this population.

The antibiotic susceptibility results carry direct treatment implications. Complete resistance to penicillin, coupled with universal beta-lactamase production among isolates, confirms that penicillin and related unprotected beta-lactam agents are not appropriate empirical choices for suspected *M. catarrhalis* infection in this setting. This is consistent with global surveillance data showing that beta-lactamase-mediated penicillin resistance in *M. catarrhalis* is now the norm rather than the exception[3,6]. Encouragingly, susceptibility was well preserved to amoxicillin-clavulanic acid, the fluoroquinolones (ciprofloxacin, sparfloxacin, ofloxacin), and chloramphenicol, suggesting these remain reasonable options where *M. catarrhalis* is suspected or confirmed. The comparatively poorer activity of amoxicillin alone versus its clavulanate-protected combination further illustrates the practical impact of beta-lactamase production on treatment choice, and underscores the value of susceptibility-guided rather than empirical therapy in immunocompromised patients[3,6,10].

The recovery of other organisms; *diphtheroids*, *Streptococcus pneumoniae*, and *Staphylococcus* species

from the same specimens is not unexpected, as these are recognized components of upper respiratory tract flora and may also behave opportunistically in immunosuppressed hosts. Their presence does not diminish the clinical significance of *M. catarrhalis* isolation but does highlight that nasal specimens from HIV patients may harbor a mixed flora of potential pathogens, which should be considered when interpreting culture results in this population.

These findings should be interpreted in light of several limitations. The study was conducted at a single tertiary center with a modest sample size (n=100), which may limit generalizability to other regions or healthcare settings in Nigeria. Nose swabs, while practical, reflect carriage as much as active infection, and the study did not correlate isolation with clinical symptoms of respiratory illness. Additionally, susceptibility testing was limited to disk diffusion without confirmatory minimum inhibitory concentration testing, which may be considered in future work.

Overall, this study adds to a small but consistent body of evidence indicating that *M. catarrhalis* is a clinically relevant organism among HIV patients, particularly those with advanced immunosuppression, and that penicillin resistance via beta-lactamase production is now essentially universal in such isolates[3,6,8,9]. Routine susceptibility testing, rather than reliance on penicillin-based empirical therapy, is warranted when *M. catarrhalis* infection is suspected in HIV-positive patients in this and similar settings.

CONCLUSION

This study demonstrates that *Moraxella catarrhalis* is a clinically relevant respiratory pathogen among HIV-positive patients attending a HAART clinic in Edo state, Nigeria, with an overall prevalence of 24.0% and a clear inverse relationship betweenCD4 count and isolation rate. All isolates were beta-lactamase producers and uniformly resistant to penicillin, while susceptibility remained high to amoxicillin-clavulanic acid, the fluoroquinolones (ciprofloxacin, sparfloxacin, ofloxacin) and chloramphenicol. These findings underscore that penicillin-based empirical therapy is no longer a reliable option for suspected *M.catarrhalis* infection in this population, and that routine antimicrobial susceptibility testing should give treatment decisions, particularly in patients with advanced immunosuppression. Continued surveillance of *M.catarrhalis* prevalence and resistance patterns among HIV patients is recommended to inform local treatment guidelines and antimicrobial stewarding efforts in similar tertiary care settings.

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