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Prevalence and Antibiotic Sensitivity Pattern of *Moraxella catarrhalis* in Patients with Lower Respiratory Tract Infections in a Tertiary Health Care Centre in India

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A B S T R A C T

Moraxella catarrhalis, an aerobic gram negative diplococcus is frequently found as commensal of upper respiratory tract. But over last 20-30years the bacterium has emerged as a genuine pathogen and is now considered as an important cause of upper and lower respiratory tract infections in otherwise healthy children and elderly people. Increased isolation and rise in drug resistant strains of *M. catarrhalis* has renewed the interest to assess the role of *M. catarrhalis* in respiratory tract infections and study its antibiotic profile. Sputum specimens were collected for a period of six months. Specimens were screened based on Bartlett's grading of Gram stain. The screened specimens were put up for culture, biochemical reactions and antibiotic sensitivity testing. Association with various demographic factors was studied. 928 sputum specimens were screened. 498 specimens were processed. *M. catarrhalis* was isolated in 51(10.24%) specimens. Isolates showed maximum resistance to Ampicillin(60.78%). Most cases belonged to males (64.7%) above 60years age(45.09%). 60.78% cases had risk factor of smoking. Most (52.94%) cases were clinically diagnosed as pneumonia. *Moraxella catarrhalis* should be considered as significant lower respiratory tract pathogen especially in elderly patients with underlying risk factors. Continued surveillance should be done to decrease emergence of resistant strains.

Introduction

Respiratory tract infections are the most common infectious diseases affecting humans worldwide (Ramana *et al.*, 2012). *Moraxella catarrhalis* is a gram-negative diplococcus, formerly known as *Neisseria catarrhalis* or *Branhamella catarrhalis* that is found in the human upper respiratory tract as normal flora (Safia Bader Uddin Shaikh, *et al.*, 2015). The prevalence of colonisation is highly dependent on age. The upper respiratory tract of approximately 1% to 5% of healthy adults is colonized by *M. catarrhalis.* By contrast, nasopharyngeal colonization with *M. catarrhalis* is common throughout infancy (Mandell, Douglas and Bennett's Principles and Practices of Infectious Diseases, 7th edn). But over the

last two to three decades the bacterium has emerged as a genuine pathogen (Gupta *et al.,* 2011). In children the pathogen is the third most common etiological agent of otitis media after *Streptococcus pneumoniae* and non-typeable *Hemophilus influenzae* (Yu-Ching Su *et al.,* 2012). In adults, *M. Catarrhalis* is the second cause after non-typeable *Hemophilus influenzae* that accounts for 10% of bacterial-mediated exacerbation in patients with chronic obstructive pulmonary disease (COPD) (Yu-Ching Su *et al.,* 2012). In immuno-compromised hosts, the bacterium can cause a variety of severe infections including pneumonia, endocarditis, septicemia, and meningitis. In addition, hospital outbreaks of respiratory disease due to *M. Catarrhalis* have been described, now establishing the bacterium as a nosocomial pathogen (Cees Verduin *et al.,* 2002).

The emergence of *Moraxella catarrhalis* as a pathogen together with increasing prevalence of β-lactamase producing strains has renewed the interest in these bacterial species (Tamang *et al.,* 2005). The availability of new antimicrobial agents and the evolution of bacterial resistance mechanisms have contributed to changes in the epidemiology and the treatment regimens of infections caused by *M. Catarrhalis* (Farhan Essa Abdullah *et al.,* 2013). Hence this study was aimed at determining the prevalence of *Moraxella catarrhalis* as a pathogen in lower respiratory tract infections and to determine its antibiotic sensitivity pattern.

Materials and Method

Place and Duration of the Study

The study was conducted in the Department of Microbiology, VIMS, Ballari, Karnataka for a period of six months.

Selection of Specimen

Sputum specimens were collected from patients with lower respiratory tract infections. Specimens were screened based on Bartlett's grading of sputum Gram stain (Koneman's Color Atlas and Textbook of Diagnostic Microbiology, 6th edn).

Processing of Specimen

Specimens were inoculated on blood agar and MacConkey agar and incubated aerobically for 18-24hours at 37˚C. The isolates were identified by colony characteristics and biochemical tests such as catalase test, oxidase test, sugar fermentation test, DNase test, nitrate reduction test and Hugh Leifson's oxidative and fermentative test. *Moraxella catarrhalis* was identified as gram negative diplococcus on Gram's stain. It gave positive reaction with catalase and oxidase test. Nitrates were reduced and DNase test was positive. Sugars were not fermented and Hugh Leifson's test showed asaccharolytic type of reaction. Antibiotic susceptibility test was done by Kirby Bauer disk diffusion technique (CLSI Document, 2014). Association with demographic factors such as age, sex and various risk factors was studied.

Results and Discussion

Out of total 928 sputum specimens that were screened, 498 were processed further. The organisms isolated from the specimens were *Streptococcus pyogenes* (36.74%), *Klebsiella pneumoniae* (25.3%), *Staphylococcus aureus* (16.26%), *Moraxella catarrhalis* (10.24%) and others (11.45%). [Table 1]

Rate of isolation of *Moraxella catarrhalis* was more in males than in females with male: female ratio of 1.83:1. [Figure 1]

Isolation of *M. Catarrhalis* was seen more frequently seen in above 60years of age group (45.09%) followed by 51-60years group (29.41%). [Figure 2]

The clinical diagnoses of the patients from whom *M. catarrhalis* were isolated were pneumonia, acute exacerbation of COPD and chronic bronchitis. [Table 2] Most of the patients had expectoration of purulent sputum with low grade fever as the chief complaints.

The patients had various risk factors associated with them such as smoking (60.78%), alcoholism (29.41%), and diabetes mellitus (15.68%) [Figure 3].

Of 51 isolates of *M. catarrhalis,* 49 were susceptible to amoxicillin-clavulanate and 31 were resistant to ampicillin [Table 3].

The rate of isolation of *M. catarrhalis* in patients with lower respiratory tract infections was 10.24%. This finding is similar to that of a study done by Anita KB *et al.,* 2011 whose rate of isolation was 9.8%.

The isolates showed a male preponderance of 64.7%. This is similar to that of a study conducted by Eltaib M Abd Elrhman *et al.,* 2015 in which it was 63%. This higher preponderance in males may be due to the higher incidence of risk factors such as smoking and alcoholism in males.

Maximum isolates were found above the age of 50years which finding is similar to that in the study by Anita KB *et al.,* 2011. The age group distribution is also similar to a review by Catlin B Wesley, 1990. In older age group, along with decreased immunity, higher incidence of diseases such as diabetes may play a role in higher incidence of *Moraxella* infection in that age group.

Pneumonia was the commonest presentation in our study followed by acute exacerbation of COPD and bronchitis. This finding is similar to that of HV Prashanth *et al.,* 2011 wherein pneumonia was the commonest presentation (56.36%) followed by bronchitis (19.09%). Bronchopneumonia was also the most common presentation in the study of SB Siddesh *et al.,* 2011.

All the cases were associated with risk factors such as old age, smoking, alcoholism and diabetes mellitus. This is similar to that of the study done by Tamang MD *et al.,* 2005. Smoking was found to be the most common risk factor in patients with lower respiratory tract infections by *Moraxella catarrhalis* in our study. Smoking was also the most common risk factor in a study done by Chin *et al.,* 1993.

Thus in this study *Moraxella catarrhalis* was isolated mostly in elderly males with various risk factors.

Most isolates in our study were resistant to Ampicillin (10µg) and sensitive to Amoxicillin-clavunate (10/10µg). This is a similar finding in the study of Safia Bader Uddin Shaikh *et al.,* 2015.

The susceptibility patterns for Ciprofloxacin (5µg) and Cefotaxime (30µg) is similar to that in the study of Gupta N *et al.,* 2011. Overall the antibiotic susceptibility pattern is consistent with the study done by Gary V Doern *et al.,* 1996. The resistance pattern may be due to use of higher antibiotics in hospital setup.

Table.1 Distribution of Pathogens

Pathogens Isolated	Number	Percentage (%)
Streptococcus pyogenes	183	36.74
Klebsiella pneumonia	126	25.3
Staphylococcus aureus	81	16.26
Moraxella catarrhalis	51	10.24
Others	57	11.45

Table.2 Clinical diagnosis of *M. catarrhalis* isolates

Clinical Diagnosis	Number	Percentage (%)
Pneumonia	27	52.94
Acute Exacerbation of COPD	20	39.21
Chronic Bronchitis	4	7.84

Table.3 Antibiotic susceptibility pattern of *M. catarrhalis*

Antibiotics	Sensitive (%)	Resistant (%)
Ampicillin (10µg)	20 (39.21)	31 (60.78)
Erythromicin (15µg)	45 (88.23)	6 (11.76)
Gentamicin (10µg)	45 (88.23)	6 (11.76)
Cefotaxime (30µg)	44 (86.27)	7 (13.72)
Amoxicillin clavulanate (10/10µg)	49 (96.07)	2 (3.92)
Cotrimoxazole (1.25/23.75µg)	43 (84.31)	8 (15.68)
Ciprofloxacin (5µg)	44 (86.27)	7 (13.72)

Fig.1 Sex-wise distribution of *Moraxella catarrhalis*

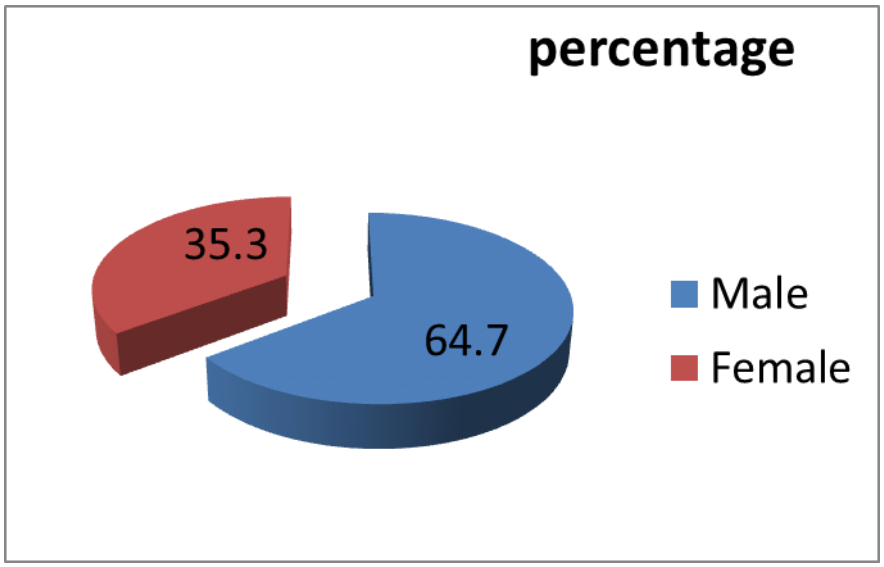


Fig.2 Age-wise distribution of *Moraxella catarrhalis*

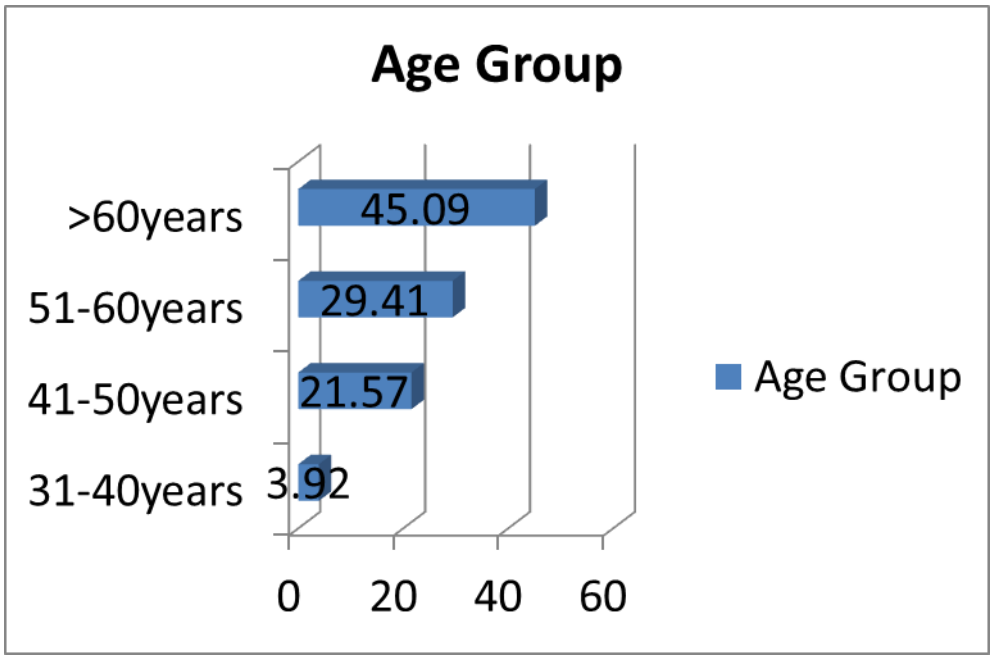
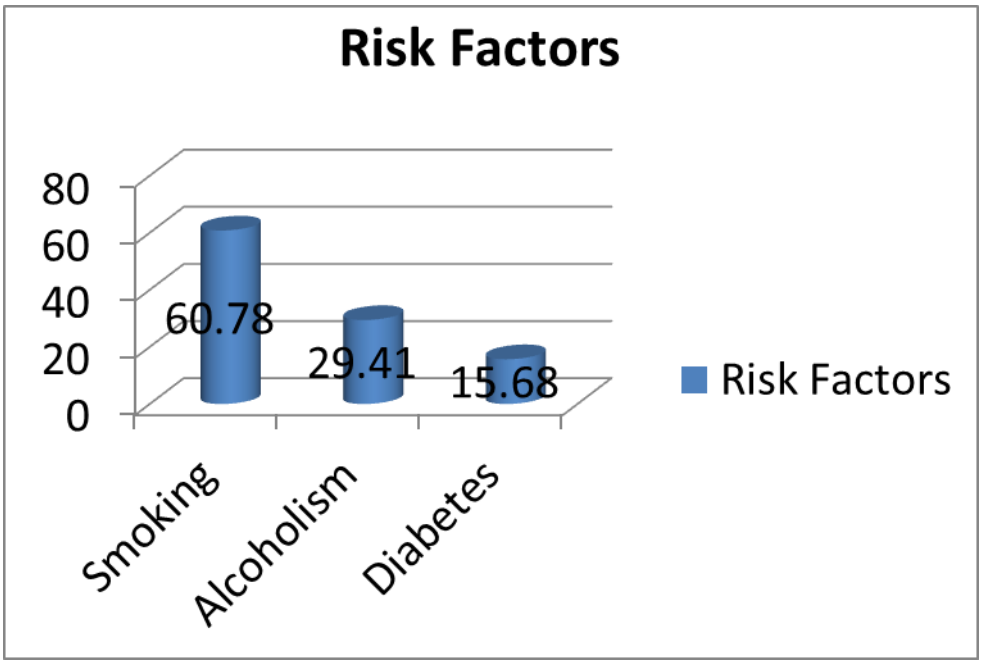


Fig.3 Risk factor distribution of *M. catarrhalis*



Colonies of *M. catarrhalis* resemble commensal *Neisseria* that are present in the normal human upper airway flora. The difficulty in distinguishing colonies of *M. catarrhalis* from those of *Neisseria* explains, in part, why *M. catarrhalis* has been overlooked as a respiratory tract pathogen (Timothy F Murphy and G Iyer

Parameswaran, 2009). Sputum culture presents a valuable tool for estimating the significance of *M. catarrhalis* in lower respiratory tract infections (Mario Vaneechoutte *et al.,* 1990). The findings of the present study show that *M. catarrhalis* isolation from sputum specimen in cases of lower respiratory tract infections, especially in elderly males and in presence of risk factors, should be taken into account. The emergence of drug resistance especially to beta-lactam antibiotics should be borne in mind.

In conclusion, over the past two decades *M. catarrhalis* has evolved from an emerging to a well-established pathogen (BV Ramana *et al.,* 2012). Continued surveillance of antimicrobial susceptibility pattern and application of control measures against further transmission are required to decrease the emergence of the resistant strains (Shih-Fen Hsu *et al.,* 2012).

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