ORIGINAL ARTICLE

Prevalence and emerging resistance of Moraxella catarrhalis in lower respiratory tract infections in Karachi

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Abstract

Objective: To determine the prevalence of Moraxella catarrhalis in sputum cultures from patients with lower respiratory tract infection and their antimicrobial sensitivity profiles.

Methods: The study comprised sputum specimens of 776 patients at various branches of Dr Essa's Diagnostic Lab, Karachi. The specimens were cultured on blood, chocolate, and eosin methylene blue agars between October 2010 and October 2011. The isolates were identified by conventional methods and anti-biograms were determined by the Kirby-Bauer Agar Disc Diffusion Method.

Results: Moraxella catarrhalis was isolated from 39 (5.02%) sputa of which 18 (46.15%) belonged to males. The bimodal age prevalence was 238 (30.7%) in age group 20-29 years, and 180 (23.1%) in 70 years and above. Amoxicillin/clavulanate, cefotaxime, and ceftriaxone were most effective (100%). Very high resistance was seen with amikacin (92.3%), cefixime (92.3%), fosfomycin (84.6%), cefuroxime (84.6%), erythromycin and amoxicillin (76.9%), cotrimoxazole (90%) and doxycycline (76.9%).

Conclusions: The incidence of Moraxella catarrhalis in sputum encourages routine culture and sensitivity of sputa from patients suffering from lower respiratory tract infection, especially the elderly and immunocompromised, for tailored drug prescription.

Keywords: Moraxella, Sputum, Antibiotic resistance, Amoxicillin/clavulanate. (JPMA 63: 1342; 2013)

Introduction

Moraxella catarrhalis, also known as ***Micrococcus catarrhalis***, ***Neisseria catarrhalis***, or ***Branhamella catarrhalis*** is a gram-negative, aerobic, oxidase-positive diplococcus. It is a common cause of otitis media, sinusitis and laryngitis.[1-3] It also causes bronchitis and pneumonia in children and in adults with underlying chronic lung disease and occasionally bacteraemia and meningitis, especially in immunocompromised persons.[1,2,4,5]

The emergence of ***M. catarrhalis*** as a pathogen in the last decade has renewed interest in this bacterial species. Studies done throughout the world show a considerable prevalence of organism in lower respiratory tract infections (LRTI), but there is lack of recent studies in Pakistan. LRTI is an important cause of infection-related mortality in Pakistan, and there is an increasing incidence of M. catarrhalis in sputa of patients with LRTI worldwide. But due to lack of routine culture and sensitivity of sputa, many cases go undiagnosed, and empiric treatment of LRTI has resulted in increased antibiotic resistance.

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***. Hence, our study was aimed at determining the prevalence of organism and effectiveness of several antibiotics against ***M. catrarrhalis*** cultured from sputa of patients suffering from LRTI.

Material and Methods

The samples were collected by instructing the patients to cough up sputum in a sterile container. Sputum cultures and sensitivity of 776 patients referred to Dr Essa's Diagnostic Lab at its various branches in Karachi from October 2010 to October 2011. Each specimen was thoroughly examined including its colour, odour, and whether blood tinged or purulent. Also, history of respiratory infection was taken regarding breathlessness, duration of infection, chest pain and cough.

We used chocolate agar, blood agar, and eosin methylene blue agar for culturing the specimens. They were incubated for 24 hours at 37°C, and bacterial growth was identified by colonial morphology, gram staining, and morphology on microscopy. Other tests used to identify the organism were oxidase test, catalase test, carbohydrate fermentation test, and nitrate reduction test. The sensitivity of micro-

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organisms was determined using antibiotic discs of 5-fluoroquinolones, aminoglycosides, cephalosporins, penicillins, and tetracyclines using Kirby-Bauer Agar Disk Diffusion Method.

Results

Cultures of sputa grew M. catarrhalis in 39 of 776 (5.02%) cultures, out of them 18 (46.15%) were males and 21 (53.8%) were females. Figure shows age wise prevalence of infection. With bimodal distribution it was found to be high in age group 20-29 years (n=12; 30.7%) and 70 years and above (n=9; 23.1%). The percentage of other organisms obtained were ***Streptococcus pneumoniae*** 261 (33.6%), ***Klebsiella pneumoniae*** 173 (22.3%), ***Pseudomonas aeruginosa*** 120 (15.5%), ***Staphylococcus aureus*** 126 (16.2%), and ***Escherichia coli*** 57 (7.3%).

In vitro agar diffusion analysis showed that in 39 specimens Amoxicillin/clavulanate, Cefotaxime, and Ceftriaxone were 100% (n=39) sensitive followed by Amikacin 36 (92.3%), Cefixime 36 (92.3%), Fosfomycin 33 (84.6%), Cefuroxime 33 (84.6%) and Erythromycin 30 (76.9%). Those that were most resistant include Cotrimoxazole 35 (90%) and Doxycycline 30 (76.9%) (Table).

Table: Drug sensitivity and resistance of *M. catarrhalis*.

Drug (%)	Resistance n (%)	Sensitivity n
Cotrimoxazole	35 (90)	4 (10)
Doxycycline	30 (76.9)	9 (23.1)
Enoxacin	27 (69.2)	12 (30.8)
Ofloxacin	27 (69.2)	12 (30.8)
Sparfloxacin	26 (66.7)	13 (33.3)
Ciprofloxacin	26 (66.7)	13 (33.3)
Moxifloxacin	23 (58.3)	16 (41.7)
Cefradine	21 (53.8)	18 (46.2)
Gentamicin	21 (53.8)	18 (46.2)
Lincomycin	18 (46.2)	21 (53.8)
Tobramycin	18 (46.2)	21 (53.8)
Erythromycin	9 (23.1)	30 (76.9)
Amoxicillin / Ampicillin	9 (23.1)	30 (76.9)
Fosfomycin	6 (15.4)	33 (84.6)
Cefuroxime	6 (15.4)	33 (84.6)
Penicillin	4 (9.1)	35 (90.9)
Cefixime	3 (7.7)	36 (92.3)
Clarithromycin	0 (0)	39 (100)
Sulbactam	0 (0)	39 (100)
Ceftriaxone	0 (0)	39 (100)
Ceftazidine	0 (0)	39 (100)
Cefotaxime	0 (0)	39 (100)
Amoxicillin/clavulanate	0 (0)	39 (100)

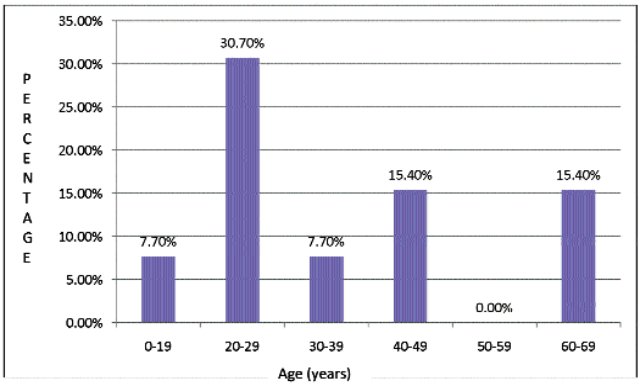

Figure: Percentage of *M. catarrhalis* in different age groups.

Discussion

M. catarrhalis is an important etiological agent associated with LRTI. The purpose of the study was to highlight the prevalence and increasing resistance of the organism. It was found in 5.02% specimens. Although in our study, other organisms including ***streptococcus pneumonia*** (33.6%), ***haemophilus influenza*** (22%), and ***klebsiella pnemoniae*** (15.4%) were frequently obtained, but the presence of ***M. catarrhalis*** in these 5.02% specimens does warrant the routine culture of sputa in patients suffering from LRTI.

Global studies show a considerable prevalence of organism. In a USA study, cultures of sputum grew ***M. catarrhalis*** in 7.7% specimens.[6] In Nepal, ***M. catarrhalis*** accounted for 6.90% of sputa cultures.[8] In a study done in Pakistan, prevalence of 12% was noted in patients having pneumonia.[8] Another local study showed ***Moraxella*** positive in sputa of 13% of patients with acute exacerbation of chronic bronchitis.[9]

The infection with ***M. catarrhalis*** can best be treated with amoxicillin/clavulanate and cephalosporins, such as cefotaxime or ceftriaxone. The drug sensitivity of ***Moraxella*** depends upon whether the strain is ß-lactamase producing or not, as the widespread production of ß-lactamase makes the micro-organism resistant to pencillins.[10]

In a European study, ***Moraxella*** was found to produce ß-lactamase in 98% of the specimens, and still showed sensitivity towards ampicillin.[11] ***Moraxella*** was found to be sensitive to ampicillin in 93.6% cases in an earlier study in Pakistan.[12] In the current study, it was found to be sensitive only in 76.9% cases.

Also, ***M. catarrhalis*** was found to be most sensitive to amoxicillin/clavulanate (100%) and results matched with a study done in Karachi which showed 98% sensitivity.[12]

The earlier study showed 92% sensitivity to cefotaxime,[12] but the current study showed 100% sensitivity. Similarly, it was also equally sensitive to ceftazidime and ceftriaxone (100%). The sensitivity of ***Moraxella*** towards amikacin was also high (92.3%) because of the fact that the drug is not frequently prescribed, as it is expensive, in developing countries like Pakistan, but on the other hand organism was sensitive to lincomycin only in 53.8% of cases. A study done in Pakistan showed ciprofloxacin effective in 93% cases,[12] but the current study it was effective only in 33% isolates. In a study done in Karachi, ***Moraxella*** was found to be sensitive to sparfloxacin in 95% isolates,[13] while in the current study it was sensitive only in 33%, while sensitivity towards ofloxacin and enoxacin was 30.7%. All of these results reflect a rapidly rising resistance of the micro-organism against quinolones within a time span of 8 to 9 years. In the current study, ***Moraxella*** was found to be sensitive to cotrimoxazole in 10% cases. Similar results were seen in an earlier study (10%)[12] compared to a higher sensitivity (93.5%) in a study done in USA.[14] Another recent study done in USA showed cotrimoxazole 85.5-96.8% sensitive against ***Moraxella***.[15] A previous study in Karachi showed 75% strains sensitive to erythromycin and clarithromycin.[12] The current study found 77% strains to be sensitive to erythromycin, which does not show a significant change.

Conclusion

Keeping in view the complications of infections caused by ***Moraxella catarrhalis***, its incidence in LRTI and its increasing resistance in our community necessitate the regular culture and sensitivity of sputum before prescribing antibiotic therapy. This is especially required for the elderly or the immunocompromised.

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References

1. Verduin CM, Hol C, Fleer A, van Dijk H, van Belkum A. Moraxella catarrhalis: from emerging to established pathogen. Clin Microbiol Rev 2002; 15: 125-44.
2. Karalus R, Campagnari A. Moraxella catarrhalis: a review of an important human mucosal pathogen. Microbes Infect 2000; 2: 547-59.
3. Murphy TF. Branhamella catarrhalis: epidemiology, surface antigenic structure, and immune response. Microbiol Rev 1996; 60: 267-79.
4. Winstanley TG, Spencer RC. Moraxella catarrhalis: antibiotic susceptibility with special reference to trimethoprim. J Antimicrob Chemother 1986; 18: 425-6.
5. Catlin B. Branhamella catarrhalisis: an organism gaining respect as a pathogen. Clin Microbiol Rev 1990; 3: 293-320.
6. Hafiz S, Naseem S. Spectrum of activity of sparfloxacin against local isolates. J Pak Med Assoc 2000; 50: 211-4.
7. Murphy TF, Brauer AL, Grant BJ, Sethi S. Moraxella catarrhalis in chronic obstructive pulmonary disease: burden of disease and immune response. Am J Respir Crit Care Med 2005; 172: 195-9.
8. Tamang MD, Dey S, Makaju RK, Jha BK, Shivananda PG, Bhramadatan KN. Prevalence of Moraxella catarrhalis infections of the lower respiratory tract in elderly patients. Kathmandu Univ Med J 2005; 3: 39-44.
9. Butt T, Rafi N, Ahmed S, Ahmed RN, Salman M, Mirza SH. Community-acquired bacterial pneumonias in Rawalpindi. Pak J Pathol 2005; 16: 14-6.
10. Khan S, Javaid A, Ghori RA, Mahmood K, Anwer N, Khan SU, et al. Cefaclor AF vs Clarithromycin in acute exacerbation of chronic bronchitis (B3M-PK-AJBG). J Pak Med Assoc 2003; 53: 338-45.
11. Schmitz FJ, Beeck A, Perdikouli M, Boos M, Mayer S, Scheuring S, et al. Production of BRO beta-lactamases and resistance to complement in European Moraxella catarrhalis isolates. J Clin Microbiol 2002; 40: 1546-8.
12. Turnak MR, Bandak SI, Bouchillon SK, Allen BS, Hoban DJ. Antimicrobial susceptibilities of clinical isolates of Haemophilus influenzae and Moraxella catarrhalis collected during 1999-2000 from 13 countries. Clin Microbiol Infect 2001; 7: 671-7.
13. Tabassum N, Ahmed A. Determination of anti-microbial susceptibilities of Haemophilus influenzae, Streptococcus pneumoniae and Moraxella catarrhalis. J Pak Med Assoc 2002; 52: 87-90.
14. Doern GV, Brueggemann AB, Pierce G, Hogan T, Holley HP Jr, Rauch A. Prevalence of antimicrobial resistance among 723 outpatient clinical isolates of Moraxella catarrhalis in the United States in 1994 and 1995: results of a 30-center national surveillance study. Antimicrob Agents Chemother 1996; 40: 2884-6.
15. Kärpänoja P, Nyberg ST, Bergman M, Voipio T, Paakkari P, Huovinen P, et al. Connection between trimethoprim-sulfamethoxazole use and resistance in Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis. Antimicrob Agents Chemother 2008; 52: 2480-5.