A Surveillance Study of Bacteriologic Profile in Rhinosinusitis


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ABSTRACT

Objective: To review the types of bacteria found in rhinosinusitis and the prevalence of a beta-lactamase producing organism in a tertiary care hospital during the year 2004 and compared with our previous reports.

Methods: Charts of patients who underwent endoscopic sinus surgery or maxillary antral puncture or endoscopic-guided culture at the Rhinology & Allergy Division, Department of Otolaryngology and the Department of Microbiology, Siriraj Hospital from January 2004 to December 2004 were reviewed. Information regarding the patient’s age, site of specimens, culture and sensitivity results were obtained.

Results: There were 162 specimens and 29 bacterial species isolated. There were 50.4% positive aerobic cultures, gram-negative bacteria were more common than gram-positive bacteria (68.5% vs 31.5%). Common aerobes were *Pseudomonas aeruginosa* (16.2%), non-fermentative gram negative rod : NF-GNR (10.8%), *Coagulase-negative Staphylococcus aureus* : CNS (9.9%) and *Klebsiella pneumoniae* (9.9%). The most common anaerobes were *Peptostreptococcus* sp., *Bacteroides fragilis* and *Fusobacterium* sp.

Conclusion: Contrary to our previous studies, gram negative organisms play a more important role than gram positive organisms. The causative pathogens of rhinosinusitis should be studied continuously because rapid progress in the development of new antimicrobial agents has a significant impact on their bacteriologic profile.

Keywords: Bacteriological study; rhinosinusitis

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The indications for obtaining specimens for culture or operation are according to the standard recommendations and guidelines. Antibiotics were withheld one week prior to the operations. A total of 162 patients (80 males and 82 females) were included in this study. The mean age was 47 +/- 18.2 years (range 10-86 years).

The specimens for bacteriological study were collected by 1. maxillary antral aspiration using sterile technique, or 2. endoscopic-guided middle meatus swab/aspiration, or 3. sinus tissue culture during endoscopic sinus surgery. For anaerobic culture, the specimens were transferred immediately on a blood agar plate, and put into GasPak anaerobic jars. All specimens were sent to the microbiology laboratory within 2 hours. Microorganisms were isolated and identified according to standard bacteriological methods and the antibiotic susceptibility was performed by the disk diffusion technique as recommended by the Clinical Laboratory Standards Institute (CLSI). Each bacterial inoculum was prepared by suspending 4-5 isolated colonies from pure culture in a peptone broth and the suspension was adjusted equal to the turbidity of McFarland standard solution No.0.5. The diameter of the inhibition zone around each antimicrobial disk after incubation on agar plates at 35°C for 18-24 hours was measured to the zone diameter interpretative standards as recommended by the CLSI. Beta-lactamase enzyme was detected by a rapid test for hydrolysis of nitrocefin solution. A positive reaction occurs when the color of the solution changes from yellow to red within 5 minutes of the procedure carried out at room temperature.

RESULTS

Altogether 162 specimens were collected and sent to the laboratory. Most of the specimens were taken from the operation room from chronic sinusitis cases. Aerobic cultures were positive in 50.6% (82 of the total 162 specimens): the 95% confident interval = 43.0-58.2 (Table 1). Gram positive bacteria were found in 35 specimens and gram negative bacteria were found in 76 specimens. The rate of cultured-positive and the bacteriological profiles were compared with our previous study in Table 2. The rate of cultured-positive profiles was statistically significantly different from the study in 2000 (95% CI). Maxillary, ethmoid and sphenoid sinuses were found positive cultured as 54.4%, 44.4% and 52.4% respectively. The most common aerobic bacteria isolated were P. aeruginosa (16.2%), non-fermentative gram negative rod (NF-GNR, 10.8%), Coagulase negative Staphylococcus (CNS, 9.9%) and Klebsiella pneumoniae (9.9%). Only 2.7% and 0.9% were positive for H. influenzae and M. catarrhalis respectively (Table 3). Due to the limited number of H. influenzae and M. catarrhalis isolated from our specimens, the incidence of the beta-lactamase producing strain of all specimens from respiratory infection in our hospital (55.1% for H. influenzae and 97.3% for M. catarrhalis) was shown instead. Prevalence of each type of aerobic bacteria isolated from each sinus was shown in Table 4. Forty three specimens were sent for anaerobic culture, 9% (4/43) were positive for anaerobic only and 13.95% (6/43) were positive for mixed aerobic and anaerobic organisms (Table 5). The most common anaerobes were Peptostreptococcus (4 specimens : 30.8%), Bacteroides fragilis (3 specimens : 23.1%) and Fusobacterium (2 specimens : 15.45%).
DISCUSSION

The percentage of positive aerobic cultures in this study is 50.6 % (95% CI = 43.0-58.2). The positive rate differs significantly from our previous study (71% positive rate with 95% CI = 68.5-85.3)³. But the positive rate does not reach the statistical significance for our studies during 1974-1978 and in 1979⁷. The positive rate depends on: 1. patient factors such as type of rhinosinusitis, duration of infection, antibiotics used, associated diseases; and 2. technical factors such as method of obtaining specimens from sinuses, delivery process and microbiologic identification process. Jiang RS, et al. (2000) study the rate of positive culture in sinusitis with or without secretion seen in middle meatus and found 44-53% positive in middle meatus without secretion and 51-70% in middle meatus with secretion⁹. The rate of positive culture (50%) may increase by improving: 1) the handling process of specimens to the laboratory such as the excessive dryness of specimens or 2) a short period of time from the outpatient department to the microbiology department. In this study, the specimens came from the operating room and outpatient section which are not in the same building as the lab. Direct comparison of positive cultures between studies is also not appropriate due to different sources of specimens. Karina P, et al. (1979) found the sinus mucosa yielded the highest rate of bacterial growth compared with pus in the sinus.⁵ On the contrary, Winther B, et al. (1996) found the cultures of small pieces of mucosa obtained at the time of surgery have a greater problem with contamination.¹⁴ Further prospective study may be beneficial for comparing the results of tissue culture and direct pus culture.

The predominant aerobic bacteria in this study were *P.aeruginosa*, NF-GNR and CNS. Gold and Tami (1997) found gram negative organisms are rarely implicated in chronic rhinosinusitis except in immunocompromized patients⁶. This study correlates with the study of Bolger in 1994, who reported CNS, *S.aureus* and *Pseudomonas* as predominant organisms⁷. The high rate of gram negative bacilli and *Pseudomonas* in this study may be explained by the fact that the majority of the cases were chronic cases which needed surgery⁶. It is possible that gram negative infections are found frequently in the refractory cases⁶. The role of CNS in rhinosinusitis remains controversial. Some authors consider CNS as contaminant but its role as a pathogen in other body sites has been reported¹⁰,¹¹. In this study, CNS grows 9.9% and is comparable to other reports (0-8%).¹²,¹³ Even the maxillary sinus tap which is considered a gold standard because it eliminates the chance of contamination from nasal flora, grows CNS for 6.9%. Then, CNS may play a role as pathogen in rhinosinusitis. Moreover, the semi-quantitative culturing method will guide the physician to consider CNS as a contaminant or a pathogen. Correlation of positive culture result with the patient’s clinical features such as sinusitis symptoms or endoscopic finding will be another parameter to support the role of CNS in sinusitis patients.

Comparing with our previous study during 1974-78 and 1979, the majority of causative organisms changed from gram positive to gram negative bacteria (68.5%). The incidence of beta-lactamase producing strains in our hospital is high (55% of *H.influenzae* and 97% of *M.catarrhalis*), but comparable with the study of Gwaltney JM, et al.²² Thus, the second-line antibiotics such as beta-lactamase inhibitor or newer-generation quinolone should be recommended in chronic cases.

The prevalence of anaerobic bacteria in our study in 1986 was 28.6%.¹² This study, showed the overall positive rate of anaerobe is 23.25%. When the sites of infected sinuses are taken into consideration, the ethmoid sinus had 25% positive, and the maxillary sinus had 24.24% anaerobic culture. Some studies reported that the prevalence of anaerobe was as high as 90%,¹⁰,¹² The question remaining for debate is whether the routine anaerobic culture should be done in every case of rhinosinusitis. Considering the high cost and limited accessibility of anaerobic culture together with the low rate of resistance to antibiotics, anaerobic culture should not yet be recommended as routine.

The drawback of this study is being a retrospective chart review. Most of the cases are chronic rhinosinusitis or acute exacerbation of chronic rhinosinusitis which need surgical treatment. However, it is relevant to our daily practice in dealing with the refractory cases. Maxillary sinus puncture/aspiration, which is considered the gold-standard for identifying causative organisms of rhinosinusitis is invasive, difficult to perform and not acceptable by most patients. So there is a need for other methods to provide some clues. It is true that surveillance study of pathogenic bacteria in bacterial rhinosinusitis is rare.²² Routine collection would at least provide a monitoring system of the bacterial pattern in rhinosinusitis in that locality which would facilitate more appropriate antimicrobial selection for the treatment of rhinosinusitis. Nevertheless, a prospective multicenter study of bacteriology of rhinosinusitis patients is being performed in our country, so there will be more useful data in this aspect in the future.

CONCLUSION

The common organisms of rhinosinusitis in our hospital are *P.aeruginosa*, NF-GFR and CNS. The emerging role of gram negative bacteria as a cause of rhinosinusitis should be recognized, and a surveillance study of common responsible bacteriology should be done continuously.

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