ORIGINAL ARTICLE

# Bacteriological Study of Chronic Maxillary Sinusitis with Special Reference to Anaerobes

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**Abstract**

Aspirates from 50 chronically inflamed maxillary sinuses were processed for aerobic and anaerobic bacteria. Bacterial growth was present in 48 (96%) specimens. There were 110 bacterial isolates (2.2/specimen). Forty of the isolates were aerobic or facultative organisms (0.8/specimen). The predominant aerobic or facultative organisms were *Staphylococcus aureus*, coagulase-negative staphylococcus (CNS), *S. pneumoniae, E. coli, H. influenzae and P. aeruginosa*. Seventy anaerobes were isolated (1.4/specimen), Prevotella spp, Peptostreptococcus spp., Porphyromonas spp. and bacteroides spp. being predominant. These findings illustrate the presence of polymicrobial aerobic-anaerobic flora in patients with chronic maxillary sinusitis.

**Keywords:** Chronic maxillary sinusitis, Anaerobic bacteria, Aerobic bacteria.

## INTRODUCTION

The microbiology of chronic maxillary sinusitis is polymicrobial, consisting of aerobic and anaerobic bacteria.[1-5] The recovery rate of anaerobic bacteria varied in these studies from 25-56%. When adequate methods are used, anaerobes can be recovered in more than half of all cases.[5] The prevalence of isolation of *Staphylococcus aureus* and gram negative rods also varied and ranged from 1-29%[1-4,6,7] and 0-15%[1-4,6] respectively.

Chronic sinusitis is suspected of being caused by impaired paranasal sinus ventilation and drainage disorders. Several studies have shown that in the majority of cases of chronic sinusitis, bacterial cultures are negative. Even PCR techniques have failed to demonstrate bacterial infection in most cases.[8] In a study antral cultures from 12 subjects were cultured for the organisms, growth was obtained only from 3 samples.[9] However, none of these studies employed methods that were adequate for the recovery of anaerobic bacteria.

This study summarizes our experience in recovery of microorganisms in adults.

## MATERIALS AND METHODS

The current study was conducted in the department of Microbiology and Otorhinolaryngology and Head-Neck Surgery, S. Nijlingappa Medical College and HSK Hospital and RC between 2009 and 2010.The study included 50 patients, 32 men and 18 women. Their ages ranged from 18-60 years. All patients had obstructive or subobstructive chronic hyperplastic sinusitis, had failed medical therapy and required surgical intervention. Cultures of sinus contents were done by either inferior or middle meatal antrostomy.

Sinusitis was judged to be present if the radiographic studies showed mucosal thickening and either an air-fluid level or complete opacification of the maxillary sinus. Water's view (occipitomental), lateral view, or CT scan nose and paranasal sinuses were obtained for confirmation. The degree of mucosal thickening was evaluated by noting the nearest distance between the air-mucosal interface and the lateral part of the sinus wall. Mucosal thickening was defined as a mucosal width of 5 mm or more. Patients had atleast one of the following complaints: facial pain, headache, purulent nasal discharge, fever or malaise. Chronic sinusitis was defined based on clinical records as an infection of atleast 12 weeks duration.[10]

Specimens were obtained using sinus puncture through the inferior meatus or by middle meatal antrostomy while endoscopic sinus surgery. Specimens were transported to the laboratory in a thioglycollate broth. The time between the collection materials and the inoculation of the specimen generally did not exceed 30 minutes.

Specimens were inoculated on to 5% sheep's blood, chocolate and Mac-Conkey's agar plates for aerobic and

facultative organisms. The plates were incubated at 37°C aerobically (Mac-Conkey agar) or under 5% carbon dioxide (5% sheep blood and chocolate agars) and examined at 24 and 48 hours.

For anaerobes, the material was plated on to prereduced vitamin $K_1$-enriched Brucella blood agar, an anaerobic blood agar plate containing Kanamycin sulfate and Vancomycin hydrochloride, an anaerobic blood plate containing Colistin sulfate and Nalidixic acid.[11] The anaerobic plates were incubated in jars (Gaspak) and examined at 48 and 96 hours.

Anaerobic and aerobic bacteria were identified using conventional techniques. Antibiotic sensitivity testing was done by Kirby Bauer disk diffusion method using standard antibiotic disks on all aerobic/facultative organisms.

## RESULTS

Bacterial growth was present in 48 (96%) specimens. Aerobic or facultative bacteria were present in 8 (16%) of the culture positive specimens, anaerobic bacteria alone in 20 (40%) and mixed aerobic and anaerobic bacteria in 20 (40%). There were 110 individual bacterial isolates recovered from the 48 specimens. Forty of the isolates were aerobic or facultative organisms (0.8/specimen). The predominant aerobic or facultative organisms were *S.aureus*, CNS, *S. pneumoniae*, *E. coli*, *H. influenzae and P. aeruginosa*. *P. aeruginosa* produces bluish green pigment on nutrient agar as shown in Figure 1.

There were 70 anaerobes isolated (1.4/specimen). The predominant anaerobes were Prevotella spp., Peptostreptococcus spp., Porphyromonas spp. and Bacteroides spp., as shown in Table 1. Prevotella spp. was the commonest anaerobe isolated in our study, it produces black colored colonies on blood agar, as it is shown in Figure 2. Bacteroides fragilis growth on blood agar and

**Table 1:** Bacteriology of 48 patients with chronic maxillary sinusitis

| *Bacteria* | *No. of isolates* |
|---|---|
| **Aerobic bacteria** | |
| *S.aureus* | 12 |
| *E.coli* | 08 |
| CNS | 05 |
| *P.aeruginosa* | 05 |
| *Klebsiella* | 05 |
| *S.pneumoniae* | 03 |
| *H.influenzae* | 02 |
| **Subtotal** | **40** |
| Anaerobic bacteria | |
| Porphyromonas spp. | 18 |
| Bacteroides fragilis | 14 |
| Peptostreptococcus spp. | 13 |
| Prevotella intermedia | 12 |
| Prevotella loescheii | 05 |
| Bacteroides ureolyticus | 05 |
| Prevotella melaninogenicus | 03 |
| **Subtotal** | **70** |
| **Total** | **110** |

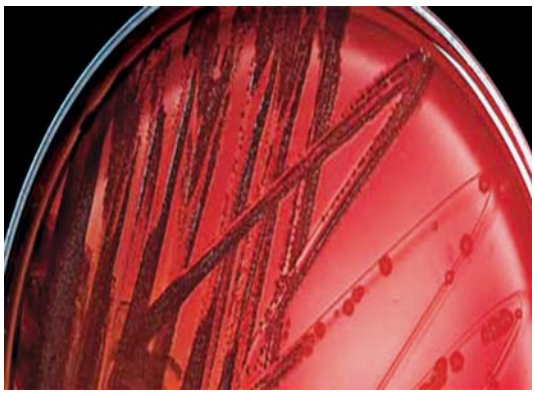

**Fig. 2:** Growth of Prevotella spp. on blood agar

**Fig. 1:** Pigmented colonies of *P. aeruginosa* on nutrient agar

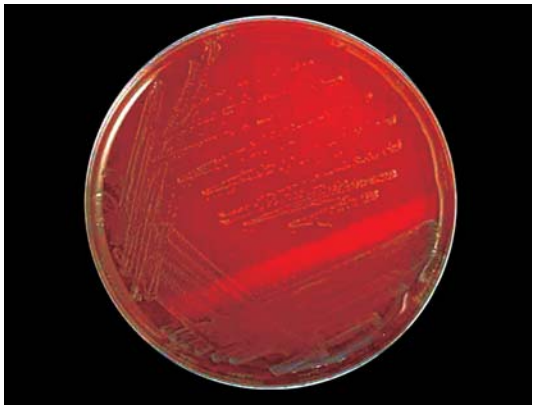

**Fig. 3:** Growth of Prevotella spp. on blood agar

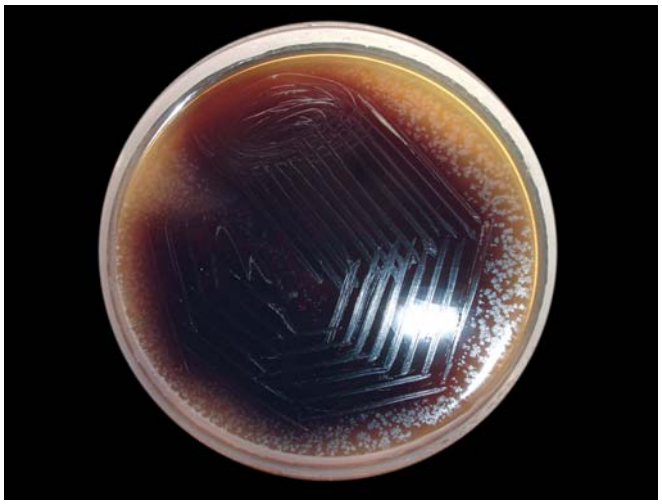

**Fig. 4:** Bacteroides fragilis on BBE agar

bacteroides bile esculin (BBE) agar is shown in Figures 3 and 4.

Antibiotic sensitivity testing was done on the aerobic isolates. The organisms were most sensitive to Cefotaxime, Amoxycillin + Clavulamic acid, Ciprofloxacin followed by Amikacin, Erythromycin and Cotrimoxazole. Sixty percent of the *S. aureus* isolates were sensitive to Oxacillin as shown in Table 2.

## DISCUSSION

This study report confirms findings from previous studies that demonstrate the predominance of anaerobic organisms (pigmented Prevotella, Porphyromonas, Fusobacterium and Peptostreptococcus spp.) in chronic maxillary sinusitis.[12] The lack of recovery of these organisms in previous studies and the inability to isolate any bacteria from most of the specimens recovered from patients with chronic maxillary sinusitis may be attributed to the lack of employment of methods adequate for the recovery of these organisms.

The frequent involvement of anaerobes in chronic sinusitis is probably related to the poor drainage and increased intranasal pressure that develops during inflammation. This can reduce the oxygen tension in the inflamed sinus by decreasing the mucosal blood flow and depressing ciliary action. The lowering of the oxygen content and pH of the sinus cavity supports the growth of anaerobic organisms providing them with an optimal oxidation-reduction potential.

Aerobic organisms were isolated in 28 specimens. Commonest isolate was the *S. aureus* followed by *E.coli*, CNS, *P. aeruginosa* and *Klebsiella*. Aerobic isolates were most sensitive to Cefotaxime, Amoxyclav, Ciprofloxacin followed by Amikacin, Erythromycin and Cotrimoazole. Around 60% of *S. aureus* isolates were sensitive to Oxacillin. Isolates resistant to beta lactam antibiotics were recovered from patients, who were on systemic antibiotics within the previous 6 weeks.

Obtaining a culture of the maxillary sinus may be of particular importance, so that appropriate antimicrobial therapy directed at their specific pathogens could be administered.

## CONCLUSION

Obtaining a culture including both aerobes and anaerobes from a case of maxillary sinusitis is of particular importance. Isolation of anaerobic bacteria can be improved by employing newer techniques adequate for the recovery since anaerobes are the most common organisms associated with chronic maxillary sinusitis and appropriate antimicrobial therapy directed at specific pathogens could be administered.

**Table 2:** Antibiotic sensitivity of aerobic isolates

| | *Ce (%)* | *Ak (%)* | *E (%)* | *Cf (%)* | *Co (%)* | *Ac (%)* | *Ox (%)* |
|---|---|---|---|---|---|---|---|
| *S. aureus* | 100 | 65 | 36 | 68 | 50 | 70 | 60 |
| CNS | 80 | 60 | 40 | 70 | 60 | 60 | 65 |
| *S. pneumoniae* | 100 | 70 | 30 | 70 | 30 | 100 | 70 |
| *E. coli* | 95 | 75 | 45 | 65 | 35 | 85 | — |
| *H. influenzae* | 100 | 50 | 50 | 100 | 100 | 100 | — |
| *p. aeruginosa* | 60 | 70 | 30 | 75 | 40 | 70 | — |
| *Klebsiella* | 70 | 60 | 30 | 70 | 40 | 65 | — |

Ce—Cefotaxime, Ak—Amikacin, E—Erythromycin, Cf—Ciprofloxacin, Co—Cotrimoxazole, Ac—Amoxyclav, Ox—Oxacillin
%—Percentage of strains sensitive to antibiotic.

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