SHORT ARTICLE

Microbiology of chronic maxillary sinusitis: comparison between specimens obtained by sinus endoscopy and by surgical drainage

I. BROOK, E. H. FRAZIER and P. A. FOOTE

Departments of Pediatrics and Infectious Diseases, Naval Hospital, Bethesda, MD and *Department of Otolaryngology, Alachua General and North Florida Regional Hospitals, Gainesville, FL, USA

The aerobic and anaerobic microbiology of sinus aspirates obtained during surgery was compared with culture of samples obtained by endoscopy. Six patients with chronic maxillary sinusitis were evaluated. Polymicrobial flora was found in all specimens (two-to-five isolates/sample). A total of 24 isolates (18 anaerobic, five aerobic and one microaerophilic) was obtained from sinus aspirates, and 25 isolates (16 anaerobic and nine aerobic) were found in endoscopic specimens. The predominant organisms were Prevotella spp., Fusobacterium nucleatum, Peptostreptococcus spp. and Staphylococcus spp. Concordance in the type and concentration of organisms was found in all cases. Sixteen of the 18 anaerobes isolated from sinus aspirates were also found in the concomitant endoscopic sample. Five aerobic isolates were found in both sinus aspirates and endoscopic samples and their concentration was similar. However, four aerobic gram-positive bacteria (<10^4 cfu/sample) were found only in endoscopy samples. This pilot study demonstrates the usefulness of endoscopic aspiration in the isolation of bacteria from chronically infected maxillary sinuses.

Introduction

Aspiration of the maxillary sinus during an aseptic surgical procedure or by antral puncture is considered to provide the optimal culture material for determination of the microbiology of sinusitis [1-5]. However, aspiration of the sinus is an invasive procedure that requires local or general anaesthesia, and can be associated with discomfort, pain and complications. The diagnostic and therapeutic use of endoscopy has increased in recent years [6]. However, as the procedure involves passage of the endoscope thorough the nose, the specimens obtained by endoscopy may contain organisms that originate from the nasal mucosal flora and not the involved sinus. The adequacy of sinus cultures obtained by endoscopy has therefore been questioned.

The increasing resistance to antibiotics of organisms from sinus infections has made the management of these infections more complex [7]. Sinus aspiration is used in many instances to provide guidance for the selection of appropriate antimicrobial therapy. This pilot study was designed to compare the microbiology of sinus secretions that were obtained by endoscopy with those obtained by aspiration during surgical drainage.

Patients and methods

The six patients presented in this report were seen consecutively. All underwent a Caldwell-Luc operation for chronic maxillary sinusitis. Chronic sinusitis was judged to be present if the roentgenographic studies showed mucosal thickening and either an air-fluid level or complete opacity the maxillary sinus. All patients had tenderness over the maxillary sinus. Occipitomental (Waters’ view), lateral, oblique and verticomental views were obtained. 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 ≥6 mm. Patients had at least two of these symptoms: facial pain, frontal headache, cough, purulent nasal discharge or fever. None of the patients had received local or systemic antimicrobial therapy for at least 1 week before sample collection. The disease was of at least 3 weeks’ duration.

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Address for correspondence: Professor I. Brook, Post Box 70412, Chevy Chase MD 20813–0412, USA.
Two specimens were obtained from each patient. One specimen was obtained before the Caldwell-Luc operation, by maxillary sinus endoscopy, while the other was obtained after the operation, by maxillary sinus endoscopy, with the number of isolates/specimen ranging from 5 to 11 (median, 7). The predominant aerobic organisms were Pseudomonas aeruginosa (8), Staphylococcus aureus (8), and Streptococcus pneumoniae (2). The predominant anaerobic organisms were Prevotella spp. (13 isolates), Peptostreptococcus spp. (11) and Fusobacterium nucleatum (6).

**Results and discussion**

All six sinus aspirates and endoscopy specimens showed bacterial growth. A total of 24 isolates (18 anaerobic, five aerobic and one microaerophilic) was obtained from sinus aspirates; 25 isolates (16 anaerobic and nine aerobic) were obtained from endoscopic specimens (Table 1). Anaerobic bacteria were isolated from all specimens. Aerobic bacteria were found in four of the six sinus aspirates and in all six endoscopic specimens. Polymicrobial flora was found in all specimens, with the number of isolates/specimen ranging from two to five (Table 1). The predominant anaerobic organisms were *Staphylococcus* spp. (5), *Haemophilus influenzae* (2), *Streptococcus pneumoniae* (2), and *Streptococcus pyogenes* (2). β-Lactamase-producing-organisms were isolated from aspirates from five of the six patients (Table 1). Gram's stain preparations of all aspirates showed organisms similar to those isolated by culture in all instances.

The number of most aerobic and anaerobic organisms that were isolated by both methods was $\geq 10^6$ cfu/ml. Concordance in the types and generally in the number

### Table 1. Microbiology of sinus aspirates obtained from six patients with chronic maxillary sinusitis by either direct or endoscopic sampling

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (years)/sex</th>
<th>Bacteria isolated (cfu/ml)</th>
<th>Gram's stain</th>
<th>Endoscopic samples</th>
<th>Bacteria isolated (cfu/ml)</th>
<th>Gram's stain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36/M</td>
<td><em>H. influenzae</em> (4 × 10^5)*</td>
<td>GNR</td>
<td><em>H. influenzae</em> (4 × 10^5)*</td>
<td>GNR</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>44/F</td>
<td><em>F. nucleatum</em> (2 × 10^5)*</td>
<td>GFC</td>
<td><em>F. nucleatum</em> (5 × 10^5)*</td>
<td>FGNC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>31/M</td>
<td><em>P. intermedia</em> (5 × 10^5)</td>
<td>GNR</td>
<td><em>P. intermedia</em> (9 × 10^5)</td>
<td>GNR</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>25/F</td>
<td><em>F. nucleatum</em> (7 × 10^5)*</td>
<td>GFC</td>
<td><em>P. intermedia</em> (8 × 10^5)</td>
<td>GFC</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>29/M</td>
<td><em>P. intermedia</em> (5 × 10^5)</td>
<td>GNC</td>
<td><em>P. intermedia</em> (8 × 10^5)</td>
<td>GNC</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>30/M</td>
<td><em>P. intermedia</em> (2 × 10^5)*</td>
<td>GNR</td>
<td><em>P. intermedia</em> (8 × 10^5)</td>
<td>GNR</td>
<td></td>
</tr>
</tbody>
</table>

GNC, gram-negative cocci; GPC, gram-positive cocci; GNR, gram-negative rods; FGNC, fusiform gram-negative rods.

*β-Lactamase producer.*
of organisms/ml was found in all instances. Sixteen of 18 anaerobes isolated from sinus aspirates were also found in the concomitant endoscopic sample. The only two anaerobic isolates that were not also found in the concomitant endoscopic specimens were *P. aerobacter* (patient no. 3) and *P. intermedia* (patient no. 4). The micro-aerophilic streptococci (*S. sanguis*) found in a sinus aspirate (no. 2) was also not isolated in the concomitant endoscopic sample. Five aerobic organisms that were found in sinus aspirates were also cultured from the corresponding endoscopic sample in similar numbers per sample. However, four gram-positive aerobic organisms (in numbers <10^4 cfu/ml) were found only in the endoscopic samples (patients nos. 2, 3, 4 and 6).

This report confirms previous studies that illustrated the polymicrobial aerobic–anaerobic flora of chronically infected maxillary sinuses [1–5]. This study also demonstrated the usefulness and general accuracy of endoscopic samples in the isolation of organisms from chronically infected maxillary sinuses. The microorganisms that were found in both locations were generally found in numbers >10^5 cfu/ml. In contrast, the isolates that were found only in endoscopically obtained specimens were generally present in numbers <10^4 cfu/ml (except in patient no. 2). These findings suggest that the origin of the latter isolates was the nasal mucosa rather than the sinus cavity.

This pilot study indicates the usefulness of endoscopy in establishing the microbiology of chronically infected maxillary sinuses. Quantitative cultures can exclude aerobic organisms in concentrations of <10^4 cfu/ml while the recovery of anaerobic bacteria even in smaller concentrations may be significant. However, studies of larger numbers of patients are warranted to further elucidate the usefulness and limitations of bacterial cultures obtained through endoscopy in acute and chronic maxillary sinus infections.

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**References**