Predominance of Anaerobes in Polymeric Ear Fluid and PE Tubes

James C. Wang, PhD1;2, Terrell Bibb, MS1; Debdeep Banerjee, AB1; Joehassin Cordero, MD3; Joshua C. Demke, MD3; Jane A. Colmer-Hamood, PhD4; Abdul N. Hamood, PhD4

1School of Medicine, 2Department of Surgery, 3Department of Otolaryngology – Head and Neck Surgery, 4Department of Immunology & Infectious Diseases, Texas Tech University Health Sciences Center (TTUHSC)

INTRODUCTION

Post tympanostomy-tube otitis media (PTTO) is active drainage through an existing TT, which can lead to tube occlusion and discomfort. Bacterial pathogens that are commonly associated with PTTO are Staphylococcus aureus, Haemophilus influenzae, Moraxella catarrhalis, Pseudomonas aeruginosa, and Streptococcus pneumoniae. In addition, many unique bacterial species of the otologic microbiome were indicated, with P. aeruginosa as the majority with a 82.7% relative abundance rate. Bacteria inhabiting the middle ear cavity can be characterized into an assortment of aerobic and anaerobic families. In the following study, we present a case report of recurrent ear infections for an extended period of time resulting in removal of the contaminated tubes. After tube removal, culture samples from both the ear fluid and the tubes themselves were processed using gene pyrosequencing.

CASE PRESENTATION

A 3-year-old girl with tubes placed when she was one presented with brownish-green purulent drainage after more than a year without follow-ups. The patient had chronic PTTO since tube placements, but had not followed up in clinic. She had recently completed an oral course of cephalexin and had not been on topical otic drops. She had been medically managed with multiple rounds of antibiotics including cefazolin, ciprofloxacin, levofloxacin, and ticarcillin/clavulanate. Microbiology cultures of her ear fluids several months earlier were positive for H. influenzae. Clinical examination with handheld otoscope confirmed the presence of bilateral drainage. She was schedule for tube removal. The right ear revealed crustings along the conchal bowl on the external auditory canal (EAC). In addition, the right EAC was filled with mucopurulent fluid overlying the tympanic membrane (TM). The TM was perforated but not patched due to the nature of the otonea. The left ear also contained a mucopurulent drainage. Culture based diagnosis of otomea from both ears revealed the presence of Pseudomonal strains that were resistant to cefotaxime, cefpodoxime, ciprofloxacin, levofloxacin, and ticarcillin/clavulanate. The tubes were extracted and together with the ear fluid were analyzed with pyrosequencing.

RESULTS

Table 1: Results obtained for middle ear fluid versus TT using pyrosequencing

<table>
<thead>
<tr>
<th>Gram</th>
<th>Aerobiasis</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefuroxime axetil (79%)</td>
<td>Gram-negative (79%)</td>
<td>Pseudomonas aeruginosa (79%)</td>
</tr>
<tr>
<td>Ceftriaxone (79%)</td>
<td>Gram-negative (79%)</td>
<td>Pseudomonas aeruginosa (79%)</td>
</tr>
<tr>
<td>Ciprofloxacin (79%)</td>
<td>Gram-negative (79%)</td>
<td>Pseudomonas aeruginosa (79%)</td>
</tr>
</tbody>
</table>

Table 2: Clinical Microbiology Laboratory Findings

<table>
<thead>
<tr>
<th>Left Ear Tube</th>
<th>Right Ear Tube</th>
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</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa (0%)</td>
<td>Pseudomonas aeruginosa (0%)</td>
</tr>
<tr>
<td>Pasteurella pneumotropica (0%)</td>
<td>Pasteurella pneumotropica (0%)</td>
</tr>
<tr>
<td>Enterobacter cloacae (0%)</td>
<td>Enterobacter cloacae (0%)</td>
</tr>
</tbody>
</table>

In addition, many studies have suggested that the role of anaerobic bacteria in chronic suppurative otitis media in children. Within this model, early colonizers cannot coaggregate with late colonizers and therefore rely on P. aeruginosa to serve as the glue between these different species.

As shown in Table 1, within the middle ear as well as the tympanostomy tube, bacterial populations include Gram +, Gram -, aerobes and anaerobes. Data provided in this study, point to certain important clinically relevant observations. First, depending on the stage of infection and the duration of the TT placement and the history of both the culture-based diagnosis and pyrosequencing, the population of microorganisms may vary. For example, this patient suffered from chronic otitis media with TT placement for a duration of 2 years. Second, based on culture based diagnosis and antibiogram profile analyses, these bacterial populations also varied in their antibiotic resistance. For example, in this patient, the primary culture was Pseudomonas, which was resistant to numerous antibiotics including cefotaxime, ceftriaxone, ciprofloxacin, levofloxacin, and ticarcillin/clavulanate. Third, based on pyrosequencing data, the population of the bacterial pathogens varies between planktonic cells within the isolated from the infected ear fluid and those recovered from the TTs. For example, in this case, Pseudomonas and Streptococcus species were both identified through standard laboratory cultures and pyrosequencing. Laboratory cultures also identified coagulase negative Staphylococcus species, diphtheroids, and E. faecalis which were not detected through pyrosequencing (Table 2).

DISCUSSION

Based on these findings, we suggest the following model for the possible interaction between P. aeruginosa and F. nucleatum and the influence of the environment on their interaction (Figure 1). In this study, we showed that the number of anaerobes within the middle ear fluid or on the TTs was significantly higher than those of other aerobic bacteria (Table 1). Although classified as an aerobic organism, P. aeruginosa is considered by many as a facultative anaerobe, as it can survive and proliferate in partial or totally anoxic environments. In addition, P. aeruginosa can utilize nitrate as a terminal electron acceptor in the absence of oxygen. Current studies are further elucidating the interactions between aerobic and anaerobic in the middle ear.

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REFERENCES