Aerobic and Anaerobic Bacteriology of Purulent Nasopharyngitis in Children

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Purulent nasopharyngitis is commonly found in children with upper respiratory tract infections. It is often, but not always, associated with acute pharyngitis. Previous microbiological studies (1, 4, 10) of the purulent nasal discharge utilized techniques for the recovery of only aerobic and facultative anaerobic bacteria. The role of strictly anaerobic bacteria, which have been recovered in many other upper respiratory tract infections (2), was therefore unknown.

This study characterizes the aerobic and anaerobic flora of nasal cavity specimens obtained from patients with purulent nasopharyngitis.

Twenty-five patients (18 males and 7 females) seen in the outpatient clinic for acute purulent nasopharyngitis were included in this study. The presence of leukocytes in the purulent discharge was assessed by Wright stain. Although nasopharyngitis is often, but not always, associated with pharyngitis, for this study it was defined as the presence of nontransparent anterior nasal discharge associated with clinical signs of acute pharyngitis. Patients ranged in age from 6 months to 5 years (average, 3 years and 5 months). Patients were included in the study if they had no evidence of otitis media or a nasal foreign body and had received no antimicrobial therapy within the past 4 weeks.

Twenty-five children (15 males and 10 females) seen in the pediatric clinic for routine physical examination served as controls. Their ages ranged from 8 months to 5 years and 4 months (average, 3 years and 10 months). They were included in the control group if they had no signs of infection or any other illness and had not received antimicrobial therapy within the past 4 weeks.

Swab cultures for aerobic and anaerobic bacteria were obtained from one nostril (left). Two nasopharyngeal swabs (one for aerobic and one for anaerobic bacterial cultures) were inserted beneath the inferior turbinate approximately 3 to 5 cm into the nasal cavity, and the inferior meatus area was swabbed. Swab cultures for aerobic bacteria were obtained from the posterior pharyngeal wall.

Cultures for aerobic bacteria were obtained with a single sterile rayon swab system (Culturette; Marion Scientific, Div. Marion Laboratories, Inc., Kansas City, Mo.). Cultures for anaerobic bacteria were obtained by introducing a cotton swab into anaerobic transport medium (Port-A-Cul; BBL Microbiology Systems, Cockeysville, Md.). The specimens were transported to the bacteriology laboratory and inoculated within 20 min of collection.

Sheep blood (5%), chocolate, and MacConkey agar plates were inoculated for the isolation of aerobic organisms. The culture plates were incubated aerobically at 37°C (Mac-Conkey agar) and under 5% CO₂ (blood agar and chocolate agar) and examined at 24 and 48 h. For anaerobic cultures, the specimens were inoculated onto preduced vitamin K₁-enriched brucella blood agar, onto blood agar containing kanamycin (75 μg/ml) and vancomycin (7.5 μg/ml), into an anaerobic blood plate containing phenylethyl alcohol, and into enriched thioglycolate broth (9). These media were incubated in GasPak (BBL) jars at 37°C and examined after 48 and 96 h of incubation at 37°C. The thioglycolate broth cultures were incubated for 14 days. Anaerobic bacteria were identified by techniques described previously (5, 9). Aerobic bacteria were identified by conventional methods (6).

β-Lactamase activity was determined on five colonies of each morphological type by the chromogenic cephalosporin analog 87/312 methodology (7). Statistical analysis was done with Student's t test of independent means.

Microorganisms were recovered from all clinical specimens. Aerobic or facultative anaerobic organisms only were recovered from the nostrils of 2 (8%) of the patients with nasopharyngitis, anaerobes were found in only 3 (12%) patients, and mixed aerobic-anaerobic flora were found in 20 (80%) patients. Aerobic bacteria were recovered in 8 (24%) of the control group, anaerobes were found in only 1 (4%) child, and mixed aerobic-anaerobic flora was found in 16 (64%) children.

A total of 98 isolates (3.9 per patient), 45 aerobic or facultative anaerobic (1.8 per patient) and 53 anaerobic (2.1 per patient) isolates, were isolated in patients without purulent nasopharyngitis. Only 73 isolates (2.9 per patient) were...
found in the controls, i.e., 47 aerobic or facultative anaerobes (1.9 per patient) and 26 anaerobes (1.0 per patient) (Table 1).

The organisms recovered in statistically significantly higher numbers in patients with nasopharyngitis were *Streptococcus pneumoniae* (P < 0.05), *Haemophilus* spp. (P < 0.05), *Peptostreptococcus* spp. (P < 0.001), all *Fusobacterium* spp. (P < 0.001), and all *Bacteroides* spp. (P < 0.001). The organisms recovered in higher numbers from control specimens compared with those from purulent nasopharyngeal discharges were *Staphylococcus aureus* (P < 0.1) and *Propionibacterium acnes* (P < 0.01).

β-Lactamase activity was detected in 19 isolates recovered from 15 individuals (9 patients and 6 controls). These included 10 of the 11 *S. aureus*, 1 of 6 *H. influenzae*, 2 of 15 *Branhamella catarrhalis*, 2 of 3 *Escherichia coli*, and 4 of 13 *Bacteroides melaninogenicus* group isolates.

All pharyngeal cultures showed bacterial growth. Organisms similar to those isolated in the nostrils were isolated in 21 cases (Table 1).

The results of this study demonstrate the recovery of numerous bacterial isolates from children with purulent nasopharyngitis, as well as from the healthy control group. However, differences were noted in the types of organisms recovered in purulent nasopharyngeal discharges as compared with the controls. Whereas *S. aureus* and *P. acnes* were more frequently isolated in controls, *S. pneumoniae*, *Haemophilus influenzae*, *Peptostreptococcus* spp., *Fusobacterium* spp., and *Bacteroides* spp. were more often isolated in the mucopurulent discharges. The differences in recovery of aerobic and facultative anaerobic bacteria were previously described (1, 4, 10). However, the differences found in anaerobic bacteria have not been previously observed. The isolation of anaerobes in purulent nasopharyngeal discharge is not surprising, since these organisms can be found as part of the normal oropharyngeal flora (2), as well as in the normal nasal mucosa (8). The anaerobes normally found to colonize the nasal mucosa were *Peptostreptococcus* spp., *Veillonella parvula*, and *Propionibacterium acnes* (8, 11). *Bacteroides* spp. and *Fusobacterium* spp., which are found as normal flora in the oropharynx, were not isolated in the nose.

The exact etiologies of the infections of the patients studied for this report were not determined, since no viral cultures were taken. However, the recovery of several aerobic and anaerobic bacteria not generally found as part of the nasal flora, from patients with purulent nasopharyngitis, may signify a potential pathogenic role for these organisms. A pathogenic role was suggested for *H. influenzae* and *Streptococcus pyogenes* in nasal and perinatal infections by Cherry and Dudley (3). The concomitant presence of these organisms in the inflamed pharynx suggests the concept of a generalized inflammation that also involves the nostrils. Further studies are needed to investigate the pathogenic role of anaerobic bacteria in this infection.

Todd et al. (10) attempted to modify the progress of purulent nasopharyngitis by using cephalixin. Although some bacterial strains susceptible to cephalixin were identified, the clinical outcome was not affected. However, since the antibacterial spectrum of cephalixin is limited, these researchers suggested the need for further studies to investigate the therapy of nasopharyngitis with antimicrobial agents with wider spectra of activity. The finding, in the purulent exudate, of several aerobic and anaerobic organisms that produce β-lactamases warrants the use of antimicrobial agents resistant to this enzyme in any future studies.

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**LITERATURE CITED**


