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Microbiology of Adenoid Infection in Children with Recurrent of Otitis Media

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ABSTRACT

This analysis aimed to resolve the qualitative and quantitative microbiology of adenoid tissue in children with or without recurrent otitis media. Total 133 children (aged 1-9 years) due to adenoid infection that underwent adenoidectomy in Imam Khomeini Hospital between Jan 2008 to Dec 2009, were engaged in this study. Of the 133 children studied, 67 (50.36%) patients with recurrent otitis media and 66 (49.62%) patients in the group without recurrent otitis media were observed. The most common organisms isolated were *Alpha-hemolytic streptococci*, *Heamophilus influenzae* and *Streptococcus pneumoniae*. All the organisms were sensitive to Ciprofloxacin. *Alpha-hemolytic Streptococci* were the most common types that were isolated from 31 (23.3%) patients with recurrent otitis media and from 27 (20.3%) patients without recurrent otitis media. Out of 66 cases without recurrent otitis media, *Alpha-hemolytic Streptococci* were more common in age groups of 2 to 3 years [9 patients (6.76%)] and age groups of 4 and 5 years [9 patients (6.76%)]. Of 67 patients with recurrent otitis media, *Alpha-hemolytic Streptococci* were observed more in age group 4 to 5 years [8 patients (6%)]. As the result, Gram negative bacteria revealed significant differences among patients with and without recurrent otitis media ($p<0.001$). This study shows that the incidence of tonsil bacterial infection in children with recurrent otitis media is higher than children without recurrent otitis media.

Key words: Adenid, bacteria, Gram's positive, Gram's negative, recurrent otitis media

INTRODUCTION

Otitis media is one of the most common otolaryngology infectious disease occurring especially in children (Chonmaitree, 2009; Saki *et al*., 2005). Otitis media's etiology and pathogenesis has been linked with to the eustachian tube dysfunction and bacterial infection of head and neck space (Czechowicz *et al*., 2010; Nikakhlagh *et al*., 2010). Adenoids are a component of Waldeyer's ring and are relevant in the pathogenesis of otitis media when they are inflamed or enlarged because of their anatomic position. They can induce the eustachian tube obstruction (Marseglia *et al*., 2009).

There is a belief that adeniod plays an important role in the infections of upper airway. The adeniod might involve in ear pain (Tomonaga *et al*., 1989; Takahashi *et al*., 2003), Rhino-sinusitis

(Bercin *et al.*, 2008; Criddle *et al.*, 2008), adenotonsillitis (Brook, 1981) and chronic nasal obstruction, due to be massive and hypertrophic (Li *et al.*, 2008; Faramarzi *et al.*, 2009). Microbiology of the adenoid in patients with various pathological conditions is important; because it can help in manage them. Many studies examined the role of adeniod microbiology (Tomonaga *et al.*, 1989; Brook, 1981; Ilki *et al.*, 2005; Brook *et al.*, 2000; Bitar *et al.*, 2005). However, some of these studies did not only evaluate the role of anaerobic bacteria, but also appropriate methods for their optimal use have not improved (Tomonaga *et al.*, 1989; Brook, 1981; Ilki *et al.*, 2005; Brook *et al.*, 2000; Bitar *et al.*, 2005). Furthermore, this bacterial infection has been concerned during the past 10 years because of their ability to create otitis media, nasal cavity and respiratory tract infection and their resistance to treatment. In fact, disease-causing bacteria are found at the same time in the middle ear and nasopharyngeal cultures in 70% of patients and pathogenic bacteria in more than 95% of the nasopharynx of children with otitis media (De Baere *et al.*, 2009).

In particular, studies that evaluated adenoid diagnosed more disease-causing bacteria in patients with refractory or recurrent otitis media than the control group (Karlidağ *et al.*, 2002; Harrison, 2005). These results indicate that adenoids may act as a reservoir of infection. The purpose of this study was to determine the adenoid tissue infection in children with or without the otitis media.

MATERIALS AND METHODS

Patient's selection and evaluation: Total of 133 children aged 1-9 years [41 (30.82%) females, 92 (69.18%) male], underwent Adeniodectomy in Imam Khomeini Hospital between Jan 2008 to Dec 2009 due to adenoid hyperplasia and otitis media were located in the study. The patients were evaluated for aerobic microbial flora of adenoid tissue or swab prepared from the adenoids. Aerobic pathogenic agents were isolated from both groups: Gram's positive and Gram's negative bacteria were identified.

The disorder was diagnosed by physical examination and confirmed by tympanometry, an examination used to test the condition of the middle ear and mobility of the tympanic membrane and the conduction bones by creating variations of air pressure in the ear canal and unresponsiveness to medical therapy for at least 3 months. The diagnosis of hyperplasic adenoid was made from medical history reports (nasal obstruction, mouth breathing, snoring, or sleep apnea), physical examinations (indirect or direct nasopharyngoscopy) and/or skull lateral X-ray imaging of the adenoids.

Surgery and sample collection: After the induction of general anesthesia, the soft palate was retracted with Nelaton tube. The nasal and oral cavities were irrigated with the sterile isotonic sodium chloride solution and disinfected with aqueous beta-iodine solution in order to reduce bacterial contamination on the mucosal surface of the adenoid. Adenoidectomy was then performed under trans-oral endoscopic guidance. The core of the adenoid tissue was dissected and sampled using a scalpel and forceps.

Sample culture: Each sample was taken with a sterile swab which was then cultured on BAP/EMB (blood agar plate/eosin methylene blue) agar, CNA (Comumbia nalidixic acid) agar and Brucella agar. The agars were for aerobes and were incubated in a 5% carbon dioxide incubator for 18 to 24 h. After presumptive pathogens were isolated and identified using standard methods (Lazcka *et al.*, 2007).

The sampling of middle ear fluid was performed either via needle aspiration or forceps under microscopy, after disinfecting the external ear canal. The tympanostomy tube was inserted after the middle ear fluid was cleaned. The middle ear fluid was swabbed and sent for culture.

Statistical analysis: Results obtained between the groups were expressed as the number and percentage. The SPSS 13.0, software was used for statistical assistance. Statistical analyses between groups were done by Chi-square test score. p-value of less than 0.05 was considered as significant.

RESULTS AND DISCUSSION

A total of 133 children were studied, 67 (50.36%) patients were diagnosed with recurrent otitis media and 66 (49.62%) patients were diagnosed without recurrent otitis media. Gram's positive group *Alpha-hemolytic Streptococci*, *Streptococcus pneumoniae* and Gram's negative *Heamophilus influenzae were* isolated from patients with recurrent otitis media and patients without recurrent otitis media. In patients with recurrent otitis media, from 31 (23.3%) children, *Alpha-hemolytic Streptococci*, one (0.75%) patient *Streptococcus pneumoniae*, 18 (13.53%) patients *Heamophilus influenzae* and in 17 (12.78%) other pathogens were extracted. Similarly, among patients in the group without recurrent otitis media in 27 (20.3%) children *Alpha-hemolytic Streptococci* and 39 (29.32%) patients with other types of residual disease agents were extracted (Table 1). Among 67 cases of patients with recurrent otitis medias in male patients: 18 (13.53%) cases of *Alpha-hemolytic Streptococci*, 11 (8.27%) patients *Heamophilus influenzae* and 12 (9.02%) of other types of disease agents were observed. Hence, in female patients: 13 (9.77%) cases of *Alpha-hemolytic Streptococci*, one patient (0.75%) with *Streptococcus pneumoniae*, 7 (5.26%) patients *Heamophilus influenzae* and 5 (3.75%) cases of other types of disease agents were showed (Table 2).

Table 1: Adeniod core tissue culture findings in patients with or without the recurrence otitis media

Possible pathogenic microorganisms	Group 1 (n = 67)	Group 2 (n = 66)	p-value
Gram positive			
Alpha-hemolytic streptococci	31 (23.3)	27 (30.3)	0.23
Streptococcus pneumoniae	1 (0.75)	0	ND
Gram negative			
Heamophilus influenzae	18 (23.83)	0	0.001
Others	17 (12.87)	39 (29.32)	-------
Total	67 (50.36)	66 (49.62)	-------

Values in brackets indicate percentage. Group 1: Patients with recurrent otitis media, Group 2: Patients without recurrent otitis media, ND: Not done

Table 2: Gender base differentiation of 133 children with and without otitis media

	Group 1 (n = 67)		Group 2 (n = 66)	
Possible pathogenic microorganisms	Male	Female	Male	Female
Gram positive				
Alpha-hemolytic streptococci	18 (13.53)	13 (19.77)	24 (18.04)	3 (2.55)
Streptococcus Pneumoniae	0	1 (0. 75)	0	0
Gram negative				
Heamophilus influenzae	11 (8.27)	7 (5.26)	0	0
Others	12 (9.02)	5 (3.75)	27 (20.3)	12 (9.02)

Values in brackets indicate percentage. Group 1: Patients with recurrent otitis media, Group 2: Patients without recurrent otitis media. Total male: 92 (69.18%). Total female: 41 (82.30%)

Table 3: Numbers and percentages of possible pathogenic microorganisms extracted from 66 children without recurrent otitis media based on the age and pathogen variables

	Possible pathogenic microorganisms				
	Gram positive		Gram negative		
Age (years)	A-H.S	S.P	H.I	Others	Total
0-1	3 (2.25)	0	0	18 (13.53)	21 (15.78)
1-2	0	0	0	9 (6.79)	9 (6.79)
2-3	9 (6.79)	0	0	3 (2.25)	12 (9.02)
3-4	3 (2.25)	0	0	6 (4.51)	9 (6.79)
4-5	9 (6.79)	0	0	0	9 (6.79)
5-6	3 (2.25)	0	0	0	3 (2.25)
6-7	0	0	0	3 (2.25)	3 (2.25)
7-8	0	0	0	0	0
8-9	0	0	0	0	0
9-10	0	0	0	0	0
10-11	0	0	0	0	0
11-12	0	0	0	0	0
Total	27 (20.3)	0	0	39 (29.32)	66 (49.62)

Values in brackets indicate percentage. A-H.S: *Alpha-hemolytic streptococci*, S.P: *Streptococcus pneumoniae*, H.I: *Heamophilus influenzae*

Similarly, among 66 patients in the group without recurrent otitis medias in male patients: 24 (18.04%) cases of *Alpha-hemolytic Streptococci* and 27 (20.3%) were other types of disease agents, while in female patients: 3 (2.55%) *Alpha-hemolytic Streptococci* and 12 (9.02%) with other types of disease agents were extracted (Table 2). Out of 66 cases with recurrent otitis media, *Alpha-hemolytic Streptococci* were more common in age groups of 2 to 3 years [9 patients (6.76%)] and age groups of 4 and 5 years [9 patients (6.76%)] (Table 3). Of 67 patients with recurrent otitis media, *Alpha-hemolytic Streptococci* were observed more in age group 4 to 5 years [8 patients (6%)] (Table 4). As the result, gram negative bacteria revealed significant differences among patients with and without recurrent otitis media ($p<0.001$).

The study compared the capacity of potential pathogens and aerobic and anaerobic bacteria that possess interference ability from the adenoids of children with or without the otitis media. As previously has been described, *Heamophilus influenzae* and *Streptococcus pneumoniae* were more frequently isolated in the adenoids of otitis media patients than in those of non-otitis media patients (Vergison, 2008; Yano, 2003; Homoe, 2001; Iino *et al*., 2003). In agreement with the present study (Iino *et al*., 2003) were also able to confirm a higher recovery rate of interfering *Alpha-hemolytic Streptococci* in non-otitis media children than in those who have otitis media (Iino *et al*., 2003).

Vergison (2008) conducted a study on acute otitis media patients and found that *Streptococcus pneumoniae, non-encapsulated Haemophilus influenzae, Moraxella catarrhalis* and group A *Streptococcus* are the leading causes of bacterial acute otitis media worldwide. While in the present study the most common cause were *alpha-hemolytic Streptococci*.

The ability of the indigenous normal nasopharyngeal flora to inhibit colonization with potential pathogenic bacteria has been investigated. The present study also confirmed the results of previous reports on which *Alpha-hemolytic Streptococci* inhibited colonization and in vitro growth of a variety of pathogenic bacteria: *S. pneumoniae, S. pyogenes* and *Staphylococcus aureus* (Brook and Hausfeld, 2005; Kooistra-Smid *et al*., 2009; Rajam *et al*., 2008).

Table 4: Numbers and percentages of possible pathogenic microorganisms extracted from 67 children with recurrent otitis media based on the age and pathogen variables

	Possible pathogenic microorganisms No. (%)				
	Gram positive		Gram negative		
Age (years)	A-H.S	S.P	H.I	Others	Total
0-1	1 (0.75)	0	0	0	1 (0.75)
1-2	3 (2.25)	1 (0.75)	2 (1.5)	2 (1.5)	8 (6)
2-3	3 (2.25)	0	3 (2.25)	1 (0.75)	7 (5.26)
3-4	4 (2.25)	0	1 (0.75)	2 (1.5)	7 (5.26)
4-5	8 (6)	0	2 (1.5)	2 (1.5)	12 (9.02)
5-6	5 (3.7)	0	3 (2.25)	5 (3.7)	13 (9.77)
6-7	3 (2.25)	0	4 (2.25)	5 (3.7)	12 (9.02)
7-8	0	0	2 (1.5)	0	2 (1.5)
8-9	3 (2.25)	0	1 (0.75)	0	4 (2.25)
9-10	1 (0.75)	0	0	0	1 (0.75)
10-11	0	0	0	0	0
11-12	0	0	0	0	0
Total	31 (23.3)	1 (0.75)	18 (13.53)	17 (12.78)	67 (50.38)

Values in brackets indicate percentage. A-H.S: *Alpha-hemolytic streptococci,* S.P: *Streptococcus pneumoniae,* H.I: *Heamophilus influenzae*

This phenomenon was possibly explained by the production of bacteriocin and other inhibitory substances that suppresses some bacterial growth, or utilization of essential nutrients in the environment (Patek *et al*., 1986). Easton and colleagues reported the administration of a broad spectrum antimicrobial for the therapy of otitis media was associated, at time of termination of therapy, with reduction of recovery of members of the oral flora with interfering capabilities as compared with a second generation cephalosporin (Easton *et al*., 2003).

Therapeutic colonization of the nasopharynx with interfering bacteria was recently studied. Huovinen (2001) colonized 112 children who had repeated episodes of tonsillitis with either *Alpha-hemolytic Streptococci* or placebo. Recurrences developed in 1 of 51 children (2%) in the *Alpha-hemolytic Streptococci* group and in 14 of 61 (23%) in the placebo group. Further studies are warranted to investigate whether maintaining a normal flora in the nasopharynx could be beneficial to children who have recurrent otitis media.

CONCLUSION

This study demonstrates the importance of bacterial capacity in the Adenoids as a factor that may help in detection and management of the recurrent otitis media, especially in young children. With the help of quantitative microbiology, this research shows that the incidence of tonsil bacterial infection in children with recurrent otitis media is higher than children without recurrent otitis media.

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