



Cotton-tip applicators as a leading cause of otitis externa

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Summary Objective: Otitis externa (OE), also known as "swimmer's ear", is an inflammation or infection of the external auditory canal. Many risk factors have been identified, mainly excessive moisture in the canal from swimming. **Study design/methods:** To study the leading risk factors of otitis externa. Eighty-seven children aged 3.5–12 years (mean 68 ± 6.5 months) who were diagnosed with otitis externa from December 1999 to March 2001 were studied for age, sex, cerumen cleaning habits, signs and symptoms. Findings were compared to an age-matched control group of 90 children without otitis externa. **Results:** Sixty-one children (70.1%) in the study group had their ears cleaned with a cotton-tip applicator (Q-tip) during the 10 days preceding the diagnosis of otitis externa. In the control group, only 31 (34%) used applicators routinely during the 10 days prior to diagnosis ($P < 0.001$). Other risk factors for otitis externa were swimming in a pool (34%), wax removal (5.8%) and ventilation tubes (1.1%). **Conclusions:** Use of a cotton-tip applicator to clean the ear seems to be the leading cause of otitis externa in children and should be avoided.
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1. Introduction

Otitis externa (OE) is an inflammation or infection of the external auditory canal. It is most commonly caused by infection (usually bacterial and occasionally fungal), but it may also be associated with a variety of noninfectious systemic or local dermatologic processes. It results from the loss of the protective cerumen and chronic irritation and maceration of the canal. OE is also known as "swimmer's ear" because the accepted major risk factor is excessive moisture in the canal which

makes the skin of the canal vulnerable to infection by normal flora or virulent exogenous bacteria. Other risk factors for OE include mechanical removal of cerumen, and insertion of foreign objects like cotton-tip applicators (Q-tip) [1–7]. The aim of the present study was to investigate the leading risk factors of OE.

2. Methods

This prospective study included children who visited the clinics of the Schneider Children's Medical Center of Israel, between December 1999 and March 2001. The study group comprised children who presented with OE. Control patients, without diagnosis

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of OE, were seen on the same day, during the same season and at same hospital; 28% of the children suffered from otitis media and OE in the past. A patient was considered to have otitis externa if he complained of ear pain and tenderness (especially with manipulation of the pinna) and otorrhea. On physical examination, the external ear canal was red, edematous and tender.

Eighteen patients (20.6%) with a pushed forward auricle, with a possible diagnosis of mastoiditis were hospitalized. The diagnosis was ruled out due to a lack of involvement of the middle ear by otoscopy or of the skin over the mastoid region. A mastoid X-ray and CT were done as needed. Bacterial swabs were taken. All hospitalized children receive systemic antibiotics, until the diagnosis of mastoiditis was ruled out.

Data were collected on age, sex, cerumen cleaning habits, swimming in a pool or cleaning with a cotton-tip applicator by the parent or the child, during 10 days preceding diagnosis as well as for signs, symptoms, and timing of wax removal. The records of the hospitalized children were also reviewed for diagnostic procedures, laboratory results, and treatment. Comparison of data between the different groups was performed by student's *t*-test and regression analysis. All results were given as mean \pm S.D.

3. Results

The study group comprised 87 children aged 3.5-12 years (mean 68 ± 6.5 months) who presented with OE. Ninety age-matched children (mean 52 ± 8 months), without a diagnosis of OE attending the same hospital served as controls (Table 1). The seasonal distribution of cases of OE was not equal, with 58 children (67%) presenting in summer (April to September) and 29 (33%) in winter (October to March). There was no difference in prevalence by

sex. Analysis of aural cleaning habits revealed that 61 children (70.1%) had their ears cleaned with a cotton-tip applicator during the 10 days preceding diagnosis; in 90% of them, the procedure took place during the 48 h preceding diagnosis. In the group of children without OE, only 34% used cotton-tip applicators routinely during the preceding 10 days ($P < 0.001$, Table 1). There was no difference whether the child or the parent performed the procedure: in 85% of the study children and 90% of the control group, the parent did the cleaning.

Regarding other risk factors for OE, 30 patients (34%) reported swimming in a pool during the 10 days preceding diagnosis, 5 (5.8%) had undergone wax removal by a physician, and 1 (1.1%) had ventilation tubes. In the control group, 18 patients (20%) reported swimming in a pool during the 10 days preceding diagnosis, 4 (4.4%) had wax removal. None of the patients or their parents reported inserting a foreign body into the external auditory canal (Table 1).

The signs and symptoms of OE in the study group are shown in Table 2. The main symptom was ear pain, followed by signs of redness and swelling. Redness and swelling of the external ear canal may spread in the retroauricular direction, making mastoiditis a possible differential diagnosis. In our sample, 18 patients (20.6%) were hospitalized mainly to rule out mastoiditis. This was done according to local clinical signs, computerized tomography of the mastoid in 4, mastoid X-ray in 10 patients.

Analysis of the medical records of the 18 hospitalized children yielded a mean white blood cell count of $12,500 \pm 520$ mm³ and a mean erythrocyte sedimentation rate of 42 ± 6 mm/h. Bacterial swabs from the external canal grew *Pseudomonas aeruginosa* in three cases and *Staphylococcus aureus* in two and no growth in the remaining. All hospitalized children received systemic antibiotics (until the diagnosis of mastoiditis was ruled out). Average hospitalization time was 3.2 ± 1.2 days.

Table 1 Risk factors for otitis externa

	OE group (N = 87)	Control group (N = 90)	P
Age (months)	68 ± 6.5	52 ± 8	NS
Sex (male)	42 (48%)	45 (50%)	NS
Q-tip applicators	61 (70%)	31 (34%)	<0.001
Swimming	30 (34%)	18 (20%)	NS
Wax removal (by physician)	5 (5.8%)	4 (4.4%)	NS
Ventilation tube	1 (1.1%)	0	NS

NS: not significant.

Table 2 Signs and symptoms of otitis externa (N = 87)

Sign/symptoms	Number	Percent
Ear pain and tenderness	87	100
Redness and swelling ^a	60	69
Fever ^b	20	23.5
Itching in the ear	20	23.5
Restlessness	15	17.6
Discharge of pus or fluid	20	23.5
Pushed forward auricle	18	20.6

^a External ear canal.

^b Fever $>38^{\circ}\text{C}$ (oral).

4. Discussion

Acute otitis externa or swimmer's ear occurs mostly in the summer and may be caused by a decrease in canal acidity, resulting in bacterial overgrowth. The ear is pruritic and painful and the canal appears swollen and red. The most common pathogens are *P. aeruginosa*, *S. aureus* and *Streptococci* [8]. In adults, and rarely in children, malignant or necrotizing external otitis is a complication of infectious external otitis, occurring in diabetics and immunocompromized patients [1,2,8,9].

OE may present in children with a pushed forward curicle. Thus, acute mastoiditis is the most common and important differential diagnosis of OE. There are several clues for making the correct diagnosis. OE may involve the superficial squamous epithelium of the tympanic membrane but without true opacity, thickness, loss of anatomical landmarks or bulging of the drum as in cases of acute mastoiditis. The swelling of the external canal in cases of OE is usually circumferential and not posterior superior (the direction of the mastoid) as in cases of acute mastoiditis. In OE, there is no true involvement over the mastoid region. Finally, OE tend to occur more during summertime and in older children whereas acute mastoiditis, a complication of otitis media occurs more frequently during the winter and in younger children.

Risk factors for the development of acute OE include moisture (from swimming, perspiration, and high humidity), high environmental temperatures, mechanical removal of cerumen, insertion of foreign objects (cotton-tip applicators, fingernails, hearing aid, or ear plugs), other trauma to the ear canal, and chronic dermatologic disease (e.g. eczema, psoriasis, seborrheic dermatitis, acne and Langerhan's histiocytosis) [1]. Maceration causes itching to which the patient responds by scratching with a fingernail or cotton-tipped applicator, resulting in trauma and breaking the surface of the external auditory canal. Edema follows along with implantation of indigenous bacteria. The normal pH of 5 changes to an alkaline pH and a superficial spreading of the infection develops.

Not all authorities agree that exposure to water contaminated with high bacterial counts is a sig-

nificant precipitant as are the results in our study. [1,2]. Our study found that cleaning the ear cerumen with a cotton-tip applicators was the risk factor of OE in our sample.

As pediatricians, we are aware of the common practice of cleaning children's ears with cotton-tip applicators, either by the parents or by the child him/herself. This can predispose the ear to infection in several ways. First, there may be maceration of the epithelial lining of the auditory canal or rarely direct damage to the ear from perforation of the tympanic membrane by the applicator tip (rare). Second, pressure exerted by the tip can cause impaction of the cerumen and prevention of drying of the moisture from bathing or swimming. Finally, removal of the cerumen is itself dangerous because the cerumen provides the skin with a protection against pathogens and contains certain antimicrobial components such as lysozyme [2,3].

On the basis these findings, we recommend that parents (and children) refrain from using cotton-tip applicators to clean the ears. Cerumen should be removed only in cases of impaction or obstruction of tympanic membranes under direct vision [9] by an experienced otorhinolaryngologist.

References

- [1] R. Sander, Otitis externa: a practical guide to treatment and prevention, *Am. Fam. Phys.* 63 (2001) 927–936.
- [2] E. Hughes, J.H. Lee, Otitis externa, *Pediatr. Rev.* 22 (2001) 191–197.
- [3] V.L. Schramm Jr., Physician and patient-induced diseases in otolaryngology office practice, *Laryngoscope* 86 (1976) 1524–1530.
- [4] I. Brook, Treatment of otitis externa in children, *Pediatr. Drugs* 1 (1999) 289–289.
- [5] M.J. Felis, Acute otitis externa, *Lippincott's Prim. Care Pract.* 4 (2000) 529–533.
- [6] N. Mirza, Otitis externa. Management in the primary care office, *Postgrad. Med.* 99 (153-154) (1996) 157–158.
- [7] M. Hawke, J. Wong, S. Krajden, Clinical and microbiological features of otitis externa, *J. Otolaryngol.* 13 (5) (1984) 289–295.
- [8] J.O. Klein, Otitis externa, otitis media, mastoiditis, in: G.L. Mandell (Ed.), *Principles and Practice of Infectious Disease*, fourth ed., Churchill Livingstone, New York, 1995, p. 579.
- [9] M. Grossan, Cerumen removal: current challenges, *ENT J.* 77 (1998) 541–548.

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