Does earwax lose its pathogens on your auriscope overnight?

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Abstract

Objectives—To describe the organisms cultured from general practitioners' auriscope earpieces; and to explore general practitioners' perceptions of the possibility of cross infection from contaminated auriscope earpieces and of how their auriscope earpieces are cleaned.

Design—Microbiological survey of auriscope earpieces in two general practices and a semistructured questionnaire sent to 105 general practitioners.

Setting—General practitioners served by one district general hospital microbiology laboratory in the north of England.

Results—Organisms were cultured from 41 (93%) of 44 auriscope earpieces, of which 14 (32%) carried potential pathogens; four (9%) were heavily contaminated. Of the 85 (81%) general practitioners who responded, 72 (85%) believed that contaminated auriscope earpieces could cause serious infection, 66 (78%) did not clean earpieces between patients, and 70 (82%) thought that patients would mind if they knew that dirty earpieces were used.

Conclusions—Almost a third of auriscope earpieces were contaminated by pathogenic bacteria. Although general practitioners suspected this, most did not ensure that a clean earpiece was used for each patient.

Introduction

As a trainee in general practice, one of the authors (AO) often used auriscopes belonging to other doctors and often saw earwax from previous patients remaining on uncleaned earpieces. Speculation arose as to how common this phenomenon was, and if cross infection could ensue.

Research into earwax has been confined to hospitals, where the microbial flora may differ from that found in general practice. Ayliffe described a protocol for cleaning earpieces in a hospital ear, nose, and throat clinic, noting that organisms resistant to antibiotics can be found in patients with chronic otitis externa, and these could be transferred to other patients.¹ A literature search did not find any studies of otitis externa caused by contaminated auriscope earpieces, but similar objects such as headsets for airline passengers and bath sponges have been the source of cross infection.^{2,3}

The microbial flora of the external auditory canal is the same as on normal skin. The canal possesses mechanical and chemical barriers to infection. Mechanical barriers include protective hairs, the overlapping cartilage of the external ear, the S shape of the canal itself, and the epithelial migration from the tympanum outwards, which expels keratin and earwax. Earwax, formed from the mixed secretions of sebaceous and apocrine glands, provides the chemical barrier. It is water repellent and its sticky nature is an additional defence. Fatty acids, lysozymes, copper,

Earwax lingers on uncleaned earpieces

and immunoglobulins G and A render earwax bacteriostatic.⁴

Despite its defences, the external ear is often a site of infection and has been described as "a nearly perfect skin lined culture tube." The ear's defences can be altered by increased temperature and moisture, trauma, maceration, antibiotic treatment, and exogenous organisms, especially *Pseudomonas aeruginosa*, which can grow in the presence of earwax.^{5,6} These insults may damage the epithelial lining, allowing colonisation by pathogenic bacteria.

The aims of the study were to describe the organisms that were cultured from auriscope earpieces found in general practice and to explore general practitioners' beliefs about dirty earpieces and the methods used to clean them.

Methods

The first part of the study was a microbiological survey of auriscope earpieces found in two general practices, one rural and one urban. Without prior warning of the nature of the study, earpieces were collected from consulting rooms. Earpieces from the rural practice were sent by van to the microbiology department of Airedale General Hospital. Earpieces from the urban practice were swabbed and plated out on site by one of the authors (AO).

Each earpiece was processed as follows. The tip was rolled on half strength blood agar, half strength chocolate agar, or half strength Sabouraud's agar. The tip was wiped with a swab moistened with saline and spread on half strength plates of agar as above. A swab was inoculated into tryptic soy broth and incubated for two days anaerobically, then subcultured aerobically and anaerobically. All chocolate agar plates were incubated in 5% carbon dioxide for 48 hours; blood agar plates were incubated anaerobically for 48 hours. All isolates were identified by standard procedures.⁷

For the second part of the study a semistructured, anonymised questionnaire was sent by internal mail to 105 general practitioners who used the microbiology services at Airedale General Hospital. A reminder

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letter with a spare questionnaire was sent to non-responders.

The questionnaire asked respondents to indicate on a four point scale (never, sometimes, often, always) whether they thought bacteria could be found on auriscope earpieces, if these bacteria could be transferred to other patients through use of a contaminated earpiece, and if this transfer of bacteria could cause clinically serious disease. Respondents were asked what they thought patients' attitudes would be to unclean earpieces, and how often and with what technique they claimed to clean them. Free text comments were encouraged after each question. The questionnaire and letters used can be obtained from the authors.

Results

MICROBIOLOGICAL SURVEY

Forty four earpieces were collected from the two practices studied and bacterial colonies were cultured from 41 (93%). The number of colonies from each earpiece ranged from none to over 30 (table I). A wide range of organisms was cultured from the earpieces, including the potential pathogens *Staphylococcus aureus* and *Aspergillus fumigatus*.

SEMISTRUCTURED QUESTIONNAIRE

Of the 105 general practitioners sent a questionnaire, 85 (81%) responded. Non-responders could not be identified, and no information is available about them. Of the 85 responders, 81 (95%) thought that bacteria could be cultured from earwax and 83 (98%) that bacteria could be transferred to other patients through unclean earpieces. The possibility of serious infection arising in this way was acknowledged by 72 (85%). An obstructed view of the eardrum caused by earwax in the earpiece was reported at least occasionally by 63 (74%). Seventy (82%) thought that patients would be concerned if they suspected that unclean earpieces were being used, and 30 (35%) admitted that they had concealed unclean earpieces from their patients. Nearly all respondents (82; 96%) replied that they cleaned their earpieces at least occasionally, but only 19 (22%) claimed to do so between each patient. Only three (4%) recalled a patient noticing an unclean earpiece, but a further 17 (20%) were uncertain.

Table II shows the method of cleaning used. The use of alcohol impregnated swabs predominated (31/85; 36%). No respondents mentioned disposable earpieces or autoclaves.

From the abundance of free text responses it seemed that the topic was one that interested the respondents, and these responses gave a fuller impression of general practitioners' views on the cleanliness of auriscope earpieces than was obtained from the questionnaire itself. "My auriscope cleaning habits are disgusting" was a typical unsolicited comment. The appearance of cleanliness of the earpieces seemed more important to some respondents than did sterility. For example, "the appearance of sterility matters—it looks clean to me and the patient. Clinically, wiping makes no difference." Twelve reported that they cleaned obviously dirty or infected earpieces. The need for sterility was questioned by seven, a viewpoint summarised by this remark: "intact skin is perfectly capable of resisting the odd bacterium—no more problem than shaking hands or using a stethoscope." Five respondents commented that they had never experienced any patients returning with otitis externa after an examination of their ear, but three suspected that cross infection might be a problem. For instance: "tell us the worst—*Pseudomonas* perhaps?" The "Hawthorne effect" (the process of being observed changing the behaviour of participants)¹⁰ was mentioned by two respondents, one of whom stated, "I've cleaned my pieces since the study arrived."

Time constraints preventing adequate cleaning were cited by seven respondents, and four stated that this was a particular problem on home visits. Five said that practice nurses cleaned their earpieces, but did not state the method that was used.

Discussion

The data received from respondents were based on self reporting of retrospective behaviour, and were not validated from other sources. This is an important source of bias, but would probably lead respondents to report their auriscope earpiece cleaning to be more thorough than it really was.

The microbiological survey showed that organisms were cultured from almost all the earpieces studied, and 14/44 (32%) carried the potential pathogens *S aureus* or *Aspergillus*. Four earpieces (9%) carried more than 30 colonies of *S aureus*, and these heavily contaminated earpieces may have borne particular risks of cross infection. *Pseudomonas aeruginosa* was not found, but it survives poorly on drying and the study design meant that culture of this bacterium would be unlikely. Cross infection with *P aeruginosa* could occur if only a short time elapsed between use of the earpiece for successive patients. However, this study did not attempt to link the presence of pathogenic bacteria on auriscope earpieces with the clinical presentation of otitis externa; the occurrence of cross infection was not an outcome measure.

Most general practitioners believed that bacteria could be cultured from earwax, that these bacteria could be pathogenic, and that disease could occasionally result from cross infection. Despite these beliefs, only a quarter of general practitioners claimed to clean earpieces between each patient. There is an apparent paradox between what general practitioners believe and how they behave. The health belief model¹¹ can be used as a framework to explain this dissonance between belief and behaviour.

HEALTH BELIEF MODEL

Certain cues prompt individuals to pay attention to a health related topic and then to decide whether they need to change their behaviour related to this topic.

Despite its mechanical and chemical barriers to infection, the external ear is "a nearly perfect skin lined culture tube"

ELISABETH SMITH

TABLE I—Number and type of colonies cultured from 44 auriscope earpieces

Micro-organisms cultured	No of colonies per earpiece)					
	0	After enrichment	1-10	11-20	21-30	>31
<i>Staphylococcus aureus</i> *	32		7	1		4
Other staphylococcus spp	9	2	18	2	3	10
<i>Aspergillus</i> *	42		2			
<i>Pseudomonas</i> (not <i>P aeruginosa</i>)	43	1				
<i>Micrococcus</i>	42		2			
<i>Bacillus</i> spp	36		7			1
Diphtheroids	27		7			10
<i>Penicillium</i> spp	42		2			
<i>Clostridium perfringens</i>	42	2				
Haemolytic streptococci (not <i>S pneumoniae</i>)	42		2			

*Potential pathogens

TABLE II—Methods of cleaning auriscope earpieces declared by general practitioners

Method	No (%) of GPs (n=85)
Alcohol swab	31 (36)
Soap and water	24 (28)
Antiseptic lotion	16 (19)
Cotton wool or tissue	5 (6)
Practice nurse's task	5 (6)
Other	1 (1)
No response	3 (4)

Cues that change general practitioners' behaviour include peer influence, literature reports, and financial inducements¹²—none of these factors currently prompt general practitioners to consider cleaning their earpieces more assiduously. Once a cue has been received, an appraisal is made of the threats and benefits involved and of the advantages and disadvantages to be gained or lost. The threat of using uncleaned earpieces seemed slight, and improving hygiene was not perceived as carrying great benefit. Although some advantages were perceived from using clean earpieces (reducing infection, complying with patients' expectations of cleanliness), the perceived disadvantages were important ones (lack of time and the inconvenience, especially on home visits and at weekends). The health belief model thus suggests that there is little motivation for general practitioners to improve their auriscope cleaning behaviour.

Conclusion

A study directly assessing the risk of cross infection from using contaminated auriscope earpieces would be unlikely to gain ethical approval. However, this study may raise awareness that auriscope earpieces can harbour organisms that are potentially pathogenic. General practitioners may be alerted to change their behaviour by cleaning their earpieces more assiduously or using disposable ones.

Most general practitioners in the study used alcohol swabs to clean their earpieces, but this may not be

an effective technique. Ayliffe recommends three methods: boiling earpieces in water for five to 10 minutes, five minutes' immersion in 70% alcohol, or autoclaving.¹ One manufacturer recommends that non-disposable earpieces should be boiled in distilled water for five minutes or autoclaved at 134-138°C for three minutes. Immersion in some cold disinfectant solutions may also be appropriate (see manufacturers' instructions), but phenolic and carbolic solutions should not be used, as these will damage the earpieces.¹³ Disposable earpieces cost from 7p to 16p each, depending on the manufacturer and the quantity purchased.¹⁴

Ensuring clean earpieces for each patient will mean increases in workload, equipment, and expense. Clarification of the most appropriate and cost effective cleaning technique for auriscope earpieces in general practice is required.

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Stethoscopes as possible vectors of infection by staphylococci

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Hand carriage of staphylococci by hospital staff is thought to be one of the main modes of spread between patients,¹ and frequent handwashing to prevent such spread is emphasised in infection control measures.² Stethoscopes, an almost universal tool of the medical profession, are an additional possible vector of infection as they touch many patients. Twenty years ago stethoscopes were shown to harbour staphylococci,³ yet standard sources on infection control still give no advice on cleaning these instruments.^{4,5}

We surveyed current practices of stethoscope hygiene among junior doctors in our hospital and assessed the degree of carriage of staphylococci by stethoscopes and the effect of cleaning on this.

Methods and results

Twenty nine doctors were questioned, and their stethoscopes were examined by moistening sterile

swabs in saline, rubbing them over the diaphragm, and inoculating them on to blood agar, which was incubated aerobically overnight. Staphylococci were identified by standard methods.

We examined the effect of cleaning on 13 additional stethoscopes. One half of the diaphragm was swabbed and cultured; the diaphragm was then cleaned with a commercial saturated with alcohol swab (Sterets, Seton Prebbles Ltd) and allowed to dry; the other half of the diaphragm was then swabbed and cultured. Total colony counts before and after cleaning were noted.

Of the 29 doctors spoken to, only three had ever cleaned their stethoscopes, two intermittently and the other only once. None of the doctors could recall ever being advised in this matter.

Twenty six of the 29 instruments yielded staphylococci and the remainder were sterile. Most of the staphylococci were coagulase negative, but of the 29 stethoscopes five yielded *S aureus*. The mean