Stethoscopes and otoscopes—a potential vector of infection?

Herman A Cohen, Jacob Amir, Andre Matalon, Rachel Mayan, Sara Beni and Asher Barzilai


Objectives. We aimed to determine whether stethoscopes and otoscopes used in community paediatric clinics harboured pathogenic micro-organisms, and, if so, which measures could prevent this.

Methods. Fifty-five stethoscopes belonging to paediatric physicians working in 12 community clinics were sampled for bacterial cultures by two methods: (i) direct impression of the diaphragm and bell section of each stethoscope for 5 seconds onto blood agar plates and a mannitol–salt–agar plate; (ii) swabbing the entire surface of the diaphragm of the stethoscope with a sterile cotton-tipped applicator. Forty-two otoscopes from the same physicians were sampled by rubbing the handles of the otoscopes with cotton-tipped swabs. The plates were incubated at 37°C for 48 hours and examined for colony growth at 24 and 48 hours of incubation. Culture results were recorded as mean numbers of colony-forming units (CFUs). Eight additional stethoscope diaphragms were chosen at random at the participating clinics and cultured as described above. They were then wiped with alcohol swabs (isopropyl alcohol 70%), allowed to air dry for approximately 10 minutes and cultured a second time.

Results. All the stethoscopes and 90% of the otoscope handles were colonized by micro-organisms. Staphylococci were isolated from 85.4% of the stethoscopes and 83.3% of the otoscopes, with 54.5% and 45.2% respectively being S. Aureus. Methicillin-resistant S. aureus were found in four each of the stethoscopes (7.3%) and otoscopes (9.5%). Cleaning with alcohol reduced the colony count by an average of 96.3%.

Conclusions. Fomites can harbour potentially pathogenic bacteria, and with the increasing trend for children with more complex medical problems to be managed in an ambulatory setting, often by physicians who also work in hospitals, there is a real risk of spreading potentially serious infections to such patients. Simple cleansing with alcohol effectively eliminates the bacterial contamination of the fomites, and should be encouraged.

Keywords. Community paediatric clinics, otoscopes, Staphylococcus aureus, stethoscopes, vector of infection.

Introduction

Nosocomial infections occur at a rate of 5–10 per 100 admissions. It has been estimated that one-third of all nosocomial infections may be preventable, and are frequently caused by organisms acquired within the hospital environment. Stethoscopes and otoscopes, universal tools of the medical profession, may be vectors for nosocomial infection, and, indeed, several studies in hospital settings demonstrated that stethoscopes were frequently contaminated with Staphylococcus species, and could serve as a vector of infection. Furthermore, Staphylococcus aureus resistant to methicillin has been isolated from 17% of stethoscopes of medical personnel in a hospital setting. However, there are no reported data on stethoscopes and otoscopes in a community primary care paediatric setting as potential vectors for infection with
methicillin-resistant *Staphylococcus* and other organisms. Methicillin-resistant *S. aureus* (MRSA) and other organisms can be involved in serious infections in children with a compromised immune system, in patients undergoing haemodialysis or organ transplants, or in children with open wounds. In the past, such children were almost exclusively treated in hospital wards, whereas today there is an increasing trend to deal with them in paediatric community clinics.

The purpose of this study was to determine whether stethoscopes and otoscopes used by physicians working in primary care paediatric community clinics could serve as a potential source of pathogenic bacteria which might be responsible for bacterial infection.

**Materials and methods**

Fifty-five stethoscopes belonging to paediatric physicians working in 12 community clinics were sampled for bacterial cultures by two methods:

(i) direct impression of the diaphragm and bell section of each stethoscope for 5 seconds onto blood agar plates (TSA + 5% sheep blood; HY-LAB, Rehovot, Israel) and a mannitol–salt–agar plate (Novamed, Israel); and

(ii) swabbing the entire surface of the diaphragm of the stethoscope with a sterile cotton-tipped applicator moistened in sterile transport medium solution (COPAN®; Bovezzo, Italy), which was inoculated within 2 hours onto a blood agar plate and a mannitol–salt–agar plate.

Forty-two otoscopes from the same physicians were sampled by rubbing the handles of the otoscopes with cotton-tipped swabs moistened in transport medium solution. The swabs were cultured within 2 hours on blood agar and mannitol–salt–agar plates.

The plates were incubated at 37°C for 48 hours and examined for colony growth at 24 and 48 hours of incubation; the culture results were recorded as mean numbers of colony-forming units (CFUs).

*Staphylococcus aureus* was identified by standard laboratory methods. Slide coagulase tests (Microgen Bioproducts Microscreen, STAPH, UK) were performed on suspected staphylococci. Sensitivity testing on *Staphylococcus* isolates was performed using the disc diffusion methods in accordance with the standards set out by the National Committee for clinical laboratory standards; oxacillin (1 mg; Difco) and methicillin (5 mg; Difco) discs were used.

Gram-negative organisms were identified by a test strip that was inoculated with the organism suspended in physiological saline (API, VITEK).

Eight additional stethoscope diaphragms were chosen at random at the participating clinics and cultured as described above. They were then wiped with alcohol swabs (isopropyl alcohol 70%), allowed to air-dry for approximately 10 minutes, and cultured a second time on blood agar and mannitol–salt–agar plates. Isolation of bacteria, classification, sensitivities and colony counts were carried out as described above.

**Results**

All the stethoscopes, as well as 90% of the otoscope handles, were found to be contaminated with microorganisms. The micro-organisms isolated are presented in Table 1. Staphylococci were isolated from 47 (85.4%) of the stethoscopes and 35 (83.3%) of the otoscopes; *S. aureus* was isolated from 54.5% and 45.2% of the stethoscopes and otoscopes, respectively.

Of the 19 otoscopes contaminated with *S. aureus*, for 16 (84.2%) the stethoscope of the same physician was also positive for that micro-organism. Four isolates (7.3%) from the stethoscopes and four (9.5%) from the otoscopes yielded *S. aureus* resistant to methicillin. The paired MRSA were from the same four physicians who worked in two different community clinics.

The other isolates were mostly Gram-positive bacteria—coagulase-negative staphylococci, anaerobes, *Sarcina lutea*, *Bacillus* species and *Diphtheroides*.

Only a few Gram-negative bacteria and yeast were isolated. The micro-organisms isolated from the stethoscopes and the otoscopes were very similar (Table 1).

In the eight stethoscopes cultured before and after cleaning with alcohol there was a significant decrease in the colony count (Table 2). *S. aureus* was not isolated from any of the cleaned diaphragms, and there was a 95% reduction in the isolation of coagulase-negative *Staphylococci* following alcohol-swatting. The decrease in the isolation of micro-organisms from the

**Table 1. Organisms isolated from contaminated stethoscopes and otoscopes of primary care community physicians**

<table>
<thead>
<tr>
<th>Organism</th>
<th>Stethoscopes (n = 55)</th>
<th>Otoscopes (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>30 (54.5)</td>
<td>19 (45.2)</td>
</tr>
<tr>
<td><em>Staphylococcus epidermidis</em></td>
<td>7 (12.7)</td>
<td>9 (21.4)</td>
</tr>
<tr>
<td><em>Staphylococcus coagulase</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>negative</em></td>
<td>37 (67.3)</td>
<td>29 (69.0)</td>
</tr>
<tr>
<td><em>Sarcina lutea</em></td>
<td>28 (50.9)</td>
<td>22 (52.4)</td>
</tr>
<tr>
<td><em>Diphtheroides</em></td>
<td>9 (16.4)</td>
<td>4 (9.5)</td>
</tr>
<tr>
<td><em>Bacillus species</em></td>
<td>23 (41.8)</td>
<td>18 (42.9)</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>4 (7.3)</td>
<td>4 (9.5)</td>
</tr>
<tr>
<td>Others (Gram-negative</td>
<td>6 (10.9)</td>
<td>2 (4.8)</td>
</tr>
<tr>
<td>organisms)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Multiple organisms were cultured from several stethoscopes.
清洁的表皮的范围为89%到100%，平均减少为96.3%。听诊器完全在清洁后为无菌。

讨论

大多数初级保健儿科患者是没有疾病的，它们在接触感染的听诊器时不会发生任何感染。然而，近年来有一种趋势，即许多儿童和青少年从医院转到初级保健儿童医疗中心。这导致了在社区中心的医疗资源的增加。同样的原因，而且也有一个增加的病例数的患者，如烧伤，医疗，胃镜检查，胃镜检查，以及由侵入性检查引起的。在某些情况下，主治医生要管理患者在医院并随后看到他/她在社区实践中。这种患者可能由微小的感染的微生物所感染，这些微生物可以在患者的手，或者用于医疗的物品上。基本的措施，如手卫生和屏障保护都是最简单的，同时是最重要的预防措施。

尽管存在这些措施，但没有证据表明在护理单位中，这些措施存在缺陷。研究显示，听诊器的清洁和消毒在医院和医院内患者之间存在明显的差异。

这张表显示，大多数听诊器（85.4%）和内窥镜（83.3%）是与金黄色葡萄球菌，一种抗药性病原体有关。氯霉素耐药的S. aureus被发现有3.7%的污染。此污染在S. aureus污染的内窥镜（13.3%）和21%的污染的内窥镜（9.5%）中被发现。抗药性初步结果表明，医院内和医院内的患者都有MRSA的存在。

虽然没有直接的证据证明在初级保健和内窥镜上的微生物的存在，直接结果表明在患者的感染，研究的结论是无意义的，无论是间接的还是直接的。随着医疗的提高和内窥镜的高风险患者的医疗服务，很可能感染的患者的医疗和手术问题，患者的耐药性以及可能的后果，都是令人担忧的。

因此，我们强烈建议，内窥镜和听诊器的清洁和消毒（不必提医疗）
hands!) should be regularly disinfected so as to minimize the spread of infection.

References


