Improving care in paediatric asthma
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Chapter 9: Bacterial contamination of inhalation chambers, results of a pilot study.

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Eric R. van der Vorm

Abstract

Introduction
Spacers are used in the treatment of children with asthma. It is advised to clean the spacers regularly. However, cleaning can influence drug delivery. One obvious reason to clean a spacer is prevention of bacterial contamination. Whether spacers are contaminated or not is unknown.

Methods
We cultured spacers, brought in by children with asthma or recurrent wheeze who visited our outpatient clinic during a 4-month period.

Results
The spacers of 64 children were studied and 24 (38%) were contaminated, most often (13 cases) Bacillus species were found. Only one spacer grew a potential pathogenic bacterium (Pseudomonas aeruginosa). No correlation with type of inhaler, duration of usage, drug or visual aspect was found. Spacers, cleaned according to national guidelines, were not less contaminated.

Conclusions
Bacterial contamination of spacers is frequent, but the bacteria cultured are not pathogenic. Intensive cleaning of spacers does not influence the level of contamination with environmental bacteria.
Introduction

There has been concern about the colonization of nebulisers with pathogenic microorganisms. Indeed, contamination with Pseudomonas aeruginosa of up to 35% of the nebulisers has been reported. Instructions to prevent colonization have been made available by asthma nurses, in leaflets for patients, as well as on the Internet. It is advised to clean holding chambers, used in the treatment of children with asthma or recurrent wheeze, at least once a week by washing them in warm water with household detergents and dry them in the air. One of the obvious reasons for cleaning a spacer is to prevent possible bacterial contamination.

As far as we know, formal studies concerning the effect of frequency and method of cleaning on bacterial colonization of inhalation chambers have not been published. Information thereabout is warranted because the method of cleaning can influence aerosol delivery. Therefore we studied the bacterial contamination of spacers and possible factors of influence.

Materials and methods

During a 4-month period in 2001 we asked the parents of children, treated in our outpatient clinic for at least 6 months because of asthma or recurrent wheeze, to bring in their spacers. Because most of the patients were on inhaled steroids, only spacers used at least twice daily were studied. The asthma nurse had given cleansing instructions to all parents. These instructions were according to national guidelines. The local ethical committee gave permission; all parents gave written consent.

Parents filled in a questionnaire about frequency of use, medication, spacer used, age, sex, duration of treatment, and were asked to describe their method of cleansing. Cultures were taken by making a spiral movement on the total inner side of the spacers, with a swab that was soaked in sterile NaCl 0.9%. The swabs were transferred to the laboratory and cultured on blood- and chocolate agar plates. These were incubated for 48 hours at 37°C and then investigated and counted. By doing so we made our study semi-quantitative. When > 50 colony-forming units were found, the spacer was considered contaminated, this number was chosen arbitrarily. Statistics (chi-square tests) were performed using SPSS (version 10.0), p < 0.05 was considered statistically significant.

Results

The spacers of 64 children (age: 9 – 113 months, 44 boys) were studied, 24 (38%) were contaminated. Bacillus species were found in 13 cases (48%), coagulase negative Staphylococci and Gram negative rods both in 4 cases, Corynebacterium in 2, Pseudomonas aeruginosa in 1, Pseudomonas- like
bacteria in 2 and a yeast, Candida glabrata, in 1 (table 1). All parents had received instructions for cleansing and 49 spacers (77%) were cleaned according to these instructions. This had no effect on the level of spacer contamination. Twenty-three (36%) spacers were cleaned longer than one week before the samples were taken, of these 23 spacers, 6 (26%) were contaminated. Of the 41 spacers which were cleaned in the week before sample taking, 22 (54%) were contaminated (p = 0.033). No influence of the drugs prescribed could be demonstrated. The visual appearance of the spacer did not predict bacterial contamination. Thirty-one spacers were used shorter than 6 months, 12 spacers 7 – 12 months and 22 spacers were longer than one year in use. No relationship between duration of use and contamination was found. No differences between the various spacers (Volumatic, Babyhaler, (GlaxoWellcome, Zeist, The Netherlands); Aerochamber (Boehringer, Alkmaar, The Netherlands); Nebuhaler (AstraZeneca, Zoetermeer, The Netherlands)) could be demonstrated.

<table>
<thead>
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<th>spacer</th>
<th>n</th>
<th>contaminated</th>
<th>Bacillus</th>
<th>CNS</th>
<th>GNR</th>
<th>Other</th>
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<tr>
<td>Nebuhaler(2)</td>
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<td>7</td>
<td>3</td>
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<td>2</td>
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<tr>
<td>Volumatic(1)</td>
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<td>8</td>
<td>4</td>
<td>2</td>
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<tr>
<td>Aerochamber(3)</td>
<td>14</td>
<td>5</td>
<td>2</td>
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<td>3</td>
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</tbody>
</table>


CNS = Coagulase negative staphylococci
GNR=Gram negative rods
Other: see text.

Discussion

As far as we know, this is the first study in which bacterial contamination of spacers is described. Because of this, this study has limitations. We chose to culture the spacers with wet swabs because the spacers had to be used again. Only the inside of the spacers were cultured. We did not formally test the reliability of the answers of the parents.

The methods of culture and determination were aimed to find aerobic Gram-positive and Gram-negative bacteria that are able to grow at body temperature (37°C).

By doing so, bacterial contamination was found in one third of all spacers. The species cultured were
in the majority of cases bacteria, which are common in the environment. The most frequently isolated bacteria were Bacillus species. This is not surprising, as Bacillus species are able to make spores by which they can survive a long time in a dry environment. Only in one sample was P. aeruginosa detected. Spacers seemed not to be contaminated with bacteria that are normally found in the nasopharynx of children. A relationship between method of cleaning, manufacturer of the spacer, duration of usage and used drugs could not be demonstrated. The only difference detected was the period elapsed between culturing and last cleaning: the more time elapsed, the lower the possibility of contamination. This may be a reflection of the frequency of spacer use. Frequent use may enhance the possible contamination by environmental flora. In this study it appeared that whether the parents used their own method or the instructed method for cleaning, there was no detectable effect on contamination with environmental bacteria.

In conclusion: intensive cleaning of spacers does not influence the level of contamination with environmental bacteria, and therefore is not necessary.

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References