# Effect of a new simplified hygiene standard on nebulizer contamination

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Summary:

A new method of nebulizer disinfection for Cystic Fibrosis (CF) patients, presented in a previous study "An evaluation of different steam disinfection protocols for cystic fibrosis nebulizers" (Fig. 2) by the authors of the present paper was examined in real life and

# proved to be valid.

## Introduction:

Because nebulizer hygiene is crucial our physiotherapists check the hygienic standard of the nebulizers of each CF patient every year. (Fig. 1)

## **Comparing disinfection procedures:**

**Until 2013** the disinfection procedure consisted in drying the nebulizers after steam disinfection in the disinfector with a clean lint-free hot ironed cotton towel.

Duration of the procedure: about 30`.

In 2014 the new method according to the results of the study (Fig. 2) was introduced: The nebulizer parts have to be left in the disinfector after disinfection until the next use. The patients were informed and started to practice the new method.

### Duration of the procedure: 5`.

**2015**: The results of the hygiene checks from 2013 and from 2015 were compared in order to validate the impact of the change of disinfection procedures in hygienic respect. The data of 29 patients from 2013 and 2015 were at disposal for this purpose.

#### Methods:

A fixed number of swaps is taken from each nebulizer. These are cultivated on Columbia 5% sheep blood, Mac Conkey II and BCSA. Agar are read after 48h at 37°C, BCSA additionally after five days at 32°C and again after five days at room temperature. Organisms are determined by MALDI-TOF. The results are documented and archived.

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Keimnachweis nach Aufbereitung von Eflow rapid-Inhalation	sgerät	PatName:	
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Ambulanz  Physiotherapie  Station	Befun	Entnahmeart: Abstrich Gewinnungsdatum: Klinische Angaben: Keimnachweis nach Aufbereitung von Pari junior od. Abgenommen von:	<b>boy</b> -Inhalationsgerät
F1 Mundstück (innen inkl. blaues Ventil)		□ Kinder □ Lunge	
E2. Vernehlerkammer/Medikamentenhehälter		🗆 Ambulanz 🗆 Physiotherapie 🛛 Statio	on
F3 Finatemyentil /Pitze Cymmileschel		Pari junior oder boy	Befund
E4 AprocolorZougor (Matellmombran)		P1. Maske	
		P2. Mundstück	
E5. Deckel (weiß und grau)		P3. Deckel (blau)	
E6. Verneblerkabel (falls Pat. Dabei hat) Kabel = grau		P4. Medikamentenbehälter ( <i>weiβ</i> )	
E7. Steuerungseinheit		P5. Aerosolerzeuger (gelb/rot/blau)	
		P7. Adapter für Cornet (blau)	
		P8. Antibiotikafilter (Innenraum inkl. blaues Ve	ntil)
E = Eflow rapid	B	P = Pari junior od. boy	

Fig. 1: Standard form for nebulizer swabs





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**Results:** (Fig. 3)

- 7 of 29 patientshad 2013: no critical bacterial and fungal contaminationand 2015: no critical bacterial and fungal contamination
- 2 of 29 patients had 2013: no critical bacterial and fungal contamination but 2015: critical bacterial and fungal contamination
- 17 of 29 patientshad 2013: critical bacterial and fungal contamination.but 2015: no critical bacterial and fungal contamination

# **Conclusions:**

An evaluation of different steam disinfection protocols () CrossMark

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#### Abstra

*Background:* Contamination is a key element in cystic fibrosis. For this reason, nebulizer hygiene is an important, but complex and timeconsuming task for cystic fibrosis patients. The aim of this study was to compare different steam disinfection and drying protocols. *Methods:* One hundred nebulizer parts were inoculated with cystic fibrosis-related bacteria in high concentrations (*Burkholderia multivorans*  $3.9 \times 10^{10}$ /ml, *Staphylococcus aureus*  $8.9 \times 10^{8/}$ ml and *Pseudomonas aeruginosa*  $2.1 \times 10^{9}$ /ml). Tubes with *Mycobacterium abscessus* complex were additionally tested. Six steam disinfectors were compared. Different methods of drying were examined. *Results:* All tested bacteria were efficiently killed by the different steam disinfectors tested. The risk of contamination depended on the method of drying.

Conclusions: Steam disinfection is a safe disinfection method. It is better to leave the nebulizers wet after steam disinfection than to manipulate them by active drying, which seems to be a source of recontamination. © 2015 European Cystic Fibrosis Society. Published by Elsevier B.V. All rights reserved.

Keywords: Aerosol drug therapy; Equipment contamination; Infection control; Infection prevention; Inhalers; Medical devices; Nebulizer; Inhalation; Hygiene; Cleaning; Steam disinfection; Mycobacteria; Compliance; Cystic fibrosis; Bacteria; Pseudomonas aeruginosa

#### Fig. 2: http://dx.doi.org/10.1016/j.jcf.2015.07.005

The results show that the new method of disinfection procedures produces significantly better hygienic results and is easier and quicker to perform than the traditional method. The disinfection method of leaving disinfected parts in the steam disinfector is proved successfully and is recommended to be applied in future by all CF patients. Hand hygiene should now become an educational priority to complete nebulizer hygiene.

**Proposition for Recommendations for effective steam disinfection** 

#### After every use:

- 1. Wash the assembled nebulizer with water, with or without dish washing detergent.
- 2. Steam disinfect the assembled nebulizer using tap water.
- 3. Open the steam disinfector after disinfection only for a short time, if it is desired to let some steam out, otherwise leave the lid closed until the nebulizer is reused (a maximum of 24 hours).

2	013	2015		
Pilze	Bakterien	Pilze	Bakterien	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
U	U	0	0	
Aspergilius tumigatus	Pseudomonas sp	0	0	
0	Enterobacter cloacae	0	0	
0	Acinetobacter Iwofii	0	0	
0	Acinetobacter baumanii	0	0	
0	Staphylococcus aureus, Xantomonas sp., A.lwoffi, Enterobacter cloacae	0	0	
0	Enterococcus faecalis	0	0	
0	Stenotrophomonas mal- tophilia, A.johnsonii, Pantoea agglomerans	0	0	
0	Enterobacter cloacae, En- terococcus faecalis	0	0	
0	Staphylococcus aureus, Neisseria sp	0	0	
0	A.lwoffi	0	0	
0	Enterococcus faecalis	0	0	
Candida parapsilosis	Pantoea agglomerans	0	0	
0	Staphylococcus aureus (SCV)	0	0	
Aspergillus fumigatus, Candida sake	0	0	0	
Aspergillus fumigatus, Candida dublinensis	0	0	0	
0	Acinetobacter johnsonii	0	0	
0	Enterobacter cloacae, En- terococcus faecalis	0	0	
0	Moraxella osloensis	0	0	
0	0	Aspergillus fumigatus		
0	0		Alcaligenes faecalis	
0	A. lwofii, Xanthomonas sp.	0	Moraxella osloensis	
0	Actinomyces neuii	0	Enterobacter cloacae	
0	Staphylococcus aureus	Aspergillus fumigatus	0	

- 4. Wash hands and dry them with a clean paper towel (e.g. the inner side of a leaf of kitchen roll) and place another clean paper towel next to the steam disinfector.
- 5. Open steam disinfector and assemble the parts if dismantled.
- 6. If the parts are too wet, shake off the water or tap it off on the clean paper towel.
- 7. Place the nebulizer only in the steam disinfector or on a clean paper towel

At the end of the day: Dismantle the nebulizer parts, wash them with or without dish washing detergent and steam disinfect them. Leave them inside the steam disinfector overnight and assemble just before use.

Weekly: clean the area around the steam disinfector and the steam disinfector inside and out with a detergent and let it dry. Clean the steam disinfector outside with a disposable, singly packed, alcohol-based disinfecting wipe.

Advice: If more water than usual remains in the disinfector after the process, replace the steam disinfector with a new one.

0 = no bacteria or apathogenic bacteria like aerobic spore former, coagulase-negative staphylococci, Corynebacterium sp., Micrococcus sp., Streptococcus sp.

Fig. 3: Results of the annual nebulizer check 2013/2015





