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A new method of disinfection of the flexible fibrebronchoscope

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Garcia de Cabo, A., Martinez Larriba, P. L., Checa Pinilla, J., and Guerra Sanz, F. (1978). *Thorax*, **33**, 270–272. **A new method of disinfection for the flexible fibrebronchoscope.** A modified method for rapid sterilisation of the fibrebronchoscope using immersion of the instrument in 0·1% benzalkonium chloride for five minutes followed by a further five minutes' immersion in 96% alcohol was tested both by deliberate contamination of rubber catheters and on bronchoscopes after use in patients. The method proved effective in eliminating a wide range of potentially pathogenic organisms.

For several years we have sterilised the flexible fibrebronchoscope using benzalkonium chloride, which has given excellent results. This cleansing agent has several advantages in addition to its antibacterial activity, as it is harmless to the materials used in the construction of the fibrebronchoscope, it is cheap and noncorrosive, and it does not stain. As Kato and Matsushima (1974) obtained unsatisfactory results using a similar technique we decided to test the antibacterial efficacy of our method.

Methods

VALIDATION OF THE ORIGINAL METHOD

The method we use for disinfection of the flexible fibrebronchoscope consists of initial rinsing of the instrument with normal saline and aspiration of 200 ml 0·1% benzalkonium chloride solution through the internal lumen followed by a second rinse with normal saline. The exterior of the instrument is cleaned with gauze soaked in benzalkonium chloride and, after a further saline rinse, the instrument is air-dried. To test the efficacy of this method the following experiment was performed.

Two 50-cm rubber catheters were immersed for five minutes in a culture of a mixture of microorganisms (Table 1) prepared in trypticase soy culture medium. One of the catheters was then immediately transferred to sterile culture medium while the second was cleaned and disinfected by the method regularly used for sterilisation of the flexible fibrebronchoscope, after which it, too, was placed in sterile culture medium. Colony counts were performed on the two plates after 24 hours' incubation at 37°C.

INVESTIGATION OF EFFICACY OF A MODIFIED CLEANING PROCEDURE

The original method was modified by the addition of a second active agent, 96% alcohol. After initial rinsing of the exterior and lumen of the flexible fibrebronchoscope with normal saline the instrument was immersed in 0·1% benzalkonium chloride solution for not less than five minutes and a quantity was drawn through the length of the inner lumen by means of a syringe. The procedure was then repeated for five minutes using 96% alcohol and the instrument was air-dried.

The method was tested in two ways. Two rubber catheters were infected by a five-minute immersion in the trypticase soy culture medium described above; one was immediately placed in sterile culture medium, and the other was cleaned by the modified method described above before it, too, was placed in the culture medium. Both test and control plates were incubated for 24 hours at 37°C.

After examination of a series of randomly chosen patients with the Olympus BF2 fibrebronchoscope, swabs were taken after each examination from the brush and external surfaces of the instrument and cultured on blood and chocolate agar plates. In addition, 5 ml of sterile culture medium was injected down the inner

lumen, collected under sterile conditions, and incubated at 37°C for 24 hours, after which it was cultured on blood and chocolate agar plates. Separate cultures for *Mycobacterium tuberculosis* and *Aspergillus* species were performed on Löwenstein-Jensen medium, read at two months, and on Sabouraud medium, read at 20 days. The fibrebronchoscope was then cleaned using the modified method and the cultures were repeated as before. All other plates were incubated for 24 hours, when the colonies were counted and identified.

Results

The results of the catheter tests are shown in Tables 1 and 2. Significant bacterial contamination after cleaning by the original method was encountered. This was eliminated by the modified method.

Specimens cultured from the fibrebronchoscope after 24 randomly selected examinations showed bacterial growth in all cases, although in only eight instances were the infecting organisms potentially pathogenic (Table 3). After cleaning with the modified technique all cultures were negative, except for one which grew *Staphylococcus epidermidis*, thought to be a contaminant.

Table 1 *Culture of experimentally contaminated catheters with and without cleaning by original method*

Microorganism	*Colonies/ml Untreated catheter*	*Treated catheter*
Escherichia	> 100 000	0
Serratia marcescens	> 100 000	0
Haemophilus influenzae	> 100 000	0
Staphylococcus aureus	> 100 000	3000
Pseudomonas aeruginosa	> 100 000	0
Proteus vulgaris	> 100 000	2000
Streptococcus pneumoniae	> 100 000	0
Klebsiella pneumoniae	> 100 000	4000

Table 2 *Culture of experimentally contaminated catheters, treated and untreated by modified method*

No. of Experiments	*Microorganism*	*Catheter Untreated*	*Treated*
3	*Aspergillus* sp.	Growth	No growth
3	*Mycobacterium tuberculosis*	Growth	No growth
6	*Streptococcus pneumoniae*	Growth	No growth
4	*Pseudomonas aeruginosa*	Growth	No growth
1	*Enterobacter cloacae*	Growth	No growth
3	*Escherichia coli*	Growth	No growth
4	*Klebsiella pneumoniae*	Growth	No growth
4	*Haemophilus influenzae*	Growth	No growth
1	*Providencia stuartii*	Growth	No growth
1	*Serratia marcescens*	Growth	No growth
3	*Proteus mirabilis*	Growth	No growth
1	*Enterobacter aerogenes*	Growth	No growth
1	*Proteus morganii*	Growth	No growth
4	*Staphylococcus aureus*	Growth	No growth
1	*Flavobacterium* sp.	Growth	No growth
1	*Pseudomonas putrefaciens*	Growth	No growth
1	*Citrobacter freundii*	Growth	No growth
1	*Pseudomonas* sp.	Growth	No growth
1	*Proteus vulgaris*	Growth	No growth
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Discussion

Although we had used the original method for several years with satisfactory results, it was found to be deficient in circumstances where there was gross bacterial contamination. The modified technique, however, appears to be effective against the organisms used in the experiments, which are

Table 3 *Culture of swabs taken from fibrebronchoscopes after use in 24 patients—before disinfection*

No. of patients	*Channel*	*Surface*	*Brush*
1–4	Saprophytes	Saprophytes	Saprophytes
5	*Haemophilus influenzae*	*Haemophilus influenzae* *Staphylococcus aureus*	*Haemophilus influenzae*
6	Saprophytes *Haemophilus influenzae*	Saprophytes —	Saprophytes *Haemophilus influenzae*
7, 8	Saprophytes	Saprophytes	Saprophytes
9	—	—	*Mycobacterium tuberculosis*
10	Saprophytes	Saprophytes	Saprophytes
11	*Staphylococcus aureus* *Pseudomonas aeruginosa*	*Staphylococcus aureus* *Pseudomonas aeruginosa*	*Staphylococcus aureus*
12–17	Saprophytes	Saprophytes	Saprophytes
18	—	Saprophytes	Saprophytes
19	—	Saprophytes	—
20	Saprophytes	Saprophytes	*Streptococcus pneumoniae*
21	*Escherichia coli*	*Escherichia coli* Saprophytes	*Escherichia coli* Saprophytes
22	Saprophytes	Saprophytes *Staphylococcus aureus*	Saprophytes *Staphylococcus aureus*
23	*Pseudomonas aeruginosa* Saprophytes	Saprophytes	*Pseudomonas aeruginosa* Saprophytes
24	Saprophytes	Saprophytes	Saprophytes

commonly encountered in practice, even though they were present in concentrations not normally found in the bronchial tree.

Although cross-infection as a result of fibrebronchoscopy is not a common occurrence, whatever the method of sterilisation used, clearly an effective method should be employed. None can be considered reliable unless tested under conditions of maximal bacterial contamination, and the modified technique we propose of 0·1% benzalkonium chloride and 96% alcohol rinsing appears to fulfil the requirements of an effective, rapid, and non-toxic cleaning procedure.

Reference

Kato, H., and Matsushima, S. (1974). Experimental study for rapid sterilisation of the flexible fiberoptic bronchoscope. *Chest*, **66**, 723–724.

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