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Microbiological monitoring of flexible bronchoscopes after high-level disinfection and flushing channels with alcohol: Results and costs

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Summary
Background: Routine microbiological surveillance of flexible bronchoscopes is recommended in different guidelines. The study aims to assess whether bronchoscopes reprocessing methods achieved an appropriate decontamination level and whether manual flushing of 70% ethyl alcohol at the end of the cycle reduces the risk of microbiological contamination.
Methods: 18 different bronchoscopes were cultured on a monthly basis during a four-year period to examine growing of bacteria, fungi and mycobacteria. 9 equipment were usually disinfected using automatic reprocessors, and the other 9 equipments were manually disinfected. Additional manual flushing of bronchoscope's channels with 70% ethyl alcohol at the end of each disinfection cycle, was implemented for automatically reprocessed equipments for a two-year period.
Results: A total of 620 samples were obtained. 564 samples (91.0%) tested negative and 56 samples (9%) tested positive for at least one specimen, of whom 3% were pathogenic or

Abbreviations: APIC, Association for Professionals in Infection Control; FB, Flexible bronchoscopy; SEPAR, Spanish Society of Pneumology and Thoracic Surgery.

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potentially pathogenic microorganisms. Only one positive sample was detected among the 167 alcohol treated bronchoscopes (0.6%), whereas before the introduction of this technique the percentage of contamination with risk pathogens was 4.1% ($p = 0.04$). The mean annual cost of the surveillance program was estimated at 23,035 euros, and the mean cost for bronchoscope was 111.5 euros.

Conclusions: The results of our study support to improve the final reprocessing of bronchoscope channels by means of additional manual flushing with 70% ethyl alcohol after each disinfection cycle. Routine microbiologic monitoring of endoscopes is both time-consuming and expensive but could be saved by implementing a highly efficient decontaminating procedure.

Introduction

Flexible bronchoscopy (FB) is one of the most common procedures performed in pulmonary medicine to obtain cytopathological or microbiological samples. Although transmission of infectious agents through bronchoscopes seems uncommon, the problem is probably under-recognized and under-reported [1,2]. During the period 1974—2004, bronchoscopy procedures accounted for 47.5% of the endoscopy-related infections and 94% of the cross-contaminations in the USA and 21.1% of the infections and 76.5% of the cross-contaminations in other countries [3]. Microorganisms can be transmitted from previous patients or from contaminated reprocessing equipment. The analysis of the suspected and confirmed causes of contamination suggests that better adherence to decontamination guidelines could have prevented more than 90% of the exogenous endoscopy-related outbreaks [4]. Nevertheless, variations in bronchoscope disinfection practices [5,6] and inconsistencies among reprocessing guidelines published by professional associations have been described [7].

We conduct this prospective study to determine whether adequate decontamination of bronchoscopes was achieved after its complete reprocessing and to analyze whether manual flushing of 70% ethyl alcohol following reprocessing procedure reduces the risk of microbiological contamination. We also performed a cost analysis for the current testing schedule at our hospital.

Methods

Setting

The study was performed at Bellvitge Hospital, a 800-bed referral university affiliated hospital located in the metropolitan area of Barcelona (Spain) and belonging to the Catalan Public Health System. FB is mainly performed by pulmonologists at the bronchoscopy suite or in the operating room. Intensive-care physicians and anesthesiologists also perform FB for diagnostic or intubation purposes. During this period, pulmonologists performed 5467 procedures (including standard diagnostic, endobronchial ultrasound, and interventional bronchoscopies), intensivists 474 and anesthesiologists 228.

Design

4-year prospective (January 2009—December 2012) quasi-experimental study.

Reprocessing procedures

After each endoscopic examination, a manual procedure was used for cleaning of the external and internal surfaces, including brushing and flushing of the working channel with a solution of water and enzymatic detergent. Automated flexible endoscope reprocessors were used in the bronchoscopy suite whereas manual disinfection was performed at the intensive care area and at the operating room. The manual method consisted on totally immersing the bronchoscope for at least 12 min in *ortho*-Phthalaldehyde (Cydex OPA *ortho*-Phthalaldehyde, division of Ethicon, Inc. a Johnson & Johnson Co, Irvine, Canada). Inner channels were irrigated manually with the disinfectant. Once disinfected, the equipment was rinsed with sterile water and medical air was forced through to dry the endoscopes without alcohol rising. In the bronchoscopy suite, automatic disinfection was done by means of an endo-thermo-disinfector using peracetic acid based process (Olympus miniETD2, Olympus Europa Holding MBH, Hamburg, Germany).

Microbiological surveillance methods

During the study period all bronchoscopes were cultured on a monthly basis, provided that they were available. Main reasons for non availability were bronchoscope in use or out of order. The cultures were obtained according to the recommendations of the Spanish Society of Pneumology and Thoracic Surgery (SEPAR) [8]. As a general rule, 9 equipments were usually disinfected with the miniETD2 at the bronchoscopy suite, and the other 9 equipments were manually disinfected. All the samples were handled by an infection control nurse and a technician under an aseptic process. The samples were obtained by a retrograde method, flushing 20 mL of sterile physiological saline through the working channel and waiting for 5 min before collecting the flow-through in three sterile containers to examine growing of bacteria, fungi and *Mycobacterium* species, respectively. This technique requires the

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