Absence of Clinical Pneumonia following Bronchoscopy with Contaminated and Clean Bronchofiberscopes*

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Two hundred forty-nine fiberoptic bronchoscopy procedures were surveyed for the presence of bronchoscopy-related pneumonia. The first 103 procedures were performed during a period when the fiberscope was presumably contaminated with Pseudomonas aeruginosa. Chart review of these 103 procedures and prospective epidemiologic surveillance of the remaining 146 procedures revealed no cases of bronchoscopy-related pneumonia.

Fiberoptic bronchoscopy has become a widely used procedure in the diagnosis and management of respiratory disease. Although the morbidity of the procedure has been reported to be low, the occurrence of pneumonia following the procedure could further compromise ill patients.

The incidence of pneumonia after fiberoptic bronchoscopy has not been studied extensively. In a questionnaire study, Credle et al noted that only two cases of pneumonia followed 24,521 bronchoscopies. Webb and Vall-Spinosa reported three patients who developed pulmonary nosocomial Serratia marcescens infection from a contaminated bronchoscope, but the infection rate for the procedure was not given. Recently, in a prospective study, Pereira et al identified six of 100 consecutive patients who developed fever and a pulmonary infiltrate following bronchoscopy.

At the University of Virginia Hospital, an unusual increase in the number of bronchial washings growing Pseudomonas aeruginosa was noted in September, 1973. A retrospective chart review of all patients who underwent bronchoscopic procedures in the preceding six months was undertaken to determine the incidence of fiberoptic bronchoscope-related pneumonia and to examine the frequency of specific bacterial isolates from bronchial washings. Contamination of the instrument was confirmed by culture, and the method of disinfecting the fiberscope was changed. Subsequently, prospective surveillance of patients undergoing bronchoscopies was begun by the infection control team in November, 1973. This article reports on the incidence of bronchofiberscope-related pneumonias in periods before and after contamination was documented.

MATERIALS AND METHODS

Bronchoscopy

All bronchoscopies were performed in the same operating room by thoracic surgeons utilizing Olympus 4 and 5 mm bronchofiberscopes. The fiberscope always was inserted through an oral endotracheal tube. Masks, sterile gloves and gowns were worn by the endoscopist throughout the procedure.

The method of disinfecting the bronchoscope between April and September, 1973 (period 1) included an initial wash in an antibacterial soap and water solution and subsequent rinsing in sterile water. The new method instituted in September, 1973 and used through August, 1974 (Period 2), included an initial wash with an antibacterial soap. In addition, the fiberscope was soaked for 20 minutes in a solution containing two parts iodine, two parts 70 percent ethanol, and one part water. Washings of the disinfected fiberscope then were cultured periodically.

Surveillance for Pneumonia

All patients had their temperatures recorded at least four times a day following bronchoscopy. Chest roentgenograms were performed when the physician in charge thought they were indicated.

In period 1, charts were reviewed of all patients who had undergone bronchoscopic procedures. Patients were included in the study only if they had cultures of bronchial washings performed and were observed for at least three days following the procedure. Charts were examined for the frequency of particular bacterial isolates from bronchial washings and for evidence of nosocomial pneumonia. The criteria used for diagnosing nosocomial pneumonia were as follows: the pres-
ence of a new infiltrate, new sputum production, and a compatible clinical picture. Changes in an existing infiltrate and the occurrence of an infiltrate behind a known obstruction were not considered evidence for bronchoscopy-related pneumonia.

In period 2, prospective surveillance was performed on all patients (145) undergoing bronchoscopy (146 procedures). Trained nurse epidemiologists reviewed charts on the wards and sought evidence for infection in these patients weekly. At the completion of the study, charts of all patients were reviewed by the authors. Only data from patients who were observed for three days following the procedure are included.

**Bacteriology of Bronchial Washings**

In both study periods, culture results from bronchial washings were analyzed for the frequency of particular bacterial isolates. In period 1, 103 bronchial washings were analyzed (100 percent of bronchoscopies which satisfied the criteria for inclusion in the study). In period 2, analysis was confined to the first 103 bronchial washings from a total of 146 bronchoscopies which met the study criteria.

**RESULTS**

**Bacteriology of Bronchial Washings**

A review of bronchial washings from patients undergoing the procedure in period 1 indicated growth of *Pseudomonas aeruginosa* in 82 of 103 samples (80 percent) (Fig 1). In September, 1973, a single culture of the “disinfected” bronchoscope yielded *Pseudomonas aeruginosa*. In contrast, during period 2, patient bronchial washings were positive for *Pseudomonas aeruginosa* in only six of 103 specimens (6 percent) ($X^2 = 49.28$, $P<0.0005$) and six cultures from the “disinfected” bronchoscope were negative. The combination of a positive fibroscope culture for *Pseudomonas aeruginosa* and the high proportion of *Pseudomonas aeruginosa* isolates from bronchial washings in period 1 provides presumptive evidence that the fibroscope was contaminated with *Pseudomonas aeruginosa* during this period.

In period 1 the fibroscope also may have been transiently contaminated with two other bacterial species, *Serratia marcescens* and *Klebsiella pneumoniae*. *Serratia marcescens* was isolated from patient bronchial washings 20 times in several discrete clusters (Fig 1). In period 2 it was not isolated once in 103 bronchial washings ($X^2 = 18.37$, $P<0.0005$). *Klebsiella pneumoniae* was isolated 22 times from patient bronchial washings in period 1 without demonstrable clustering. In Period 2, *Klebsiella pneumoniae* was isolated only 3 times in 103 cultures ($X^2 = 12.96$, $P<0.0005$).

**Occurrence of Pneumonia**

In period 1, chart review of 103 procedures showed no cases of bronchoscopy-related pneumonia. In this period, 41 of the 103 bronchoscopies (40 percent) were followed by a chest roentgenogram of the patient within four days of the procedure. Only one patient was receiving immunosuppressive therapy; he had diffuse interstitial fibrosis and had been receiving prednisone, 70 mg a day. Fifty-two patients (50 percent) had carcinoma; 33 (32 percent) had inflammatory disease; none had leukemia.

No cases of bronchoscopy-related pneumonia were identified in period 2 from among 146 procedures. Seventy-three of the 146 bronchoscopies (50 percent) in this period were followed by a chest roentgenogram of the patient within four days of the procedure.

**DISCUSSION**

Many patients undergoing bronchofiberoscopy have elevated temperatures or infiltrates associated
with their underlying disease. Using established criteria for nosocomial pulmonary infections, we were unable to document pneumonia occurring as a complication of fiberoptic bronchoscopy. During period 2, however, routine hospital infection surveillance utilizing identical techniques did identify 131 nosocomial pneumonias that were not related to bronchofiberoscopy.

Data obtained when the fibroscope was contaminated with Pseudomonas aeruginosa represents information that is unlikely to be obtained by a prospective study. Thus, it seemed important to analyze this information despite the problems inherent in retrospective studies. To our surprise, we were unable to document a bronchoscopy-related pneumonia in this period. It should be noted that only one patient was receiving immunosuppressive therapy and that none had leukemia or were granulocytopenic. It would be hazardous to extrapolate this information to include patients with such disorders. Because disinfection of the fiberscope is not difficult, we recommend employing optimal techniques.

Our failure to find bronchoscopy-related pneumonia is at variance with results of Pereira et al. They identified fever and pulmonary infiltrates in six of 100 patients following bronchoscopy. The divergent findings between the studies may be explained in part by the different criteria used for detection of nosocomial pneumonia. Infiltrates described by Pereira et al were of two types: "Extensions of preexisting abnormalities, usually dense infiltrates, and entirely new abnormalities which were more often small fluffy infiltrates with poorly defined borders." Three of their six patients developed the infiltrate behind a mass lesion. Our study excluded infiltrates occurring behind a mass lesion and extensions of existing infiltrates. We find it difficult to determine if such changes are related to bronchofiberoscopy or to the underlying disease.

Another difference between our study and the one reported by Pereira et al is that in the former, the bronchofiberscope was inserted through an oral endotracheal tube, whereas in the latter, it was inserted through the nose. It is possible that there is greater contamination of the bronchofiberscope when inserted through the nose than when inserted through an oral endotracheal tube. Thus, the transnasal approach could lead to a higher incidence of pneumonia.

An additional reason to explain why the findings of Pereira et al are different from ours may be that we obtained chest roentgenograms only when the attending physician considered it clinically necessary, whereas Pereira et al obtained chest roentgenograms on all patients. It is possible that our study missed infiltrates which were not associated with new symptoms or fever. Nevertheless, if bronchoscopy-related pneumonias were an important problem, one would expect several unequivocal cases in the course of 146 procedures.

All but two of our patients underwent a single bronchoscopy. Webb and Vall-Spinosa's patients who developed a Serratia marcescens pulmonary infection following bronchoscopy with a contaminated scope underwent bronchoscopy between three and 14 times. Additionally, all had received broad spectrum antibiotics, corticosteroids, and were receiving assisted ventilation at the time of the procedure. The trauma of repeated, bronchoscopic procedures in ventilated patients receiving corticosteroids may have damaged the bronchial epithelium and facilitated invasion by Serratia marcescens.

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