Several techniques have been proposed to differentiate bacterial colonization of the tracheobronchial tree from lung infection in critically ill patients under mechanical ventilation. The insertion of a sterile catheter through the endotracheal tube blindly wedged in a peripheral bronchus was initially advocated by Matthew. Because this technique is frequently associated with contamination, Winmberry recently proposed a fiberoptic bronchoscopy technique (protected brush) to obtain uncontaminated lower airway secretions for quantitative bacterial culture. However, this technique is invasive and can be associated with pneumomediastinum and tracheal hemorrhage. In this study, we evaluated the accuracy of a new protected bronchial catheter for diagnosing bacterial pneumonia in ventilated patients.

METHODS

Patients

The study population consisted of 46 surgical critically ill patients enrolled in a prospective study of Acute Respiratory Failure in the ICU from March 1985 to March 1987:

- Group I (control) included 25 post-operative and/or post-trauma patients (mean age 46 ± 22 years) who were considered to be free of any pulmonary insufficiency throughout the course of their stay in the ICU. For extrapulmonary reasons, they were mechanically ventilated for a mean time of 14 ± 9 days.

- Three patients from this group died, and autopsy confirmed that the lungs were normal.

- Group II included 21 post-operative and/or post-trauma patients (mean age 51 ± 14 years) who died with acute respiratory failure secondary to a bacterial pneumonia which was histologically confirmed by a lung biopsy (5-10 cm²) obtained through an immediate post-mortem thoracotomy. A second lung biopsy (1 cm²) in the same area was used for bacteriologic examination and culture. These patients were mechanically ventilated for a mean time of 15 ± 13 days.

Distal pulmonary sample collection

- After disconnection of the patient from the ventilator, and under sterile conditions, the proximal tip of the endotracheal tube was carefully swabbed with an iodine solution. A 50 cm sterile catheter, 1.7 mm ID, occluded by a polyethylene glycol plug (Plastimod Model CombiCat®) was inserted in the endotracheal tube and blindly advanced to the distal airways. The plug was then expelled with 10 cc of air administered via a sterile syringe and the catheter wedged in the distal airways. A second sterile catheter - 58 cm in length, 0.8 mm ID - was advanced 2 cm past the distal tip of the first catheter in order to reach the sampling site. Five cc of sterile water were then injected in the distal airways and 1 cc was aspirated and immediately transported for bacteriologic examination (gram-stain, cell count and culture). When direct cytologic examination evidenced epithelial cells, the distal pulmonary sample was considered contaminated and non-valid for bacteriologic analysis.

RESULTS

1) The sensitivity and the specificity of the protected bronchial catheter for diagnosis of bacterial pneumonia were respectively 86 % and 64 %.

2) All patients in group II had positive lung cultures. In 15 patients, lung cultures yielded one microorganism while in 6 patients lung cultures evidenced mixed infection with 2 to 3 microorganisms. 70 % of the microorganisms isolated in lung specimen cultures were gram-negative bacilli with a large predominance of pseudomonas aeruginosa (40 %). In 16 patients (76 %) lung biopsy specimens and distal pulmonary sample cultures were in accord. In 3 patients (15 %) distal pulmonary sample cultures were falsely negative while in 2 patients (9 %) distal pulmonary sample cultures and lung biopsy specimen cultures yielded different microorganisms.

DISCUSSION

This study shows that the protected bronchial catheter method has a sensitivity of 86 % and a specificity of 64 % for the diagnosis of bacterial pneumonia in mechanically ventilated patients. Fiberoptic bronchoscopy sampling technique described by Winmberry has a sensitivity of 100 % and a specificity of 60 % in identifying bacterial pneumonia in ventilated patients. Our study also shows that the protected bronchial catheter method identifies 76 % of the causative organisms of lung infection. Since this technique is simple, non-invasive and easily repeatable at the bedside, it might represent an attractive alternative to the fiberoptic bronchoscopy technique in ventilated critically ill patients.

REFERENCES

1 - Matthew EB et al
Crit. Care Med. 5 : 76-81, 1977

2 - Winmberry N et al

3 - Chastre et al