Comparison of bronchoscopic diagnostic techniques with histological findings in brain dead organ donors without suspected pneumonia

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Abstract

Background – The techniques for recognizing pneumonia in mechanically ventilated patients were evaluated as no "gold standard" is available to establish the diagnosis in these patients.

Methods – A prospective study was performed on nine brain dead organ donors not suspected of having pneumonia to assess the specificity of bacteriological results from different samples by comparing them with the histological findings from an open pulmonary biopsy specimen taken immediately after death through a mini-thoracotomy.

Results – Seven of the nine organ donors without clinical evidence of pulmonary infection and not on antibiotic therapy showed histological features of bronchopneumonia. There was no association between the histological findings and quantitative cultures of the lung biopsy specimen.

Conclusions – Histological evidence of pneumonia was common in this group of ventilated patients who had no clinical signs of the disease. (Thorax 1996;51:929-931)

Keywords: protected specimen biopsy, bronchoalveolar lavage, intracellular organisms, pulmonary biopsy, brain dead organ donors.

We have shown that up to 18% of protected specimen brush biopsies and bronchoalveolar lavage specimens yield significant bacterial growth in ventilated patients without evidence of pulmonary infections and have suggested that these findings may be a feature common to most patients who undergo prolonged mechanical ventilation. This prompted us to perform a prospective study to assess the significance of these results by comparing them with the findings obtained in a pulmonary biopsy specimen taken immediately after death in ventilated brain dead organ donors not suspected of having pneumonia.

Methods

PATIENTS
Nine brain dead organ donors in the intensive care unit (ICU) who were not suspected of having pneumonia participated in a prospective study. None had fever, leucocytosis, evidence of pulmonary infiltrates on chest radiographs, or had received antibiotics. All patients had an endotracheal tube in place for at least 24 hours. At the outset 10 ml of sterile 0.9% saline was aspirated through the suction channel of the bronchoscope for bacteriological examination.

SPECIMEN COLLECTION
Both protected specimen brush biopsy and bronchoalveolar lavage were performed in the superior segment of the lower right lobe through a fibroptic bronchoscope as previously described. A large specimen (approximately 3 cm³) was then cut from the superior segment of the lower right lobe through a mini-thoracotomy. This biopsy sample was sectioned into two fragments, one for bacteriological examination and the other for pathological processing.

The study was approved by the local research ethics committee and informed consent was obtained in all cases.

MICROBIOLOGICAL PROCESSING OF SPECIMENS
Specimens were transported immediately to the laboratory and processed for quantitative bacterial and fungal culture using standard methods as described in previous studies. Biopsy samples were weighed, covered with 1 ml of sterile saline, and homogenised. An aliquot of 0.1 ml was inoculated onto the same plates as those used for the protected specimen brush biopsy and bronchoalveolar lavage. Bacteriological counts for the biopsy specimens were expressed as colony forming units per gram of tissue (cfu/g) with counts of ≥ 10³ cfu/g being considered significant.

CYTOPATHOLOGICAL STUDY
Two 0.5 ml samples of resuspended original bronchoalveolar lavage fluid were cytocentrifuged and stained for cell identification, differential counting, and estimation of the percentage of cells with intracellular organisms as described in previous studies. Tissue blocks were embedded in paraffin and cut into sections of 4 μm. At least 10 sections were obtained per sample. The presence or absence of bronchopneumonia was determined according to the criteria described by Rouby et al. Two different pathologists evaluated all histological specimens without knowing the study protocol.

Results
The mean (SD) age of the nine donors (six men) was 37.6 (16.2) years (range 20–63
The cause of brain death was head injury in six cases, cerebrovascular disease in two, and cardiac arrest in one (table 1). The mean duration for which patients were mechanically ventilated was 93.1 (68.4) hours (range 33–240) and the mean time lapse from fibroptic bronchoscopy to thoracotomy was 2.66 (3.73) hours. Arterial blood gas analysis showed a $PaCO_2$ of 5 (1.6) kPa, pH of 7.37 (0.03), and $PaO_2$ of 47.3 (14.6) kPa with an $FiO_2$ of 100%. Fibroptic bronchoscopy was considered normal in seven cases and purulent bronchial secretions were noted in the remaining two patients. None had received antibiotics. The mean axillary temperature was 36.5 (0.75)°C and the mean white blood cell count was 8.5 (2.0) x 10^9/l.

The histological and bacteriological results are shown in table 1. The average percentage of bronchoalveolar fluid retrieved was 30% (range 15–45%). Contamination by squamous epithelial cells was less than 1% of the total number of cells recovered by lavage in all cases.

The percentage of neutrophils recovered by lavage was 70.6 (31.1)% and the percentage containing intracellular organisms was 20.7 (27.1)%. Only in three patients were infected cells not observed.

**Discussion**

The main finding of this study is that seven out of nine donors with no clinical evidence of pulmonary infection who were not receiving antibiotic therapy showed characteristic lesions of bronchopneumonia (fig 1). To our knowledge, these findings have not previously been reported in patients not suspected of having pneumonia.

We have previously studied the results of protected specimen brush and bronchoalveolar lavage cultures in ventilated patients without clinical suspicion of pneumonia and found a significant percentage of patients with a moderate or high bacterial growth in specimens obtained from the distal airways. It was not clear whether these findings represented a limitation of the diagnostic techniques or were a feature present in many patients who undergo prolonged mechanical ventilation. From the present results the latter hypothesis seems to be the most probable. As stated by Carlet, two types of pneumonia are found in ventilated patients – one localised but extending rapidly which has a poor prognosis and the other a diffuse bronchopneumonia which is often subacute and may resolve without antibiotic therapy. An alternative explanation would be that, since it may take several days for...
Bronchoscopic techniques and histology in ventilated patients without suspected pneumonia

As the bacterial burden can vary considerably from one zone to another, it is possible that lung culture, bronchoalveolar lavage, and protected specimen brush biopsy may be sampling different areas of the lung from that sampled during the pneumonectomy immediately after death and may explain our findings.

We observed a poorer yield of positive results by protected specimen brush biopsy than with bronchoalveolar lavage which may provide a better reflection of the lung's bacterial burden. Moreover, we did not find any association between the histological findings and quantitative cultures from lung biopsy specimens (table 1). This has also been observed by Roubey et al and Torres et al and may be due to the effect of antibiotics and the non-homogeneous distribution of bacteria infecting the lung parenchyma.


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