

An Oxygen Analyzer as a Source of *Pseudomonas*

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Previous investigation in our intensive care unit has shown gram-negative bacilli to be a major source of morbidity in the critically ill patient<sup>1</sup> and implicated environmental reservoirs as a source of such bacteria.<sup>2</sup> We have, in addition, conducted close bacteriologic surveillance of all Respiratory-Surgical Intensive Care Unit (R-SICU) patients and their environment over the past six years while evaluating methods of prevention of airway colonization.<sup>3-5</sup> It is noteworthy that during this extensive period of study respiratory therapy equipment, including mechanical ventilators and nebulizers, have not been implicated as a source of airway colonization in the R-SICU.

Recently, however, a commonly used piece of equipment, generally considered not to be a reservoir of infection, was implicated in the colonization of the airways of several patients. A species of *Pseudomonas* not commonly present in our R-SICU, *Pseudomonas maltophilia*, was found to be present in the airways of four patients within an eight-day period. Three

of these four patients' hospitalizations in the R-SICU overlapped, while the fourth patient was in the R-SICU for only two days during the course of hospitalization of patient 3 (see fig. 1). All four patients were mechanically ventilated via an endotracheal tube or tracheostomy tube and had been receiving broad-spectrum antibiotics.

*Pseudomonas maltophilia* was originally cultured from the endotracheal tube in the case of patient 2, the patient's airway remaining colonized with this organism throughout his remaining 11-day stay in the R-SICU. Because of the suddenness with which *Pseudomonas maltophilia* appeared in the airways of these four patients and the potential of this organism for causing infection, environmental cultures were undertaken to elucidate the source. Areas cultured were considered, based upon previous experience, to be potential reservoirs of gram-negative organisms. These areas included the automatic ice machine, hand-washing sinks, etc. Respiratory therapy equipment shared by patients in the R-SICU was also surveyed, including spirometers, peak-negative-pressure meters, and an oxygen analyzer. Results of these cultures revealed only one source of *Pseudomonas maltophilia* in the R-SICU. The inside walls of the distal 4 centimeters of plastic tubing from the only paramagnetic oxygen analyzer in the R-SICU were coated with condensate and upon culturing yielded an abundant growth of *Pseudomonas maltophilia* and *Acinetobacter calcoaceticus*. The biochemical profile and antibiotic sensitivity pattern of this

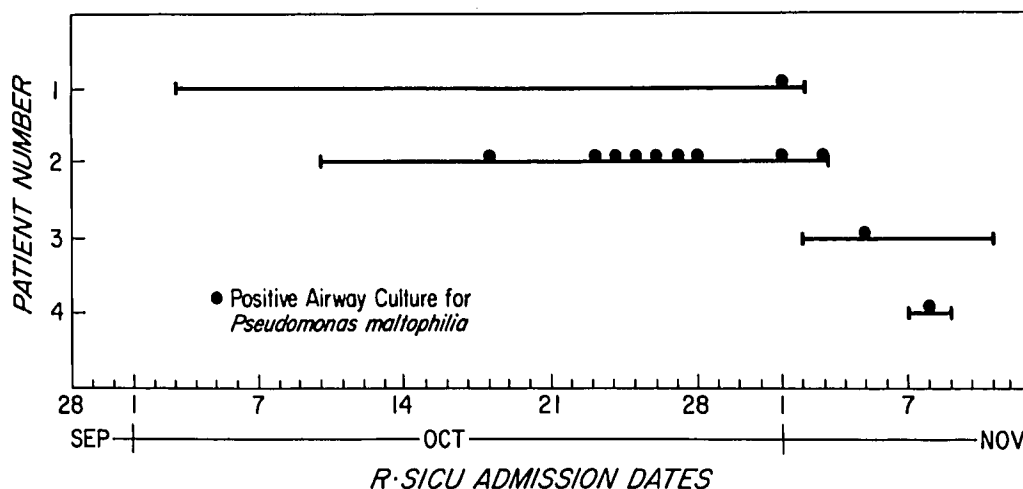
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FIG. 1. Duration of R-SICU hospitalization for each patient from whose airway *Pseudomonas maltophilia* was cultured. Dates of tracheal aspirates positive for *Pseudomonas maltophilia* are indicated. Note the brief period during which the airways of all four patients were colonized.



isolate were identical to those of the organisms recovered from all four patients. The organism was resistant to all antibiotics except colistin.

In our practice a sterile needle is connected to the distal end of the tubing from the analyzer and the needle is inserted through the corrugated rubber tubing of a Mörch swivel to aspirate a sample of gas for analysis. Although the flow of gas in the oxygen analyzer is in a one-way direction away from the patient, condensate may have contaminated the needle or the fingers of personnel using the analyzer. The tubing, once established as an environmental reservoir of *Pseudomonas maltophilia*, might quickly have become the source of additional airway contamination via tubing → needle → tracheal tube or tubing → hand → tracheal tube routes. It is important to note that dry areas of the oxygen analyzer have been sterile in the past. Although generally considered nonpathogenic, nonfermentative gram-negative bacilli such as *Pseudomonas maltophilia* have been increasingly associated with a wide variety of infections, particularly in critically ill patients.<sup>6,7</sup>

In this present instance, *Pseudomonas maltophilia* was responsible for airway colonization in four seriously ill patients within a brief period. Each patient had a tracheal tube in place and had been treated with broad-spectrum antibiotics. The only environmental source of this organism found in the R-SICU was a length of oxygen analyzer tubing containing condensate.

Continued awareness of all respiratory equipment shared by patients as potential foci of hospital infections cannot be overemphasized. Items of respiratory equipment frequently considered free from contami-

nation because of presumed dry surfaces, such as peak-negative-pressure meters, oxygen analyzers, and spirometers, remain potential sources of airway contamination. Such equipment must be sterilized between uses. Alternatively, sterile connectors should be inserted between instrument and patient when this equipment cannot be adequately decontaminated. In addition, there will be less likelihood of oxygen analyzer contamination if the inspired oxygen concentration is measured near the gas source rather than near the patient.

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### The Use of PEEP to Identify the Source of Cardiopulmonary Air Embolism

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Air embolism is an acknowledged hazard when patients are placed in the sitting position for surgical procedures.<sup>1,2</sup> When the surgical field is higher than the right atrium, air may enter the cardiovascular

system. The following report describes the identification of the site of air entry by application of positive end-expiratory pressure (PEEP) during an intra-operative episode of massive air embolization.

#### REPORT OF A CASE

A 75-year-old man experienced rapid deterioration of mental status 12 hours after blunt trauma to the head. Respiratory arrest occurred during diagnostic radiography; with the endotracheal tube in place, and comatose, the patient was brought immediately to the operating room for emergency suboccipital craniotomy with exploration of the posterior fossa. Anesthetic induction and maintenance were accomplished with intermittent iv administration of thiopental and nitrous oxide in oxygen (50 per cent); pancuronium

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