Commentary

Qualitative cultures in ventilator-associated pneumonia – can they be used with confidence?

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Published online: 25 October 2004
This article is online at http://ccforum.com/content/8/6/425

Critical Care 2004, **8:**425-426 (DOI 10.1186/cc2988)

Related to *Research* by Camargo *et al*., see page 513

Abstract

The sensitivity and specificity of the radiographic and clinical evidence used to diagnose ventilator-associated pneumonia vary depending on the number of clinical criteria present. Bacteriological confirmation that rules out other diseases can be achieved by quantitative or qualitative cultures of tracheal aspirate. The rate of tracheal colonization in ventilated patients reduces the usefulness of qualitative cultures, but the absence of multiresistant micro-organisms in cultures from patients on prior antibiotics or a sterile culture in patients without prior antimicrobials may provide sufficient justification to stop or de-escalate antibiotics. However, more accurate guidance regarding whether antibiotics are unnecessary and should be stopped is provided by quantitative culture.

Keywords antibacterial agents, diagnostic techniques, microbiology, respiratory tract infections

Clinically, ventilator-associated pneumonia (VAP) is defined by the presence of new or progressive radiographic infiltrates plus clinical evidence that these infiltrates are of infectious origin. The presence of an infiltrate plus at least two out of three clinical features (abnormal temperature [>38°C or <36°C], leucocytosis or leucopenia, and purulent secretions) are the most accurate criteria for starting empirical antibiotic therapy [1]. Although sensitivity for the diagnosis of pneumonia is increased if only one criterion is used, this occurs at expense of specificity, leading to significantly more antibiotic treatment. Requiring all three clinical criteria is too insensitive and will result in many patients with true pneumonia not receiving therapy. Bacteriological confirmation of VAP is important because many aetiologies other than infection can cause the same clinical picture [2]. The 'gold standard' ultimately remains controversial, because histological confirmation is very difficult and the criteria used to define it are not uniform [2].

The aetiological cause of pneumonia can be defined by semiquantitative cultures of tracheal aspirates or sputum. Tracheal aspirate cultures consistently grow more micro-organisms than do invasive quantitative cultures, and most microbiology laboratories report the findings in a semiquantitative manner. Confirmation of VAP is difficult; confirmation of aetiology usually requires a lower respiratory tract culture, including tracheal aspirate, bronchoalveolar lavage, or protected specimen brush. Although an aetiological diagnosis is made from a respiratory tract culture, colonization of the trachea precedes development of pneumonia in almost all cases of VAP, and therefore a positive culture cannot always distinguish between pathogen and a colonizing organism. However, a sterile culture from the lower respiratory tract in an intubated patient, in the absence of a recent change in antibiotic therapy, is strong evidence that pneumonia is not present, and an extrapulmonary site of infection should be considered [2,3]. Also, the absence of multiresistant micro-organisms from any lower respiratory specimen in intubated patients, in the absence of a change in antibiotics within the preceding 72 hours, is strong evidence that they are not the causative pathogen. The time course of clearance of these difficult-to-

VAP = ventilator-associated pneumonia.

treat micro-organisms is usually slow and so, even in the face of a recent change in antibiotic therapy, sterile cultures may indicate that these organisms are not present [4]. For these reasons, a lower respiratory sample for culture should be collected from all intubated patients when the diagnosis of pneumonia is considered.

In this issue of *Critical Care* Camargo and coworkers [5] report a prospective study in which they compared quantitative versus qualitative cultures of tracheal aspirate in patients with VAP. They conducted weekly surveillance in severely ill, mechanically ventilated patients admitted to the intensive care unit, performing sequential evaluations for the diagnosis of VAP. In 97% of the evaluations, patients were receiving antimicrobials. The authors evaluated tracheal aspirates qualitatively and quantitatively, simultaneous with expert evaluation. The experts' evaluations yielded a diagnosis of VAP in 38 assessments in 33 patients, and a negative diagnosis in 181 evaluations performed in 73 patients (incidence of VAP 17.4%). In quantitative culture evaluation, tracheal aspirate yielding $\geq 10^5$ colony-forming units/ml included 25 out of 38 cases of 'true VAP', resulting in a sensitivity of 65.8% and a specificity of 48%. When $\geq 10^6$ colony-forming units/ml was used as the cutoff point, the sensitivity was 26% and specificity was 78%. With regard to qualitative evaluation, the sensitivity was 81% but specificity was only 23%. Camargo and coworkers concluded that quantitative cultures of tracheal aspirates in selected critically ill patients have decreased sensitivity as compared with qualitative analysis, and should not replace the latter for confirming a clinical diagnosis of VAP or to guide adjustment to antimicrobial therapy.

The use of qualitative cultures has some associated problems; the incidence of colonization is very high in hospitalized patients in general, and even more so in patients requiring endotracheal intubation [6]. It may be inappropriate to base a decision to begin or to continue antibiotic treatment for VAP on the results of qualitative cultures, because positive qualitative culture findings may represent simple colonization, and if this were the case then antimicrobial therapy would be strongly discouraged.

The study by Camargo and coworkers confirms that it is uncommon for a tracheal aspirate culture to yield no pathogens, independently if such pathogens were found at high concentrations in invasive quantitative cultures [2,7,8]. Qualitative cultures have their greatest value if they are negative and the patient has not been receiving new antibiotics within the preceding 72 hours. Negative lower respiratory tract cultures in such patients can be used to justify stopping antibiotic therapy.

We believe that the take-home message of the study is that a negative qualitative culture from tracheal aspirate, in the absence of prior antibiotics or a recent change in antibiotic therapy, is sufficient evidence to discount a diagnosis of VAP and therefore to stop antibiotic therapy. However, the decision to maintain antibiotic administration guided only by qualitative culture findings may lead to unnecessary antibiotic use, leading to higher costs and encouraging bacterial resistance. To do qualitative cultures is better than not to do cultures, and if they are negative then this finding can safely be used to justify discontinuing antimicrobial therapy. However, quantitative cultures are preferable for making decisions regarding therapy for VAP.

Competing interests

The author(s) declare that they have no competing interests.

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