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Journal club critique

No sampling technique was superior for the diagnosis of ventilator-associated pneumonia

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Expanded Abstract

Citation

Wood AY, Davit AJ 2nd, Ciraulo DL, Arp NW, Richart CM, Maxwell RA, Barker DE: A prospective assessment of diagnostic efficacy of blind protective bronchial brushings compared to bronchoscope-assisted lavage, bronchoscope-directed brushings, and blind endotracheal aspirates in ventilator-associated pneumonia. *J Trauma* 2003, 55:825-834.[1]

Background

The diagnosis of ventilator-associated pneumonia (VAP) has proven to be a challenging task. Studies comparing invasive and non-invasive diagnostic approaches are lacking.

Hypothesis

The use of a blind protected brush is equivalent to bronchoscope-directed techniques in determining the microbiology of VAP, while endotracheal aspirates are contaminated with oropharyngeal flora and of little value.

Methods

Design: Single center, prospective cohort study.

Setting: Level 1 trauma center at an academic medical center.

Subjects: Ninety trauma patients who were mechanically ventilated for at least 48 hours and deemed to have clinical indications suggestive of pneumonia (new infiltrate on chest radiograph, excessive or purulent respiratory secretions, suspected aspiration, fever (>38.2° C), leukocytosis (>12,000/mm^3), or respiratory distress of unknown cause).

Intervention: Four samplings were performed on each patient in the following order: blind protected brush (BPB), bronchoscopic-directed protected brush (BDPB), bronchoalveolar lavage (BAL), and endotracheal aspirates (ETA). Procedures were performed from least to greatest degree of invasiveness to avoid contamination of lower airways, except for ETA.

Measurements: With patients serving as their own controls, quantitative cultures were obtained using each sampling technique. BDPB and BAL were set as the "gold standards" for comparison against each other and with BPB and ETA. Kappa analysis was used to measure the strength of agreement between techniques. Results were stratified by type of organism.

Results

BPB had the highest strength of agreement with both BAL and BDPB (κ=0.547 and κ=0.467, respectively). The strength of agreement between techniques was moderate to good for gram-negative cocci and fair to poor for gram-negative rods and gram-positive cocci. Comparing the growth of specific pathogens, *Haemophilus*, *Klebsiella*, *Escherichia, Acinetobacter*, and *Streptococcus* correlated well across the majority of techniques, while *Enterobacter* agreement was consistently poor to fair.

Using BDPB as the gold standard, BPB was found to have the highest sensitivity (91.1%) and specificity (89.8%). Sensitivities overall were higher when using BAL as the gold standard across all modalities. Kappa analysis comparing blind samples obtained from the same vs. the opposite side of the radiographic infiltrate found no differences between sides.

Conclusion

A quantitative analysis of bacteriologic cultures obtained by four standard sampling techniques demonstrated with statistical significance that no difference exists between

techniques in terms of reliability or obtaining clinically significant pathogens.

Commentary

VAP is a common disorder, occurring in 8-28% of mechanically ventilated patients with an associated morality rate of 24-50%.[2] The diagnosis of VAP has proven to be a challenge. Clinical indicators are neither sensitive nor specific and culture data can sometimes be misleading due to contamination and concurrent antibiotic therapy. There are many publications supporting quantitative cultures for the diagnosis of VAP, but studies comparing multiple sampling techniques to determine the most sensitive and specific method are lacking. This study attempted to compare four of the most common diagnostic tests (BPB, BDPB, BAL, ETA) to determine which is most reliable yet least invasive. The authors determined that there were no significant differences between the bronchoscopic and nonbronchoscopic techniques. They were careful to note, however, that while positive cultures appear to be reliable, a negative culture does not necessarily rule out infection. Thus, when a negative culture is obtained, and clinical suspicion for VAP persists, repeat sampling may be warranted.

This study has a number of strengths, including using each patient as his own control, using explicitly defined criteria for quantitative culture positivity, and stratifying results by organism. However, this study suffers from the same problem that all studies in this area do: the lack of a true gold standard. To be sure, the authors used what many believe are the most reliable bronchoscopic techniques (BDPB and BAL) as gold standards, but even these methods are not 100% sensitive or specific. It has been suggested that only the combined results of histological examination and quantitative cultures of lung tissue are strong enough to rule in or rule out VAP in patients who have been mechanically ventilated for more than 3 days.[3] Clearly, such a highly invasive sampling approach would not be practical in all patients. Without an indisputable and easily obtainable reference, calculations of sensitivity and specificity will remain problematic.

A few additional limitations of this study deserve mention. The sampling techniques were always performed in the same order, potentially biasing the results; concern is raised about contamination by the earlier tests causing false readings in the later ones. Blind non-bronchoscopic BAL (mini-BAL), a technique that has recently gained in popularity, was not included. Few details are given regarding the study population, limiting our ability to determine if these results apply to other patient populations.

Given that a true gold standard is unlikely to emerge, investigations have shifted from trying to determine which technique can best diagnose VAP to which diagnostic strategy leads to improved outcomes, such as morbidity, antimicrobial use, and mortality. Four studies have sought to determine if invasive strategies improve VAP outcomes.[4-7] Each study used a different design and had important methodological limitations.[8] A recent meta-analysis pooled the results of these trials, concluding that invasive sampling approaches do alter antibiotic management, but do not appear to alter mortality.[9] The authors were careful to note, however, that the combined sample size may still have been too small to detect important clinical outcome differences.

Recommendation

Until compelling data are produced showing a particular sampling technique is superior, we recommend a VAP management strategy[8,10] that includes: a) initial evaluation with quantitative microbiology of respiratory secretions and immediate initiation of antimicrobial agents, and b) reevaluation within 2 to 3 days with adjustment or discontinuation of antimicrobials based on clinical course, culture results, and whether any noninfectious or nonpulmonary etiologies have been identified.

Competing interests

The authors declare that they have no competing interests.

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