Evaluation of the Role of Selective Digestive Tract Decontamination in prevention of Ventilator Associated Pneumonia in Intensive Care Unit Patients.

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Aknoledgement

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List of Abbreviation

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Aerobic Gram –negative bacteria	AGNB	44
Acute respiratory distress syndrome	ARDS	7
American thorathic society	ATS	26
Bronchalveolar lavage	BAL	17
Blind bronchial sampling	BBS	17
Biphasic intermittent positive airway pressure	BIPAP	65
Colony forming unit	CFU	18
Contanious positive airway pressure	CPAP	65
Clinical pulmonary infection score	CPIS	13
Computed tomography	CT	14
Duration of mechanical ventilation	DOMV	33
Endotracheal aspirate	ETA	16
Fraction of inspired oxygen	Fio_2	19
The gastrointestinal tract	GIT	39
Heat and moisture exchangers	HMEs	33
Intracellular organisms	ICOs	18
Intensive care unit	ICU	7
Invasive mechanical ventilation	IMV	32
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Introduction

Introduction:

While critically ill patients experience a life-threatening illness, they commonly contract ventilator-associated pneumonia. This nosocomial infection increases morbidity and likely mortality as well as the cost of health care. Nosocomial infections, especially pneumonia, are an important cause of morbidity and mortality in critically ill patients. The incidence of pneumonia in such patients ranges between 7% and 40%, and the crude mortality from ventilator associated pneumonia (VAP) may exceed 50%. [1]

Patients in the intensive care unit (ICU) are at risk for dying not only from their critical illness but also from secondary processes such as nosocomial infection. Pneumonia is the second most common nosocomial infection in critically ill patients, affecting 27% of all critically ill patients [2]. Eighty-six percent of nosocomial pneumonias are associated with mechanical ventilation and are termed ventilator-associated pneumonia (VAP). The mortality attributable to VAP has been reported to range between 0 and 50% [3], [4], [5], [6] [7].

In a case-control study of ventilated patients an increase in mortality of 27% was attributable to ventilator associated pneumonia. [8]

Higher mortality rates seen in VAP caused by *Pseudomonas aeruginosa*, *Acinetobacter* and *Stenotrophomonas maltophilia* [9]. Beyond mortality, the economics of VAP include increased ICU lengths of stays (LOS) (from 4 to 13 days), as well as the cost of health care [10].

Although not all deaths in patients with this form of pneumonia are directly attributable to infection [it may occur due to aspiration or ARDS], it has been

shown to contribute to mortality in intensive care units independently of other factors that are also strongly associated with such deaths**.** ***(1)***

The gastrointestinal tract is believed to play an important role in ventilator-associated pneumonia(VAP), because during critical illness the stomach often is colonized with enteric Gram-negative bacteria. These are the same bacteria that frequently are isolated from the sputum of patients with VAP ***(1).*** Interventions such as selective decontamination of the digestive tract (SDD), use of sucralfate for stress ulcer prophylaxis, and enteral feeding strategies that preserve gastric pH, or lessen the likelihood of pulmonary aspiration, are used to decrease the incidence of VAP. SDD substantially decreases the incidence of VAP and may have a modest positive effect on mortality. However, there is strong contravening evidence that SDD promotes infections by Gram-positive bacteria.

Selective digestive decontamination (SDD) is a technique aimed at selectively eliminating aerobic Gram-negative bacilli and yeast from the mouth and stomach to reduce the occurrence of hospital-acquired infections, including ventilator-associated pneumonia. Traditionally, selective decontamination of the digestive tract indicates a method designed to prevent infection by eradicating and preventing carriage of potentially pathogenic aerobic microorganisms from the oropharynx, stomach, and gut. It consists of antibiotics applied topically to the oropharynx and through a nasogastric tube. In many trials treatment with systemic antibiotics has been added in the first days after patients are admitted to prevent "early" infections. ***(11)***

The use of gastrointestinal decontamination is a historical cornerstone in the management of intoxicated patients ***(12).***

Selective Digestive Decontamination (SDD) was first used in critically ill patients by Stoutenbeek et al. (1984**)** ***(13)*****,** and has been extensively studied to prevent the colonization of the respiratory tract. It is an infection prophylaxis regimen that employs enteral non-absorbable antimicrobials to prevent or eradicate, if initially present, oropharyngeal and gastrointestinal carriage of potentially pathogenic microorganisms ***(14)***. This regimen consists of topical non-absorbed antibiotics applied oropharyngeally and is associated with a short course of parenteral antibiotic ***(15).***

Review of literature

Chapter I

Ventilator-Associated Pneumonia

Ventilator-Associated Pneumonia: Diagnosis, Treatment, and Prevention

DEFINITION:

Ventilator-associated pneumonia is defined as pneumonia occurring more than 48 h after patients have been intubated and received mechanical ventilation. Diagnosing VAP requires a high clinical suspicion combined with bedside examination, radiographic examination, and microbiologic analysis of respiratory secretions.

DIAGNOSIS

Clinical Diagnosis

Ventilator-associated pneumonia is usually suspected when the individual develops a new or progressive infiltrate on chest radiograph, leukocytosis, and purulent tracheobronchial secretions. Unfortunately, and unlike for community-acquired pneumonia, accepted clinical criteria for pneumonia are of limited diagnostic value in definitively establishing the presence of VAP. In a postmortem study by Fabregas et al., when findings on histologic analysis and cultures of lung samples obtained immediately after death were used as references, a new and persistent (>48-h) infiltrate on chest radiograph plus two or more of the three criteria (i) fever of >38.3°C, (ii) leukocytosis of >12 x 10^9/ml, and/or (iii) purulent tracheobronchial secretions had a sensitivity of 69% and a specificity of 75% for establishing the diagnosis of VAP ***(16)***. When all three clinical variables were required for the diagnosis, the sensitivity declined further (23%); the use of a single variable resulted in a decrease in specificity (33%). The poor accuracy of clinical criteria for diagnosing VAP should not be surprising considering that purulent

tracheobronchial secretions are invariably present in patients receiving prolonged mechanical ventilation and are seldom caused by pneumonia. In addition, the systemic signs of pneumonia such as fever, tachycardia, and leukocytosis are nonspecific; they can be caused by any state that releases the cytokines interleukin-1, interleukin-6, tumor necrosis factor alpha, and gamma interferon ***(17, 18, 19, and 20).*** Examples of such conditions include trauma, surgery, the fibroproliferative phase of ARDS, deep vein thrombosis, pulmonary embolism, and pulmonary infarction. **Reasonable clinical criteria for the suspicion of VAP include a new and persistent (>48-h) or progressive radiographic infiltrate plus two of the following: temperature of >38°C or <36°C, blood leukocyte count of >10,000 cells/ml or <5,000 cells/ml, purulent tracheal secretions, and gas exchange degradation** ***(21, 22).***

The sensitivity of the clinical criteria for VAP outlined above is even lower in patients with ARDS, where it may be difficult to detect new radiographic infiltrates. In the setting of ARDS, Bell et al. reported a false-negative rate of 46% for the clinical diagnosis of VAP ***(23).*** Consequently, suspicion for VAP in the setting of ARDS should be high. ***(24).***

When purulent sputum, a positive sputum culture, fever, and leukocytosis are present without a new lung infiltrate, the diagnosis of nosocomial tracheobronchitis should be entertained. In mechanically ventilated patients, nosocomial tracheobronchitis has been associated with a longer ICU stay and time on the ventilator, without increased mortality ***(3).*** Differentiation of tracheobronchitis from pneumonia is dependent upon the radiograph, which in the ICU is portable and often of poor quality. Hence, the clinician should utilize a clinical pulmonary infection score (CPIS) it is based on six variables: temperature, blood leukocyte count, volume and purulence of

tracheal secretions, oxygenation, pulmonary radiography, and semiquantitative culture of tracheal aspirate. The score varied from 0 to 12. A CPIS of >6 had a sensitivity of 93% and a specificity of 100% [25].

Radiologic Diagnosis

While the portable chest radiograph still remains a mandatory component in the diagnosis of ventilated patients with suspected pneumonia, as with clinical criteria for diagnosing VAP, it too has problems with both sensitivity and specificity. Poor-quality films further compromise the accuracy of chest X rays. Although a normal chest radiograph makes VAP unlikely, in one study of surgical patients, 26% of opacities were detected by computed tomography (CT) scan but not by portable chest X ray [26]. In addition, asymmetric pulmonary infiltrates consistent with VAP can be caused by numerous noninfectious disorders, including atelectasis, chemical pneumonitis, asymmetric cardiac pulmonary edema, pulmonary embolism, cryptogenic organizing pneumonia, pulmonary contusion, pulmonary hemorrhage, drug reaction, and asymmetric ARDS. The overall radiographic specificity of a pulmonary opacity consistent with pneumonia is only 27% to 35% [27, 28].

Nonetheless, because of their high specificity, certain chest radiograph findings can be useful in establishing the diagnosis of pneumonia when present. Based on several studies, including an autopsy study by Wunderink et al., these useful findings include rapid cavitation of the pulmonary infiltrate, especially if progressive; an air space process abutting a fissure (specificity, 96%); and an air bronchogram, especially if single (specificity, 96%). Unfortunately, such radiographic abnormalities are uncommon [28].

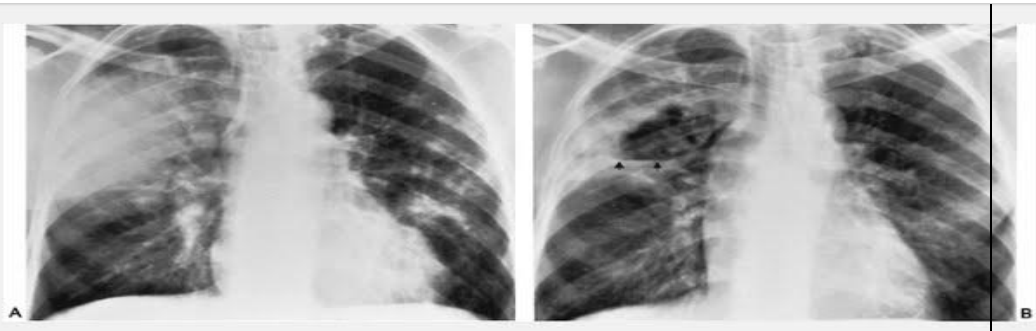

FIG C 1-4. *Klebsiella* **pneumonia.** (A) Air-space consolidation involving much of the right upper lobe. (B) Progression of the necrotizing infection produces a large abscess cavity with an air-fluid level (arrows).

Microbiologic Diagnosis

Blood and pleural fluid cultures. Although VAP spreads to the blood or pleural space in <10% of cases, if an organism known to cause pneumonia is cultured in the setting of clinically suspected pneumonia, treatment is warranted. The sensitivity of blood cultures for the diagnosis of VAP is less than 25% but when positive, the organisms may originate from an extra pulmonary site of infection in as many as 64% of cases and even when VAP is present ***(29,30).***

Nonquantitative or semi quantitative airway sampling. Gram staining and nonquantitative and semiquantitative cultures of tracheal secretions have the advantages of reproducibility and of requiring little technical expertise and no specialized equipment or technique. However, these studies add little to the sensitivity and specificity of the clinical diagnosis of VAP, as the upper respiratory tract is rapidly, within hours of intubation, colonized by potential pulmonary pathogens, even when pneumonia is not present ***(31,32).*** Thus, if an organism is cultured or noted on Gram stain, one does not know if it is the cause of the pneumonia or simply colonization. In a study of 48 patients with