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VANDERBILT UNIVERSITY MEDICAL CENTER
DIVISION OF TRAUMA, BURNS AND SURGICAL CRITICAL CARE

CLINICAL MANAGEMENT GUIDELINES: DIAGNOSIS AND TREATMENT OF VENTILATOR ASSOCIATED PNEUMONIA

INTRODUCTION

Nosocomial and Ventilator associated pneumonia (**VAP** - pneumonia develops after 48 hours of mechanical ventilation) occurs in roughly one fourth of ICU patients. Overall mortality for patients with VAP range from 20 – 50%. By far the strongest risk factor for developing nosocomial pneumonia is mechanical ventilation, increasing the risk by 6 – 21 fold. Other risk factors include:

- Age > 70 years
- Chronic lung disease
- Depressed LOC
- ICP monitors, naso-gastric tubes
- Chest surgery / trauma
- H-2 / antacid therapy
- Frequent changes in ventilator circuit
- Transport from the ICU for procedures

Numerous studies have demonstrated rapid (by 48 hours) colonization of critically ill patients with nosocomial pathogens and that ventilator circuits become populated with strains from the patient rather than the circuit causing overgrowth in the patient. In addition, oral – pharyngeal secretions are aspirated around cuffed endotracheal tubes (particularly with cuff pressures < 20 cm H_20) and this fact emphasizes the importance of adequate and consistent oral hygiene.

DIAGNOSIS

Commonly accepted clinical findings that are used to establish the presence of VAP are the following:

- New, persistent, or progressive infiltrate
- Fever
- Leukocytosis
- Purulent tracheobronchial secretions

However, only one-third to one-half of critically ill patients with these four criteria will actually have VAP. Bacteria within tracheobronchial secretions correlate poorly with the presence and cause of VAP. Bronchoalveolar lavage (**BAL**) increases the sensitivity and specificity of the diagnosis of VAP. Sensitivity varies with the quantitative level chosen for diagnosis and it is decreased by prior initiation of antibiotics.

THE FOLLOWING ALGORITHM WILL BE USED IN SUSPECTED VAP:

1. Presence of 3 of the 4 clinical findings above
2. Patient undergoes bronchoscopy with BAL
3. Empiric therapy initiated
4. Therapy adjusted based on quantitative BAL results and antibiotics withheld if bacterial counts are < 10^4 CFU/mL. Patients already receiving antibiotic therapy and with counts of 10^3 - 10^4 CFU/mL should undergo repeat bronchoscopy if clinical course still suggests pneumonia.

Performance of BAL:
Patients suspected of VAP should undergo **bronchoscopy and BAL**.

1. The bronchoscope should be advanced into the segment in question as directed by the chest x-ray and the tip of the scope wedged into the bronchus.
2. 100 mL of sterile non-bacteriostatic saline instilled in 20 mL aliquots and aspirated into sterile collection container. **The first aliquot should be discarded to limit contamination**.
3. Pooled contents should be sent immediately to the microbiological laboratory for quantitative culture.
4. **To order test – type in BRB or BAL and select appropriate test. Type into the instruction box "quantitative culture".**

Cultures with **> 10^4 CFU/mL of bacteria** are considered positive and should be treated. Specificity is increased in the presence of a high % of PMNs in the fluid gram stain. For patients already receiving antibiotics, a level of 10^3 - 10^4 CFU/mL may suggest pneumonia and patients should undergo repeat BAL if the clinical course warrents.

EMPIRIC THERAPY
The most common pathogens in VAP at VUMC surgical ICUs are evaluated for each unit on a quarterly basis.

- Empiric antibiotics for pneumonia are included in the WIZ order-sets for each ICU and updated quarterly.
- PharmD's for each unit will monitor compliance and assist with dosing and de-escalation when appropriate.

Specific Information Regarding Antibiotic Therapy:

- **Double coverage of Pseudomonas pneumonia with beta-lactam and aminoglycoside has proven benefit.** Benefit of double coverage with other classes is less clear but has theoretical basis.

- Enterobacter sp. may have chromosomally mediated, inducible resistance to cephalosporins and other members of the "Space" group may have this trait passed by plasmids. In general these pathogens should not be treated with cephalosporins alone, regardless of sensitivity reports.

- Antimicrobial agents should be **adjusted based on BAL** results, either narrowing the spectrum or stopping all AB if results are negative as defined above.

- Therapy for VAP, in general, should be continued for 8 days. Patients who are extubated and who have resolved all signs of infection may require shorter courses.

- **Rational aminoglycoside use:** Data regarding efficacy of aminoglycoside in combination with another agent to provide synergy is predominately for pseudomonas pneumonia and benefit is achieved during the first 5 days of therapy. Theoretical benefit exists for limiting resistance when combination of mechanisms are used. However, aminoglycosides have relatively poor tissue penetration and loose efficacy in acidic environments (soft tissue infections and peritonitis) with Class 1 data for single broad spectrum coverage in these clinical settings (including high risk populations).

    - Toxicity is much more related to length of therapy rather than levels. Toxicity is rare within first few days but increases exponentially after 21 days of therapy.

      Recommendation: aminoglycoside empirically and for short course in pneumonia (5-7 days).

*Clinical Management Guidelines (CMG) have been developed by the Division of Trauma and Surgical Critical Care in an attempt to standardize and optimize care. They are based on a combination of accepted surgical practice and recent contributions to the medical literature CMGs are intended to provide guidelines for the management of the majority of patients, and are not proposed as rules, policies or as a substitute for clinical judgment. Deviations from the CMGs are necessary and expected; all exceptions should be documented in the medical record and discussed with the attending physician.

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