

## Updates on Inhaled Antibiotics in Ventilator-Associated Bacterial Pneumonia

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### Lecture Objectives

- Discuss the current role of inhaled antibiotics in ventilator-associated pneumonia (VAP)
- Explain the potential benefit of inhaled aminoglycosides and colistin for the treatment of VAP
- Summarize the different clinical and microbiological outcomes presented in literature associated with inhaled aminoglycosides and colistin for the treatment of VAP to determine their role in therapy.

### Common Abbreviations

- HAP: hospital-acquired pneumonia
- VAP: ventilator-associated pneumonia
- MDR: multi-drug resistant
- MDRO: multi-drug resistant organism
- IDSA: Infectious Diseases Society of America
- ICU: intensive-care unit
- AA: aerosolized antibiotics
- AFIS: amikacin-fosfomycin inhalation system

### CPIS Score Interpretation

- Factors that affect the Clinical Pulmonary Infection Scale (CPIS) score
  - Temperature
  - WBC
  - Tracheal secretions
  - Oxygenation:  $Pa_{O_2}/Fi_{O_2}$
  - Pulmonary radiography
  - Progression of pulmonary infiltrate
  - Culture of tracheal aspirate

Score	Interpretation
<6	Low risk of pulmonary infection
≥6	High likelihood of VAP

### APACHE II Score Interpretation

- Factors that affect the Acute Physiology and Chronic Health Evaluation (APACHE) II Score
  - Temperature
  - MAP
  - Heart rate
  - Respiratory rate
  - Oxygenation
  - Arterial pH or  $HCO_3$
  - Na, K, SCr
  - Hematocrit
  - WBC

- Glasgow
- Age

Score	Interpretation
15	24% predicted mortality
25	50% predicted mortality
35	80% predicted mortality

### IASIS Definitions

- Pneumonia
  - Presence of new or progressive infiltrate(s) with signs of infection:
    - Fever >38 C, leukopenia (<4000 WBCs/mm<sup>3</sup>), or leukocytosis (≥12,000 WBCs/mm<sup>3</sup>)
- Immunocompromised
  - Neutropenia not due to current infection, leukemia, lymphoma, HIV with CD4<200 cell/mm<sup>3</sup>, splenectomy, recent organ transplantation, or receiving cytotoxic chemotherapy or high-dose steroids
- MDR
  - Resistance to all antibiotics in 2 of 3 antibiotic classes: β-lactams, including carbapenems; aminoglycosides; and fluoroquinolones
- Absence of Gram-negative bacteria
  - Negative culture OR
  - No sputum available to culture in an extubated patient at day 14 or earlier
- Clinical Cure
  - Absence of Gram-negative bacteria
  - CPIS<6 at day 14 or earlier
- Clinical relapse
  - New episode of pneumonia requiring re-institution

### INHALE Definitions

- Presence of Gram-negative organism (GNO)
  - Gram-stain OR
  - Culture of pre-therapy respiratory specimen OR
  - Suspected GNO-based on local surveillance data and medical history, such as recent incidence of infections with GNO
- MDR Organism
  - Defined as pathogen resistant to agent in 2 or more of following antibiotic classes:
    - β-lactams including penicillins, cephalosporins, and monobactams; carbapenems; fluoroquinolones; and aminoglycosides
  - Extensively drug resistant if resistant to 5 or more classes of antibiotics
- Presence of MDR Organism
  - Presence in pre-therapy respiratory specimen or at least two of the following risk factors:
    - Antimicrobial therapy in preceding 2 weeks
    - Current hospitalization ≥ 5 days
    - High frequency (>10% of antibiotic resistance) in community or hospital unit
    - Immunosuppressive disease and/or therapy

- Presence of risk factors for healthcare-associated pneumonia
- Risk Factors for Healthcare-Associated Pneumonia
  - Hospitalization for 2 days or more in past 90 days
  - Residence in nursing home or extended care facility
  - Home infusion therapy (including antibiotics)
  - Chronic dialysis within 30 days
  - Home wound care
  - Family member with MDR pathogen

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