

Guidelines on antimicrobial therapy of pneumonia in adults in Taiwan, revised 2006

Infectious Diseases Society of Taiwan; Taiwan Society of Pulmonary and Critical Medicine; Medical Foundation in Memory of Dr. Deh-Lin Cheng; Foundation of Professor Wei-Chuan Hsieh for Infectious Diseases Research and Education; and CY Lee's Research Foundation for Pediatric Infectious Diseases and Vaccines

The Infectious Diseases Society of Taiwan (IDST) established and issued the first version of "Guidelines on Antimicrobial Therapy of Pneumonia in Taiwan" in December 1999. A revised version was issued in conjunction with the Taiwan Society of Pulmonary and Critical Medicine in 2001. With the advances in many areas of medicine and revisions in the American "Update of Practice Guidelines for the Management of Community-acquired Pneumonia in Immunocompetent Adults" and "Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia", featuring the addition of new antimicrobial agents and classification of pneumonia according to risk class, Taiwan investigators have published extensively regarding causative pathogens and antimicrobial resistance in pneumonia. This prompted the IDST-led consensus conference "Revisions of Guidelines on Antimicrobial Therapy of Pneumonia in Taiwan" held in late 2005.* After a year

of discussion and evaluation, the revised "Guidelines on Antimicrobial Therapy of Pneumonia in Adults in Taiwan" were completed and approved by the board of the IDST in 2006. The 2006 version includes new antimicrobial agents and dosages of parenteral agents in its recommendations. Community-acquired pneumonia is classified as outpatient and inpatient, with the latter further subdivided into mild/moderate and severe/intensive care unit. Nosocomial pneumonia is categorized as early-onset and late-onset, and considers the presence or absence of risk factors for acquisition of multidrug-resistant pathogens.

The guidelines are published in the *Journal of Microbiology, Immunology and Infection* and are also available in the website of IDST (<http://www.idsroc.org.tw>). These guidelines will be updated and revised periodically to serve as an accessible reference for physicians in Taiwan.

Guidelines on antimicrobial therapy of pneumonia in adults

A. Target Therapy

| Etiology | Antibiotic of choice | Alternative |
|---------------------------------|--|---|
| <i>Streptococcus pneumoniae</i> | | |
| Penicillin MIC | | |
| ≤1 mg/mL | Penicillin Penicillin or amoxicillin | First-generation cephalosporins |
| 2 mg/mL | Penicillin (12-18 MU/d) Ampicillin or amoxicillin | Third- or fourth-generation cephalosporins ^a Telithromycin |
| ≥4 mg/mL | Third- or fourth-generation cephalosporins ^a Vancomycin or teicoplanin | Vancomycin or teicoplanin + rifampicin Newer fluoroquinolones ^b Telithromycin |
| <i>Haemophilus influenzae</i> | | |
| Beta-lactamase-negative | Ampicillin or amoxicillin | New macrolides ^c TMP-SMX |
| Beta-lactamase-positive | Ampicillin-sulbactam Amoxicillin-clavulanate Second-generation cephalosporins | Third-generation cephalosporins New macrolides ^c Fluoroquinolones Telithromycin |

(Table continued on page 280)

Guidelines on Antimicrobial Therapy of Pneumonia

(Table continued from page 279)

| | | |
|--|--|--|
| <i>Moraxella catarrhalis</i> | Second-generation cephalosporins Ampicillin-sulbactam Amoxicillin-clavulanate | Erythromycin or new macrolides ^c Third-generation cephalosporins Fluoroquinolones Telithromycin |
| <i>Legionella</i> spp. | Erythromycin or new macrolides ^c | Erythromycin or new macrolides ^c + Rifampicin Tetracyclines Fluoroquinolones |
| <i>Mycoplasma pneumoniae</i> | Erythromycin or new macrolides ^c | Tetracyclines Fluoroquinolones |
| <i>Chlamydia pneumoniae</i> | Tetracyclines Erythromycin or new macrolides ^c | Fluoroquinolones |
| B. Empirical Therapy | | |
| 1. Community-acquired pneumonia | | |
| Age/core pathogen(s) | Antibiotic of choice | Alternative |
| Outpatients | | |
| <i>Streptococcus pneumoniae</i> <i>Mycoplasma pneumoniae</i> <i>Chlamydia pneumoniae</i> <i>Haemophilus influenzae</i> , other | Penicillin or Erythromycin, new macrolides ^c or in combination | Ampicillin-sulbactam, Amoxicillin-clavulanate, Second-generation cephalosporins or Erythromycin, new macrolides ^c or in combination |
| GNB | | |
| <i>Staphylococcus aureus</i> | | Tetracyclines Newer fluoroquinolones ^b Telithromycin |
| Inpatients, mild-to-moderate | | |
| <i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> Other GNB <i>Legionella</i> spp. <i>Chlamydia pneumoniae</i> | Penicillin, Second-generation cephalosporins or Erythromycin, new macrolides ^c or in combination | Ampicillin-sulbactam, amoxicillin-clavulanate, ertapenem or Erythromycin, new macrolides ^c or in combination Tetracyclines Newer fluoroquinolones ^b Telithromycin |
| Inpatients, severe, ICU stay^d | | |
| <i>Klebsiella pneumoniae</i> , <i>Streptococcus pneumoniae</i> <i>Legionella</i> spp. Other GNB <i>Pseudomonas aeruginosa</i> <i>Acinetobacter</i> spp. | Third-generation cephalosporins ^e or Ureidopenicillins ± Aminoglycosides ^f ± Erythromycin or new macrolides ^c | Ticarcillin-clavulanate or Piperacillin-tazobactam or Fourth-generation cephalosporins ± Aminoglycosides ^f ± Erythromycin or new macrolides ^c Fluoroquinolones |

(Table continued on page 281)

Aspiration pneumonia (including lung abscess)

| | | |
|---------------------------------|------------------------------|---|
| Anaerobes | Penicillin or Clindamycin | Penicillin + metronidazole or Ampicillin-sulbactam or Amoxicillin-clavulanate or Second-generation cephalosporins (cephamycins) ^g or Ertapenem |
| <i>Streptococcus pneumoniae</i> | | |
| Other streptococci | | |
| <i>Enterobacteriaceae</i> | | |

2. Hospital-acquired pneumonia

| Severity/primary pathogen | Antibiotic of choice | Alternative |
|--|--------------------------------------|------------------------------|
| No risk factors ^h for MDRP, early-onset, ⁱ any disease severity | | |
| <i>Klebsiella pneumoniae</i> | Ampicillin-sulbactam or | Ticarcillin-clavulanate or |
| <i>Enterobacter</i> spp. | Amoxicillin-clavulanate or | Piperacillin-tazobactam or |
| <i>Haemophilus influenzae</i> | Second- or | Aztreonam or |
| Other GNB | third-cephalosporins ^a or | Ertapenem or |
| <i>Streptococcus pneumoniae</i> | Ureidopenicillins ± | Fluoroquinolones ± |
| MSSA | Aminoglycosides ^f | aminoglycosides ^f |
| Risk factors ^h for MDRP, late-onset, ^j any disease severity | | |
| <i>Pseudomonas aeruginosa</i> | Third-generation | Ticarcillin-clavulanate or |
| <i>Acinetobacter</i> spp. | cephalosporins ^e or | Piperacillin-tazobactam or |
| MRSA | Ureidopenicillins | Aztreonam or |
| <i>Stenotrophomonas maltophilia</i> | Fluoroquinolones ^k | |

(Table continued from page 281)

C. Recommended dosage of parenteral antimicrobial agents for the treatment of hospital-acquired pneumonia in adults

| Antibiotic | Recommended dosage |
|--------------------------------------|-----------------------|
| Anti-pseudomonal cephalosporins | |
| Cefepime | 2 g q8h |
| Cefpirome | 2 g q8-12h |
| Ceftazidime | 2 g q8h |
| Carbapenems | |
| Imipenem | 500 mg q6h or 1 g q8h |
| Meropenem | 1 g q8h |
| Beta-lactam/beta-lactamase inhibitor | |
| Piperacillin-tazobactam | 4.5 g q6h |
| Aminoglycosides | |
| Gentamicin | 7 mg/kg/d |
| Tobramycin | 7 mg/kg/d |
| Amikacin | 20 mg/kg/d |
| Isepamicin | 400 mg/d |
| Antipseudomonal quinolones | |
| Ciprofloxacin | 400 mg q8h |
| Levofloxacin | 750 mg/d |
| Glycopeptides | |
| Vancomycin | 15 mg/kg q12h |
| Teicoplanin | 400 mg/d |
| Miscellaneous | |
| Linezolid | 600 mg q12h |
| Colistin | 2 MU q8h |
| Sulbactam | 1-2 g q6h |

Abbreviations: MIC = minimal inhibitory concentration; TMP-SMX = trimethoprim-sulfamethoxazole; GNB = Gram-negative bacilli; ICU = intensive care unit; MDRP = multidrug-resistant pathogens, including *P. aeruginosa*, *Acinetobacter baumannii*, and extended-spectrum beta-lactamase-producing *Enterobacteriaceae*; MSSA = methicillin-susceptible *S. aureus*; MRSA = methicillin-resistant *S. aureus*; MDRAB = multidrug-resistant *A. baumannii*; MDRPA = multidrug-resistant *P. aeruginosa*

^aCefotaxime, ceftriaxone, cefepime and cefpirome.

^bMoxifloxacin, levofloxacin: when used, pulmonary tuberculosis should be considered and aggressive microbiological evaluation for *Mycobacterium tuberculosis* should be performed.

^cClarithromycin and azithromycin.

^dThe definition of severe pneumonia is: 1) admission to the ICU; 2) respiratory failure (mechanical ventilation or fraction of inspired oxygen (FiO₂) >0.35 to maintain saturation >90%); 3) rapid radiographic progression, multilobar pneumonia, or cavitation of a lung infiltrate; and 4) evidence of sepsis with hypotension and/or end-organ dysfunction: shock, vasopressor requirement >4-h urine output <20mL/h or <80mL in total, acute renal failure (requiring dialysis).

^eConsider pneumonia due to *P. aeruginosa*.

^fInclude isepamicin.

^gCefoxitin, cefotetan and cefmetazole.

^hRisk factors for MDRP are: 1) antimicrobial therapy in the preceding 90 days; 2) current hospitalization of 5 days or more; 3) high frequency of antibiotic resistance in the community or in the specific hospital unit; 4) presence of risk factors for hospital-acquired pneumonia (hospitalization for 2 days or more in the preceding 90 days, residence in a nursing home or extended care facility, home infusion therapy [including antibiotics], chronic dialysis within 30 days, home wound care, family member with MDRP); and 5) immunosuppressive disease and/or therapy.

ⁱPneumonia occurs within the first 4 days of hospitalization.

^jPneumonia occurs 5 days or more of hospitalization.

^kIncludes ciprofloxacin, levofloxacin.

* Consensus conference participants (in alphabetical order):

Yu-Jiun Chan, Shan-Chwen Chang, Feng-Yee Chang, Po-Yen Chen, Yee-Chun Chen, Yin-Ching Chuang, Po-Ren Hsueh, Yhu-Chering Huang, Fu-Yuan Huang, Li-Min Huang, Kao-Pin Hwang, Wei-Chuan Hsieh, Yeu-Jun Lau, Chin-Yun Lee, Chun-Ming Lee, Hsieh-Shong Leu, Hsi-Hsun Lin, Tzou-Yien Lin, Ching-Chuan Liu, Yung-Ching Liu, Cheng-Yi Liu, Kwen-Tay Luh, Fu-Der Wang, Lih-Shinn Wang, Wing-Wai Wong, Muh-Yong Yen