hospital acquired pneumonia

definition

Nosocomial pneumonia (NP) or hospital-acquired pneumonia (HAP) is defined as pneumonia occurring more than 48 hours after hospital admission and excluding any infection that is incubating at the time of hospital admission. - NP is the second most frequent nosocomial infection and represents the leading cause of death from infection that is acquired in the hospital.

pathogenesis

- Most bacterial nosocomial pneumonia occurs by microaspiration of bacteria colonising the oropharynx or upper gastrointestinal tract of the patient.
- Intubation greatly increases the risk of HAP because it interferes with first-line patient defences

predisposing factors

1. specific high-risk populations:
(i) patients with COPD,
(ii) patients with ARDS,
(iii) serum albumin level less than 2.2 g/dL,
(iv) patients undergoing mechanical ventilation for more than 3 days,
(v) those requiring intracranial pressure monitoring,
(v) those with coma or impaired consciousness,
(vi) burns, or trauma, and
(vii) those with severe underlying medical conditions as evaluated by a high APACHE II or APACHE III score or presence of organ failure

2. specific treatment modalities or therapeutic intervention
(i) use of H2 blockers or antacids,
(ii) previous antibiotics,
(iii) use of drugs that are markers for severe underlying disease such as dopamine, dobutamine, or paralytic agents or continuous sedation,
(iv) re-intubation, and frequent changes of ventilator circuits,
(v) bronchoscopy, or
(vi) nasogastric tube
(vii) transport

diagnosis

Crackles on auscultation or dullness to percussion on physical examinaion of the chest and any of the following:
New onset of purulent sputum
Organism isolated from blood cultures
Isolation of pathogen from specimen obtained by transtracheal aspirate, bronchial brushing or biopsy
Chest radiography examination shows ne or progressive infiltration, consolidation, cavitation or pleural effusion
Isolation of virus or detection of virus antigen in respiratory secretions
Diagnostic single antibody titre (IgM) or fourfold increase in paired serum samples (IgG) for pathogen
Histopathological evidence of pneumonia

- The presence of bacteria in expectorated sputum or endotracheal aspirate cultures usually represents colonisation only, and does not itself justify a diagnosis of HAP.
- Postoperative atelectasis should be managed with physiotherapy; antibiotic therapy is not indicated, irrespective of sputum culture results. However, in the presence of pneumonia, sputum culture may give some indication of the bacterial agent(s) responsible and their antibiotic susceptibilities.
- Findings from serial chest X-rays may help to distinguish nonpneumonic causes of shadowing (eg atelectasis). Use of bronchoalveolar lavage, endotracheal aspirates and protected specimen brush may be valuable, particularly in de-escalation of therapy.

organisms which are almost always pathogenic when obtained from respiratory secretions

Legionella
Chlamydia
TB
Influenza, para-influenza virus, RSV, adenovirus, Hantavirus
Stronglyloides stercoralis
Toxoplasma gondii
Pneumocystis carinii
Histoplasma capsulatum
Coccidiodes immitis
Blastomycoses dermatitidis
Cryptococcus neoformans

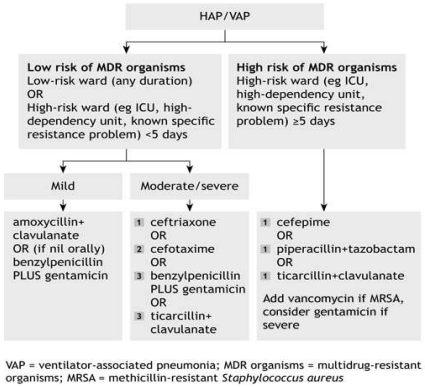
causative organisms

- The spectrum of potential pathogens associated with HAP differs from that of CAP.
- Hospitalised patients frequently develop colonisation of the oropharynx with aerobic Gram-negative bacilli and may also be exposed to multiresistant hospital pathogens such as MRSA, drug-resistant Enterobacteriaceae, Pseudomonas aeruginosa, Acinetobacter species and Stenotrophomonas maltophilia.
- HAP due to Legionella, Aspergillus species or influenza virus is often caused by inhalation of contaminated aerosols. Respiratory syncytial virus infection usually follows viral inoculation of the conjunctivae or nasal mucosa by contaminated hands.

principles of therapy

- Therapy can be stratified according to the risk of acquiring multidrug-resistant (MDR) organisms
- patients hospitalised in a low-risk ward (for any duration) or in a high-risk area (eg intensive care unit, high dependency unit including areas providing mechanical ventilation, or area with a known specific resistance problem) for less than 5 days should have therapy aimed at Streptococcus pneumoniae and non-MDR Gram-negative bacilli
- Patients hospitalised for 5 days or longer in high-risk areas are more likely to have MDR infection.
- As survival is improved by early appropriate therapy a broader-spectrum initial regimen is required
- Antibiotic susceptibility patterns will differ between institutions.
- The recommended initial antibiotic regimens may need to be modified to cover local pathogens.
- Failure to control the infection should lead to re-evaluation of antibiotic therapy.
- If diagnostic tests identify the causative organism, specific regimens can be used

treatment algorithm



VAP = ventilator-associated pneumonia; MDR organisms = multidrug-resistant organisms; MRSA = methicillin-resistant *Staphylococcus aureus*

treatment of patients with low risk of MDRs

1. Mild disease
- For patients with mild disease, use:
amoxycillin+clavulanate 875+125 mg (child: 22.5+3.2 mg/kg up to 875+125 mg) orally, 12-hourly for 7 days.
- If patient is unable to take oral therapy, use:
benzylpenicillin 1.2 g (child: 30 mg/kg up to 1.2 g) IV, 6-hourly
PLUS
gentamicin 4 to 6 mg/kg (child <10 years: 7.5 mg/kg; >10 years: 6 mg/kg) IV, daily
Switch to amoxycillin+clavulanate (as above) when patient is able to tolerate oral therapy.
- In patients hypersensitive to penicillin (excluding immediate hypersensitivity use:
cefuroxime 500 mg (child: 10 mg/kg up to 500 mg) orally, 12-hourly for 7 days.
- In adult patients with immediate penicillin hypersensitivity, as a single drug, use:
moxifloxacin 400 mg orally, daily for 7 days.

2. Moderate to severe disease
- For patients with moderate to severe disease, use:
ceftriaxone 1 g (child: 25 mg/kg up to 1 g) IV, daily
OR
cefotaxime 1 g (child: 25 mg/kg up to 1 g) IV, 8-hourly
OR
ticarcillin+clavulanate 3+0.1 g (child: 50+1.7 mg/kg up to 3+0.1 g) IV, 6-hourly
OR THE COMBINATION OF
benzylpenicillin 1.2 g (child: 30 mg/kg up to 1.2 g) IV, 6-hourly
PLUS
gentamicin 4 to 6 mg/kg (child <10 years: 7.5 mg/kg; >10 years: 6 mg/kg) IV, daily
- Switch to oral therapy as for patients with mild disease after there has been significant improvement.
- In adult patients with immediate penicillin hypersensitivity as a single drug, use:
moxifloxacin 400 mg orally or IV, daily for 7 days.

treatment of patients with high risk of MDRs

- In most patients receiving mechanical ventilation, fever and pulmonary infiltrates are not due to infection and a specific diagnosis should be sought using appropriate diagnostic techniques.
- Quantitative microbiological culture of appropriately obtained lower respiratory tract specimens before commencing therapy, or when antibiotic therapy has remained unchanged for 72 hours, may improve diagnostic accuracy.
- There is little published evidence to guide treatment options.
- The following regimens are likely to be equivalent but site-specific protocols based on local endemic multidrug-resistant (MDR) organisms should be developed.
- In addition, local protocols for de-escalation or cessation of therapy if cultures are negative on day 3 are encouraged.
- There is evidence that the response to appropriate antimicrobial therapy for ventilator-associated pneumonia (VAP) occurs within the first 6 days and that prolonged therapy results in colonisation and reinfection with resistant organisms.
- Treatment for 8 days is recommended except for Pseudomonas aeruginosa, Acinetobacter species or Stenotrophomonas maltophilia when treatment may be needed for up to 15 days.

- For patients with hospital-acquired pneumonia in high-risk wards (eg ICU, high-dependency units, known specific resistance problem) for 5 days or longer, use:
cefepime 2 g (child: 50 mg/kg up to 2 g) IV, 12-hourly
OR
piperacillin+tazobactam 4+0.5 g (child: 100+12.5 mg/kg up to 4+0.5 g) IV, 8-hourly
OR
ticarcillin+clavulanate 3+0.1 g (child: 50+1.7 mg/kg up to 3+0.1 g) IV, 6-hourly.
- If Gram-positive cocci are seen on Gram stain and/or the hospital has a high prevalence of MRSA, add vancomycin to the above regimen and discontinue if cultures are negative after 48 hours:
vancomycin 25 mg/kg up to 1 g (child <12 years: 30 mg/kg up to 1 g) IV, 12-hourly (monitor blood levels)

- Combination therapy using an aminoglycoside has shown a strong trend to reduced mortality for HAP due to MDR organisms in critically ill patients. In patients with severe pneumonia, consider adding gentamicin to the above regimen:
gentamicin 4 to 6 mg/kg (child <10 years: 7.5 mg/kg; >10 years: 6 mg/kg) IV, daily
- if staphylococcal pneumonia is suspected, see Staphylococcal pneumonia.
- If indicated as the result of susceptibility testing, use:
meropenem 1 g (child: 25 mg/kg up to 1 g) IV, 8-hourly
OR
imipenem 1 g (child: 25 mg/kg up to 1 g) IV, 6-hourly.

- Risk factors for infection with Legionella species include diabetes, immunosuppression, high-dose corticosteroid therapy, malignancy, end-stage renal failure, history of smoking, excessive alcohol use or a known local prevalence of hospital-acquired disease.