
به نام خدا

Clinical manifestations and diagnostic evaluation of hospital acquired and ventilator induced Pneumonia

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Pneumonia

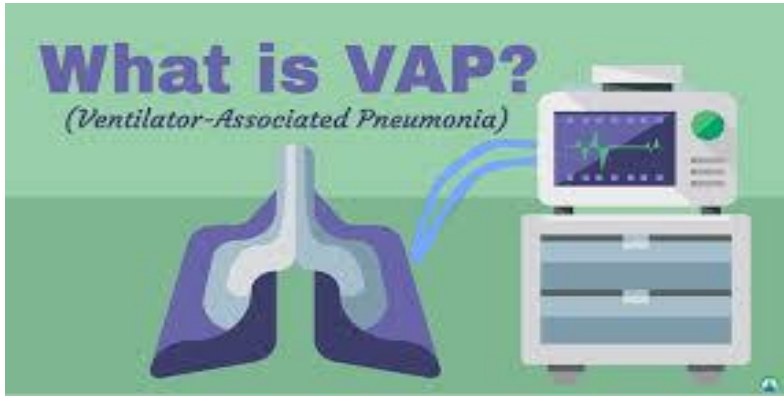
Pneumonia is the presence of an abnormal collection of microorganisms in the alveolar space that induces a consequent acute systemic host immune response..

Definitions pneumonia

Community-acquired pneumonia (CAP) *is pneumonia with onset* that occurs outside an acute medical care setting. Pneumonia that occurs within the first 48 hours is also considered CAP in most studies, with the assumption being that the pneumonia was incubating at the time of hospitalization.

Hospital-acquired pneumonia (HAP) *is pneumonia with onset* more than 48 hours after hospital admission or after a period of hospitalization.

Ventilator-associated pneumonia (VAP) *is a subgroup of HAP,* occurring in patients who have been endotracheally intubated for at least 48 hours.



Diagnosis
Clinical and Radiologic

The most common symptoms are fever, chills, nonproductive or productive cough, pleuritic chest pain, and shortness of breath.

Less frequently patients may present with diarrhea; new-onset or worsening confusion, particularly in elderly patients; and headache.

On physical examination, patients are hyperthermic or hypothermic,tachypneic, and tachycardic.

Lung examination reveals dullness on percussion, increased tactile and vocal fremitus, bronchial breath sounds, and egophony.

Diagnosis
Clinical and Radiologic

Auscultation findings include crackles hispering pectoriloquy, egophony, and pleural friction rub.

Distant manifestations of pneumonia include involvement of the joints with arthritis, heart with endocarditis, and meninges with meningeal signs.

Infections caused by "atypical pathogens," such as *Mycoplasma pneumoniae or Chlamydia pneumoniae, can lead to complications* such as bullous myringitis, skin rash, pericarditis, hepatitis, hemolytic anemia, or meningoencephalitis.

In the elderly or those with comorbid conditions, elevated respiratory rate can be the initial presenting sign of pneumonia,preceding other clinical findings by as much as 1 to 2 days. Respiration rates more than 30 breaths/min indicate an increased pneumonia severity and are usually included in severity of illness scores.

Overall, the clinical diagnosis of pneumonia has moderate sensitivity (79%) and specificity (66%). Given this lack of specificity,clinical characteristics suggestive of a pneumonic process require further confirmation by imaging.

TABLE 40.3 Risk Factors Associated With Severe Community-Acquired Pneumonia

Demographics
Age
Genetic polymorphisms
Male gender
Humid weather
Low socioeconomic status
Winter season

Cardiovascular Conditions
Coronary artery disease
Congestive heart failure

Pulmonary Conditions
Asthma
COPD
Chronic systemic or inhaled corticosteroids
Bronchiectasis

Neurologic Conditions
Cerebrovascular disease
Decrease functional status
Dementia
Seizure

Immunosuppressive Conditions
HIV/AIDS
Malignancies
Chemotherapeutic agents
Endocrine conditions
Diabetes mellitus

Renal Conditions
Acute renal failure
Chronic renal failure and ESRD
Need for dialysis

Liver Conditions
Chronic liver disease
Cirrhosis

Exposures
Alcohol
Air pollutants
Intravenous drug use
Prior antibiotic therapy
Smoking
Influenza and other viral infection
Proton pump inhibitors
Skin infections
Prior MRSA colonization
Prior *Pseudomonas aeruginosa* colonization
Severe dental plaque/periodontal disease

COPD, Chronic obstructive pulmonary disease; *ESRD*, end-stage renal disease; *HIV*, human immunodeficiency virus.

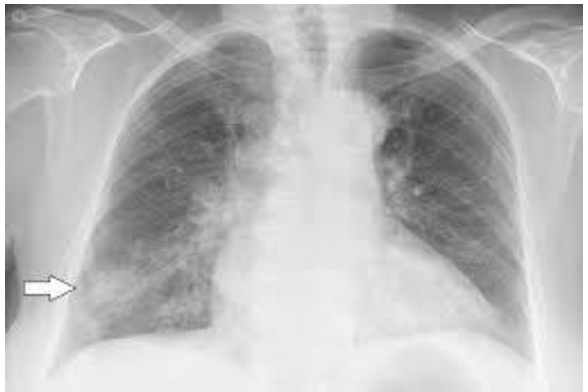
The classic imaging includes alveolar filling densities with air bronchograms or peribronchial infiltrates; diffuse ground-glass changes are also common.

The chest radiograph may be suboptimal in patients with early infection (especially with volume depletion),severe granulocytopenia, bullous emphysema, and obesity.

In those instances, a repeat chest radiograph in 24 to 48 hours is reasonable.

HAP severity correlates radiologically with multilobar and bilateral infiltrates, cavitation, or a loculated pleural effusion (suggesting an empyema).

Chest radiographic patterns are generally not useful for identifying the cause of HAP, although findings such as pleural effusion (*Pneumococcus, Haemophilus influenzae, M. pneumoniae,* pyogenic streptococci) and cavitation (*P. aeruginosa, S. aureus,*anaerobes, tuberculosis) can suggest certain groups of organisms.



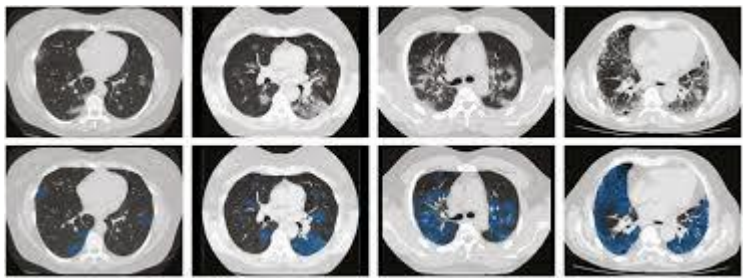
Chest computed tomography (CT) scan has better sensitivity in diagnosing pulmonary infiltrates suggestive of pneumonia, as well as excluding pneumonia in patients with borderline findings.

In emergency department patients with suspected HAP**,** chest CT scan results markedly affect diagnosis, treatment, and decision for site of care.

Use of chest ultrasound for diagnosis of pneumonia has become more common and facilitates the diagnosis of parapneumonic pleural effusions and subsequent sampling of pleural fluid.

Pointof-care ultrasound is frequently used in the ICU to avoid unnecessary chest radiographs and decrease radiation.

The accuracy of lung ultrasound is limited by some patient factors but mainly the competence of the operator.



Laboratory Testing

A complete blood cell count, chemistry panel, lactic acid, and arterial blood gas analysis are recommended in all patients with severe HAP.

Leukopenia and leukocytosis are seen in patients with severe HAP owing to *Pneumococcus or gram-negative organisms.*

Several abnormalities observed in the complete blood cell count, such as leukopenia, thrombocytosis, and thrombocytopenia, are associated with poor prognosis in patients with severe CAP.

Hyponatremia and hyperglycemia on admission are associated with poor outcome in HAP patients.
Increased levels of blood urea nitrogen and creatinine are considered markers of severity in patient with HAP, indicate systemic organ dysfunction, and are associated with poor clinical outcomes.

Elevated liver function test results can be seen in a variety of viral and bacterial pneumonias secondary
to atypical agents such as *Legionella spp. and Mycoplasma spp., Q* fever, tularemia, and psittacosis, as well as in pneumococcal infection.
Acidosis, hypoxemia, and alternations of carbon dioxide are frequently overlapping in patients with chronic comorbid conditions
and are associated with high mortality.

Respiratory samples, including sputum Gram stain and culture,may assist clinicians in identifying the probable cause of severe CAP, but the results must be assessed carefully to distinguish between normal flora, colonization, or infection.

Gram stain can be used to broaden initial empiric therapy to cover pathogens resistant to usual empiric therapy such as MRSA (presence of clusters of gram-positive cocci, particularly during influenza season).

A sputum sample that contains less than 10 squamous epithelial cells and more than 25 polymorphonuclear cells per low-power field enhances the value of the sputum culture results in patients with severe CAP.

Collection of invasive respiratory samples by bronchoscopic or nonbronchoscopic techniques is highly recommended in patients with severe CAP, who tend to have higher rates of microbial pathogens recovered at the time of pneumonia.

Respiratory sampling, including endotracheal aspirates obtained from patients with severe CAP requiring ventilation, assist with the diagnosis, direct changes of empiric antimicrobial therapy according to the culture results, and potentially alter duration of antibiotics.

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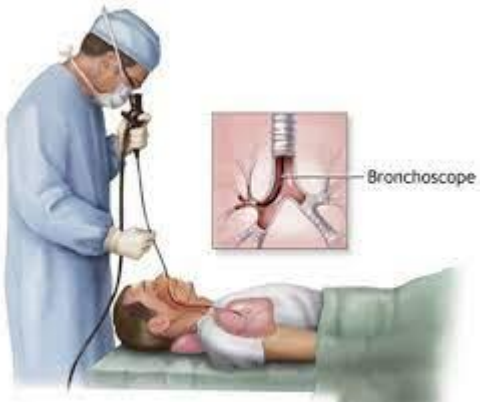

Open lung biopsy is rarely needed to diagnose severe CAP and is reserve principally for highly immunocompromised patients not responding to appropriate standard treatments or in patients with suspected pneumonia mimics, such as inflammatory lung disease, eosinophilic pneumonia, acute interstitial pneumonia, diffuse alveolar hemorrhage,
or malignancy.

The development of molecular diagnostic tests has largely obviated the need for open lung biopsy for diagnosis of *Aspergillus spp., cytomegalovirus, Cryptococcus spp., Blastomyces, Histoplasma, Nocardia spp., and Toxoplasma gondii and other fastidious* pathogens

Serologic testing is not routinely recommended in patients with severe CAP.

Therefore routine serologic testing for atypical pathogens such as *C. pneumoniae,Coxiella burnetii (Q fever), Chlamydia psittaci, Legionella,* and *M. pneumoniae is reserved for epidemiologic evaluations.*

Patients with severe CAP at risk for *Legionella infection should be* tested with *Legionella urinary antigen, which tends to be positive at* the time of admission if the patient is infected with *L. pneumophila* serogroup I infection (which accounts for 70%–80% of legionella cases).
A positive *Legionella urinary antigen test result should be* accompanied by culture confirmation on special charcoal-containing agar.

Pneumococcal urinary antigen has a sensitivity of 50% to 80% and specificity of more than 90%
False-positive test results are seen in patients who had pneumonia within the previous 3 months.
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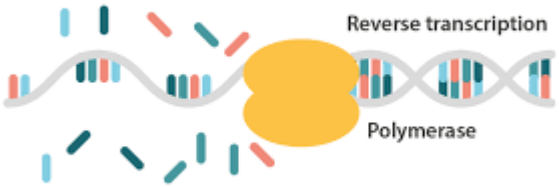
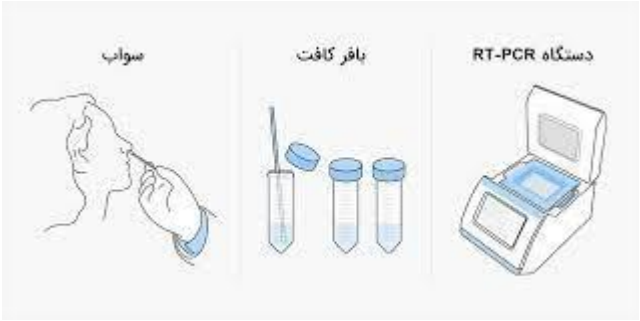
Polymerase chain reaction (PCR) assays are used for the detection of viruses (as was the case in the H1N1 epidemic) and other agents such as *M. tuberculosis. They have now become the standard for* diagnosis of respiratory viruses, as well as *Mycoplasma and Chlamydophila.*

12 PCR assays, usually performed on nasal or oropharyngeal swabs of lower respiratory tract samples, have additional sensitivity and increase the probability that the virus is causative of pneumonia rather than simple persistent shedding from an upper respiratory tract infection.

Direct immunofluorescence or enzyme immunoassay can also be used to detect viral antigens

such as influenza, parainfluenza, respiratory syncytial virus, and adenovirus. The impact of a positive test result on management of CAP is still unclear, but a negative test result is valuable in directing a focused antibiotic regimen





Biomarkers

Inflammatory biomarkers such as C-reactive protein (CRP), procalcitonin(PCT), midregional proadrenomedullin, midregional proatrial natriuretic peptide, proarginine-vasopressin, proendothelin-1,and the ILs have been used to distinguish bacterial infection from viral infection.

Inflammatory biomarkers such as PCT, CRP, tumor necrosis factor α, and IL-6 levels tend to be higher in patients admitted to the ICU, including those with delayed ICU admission compared with patients not needing ICU care. CRP is a biomarker that may be of use in patients with less disease to determine site of care. But CRP is nonspecifically elevated with any inflammatory state, such as severe CAP, and therefore lacks discriminating value for complications, such as parapneumonic effusion or empyema.