BMJ Best Practice

Overview of pneumonia

Straight to the point of care

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Introduction

Pneumonia is inflammation of the lungs with consolidation or interstitial lung infiltrates, most often categorized according to the causative organism. Typical symptoms might include fever, cough, dyspnea, and chest pain. Characteristic risk factors, signs, and symptoms of each specific type of pneumonia may result from a different etiology and pathogenic mechanism.

Related conditions

◊ Community-acquired pneumonia in adults (non COVID-19)

» see our comprehensive coverage of Community-acquired pneumonia in adults (non COVID-19) (https://bestpractice.bmj.com/topics/en-us/17)

Community-acquired pneumonia (CAP) is defined as pneumonia acquired outside hospital or healthcare facilities. Patients with CAP typically present with signs and symptoms of lower respiratory tract infection (i.e., cough, dyspnea, pleuritic chest pain, mucopurulent sputum, myalgia, fever).[1] Older people present more frequently with confusion or worsening of pre-existing conditions, without chest signs or fever.[2]

Bacterial and viral pathogens are the leading cause of CAP; most infections are caused by *Streptococcus pneumoniae* (also known as pneumococcus). Clinical judgment along with a validated prediction rule for prognosis is used to determine the need for hospital admission in adults with CAP.[3] Radiographic confirmation of the diagnosis (presence of new consolidation on a chest radiograph) should be obtained in hospitalized patients.

◊ Community-acquired pneumonia in children

» see our comprehensive coverage of Community-acquired pneumonia in children (https://bestpractice.bmj.com/topics/en-us/3000363)

Community-acquired pneumonia (CAP) in childhood typically presents with fever and cough, together with hypoxemia (oxygen saturation ≤96% on pulse oximetry), tachypnea, and often signs of increased work of breathing (e.g., chest retractions, nasal flaring, head bobbing, grunting). Most cases are caused by viruses, particularly in infants and younger children, and there is no reliable way clinically to distinguish viral from bacterial etiology.

Pneumonia accounts for 14% of all deaths globally of children <5 years old, and 22% of deaths among those ages 1-5 years.[4] In a previously healthy child with nonsevere symptoms, the diagnosis can be made clinically without any need for blood tests, imaging, or microbiology investigations.

◊ Hospital-acquired pneumonia (non COVID-19)

» see our comprehensive coverage of Hospital-acquired pneumonia (non COVID-19) (https://bestpractice.bmj.com/topics/en-us/720)

Hospital-acquired pneumonia (HAP) is an acute lower respiratory tract infection that is by definition acquired after at least 48 hours of admission to the hospital and is not incubating at the time of admission.[5] The spectrum of HAP is now distinct from ventilator-associated pneumonia (VAP), which is defined as pneumonia occurring more than 48 hours after endotracheal intubation.

HAP is more common in patients in the intensive care unit, those who have recently had major surgery, and those who have been in hospital for a long time.[6] Patients with HAP usually present with a combination of fever (or hypothermia), leukocytosis (or leukopenia), purulent sputum, and poor oxygenation.

◊ Viral pneumonia (non COVID-19)

» see our comprehensive coverage of Viral pneumonia (non COVID-19) (https://bestpractice.bmj.com/topics/en-us/)

Viral pathogens are frequently responsible for both community-acquired and hospital-acquired pneumonias. Infection is often caused by influenza virus, respiratory syncytial virus (RSV), or parainfluenza virus; of these, influenza virus is the leading cause in adults.[7]

Patients at the extremes of age, and individuals with immune suppression of any cause, including pregnancy, are at increased risk of viral pneumonia. The clinical features are nonspecific, but a diagnosis can be made by isolating viral nucleic acid from respiratory tract secretions.[8] Coinfection with a bacterial pathogen (e.g., *Staphylococcus aureus* , *Streptococcus pneumoniae* , and *Haemophilus influenzae*) is associated with increased bacterial virulence, and greater morbidity and mortality.[9]

◊ Coronavirus disease 2019 (COVID-19)

» see our comprehensive coverage of Coronavirus disease 2019 (COVID-19) (https://bestpractice.bmj.com/topics/en-us/3000168)

A potentially severe acute respiratory infection caused by the novel acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Cases have been reported across all continents since the beginning of the pandemic in 2019, with over 772 million confirmed cases and over 6.9 million deaths reported globally.[10]

The clinical presentation is generally that of a respiratory infection with a symptom severity ranging from a mild common cold-like illness, to a severe viral pneumonia leading to acute respiratory distress syndrome that is potentially fatal. Numerous COVID-19 vaccines are available globally, including: mRNA vaccines; adenovirus vector vaccines; protein subunit vaccines; and inactivated virus vaccines.

◊ Severe acute respiratory syndrome (SARS)

» see our comprehensive coverage of Severe acute respiratory syndrome (SARS) (https://bestpractice.bmj.com/topics/en-us/904)

Severe acute respiratory syndrome (SARS) is a viral pneumonia that rapidly progresses to respiratory failure.[11] In 2003, an international outbreak developed involving 29 countries with 8098 cases of probable SARS and 774 (9.6%) deaths.[12] There have been no reported cases since 2004.

The case fatality rate is approximately 10% and death usually occurs due to severe respiratory failure. Strong risk factors include recent travel (within 10 days of the onset of symptoms) to a foreign or domestic location with documented or suspected recent transmission of SARS, close and prolonged contact with an infected individual, or working in research laboratories on SARS-CoV.[13][14] [15] [16]

◊ Middle East respiratory syndrome (MERS)

» see our comprehensive coverage of Middle East respiratory syndrome (MERS) (https://bestpractice.bmj.com/topics/en-us/1301)

An acute viral respiratory tract infection caused by the novel betacoronavirus MERS coronavirus. It was first identified in Saudi Arabia in 2012. Cases have been limited to the Arabian Peninsula and its surrounding countries, and to travelers from the Middle East or their contacts.

The majority of patients present with fever and respiratory symptoms (e.g., cough, dyspnea); however, some patients may present with gastrointestinal symptoms only (e.g., nausea, vomiting, diarrhea, abdominal pain). The case fatality rate is approximately 35%.[17]

◊ Atypical pneumonia (non COVID-19)

» see our comprehensive coverage of Atypical pneumonia (non COVID-19) (https://bestpractice.bmj.com/topics/en-us/18)

Atypical bacterial pneumonia is caused by atypical organisms that are not detectable on Gram stain and cannot be cultured using standard methods. The most common organisms are *Mycoplasma pneumoniae* , *Chlamydophila pneumoniae* , and *Legionella pneumophila* .[18] The incidence of atypical pathogens in community-acquired pneumonia is approximately 22% globally, but this varies with location.[19]

Atypical bacterial pneumonia is usually characterized by a symptom complex that includes headache, low-grade fever, cough, and malaise. Constitutional symptoms often predominate over respiratory findings, and there may be extrapulmonary manifestations. In most cases, presentation is in the milder spectrum of community-acquired pneumonia; some cases, especially if caused by *L pneumophila* , may present as severe pneumonia, necessitating intensive care unit admission.

◊ Mycoplasma pneumoniae infection

» see our comprehensive coverage of Mycoplasma pneumoniae infection (https://bestpractice.bmj.com/topics/en-us/605)

Mycoplasma are a group of bacteria, some of which are pathogenic in humans and animals. *M pneumoniae* is the cause of up to 20% of cases of community-acquired pneumonia and has also been implicated in some hospital-based epidemics.

Patients may present with symptoms including an unresolved persistent cough, low-grade fever, headache, hoarseness, rash, and, rarely, bullous myringitis. *M pneumoniae* occurs mainly in children and young adults, and is often seen in close community settings (e.g., boarding schools, army bases, and universities).[18] The diagnosis is usually made clinically, but can be confirmed using nucleic acid amplification tests or cultures.

◊ Chlamydia pneumoniae infection

» see our comprehensive coverage of Chlamydia pneumoniae infection (https://bestpractice.bmj.com/topics/en-us/606)

Chlamydia pneumoniae is a common cause of acute respiratory tract infection in all age groups, worldwide. Patients may have 1-2 weeks of fever and cough, and may complain of pleuritic chest pain, headache, and sore throat.[20]

Pneumonia due to *C pneumoniae* cannot be differentiated clinically from other atypical pneumonia-causing organisms, especially *Mycoplasma pneumoniae* .[21] The diagnosis can be confirmed using nucleic acid amplification tests.

◊ Legionella infection

» see our comprehensive coverage of Legionella infection (https://bestpractice.bmj.com/topics/en-us/414)

Legionella pneumonia, known as Legionnaires' disease, occurs when the bacteria are inhaled (or rarely aspirated) into the lungs. Nearly all cases of community-acquired Legionnaires' disease are associated with contaminated aerosols produced by man-made water systems.[22] Community-acquired Legionnaires' disease appears to be most prevalent during summer and fall months.[23] Studies have linked this to warmer and wetter weather conditions and higher relative humidity in these seasons.[24]

Presentation includes respiratory symptoms such as cough (may not be productive) and shortness of breath, fever, chills, and chest pain. Other symptoms include headache, nausea, vomiting, abdominal pain, or diarrhea. Risk factors include nonmunicipal water supply, recent residential plumbing repair, smoking, use of whirlpool spas, and living close to a cooling tower.

◊ Pneumocystis jirovecii pneumonia

» see our comprehensive coverage of Pneumocystis jirovecii pneumonia (https://bestpractice.bmj.com/topics/en-us/19)

Pneumocystis pneumonia (PCP) is an infection of the lung caused by the fungal organism *Pneumocystis jirovecii* (formerly known as *Pneumocystis carinii*). Typically, it causes clinical disease in severely immunocompromised patients, such as HIV-infected people with CD4+ count <200 cells/microliter, hematopoietic cell transplant patients, solid-organ transplant patients, or patients on chronic immunosuppressive therapy. In the era of combination antiretroviral therapy, the incidence of PCP has declined.[25]

Suspicion for PCP is based on clinical signs or symptoms of pneumonia in a person with immune suppression, especially when due to HIV infection.

◊ Coccidioidomycosis

» see our comprehensive coverage of Coccidioidomycosis (https://bestpractice.bmj.com/topics/en-us/558)

Coccidioidomycosis is a fungal infection caused by the endemic fungus *Coccidioides* species and is acquired through inhalation of airborne arthrospores within the endemic areas of the southwest US, northern Mexico, and limited areas of Central and South America. Coccidioidomycosis may be asymptomatic or can cause acute and chronic pulmonary syndrome; less than 5% of people with coccidioidomycosis experience extrapulmonary spread of infection.[26] Common symptoms include fever, headache, dry cough, shortness of breath, inspiratory chest pain, myalgia, and arthralgia, and may be accompanied by a rash.

◊ Aspergillosis

» see our comprehensive coverage of Aspergillosis (https://bestpractice.bmj.com/topics/en-us/425)

Invasive aspergillosis (IA) is caused by filamentous fungi of the *Aspergillus* species, which are found ubiquitously in soil. Inhalation of the aerosolized conidia (spores) causes the infection.

Aspergillosis mostly affects immunocompromised patients and is rare in immunocompetent people. Clinical findings are nonspecific and include fever, cough, and pleuritic pain. Lungs, sinuses, brain, and skin are sites of involvement. Key risk factors include allogeneic stem cell transplantation, prolonged severe neutropenia (>10 days), immunosuppressive therapy, chronic granulomatous disease, acute leukemia, aplastic anemia, and solid organ transplantation for invasive aspergillosis.

Aspergilloma is mostly asymptomatic. It occurs in preexisting lung cavities, and is generally secondary to tuberculosis.[27]

◊ Allergic bronchopulmonary aspergillosis

» see our comprehensive coverage of Allergic bronchopulmonary aspergillosis (https://bestpractice.bmj.com/topics/en-us/836)

Allergic bronchopulmonary aspergillosis (ABPA) is a hypersensitivity reaction to bronchial colonization by *Aspergillus fumigatus*. Patients usually have a prior diagnosis of atopy, asthma or cystic fibrosis.[28] ABPA most often affects teenagers with cystic fibrosis and young to middle-aged adults with asthma, but it has also been diagnosed in infants with cystic fibrosis and older patients with asthma.[29] Presents as asthma complicated by bronchial obstruction, fever, malaise, expectoration of brownish mucus plugs, peripheral blood eosinophilia, and hemoptysis. Untreated, ABPA can lead to bronchiectasis, fibrosis, and respiratory compromise.

◊ Acute aspiration

» see our comprehensive coverage of Acute aspiration (https://bestpractice.bmj.com/topics/en-us/528)

Aspiration is the inhalation of foreign material into the airways beyond the vocal cords.[30] It can be categorized as aspiration pneumonitis or aspiration pneumonia. Aspiration pneumonitis is chemical injury after aspiration of gastric contents.[31] Aspiration of gastric contents is commonly seen in older patients due to associated swallowing dysfunction and comorbidities, or as a consequence of substance misuse.

Strong risk factors include a decreased level of consciousness of any cause, which may lead to inadequate cough reflex and impaired glottal closure; dysphagia; general anesthesia; intubation or tracheostomy tube; and older age.

◊ Aspiration pneumonia

» see our comprehensive coverage of Aspiration pneumonia (https://bestpractice.bmj.com/topics/en-us/21)

Aspiration pneumonia results from the inhalation of oropharyngeal contents into the lower airways that leads to chemical pneumonitis, lung injury, and resultant bacterial infection. It commonly occurs in patients with risk factors such as impaired conscious level, swallowing dysfunction, and gastrointestinal disease.

Aspiration pneumonia predominantly occurs in older adults. Diagnosis is based on clinical signs or symptoms of pneumonia (e.g., cough, breathlessness, fever) in a person with a history of, or risk factors for, aspiration.

◊ Meconium aspiration syndrome

» see our comprehensive coverage of Meconium aspiration syndrome (https://bestpractice.bmj.com/topics/en-us/1185)

Respiratory distress in the newborn due to the presence of meconium in the trachea. Meconium causes an inflammatory reaction in the airways; neonatal pneumonia may result.

Clinical presentation includes tachypnea and respiratory distress with cyanosis.[32] Infants born through meconium-stained amniotic fluid are at risk and typically present with respiratory distress soon after birth.[33] Key risk factors include: gestational age >42 weeks; maternal history of hypertension, preeclampsia, eclampsia, smoking, substance abuse; fetal distress; oligohydramnios; thick meconium; an Apgar score <7; chorioamnionitis and cesarean delivery.

◊ Organizing pneumonia

» see our comprehensive coverage of Organizing pneumonia (https://bestpractice.bmj.com/topics/en-us/137)

Organizing pneumonia (OP) is an inflammatory disorder involving both the peripheral bronchioles and alveoli simultaneously. It has distinctive radiographic findings, histological features, and response to corticosteroids (unlike usual interstitial pneumonia).

OP may be caused by multiple insults such as medication, infection, rheumatologic disease, autoimmune disease, posttransplantation, radiation, and environmental causes. In cryptogenic organizing pneumonia, a cause cannot be elicited after a careful history, exam and pertinent laboratory studies. Most often, diagnosis is made using clinico-radiologic criteria and usually in the setting of a multidisciplinary team.

◊ Hypersensitivity pneumonitis

» see our comprehensive coverage of Hypersensitivity pneumonitis (https://bestpractice.bmj.com/topics/en-us/647)

Hypersensitivity pneumonitis (HP), also known as extrinsic allergic alveolitis, is the result of non-IgE mediated immunologic inflammation. Occupational exposure to organic dust is the key epidemiologic factor - most commonly including *Actinomycetes* bacteria, animal proteins, or reactive chemicals. The inflammation of HP manifests itself in the alveoli and distal bronchioles. Classification is determined by the predominant presence or absence of fibrosis on radiographic and/or histopathologic examination.

◊ Evaluation of dyspnea

» see our comprehensive coverage of Evaluation of dyspnea (https://bestpractice.bmj.com/topics/en-us/862)

Dyspnea, also known as shortness of breath or breathlessness, is a subjective sensation of breathing discomfort. The etiology is broad, ranging from mild, self-limiting processes to life-threatening conditions. Diseases of the cardiovascular, pulmonary, and neuromuscular systems are the most common etiologies. Dyspnea may be acute (e.g., acute exacerbation of congestive heart failure, acute pulmonary embolism, acute heart valve insufficiency), subacute (e.g., worsening asthma, exacerbation of chronic obstructive pulmonary disease [COPD]) or chronic (e.g., stable COPD, stable interstitial lung disease). Dyspnea is a key diagnostic feature of pneumonia.

◊ Evaluation of chronic cough

» see our comprehensive coverage of Evaluation of chronic cough (https://bestpractice.bmj.com/topics/en-us/69)

Common etiologies of chronic cough (cough persisting for >8 weeks) in nonsmoking adults, with a normal chest x-ray, who do not take ACE inhibitors, include upper airway cough syndrome; asthma; gastroesophageal reflux disease; and nonasthmatic eosinophilic bronchitis.[34] [35]

Patients with chronic cough (usually productive of sputum), a history of fever, malaise, and chest pain, and exam findings of dullness to percussion, decreased breath sounds, and presence of rales, should be tested for pneumonia.

◊ Evaluation of persistent pulmonary infiltrate

» see our comprehensive coverage of Evaluation of persistent pulmonary infiltrate (https://bestpractice.bmj.com/topics/en-us/1094)

Persistent pulmonary infiltrate results when a substance denser than air (e.g., pus, edema, blood, surfactant, protein, or cells) lingers within the lung parenchyma. Nonresolving and slowly resolving pneumonias are the most common broad categories of persistent pulmonary infiltrate.[36] Persistence is attributed to defects in host immune defense mechanisms, presence of unusual or resistant organisms, or diseases that mimic pneumonia.[37][38]

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Please note that recommended formulations and doses may differ between drug databases drug names and brands, drug formularies, or locations. A local drug formulary should always be consulted for full prescribing information.

Treatment recommendations in BMJ Best Practice are specific to patient groups. Care is advised when selecting the integrated drug formulary as some treatment recommendations are for adults only, and external links to a paediatric formulary do not necessarily advocate use in children (and vice-versa). Always check that you have selected the correct drug formulary for your patient.

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Regardless of the language in which the content is displayed, numerals are displayed according to the original English-language numerical separator standard. For example 4 digit numbers shall not include a comma nor a decimal point; numbers of 5 or more digits shall include commas; and numbers stated to be less than 1 shall be depicted using decimal points. See Figure 1 below for an explanatory table.

BMJ accepts no responsibility for misinterpretation of numbers which comply with this stated numerical separator standard.

This approach is in line with the guidance of the International Bureau of Weights and Measures Service. https://www.bipm.org/en/about-us/

Figure 1 – BMJ Best Practice Numeral Style

5-digit numerals: 10,000

4-digit numerals: 1000

numerals < 1: 0.25

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