Pneumonia Cheat Sheet

by gnvr (Guenevere) via cheatography.com/147429/cs/34538/

Anatomic Alterations of the Lungs

Pneumonia or ***pneumonitis with consolidation***	The result of an inflammatory process that primarily affects the gas exchange area of the lung.

Sequence of Events

Inflammation	
Effusion	Fluid (serum) and some red blood cells (RBCs) from adjacent pulmonary capillaries pour into the alveoli.
Surface Phagocytosis	Polymorphonuclear leukocytes move into the infected area to engulf and kill invading bacteria on the alveolar walls.
Consolidation	Increased numbers of macrophages also appear in the infected area to remove cellular and bacterial debris.
	If the infection is overwhelming, the alveoli become filled with fluid, RBCs, polymorphonuclear leukocytes, and macrophages.

Atelectasis is often associated with patients who have ***aspiration pneumonia***.

Major pathologic or structural changes

	Inflammation of the alveoli

Anatomic Alterations of the Lungs (cont)

Alveolar consolidation
Atelectasis (e.g., aspiration pneumonia)

Etiology and Epidemiology

Pneumonia and influenza	eighth leading cause of death among Americans
	sixth leading cause of death over the age of 65 years
	especially life threatening in individuals whose lungs are already damaged by chronic obstructive pulmonary disease (COPD), asthma, or smoking
	The risk of death from pneumonia orinfluenza is also higher among peoplewith heart disease, diabetes, or a weakened immune system.
Causes of pneumonia	bacteria, viruses, fungi, protozoa, parasites, tuberculosis, anaerobic organisms, aspiration, and the inhalation of irritating chemicals such as chlorine
Pneumonia	is an *insidious disease* because its symptoms vary greatly, depending on the patient's specific underlying condition and the type of organism causing the pneumonia.

Etiology and Epidemiology (cont)

	often mimics a common cold or the flu
	For example, the patient may suddenly experience chills, shivering, high fever, sweating, chest pain (pleurisy), and a dry and nonproductive cough. Often what initially appears to be a cold or the flu, however, can in fact be a much more serious pulmonary infection

Anatomic Location of the Inflammation

Bronchopneumonia	patchy pattern of infection that is limited to the segmental bronchi and surrounding lung parenchyma
	usually involves both lungs and is seen more often in the lower lobes of the lung
Lobar pneumonia	widespread or diffuse alveolar inflammation and consolidation
	typically the end result of a severe or long-term bronchopneumonia in which the infection has spread from one lung segment to another until the entire lung lobe is involved
Interstitial pneumonia	a diffuse and often bilateral inflammation that primarily involves the alveolar septa and interstitial space

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Etiology and Epidemiology (cont)

	In contrast to alveolar pneumonia caused by bacteria, the polymorphonuclear leukocytes do not migrate into the alveoli—they remain in the alveolar interstitial spaces.
	Mycoplasma pneumonia and other viruses cause interstitial pneumonias.
	most interstitial pneumonias cause only minor permanent alveolar damage and usually resolve without consequences

When both lungs are involved, the condition is sometimes called **double pneumonia** by laypersons.

"Walking pneumonia"	used to describe a mild case of pneumonia
	patients infected with *Mycoplasma pneumoniae*, who generally have mild symptoms and remain ambulatory

Because the distinction between lobar pneumonia and bronchopneumonia can often be hazy, it is generally best to classify pneumonias either by the specific etiologic agent or, when no specific pathogen can be identified, by the clinical setting in which the pneumonia occurs; for example, hospital-acquired pneumonia or community-acquired pneumonia (CAP).

Risk Factors for Pneumonia

- Age over 65 years
- Aspiration of oropharyngeal secretions
- Viral respiratory infections
- Chronic illness and debilitation (e.g., diabetes mellitus, uremia)

Risk Factors for Pneumonia (cont)

- Chronic respiratory disease (COPD, asthma, cystic fibrosis)
- Cancer (especially lung cancer)
- Prolonged bed rest
- Tracheostomy or endotracheal tube
- Abdominal or thoracic surgery
- Rib fractures
- Immunosuppressive therapy
- AIDS

Clinical Settings and Pathogens

Community-Acquired Pneumonia

- Streptococcus pneumonia
- *Staphylococcus aureus* (also hospital-acquired pneumonia)
- *Haemophilus influenza*
- *Legionella pneumophila*
- Enterobacteriaceae (*Klebsiella* pneumonia)
- *Pseudomonas aeruginosa* (also hospital--acquired pneumonia)

Community-Acquired Atypical Pneumonia

- Mycoplasma pneumonia
- *Chlamydia* spp.—*C. pneumonia*, *C. psittaci*, *C. trachomatis*, and *C. burnetii* (Q fever)
- Viruses: respiratory syncytial virus, parainfluenza virus (children); influenza A and B (adults); adenovirus (military recruits), human metapneumovirus

Hospital-Acquired Pneumonia (Nosocomial Pneumonia)

- Gram-negative bacilli belonging to Enterobacteriaceae (*Klebsiella* spp., *Serratia marcescens*, *Escherichia coli*) and *Pseudomonas* spp., and *Staphylococcus aureus* (usually methicillin-resistant)
- Ventilator-acquired pneumonia (*P. aeruginosa*, *Klebsiella*, and *S. aureus*)

Aspiration Pneumonia

Clinical Settings and Pathogens (cont)

- Anaerobic oral flora (Bacteroides, Prevotella, Fusobacterium, Peptostreptococcus), admixed with aerobic bacteria (*S. pneumonia*, *S. aureus*, *H. influenza*, and *Pseudomonas aeruginosa*)

Chronic Pneumonia

- Granulomatous: *Mycobacterium tuberculosis* and atypical mycobacteria, *Histoplasma capsulatum*, *Coccidioides immitis*, *Blastomyces dermatitidis*
- *Candida albicans*, *Cryptococcus neoformans*, and *Aspergillus*
- Nocardia
- Actinomyces

Necrotizing Pneumonia and Lung Abscess

- Anaerobic bacteria (extremely common), with or without mixed aerobic infection *S. areus*, *K. pneumonia*, *Streptococcus pyogenes*, and type 3 pneumococcus (uncommon)

Pneumonia in the Immunocompromised Host

- Cytomegalovirus
- *Pneumocystis jirovecii*
- *Mycobacterium avium* complex (MAC)
- Invasive aspergillosis
- Invasive candidiasis
- "Usual" bacterial, viral, and fungal organisms (listed above)

Community-Acquired Pneumonia (CAP)

a pneumonia acquired from normal social contact

Streptococcal pneumonia

"Pneumococcal pneumonia"	*Streptococcus pneumoniae* (+)
	accounts for more than 80% of all the bacterial pneumonias

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Community-Acquired Pneumonia (CAP) (cont)

	gram-positive, nonmotile coccus that is found singly, in pairs (called *diplococci*), and in short chains
	cocci are enclosed in a smooth, thick polysaccharide capsule that is essential for virulence
	more than 80 different types of S. pneumoniae
	Serotype 3 organisms are the most virulent.
	transmitted by aerosol from a cough or sneeze of an infected individual
	Most strains of *S. pneumoniae* are sensitive to ***penicillin*** and its derivatives.
	cultured from the sputum of patients having an acute exacerbation of chronic bronchitis

Staphylococcal pneumonia

two major groups of ***Staphylococcus***:	(1) *Staphylococcus aureus*, which is responsible for most "staph" infections in humans
	(2) *Staphylococcus albus* and *Staphylococcus epidermidis*, which are part of the normal skin flora
staphylococci	gram-positive cocci found singly, in pairs (called *diplococci*), and in irregular clusters
Staphylococcal pneumonia	often follows a predisposing virus infection and is seen most often in children and immunosuppressed adults
	transmitted by aerosol from a cough or sneeze of an infected individual and indirectly via contact with contaminated floors, bedding, clothes, and the like
	common cause of **hospital--acquired pneumonia** or **nosocomial pneumonia**
	becoming increasingly antibiotic resistant—thus the term **multiple drug–resistant S. *aureus* (MDRSA)** organisms

Haemophilus influenzae

Haemophilus influenzae	a common inhabitant of human pharyngeal flora
	s one of the smallest gram-negative bacilli, measuring about 1.5 mm in length and 0.3 mm in width
	It appears as coccobacilli on Gram stain.
	There are six types of H. influenzae, designated A to F
	only **type B** is commonly pathogenic
	transmitted via aerosol or contact with contaminated objects
	sensitive to cold and does not survive long after expectoration
	y cultured from the sputum of patients having an acute exacerbation of chronic bronchitis
	Additional risk factors for *H. influenzae* infection include COPD, defects in B-cell function, functional and anatomic asplenia, and human immunodeficiency virus (HIV) infection.

Community-Acquired Pneumonia (CAP) (cont)

H. influenzae type B	Pneumonia caused by *H. influenzae* type B is seen most often in children aged 1 month to 6 years old.
	almost always the cause of **acute epiglottitis**

Legionella pneumophila

	In July 1976, a severe pneumonia-like disease outbreak occurred at an American Legion convention in Philadelphia.
	an unusual and fastidious gram-negative bacillus with atypical concentrations of certain branched-chain lipids
	More than 20 *Legionella* species have now been identified
	Most of the species are free-living in soil and water, where they act as decomposer organisms.
	multiplies in standing water such as contaminated mud puddles, large air-conditioning systems, and water tanks

Community-Acquired Pneumonia (CAP) (cont)

	transmitted when it becomes airborne and enters the patient's lungs as an aerosol
	No convincing evidence suggests that the organism is transmitted from person to person
	can be detected in pleural fluid, sputum, or lung tissue by direct fluorescent antibody microscopy
	rarely found outside the lungs, the organism may be found in other tissues
	. The disease is most commonly seen in middle-aged men who smoke

Enterobacteriaceae *(Klebsiella pneumonia)*

Klebsiella pneumoniae	**Friedländer's Bacillus**
	have long been associated with lobar pneumonia, particularly in men older than 40 years and in chronic alcoholics of both genders
	a gram-negative bacillus that is found singly, in pairs, and in chains of varying lengths

Community-Acquired Pneumonia (CAP) (cont)

normal inhabitant of the human gastrointestinal tract
can be transmitted directly by aerosol or indirectly by contact with freshly contaminated articles
a common nosocomial, or hospital-acquired, disease
typically transmitted by routes such as clothing, intravenous solutions, foods, and the hands of health-care workers
mortality of patients with *K. pneumoniae* is very high because septicemia is a frequent complication

Pseudomonas aeruginosa

highly mobile, gram-negative bacillus
often found in the gastrointestinal tract, burns, and catheterized urinary tract and is a contaminant in many aqueous solutions

Community-Acquired Pneumonia (CAP) (cont)

frequently cultured from the respiratory tract of patients who are chronically ill and tracheostomized, and is a leading cause of **hospital-acquired pneumonia**

a particular problem for the respiratory therapist. Risk factors include neutropenia, HIV infection, preexisting lung disease, endotracheal intubation, and previous antibiotic use

thrives in dampness; it is often cultured from contaminated respiratory therapy equipment

transmitted by aerosol or by direct contact with freshly contaminated articles

very mucoid colonial form and the sputum is frequently green and sweet smelling

Community-Acquired Atypical Pneumonia

The clinical presentation of the patient with community-acquired atypical pneumonia is often **subacute**.

Community-Acquired Atypical Pneumonia (cont)

The patient typically presents with a variety of both **pulmonary** and **extra-pulmonary** findings (e.g., respiratory symptoms such as cough plus headache, general fatigue, or diarrhea).

Mycoplasma pneumonia

mycoplasma organism	most common cause of an acquired atypical pneumonia
	tiny, cell wall–deficient organisms
	smaller than bacteria but larger than viruses
	The pneumonia caused by the mycoplasmal organism is commonly described as a *primary atypical pneumonia*
The term *atypical* refers to the fact that	(1) the organism escapes identification by standard bacteriologic tests
	(2) there is generally only a moderate amount of sputum
	(3) there is an absence of alveolar consolidation
	(4) there is only a moderate elevation of white cell count
	(5) there is a lack of alveolar exudate

Community-Acquired Atypical Pneumonia (cont)

mycoplasma organism (cont)	causes symptoms similar to both bacterial and viral pneumonia, although the symptoms develop more gradually and are often milder
	Chills and fever are early symptoms
	patient typically presents with a mild fever, and patchy inflammatory changes in the lungs that are mostly confined to the alveolar septa and pulmonary interstitium
	common symptom of mycoplasma pneumonia is a **cough that tends to come in violent attacks**, producing only a **small amount of white mucus**
	Some patients experience nausea or vomiting
	In some cases, the patients may experience a profound weakness that lasts for a long time.
	Mycoplasma pneumonia is commonly seen among children and young adults.

Community-Acquired Atypical Pneumonia (cont)

	spreads easily in areas where people congregate, such as child-care centers, schools, and homeless shelters
	e **"walking pneumonia"** because the condition is mild and the patient is usually ambulatory

Chlamydia* spp. *pneumonia

	Chlamydia pneumonia, *Chlamydia psittaci*, *Chlamydia trachomatis* and ***Coxiella burnetii*** (Q fever) closely resemble the clinical manife-stations of those caused by *M. pneumoniae*.
Chlamydia	a type of bacteria that may be found in the cervix, urethra, rectum, throat, and respiratory tract
	also found in the feces of a variety of birds
	The clinical manifestations of *C. psittaci* closely resemble those caused by *M. pneumoniae*.

Viruses

Community-Acquired Atypical Pneumonia (cont)

50% of all pneumonias, and several are associated with a community-acquired atypical pneumonia

Although most viruses attack the upper airways, some can produce pneumonia.

Most of these pneumonias are not life threatening and last only a short time.

tends to start with flulike signs and symptoms. The early symptoms are a dry (nonproductive) cough, headache, fever, muscle pain, and fatigue.

As the disease progresses, the patient may become short of breath, cough, and produce a **small amount of clear or white sputum**.

Viral pneumonia always carries the risk of development of a secondary bacterial pneumonia.

minute organisms not visible by ordinary light microscopy

Community-Acquired Atypical Pneumonia (cont)

	parasitic and depend on nutrients inside cells for their metabolic and reproductive needs
	90% of acute upper respiratory tract infections are caused by viruses
	most common cause of pneumonia in young children, peaking between the ages of 2 and 3 years
	By school age, *M. pneumoniae* become more prevalent

Common viruses associated with commun-ity-acquired atypical pneumonia include *respiratory syncytial virus*, *parainfluenza virus* (children); *influenza A and B* (adults); *adenovirus* (military recruits), and *human metapneumovirus*.

Respir-atory Syncytial Virus (RSV)	member of the paramyxovirus group
	Parainfluenza, mumps, and rubella viruses also belong to this group.
	most often seen in children less than 12 months of age and in older adults with underlying heart or pulmonary disease

Community-Acquired Atypical Pneumonia (cont)

	Almost all children will be infected with RSV by their second birthday.
	infection is rarely fatal in infants
	often goes unrecognized but may play an important role as a forerunner to bacterial infections
	Early attempts to develop an RSV vaccine have been unsuccessful.
	transmitted by aerosol and by direct contact with infected individuals
	most commonly seen in patients during the late fall, winter, or early spring months
	Many times the virus is misdiagnosed in older children, who are given antibiotics that do not produce improvement.
Parainfluenza viruses	related to mumps, rubella, and RSV
	There are five types of parainfluenza viruses: types 1, 2, 3, 4A, and 4B.

Community-Acquired Atypical Pneumonia (cont)

	Types 1, 2, and 3 are the major causes of infections in humans.
	Type 1 is considered a **croup** type of virus.
	Types 2 and *3* are associated with severe infections.
	Although type 3 is seen in persons of all ages, it usually is seen in infants younger than 2 months of age; types 1 and 2 are seen most often in children between the ages of 6 months and 5 years.
	Types 1 and 2 typically occur in the fall, whereas type 3 infection most often is seen in the late spring and summer.
	transmitted by aerosol droplets and by direct person-to-person contact
	known for their ability to spread rapidly among members of the same family
Influenza viruses A and B	most common causes of viral respiratory tract infections

Community-Acquired Atypical Pneumonia (cont)

In the United States, influenza A and B commonly occur in epidemics during the winter months.
Children, young adults, and older individuals are most at risk.
transmitted from person to person by aerosol droplets
Often the first sign of an epidemic is an increase in school absenteeism.
survives well in conditions of low temperatures and low humidity
found in horses, swine, and birds
incubation period of 1 to 3 days and usually cause upper respiratory tract infections
Epidemiologists fear a pandemic of influenza, stating it is an issue of “when” and “where” rather than “if.” The recent epidemic of H1N1 (“swine flu”) is a case in point.

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Community-Acquired Atypical Pneumonia (cont)

Adenovirus	serotypes 4, 7, 14, and 21 cause viral infections and pneumonia in all age groups
	Serotype 7 has been related to fatal cases of pneumonia in children.
	transmitted by aerosol
	Pneumonia caused by adenoviruses generally occurs during the fall, winter, and spring.
Human metapneumovirus (hMPV)	negative single-stranded RNA virus associated with a family of viruses that also includes respiratory syncytial (RSV) virus and parainfluenza virus
	After the respiratory RSV, hMPV is the second most common cause of lower respiratory infections in young children.
	In comparison to RSV, the hMPV tends to occur in older children and is less severe.

Community-Acquired Atypical Pneumonia (cont)

Most patients with hMPV infection have mild symptoms including cough, runny nose or nasal congestion, sore throat, and fever.

More severe cases demonstrate wheezing, difficulty breathing, hoarseness, cough, and pneumonia.

Hospital-Acquired Pneumonia

	• *Nosocomial pneumonia*
	• an infection whose development is caused by the hospital environment
	• Common causes of hospital-acquired pneumonias include **Enterobacteriaceae** (*Klebsiella* spp., *Serratia marcescens*, *Escherichia coli*), ***Pseudomonas* spp.**, and ***Staphylococcus aureus*** (usually methicillin-resistant).
Ventilator-acquired pneumonia (VAP)	*ventilator-associated pneumonia*
	a pneumonia that develops more than 48 to 72 hours after endotracheal intubation

Hospital-Acquired Pneumonia (cont)

Common ventilator-associated infections include *P. aeruginosa*, *Enterobacter*, *Klebsiella*, and *S. aureus*

Concern that the occurrence of VAP is preventable lies as the root of possible reimbursement penalties for hospitals in which it occurs.

Aspiration Pneumonia

Common pathogenic agents associated with *aspiration pneumonia* include anaerobic oral flora (*Bacteroides*, *Prevotella*, *Fusobacterium*, *Peptostreptococcus*), admixed with aerobic bacteria such as *S. pneumonia*, *S. aureus*, *H. influenza*, and *P. aeruginosa*.

Aspiration of gastric fluid with a pH of 2.5 or less causes a serious and often fatal form of pneumonia.

Aspiration of oropharyngeal secretions and gastric fluids are the major causes of anaerobic lung infections.

Aspiration pneumonitis is commonly missed because acute inflammatory reactions may not begin until several hours after aspiration of the gastric fluid.

The inflammatory reaction generally increases in severity for 12 to 26 hours and may progress to **acute respiratory distress syndrome (ARDS)**, which includes interstitial and intraalveolar edema, intraalveolar hyaline membrane formation, and atelectasis.

In the absence of a secondary bacterial infection, the inflammation usually becomes clinically insignificant in approximately 72 hours.

Aspiration Pneumonia (cont)

In 1946, Mendelson first described the clinical manifestations of tachycardia, dyspnea, and cyanosis associated with the aspiration of acid stomach contents.

The clinical picture he described is now known as **Mendelson's syndrome** and is usually confined to aspiration pneumonitis in pregnant women

Aspiration pneumonia

	broadly defined as the pulmonary result of the entry of material from the stomach or upper respiratory tract into the lower airways
	three distinctive forms of aspiration pneumonia, classified according to the **nature of the aspirate**, the **clinical presentation**, and **management guidelines**, as follows:
	1. Toxic injury to the lung (such as that caused by gastric acid)
	2. Obstruction (by foreign body or fluids)
	3. Infection
Aspiration	the presumed cause of nearly all cases of anaerobic pulmonary infections
	Studies suggest that anaerobic bacteria are the most common causative agents of lung abscesses; they are also commonly isolated in cases of empyema.

There is a difference between the aspiration of gastric contents and the aspiration of food. Aspiration of gastric contents causes initial hypoxemia regardless of the pH level of the aspirate.

Aspiration Pneumonia (cont)

Consequently, **oximetry** is a good measurement if aspiration is suspected.

If the pH of the aspirate is relatively high (greater than 5.9), the initial injury is rapidly reversible. Such aspiration occurs in patients who receive antacids or proton pump inhibitors (PPIs).

If the pH is low (pH of unbuffered gastric contents normally ranges from 1 to 1.5), parenchymal damage may occur, with inflammation, edema, and hemorrhage.

When food is aspirated, obliterative bronchiolitis with subsequent granuloma formation occurs.

Gastroesophageal reflux disease (GERD)

regurgitation of stomach contents into the esophagus

causes disruption in nerve-mediated reflexes in the distal esophagus, resulting in alteration of the primary and secondary peristaltic wave and reflux

Therefore "to-and-fro" peristalsis can result from spasticity at the distal esophageal sphincter and retropulsion of middle and upper esophageal contents.

This may result in aspiration, although not necessarily.

three times more prevalent in patients with asthma than in other patients

a frequently unrecognized cause of asthma

Presumably, acid reflux into the esophagus causes vagal stimulation, resulting in a reflexive increase in bronchial tone in patients with asthma.

Aspiration Pneumonia (cont)

Recent literature suggests that asymptomatic reflux does not contribute to worsening lung function, although it and chronic sinusitis are the two most unrecognized causes of chronic cough. GERD causes chronic cough in 10% to 20% of patients.

Normal **swallowing mechanics** has four phases, as follows:

1. Oral preparatory
2. Oral
3. Pharyngeal
4. Esophageal

The first two phases are considered voluntary stages (cerebral). These phases occur as the food or liquid is prepared for entry to the pharynx and esophagus. The airway is open while food is prepared in the oral cavity. Adequate tongue function is important for the manipulation and propulsion of the prepared food or liquid (called a bolus) into the pharynx. Spillage of liquid into the pharynx during the chewing of food is usually not a problem in patients with good airway protection.

The pharyngeal phase (involuntary brain stem function) of swallowing involves numerous physiologic actions that direct the bolus into the esophagus:

- Elevation and retraction of the velopharyngeal port (velum closure)
- Pharyngeal muscle contraction
- Elevation and forward excursion of the larynx (epiglottic closure)

Aspiration Pneumonia (cont)

• Closure of the laryngeal vestibule, false vocal folds, and true vocal folds (laryngeal closure)

• Relaxation of the upper esophageal sphincter (UES)

Airway closure progresses inferiorly to superiorly in the larynx as the food bolus is directed laterally around the airway and into the esophagus.

Respiration is halted during the pharyngeal phase for an approximately 1-second apneic period, although duration varies with bolus volume and viscosity.

Bolus transit in the esophageal phase (under both brain stem and intrinsic neural control) lasts 8 to 20 seconds.

In this phase, the UES relaxes to receive the bolus with a peristaltic wave from the pharyngeal superior constrictor muscles, forcing the bolus through the relaxed UES.

The primary peristalsis propels the bolus through the esophagus and lower esophageal sphincter and into the stomach.

Six cranial nerves carry motor signals generated by cerebral and brain stem swallowing centers:

• V (trigeminal)

• VII (facial)

• IX (glossopharyngeal)

• X (vagus)

• XI (spinal accessory [minor involvement])

• XI (spinal accessory [minor involvement])

The relationship between respiration and swallowing is not random.

Aspiration Pneumonia (cont)

Expiration before and after the pharyngeal phase in normal swallowing is believed to serve as an inherent closure and clearance mechanism against penetration of food or liquids into the airway entrance.

Dysphagia

result of an abnormal swallow that can involve the oral, pharyngeal, and esophageal phases

Penetration into the laryngeal vestibule occurs when food or liquid (or both) enters the larynx but does not pass through the vocal cords into the trachea.

Aspiration is the passage of food or liquid into the trachea via the vocal cords.

Diagnostic tests for dysphagia include the modified barium swallow (MBS), video-fluoroscopy, video-fiberoptic endoscopy, and the modified Evan's blue dye tests.

The **Evan's blue dye test** involves instilling a deep blue dye into the gastrointestinal tract and seeing if it can be suctioned from the trachea. If it can, it suggests a communication between the two structures, such as a fistula.

The MBS and video-fluoroscopy tests are most definitive for identification of the particular phase of the swallow that is dysfunctional.

The modified Evan's blue dye test can be unreliable (as much as 40% of the time) as a test suggesting aspiration in a patient who is tracheostomized.

Both false-positive and false-negative test results occur

Aspiration Pneumonia (cont)

A compromised respiratory system can cause dysphagia and, conversely, dysphagia may cause respiratory complications. COPD can result in a slowed oral and pharyngeal transit time, reduced coordination and strength of the oral and pharyngeal musculature, and reduced airway clearance by coughing.

Treatment of dysphagia is specific to the nature of the disorder.

Varied methods of presentation of foods and liquids, bolus volumes and consistency, postural movements, and food temperature can affect the dynamics of the relation between respiration and swallowing.

Large volumes of liquid requiring uninterrupted swallowing result in longer apneic periods and can be difficult for patients with shortness of breath and dyspnea.

Small-volume bites and swallows make sense in this setting.

Unilateral cerebrovascular accidents (strokes) and hemorrhage tend to cause hypopharyngeal hemiparesis.

Difficulty in swallowing (with impairment of the oral phase) and aspiration of thin fluids therefore may follow.

The facial and tongue weakness can result in poor bolus control in the oral cavity.

Silent aspiration

aspiration that does not evoke clinically observable adverse symptoms such as overt coughing, choking, and immediate respiratory distress

Some patients have silent aspiration after a stroke.

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Aspiration Pneumonia (cont)

Evidence also suggests that some sequelae of stroke include laryngopharyngeal sensory deficits with no subjective or objective evidence of dysphagia, such as choking, gagging, or cough.

Some patients with severe and bilateral sensory deficits develop aspiration pneumonia.

The clinical findings of **dysphonia**, **dysarthria**, abnormal gag reflex, abnormal volitional cough, cough after swallow, and voice change after swallow all significantly relate to aspiration and are predictors of silent aspiration.

Conversely, a normal reflex cough after a stroke indicates an intact laryngeal cough reflex, a protected airway, and low risk for developing aspiration pneumonia with oral feeding.

The cough reflex is significantly reduced in older patients.

Patients with a **tracheostomy** are at high risk for silent aspiration.

Perhaps 55% to 70% of intubated or tracheostomy patients aspirate.

A tracheostomy tube has a direct effect on the pharyngeal phase of a swallow because of the alteration of normal respiratory function (exhalation timing) as well as the anatomic alteration and the physical resistance imposed by the tracheostomy tube itself.

Normal laryngeal elevation is reduced, particularly with the cuff inflated, which leads to inadequate airway closure and increased pharyngeal residue.

Poor sensory response to material entering the larynx contributes to the slowing of an uncoordinated laryngeal closure.

Aspiration Pneumonia (cont)

The protective cough may be lessened because of the impaired laryngeal sensation. Subglottic air pressure (coordinated exhalation with swallow) helps prevent entry of material into the trachea and is reduced in patients with a tracheostomy. An inflated cuffed tracheostomy can cause complications that can anchor the larynx to the anterior wall of the neck and desensitize the pharynx. Delayed triggering of the swallowing response and increased pharyngeal residue are prevalent.

Recommendations for oral feeding include considerations of dietary consistency, specifically defined for solids and liquids; skilled supervision with oral intake; safe swallowing strategies; positioning requirements; cuff deflation; and tracheal occlusion issues. It may be necessary to coordinate mealtime with ventilator weaning attempts to optimize more positive pressure generation to aid in expelling laryngeal residue and creating subglottic pressure.

The dynamic changes a patient may experience clinically necessitate a coordinated team approach, including physical, occupational, and respiratory therapists; a speech-language pathologist; registered dietitian; and nurse.

This approach allows for effective management of tracheostomy and non-tracheostomy patients and avoidance of aspiration

Chronic Pneumonia

A localized lesion in patients with a normal immune system, with or without regional lymph node involvement.

Patients with chronic pneumonia usually have **granulomatous inflammation**, which is often due to bacteria (e.g., *M. tuberculosis*) or fungi.

Chronic Pneumonia (cont)

In patients whose immune system is compromised, the dissemination of the causative organism throughout the body is the usual presentation.

Tuberculosis is by far the most important organism within the category of chronic pneumonias.

The World Health Organization (WHO) estimates that tuberculosis causes 6% of all deaths worldwide, making it the *most common cause of death resulting from a single infectious agent*.

Chronic pneumonias associated with **granulomas** include tuberculosis and fungal diseases of the lung.

Tuberculosis	an infectious disease caused by *Mycobacterium tuberculosis*.
	M. tuberculosis is a slender, rod-shaped aerobic organism.
	Predisposing factors of tuberculosis include homelessness, drug abuse, and acquired immunodeficiency syndrome (AIDS).
	The initial response of the lung is an inflammatory reaction that is similar to any acute pneumonia.

Because most fungi are aerobes, the lung is a prime site for fungal infections.

Primary fungal pathogens include *Histoplasma capsulatum*, *Coccidioides immitis*, and *Blastomyces dermatitidis*.

In addition, the **opportunistic yeast pathogens** *Candida albicans*, *Cryptococcus neoformans*, and *Aspergillus* may also cause pneumonia in certain patients.

C. albicans	occurs as normal flora in the oral cavity, genitalia, and large intestine
	rarely seen in the tracheobronchial tree or lung parenchyma

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Chronic Pneumonia (cont)

	In patients with AIDS, however, *C. albicans* commonly causes an infection of the mouth, pharynx, esophagus, vagina, skin, and lungs.
	A *C. albicans* infection of the mouth is called ***thrush***; it is characterized by a white, adherent, patchy infection of the membranes of the mouth, gums, cheeks, and throat.
C. neoformans	proliferates in pigeon droppings, which have a high nitrogen content, and readily scatters into the air and dust
	Today, the highest rate of cryptococcosis occurs among patients with AIDS and persons undergoing steroid therapy.
Aspergillus	The molds of the genus *Aspergillus* may be the most pervasive of all fungi—especially ***Aspergillus fumigatus***.
	found in soil, vegetation, leaf detritus, food, and compost heaps
	Persons who breathe the air of granaries, barns, and silos are at the greatest risk.
	Aspergillus infection usually occurs in the lungs.
	almost always an opportunistic infection and lately has posed a serious threat to patients with AIDS

Chronic Pneumonia (cont)

When fungal organisms are inhaled, the initial response of the lung is an inflammatory reaction similar to that produced by any acute pneumonia.

Nocardia

gram-positive, rod-shaped bacteria that can be found worldwide in soils that are rich with organic matter

It has a total of 85 species.

also found in healthy gingiva and periodontal pockets

Most *Nocardia* infections occur as an opportunistic infection in patients with weak immune systems, such as small children, the elderly, and the immunocompromised (most common in patients with HIV).

Actinomyces

normally present in the gingival area and are common opportunistic pathogens of humans, particularly in the oral cavity (e.g., infections associated with dental procedures and oral abscesses)

In rare cases, these bacteria can cause ***actinomycosis***, a disease characterized by the formation of abscesses in the mouth, lungs, or the gastrointestinal tract.

Necrotizing Pneumonia and Lung Abscess

Cytomegalovirus (CMV)

	a member of the herpesvirus family, is the most common viral pulmonary complication of AIDS
	CMV infection commonly coexists with ***Pneumocystis carinii*** infection.

Pneumocystis jirovecii

	also known as *Pneumocystis carinii*
	an opportunistic, often fatal, form of pneumonia seen in patients who are profoundly immunosuppressed
	Although the *Pneumocystis* organism has been identified as a protozoan, recent information suggests that it is more closely related to fungi.
Pneumocystis	can normally be found in the lungs of humans, but it does not cause disease in healthy hosts, only in individuals whose immune systems are critically impaired
Pneumocystis pneumonia	the major pulmonary infection seen in patients with AIDS and HIV infection

In vulnerable hosts the disease spreads rapidly throughout the lungs.

Necrotizing Pneumonia and Lung Abscess (cont)

Before AIDS, *P. carinii* pneumonia was seen primarily in patients with malignancy, in organ transplant recipients, and in patients with diseases requiring treatment with large doses of immunosuppressive agents.

Today, most cases of *P. carinii* pneumonia are seen in patients with AIDS.

The **early clinical manifestations** of *Pneumocystis* in patients with AIDS are indistinguishable from those of any other pneumonia.

Signs and Symptoms include progressive exertional dyspnea, a dry cough that may or may not produce mucoid sputum, difficulty in taking a deep breath (not caused by pleurisy), and fever with or without sweats.

The therapist may hear **normal breath sounds on auscultation** or **end-inspiratory crackles**.

The chest x-ray film may be **normal at first**; later it will show **bilateral interstitial infiltrates**, which may progress to **alveolar filling** and **"white out"** of the chest x-ray film.

Mycobacterium avium complex (MAC)

a serious opportunistic infection that is caused by the following two similar bacteria: *Mycobacterium avium* and *Mycobacterium intercellulare*

found in the soil and dust particles

MAC is commonly found in patients with AIDS.

Necrotizing Pneumonia and Lung Abscess (cont)

The **mode of infection** is usually **inhalation** or **ingestion**.

can spread through the bloodstream to infect lymph nodes, bone marrow, the liver, the spleen, spinal fluid, the lungs, and the intestinal tract

Typical symptoms of MAC include fever, night sweats, weight loss, fatigue, anemia, diarrhea, and enlarged spleen.

Invasive Aspergillosis

general term used for a wide variety of infections caused by the fungi of the genus *Aspergillus*

The most common forms are **allergic bronchopulmonary aspergillosis**, **pulmonary aspergilloma**, and **invasive aspergillosis**.

Most humans inhale *Aspergillus* spores every day

However, in individuals who are immunocompromised, an aspergillosis pneumonia often develops.

Invasive Candidiasis

general term describing fungal infections caused by a variety of species of the genus *Candida*, most often by *Candida albicans*, a **yeastlike fungus**

Necrotizing Pneumonia and Lung Abscess (cont)

These fungi are normally found in the mouth, vagina, and intestines of healthy individuals.

Under normal circumstances, the normal bacteria in these areas keep the amount of *Candida* species in balance.

However, in patients with a weakened immune system (such as people with HIV/AIDS), the fungi can invade tissue that normally would be resistant to infection—thus, producing an opportunistic infection.

Candida infections can involve any part of the body

In some cases, the fungus enters the bloodstream and causes invasive disease affecting internal body organs such as the kidneys, spleen, lungs, liver, eyes, meninges, brain, and heart valves.

Other Causes

Rickettsiae

small, pleomorphic coccobacilli

Most rickettsiae are intracellular parasites possessing both ribonucleic acid (RNA) and deoxyribonucleic acid (DNA).

Necrotizing Pneumonia and Lung Abscess (cont)

There are several pathogenic members of the *Rickettsia* family: *Rickettsia rickettsii* (Rocky Mountain spotted fever), *Rickettsia akari* (rickettsialpox), *Rickettsia prowazekii* (typhus), and *Rickettsia burnetii*, also called *Coxiella burnetii* (Q fever).

All species of the genus *Rickettsia* are unstable outside of cells except for *R. burnetii* (Q fever), which is extremely resistant to heat and light.

Q fever can cause pneumonia as well as a prolonged febrile illness, an influenza-like illness, and endocarditis.

The organism is commonly transmitted by arthropods (lice, fleas, ticks, mites). It may also be transmitted by cattle, sheep, and goats and possibly in raw milk.

Varicella (Chickenpox)

varicella virus	usually causes a benign disease in children aged 2 to 8 years, and complications of varicella are not common

Necrotizing Pneumonia and Lung Abscess (cont)

In some cases, however, varicella has been noted to spread to the lungs and cause a serious secondary pneumonitis.

The mortality rate of varicella pneumonia is about 20%.

Rubella (Measles)

Measles virus spreads from person to person by the respiratory route.

Respiratory complications are often encountered in measles because of the widespread involvement of the mucosa of the respiratory tract (e.g., excessive bronchial secretions and infection).

Severe Acute Respiratory Syndrome

In 2002, China reported the first case of **severe acute respiratory syndrome (SARS)**.

Shortly after this report, the disease was documented in numerous countries, including Vietnam, Singapore, and Indonesia. Both the United States and Canada have reported imported cases.

Health officials believe that the cause of SARS is a newly recognized virus strain called a **coronavirus**.

Necrotizing Pneumonia and Lung Abscess (cont)

Other viruses, however, are still under investigation as potential causes.

Coronaviruses are a group of viruses that have a halolike or corona-like appearance when observed under an electron microscope.

Known forms of coronavirus cause common colds and upper respiratory tract infections.

SARS is highly contagious on close personal contact with infected individuals.

It spreads through droplet transmission by coughing and sneezing.

SARS might be transmitted through the air or from objects that have become contaminated.

The incubation period for SARS is typically 2 to 7 days

Initially, the patient usually develops a fever (>100.4 °F or >38.0 °C), followed by chills, headaches, general feeling of discomfort, and body aches.

Toward the end of the incubation period, the patient with SARS usually develops a dry, nonproductive cough, shortness of breath, and malaise.

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Necrotizing Pneumonia and Lung Abscess (cont)

In severe causes hypoxemia develops.

According to the Centers for Disease Control and Prevention (CDC), 10% to 20% of patients with SARS require mechanical ventilation.

In spite of this fact, death from SARS is rare.

No specific treatment recommendations exist at this time.

The CDC, however, recommends that patients with SARS receive the same treatment used for any patient with serious community-acquired atypical pneumonia of unknown cause

Lipoid Pneumonitis

The aspiration of mineral oil, used medically as a lubricant, has also been known to cause **pneumonitis–lipoid pneumonitis**.

The severity of the pneumonia depends on the type of oil aspirated.

Oils from animal fats cause the most serious reaction, whereas oils of vegetable origin are relatively inert.

Necrotizing Pneumonia and Lung Abscess (cont)

When mineral oil is inhaled in an aerosolized form, an intense pulmonary tissue reaction occurs.

Avian Influenza A

(also called ***bird flu*** and ***H5N1***)

a subtype of the A strain virus and is highly contagious in birds.

Historically, bird flu has not been known to infect humans.

However, in Hong Kong in 1997 the first avian influenza virus to infect humans directly was reported.

This outbreak was linked to chickens and classified as avian influenza A (H5N1).

Since the Hong Kong outbreak, the bird flu virus has been reported in parts of Europe, Turkey, Romania, the Near East, and Africa.

Many of the infected people have died.

Experts are concerned that if the avian flu virus continues to spread, a worldwide pandemic outbreak could occur.

Necrotizing Pneumonia and Lung Abscess (cont)

People with bird flu may develop life-threatening complications,such as viral pneumonia and ARDS (the most common cause of bird flu–related deaths).

General Management of Pneumonia

treatment of pneumonia is based on

(1) the specific cause of the pneumonia, and

(2) the severity of symptoms demonstrated by the patient

For bacterial pneumonia	first line of defense is usually an antibiotic prescribed by the attending physician

Although there are a few viral pneumonias that may be treated with antiviral medications, the recommended treatment is usually the same as for the flu—bed rest and plenty of fluids.

In addition, over-the-counter medications are often helpful to reduce fever, treat aches and pains, and depress the dry cough associated with pneumonia.

In severe pneumonia, hospitalization may be required.

Respiratory Care Treatment Protocols

Oxygen Therapy Protocol

- used to treat hypoxemia, decrease the work of breathing, and decrease myocardial work
- Because of the hypoxemia associated with pneumonia, supplemental oxygen may be required.

By **gnvr** (Guenevere)
cheatography.com/guenevere/

Published 21st October, 2022.
Last updated 21st October, 2022.

Respiratory Care Treatment Protocols (cont)

- The hypoxemia that develops in pneumonia is most commonly caused by alveolar consolidation and capillary shunting associated with the disorder.
- Hypoxemia caused by capillary shunting is at least partially refractory to oxygen therapy.

Lung Expansion Therapy Protocol

- Lung expansion therapy may be administered to attempt to offset the atelectasis associated with some pneumonias, but its effects are not consistently good.

Thoracentesis

- Diagnostic and therapeutically, thoracentesis may be used if a pleural effusion is present
- From a diagnostic standpoint, fluid samples may be examined for the following:
  - Color
  - Odor
  - RBC count
  - Protein
  - Glucose
  - Lactic dehydrogenase (LDH)
  - Amylase
  - pH
  - Wright's, Gram, and acid-fast bacillus (AFB) stains
  - Aerobic, anaerobic, tuberculosis, and fungal cultures
  - Cytology
- Therapeutic thoracentesis may be used to encourage lung reexpansion when atelectasis is part of the clinical prese