

# Infections of respiratory tract

# Upper Respiratory Tract Infections

- common cold
  - pharyngitis
  - epiglottitis - serious diseases in children and young infants
  - laryngotracheitis
- 
- winter
  - indoor crowding facilitates transmission

# Common cold

- most prevalent
- most caused by viruses
- Rhinoviruses - 100 serotypes - 25% of colds in adults
- Coronaviruses - 10% of cases
- Parainfluenza viruses, Respiratory Syncytial Virus, adenoviruses  
influenza
- seasonal variations
- cause of 30% to 40% of cold syndromes has not been determined

# Common cold – microbiologic diagnosis

- based on the symptoms
- eosinophils - absent in nasal secretions
- possible to isolate viruses - rarely used

# Sinusitis

- acute inflammation- one or more paranasal sinuses
- often follows common cold
- Predisposition - deviation of the nasal septum, presence of foreign bodies, polyps, tumors
- infection of maxillary sinuses – after dental extractions
- bacterial agents - *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*, *Staphylococcus aureus*, *Streptococcus pyogenes*, gram-negative organisms and anaerobes
- Chronic sinusitis - aerobic and anaerobic organisms

# Sinusitis – microbiologic diagnosis

- clinical findings
- bacterial culture of the nasal discharge - not helpful – contaminated by nasal flora
- chronic sinusitis - dental examination, sinus x-rays
- antral puncture - sinusal specimens for bacterial culture

# Otitis externa, otitis media

- infection of external auditory canal
- Otitis externa - *Staphylococcus epidermidis*, *Staphylococcus aureus*, diphtheroids and occasionally an anaerobic organism, *Propionibacterium acnes*
- moist and warm environment - (Swimmer's ear) - *Pseudomonas aeruginosa*
- otitis media - *Streptococcus pneumoniae*, *Hemophilus influenzae*, *Moraxella catarrhalis*
- *Mycoplasma pneumoniae* - hemorrhagic bullous myringitis

# Otitis externa, otitis media

- history, clinical symptomatology, physical examinations
- Inspection of tympanic membrane
- discharge, ear wax and debris must be removed
- routine cultures are not necessary - consistently the same microbial pathogens
- tympanocentesis (needle aspiration) - for microbiologic culture – for immunocompromised patients, not responding to antimicrobial therapy

# Pharyngitis

- inflammation of the pharynx involving lymphoid tissues of the posterior pharynx and lateral pharyngeal bands
- Most cases - **viral** infections - accompany common cold, influenza
- Type A coxsackieviruses - ulcerative pharyngitis in children (herpangina)
- adenovirus and herpes simplex virus- less common - severe pharyngitis
- Epstein-Barr virus, cytomegalovirus infections
- Bacteria - **Group A beta-hemolytic streptococcus (*Streptococcus pyogenes*)** , *Corynebacterium diphtheriae*, mixed anaerobic infections (Vincent's angina), *Corynebacterium haemolyticum*, *Neisseria gonorrhoeae*, and *Chlamydia trachomatis*, *Chlamydia pneumoniae* , *Mycoplasma pneumoniae*
- *Fungi* - *Candida albicans*- oral candidiasis or thrush, can involve the pharynx,

# Pharyngitis – microbiological diagnosis

- identify cases - group A beta-hemolytic strepto
- various forms of pharyngitis - cannot be distinguished on clinical grounds
- routine throat cultures for bacteria - sheep blood and chocolate agar
- Thayer-Martin medium – *N. gonorrhoeae*
- viral cultures - not routinely obtained
- serologic studies – to confirm the diagnosis of viral, mycoplasmal or chlamydial pathogens
- rapid diagnostic tests - fluorescent antibody, latex agglutination
- gene probe, PCR - to detect unusual organisms - *M. pneumoniae*, chlamydia, viruses

# Epiglottitis and Laryngotracheitis

- Inflammation of the upper airway - epiglottitis or laryngotracheitis (croup) - location, clinical manifestations, and pathogens
- **Epiglottitis** - *Haemophilus influenzae* type b - the most common - children age 2 to 5 years
- laryngotracheitis – viruses – Parainfluenza, Respiratory syncytial virus, adenoviruses, influenza viruses, enteroviruses
- laryngotracheitis - bacteria - *H influenzae* type b, group A beta-hemolytic streptococcus, *C. diphtheriae* *Mycoplasma pneumoniae*

# Epiglottitis and Laryngotracheitis – microbiological diagnosis

- *Haemophilus influenzae* type b - isolated from blood or epiglottis
- blood culture should always be performed
- serologic studies - rise in antibody titers to viruses - retrospective diagnosis
- rapid diagnostic techniques - immunofluorescent-antibody staining - virus in sputum, pharyngeal swabs, or nasal washings,
- Enzyme-linked immunosorbent assay (ELISA), DNA probe, PCR

# Lower respiratory tract infections

- bronchitis
  - bronchiolitis
  - pneumonia
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- viruses, mycoplasma, rickettsiae and fungi
  - **bacteria** - dominant pathogens

# Bronchitis and bronchiolitis

- inflammation of the bronchial tree
- **bronchitis** - preceded by URT infection - or part of influenza, rubeola, rubella, pertussis, scarlet fever, typhoid fever
- chronic bronchitis - combination of environmental factors (smoking), and bacterial infection – ***H. influenzae*** and ***S. pneumoniae***
- **bronchiolitis** - **viral** - infants and - **respiratory syncytial virus**
- other viruses – parainfluenza, influenza, adenoviruses

# Bronchitis and bronchiolitis – microbiological diagnosis

- culture - purulent respiratory secretions
- chronic bronchitis - sputum cultured for bacteria
- aspirations of nasopharyngeal secretions or swabs - specimens for viral culture (infants with bronchiolitis)
- serologic - rise in antibody titer to specific viruses
- rapid diagnostic tests - fluorescent-antibody staining, ELISA or DNA probe procedures

# Pneumonia

- **Bacterial pneumonia**
  - **Aspiration pneumonia**
  - **Atypical pneumonias**
  - **Other pneumonias**
- 
- **Mycobacterium tuberculosis**

# Bacterial, viral and fungal pneumonia

<b>Bacterial pneumonia</b>	<b>Viral pneumonia</b>	<b>Fungal pneumonia</b>
<p>It is the most common type. Prior viral infections like cold or flu or a weak immune system may trigger its development.</p>	<p>Usually mild and goes away on its own within a few weeks. The risk of getting bacterial pneumonia increases if you have viral pneumonia.</p>	<p>More common in people with chronic health issues or weakened immune system.</p>
<p>A few examples of bacteria causing pneumonia include:</p> <ul style="list-style-type: none"><li>• Streptococcus pneumoniae</li><li>• Legionella pneumophila; often called Legionnaires' disease</li><li>• Mycoplasma pneumoniae</li><li>• Chlamydia pneumoniae</li><li>• Haemophilus influenzae</li></ul>	<p>Different viruses causing pneumonia include:</p> <ul style="list-style-type: none"><li>• Respiratory syncytial virus (RSV)</li><li>• Some common cold and flu viruses</li><li>• SARS-CoV-2, the virus that causes COVID-19</li></ul>	<p>Following could be some of the types:</p> <ul style="list-style-type: none"><li>• Pneumocystis pneumonia (PCP)</li><li>• Coccidioidomycosis, which causes valley fever</li><li>• Histoplasmosis</li><li>• Cryptococcus</li></ul>

# Aspiration pneumonia

- inhaling saliva, food, liquid, vomit and even small foreign objects
- If left untreated - complications - even fatal
- Bacteria from saliva and secretions from mouth and nose
- Stomach contents - digestive juices or vomit
- Food or beverages.
- Small foreign objects

# Atypical pneumonias

- *Mycoplasma pneumoniae* - people younger than age 40.
- *Chlamydophila pneumoniae*
- *Legionella pneumophila* - middle-aged and older adults - Legionnaire disease

# Infections of GIT

- viral, bacterial, parasitic
- Gastroenteritis – stomach, small intestine
- Symptoms - **diarrhea, vomiting, abdominal pain, dehydration**
- Rapid diagnosis, appropriate treatment , infection control

# Pathogens Associated with Infectious Gastritis

## *Viruses*

Cytomegalovirus

Immunocompromised patients

Erosive gastritis

Herpes simplex virus

- AIDS

- Cancer

Varicella-zoster virus

- Immunosuppressive therapies

# Pathogens Associated with Infectious Gastritis

## ***Bacteria***

*Streptococcus*

- Large intake of alcohol
- Upper respiratory tract infection, AIDS, and other immunocompromised states

**Necrotizing gastritis**

*Escherichia coli*

Enterobacteriaceae

*Staphylococcus aureus*

*Mycobacterium tuberculosis*

Endemic area

**Erosive and fibrosing gastritis with necrotizing granulomas**

*Helicobacter pylori*

General population

**Chronic active gastritis**

*Helicobacter heilmannii*

*Mycobacterium avium*

AIDS

**Ill-formed granulomas**

*Actinomyces*

**Suppurative and mass-forming gastritis**

Syphilis

Sexually transmitted disease

**Diffuse inflammatory gastritis**

*Clostridium perfringens, E. coli,*

*Streptococcus, Enterobacter,*

*Pseudomonas aeruginosa*

- Gastroduodenal surgery
- Corrosive material
- Gastrointestinal infarction

**Emphysematous gastritis**

# Pathogens Associated with Infectious Gastritis

## *Fungi*

### *Candida*

- Cancer
- Immunocompromised patient
- Severe alcoholism
- Corrosive gastritis

Aphthous, or linear ulcerations or even larger ulcers.

### *Histoplasma capsulatum*

- Cancer
- Immunocompromised patient
- Corrosive gastritis

Inflammatory mass.

### Phycomycosis

- Immunocompromised patient
- Corrosive gastritis

Ulceration and hemorrhagic necrosis

# Pathogens Associated with Infectious Gastritis

## *Parasites*

Cryptosporidiosis

AIDS

Minimal inflammation

*Strongyloides stercoralis*

Immunosuppressed patient (e.g., AIDS, diabetes)

Diffuse mucosal involvement

Anisakiasis

Consumption of raw shellfish

Eosinophilic and  
granulomatous gastritis

*Ascaris lumbricoides*

Gastric outlet obstruction

# *Helicobacter pylori*–associated Chronic Gastritis

- gram-negative rod, comma-shaped or slightly spiral
- infect gastric mucosa - chronic gastritis
- Majority of patients - without any symptoms.
- gastritis progresses - gastric
- patients with chronic atrophic gastritis have up to a 16-fold increased risk of developing gastric cancer.

# Infestions of small bowel

- **Viruses** : Norovirus, Rotavirus, Adenovirus, Astrovirus.
- **Bacteria**: Salmonella, Shigella, E. coli, C. jejuni, C. difficile, S. aureus
- **Parasites**: Giardia, Cryptosporidium, Cyclospora
- **Fungi**: Candida, Aspergillus, Histoplasma capsulatum

# Small intestinal bacterial overgrowth (SIBO)

- more prevalent digestive disorder - 64% patients with irritable bowel syndrome (IBS)
- Definition - bacterial population in the small intestine that exceeds  $10^5$ – $10^6$  organisms/ml, contains certain types of organisms, specifically coliform bacteria. (small intestine - less than  $10^5$  bacteria/ml, large intestine -  $10^{14}$  bacteria/ml)
- symptoms - from mild (constipation, gas, bloating) to - chronic diarrhea, weight loss, malabsorption
- SIBO occurs - abnormal gastric acid secretion and/or intestinal clearance
- predisposition - achlorhydria (from autoimmune or iatrogenic causes or surgery), diverticulosis, systemic diseases (e.g. celiac disease, Crohn's disease), intestinal obstruction, immune deficiency states (including secretory IgA deficiency), and alcoholism

# Infections of colon

- **Bacterial** infections: *Campylobacter jejuni*, *Salmonella*, *Shigella*, *Escherichia coli* (including these subgroups - enterotoxigenic *E. coli*, enteropathogenic *E. coli*, enterohemorrhagic *E. coli*, enteroinvasive *E. coli*, enteroaggregative *E. coli*), *Yersinia enterocolitica*, *Clostridium difficile*, and *Mycobacterium tuberculosis*
- **Viral** infection: *Norovirus*, *Rotavirus*, *Adenovirus*, *Cytomegalovirus* (CMV)
- **Parasitic** infection :*Entamoeba histolytica* (causes amoebic colitis)

# Recommendations for the diagnosis of diarrheal illnesses

Evaluate severity and duration  
Obtain history and physical examination<sup>1-5</sup>  
Treat dehydration  
Report suspected outbreaks<sup>6</sup>  
Check all that apply:<sup>7</sup>

## A. Community acquired or traveler's diarrhea

(esp. if accompanied by significant fever or blood in stool)

Culture or test for:

*Salmonella*

*Shigella*

*Campylobacter*

*E. coli* O157:H7 (if blood in stool also test for Shiga toxin and refer isolates if toxin pos.)

*C. difficile* toxins A ± B (if antibiotics or chemotherapy taken in recent weeks)

Consider quinolone for suspected shigellosis in adults (fever, inflammation); macrolide for suspected resistant *Campylobacter*; avoid antimotility or certain antimicrobial drugs if suspected STEC (afebrile, bloody diarrhea)<sup>8</sup>

## B. Nosocomial diarrhea

(onset after >3 d in hospital)

Test for

*C. difficile* toxins A ± B

(In suspect nosocomial outbreaks, in patients with bloody stools, and in infants, also add tests in panel A)

Discontinue antimicrobials if possible; consider metronidazole if illness worsens or persists

## C. Persistent diarrhea >7d

(esp. if immunocompromised)

Consider parasites<sup>9</sup>

*Giardia*

*Cryptosporidium*

*Cyclospora*

*Isospora belli*

+ Inflammatory screen<sup>7</sup>

If HIV pos., add:

*Microsporidia*

(Gram-chromotrope)

*M. avium* complex

+ panel A

Treat per results of tests

# Sources:

- Richard L. Guerrant, at all. Practice Guidelines for the Management of Infectious Diarrhea, *Clinical Infectious Diseases*, Volume 32, Issue 3, 1 February 2001, Pages 331–351, <https://doi.org/10.1086/318514>
- Lauwers G, at all. Infections of the Gastrointestinal Tract. Diagnostic Pathology of Infectious Disease. 2010:215–54. doi: 10.1016/B978-1-4160-3429-2.00009-2. Epub 2010 Apr 28. PMID: PMC7152102.
- <https://microbeonline.com/urea-breath-test-ubt-h-pylori-principle-procedure-results/>