M9 - Respiratory Tract Infection

3 more properties

Learning Objectives

- Understand the major types of pathogenic Respiratory Tract Infection (RTI).
- Recognize the key pathogens of RTI.
- Understand the definition of Endemic, Epidemic, Pandemic

Term	Definition
Endemic	An outbreak that occurs at a predictable rate in a certain area or among a set population. Endemics remain at a steady state, but do not disappear from a population.
Epidemic	Rapid spread amongst a large number of people in a given population. Examples include seasonal influenza epidemics.
Pandemic	The worldwide spread of a new infectious disease. For example, in 2009 a pandemic of swine flu killed 14,286 people worldwide.

Introduction to Respiratory Tract Infection

The Anatomy & Normal Defense Mechanism

	Location	Chinese Translation	Respect Inflammation	Defense Mechanism
Upper Respiratory	Sinus	鼻窦	Sinusitis	
	Tonsils	扁桃体	Tonsillitis	
	Pharynx	咽部	Pharyngitis	
	Larynx	喉部	Laryngitis	Nasopharynx: - **Mucus secretion** - **Nasal hairs** - **Pseudostratified ciliated columnar epithelium** - Saliva - Turbulent air flow
Lower Respiratory	Trachea	气管	Tracheitis	- **Cough and epiglottic reflex** - **Mucus secretion** - **Ig production (IgG, IgM, IgA)** - Sharp-angled branching of airways
	Bronchi	支气管	Bronchitis	
	Bronchioles	细支气管	Bronchiolitis	
	Pleura	胸膜	**Pleurisy**	
	Alveoli & Surrounding	气泡	**Pneumonia**	- **Alveolar macrophages** - **Neutrophils** - **Cell-mediated immunity** - **Alveolar lining fluid** - **Cytokines**

Remarks

- Cell-mediated immunity
  - **Activation of specialized immune cells**, such as *T-lymphocytes*.
- Alveolar Lining Fluid

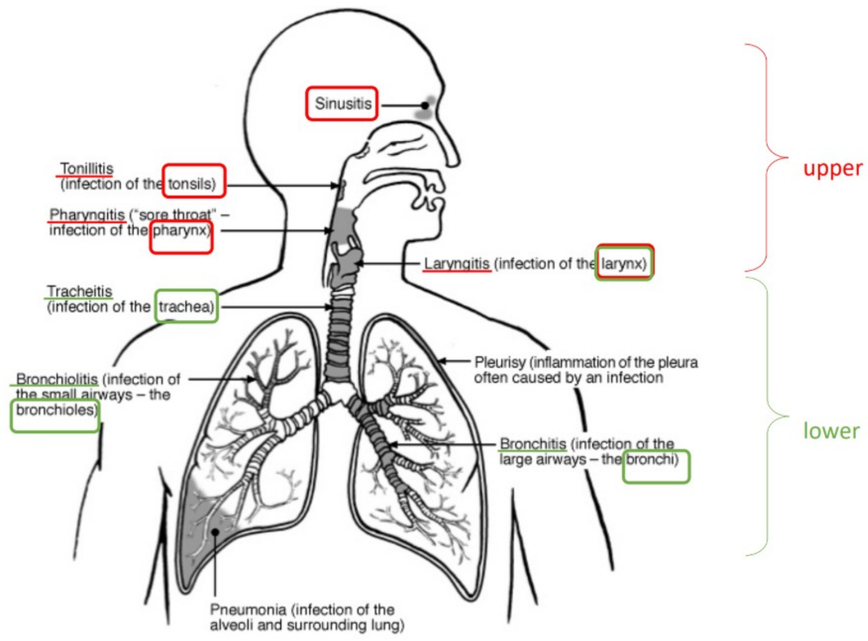
Macrophages	Neutrophils	Cytokines
Ig (Immunoglobulin)	Enzymes	Antimicrobial peptides

- **Pseudostratified ciliated columnar epithelium**

Defense Mechanism	Description
Mucus secretion	Goblet cells in the mucus to trap pathogens
Cilia	Cilia move the trapped mucus up towards the throat
Pseudostratified arrangement	Allows for a higher density of cilia → Ciliary clearance ↑

- **Ig stands for Immunoglobulin.**

	IgG	IgM	IgA
Concentration	Highest concentration in the blood	First antibody produced in response to an infection	Found in body secretions and mucosal surfaces
Function	Enhances phagocytosis Neutralizes toxins Activates complement system	Activates complement system agglutinates microorganisms 激活补体系统、凝集微生物	✓ Localized immunity on mucosal surfaces
Half-life	Long half-life (about 23 days)	Short half-life (about 5 days)	Intermediate half-life (about 6 days)



Classification of Pathogens

> Primary Pathogens & Secondary Pathogens

True pathogens	coronaviruses
	rhinovirus
	Influenza viruses
	Mycobacterium tuberculosis
Opportunistic pathogens Esp. w/ *HIV IM patients*	Penicillium marneffei infection
	Staphylococcus aureus → Upper Respiratory Infection
	Influenza A Virus
	Measles virus

Remarks

- HIV immunocompromised (IM) Patients - Weakened Immune System.
  - HIV attacks and destroys CD4 T cells [Helper T Cell] → More susceptible to infections

> Acute / Chronic

Acute Infection	Most of Bacterial & Viral Infection
	Pneumonia
	Acute Bronchitis
	Acute Exacerbations of Chronic Bronchitis
	Acute Bronchiolitis
Chronic Infection	**Mycobacterium Tuberculosis**
	Fungal Infection — Aspergillus fumigatus
	Cystic fibrosis (囊性纤维化)
	Lung abscess (肺脓肿)
	Pleural effusion (胸腔積水)
	Empyema (積膿)

> Restricted site of infections; Spread/disseminated infections
> > 限制感染部位；传播/扩散感染

Chronic infection- Tuberculosis

> **Anti-tuberculous therapy** - Mycobacterium Tuberculosis -

- Rule of 4-2-2-4 [Min. 4~6 Month Treatment]
  - 4 drugs in the first 2 months
  - 2 drugs in the next 4 months
- Directly observed therapy, short course (DOTS)
  - Patients are directly observed by a healthcare provider while taking their medication.
  - ↑ treatment & ↓ Dev. Drug-resistant
- Problem of drug resistance (MDR and TDR).
  - MDR: Multidrug-Resistant → Resistance to multiple drugs.
  - TDR: Totally Drug-Resistant → Resistant to all available drugs.

Latent and recurrent infection

Definition:

- Latent infections: pathogen remains dormant or inactive for an extended period
  - No exhibit symptoms during this phase
  - Reactivate and cause recurrent infections
    - Weakened immune system

Latent Virus	Target	Related Disease
Epstein-Barr virus (EBV)	B cells	Infectious mononucleosis
		Hodgkin's lymphoma
		Burkitt's lymphoma
	Nasopharyngeal cells	Nasopharyngeal carcinoma
Varicella zoster virus (VZV)	—	Chickenpox/Varicella (水痘)
		Herpes Zoster (shingles) 帶狀疱疹 (生蛇)
Cytomegalovirus (CMV)	Body fluids - Blood - Saliva - Semen - Breast Milk - Urine	Congenital CMV - **Before Birth**

Introduction to Common Upper RTI

Common Cold

Rhinovirus (> 100serotypes)	**Several at any given time**	**ICAM-1 (intercellular adhesion molecule-1)**	Remarks
Coxsackie virus A (24 types) 柯萨奇病毒A型	A21	ICAM-1	★ Common cold ★ Oropharyngeal vesicles ★ **Hand, foot-n-mouth disease (A16, EV71)**
Influenza virus	H3N2, H1N1, B, [C] **@ antigenic drift** **@ antigenic shift**	Sialic acids	★ Flu ★ Aseptic pneumonia ★ Viral pneumonia
Parainfluenza viruses 副流感病毒	1, 2, 3 [4]	Glycosides	
RSV - Respiratory Syncytial Virus 呼吸道合胞病毒			★ Esp. Young and Old
Coronavirus (common) **OC43, 229E** [*SARS Co-V]		Glycoprotein receptors	★ Common cold [***SARS**]
Adenovirus (41 types) 腺病毒	5- 10	Penton fiber binds to cellular receptor	★ Pharyngitis ★ conjunctivitis ★ bronchitis
Echovirus (34 types) 伊科病毒	11, 20		★ Common cold

Upper RTI - Diphtheria

- **Toxin-producing** strains of **Corynebacterium diphtheriae** → **Respiratory Obstruction**
- Treatment: **Antitoxin & Antibiotic (抗毒素和抗生素)**
- Contacts may need **chemoprophylaxis** or **immunization**
  接触者可能需要化学預防或免疫

Pharyngitis

	Streptococcal sore throat	Viral sore throat
Causative Agent	Usually **Streptococcus Pyogenes**	*Depends*
Onset	Abrupt - 突然的 & Malaise - 發熱	Gradual
Throat	Painful	Uncomfortable
Cervical nodes	**Enlarged, tender**	Nil
Eyes and nose	Nil	Watery eyes, runny nose
Throat / tonsils	Hyperemic (高血症) Red, swollen, **Greyish white exudates**	Red, vesicles, ulcers
Treatment	**Penicillin**	*Depends*

Introduction to Common Upper RTI

Acute bronchitis

> Inflammation condition of the **tracheobronchial tree**

Primary @ URT	Rhinoviruses
	Coronaviruses
Primary @ LRT	Influenza virus
	Adenovirus
	Mycoplasma pneumoniae
Secondary Infection	Streptococcus pneumoniae
	Haemophilus influenzae

Bronchiolitis

> Caused by Virus → Restricted to childhood [Esp. <2Yr]

	Case Percentage	Remarks
RVS	75%	**- No vaccine** **- Antiviral: ribavirin**
Other Viral	25%	

More about Respiratory syncytial virus

1. Cause of bronchiolitis & pneumonia
2. No Vaccine
3. Antiviral: Ribavirin

Pneumonia

> Usually be suffered by Elderly

Type of Pneumonia	Description
Lobar pneumonia	Consolidation of the affected lobes → Streptococcus pneumoniae
Bronchopneumonia	Patchy inflammation of bronchioles and surrounding alveoli
Interstitial pneumonia	Inflammation and thickening of interstitium [which is the tissue between the alveoli.]
Lung abscess	A localized collection of pus → Staphylococcus aureus.

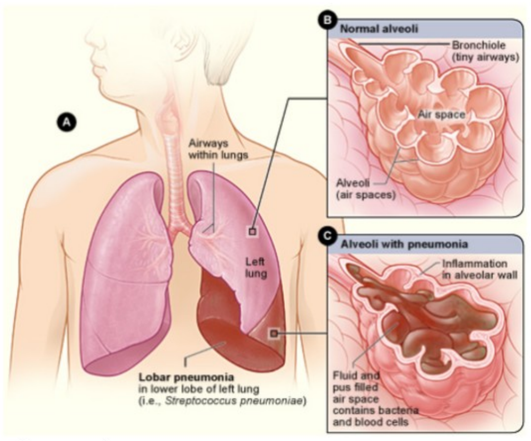
Remarks - Common Causative Agents (Bacteria)

- Legionella pneumophila []
- Streptococcus Pneumonia [16-60%]

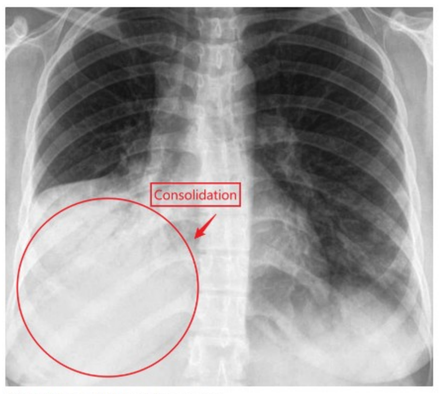
Etiology: Common Pneumonia

> Def: Etiology varies with age, underling disease, occupational and geographic risk factors.

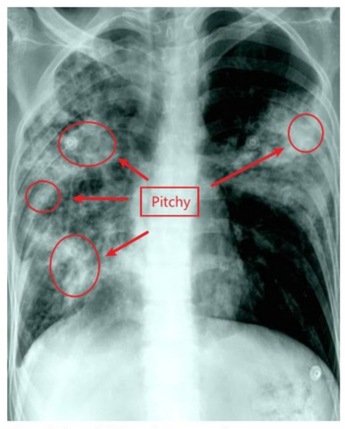
Age Group	Type of Infection
Neonates	Interstitial Pneumonia ← Chlamydia trachomatis [From Mother]
Children	Mainly Viral Infection: - RSV - Parainfluenza
	Bacterial Secondary → Viral RI
Adult	Bacterial causes (Streptococcus Pneumonia) > viral



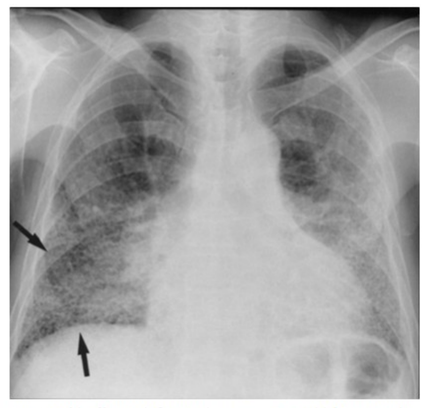
Lobar Pneumonia



Chest X-Ray with Lobar Pneumonia



Chest X-Ray with Bronchopneumonia


Intense white fibrous (inflammation) area — Interstitial Pneumonia

Atypical Pneumonia Syndrome

Characteristic

> **All not Responding to β-Lactam Antibiotics**

- ↑ Course of illness
- Illness Level can be low
  - Severity can be ↑
- "Walking pneumonia":
  - Culture of sputum → No significant pathogens

Pathogens

- Mycoplasma pneumoniae
- SARS coronavirus
- MERS coronavirus
- Influenza virus
- Parainfluenza virus
- Respiratory syncytial virus
- Adenovirus
- Chlamydia spp.
  - Chlamydia pneumoniae
  - Chlamydia psittaci
- Legionella pneumophila