# Respiratory System Module
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## Viral Respiratory Tract Infections
## (B)

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# Paramyxoviruses and other respiratory viruses

Contents:

1. Paramyxoviruses.
2. Coronaviruses.
3. Adenovirus.
4. Rhinovirus.

# Family *Paramyxoviridae*

## Genus *Paramyxovirus*

***1. Paramyxovirus***

*A. Parainfluenza viruses type 1, 3*

*B. Parainfluenza viruses type 2, 4a, 4b*

## Genus *Pneumovirus*

1. Respiratory syncytial virus (RSV)

*2. Human Metapneumovirus (hMPV)*

# Major Respiratory Viruses

1. paramyxoviruses: -ss RNA, non segmented, enveloped.
2. **Adenovirus: double stranded (ds) linear DNA, nonenveloped.**
3. Rhinoviruses: belong to Picornviruses which are +ss RNA, non segmented, non enveloped viruses.
4. Coronaviruses: include Coronavirus and SARS that are +ss RNA enveloped viruses.

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**Paramyxoviruses**

- -ss RNA enveloped viruses.
- Have RNA dependent RNA polymerase.
- The envelop has HA, NA or a fusion protein.
- Pneumoviruses has neither.

# Parainfluenza viruses / PIV

- Heat Labile, but survive on surfaces for several hours
- Highly infectious
- Susceptible to destruction by soap and water, disinfectants.
- Four serotypes 1-4
- Reinfections occur throughout life
- Many remain asymptomatic but infective
- Viral shedding lasts for about 1 week after infection
- Prolonged viral shedding in immunocompromised

# Parainfluenza viruses / PIV

## PIV / Clinically

- Transmitted via resp. secretions leading to a wide spectrum from asymptomatic, common cold to severe Lower resp. Tract infections (LRTI).

1. common cold: sore throat, hoarseness, cough and sometimes mild fever.

2. Croup (acute laryngotracheobronchitis):

  - Age:- typically <6 years of age including infants
  - Involvement of the larynx, subglottic area and trachea
  - Clinical features:- fever, cough, hoarseness, stridor
  - May cause cyanosis and resp. distress mandating tracheostomy.

# Common cold

- **Common cold (rhinitis) is a viral infection.** Infection of the upper respiratory tract (nose, nasopharynx and throat).
- Over 100 viruses can cause common cold.
- Preschool children are at greatest risk of frequent colds.
- Children have an average of 8 colds per year, adults 3 per year.
- Most people recover from common cold within a week or two.

Symptoms of common cold: Sore throat, runny nose, nasal congestion, sneezing, conjunctivitis (sometimes), myalgia, fatigue.

Complications: Secondary bacterial infection (otitis media and sinusitis).

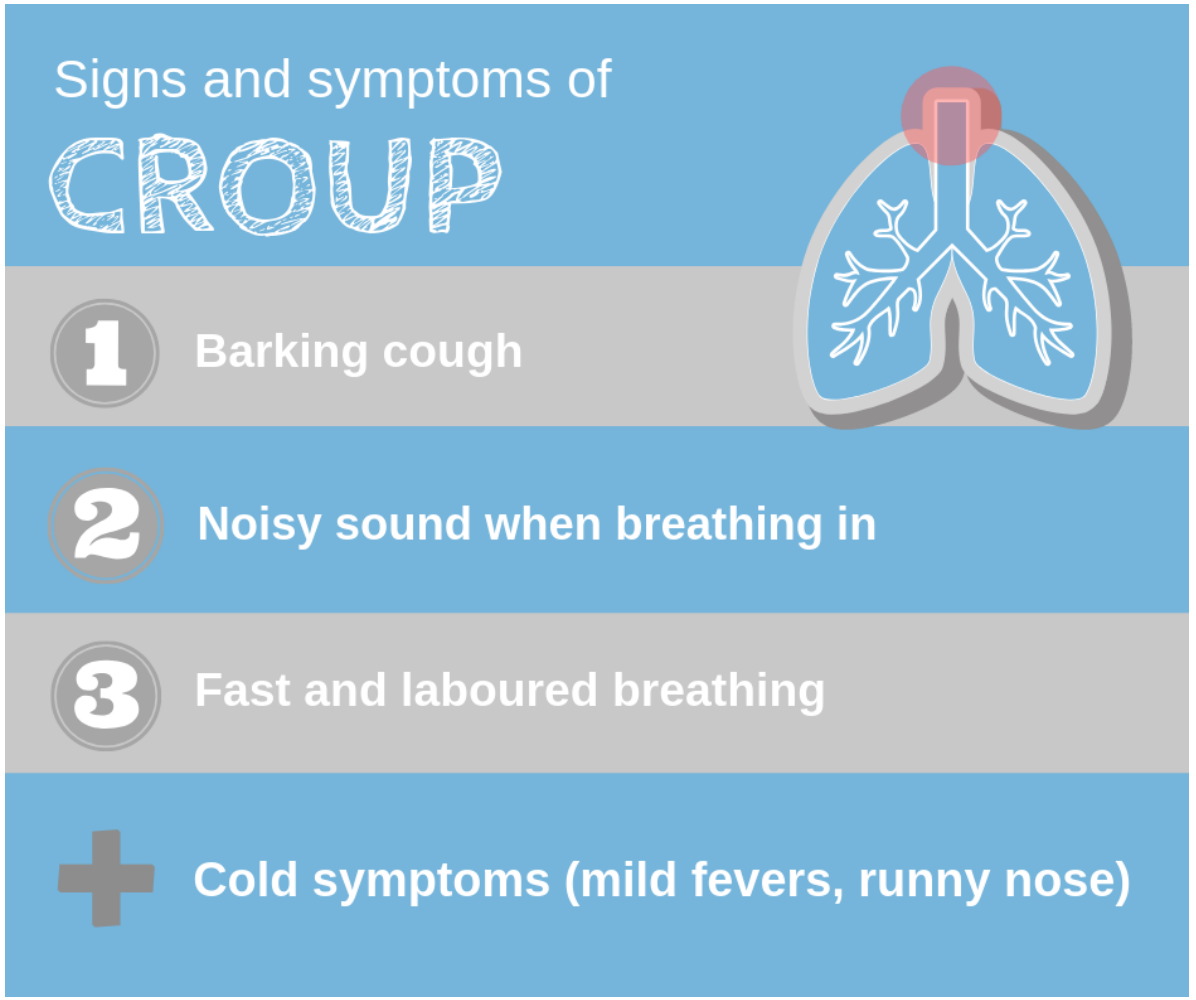
# Croup

**Infection of the Larynx (Laryngitis), Trachea (Tracheitis) and bronchi (bronchitis):**
Almost all cases are caused by viruses esp. Parainfluenza viruses.

- In rare cases: Staphylococcus aureus.
- Children have smaller airways and nonexpendable rings of trachea so **edema** is more likely to cause narrowing of the lumen.
- Typically, mild upper R.T symptoms such as nasal discharge and dry cough are present days before signs of airway obstruction followed by sudden onset of barking cough (seal barking) and difficult respiration.

**Treatment: It is a self-limited infection resolve after 5 to 7 days**

- No specific antiviral drug. Corticosteroids and inhaled aerosolized epinephrine can be used.



# PIV / Clinically

3. Bronchiolitis: Common in young children.
4. Pneumonia: Common in young children and immunocompromised.

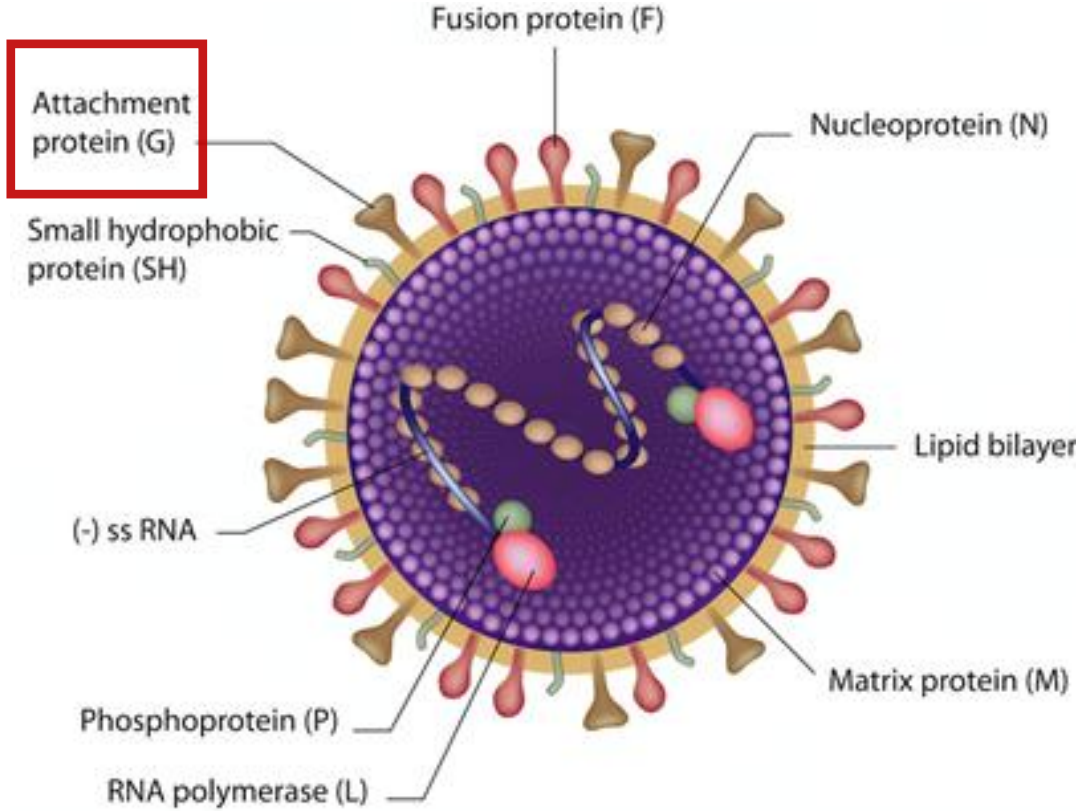
Diagnosis:

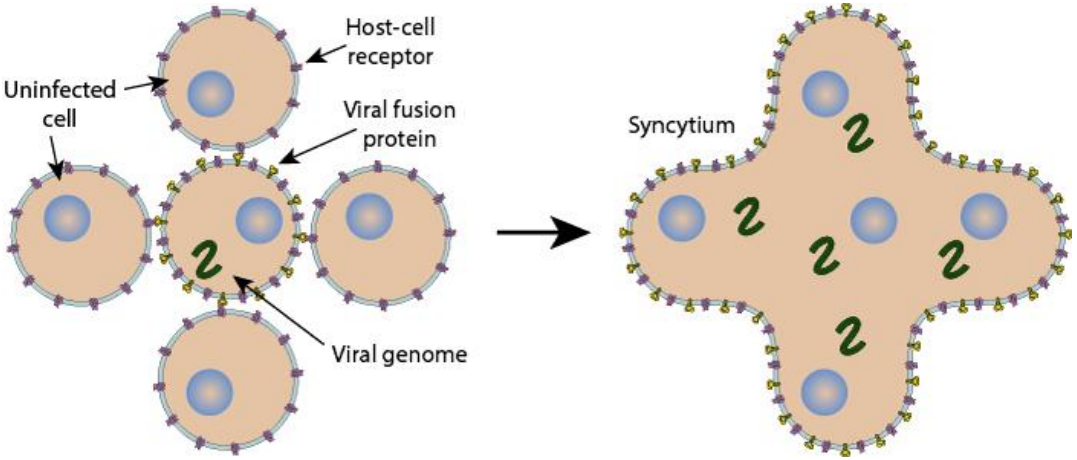
1. Direct detection of the virus antigen (Serology) or RNA by PCR.
2. Culture: less used.

Treatment: supportive.

# Respiratory syncytial virus (RSV)

- Enveloped virus.
- Envelope Glycoproteins: F and G proteins.
- Subgroups ‘A’ and ‘B’ based on variations in G protein (2 subtypes).
- Entry through mucosa of nose and eyes.
- Cell to cell spread within respiratory tract, Syncytium formation with multinucleated giant cells.



# Respiratory syncytial virus (RSV)

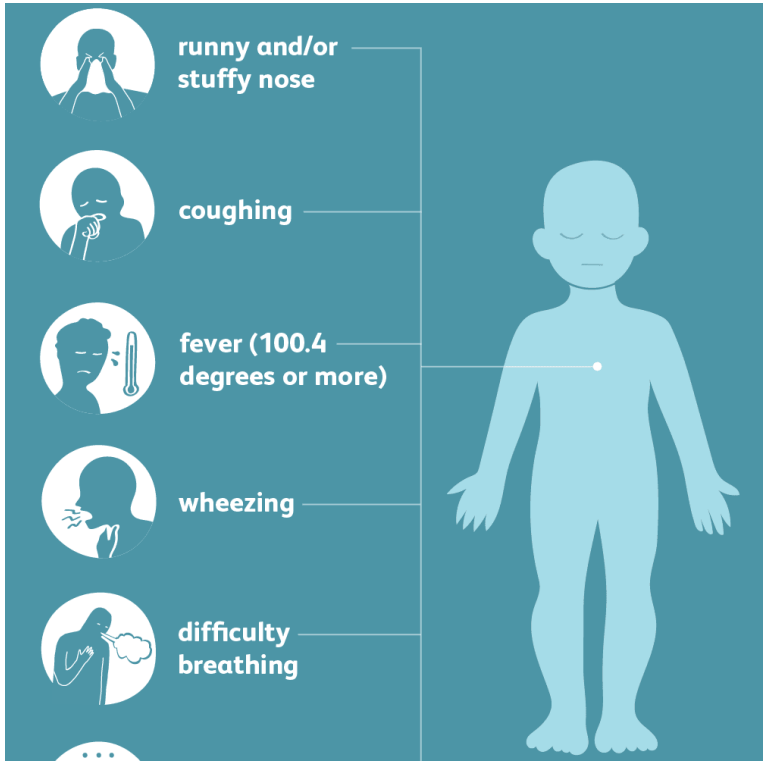
- I.P ~ 2-8 days.
- Mode of transmission: either directly via droplets, or indirectly via objects and fingers.

1. URTI:

- Fever, Rhinitis, Pharyngitis, Otitis media, Croup.

2. LRTI: Bronchiolitis, Pneumonia.

- Common in infants and in those with lung or heart diseases.
- Cough, Poor feeding, lethargy, Hypoxemia
- Respiratory Distress (tachypnea, retractions)
- Apnea, wheezes.



# Respiratory syncytial virus (RSV)

## Diagnosis

- Viral isolation/Culture
- Antigen detection - >90 % sensitivity and specificity
  - ELISA
  - RIA, IF
- PCR.
- CXR: Lung hyperinflation.

## Treatment

**Supportive**

**2. Antiviral Agents**

- Ribavirin (*Virazole*), a synthetic guanosine analogue, given as an aerosol, approved for premature and immunocompromised infants.
- Vulnerable children can be given immunoglobulins (passive immunization) for prevention and treatment.

# Coronaviruses

- Human Coronaviruse and Severe Acute Respiratory Syndrome Coronavirus (SARS CoV).
- Clinical picture:

A. Human Coronavirus:

I.P 2-4 days, symptoms persist for 1-4 days, virus shedding for a week.

1. Common cold (~30% of all common cold cases).

2. CNS involvement?: Multiple sclerosis but not yet fully proved.

# Coronaviruses

B. SARS Coronavirus:

- I.P of nearly a week.
- Respiratory and faecal routes of transmission.
- Starts as fever, myalgia and malaise then progresses to pneumonia and in 20% > ARDS and multiorgans failure.

**Treatment**:

- Supportive including Artificial ventilation if ARDS.
- Ribavirin is debatable.

# Human Metapneumovirus hMPV

- Discovered in Netherland in 2001.
- Similar to RSV at genomic level and clinically.
- Responsible for 10-12% of URTI and LRTI (bronchiolitis, Pneumonia).
- Diagnosis: RT-PCR.
- Treatment: No specific antiviral yet.

# Adenovirus/structure & characteristics

- Non-enveloped ds DNA virus.
- Infects mucoepithelial cells of respiratory, GI and GU tracts
- Enter via epithelium, replicate and spread to lymphoid tissue.
- Viremia occurs with secondary involvement of viscera.

# Adenovirus/structure & characteristics

- Stable in the environment and in GI tract.
- Relatively resistant to disinfection (nonenveloped)
- Persists for long time in adenoids , tonsills & kidneys (latent?). Also, viral shedding in faeces may persist for years.
- Sub-grouped into 6 groups A-F (according to DNA sequence), with 51 serotypes in all the groups.
- certain serotypes are associated with certain infections e.g types 1-4, 7, 14 and 21 are associated with respiratory infections, types 40 & 41 associated with Gut infection, types 8, 19 and 37 associated with epidemic keratoconjunctivitis

# Adenovirus/Epidemiology & clinically

- Many infections are sub-clinical.
- Adenovirus infections reendemic in many parts of the world however, Outbreaks are also common in Military recruits, swimming pool users, hospitals, residential institutions and nursing homes i.e crowded areas.

- IP: ~ 2-14 Days.
- M.O.T:

1. Aerosols droplets
2. Fecal-oral route
3. direct inoculation of the conjunctiva.

# Adenovirus/Clinically

- **Respiratory.**
- **Eye (conjunctivitis, keratoconjunctivitis).**
- **Genitourinary (hemorrhagic cystitis).**
- **Gastrointestinal (gastroenteritis and non bloody diarrhea especially in young children, bowel intussusceotion).**
- Others: **Myocarditis, Pericarditis, Meningitis/Encephalitis, Hepatitis and Rash.**

# Adenovirus respiratory infections

1. subclinical.

2. mild upper respiratory tract infections (URTI):

- Fever, runny nose wheezy chest and cough.
- Pharyngitis, tonsillitis and conjunctivitis.
- Majority are due to types 1-7.
- Usually mild but may progress to a serious Lower resp. Tract infections.

3. lower resp. Tract infections (LRTI):

- Fever, shortness of breath (SOB), cough and wheezing.
- Can be fatal particularly in children.
- can be associated with increased WBC count and C-reactive protein (CRP).

# Adenovirus respiratory infections

## Diagnosis

- Electron microscope: Can not detect the serotype.
- Virus antigen detection in nasopharyngeal aspirates or stool using ELISA.
- Culture: speed of isolation can provide a pointer to the clinical significant, if > days, then unlikely to be significant.
- Serology: detection of 4 fold increase in the antibodies.
- PCR: Sensitive, single or part of a multiplex PCR for most respiratory viruses.

# Adenovirus respiratory infections

## Treatment:

- Infections are usually not life threatening in immunocompetent and no treatment required apart from symptomatic treatment.
- No antiviral available or licensed.

## Prevention:

- Vaccine is not usually necessary as most infections are not serious, Nevertheless;

A vaccine is available for military people and not the civilians.

The vaccine is given orally and it contains 3 serotypes, 4, 7 and 21.

# Rhinovirus/clinically

- Common in preschool children and adults.
- It causes nearly one third of all common colds
- Found all over the year but more in Winter.
- Signs and symptoms (S & S): ‘common cold
- S&S may stay for 1-2 weeks
- Complications as sinusitis and otitis media

# Diagnosis, treatment and prevention.

- Diagnosis: not usually attempted but can be carried out by culture or PCR (single or Multiplex).
- No specific treatment.
- No specific vaccine: many sertypes.

# Bacterial Bronchitis vs. Pneumonia