

Paramyxoviruses and other respiratory viruses

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Paramyxoviruses & other respiratory viruses

1. Paramyxoviruses.

A. Parainfluenza viruses type 1-4

B. Respiratory syncytial virus (RSV)

C. Human Metapneumovirus (hMPV)

D. Mumps virus

E. Measles virus

F- Henipavirus: Hendra and Nipah viruses

2. Adenovirus.

3. Rhinovirus.

4. Coronaviruses.

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: Are +ss RNA enveloped viruses.

Paramyxoviruses

- -ss RNA enveloped viruses.
- Have RNA dependent RNA polymerase.
- The envelop has HA, NA or a fusion protein.
- Mumps and Parainfluenza viruses has NA and HA.
- Replication follows a common theme as in – ss RNA.

1- 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, yet infective
- Viral shedding lasts for about 1 week after infection
- Prolonged viral shedding in immunocompromised

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.

PIV / Clinically

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

Diagnosis:

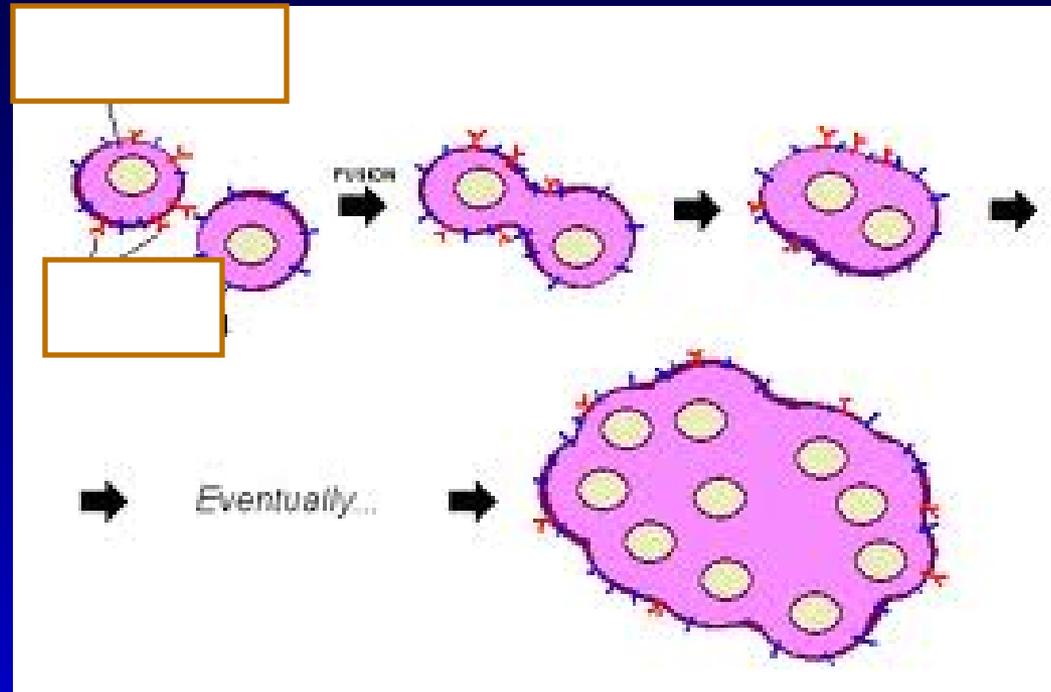
1. Direct detection of the virus antigen (Serology) or RNA by PCR.
2. Culture: less used.

Treatment: supportive,

2- 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 (tissue culture) with multinucleated giant cells.

Respiratory syncytial virus (RSV)



Respiratory syncytial virus (RSV)

- I.P ~ 2-8 days.
- respiratory 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.

RSV / Diagnosis

- Viral isolation/Culture
Up to 2 weeks, usually CPE in 2-5 days
- Antigen detection - >90 % sensitivity and specificity
ELISA
RIA, IF
- PCR.
- CRX: Lung hyperinflation.

RSV / Treatment & prevention

1. Supportive

2. Antiviral Agents

- Ribavirin (*Virazole*), a synthetic guanosine analogue, given as an aerosol, approved for premature and immunocompromised infants.
- Teratogenic in pregnant

Vulnerable children can be given immunoglobulins (passive immunization - MAb) for prevention and treatment.

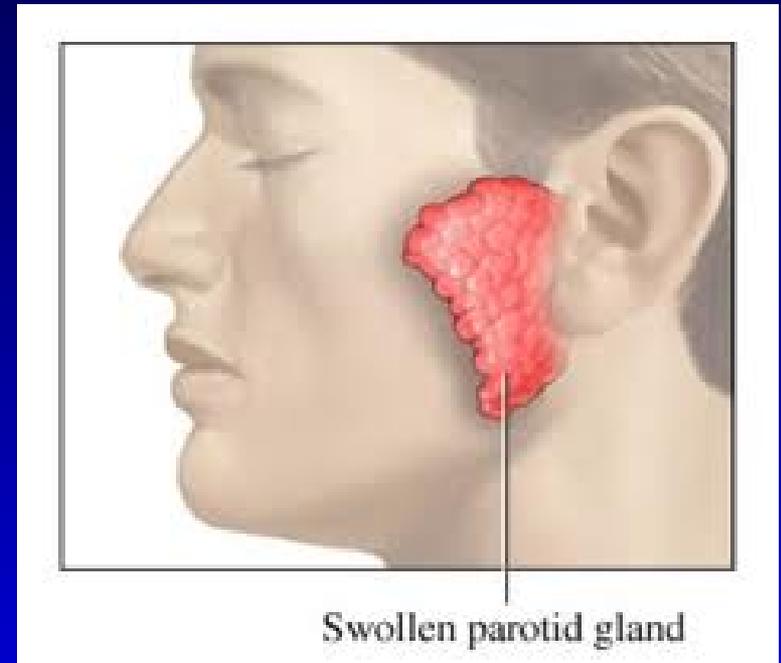
Human Metapneumovirus hMPV

- 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.

Mumps

- A generalised infection with respiratory, glandular and CNS tropism.
- Humans are the only reservoir.
- I.P: 14-25 days.
- MOT: Respiratory secretions.
- **S&S:**
- Fever, general malaise and parotitis (parotid gland inflammation and swelling - painful).
- **Complications:**
- Meningoencephalitis/Meningitis (with or without parotitis).
- Orchitis (in 25% of men) and oophoritis (in 5% of women).
- Pancreatitis and Sensorineural deafness (Rare).

Mumps



Mumps virus

- Immunity: lifelong.
- Vaccine: Available/ Part of the MMR vaccine (live attenuated).
- Diagnosis:
 - 1. Serology for the detection of viral antibodies (IgM and IgG)
 - 2. PCR in urine, throat swab or CSF.
- Treatment: Supportive.

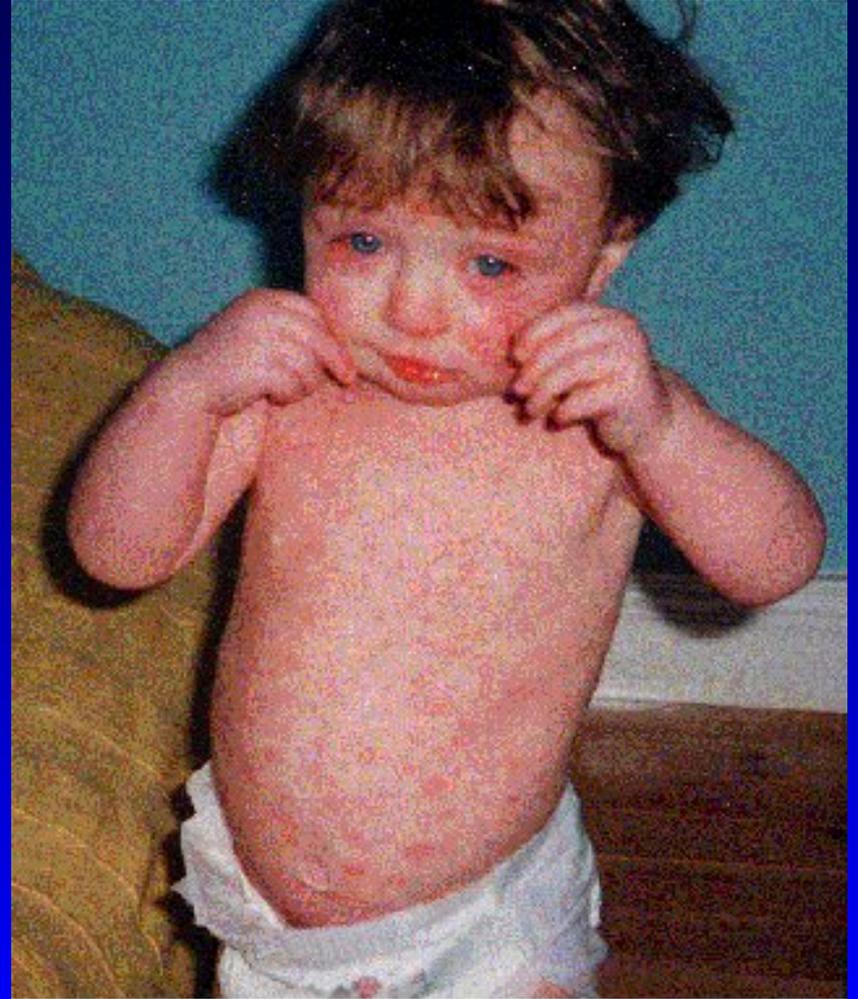
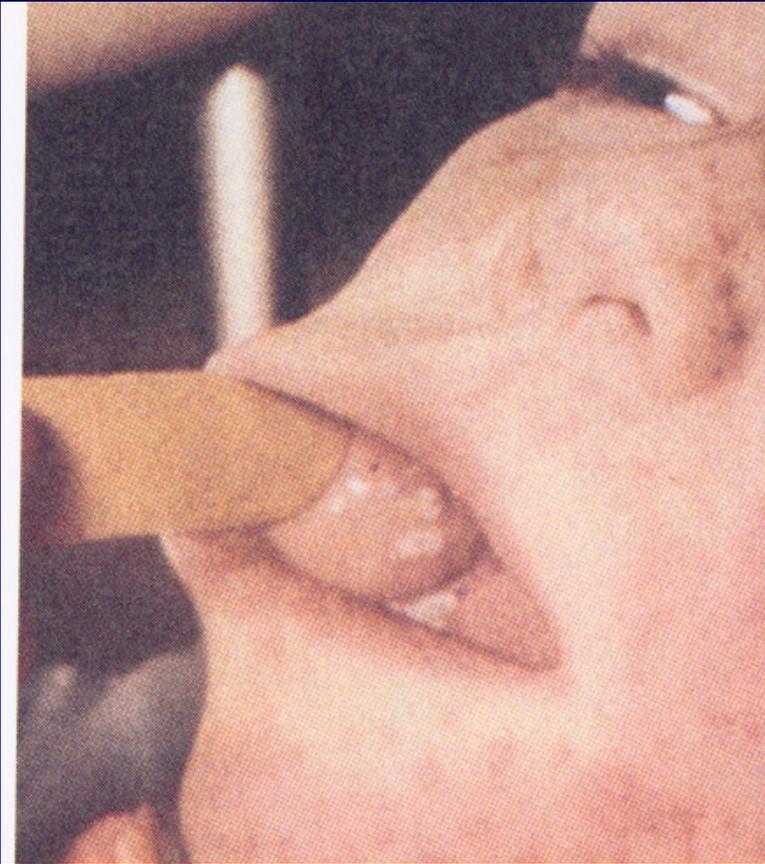
Measles virus

- A member of the Paramyxoviruses family.
- Very infectious and transmitted via respiratory (airborne) secretions or by direct contact.
- Occurrence: rare in countries with vaccination programmes.
- S & S:
 1. Respiratory phase - sore throat, cough, malaise: 5-9 days.
Koplik's spots - red with white/grey centres on the buccal1.
Respiratory phase - sore throat, cough, malaise: 5-9 days.
Koplik's spots - red with white/grey centres on the buccal mucosa near each Stenson's duct (opposite the premolars).
Conjunctivitis, photophobia, high fever.
 2. Systemic phase symptoms.
 - A. Replicate in lymph nodes, then into blood – viremia then RES then viremia and respiratory involvement.

Measles / Clinically

- B. Rash: 7-14 days, spreads from forehead down trunk and out extremities
- C. Pneumonia associated with measles, both viral and bacterial.
- Complications:
 - 1. Encephalitis: High mortality and morbidity rate.
 - 2. Subacute sclerosing panencephalitis (SSBE)
- Rare and fatal degenerative CNS complication/decades post infection.
- Personality, behavioural and intellectual changes.
- Convulsion Coma and Death.

Measles Koplik's spots and rash



Measles

- Diagnosis:
 - 1. Serology to detect IgM or IgG.
 - 2. PCR on Urine and throat swabs.
- Treatment: supportive.
- Prevention:
 - 1. Active: vaccine.
 - 2. Passive: Immunoglobulin(contains measles IgG).

NIPAH and HENDRA viruses:

Recently discovered Paramyxoviruses members, in 1999 (NIPAH) and in 1994 (HENDRA). Transmitted to human via pigs (NIPAH) or horses (HENDRA) and caused fatal cases of human Encephalitis (NIPAH) and severe respiratory disease (HENDRA) mainly hemorrhagic pneumonia.

Fruit bats appear to be the natural reservoir of both viruses.

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
- Stable in GI tract- can withstand low pH, bile acids and proteolytic enzymes
- Relatively resistant to disinfection (nonenveloped)
(Alcohol, chlorhexidine, detergents)

Adenovirus characteristics / cont'd

- Persists for long time in tonsils & kidneys (latent). Also, viral shedding in faeces may persist for years.
- Subgrouped 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- 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.

Epidemiology & clinically

- Many infections are sub-clinical.
- Adenovirus infections are endemic 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 intussusception).
- 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 (Pneumonia):

- 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).

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 significance, 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 / Treatment and prevention

- **Treatment:**

- Infections are usually not life threatening in immunocompetent and no treatment required apart from symptomatic treatment.
- Cidofovir for immunocompromised patients

- **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

- A member of the Picornaviruses which also includes Enteroviruses and Hepatovirus (hep A).
- Nonenveloped +ssRNA with more than 100 serotypes.
- Grows in tissue culture at 33°C (Human nose temp) rather than 37°C.
- Acid labile
- It causes nearly one third of all common colds

Rhinovirus/clinically

- Common in preschool children and adults.
- Found all over the year but more in Winter.
- Signs and symptoms (S & S): 'common cold
- S&S may stay for 1-2 weeks/ N.B: URTI S&S.
- Complications as sinusitis and otitis media

Diagnosis, treatment and prevention.

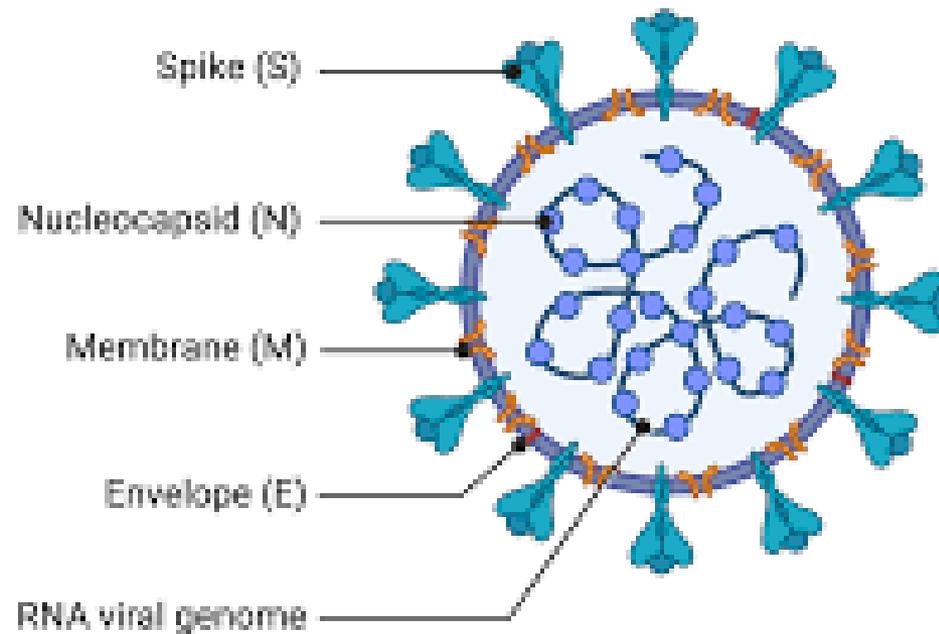
- Diagnosis: not usually attempted but can be carried out by culture or PCR (single or Multiplex).
- No specific treatment.
- No specific vaccine: many serotypes.

Coronaviruses

- Around 9 coronaviruses have been identified to infect humans namely:
 - The α -CoVs HCoV-229E, HCoV-NL63, β -CoVs, HCoV-HKU1 and HCoV-OC43 which cause mild respiratory symptoms similar to that associated with the common cold,
 - SARS-CoV-2, SARS-CoV, and MERS-CoV are implicated to cause lethal respiratory infections

Structure

Coronavirus Structure



Coronaviruses

- Clinical picture:
 - λ. 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 CoV, CoV2 and MERS Coronavirus:
 - I.P of nearly a week (2-14 days).
 - Respiratory and faecal routes of transmission.
 - Starts as fever, myalgia and malaise, smell and taste sensations loss then progresses to pneumonia, ARDS and multiorgans failure.

Treatment:

- Supportive including Artificial ventilation if ARDS.
- Anti Covid-19 therapy.....
- Prevention: Resp. precautions
- VACCINES: Yes for Covid-19

The End