

A microscopic view of several influenza viruses, showing their characteristic spherical shape and surface covered in spikes (hemagglutinin and neuraminidase). The viruses are set against a dark, blue-toned background with a bokeh effect of light spots.

INFLUENZA IN CHILDREN

BY

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Conflicts of Interest- None
Disclosures- None

Learning Outcomes

At the end of the presentation, the delegates will be able to -

- Understand the microbiology & pathogenesis of influenza virus
- Formulate the treatment plan
- Understand Prophylaxis & infection control measures
- Enumerate the vaccines available



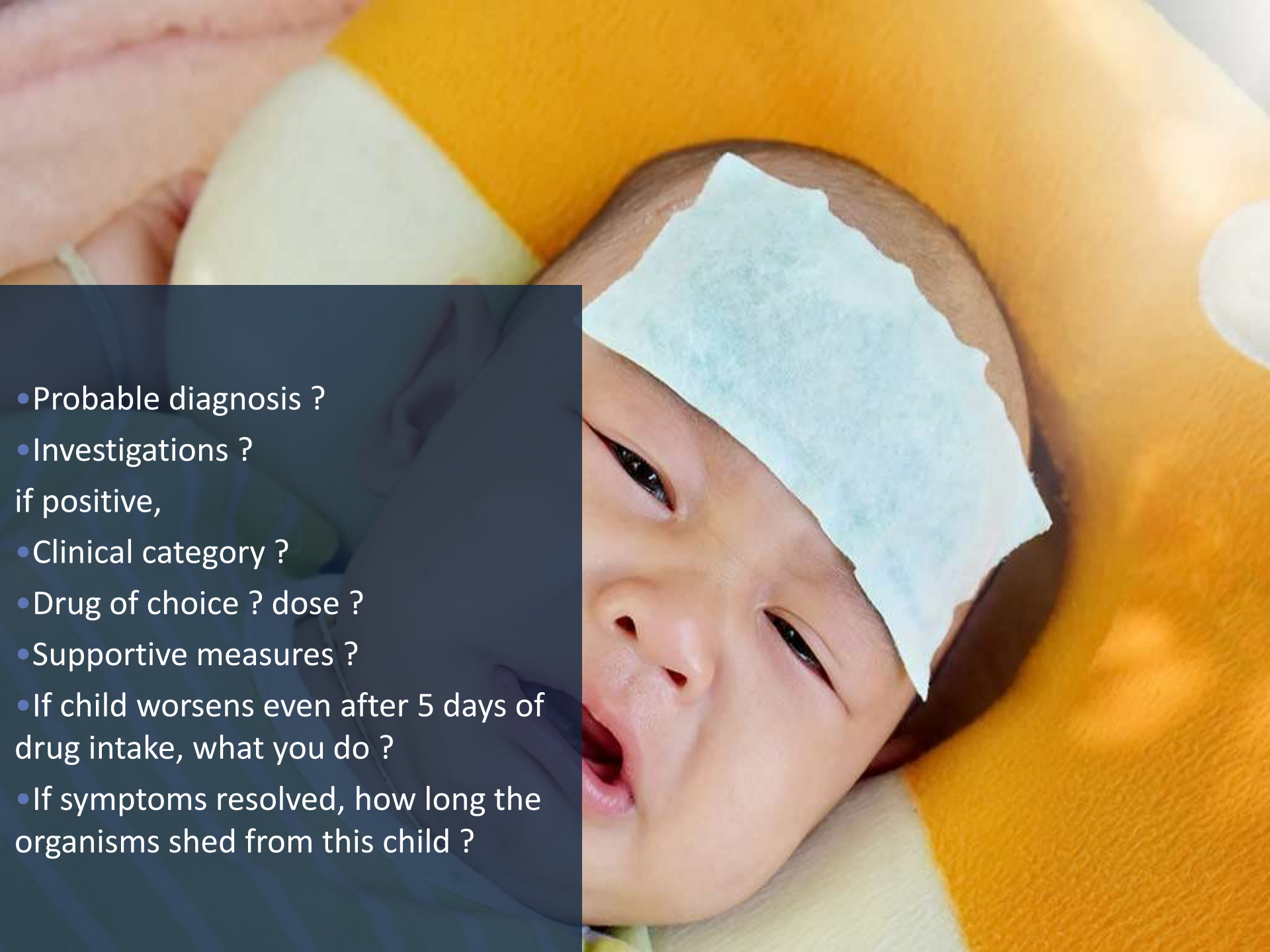
5 months old male child (7kg) brought with

- Fever for 5 days
- cold and cough for 3 days &
- Breathing difficulty for 2 days
- Blood C/S & other investigations sent and started on broad spectrum antibiotics
- fever & distress persisting after 3 days of admission



- CFT <3 Sec, Temp 38 C
- HR-166/Min RR 68/min
- SPO2 96% In Room air
- RS- Occasional Crepts + / SCR +
- Hemogram – WNL
- QBC & Widal – Negative
- ICT Scrub Typhus – Negative
- CXR – Hyperinflation + Mild B/L Insignificant Infiltrates
- CRP - Negative





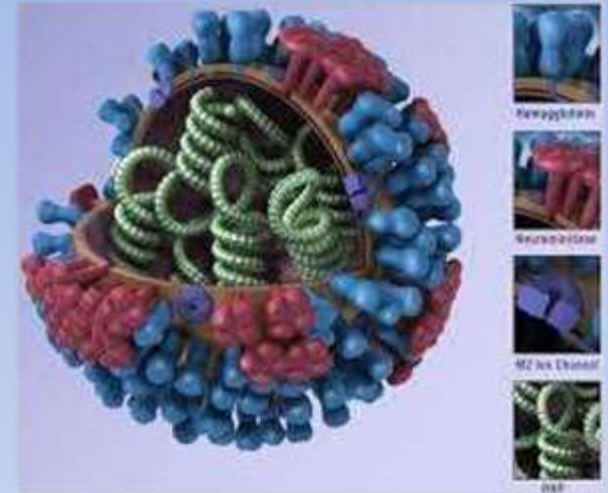
- Probable diagnosis ?
 - Investigations ?
- if positive,
- Clinical category ?
 - Drug of choice ? dose ?
 - Supportive measures ?
 - If child worsens even after 5 days of drug intake, what you do ?
 - If symptoms resolved, how long the organisms shed from this child ?

ETIOLOGY

- Importance of Influenza
- One of the most important **Emerging** and **Reemerging** infectious diseases
- Causes high morbidity and mortality in communities (epidemic) and worldwide (pandemic)
- Epidemics are associated with excess mortality

Causative Agent Of Influenza

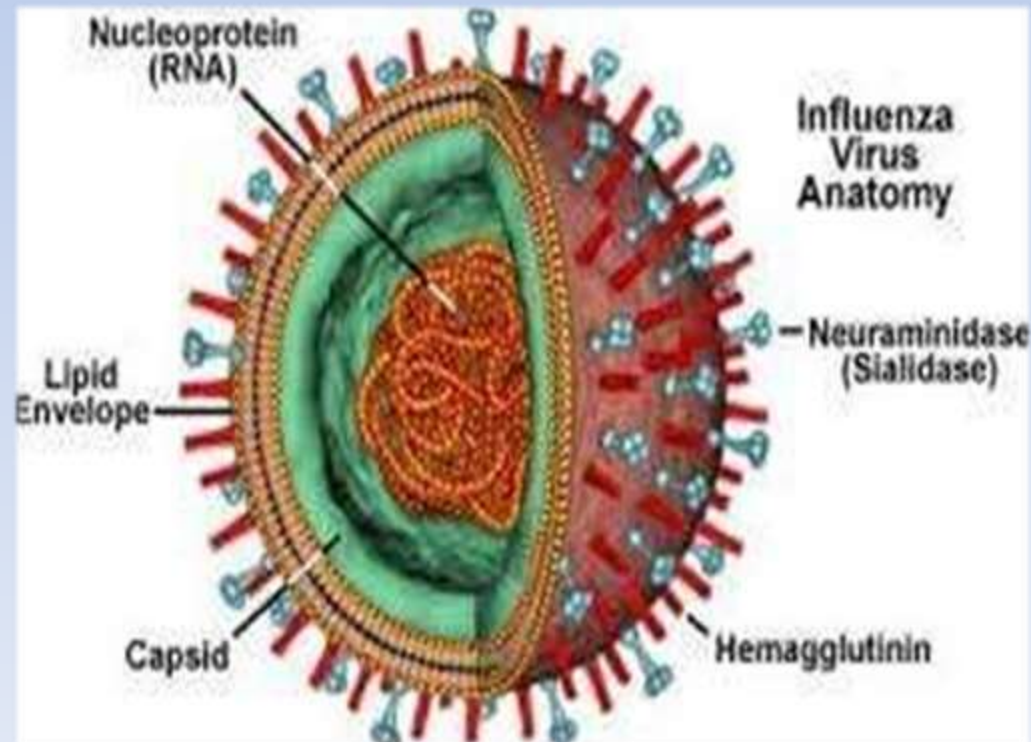
- Large single stranded RNA virus
- Orthomyxoviridae
- Includes 3 genera



Influenza virus A	}	Primary human pathogens, causing seasonal epidemics
Influenza virus B		
Influenza virus C	}	Sporadic (URI symptoms)

Classification of influenza virus

- Type A viruses are divided into subtypes
- Based on viral surface proteins or antigens
 - Hemagglutinin (H) } Reason for antigenic variation in type A
 - Neuraminidase (N)
- Type B & C
 - No such subtype designation So less antigenic variation



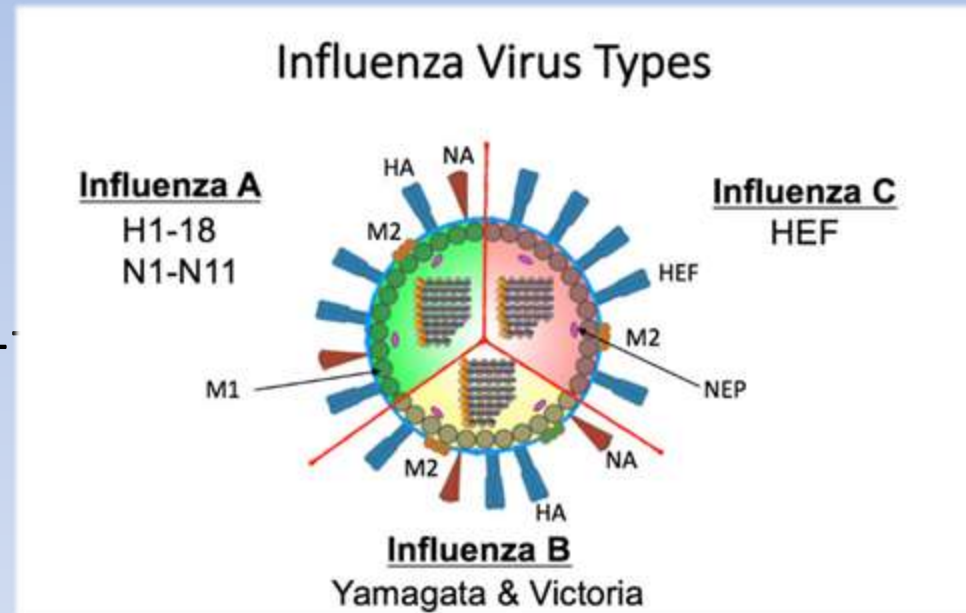
Classification of influenza virus

Classified on the basis of hemagglutinin (HA) and neuraminidase (NA)

18 subtypes of HA and 11 subtypes of NA are known to exist in animals (HA 1-18, NA 1-11)

3 subtypes of HA (1-3) and 2 subtypes of NA (1-2) are human influenza viruses.

HA 5, 7, 9 and NA 7 can also infect humans



EPIDEMIOLOGY

- Person to person
- Droplet infection (sneezing & coughing or talking)
- The portal of entry of the virus is the respiratory tract.
- IP 12 – 72 hours
- Seasonal influenza
 - colder months in temperate climates
- Four major global epidemics
 - 1918 – A(H1N1) most severe
 - 1957 – A(H2N2)
 - 1968 – A(H3N2)
 - 2009 – A(H1N1)pdm09

Mode of transmission in human

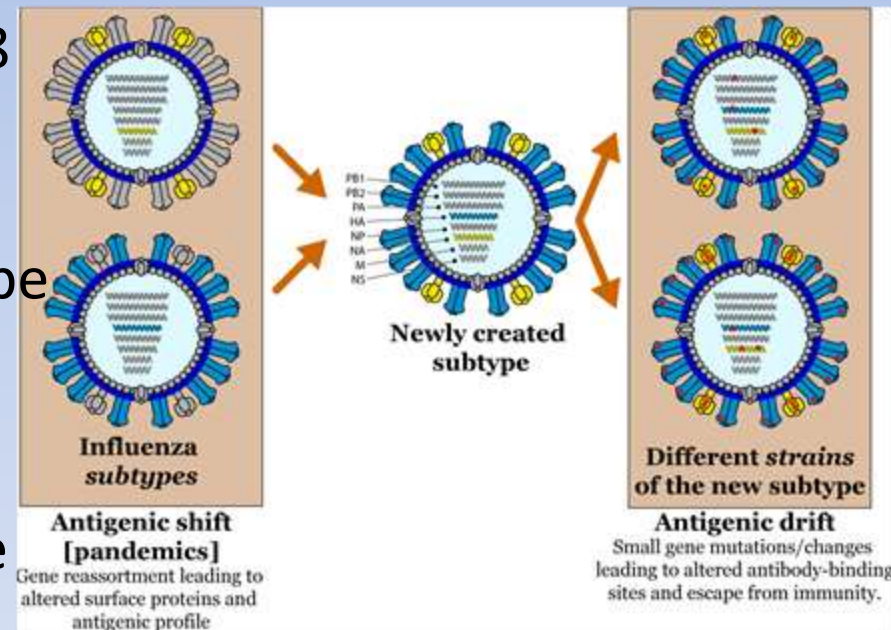
- The virus is spread from person- to- person through respiratory secretions either as droplets (close contact) or as airborne infection by droplet nuclei suspended in the air.
- Incubation period 1-3 days

GENETICS

Genetic drift

Influenza a & b has genome with 8 single strand RNA segments

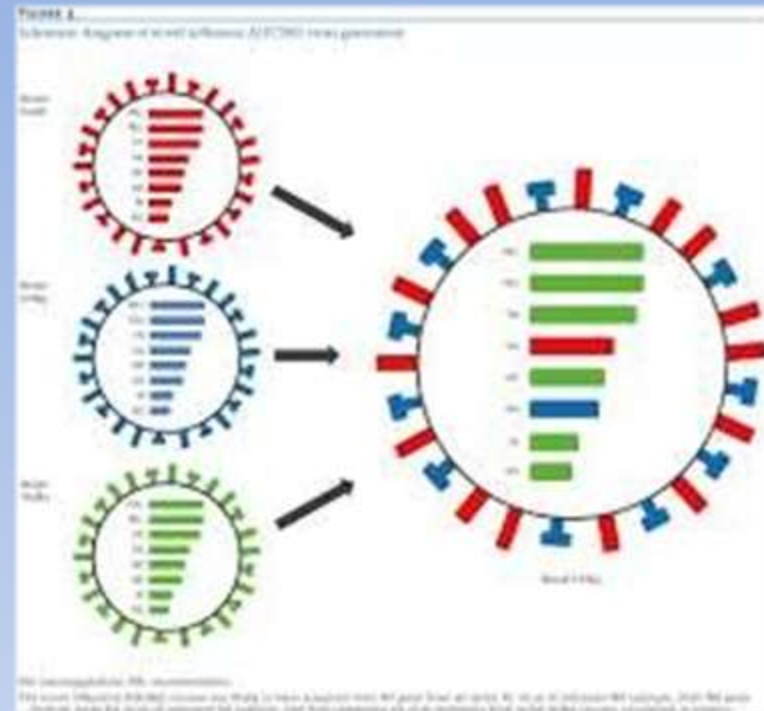
- Minor changes within the subtype
- Point mutation
- HA gene (predominantly)
- So new influenza strains of same HA type
- Can occur in both type A & B
- Occurs yearly

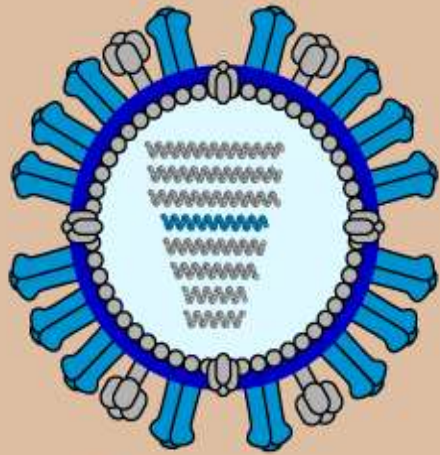
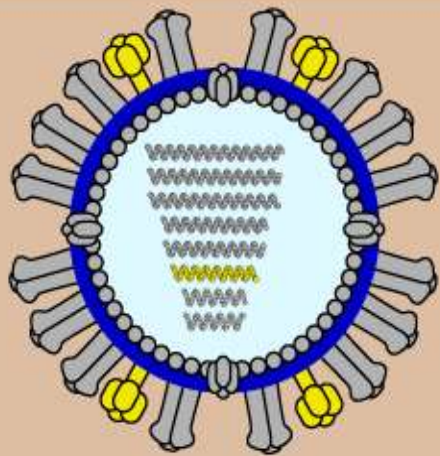


GENETICS

Genetic shift

- Major changes in subtype
- Less frequent more dramatic
- Reassortment of viral segments
- Simultaneous infection by more than single host
- Emergence of novel subtypes
 - Avian influenza A (H5N1) in 1997 in 13 counties
 - avian influenza A (H7N9) in 2013 in china
- Influenza A
- Avian & mammalian hosts

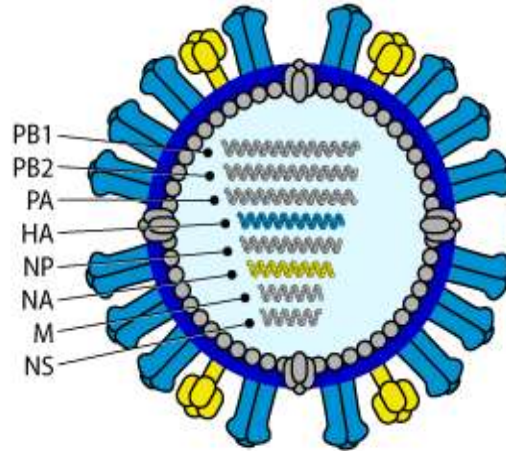




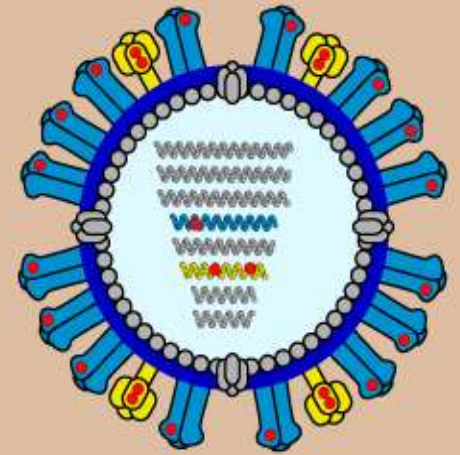
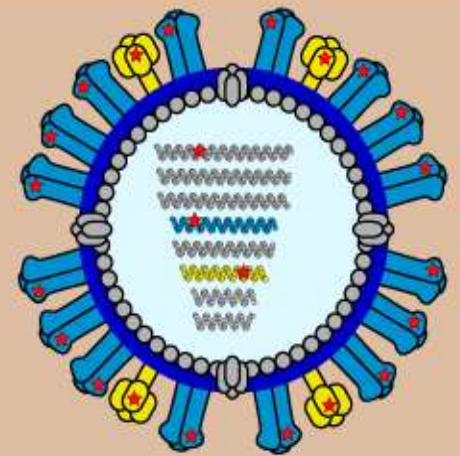
**Influenza
subtypes**

**Antigenic shift
[pandemics]**

Gene reassortment leading to altered surface proteins and antigenic profile



**Newly created
subtype**



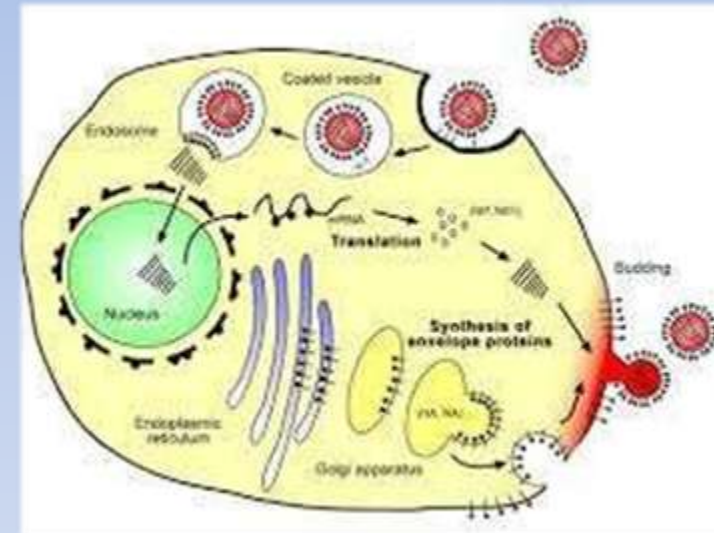
**Different strains
of the new subtype**

Antigenic drift

Small gene mutations/changes leading to altered antibody-binding sites and escape from immunity.

PATHOGENESIS

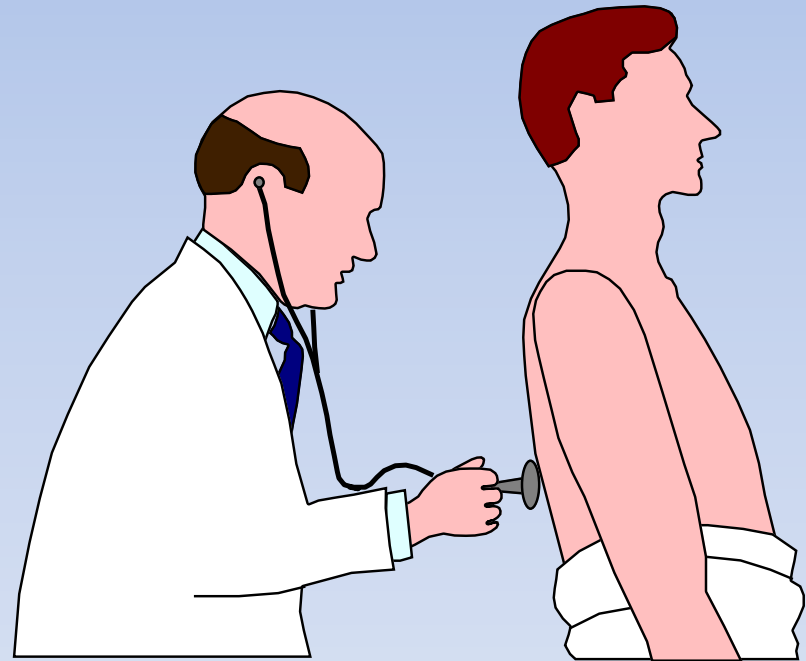
- Respiratory tract
 - Invades ciliated columnar epithelium
 - Using HA to sialic residues
- Replication occurs within 4 – 6 hours, then
- Infectious viruses produced and
- Released into neighbouring cells
- Replication continues for 10 – 14 days
- Lytic infection of respiratory epithelium



- Loss of ciliary function
 - Decreased mucous production
 - Desquamation
- } Secondary bact. infection

SIGNS & SYMPTOMS

- Fever (100 F-103 F in adults and often even higher in children)
- Chills
- Cough
- Sore throat
- Runny or stuffy nose
- Headache
- Muscle aches
- Extreme fatigue
- Anorexia
- Abdomen pain, vomiting and loose stools also can occur in children



Clinical Diagnosis

- ✓ The clinical picture of influenza is nonspecific.
- ✓ Influenza-like illness can be caused by many microbial agents other than influenza virus, such as
 - Adenovirus,
 - Parainfluenza Viruses,
 - Coronavirus,
 - Mycoplasma Pneumoniae,
 - Chlamydia Pneumoniae,
 - Beta-hemolytic Streptococcus.

CLINICAL CATEGORISATION

CATEGORY A

- Mild fever + cough / sore throat with or without
- Body ache, headache, diarrhoea and vomiting
- Oseltamivir not needed
- Symptomatic treatment.
- Monitor for progress and reassess at 24 to 48 hours
- H1N1 test not required.
- Should confine themselves at home and avoid mixing up.



CLINICAL CATEGORISATION

CATEGORY-B

- CATEGORY A + high grade fever and severe sore throat
 - Require home isolation and oseltamivir
- CATEGORY A + following high risk conditions shall be treated with oseltamivir
 - Pregnant women
 - Very young or very old age
 - Systemic diseases, blood disorders, neurological disorders & diabetes
 - Cancer and HIV/AIDS
 - Long term cortisone therapy.

- H1N1 test
- Should confine themselves at home and avoid mixing up
- Broad spectrum antibiotics as per the guideline for CAP

CLINICAL CATEGORISATION

CATEGORY-C

- CATEGORY A AND B + one or more of the following:
 - Breathlessness
 - Drowsiness
 - Sputum mixed with blood
 - Chest pain
 - Fall in blood pressure
 - Bluish discolouration of nails
- Children with influenza like illness + previous severe disease, manifests with
 - Somnolence
 - Inability to feed well
 - Shortness of breath
 - High and persistent fever
 - convulsions
 - Difficulty in breathing
- Worsening of underlying chronic conditions.
- Category-c require testing, immediate hospitalization and treatment.

INVESTIGATIONS

- Routine baseline investigations
- Confirmation of H1N1
 - Real time RT PCR or ”
 - Isolation of the virus in culture or ”
 - Four-fold rise in virus specific neutralizing antibodies
- Clinical specimens are
 - Nasopharyngeal swab
 - Throat swab
 - Nasal swab
 - Tracheal aspirate (for intubated patients)

Contd.,

- Collect before administration of the anti-viral drug.
- Keep specimens at 4°C in viral transport media until transported.
- Should be transported within 24 hours.
- If not, should be stored at -70°C.
- Paired blood samples for serological testing

PHARMACOLOGICAL TREATMENT

OSELTAMIVIR

- NA inhibitor
- Can be given as young as 2 weeks of life
- Used in both prophylaxis and treatment
- Age >1 year
 - <15kg - 30 mg BD for 5 days
 - 15-23kg - 45 mg BD for 5 days
 - 24-<40kg- 60 mg BD for 5 days
 - >40kg- 75 mg BD for 5 days
- Age <1 year
 - < 3 months - 12 mg BD for 5 days
 - 3-5 months - 20 mg BD for 5 days
 - 6-11 months - 25 mg BD for 5 days
- Transient nausea and vomiting are the common side effects

Contd.,

ZANAMIVIR

- NA inhibitors
- Used in OSELTAMIVIR resistant cases
- Available in inhalational and IV preparations
- Recommended in age 7 years and older
- Treatment
 - 10 mg twice daily (two 5mg inhalations) for 5days
- Prophylaxis
 - 10 mg once daily (two 5mg inhalations) for 5days

SUPPORTIVE TREATMENT

- S Salicylate/aspirin contraindicated (risk of Reye syndrome) Secondary bacterial infection control
- U Euglycemia / Euthermia
- P Paracetamol / Ibuprofen for fever and myalgia
- P Parenteral nutrition
- O Oxygen support (depends upon the requirement)
- R Resuscitation (ABC) / Rest
Radiological monitoring of lungs
- T Throat and nasal care
- I IV Fluids/Hydration
- V Vasopressors for shock
- E Electrolyte balance

DISCHARGE POLICY

- Responded in 2 or 3 days and become asymptomatic
 - Discharge after 5 days of treatment.
 - No need for a repeat test.
- Patients who continue to have symptoms on the 5th day
 - Continue treatment for 5 more days
 - If asymptomatic during treatment, no test needed

Contd.,

- Symptomatic after 10 days of treatment or / respiratory distress
 - Secondary infection must be taken care
 - Resistance of anti viral would be tested
 - The dose of anti viral may be adjusted on case to case basis
- Family of patients discharged earlier should be educated on
 - Personal hygiene
 - Infection control measures at home
 - Children's abstinence from school

CHEMOPROPHYLAXIS

For **health care workers** of isolation unit

- Treating physicians
- Paramedical personnel
- Unit helpers
- Oseltamivir 75 mg OD for 10 days

For contacts

- High risk patients
 - With underlying systemic diseases
 - Extremes of age < 5 years and >65 years

CHEMOPROPHYLAXIS DOSAGE

- Oseltamivir is the drug of choice.
- For 10 days after last exposure
- Age >1 year
 - <15kg - 30 mg OD for 10 days
 - 15-23kg - 45 mg OD for 10 days
 - 24-<40kg - 60 mg OD for 10 days
 - >40kg - 75 mg OD for 10 days
- Age <1 year
 - < 3 months
 - Not recommended unless judged critical
 - Limited studies
 - 3-5 months 20 mg OD for 10 days
 - 6-11 months 25 mg OD for 10 days

PPE(PERSONAL PROTECTIVE EQUIPMENT)

PPE reduces the risk of infection if used correctly

- Gloves (non sterile)
- Mask (high-efficiency mask)
- Three layered surgical mask
- Long-sleeved cuffed gown
- Protective eyewear (goggles/visors/face shields)
- Cap (increased aerosols)
- Plastic apron if splashing of secretions are anticipated.



PPE APPLYING ORDER

- Follow thorough hand wash
- Wear the coverall
- Wear the goggles/ shoe cover/and head cover in that order.
- Wear face mask
- Wear gloves

The masks should be changed after every six to eight hours.

Recommendations for Prevention and Control of Influenza in Children, 2019–2020. COMMITTEE ON INFECTIOUS DISEASES. Pediatrics, Oct 2019;144 (4)



PPE REMOVING ORDER

- Remove gloves
- Remove gown
- Wash hands with soap and water
- Remove cap and face shield
- Remove mask
 - By grasping elastic behind ears do not touch front of mask
- Wash hands with soap and water before leaving the room

Recommendations for Prevention and Control of Influenza in Children, 2019–2020. COMMITTEE ON INFECTIOUS DISEASES. Pediatrics, Oct 2019;144 (4)



INFECTION CONTROL MEASURES

ISOLATION UNIT

- The patient should wear a three layer surgical mask.
- The medical/paramedical personnel should wear PPE
- Water proof apron, if soiling anticipated.
- Avoid aerosol-generating procedures
- Perform hand hygiene
- Infection control precautions to continue
 - Adult patient for 7 days after resolution of symptoms
 - Children <12 for 14 days after resolution of symptoms
- Disinfection of contaminated surfaces and equipments
 - On daily basis
 - Once after discharge



Contd.,

DURING TRANSPORT

- Patient should also wear a three layer surgical mask
- Avoid aerosol generating procedures
- Ambulance cabin personnel should wear
 - Full complement of PPE + N95 masks
- Driver should wear three layered surgical mask
- Once the patient is admitted to the hospital
 - Interior/exterior of the ambulance
 - Reusable patient care equipment needs to be sanitized
- Standard disposal of waste (including PPE) in ambulance

Types of Vaccine



- **Inactivated**, consisting of
 - (1) whole-virus,
 - (2) subvirion,
 - (3) purified surface antigen.Only subvirion or purified antigen should be used in children.
Any of the three can be used for adults.
- **Live attenuated**

Vaccine



Inactivated influenza vaccine (IIP)(Trivalent)

- Killed influenza virus component is used
- Three strains are used
 - Influenza A (H1N1) virus
 - Influenza A (H3N2) virus
 - Influenza B virus.
- Antibodies will develop two weeks after vaccination.
- IM route
- Protective efficacy is 50 to 60 %
- Excellent safety profile

Contd.,

- Recommended after 6 completed months
- 6 months to 3 years 0.25ml / 2 doses / 4 weeks apart / per year
- >3 years 0.5 ml / one or 2 dose / per year
- Soreness, redness and tenderness over injection site are common SE
- CI in children who are at higher risk of developing complications

<https://www.cdc.gov/flu/about/qa/vaccineeffect.htm>

References

- Clinical Practice Guidelines by the Infectious Diseases Society of America: 2018 Update on Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management of Seasonal Influenza. Clin Infect Dis. 2019 Mar 5;68(6):895-902.
- The Effect of Influenza on Hospitalizations, Outpatient Visits, and Courses of Antibiotics in Children. Kathleen Maletic Neuzil N Engl J Med 2000; 342:225-231.
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- Recommendations for Prevention and Control of Influenza in Children, 2019–2020. COMMITTEE ON INFECTIOUS DISEASES. Pediatrics, Oct 2019;144 (4)

THANK YOU