

Orthomyxoviridae

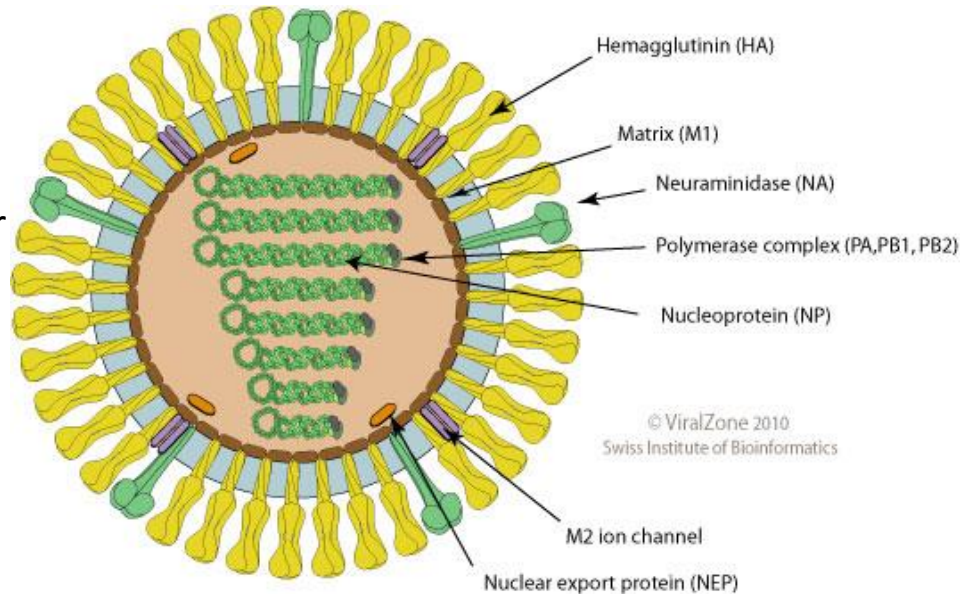
Avian, Swine & Equine Influenza

Greek **myxa** = mucus and **orthos** = correct or right.

Orthomyxoviridae

Properties of Virus

- Enveloped virus
- Virions are pleomorphic, spherical, or filamentous
- Size: 80-120 nm in diameter
- Genome: linear negative-sense, single-stranded RNA, divided into eight or seven or six segments,
- Nucleocapsid: *helically, symmetrical*
- Consist of an envelope with large peplomers surrounding eight (genus *Influenzavirus A* and *Influenzavirus B*), seven (genus *Influenzavirus C*), or six (genus *Thogotovirus*) segments
- There are two kinds of peplomers H & N
Transcription and
- RNA replication occur in the nucleus



Orthomyxoviridae

Classification

Group V: Negative sense ssRNA viruses

Family: Orthomyxoviridae

Genus: **Influenzavirus A**

- Alphainfluenzavirus - A
- Betainfluenzavirus - B
- Gammainfluenzavirus - C
- Deltainfluenzavirus
- Isavirus
- Quaranjavirus
- Thogotovirus

Subtype: H1N1

H5N1

Surface Antigens & Subtypes

18 HA and 11 NA for influenza A

Hemagglutinin (HA)

Function:

Sites for attachment to infect host cells

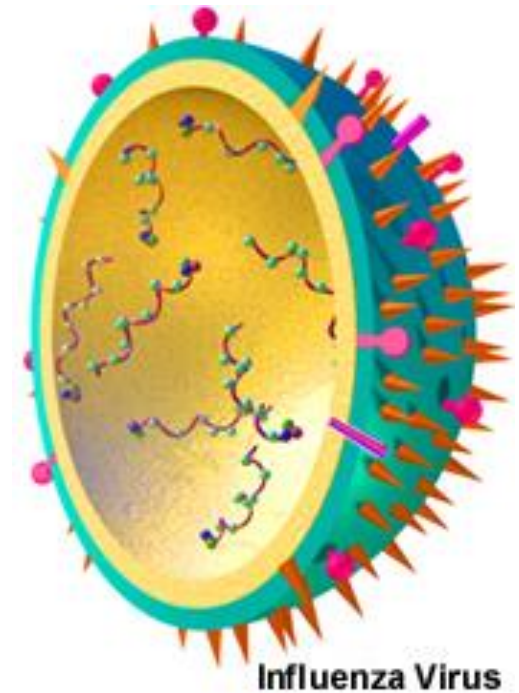
Neuraminidase (NA)

Function:

Remove neuraminic acid from mucin & release from cell

Antigenic drift

Antigenic shift



Antigenic Drift: Is the minor mutation of the surface glycoproteins, namely haemagglutinin (HA) & Neuraminidase (NA) of the influenza virus over a long period of time.

Antigenic Shift: Is a major change to the virus structure to create absolutely new subtype of virus by genetic reassortment .

Avian Influenza Virus

Highly pathogenic AI (HPAI)

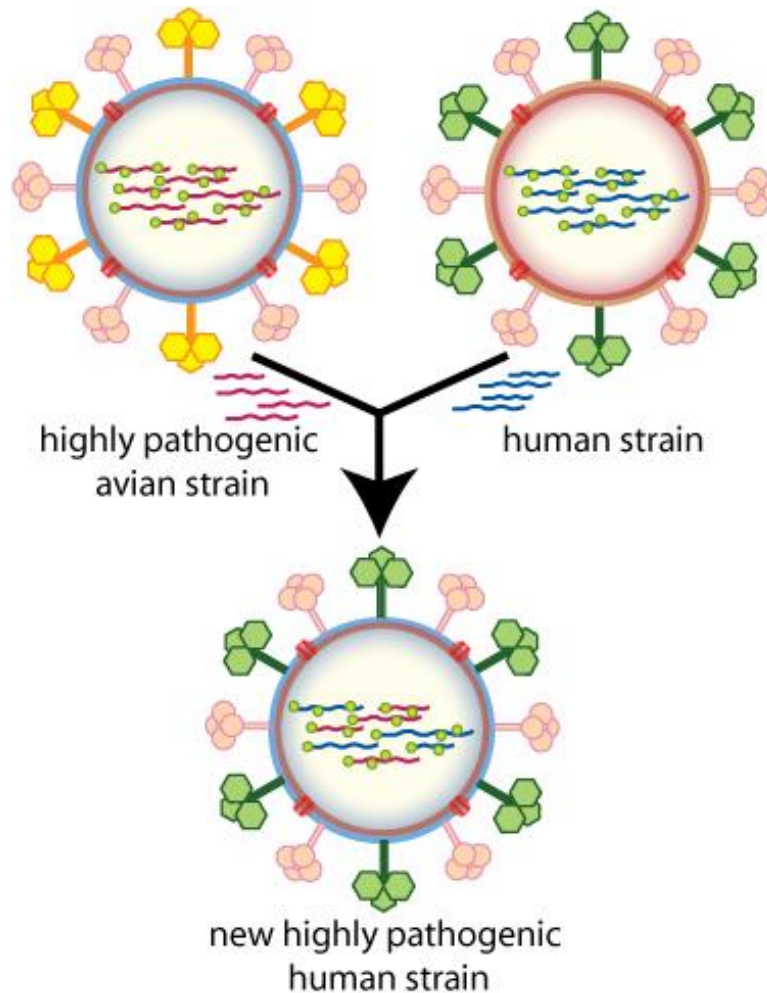
Any influenza virus lethal for 6,7 or 8 of eight , 4-8 weeks old susceptible chickens within 10 days following i/v inoculation with 0.2 ml of a 1/10 dilution of a bacteria free, infective allantoic fluid.

Any virus with IVPI greater than 1.2

Low pathogenic AI (LPAI)

Low pathogenicity avian influenza (LPAI) viruses typically cause little or no clinical signs in infected poultry.

H5 & H7 isolates that are not virulent for chickens and donot have an HAO cleavage site aminoacid sequence similar to those that have been observed in HPAI virus.



How antigenic shift, or **reassortment**, can result in novel and highly pathogenic strains of human influenza

Receptor-binding site

Antibody

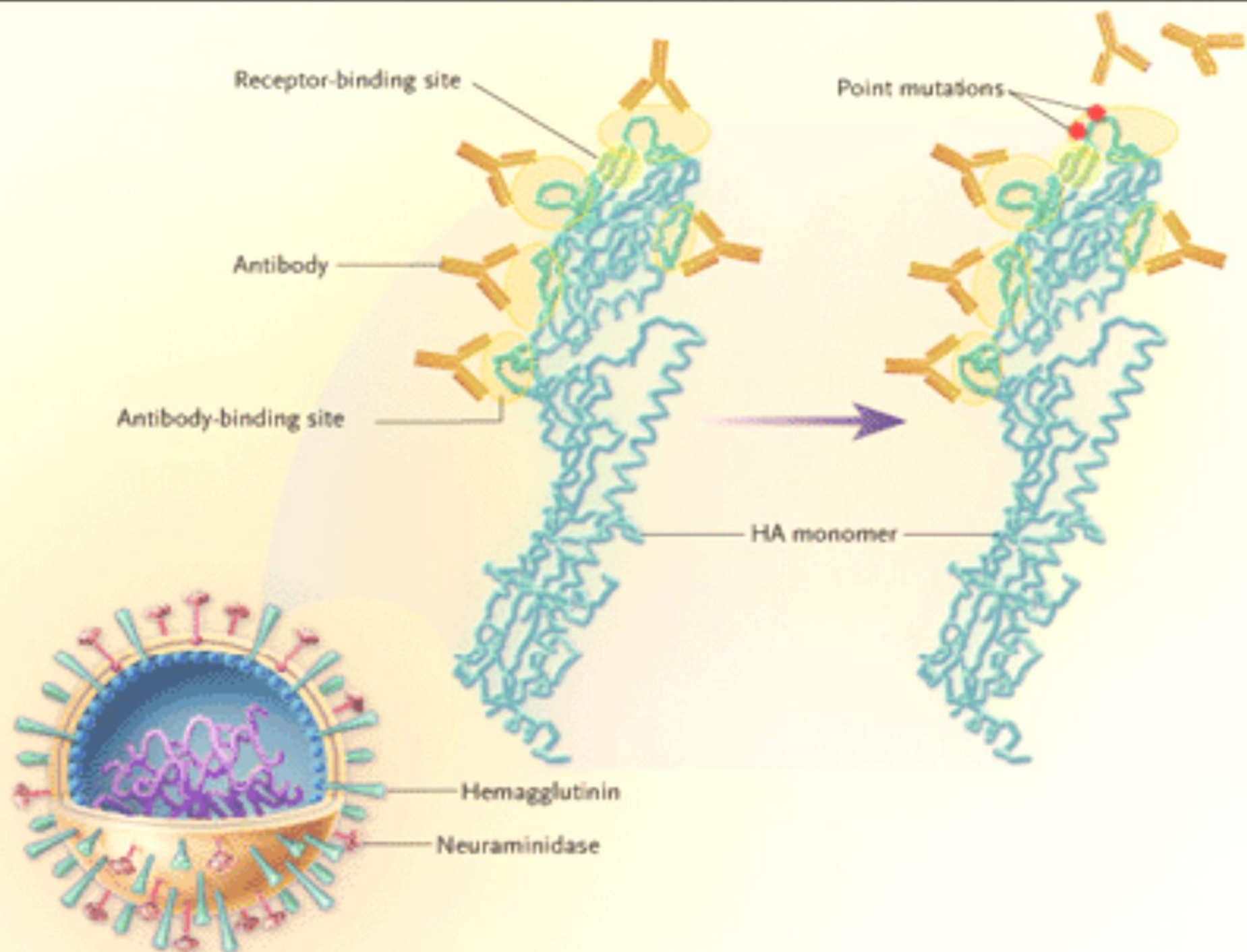
Antibody-binding site

Point mutations

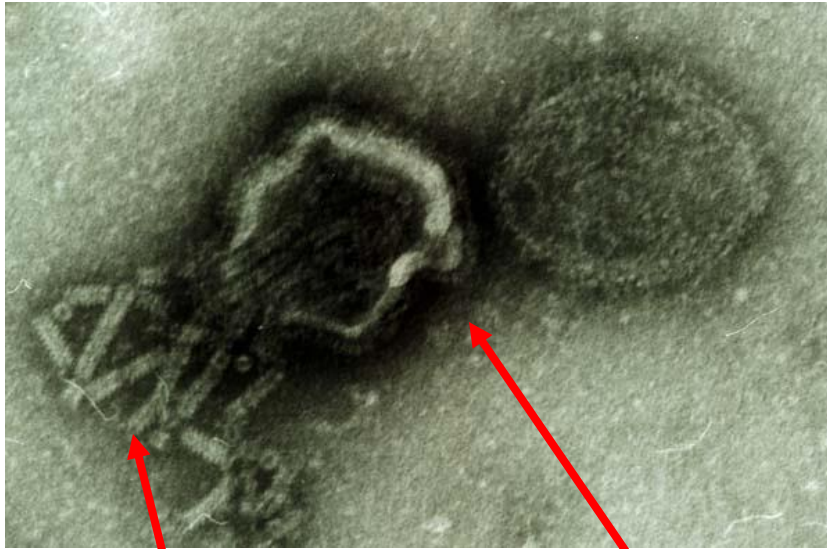
HA monomer

Hemagglutinin

Neuraminidase

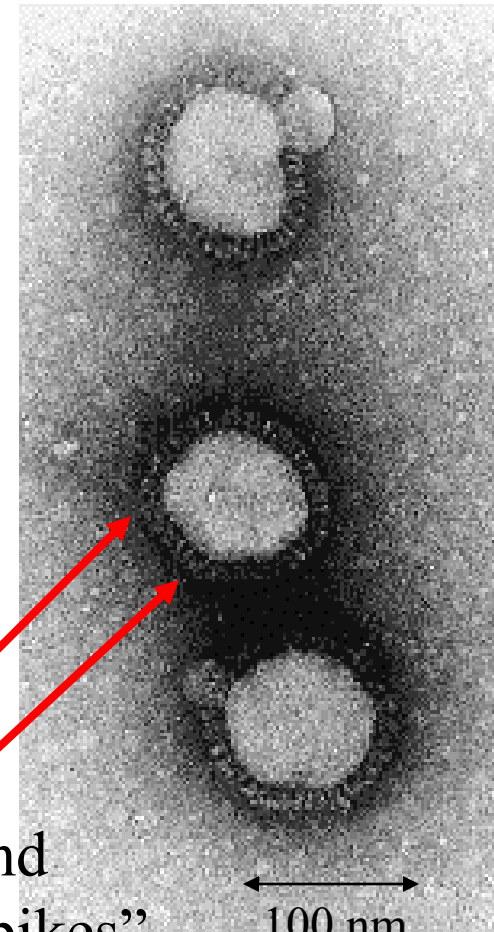


Influenza virions



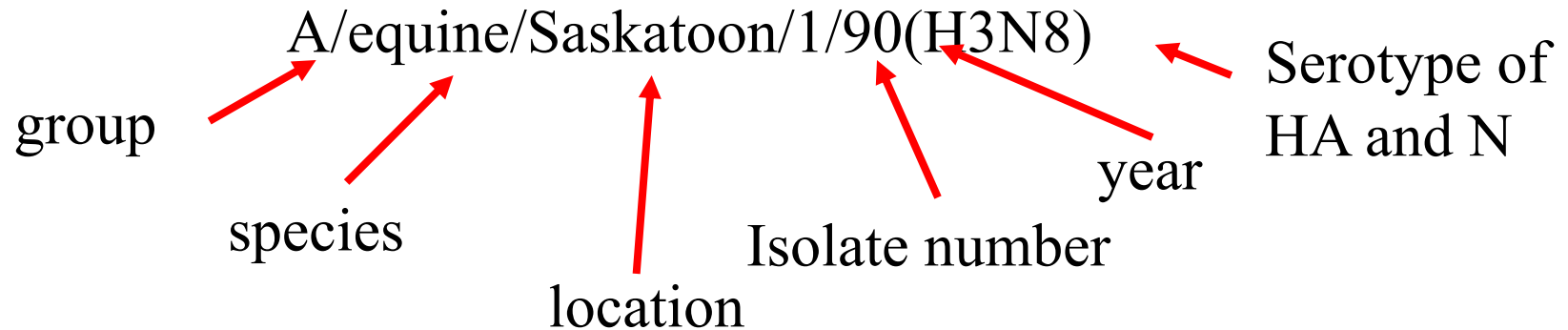
nucleocapsid
(RNA fragments
wrapped in protein)

envelope



haemagglutinin and
neuraminidase “spikes”
In envelope

Nomenclature



- A/equine/Prague/1/56(H7N7)
- A/fowl/Hong Kong/1/98(H5N1)
- A/swine/Lincoln/1/86(H1N1)

Orthomyxoviridae

Resistance to physical and chemical action

- **Temperature** : Inactivated by 56°C/3 hours; 60°C/30 min.
pH : Inactivated by acid pH
Chemicals : Inactivated by oxidising agents, sodium dodecyl sulphate, lipid solvents, B-propiolactone
Disinfectants : Inactivated by formalin and iodine compounds
Survival : Remains viable for long periods in tissues, feces and also in water

Avian Influenza

HOST Aquatic birds, Poultry birds, Human, Pig, Horse, Seals

TROPISM Epithelial respiratory cells

TRANSMISSION

Mammals: Respiratory , Zoonosis, animal contact

Birds: Fecal-oral route from contaminated water



Avian Influenza

What is Avian Influenza (AI)?

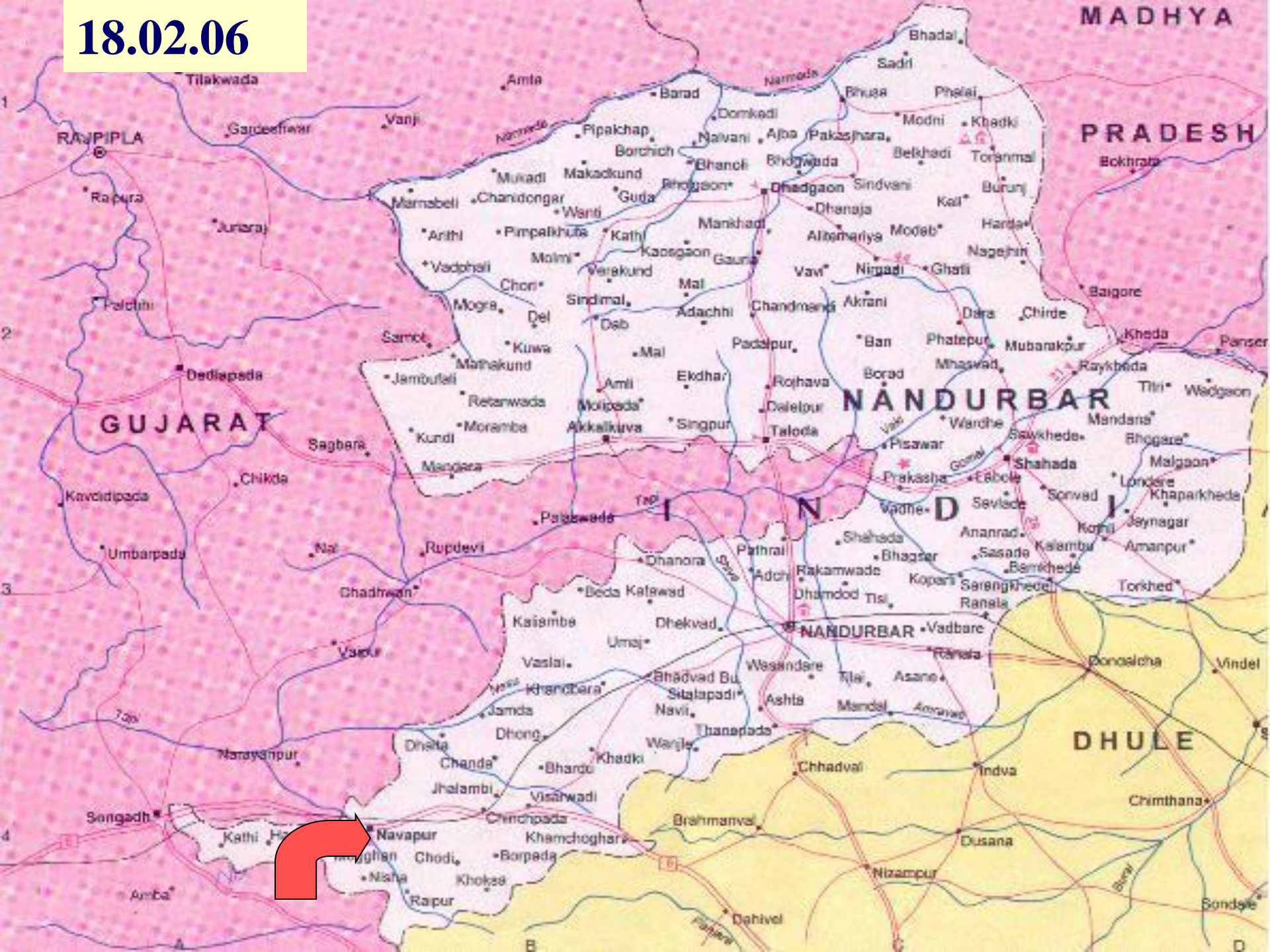
- Avian Influenza is an infectious viral disease of birds caused by type 'A' strains of the influenza virus. The flu virus appears naturally among birds.
- Wild migratory birds such as ducks, geese, gulls and shorebirds are natural carriers of the virus, but are resistant to severe infection from the virus.

Avian Influenza

HISTORY

- First noticed in Italy in the year 1878 killing a large number of birds
- The disease was named as **fowl plague**
- The causative agent as a virus was established in the year 1901
- Relationship between human influenza A virus established in 1955

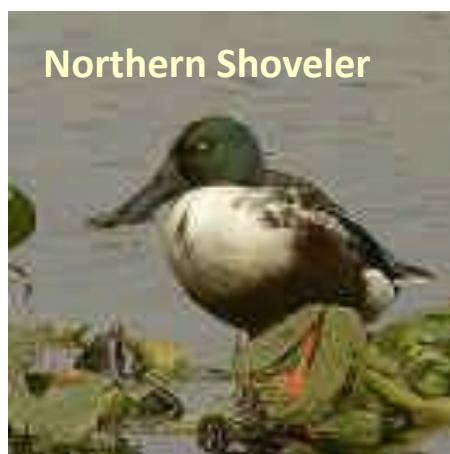
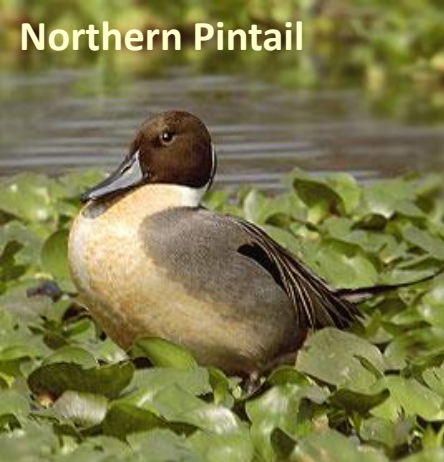
18.02.06



Avianinfluenza

Transmission

- Aerosol
- Contaminated water & food
- Inanimate Objects,
- Workers
- Migratory Birds



- Migratory water fowls, most notably wild ducks are natural reservoirs of AIV
- The virus usually does not cause clinical disease in wild birds (with exceptions)

Avian Influenza

Clinical Signs

- Clinical signs are dependent on the virulence of the infecting virus and the species infected .
- In outbreaks of Highly Pathogenic Avian Influenza (HPAI) mortality can be up to 100%.
- Low Pathogenic Avian Influenza (LPAI) in chickens may even go unnoticed.

Avian Influenza

Symptoms of HPAI in chickens

Sudden Death

Depression

If survives for 48 hours:

Decreased Appetite

Cessation / drop in Egg Production

Swollen Blue Combs and Wattles

Coughing, Sneezing , respiratory distress

Lacrymation, edema of head, face and neck

Cyanosis of unfeathered skin - Comb,

Diarrhea



Avian Influenza

Symptoms of LPAI in chickens

Mild respiratory disease

Sinusitis, Depression

Decreased egg production

Avian Influenza

Material Collection

- Throat swab or cloacal swab
- Serum



Avian Influenza

Diagnosis

1. Isolation of Virus

- 9-11 day-old embryonated chicken eggs (SPF)
- Cell cultures (Chicken embryo fibroblast)
- Demonstration of hemagglutination
- **Strain virulence evaluation**: intravenous pathogenicity index (IVPI) in 4-8 week-old chickens

Avian Influenza

Diagnosis

2. Serological tests

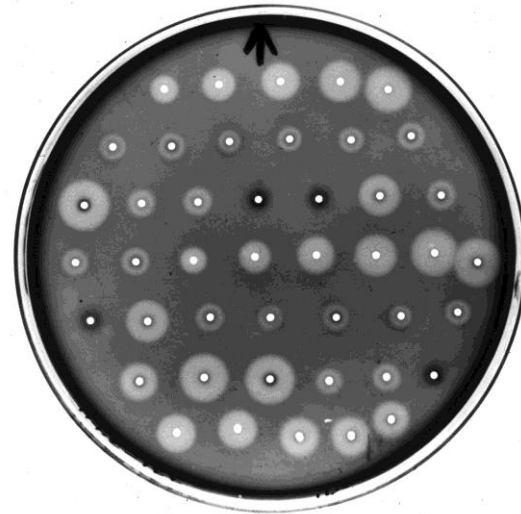
Hemagglutination inhibition tests (subtype specific serum)

Agar gel immunodiffusion

ELISA (Influenza A nucleoprotein)

Immunofluorescence technique

Single Radial Hemolysis →



Avian Influenza

Diagnosis

3. Molecular Techniques

- Subtype specific Polymerase Chain Reaction
- Multiplex PCR
- Real time PCR
- RT-PCR

Avian Influenza

Differential diagnosis

- Acute fowl cholera
- Velogenic Newcastle disease
- Infectious laryngotracheitis
- Infectious Bronchitis

Avian Influenza

Principle of Vaccination

Effective HPAI Vaccine-

- Not only Protect against disease but also prevent shedding of virus.
- Vaccine with closer antigenic Match.
- Only in High Risk Areas/Endemic.

Avian Influenza

Avian Influenza Vaccines Available Abroad

Inactivated Adjuvanted Whole Virus Vaccine

Homologus (INTERVET)

Heterologus

DIVA Based Vaccines

Recombinant Vaccines

- Recombinant fowl pox-vectored vaccine that co-expresses the HA and NA of the A/goose/Guangdong/1/96 virus **Merial**
- A recombinant LaSota strain of Newcastle disease virus (NDV) expressing an H5 HA insert

[List of Vaccine Manufacturers](#)

Vaccination Schedule for Nobilis Influenza H5*

- a. *Dosage:* 0.5 ml per dose in birds older than 3 weeks of age, 0.25 ml per dose in younger birds.
- b. *Administration:* subcutaneously in the lower back of the neck or intramuscularly in older birds.
- c. *Emergency Vaccination Schedule:*
Primary vaccination administered to all poultry irrespective of age.
Booster vaccination administered 4 – 6 weeks later.
(If the primary vaccination was administered to birds younger than 3 weeks of age a third vaccination is recommended at 16 – 18 weeks of age)
- d. *Vaccination of Replacement Flocks:*
Vaccination schedule is dependant on perceived risk of infection.
In high risk areas (active infection) primary vaccination (0.25 ml) is recommended at day old to establish immunity as early as possible.
Two booster vaccinations (0.5ml) are recommended at 4 – 6 and 16 – 18 weeks of age.
In areas with high infection pressure revaccination at midlay may be indicated.

* The vaccination schedule for Nobilis Influenza H5, which is mentioned by Intervet in product related information, is based on existing registrations. However in the light of recent

Limitations to vaccination

In India- Vaccination not permitted / Not recommended

- Expensive
- No cross protection between 16 H subtypes
- Possible creation of reassortant virus-Update the vaccine annually.
- Two doses of 10ug.
- BSL3 Containment facilities for production of vaccine.
- Whole vaccine virus s/b preferred.
- Vaccine induced antigenic drift.
- Efficacy of vaccine in ducks.

Inactivated H5 and recombinant vaccine licensed in the U.S. for emergency in HPAI outbreaks

Human vaccine

Each dose contains neuraminidase and 15 µg of each of the following strains:

A/New Caledonia/20/99 (H1N1)

A/Wisconsin/67/2005 (H3N2)

B/Malaysia/2506/2004

Chemotherapy

- Prevent membrane fusion
 - Amantidine (Symmetrel)
 - Remantidine (Flumadine)
- Neuraminidase inhibitors
 - Zanamivir (Relenza)
 - Oseltamivir (Tamiflu)



Control Strategy

- 1) Biosecurity and quarantine
- 2) Rapid Diagnostics and surveillance
High level of **true** surveillance to detect the emergence of antigenic variants.
(1st Week)
- 3) Elimination of infected poultry or controlled marketing of convalescent poultry. Culling of infected poultry reduces the viral load-& likelihood of transmission to human
- 4) Decreasing host susceptibility to the pathogen by **vaccination**- Vaccination to reduce the re-invasion of the virus in endemic areas.
- 5) Combined Antiviral therapy.
- 6) Education of personnel, owners, and villagers on disease transmission, prevention and control.
- 7) Political commitment & determined implementation.
- 8) Planning, communications, and preparation.

Swine Influenza

Porcine Influenza

History

First report was observed in USA in 1918

Subtype- H1N1

Pigs as major reservoir

Host

Pigs of all age, Turkeys, Human

Transmission

Aerosol and direct contact with infected animals.

Recovered animals sheds the virus for long time

Swine Influenza

Porcine Influenza

Pathogenesis

Incubation period: 1-3 days After entry virus multiplies in the mucosa of respiratory tract.

Develops rhinitis - May progress to Bronchopneumonia

Clinical signs

Severe **paroxysms of coughing, dyspnoea, anorexia, oculo-nasal discharge, rise of temperature**. Recovery after 5-7 days

Secondary bacterial infection-*Haemophilus suis*

Lesions include-Emphysema, hyperplasia of bronchial epithelial cells.

Swine Influenza

Laboratory diagnosis

Material collection: pharyngeal or nasal swab (50% GPB)

Isolation of virus-ECE-Allantoic cavity route-Confirm by HI test
Neuraminidase inhibition test

Prevention and control

Quarantine

Symptomatic treatment

Inactivated vaccine available-No satisfactory protection



Swine Influenza

Human

Symptoms include fever, cough, sore throat, chills, weakness and body aches. Children, pregnant women and the elderly are at risk from severe infection.

People may experience:

Pain areas: in the muscles

Cough: can be dry

Gastrointestinal: diarrhoea, nausea, or vomiting

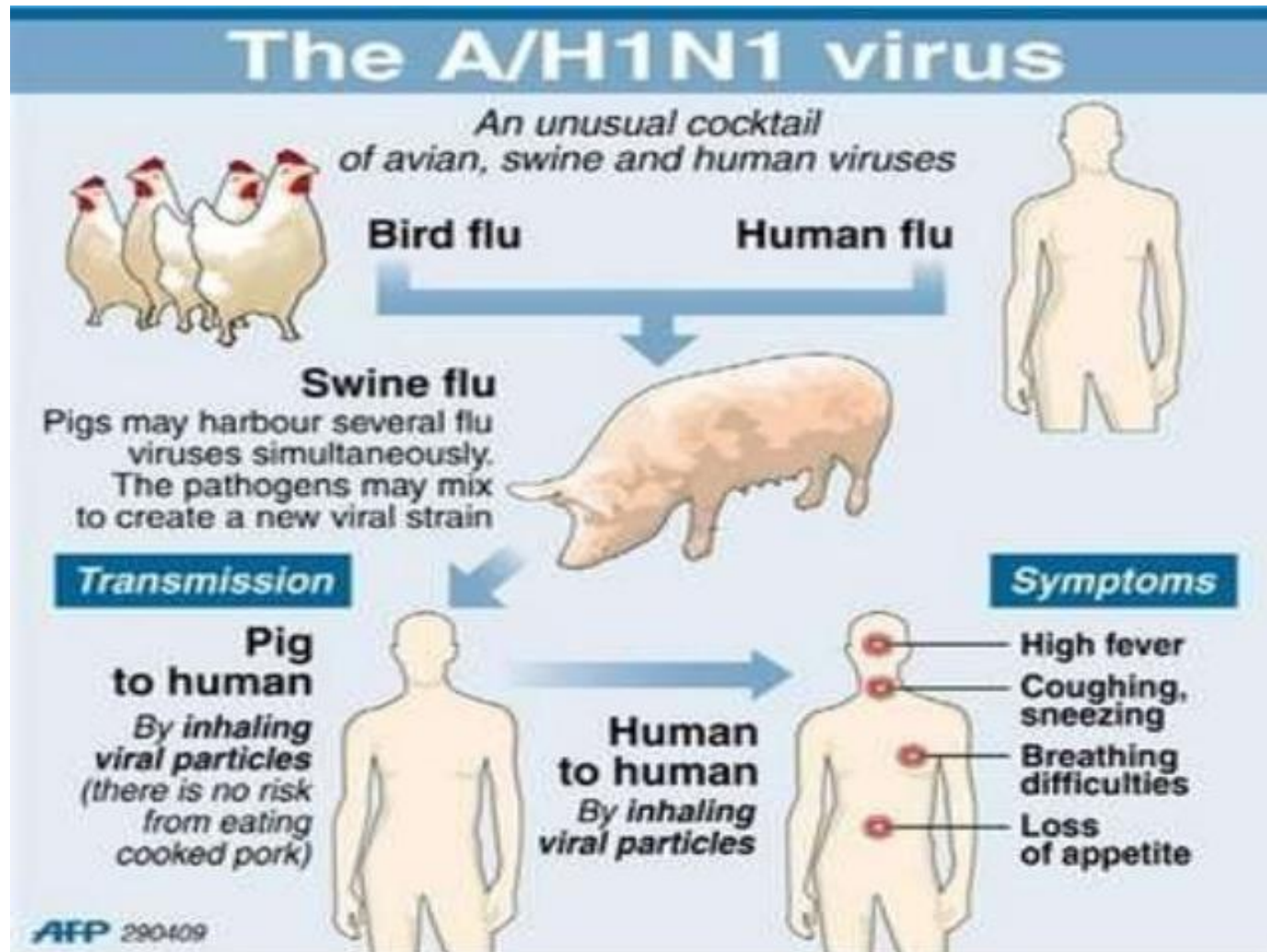
Whole body: chills, fatigue, or fever

Also common: headache, shortness of breath, or sore throat

Transmission

The main route of swine flu virus spread between humans is exposure to the virus when someone infected sneezes or coughs, and the virus enters one of the potential mucous surfaces, or when a person touched something infected with the virus and subsequently touch their nose





Swine Influenza

- Prevent membrane fusion
 - Amantidine (Symmetrel)
 - Remantidine (Flumadine)
- Neuraminidase inhibitors
 - Zanamivir (Relenza)
 - Oseltamivir (Tamiflu)



Equine Influenza

History

First report was observed in Sovinova, Czechoslovakia in 1956

Subtype- H7N7, H3N3 –Florida, USA (1963)

World wide in distribution

Host

All breeds and all ages of Horses, donkeys, mules are susceptible

Transmission

Aerosol and direct contact with infected animals.

International spread- Transport of horses for racing and breeding purpose

Equine Influenza

Pathogenesis

Incubation period: 1-3 days After entry virus multiplies in the mucosa of respiratory tract.

Develops rhinitis - May progress to Bronchopneumonia

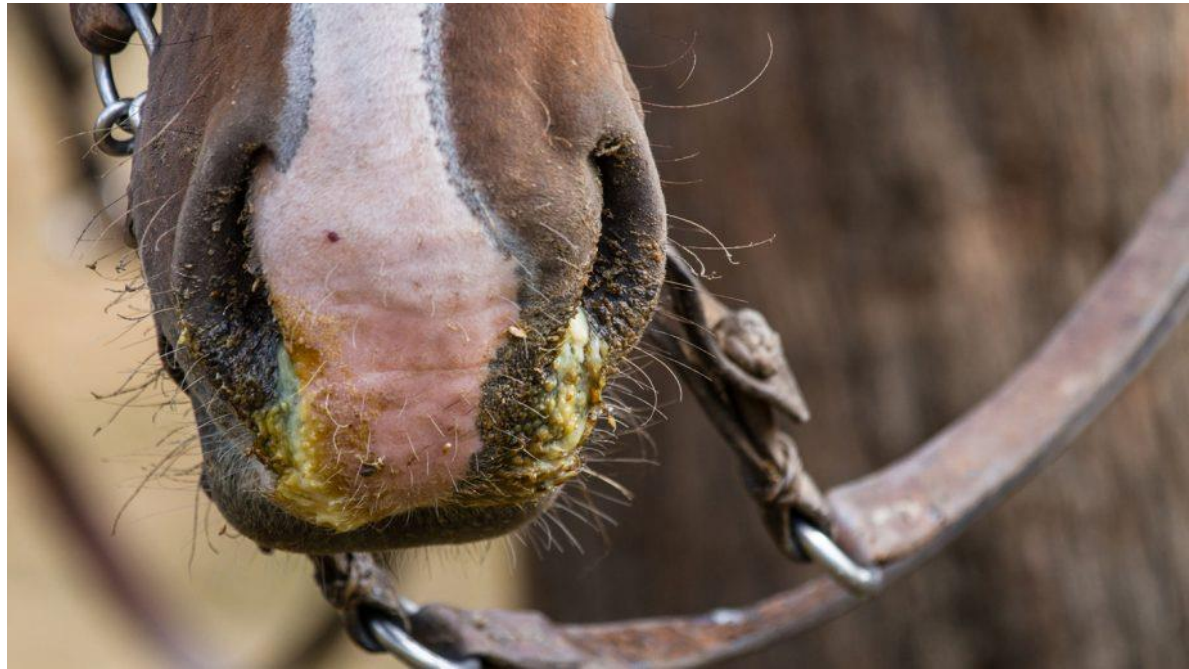
Clinical signs

Coughing, dyspnoea, reddening of nasal mucosa, anorexia, oculo-nasal discharge, sudden rise of temperature. Swelling of pharyngeal lymph node, Recovery after 5-7 days

Secondary bacterial infection-Mucopurulent nasal exudate

Catarrhal bronchopneumonia

Equine Influenza



Equine Influenza

Laboratory diagnosis

Material collection: pharyngeal or nasal swab (50% GPB)

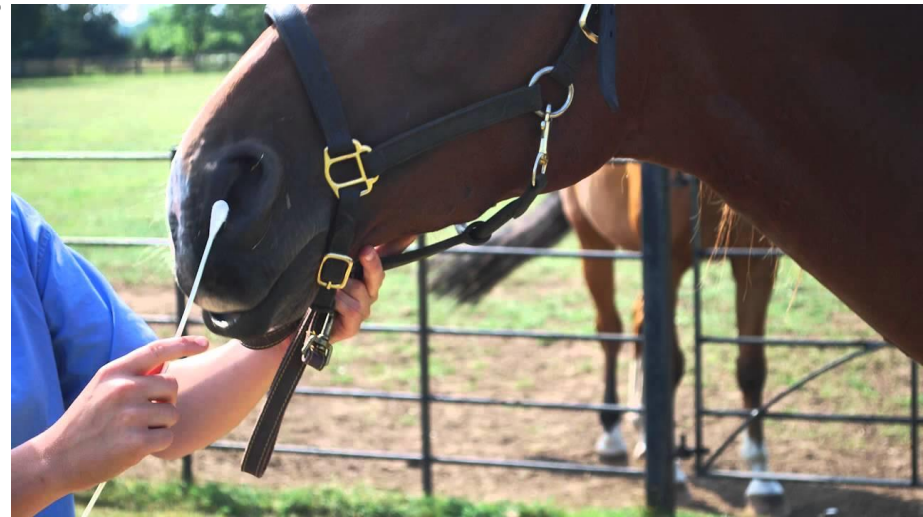
Isolation of virus-ECE-Allantoic cavity route-Confirm by HI test
Neuraminidase inhibition test

Prevention and control

Quarantine and Biosecurity at stud farms

Equine influenza Bivalent inactivated vaccines available

Two doses at a interval of 3-4 weeks



THANKS

