PANDEMIC INFLUENZA

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AVIAN INFLUENZA

- Influenza A viruses
- Birds are the reservoir
- Low pathogenicity strains (LPAI)
- High pathogenicity strains (HPAI)
- Domestic birds infected by wild birds
- Outbreaks in domestic birds lead to exposure of humans
AVIAN INFLUENZA

ORIGIN OF THE DISEASE

- H5N1, Hong Kong, 1997
- H9N2, China and Hong Kong, 1999
- H7N2, Virginia, 2002
- H5N1, China and Hong Kong, 2003
- H7N7, Netherlands, 2003
- H9N2, Hong Kong, 2003
- H7N2, New York, 2003
- H7N3, Canada, 2004
- H5N2, Texas, 2004
## AVIAN INFLUENZA

**Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO**

12 May 2006

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<th>Country</th>
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Total number of cases includes number of deaths.

WHO reports only laboratory-confirmed cases.
ETIOLOGY

- Influenza virus, types A, B and C
  - Single stranded RNA virus
  - Genome is segmented
  - Surface glycoproteins
    - Hemagglutinin (H), 16 antigenically distinct types
    - Neuraminidase (N), 9 antigenically distinct types
AVIAN INFLUENZA

- **ETIOLOGY**
  - Avian influenza
    - H5, H7, H9
    - Transmission to humans
      - Close contact with fowl or excreta is necessary for infection of humans
      - Disease severity in humans is related to the pathogenicity of the avian virus
      - Humans have no immunity to these avian viruses
  - Pandemic influenza A
    - When a human or an animal is infected with a human and an avian influenza virus, the segmented genome allows for reassortment of genes
    - Reassortment of genes between strains may produce a new strain which is readily transmitted among humans
Outbreaks of Avian Influenza (subtype H5N1) in poultry. From the end of 2003 to 24 May 2006

- Vietnam: 2,312
- Thailand: 1,078
- Indonesia: 211
- Turkey: 178
- Russia: 121
- Romania: 88
- China (Peop Rep.): 79
- Nigeria: 69
- Ukraine: 22
- Korea (Rep of): 19
- Cambodia: 16
- Malaysia: 15
- Egypt: 15
- Afghanistan: 13
- Myanmar: 11
- Israel: 9
- Palestinian Aut. Terr: 8
- Japan: 7
- Pakistan: 4
- Burkina Faso: 4
- Iraq: 3
- India: 2
- Azerbaijan: 2
- Albania: 2
- Cote d'Ivoire: 2
- Denmark: 1
- Niger: 1
- Laos: 1
- Kazakhstan: 1
- Jordan: 1
- France: 1
- Germany: 1
AVIAN INFLUENZA

- **EPIDEMIOLOGY**
  - Epidemic and pandemic strains of influenza virus usually emerge in the Far East and other areas in Asia
    - Each year, the CDC identifies the likely strains of virus that may circulate in the U.S.
    - Epidemic strains emerge as the result of small changes in the antigenic make-up of influenza A viruses (drift)
    - When a major antigenic change occurs (shift), this may be due to a reassortment of genes between a human virus and an avian virus, and this may result in a pandemic
AVIAN INFLUENZA

EPIDEMIOLOGY

- Outbreaks of avian influenza in domestic birds in North America and Europe have led to limited transmission to humans who have usually developed conjunctivitis.
- Outbreaks of influenza in domestic birds in North America and Europe have been rapidly contained.
- The greatest concern is that reassortment will occur in the Far East and lead to a pandemic strain that will be rapidly transmitted around the world by air travel.
The diagram illustrates the process of influenza virus strain reassortment across different populations:

1. **Bird population**
   - Poultry with influenza A (H5N1)
   - Influenza A (human strain)
   - Coinfected human cell
   - New reasserted virus strain

2. **Human population**
   - Coinfected human cell
   - New virus strain spreads in human population
   - New reassorted virus strain

3. **Pig population**
   - Coinfected pig cell
   - New reassorted virus strain
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- Epidemiology
  - Reservoir – birds
  - Source – infected people
    - Persons with clinical manifestations
    - Persons in late incubation period not yet manifesting signs and symptoms
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- EPIDEMIOLOGY
  - Modes of transmission
    - Large droplets
    - Direct contact with infectious secretions
    - Airborne (droplet nuclei) transmission may occur but is less common than the other 2 modes of transmission
  - Portals of entry
    - Nose
    - Mouth
    - Conjunctivae
  - Risk factors
    - No data
Acute respiratory distress syndrome
Necrosis
Tissue destruction
Influx of leukocytes
Dilatation of blood vessels

Activated macrophage
Virus replication and release

Activated T cell
Uncontrolled exuberant immune response

Macrophage

Epithelial cells

H5N1 influenza virus

Viral peptide
Immunoreceptor

T cell

Chemoattractants proinflammatory cytokines

Proinflammatory cytokines

Chemoattractants proinflammatory cytokines

Acute respiratory distress syndrome
Necrosis
Tissue destruction
Influx of leukocytes
Dilatation of blood vessels
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- **CLINICAL MANIFESTATIONS**
  - Fever most common first symptom
  - Dyspnea occurs at a median of 5 days (range 1-16 days)
  - All patients have fever, cough and dyspnea during the initial evaluation
  - Almost half have diarrhea and myalgia
  - Intermittent high fevers and persistent cough productive of thick sputum during hospital course
  - Later course
    - Respiratory failure (75%)
    - Cardiac failure (42%)
    - Renal dysfunction (33%)
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LABORATORY TESTS

- Leukopenia (58%)
- Lymphopenia (58%)
- Thrombocytopenia (33%)
- Serum Creatinine rise to > 1.5 mg/dL (33%)

CHEST X-RAYS

- All patients had abnormal chest x-rays
- Progressed to ARDS in two thirds of patients, all of whom died
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- **DIAGNOSIS**
  - Culture of nasopharyngeal specimen obtained by swab or wash
  - Detection of antibodies to influenza virus
  - Detection of influenza in nasopharyngeal specimen by rapid antigen test
  - New real-time RT-PCR test recently approved by the FDA
    - Test distributed to the Laboratory Response Network (LRN) laboratories
    - Results available in 4 hours
TREATMENT

- Adamantanes
  - Amantadine
  - Rimantadine
  - Effective only against influenza A viruses
  - Many strains of avian influenza virus are resistant to the Adamantanes

- Neuraminidase inhibitors
  - Effective against both influenza A and B
  - Effective against strains of avian influenza
AVIAN INFLUENZA

- TREATMENT
- Neuraminidase inhibitors
  - Zanamivir
    - Administered by inhalation
    - Recently approved for prophylaxis (March 29, 2006)
  - Oseltamivir
    - Administered orally
    - Approved for prophylaxis
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PREVENTION

- Emerging Infectious Diseases Response Program:
  - Patients who present with fever, cough and dyspnea will be queried about travel to a country or exposure to a person who traveled to a country with known avian influenza activity in the 10 days before onset of symptoms
  - Patients will remain on isolation for 14 days
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PREVENTION

- Emerging Infectious Diseases (EID) Response Program:
  - Healthcare workers will be under surveillance for 7 days after last contact with a patient with avian influenza
  - Healthcare workers will be immunized against epidemic influenza
  - Oseltamivir may be used for prophylaxis of patients and healthcare workers
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PREVENTION

Emerging Infectious Disease Policies (EIDs)

3.1 – Screening Policy for Persons with a Possible Emerging Infectious Disease (EID)

3.2 – Isolation of Patients with an Emerging Infectious Disease (EID) or Possible EID

3.3 – Transportation of Patients with an Emerging Infectious Disease (EID) or Possible EID

3.4 – Imaging Studies for Emerging Infectious Disease (EID) Patients
AVIAN INFLUENZA

PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.5 – Emerging Infectious Diseases (EID) Protocol for Pediatrics
3.6 – Admission of Patients with an Emerging Infectious Disease (EID) to the Hospital
3.7 – Visitation Policy for Patients with an Emerging Infectious Disease (EID)
3.8 – Protection During the conduct of High-Risk Respiratory Procedures in Patients with an Emerging Infectious Disease (EID)
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PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.9 – Post Exposure Monitoring of UTMB Employees for an Emerging Infectious Disease (EID)
3.10 – Communication on Emerging Infectious Diseases (EIDs) Between the Department of Healthcare Epidemiology and the Galveston County Health District
3.11 – Communications with the Media and the Public About an Emerging Infectious Disease (EID)
AVIAN INFLUENZA

PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.12 – Environmental Cleaning and Disinfection of Rooms Where Patients with an Emerging Infectious disease (EID) Have Been Hospitalized or Treated

3.13 – Detection and Disposition of Outpatients with a Suspected Emerging Infectious Disease (EID)

3.14 – Processing Equipment and Instruments Contaminated by an Emerging Infectious Disease (EID) Agent in the Sterile Processing Department
AVIAN INFLUENZA

PREVENTION

Emerging Infectious Disease Policies (EIDs)

3.15 – Laundry Protocol for Washing Linens Contaminated with an Emerging Infectious Disease (EID)
3.16 – Protection Against an Emerging Infectious Disease (EID) in the Dietary Service
3.17 – Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Emerging Infectious Diseases (EIDs)
3.18 – Investigation and Management of Incidents of Unprotected Exposure to Cases of an Emerging Infectious Disease (EID)
3.19 - Preparation and Transport of Deceased Patients with an Emerging Infectious Disease (EID)
Exit Room & Wash Hands
(or alcohol gel)
Wash Hands
(or alcohol gel)