



Influenza-related respiratory failure

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16.
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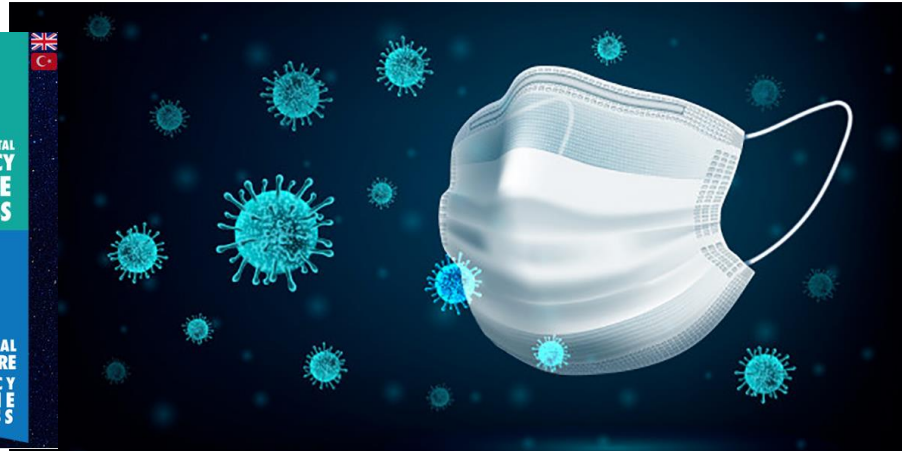


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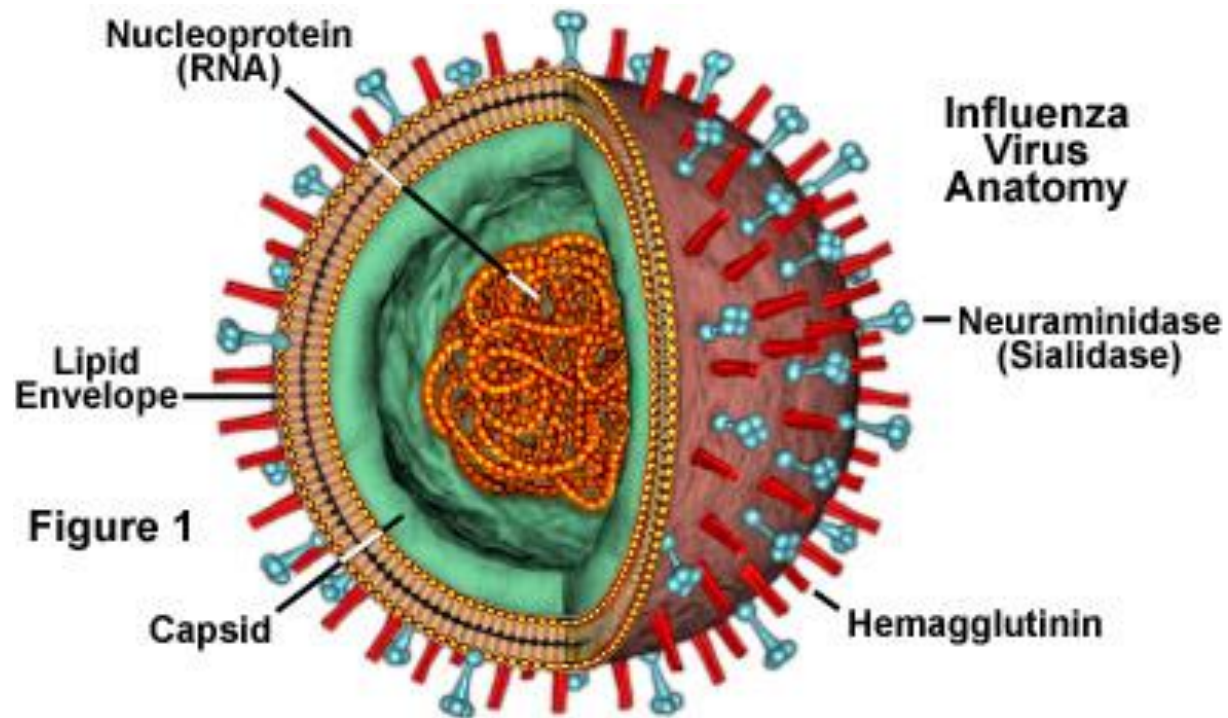


Epidemiology

- Influenza viruses that cause influenza belong to the Orthomyxoviridae family.
- According to the antigenic differences in nucleoprotein and matrix proteins, these viruses have three types defined as A, B and C.
- **The influenza A** strains that most frequently cause pandemics are divided into subtypes by looking at the antigenic structures of **hemagglutinin (H)** and **neuraminidase (N)** glycoproteins on their surface



Epidemiology





Epidemiology

- Based on the **hemagglutinin (H)** and **neuraminidase (N)** glycoproteins the presence of 16 H (H1-H16) and 9 N (N1-N9) type influenza A strains has been defined.
- For today, combinations of **H1, H2, H3** (rarely H5 and H9) and **N1 and N2** types are more frequently seen in humans.

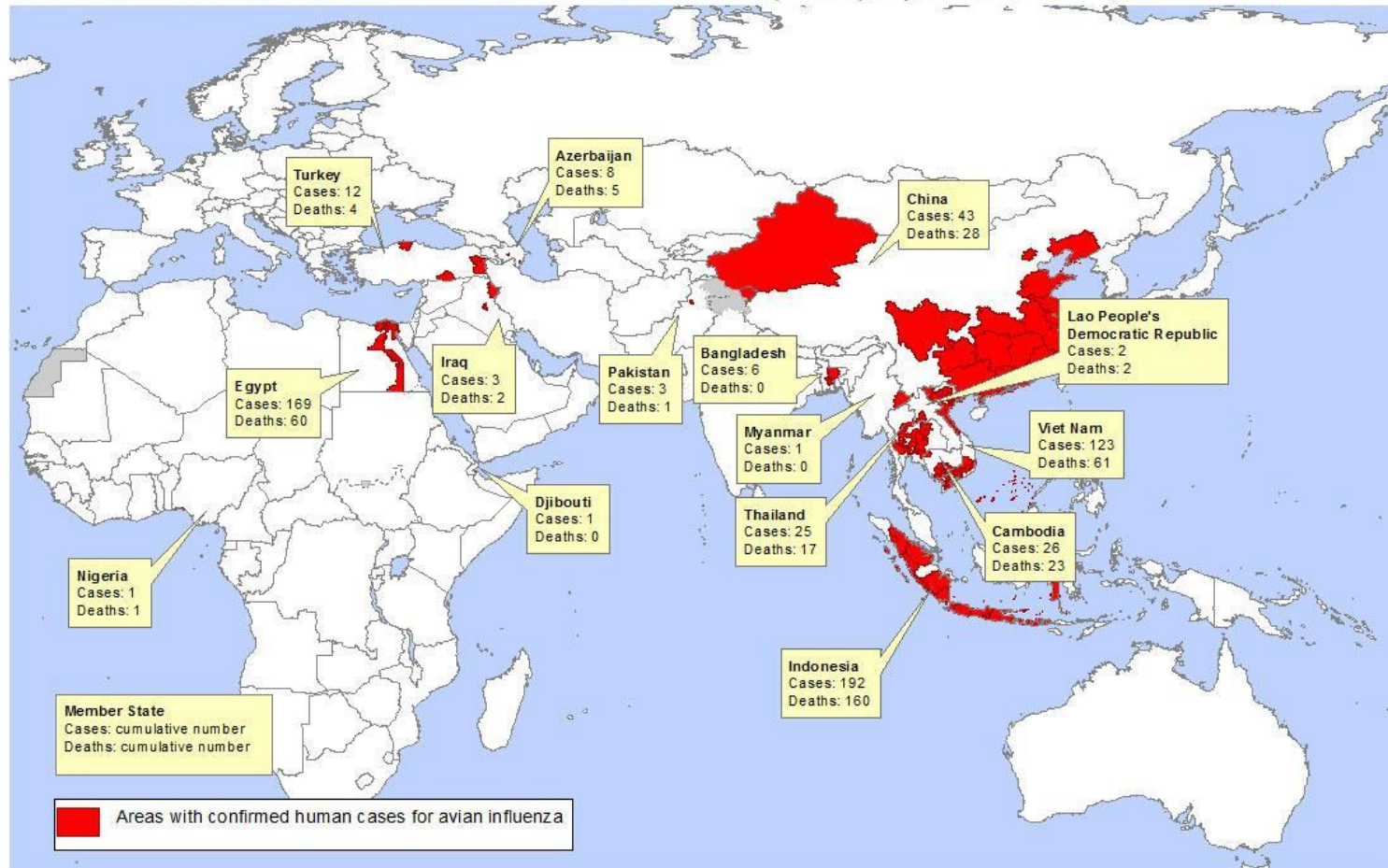


Epidemiology

- Besides humans, influenza also infects a variety of animal species.
- Some of these influenza strains are species-specific, but new strains may spread from other animals to humans
- The term **avian influenza (H5N1)** refers to zoonotic human infection with an influenza strain that primarily affects birds.
- Swine influenza (**H1N1**) refers to infections from strains derived from pigs.
- The 2009 influenza pandemic was a recombinant influenza involving a mix of swine, avian, and human gene (**H3N2**) segments.



Areas with confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2013*



*All dates refer to onset of illness
Data as of 01 February 2013
Source: WHO/HIP

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Epidemiology

- These deadly strains (Influenza A) produced 3 global pandemics in the last century.
- **Three major influenza pandemics have been recorded:**
 - The pandemic of 1918 (H1N1)
 - The pandemic of 1957 (H2N2)
 - The pandemic of 1968 (H3N2)

The worst of which occurred in 1918 was Spanish flu (though cases appeared earlier in the United States and elsewhere in Europe).

This pandemic killed an estimated **20-50 million persons**, with **549,000 deaths in the US** alone



Clinical Features

- Influenza, one of the most common infectious diseases, is a highly contagious airborne disease that occurs in seasonal epidemics
- **Manifestations**
 - ---Acute febrile illness
 - ---Systemic symptoms
 - ---Mild fatigue
 - ---**Respiratory failure**
 - ---Death.



Mortality

- The US Centers for Disease Control and Prevention (CDC) documented that seasonal influenza was responsible for **24,000-62,000 deaths** during the **2019-2020 season**.
- Mortality is highest in **infants** and **elderly** persons



Pathophysiology

- The primary mechanism of influenza pathophysiology is a result of direct viral infection of the respiratory epithelium, combined with the effects **of lung inflammation caused by immune responses**
- This inflammation can spread systemically and manifest as a multiorgan failure, but these consequences are generally downstream of lung compromise and acute respiratory distress syndrome (ARDS); **severe respiratory distress.**



Pathophysiology

- The inability of the lung to perform its primary function of **gas exchange** can result from multiple mechanisms including:
 - obstruction of the airways,
 - loss of alveolar structure,
 - loss of lung epithelial integrity from direct epithelial cell killing,
 - degradation of the critical extracellular matrix.



How influenza triggers ARDS

- Influenza virus affects the respiratory tract by direct viral infection or by damage from the immune system response.
- In humans, the respiratory epithelium is the only site where the hemagglutinin (HA) molecule is effectively cleaved, generating infectious virus particles.
- Virus transmission occurs through contact with aerosols or respiratory fomites from an infected individual



How influenza triggers ARDS

- Ultimately, the involvement of significant portions of the airways in an infectious response, either by **direct viral infection** or by **damage from the responding immune system**, represents a physiological failure.



Influenza clinical progression to pneumonia and ARDS

- Approximately 30–40% of the hospitalized patients with laboratory-confirmed influenza are diagnosed with acute pneumonia.
- These patients who develop pneumonia are more likely to be young (**< 5 years old**) and (**> 65 years old**).
- Influenza can primarily cause **severe pneumonia**, but it can also present in conjunction with or be followed by a **secondary bacterial infection**, most commonly by ***S. aureus* and *S. pneumoniae***



Influenza clinical progression to pneumonia and ARDS

- Influenza A is the predominant viral etiology of ARDS in adults.
- **Risk factors** independently associated with ARDS
 - Age between 36 and 55 years old
 - Pregnancy
 - Obesity

Protective factors

- Female sex
- Influenza vaccination
- Infections with Influenza A (H3N2) or Influenza B viruses.



Influenza clinical progression to pneumonia and ARDS

- Nonetheless, unlike seasonal epidemics of influenza virus infection that display these classic risk factors, pandemics such as the **2009 Influenza A (H1N1 strain)** were associated with a higher rate of **hospitalized respiratory failure** in previously healthy and young adults



Influenza clinical progression to pneumonia and ARDS

- More recently, a large cohort from Australia and New Zealand reported that during the winter of 2017, the predominant **H3N2** virus strain was associated with unprecedented high levels of intensive care unit (ICU) admission due to viral and bacterial pneumonias, even higher than 2009.

Burrell A, Huckson S, Pilcher DV, Anzics. ICU admissions for Sepsis or pneumonia in Australia and New Zealand in 2017. N Engl J Med 2018;378(22):2138–9.



Influenza clinical progression to pneumonia and ARDS

- In the ICU, particularly during **the winter season, influenza** should be suspected in patients with **severe pneumonia, ARDS**, sepsis with or without bacterial co-infection, as well as in patients with encephalitis, myocarditis, and rhabdomyolysis.



Transmission dynamics of the disease

- The most important way to protect against the disease is not to come into contact with the virus.
- Influenza virus is transmitted between humans mainly by **droplets and contact**.
- Contamination can be caused **by direct inhalation of droplets** spreading from the respiratory tract of the infected individual, **or by bringing hands to mucous membranes** such as mouth and nose after contact with contaminated surfaces.



Influenza Treatment & Management

- **Supplemental oxygenation** to manage respiratory symptoms or objective hypoxia
- **Ventilatory support** with a **bag-valve-mask device** or with **field intubation**.
- **Intravenous access** should be obtained, and a bolus of a **crystalloid** can be administered to support hemodynamic stability.
- Attention should be given to the appropriate use of **personal protective equipment (PPE)** by the prehospital providers.

OXYGEN DELIVERY SYSTEMS



Device: Nasal Cannula
Flow: 1 - 6 L/min
FiO₂: 25 - 40%
(~4%/L of flow)



Device: Face Mask
Flow: 5 - 10 L/min
FiO₂: 40 - 60%



Device: Face Tent
Flow: 10 - 15 L/min
FiO₂: ~40%



Device: Venturi Mask
Flow: 2 - 15 L/min
(based on valve)
FiO₂: 24 - 60%



Device: Non-Rebreather
Flow: 10 - 15 L/min
FiO₂: 80 - 95%



Device: High Flow Nasal Cannula
Flow: up to 60 L/min
FiO₂: 21 - 100%

@official_nursing_today

PEEP Valve

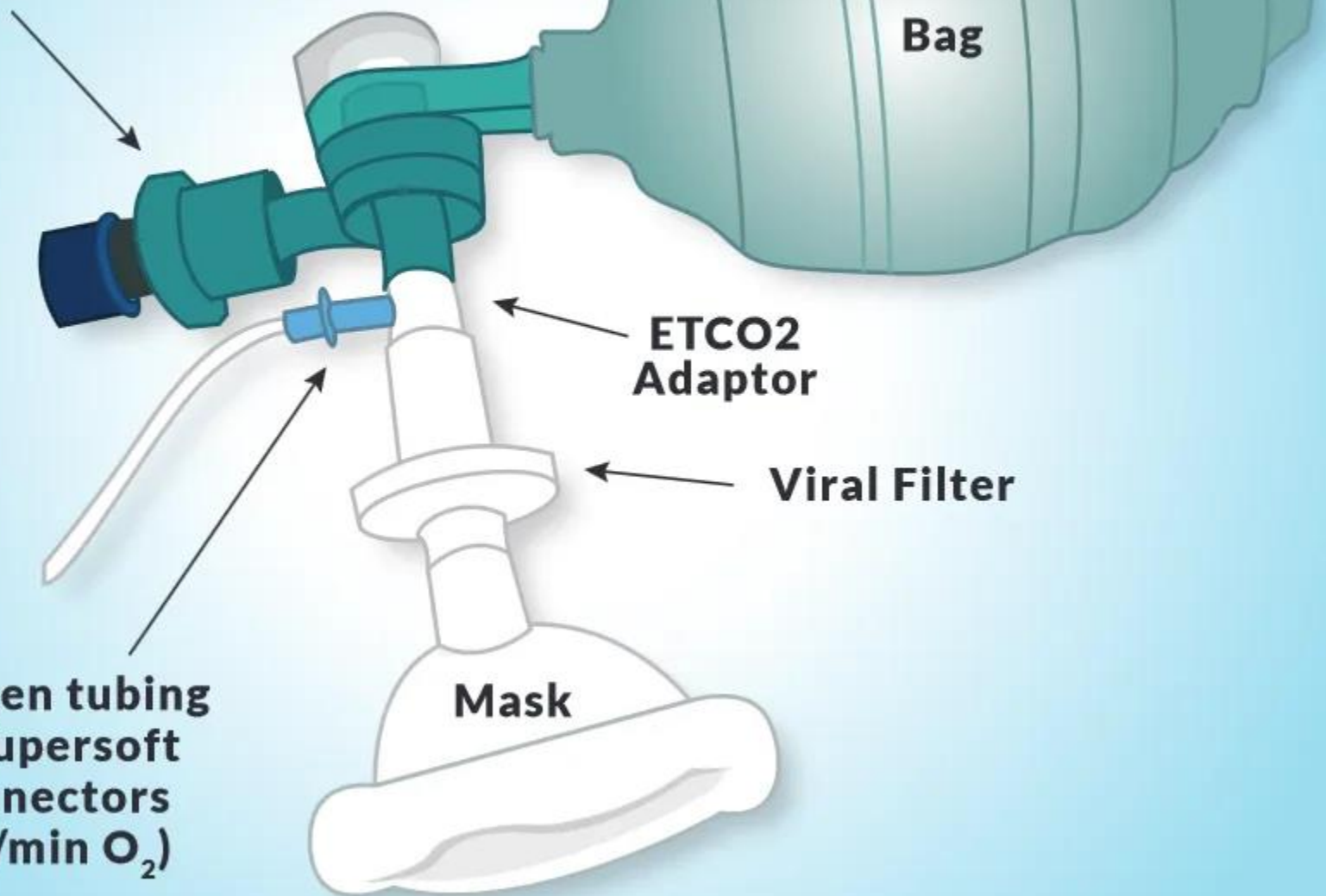
Bag

ETCO2
Adaptor

Viral Filter

Oxygen tubing
w/supersoft
connectors
(6L/min O₂)

Mask





Influenza Treatment & Management

- In the US, the following antiviral drugs are recommended for chemoprophylaxis and/or treatment of influenza:
 - Baloxavir marboxil
 - **Oseltamivir**
 - Peramivir
 - Zanamivir



Questions or Contributions...

