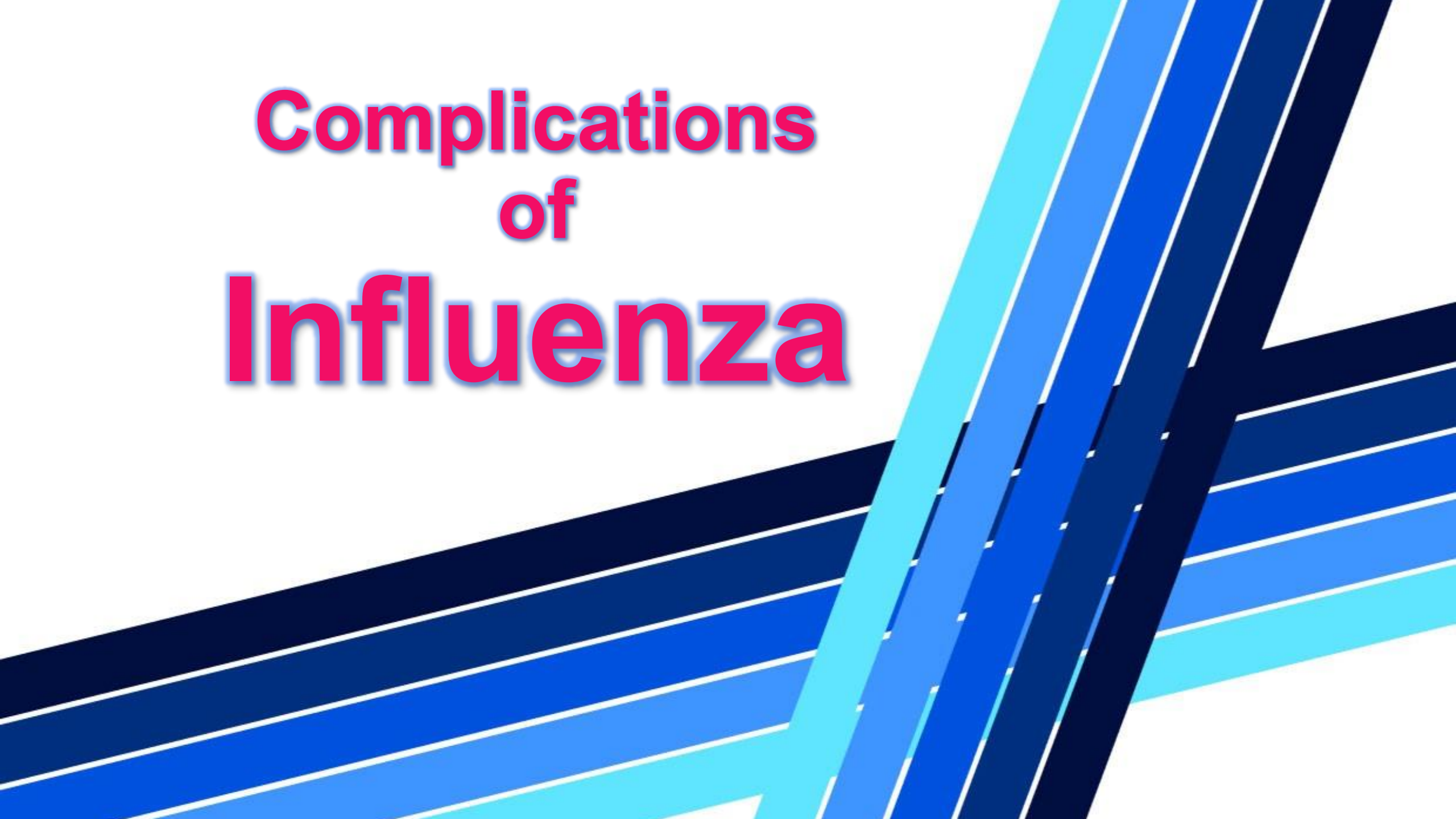


Complications of Influenza



viral and bacterial complications

- Both **viral and bacterial complications** are **common** during childhood influenza.
- **Otitis media, sinusitis, and pneumonia** all can be due either to the primary viral infection or to manifestations of coinfecting bacteria.
- Laryngotracheobronchitis (**croup**) can be a manifestation of **acute influenza** in young children.

PULMONARY COMPLICATIONS OF VIRAL INFLUENZA

- The **most frequent serious complications** of influenza are pulmonary and fall into 4 categories:
 - ✓ primary influenza pneumonia,
 - ✓ secondary bacterial pneumonia,
 - ✓ pneumonia due to unusual pathogens or in immunocompromised hosts,
 - ✓ exacerbations of chronic pulmonary diseases.

Viral pneumonia

- The most common x-ray presentation is **patchy or interstitial infiltrates**, and infrequently, pleural effusion.
- Viral pneumonia was more common with the **2009 pandemic H1N1 strain** than in recent seasons with other influenza **A or B virus strains** and was particularly prevalent in **older children and young adults**.



Influenza-related viral pneumonia. Chest X-ray demonstrates thickened pulmonary markings in both lungs and spots of shadows along the pulmonary markings in the medial middle zone of middle and lower fields of both lungs

Influenza-related viral pneumonia. Chest X-ray demonstrates thickened pulmonary markings in both lungs, spots, and small flakes of shadows along the pulmonary markings in the medial middle zone of both lung fields



Bacterial pneumonia

- Typical viral influenza infection is followed by near resolution of symptoms, subsequently complicated **4 to 14** days later by a recurrence of fever, dyspnea, productive cough, and pulmonary consolidation.
- The **most common** pathogens are **Streptococcus pneumoniae**, **Staphylococcus aureus**, Haemophilus influenzae, and occasionally other gram-negative bacilli
- Bacterial pneumonia was relatively uncommon during the 2009 pandemic compared to previous pandemics, but when superinfections were present, **outcomes were worse** and **hospitalization was prolonged**.



Influenza complicated by pneumonia. (a) Chest X-ray demonstrates thickened pulmonary markings and wedge-shaped consolidation shadow extending outward from the hilum in both upper lung fields. (b–c) CT scanning demonstrates wedge-shaped consolidation shadow in both upper lung lobes, with internal air bronchogram that is more obvious in the right lung, as well as small patches of blurry shadows in the right upper lung lobe



Influenza complicated by pneumonia. Chest X-ray demonstrates thickened pulmonary markings in both lungs, decreased transparency of the right lung field, and flakes of blurry shadows along the pulmonary markings in the right lung, with fusion of some shadows in consolidation opacity

Pulmonary Complications with Unusual Pathogens

- Multiple reports describe secondary pneumonia caused by **less common microorganisms**.
- These include **Aspergillus** sp., **Chlamydia pneumoniae**, B-hemolytic streptococci, and **Legionella pneumophila**.

Exacerbations of Chronic Lung Diseases

- Mechanisms by which influenza virus and other respiratory viruses induce exacerbations of chronic respiratory diseases are incompletely understood but are likely related to **inflammatory mediators**, including interleukins, cytokines, and modifications in the **ratio of T-cell subsets** that lead to increased sensitivity to other allergens.

Otitis media & sinusitis

- **Otitis media** associated with influenza may present as a mild, serous exudate if it is **solely due to the virus**, but in young children, **mixed viral-bacterial infections** are common and a painful, purulent exudate may result.
- Symptoms of **sinusitis** are common during acute influenza, and opacification of the sinuses can be seen on computed tomography in a significant proportion of affected persons.
- **Bacterial sinusitis** may result as a secondary complication, manifest as increased pain and a **return of fever** after an initial period of recovery

Hepatitis & Reye syndrome

- **Mild elevations of hepatic transaminases** occur commonly during acute influenza.
- **Severe elevations**, accompanied by steatosis, may be seen in Reye syndrome in the setting of salicylate exposure.
- Reye syndrome appears to be **more common** with **influenza B virus**, and encephalopathy, hepatic failure, and death may result.
- The incidence of this complication has decreased markedly since warnings to avoid aspirin in **febrile children** were issued, but occasional cases still occur

Reye syndrome

- **Reye's syndrome, a rapidly progressive disease characterized by encephalopathy and fatty infiltration of the liver, has been associated with viral infections including influenza treated with acetylsalicylic acid.**

Musculoskeletal complications of influenza

- While **myalgias** are a common complaint among individuals with many viral infections, the development of **rhabdomyolysis** represents a less common but more serious complication.
- In cases of **virus-associated rhabdomyolysis**, influenza is identified as the **most common etiology**.

acute myositis

- An **acute myositis** manifest by **severe pain and tenderness** of both calves may occur during the early convalescence stage.
- This syndrome may have a rapid onset and is accompanied by elevations of **serum creatine kinase** and **aspartate transaminase** and, occasionally, **rhabdomyolysis** in severe cases.
- Rhabdomyolysis can lead to **renal failure** by tubular obstruction from excess **myoglobin**, direct tubular injury, or vasoconstriction of renal blood vessels.

myocarditis and pericarditis

- Cardiac complications including **myocarditis** and **pericarditis** are associated rarely with influenza.
- The **pathogenesis** of these complications is unclear, as virus is rarely identified in affected tissues.

Hematologic complications of influenza

- **Influenza infection is associated with a variety of hematologic complications including:**
 - ✓ **thromboembolic disease,**
 - ✓ **thrombotic thrombocytopenic purpura (TTP),**
 - ✓ **hemolytic-uremic syndrome (HUS),**
 - ✓ **hemophagocytic syndrome (HPS).**

Endocrine complications of influenza

- **Patients with diabetes mellitus are considered high risk for severe influenza illness as infectious diseases are frequently the trigger for diabetic complications including (DKA) and hyperglycemic hyperosmolar non-ketotic coma (HHNK).**

Neurologic complication

- **Febrile seizures**
- **exacerbation of a seizure disorder**
- **Encephalitis/encephalopathy**
- **transverse myelitis**
- **aseptic meningitis**
- **focal neurologic disorders**
- **Guillain-Barré syndrome**

Neurologic complication

- **Febrile seizures** are relatively common and uncomplicated in young children with or without a previous diagnosis of seizure disorder, and **up to 30% of all febrile seizures** of childhood are due to influenza.

Neurologic complication

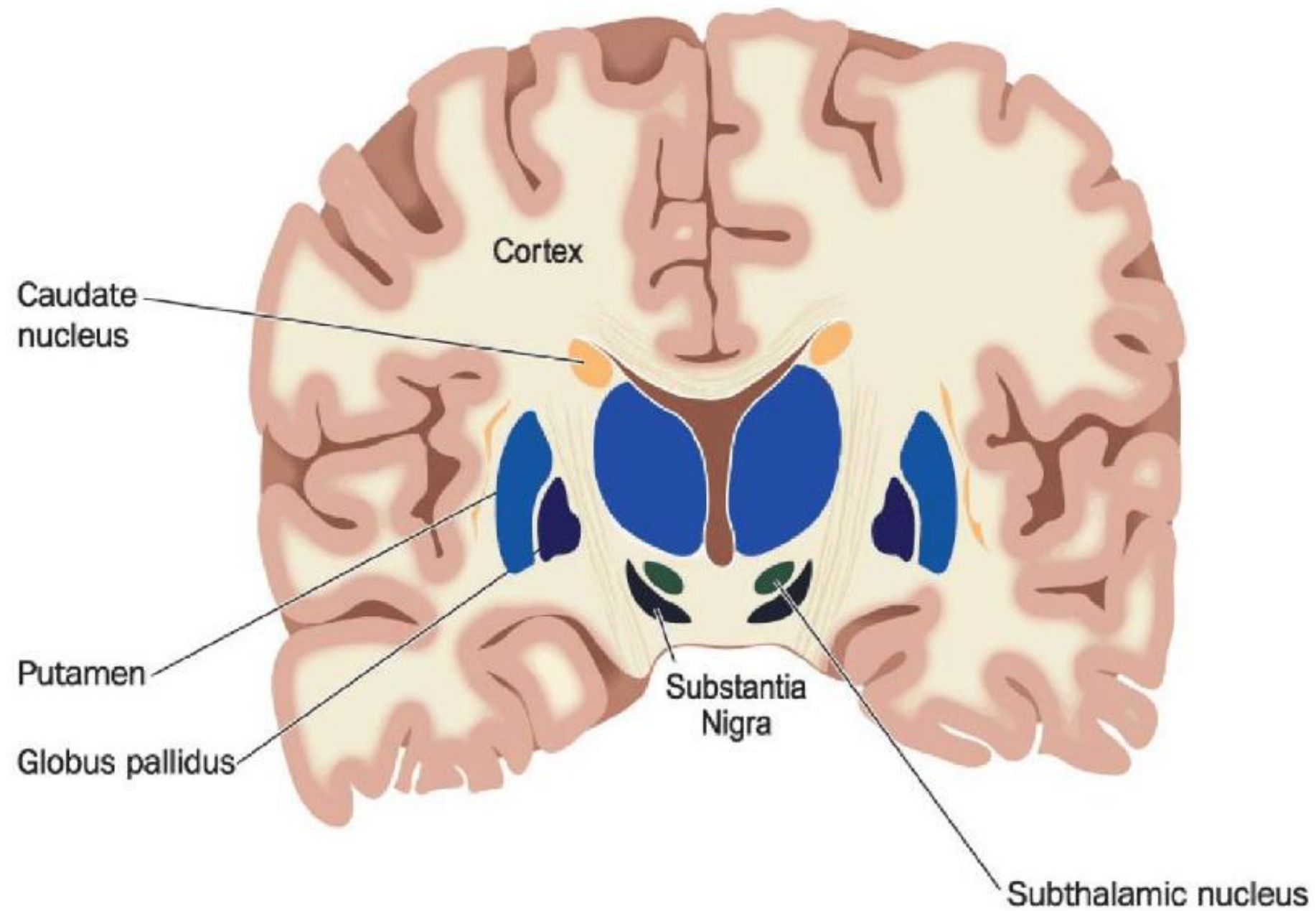
- Mild neurologic complications, such as **exacerbation of a seizure disorder**, occur more frequently in patients with **preexisting neurologic disorders**.
- **Severe** neurologic symptoms can be associated with influenza. These complications are confined almost exclusively to **young children** who are **naïve to the virus** and have never received the **influenza vaccine**.
- Central nervous system involvement is most common in children. Presentation is generally rapid, and mortality may reach 30%.

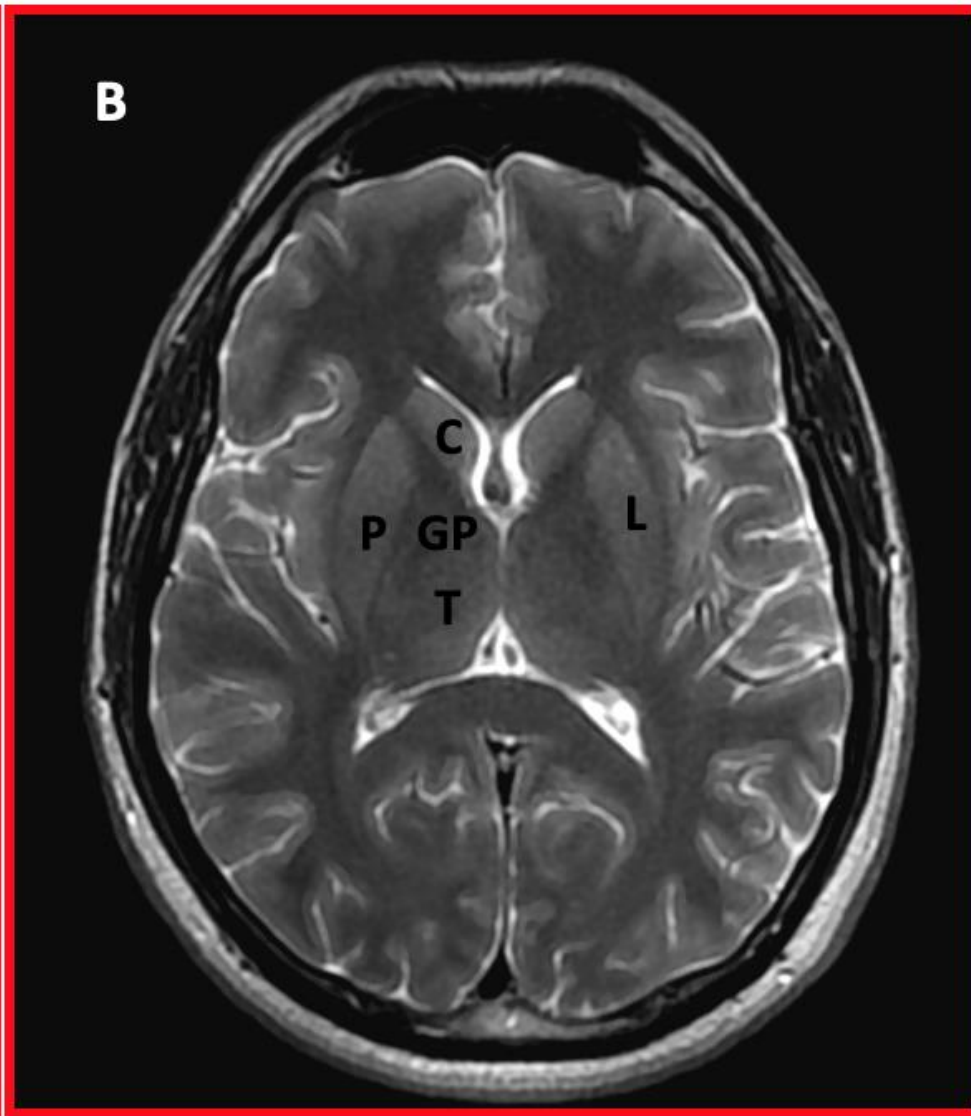
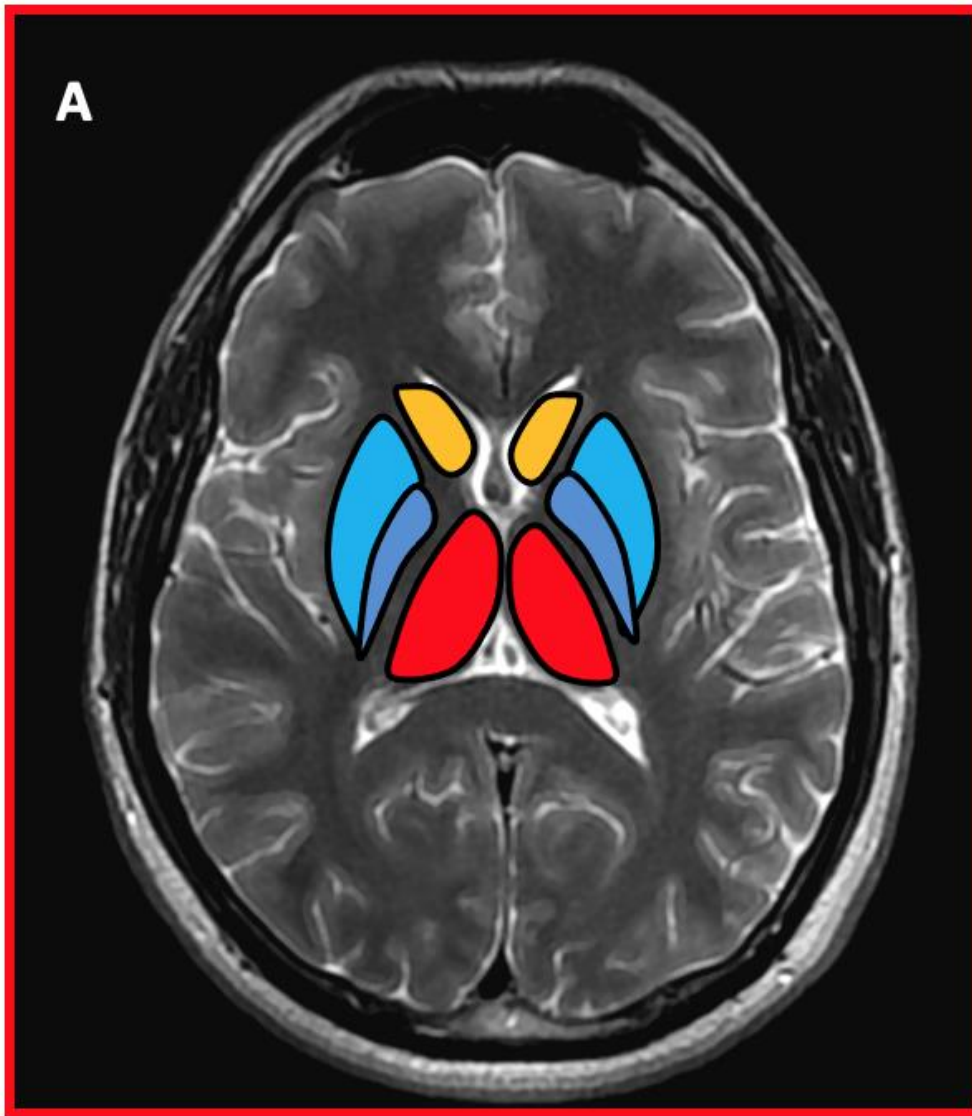
Neurologic complication

- **Encephalopathy** during influenza can present with a variety of symptoms and signs, but **mental status changes** ranging from delirium to behavioral disturbances to coma are **most prominent**.
- **Cranial nerve pareses** are unusual, as are **meningitic presentations**.
- **CSF** examination is typically normal or reveals a mild pleocytosis, and virus can be **detected in CSF by PCR** or in biopsy or autopsy material from affected brains in about **15%** of cases.
- Diagnosis is made on a clinical basis, with supporting information from **EEG and MRI** to rule out other causes.
- CT scans and MRI either are normal or demonstrate **diffuse edema** and are generally unhelpful in establishing a **definitive diagnosis or prognosis**.
- EEG typically shows a **general slowing without an acute focus**.

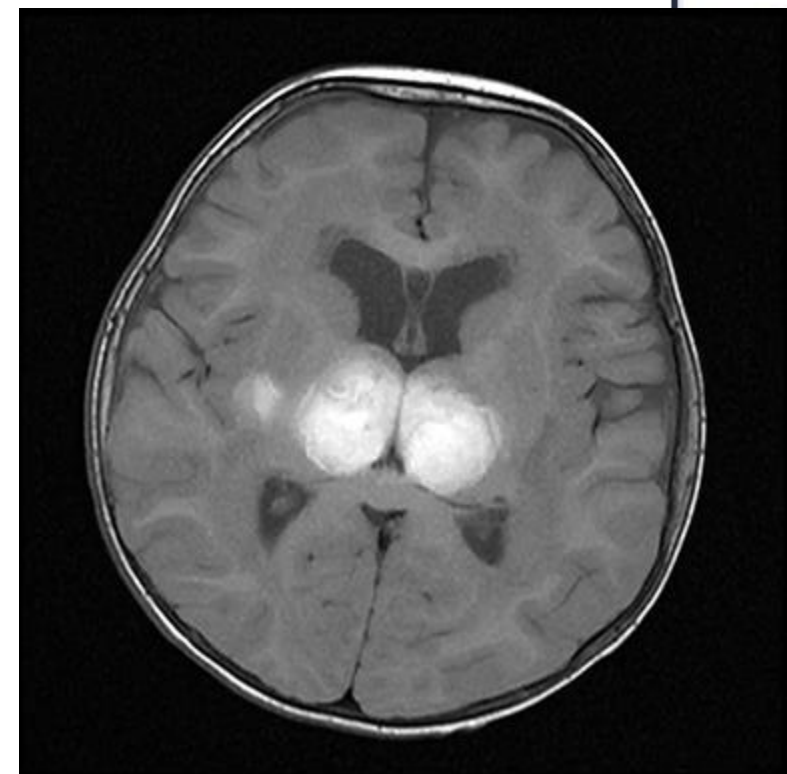
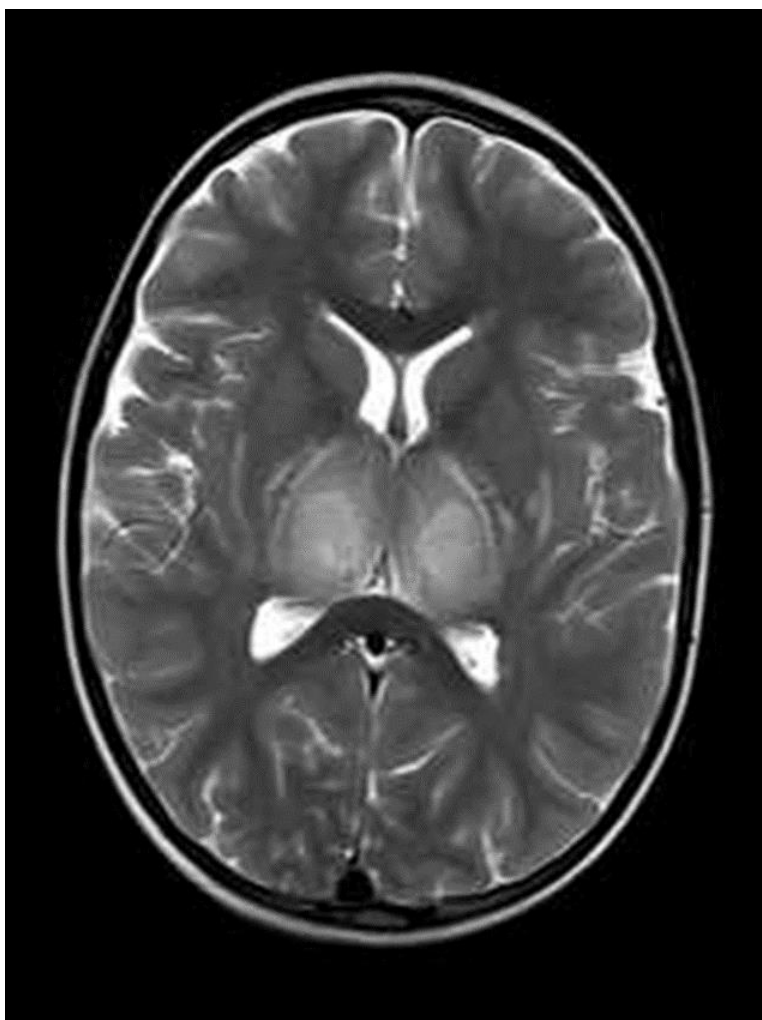
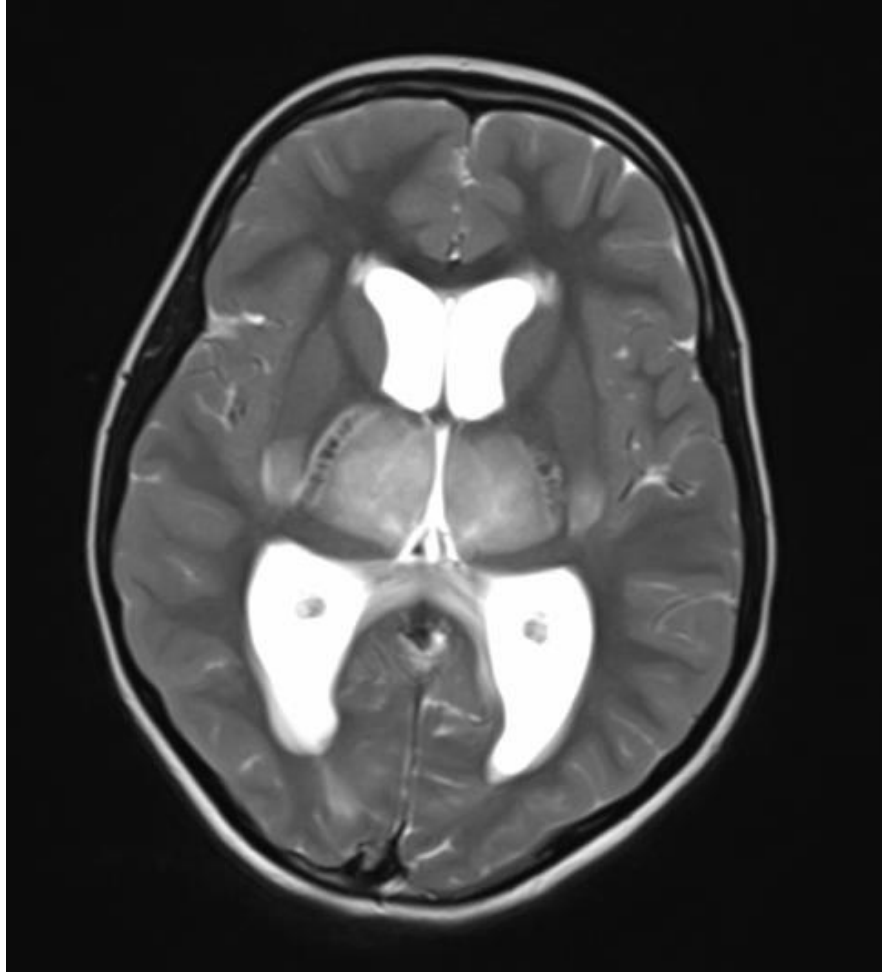
acute necrotizing encephalopathy

- A subset of patients present with a **more fulminant course** and have findings on CT or MRI suggestive of **necrosis in the subthalamic regions**, a syndrome termed acute necrotizing encephalopathy.





-  CAUDATE NUCLEUS = C
-  GLOBUS PALLIDUS = GP
-  PUTAMEN = P
-  THALAMUS = T



A case report

- A one-year-3-month girl who was previously well presented with fever and cough for past three days. Subsequently, she developed rash with itchiness and sought medical attention.
- On examination, there was urticarial rash over back, trunk, upper and lower limbs. Initial assessment made was allergic reaction and she was immediately started on oral prednisolone 1mg/kg.
- The urticarial eruption subsequently improved, especially on the back where it was completely resolved.
- However, the rash over the upper limbs, lower limbs and trunk became purpuric within a few hours of admission. Unlike the typical urticaria, this rash was fixed in the same locations lasting more than 24 hours.







A case report

- Full blood count showed a **normal leukocyte count** of $9.5 \times 10^3/\mu\text{L}$, platelet count of $343 \times 10^3/\mu\text{L}$ and haemoglobin of 11.4g/dL . **Coagulation profile** was within the normal range.
- C-reactive protein was elevated at **24.70mg/L**. Liver and renal function tests were normal.
- Mycoplasma serology was negative. Blood culture taken for bacterial culture and sensitivity showed no growth.
- Nasopharyngeal aspirate was sent for virology study using rapid immunochromatography. The result was negative for Influenza A virus, Adenovirus and RSV but positive for **Influenza B**.

A case report

- The final diagnosis is **urticarial vasculitis** secondary to Influenza B infection. She was treated with oral oseltamivir 30mg twice daily for 5 days. During monitoring for the next 72 hours resolution of the purpura was observed, leaving areas of **post-inflammatory hyperpigmentation** and bruise-like discolouration.
- She was well on discharge with no major organ complication.