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Title: David Versus Goliath: The Clinical Consequences of Influenza A Virus in an Unvaccinated Patient

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Abstract

Acute Influenza Virus (AIV) infection can manifest as a severe life-threatening illness in patients who are not vaccinated, and furthermore, have comorbidities that place them at risk for rapid respiratory decompensation. AIV infection is avoidable by vaccination; however, the illness causes death in high risk individuals due to lack of compliance. Complications of AIV infection, such as bacterial pneumonia are treatable, but other severe complications such as Acute Respiratory Distress Syndrome (ARDS) leading to Diffuse Alveolar Damage (DAD) are limited to supportive therapy and self-resolution. In most cases, including the case presented today, ARDS to DAD is fatal due to the insidious severity of symptoms leading to rapid deoxygenation without correction despite supportive therapy. This patient's poor prognosis, clinical signs and symptoms attest to the importance of vaccination, which protect against the high mortality consequences of AIV.

Keywords: Internal Medicine, Pathology, Virology, Infectious Diseases

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Introduction:

There were five cases of fatal (AIV) infection in Galveston County this winter that resulted in subsequent autopsies performed. Three of those cases (60%) were the result of Influenza A virus, and two of those cases (40%) were Influenza B virus. All AIV infections were confirmed by Polymerase Chain Reaction (PCR). Of the cases identified, four of them (80%) demonstrated superimposed acute bacterial bronchopneumonia, which tends to be a common cause of mortality in influenza infection. In two of the cases (33%), DAD was identified in the setting of ARDS. DAD as a result of ARDS is often detrimental due to inadequate maintenance of oxygenation as in this patient and is often irreversible. The patient that has been discussed in this report did not have superimposed bronchopneumonia but was found to have DAD (17%).

Unfortunately, some research suggests that patients may be unaware of the consequences of AIV [1]. It can be assumed that patients probably understand the general signs of an influenza infection, such as fever, rhinorrhea, sore throat, muscle pain, headaches, coughing, etc... However, the more severe complications may not be so readily known. Due to the nature of the virus, seasonal vaccines must be made due to influenza's ability to mutate and undergo viral reassortment. Thus, increasing public awareness of vaccine benefits is essential to preventing influenza infection and transmission.

Case Presentation:

A 41-year-old obese female with history of diabetes mellitus, morbid obesity, hypertension, seizure, asthma, obstructive sleep apnea, and anemia was admitted for acute respiratory failure to the ICU. Patient had an SpO₂ of 65, diarrhea, nausea, cough, and malaise for five days. The patient tested positive for Influenza A via PCR, and X-ray revealed underinflated pulmonary fields with bilateral airspace opacities suggestive of ARDS with right hemidiaphragm elevation (Figure 1) and can be compared to a prior study with normal findings. The patient was taken off bi-level positive airway pressure and an endotracheal tube was placed at the level of the carina. Overnight, the patient's SaO₂ declined. The cardiothoracic surgery team was consulted and Extracorporeal Membrane Oxygenation (ECMO) was started for the patient, and a 20 French catheter placement was confirmed via imaging (Figure 2). After two hours of ECMO therapy, the patient's oxygenation did not improve. Subsequent serial studies conducted due to catheter adjustment all demonstrated ARDS and worsening pulmonary edema. Upsizing of the ECMO catheter was attempted but resulted in cardiogenic shock once the circuit was clamped, and the patient did not recover after attempted cardioversion. A final chest X-ray reveals the persistence of ARDS manifestations diffusely (Figure 3). Autopsy results confirmed the presence of ARDS by demonstrating DAD without significant evidence for superimposition of bacterial pneumonia (Figure 4). It should be noted the patient was consented by faculty.

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Discussion:

It is a significant finding that AIV infection alone resulted in the mortality of the patient. That is, in a multifactorial sense, overwhelming inflammatory response due to the AIV infection, the patient's comorbid medical history such as diabetes mellitus, morbid obesity, hypertension, seizure, asthma, and obstructive sleep apnea, or both could have been the result of the patient's death [2-4]. Furthermore, of the five reported cases of AIV, the patient reported was the youngest of incidence. This can suggest that the mortality threshold was decreased in this patient with many comorbidities, especially where influenza mortality remains most prevalent in children and the elderly [5].

Another factor to consider is that both patient's with AIV A infection demonstrated DAD while cases due to AIV B virus infection only showed acute bacterial bronchopneumonia. The patient discussed had the most detrimental form of AIV infection to the extent of mortality, possibly before a superimposed bacterial bronchopneumonia could have formed. Most importantly, it is necessary to realize that regardless of the dire attempt to resuscitate the patient, the annual influenza vaccine could have prevented patient demise; flu related deaths have reached epidemic levels for multiple weeks for the 2017-2018 flu season [6]. In the case of this patient with multiple comorbidities for AIV, influenza vaccination could have possibly saved her life.

The presence DAD due to ARDS in the case of AIV A infection is rapidly fatal [7,8]; in this case, the time between onset of symptoms and the patient's demise was 48 hours. The patient had multiple comorbidities such as asthma, morbid obesity and obstructive sleep apnea that contributed to poor ventilation. Vasopressors and bronchodilators had limited effect in opening her airway and oxygenation remained poor due to the massive accumulation of pulmonary edema and inflammatory response of ARDS. Indicated ECMO therapy was limited due to the patient's body habitus and risk for parenchymal perforation. The patient DAD in the setting of ARDS via AIVA Virus infection poses a severe health and presents in patients with multiple comorbidities. Annual influenza vaccinations and reducing comorbid risk factors is preventative, especially in children and the elderly, individuals with high risk profiles for AIV, or both [9].

Figure 1. Initial admitted chest image study of the patient demonstrating diffuse and bilateral pulmonary opacities significant for Acute Respiratory Distress Syndrome. At this time, etiology for Acute Influenza A virus is unknown, but nidus is suspect for infection.

Figure 2. Chest imaging study after adjustment of Extracorporeal Membrane Oxygenation catheter in the right atrium. Significant bilateral pulmonary opacities are still present as a result of Acute Respiratory Distress Syndrome. Pulmonary fields are underinflated bilaterally and worsening compared to previous image study.

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Figure 3. Final chest imaging study before demise of the patient, conducted to rule out pneumothorax. The study reveals persistent bilateral opacities consistent with Acute Respiratory Distress Syndrome. A 20 French Extracorporeal Membrane Oxygenation catheter is shown over the right lung field and terminate in the right atrium.

Figure 4. Biopsy of the patient's lungs showing diffuse alveolar damage with characteristic hyalinization of the membrane with some exudative processes (H&E stain). There are no signs of superimposed bacterial pneumonia. {Carlsen, 2016, The swine flu vaccine, public attitudes, and researcher interpretations: a systematic review of qualitative research}

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