A Case Study on Novel H1N1

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A 51-year-old Caucasian man with a history of acute myeloid leukemia, W.H. is three years removed from an unrelated donor allogeneic stem cell transplantation. W.H. has a significant medication history of post-transplantation antibiotic usage, macrolide immunosuppressant (tacrolimus), steroids, and immunoglobulin G1k monoclonal antibody (infliximab) for chronic graft-versus-host disease (GVHD). He presented to the clinic complaining of rhinorrhea, which he attributed to seasonal allergies; chest discomfort with coughing; sinus pain; and congestion. The patient was febrile (38.6° C), but he denied hemoptysis or discolored sputum.

Diagnostic workup included a complete blood count with differential, peripheral, and central venous catheter blood cultures; urine culture; sensitivity; chest x-ray; chest and sinus computed tomography (CT) scan; cytomegalovirus antigenemia; stool for vancomycin-resistant *Enterococcus*; and a nasal wash. Pertinent laboratory results included a positive rapid antigen test for H1N1 (swine-like) virus, low hemoglobin (11.7 g/dl), hematocrit (33%), and platelet count (67,000 cells/mm^3). W.H. had elevated segmented neutrophils (80%), creatinine (1.5 mg/dl), aspartate aminotransferase (89 IU/L), and alanine aminotransferase (63 IU/L). Chest x-ray, chest CT, and blood cultures were negative, but a sinus CT revealed trace sinus disease.

W.H. was transferred to a protective isolation floor and placed on strict respiratory isolation precautions secondary to a positive test for H1N1 virus. The infectious disease team was consulted because W.H. had a significant history of bacterial, viral, and fungal infections and had recently taken medications that suppressed his immune response (i.e., antivirals and corticosteroids). In addition, W.H.'s white blood cell count remained at low normal levels, often requiring subsequent injections of filgrastim to boost white blood cell production. W.H. remained on low doses of tacrolimus as maintenance therapy after transplantation, which was titrated dependent on chronic GVHD activity and the need for steroidal intervention. W.H.'s suboptimum condition placed him in a vulnerable immunocompromised position of succumbing to attack by this virus.

Because of W.H's positive rapid antigen results, he was administered oseltamivir 75 mg orally twice daily for five days. Adjuvant antibiotics included a course of IV vancomycin for four days and IV cefepime for nine days, and he was discharged on prophylactic antibiotic and antifungal therapy including trimethoprim/sulfamethoxazole, moxifloxacin, and fluconazole.

Because of the similarity in symptoms between influenza A and novel H1N1, healthcare professionals must understand the importance of early detection and treatment in the immunocompromised patient population. In W.H.'s case, a long-standing history of chronic rhinosinusitis with clinical manifestations of rhinorrhea, sinus congestion, and a nonproductive cough can be easily confused with the initial H1N1 presentation.

W.H. spent a total of nine inpatient days for the treatment of H1N1. He remained clinically stable and has since been followed up by the infectious disease team to assess the need for any additional interventions for recurrent pneumonia. His use of steroids has been discontinued, and he remains on a low dose of tacrolimus. His GVHD remains quiescent. His wife and family have since received the H1N1 vaccination and, to date, no outbreaks have been noted within the family.

What Is Novel H1N1?

In early 2009, a number of new and emerging cases of an unknown strain of influenza A were noted in Mexico. Very soon after, a significant number of people in the United States and Mexico began demonstrating what appeared to be common flu-like symptoms. Because the signs and symptoms mimicked that of influenza A, several thousand deaths occurred because of a lack of detection of the emerging H1N1 virus and lack of appropriate treatment (Gaur et al., 2010). The spread of the virus quickly reached pandemic proportions, which eventually led to the recognition of novel H1N1 influenza (Casper, Englund, & Boeckh, 2009). The Centers for Disease Control and Prevention ([CDC], 2010) estimated that, from April 2009 to March 2010, 60 million people worldwide were infected with the H1N1 virus, 270,000 people were hospitalized, and 12,270 deaths were attributed to the virus (Kharfan-Dabaja et al., 2010).

The novel H1N1, or "swine flu" as it is commonly referred to by the public, earned its name initially because laboratory testing demonstrated direct links to some of the same genes found in North American swine. It was initially thought that contact between humans and pigs may have been the route of transmission by inhaled droplets. The CDC (2010) has since reported that the swine flu is less common in North American swine and more prevalent in swine in Europe and Asia.

Early Detection

In W.H.'s case, a long-standing history of chronic rhinosinusitis with clinical manifestations of runny nose, sinus congestion, and unproductive cough can be easily confused with the initial H1N1 presentation. Early detection with either a nasopharyngeal wash or a viral throat swab should be conducted and sent for rapid antigen testing (Crawford, 2009). These tests usually yield results within a few hours, depending on the institution or laboratory. Respiratory viral infections in the stem cell transplantation population can have high mortality rates (approaching 96%), particularly when copathogens exist and the viral respiratory infection lasts longer than three months (Kharfan-Dabaja et al., 2010). Optimal management of the H1N1 virus depends on early detection. This can be

achieved through continuing nursing education focusing on H1N1 influenza pathophysiology, clinical manifestation, symptom detection, and disease management. Oncology nurses must incorporate this knowledge into education for immunocompromised patients, emphasizing primary prevention methods such as vaccination, avoidance of individuals with flu-like symptoms, hand washing, and wearing of face masks. Teaching H1N1 symptom recognition and instructing patients to seek medical attention within the critical 48-hour window of symptom presentation also is important. A written action plan of healthcare provider notification should be provided to immunocompromised patients with cancer so that they know when to contact their doctor if symptoms appear.

Treatment

Although numerous treatments exist for viral pathogens in recipients of stem cell transplantations, the gold standard for the treatment of the H1N1 virus is oseltamivir. Oseltamivir is a neuroaminidase inhibitor that blocks proteins necessary for replication, rendering the virus ineffective. The most beneficial dosing begins within 48 hours of the onset of symptoms and should start at 75 mg BID and can be increased to 150 mg BID for adults (Rhoads, Sanchez, & Davila, 2009). Dosage forms are in capsules (30 mg, 45 mg, 75 mg) and in an oral powder suspension that reconstitutes to 12 mg/ml. A full course of treatment for adults and adolescents older than 13 years is five days, but can be safely administered for as many as 10 days. Precautions should be considered for patients who have hepatic impairment, chronic respiratory or cardiac disease, and who are immunocompromised. For patients with renal impairment (creatinine clearance of 10–30 ml per minute), a reduced dosage of 75 mg orally once daily is recommended (Genentech USA, LLC, 2010).

Adverse Effects

Nausea, vomiting, diarrhea, and abdominal pain are the most common adverse reactions noted to date. The package insert does warn against serious "skin and hypersensitivity" reactions, and also has included warnings that oseltamivir can increase the risk of confusion or abnormal behavior. Precautions should be taken with pregnant women, nursing mothers, and pediatric patients younger than 1 year old (Genentech USA, LLC, 2010).

The World Health Organization (WHO) noted the emergence of some cases of oseltamivir resistance, particularly in immunosuppressed or immunocompromised patients (WHO, 2010). Because of a compromised cell-mediated immunity of the T lymphocytes, patients with a long-standing usage of antiviral or steroids should be placed at a higher risk for developing resistance to oseltamivir and a prolonged viral shedding time (Lapinsky, 2010). The resistant viruses may carry the same "H275Y mutation" that become resistant to oseltamivir, but zanamivir, another antiviral, still is effective in the treatment of the H1N1 virus (WHO, 2010). Although oseltamivir is the first drug of choice, zanamivir should be a considered an alternative if signs and symptoms associated with the H1N1 virus persist. Zanamivir can be delivered via IV or by inhalation (Rhoads et al., 2009).

Nursing Role

Noting the effect of H1N1 on nurses in the inpatient, outpatient, or public health settings is important. Overcrowded emergency rooms and full-capacity hospitals can see a surge of patients during peak influenza outbreaks. This can provide even bigger challenges to nurses on how to educate patients, to assess for the H1N1 virus, and to effectively protect against it. One such hospital noted a "pandemic wave" of patients (Hota, Fried, Burry, Stewart, & Christian, 2009) that flooded their hospital, only to recognize it could have been avoided through better public and patient education. Through continued collaborative efforts among all healthcare professionals, nursing can continue to affect such pandemic situations through knowledge, patient- and family-centered health teaching, and proficient follow-up care.

Summary

As of March 2010, the CDC stated that significant decreases have been noted in reported cases of influenza; however, the H1N1 virus was the most prevalent pathogen for the flu season of 2009–2010. The CDC continues to alert healthcare professionals of the high probability of another pandemic wave and advises that the most effective defense is vaccination against the virus (CDC, 2010). Immunocompromised patients with cancer must have access to preventive health education, vaccination, and H1N1 flu symptom recognition education. Oncology nurses must be committed to expand their knowledge, understanding, and wisdom about the H1N1 virus, and to be proactive toward patient populations and their families.

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Clinical Highlights: Novel H1N1

What Is Novel H1N1?

In early 2009, a number of new and emerging cases of an unknown strain of influenza A were being noted. Because the signs and symptoms mimicked that of influenza A, many thousands of deaths occurred because of a lack of detection and lack of appropriate treatment of the emerging H1N1 virus (Gaur et al., 2010).

Early Detection

Early detection with either a nasopharyngeal wash or a viral throat swab should be conducted and sent for rapid antigen testing (Crawford, 2009). Some institutions require a baseline of two or more symptoms to test for the H1N1 virus. Criteria could include sinus congestion accompanied by fever or upper respiratory symptoms with accompanying fever, runny nose, sore throat, or cough (Chironna et al., 2010). Respiratory viral infections in recipients of stem cell transplantations can have high mortality rates (approaching 96%), particularly when copathogens exist and the viral respiratory infection lasts longer than three months (Kharfan-Dabaja et al., 2010).

Treatment

Although numerous treatments exist for viral pathogens in the stem cell transplantation population, the current gold standard for the treatment of the H1N1 virus is oseltamivir. Oseltamivir is a neuroaminidase inhibitor that blocks proteins that are necessary for replication, rendering the virus ineffective. The most beneficial dosing begins within 48 hours of the onset of symptoms and should start at 75 mg BID and can be increased to 150 mg BID for adults (Rhoads, Sanchez, & Davila, 2009). Dosage forms are in capsules (30 mg, 45 mg, 75 mg) and in an oral powder suspension that reconstitutes to 12 mg/ml. A full course of treatment for adults and adolescents older than age 13 years is five days, but can be safely administered for as many as 10 days. Precautions should be considered for patients who have hepatic impairment, chronic respiratory or cardiac disease, and who are immunocompromised. For patients with renal impairment (creatinine clearance of 10–30 ml per minute), a reduced dosage of 75 mg orally once daily is recommended (Genentech USA, LLC, 2010).

Nausea, vomiting, diarrhea, and abdominal pain are the most common adverse reactions noted to date. The package insert does warn against serious "skin and hypersensitivity" reactions and an increased risk for confusion or abnormal behavior. Precautions should be taken with pregnant women, nursing mothers, and pediatric patients younger than 1 year old (Genentech USA, LLC, 2010).

A few instances of oseltamivir resistance, particularly in immunosuppressed or immunocompromised patients, have been noted. The suspected culprits are resistant viruses carrying an H275Y mutation (World Health Organization [WHO], 2010). Because of compromised cell mediated immunity, patients with a long-standing history of antiviral or steroid usage may be at a higher risk for developing oseltamivir resistance and a prolonged viral shedding time (Lapinsky, 2010). Zanamivir, another antiviral, is effective in the treatment of the H1N1 virus (WHO, 2010). Oseltamivir is the first drug of choice in H1N1 virus; however, zanamivir should be a considered an alternative if signs and symptoms associated with the H1N1 virus persist. Zanamivir can be delivered via IV or by inhalation (Rhoads et al., 2009).

In patients undergoing stem cell transplantation, antibiotic resistance frequently occurs and warrants close evaluation of the patient for possible development of additional infection. If this occurs, empiric antibiotics should be started and close observation for other viral infections, such as cytomegalovirus, respiratory syncytial virus, and Epstein-Barr virus, should be monitored (Anderson, 2008).

Nursing Role

Nurses are on the front line in fighting H1N1. Overcrowded emergency rooms, full-capacity hospitals, and poor public hygiene practices (i.e., lack of covering ones mouth and failure to wash hands) can cause a surge in workloads during peak influenza outbreaks. Heavy nurse workloads provide challenges to nurses in regard to properly educating patients and families. Improved rates of early detection can be achieved through aggressive continuing nursing education focusing on H1N1 pathophysiology, clinical manifestation, symptom detection, and disease management. Oncology nurses must incorporate this knowledge into the education of immunocompromised patients, emphasizing primary prevention, such as vaccination, avoidance of individuals with flu-like symptoms, hand washing, and wearing of face masks.

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