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Monoclonal Antibodies in MS

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A 19-year-old man was diagnosed with relapsing multiple sclerosis (MS) at age 7 and is currently being treated with an infusible monoclonal antibody (mAb) therapy. Early in the day, he receives an infusion at an outpatient clinic. That night, he begins to experience numbness and tingling in his right upper extremity, which prompts a visit to an urgent care clinic. There, the clinician administers IV fluids to the patient. After his symptoms improve, the patient is discharged home.

The next morning, he has a new onset of left-side shoulder and neck pain with a pulsating headache. The patient reports his symptoms to his primary care provider (PCP), who instructs him to visit the emergency department (ED) for evaluation and treatment of a possible infection.

EXAMINATION

The patient arrives at the ED with a 102.4°F fever, vomiting, cough, mild congestion, diaphoresis, generalized myalgias, and chills. He also reports depression and anxiety, saying that for the past 7 days, "I haven't felt like my normal self."

Medical history includes moderate persistent asthma that is not well controlled, status asthmaticus, and use of an electronic vaporizing device for inhaling nicotine and marijuana/tetrahydrocannabinol (THC). Besides mAb infusions, his medications include hydrocodone/acetaminophen, prochlorperazine, gabapentin, hydroxyzine, trazodone, albuterol, and montelukast.

Examination reveals vital signs within normal limits. Lab work confirms elevated white blood cell count and absolute neutrophil count. Chest x-ray shows diffuse bilateral interstitial and patchy airspace opacities. He is diagnosed with bilateral pneumonia and is admitted and started on an IV antibiotic.

Within 24 hours, a new chest x-ray shows worsening symptoms. CT of the chest with contrast reveals diffuse bilateral ground-glass and airspace opacities suggestive of acute respiratory distress syndrome; bilateral thickening of the pulmonary interstitium; trace bilateral pleural effusions; increased caliber of the main pulmonary artery; and mediastinal and right hilar lymphadenopathy.

Subsequently, the patient developed sepsis and went into acute hypoxemic respiratory failure. He is transferred to the ICU, and pulmonology is consulted. A bronchoscopy with bronchoalveolar lavage (BAL) reveals neutrophil predominance; fungal, bacterial, and viral cultures are negative. The patient is started on broad-spectrum IV antibiotics and high-dose IV steroids. After 4 days, he begins to improve and is transferred out of the ICU. He is discharged with oral steroids and antibiotics.

DISCUSSION

Fortunately, the PCP and the ED provider identified risk factors that contributed to the patient's pneumonia and its subsequent worsening to sepsis and acute hypoxemic respiratory failure. The immunosuppressive/immunomodulatory effect of mAb therapy increased the patient's risk for infection and the severity of infection, which is why vigilant safety monitoring and surveillance is essential with mAb treatment.[1] Bloodwork should be performed at least every 6 months and include a complete blood count, complete metabolic panel with differential, and JC virus antibody test. Additionally, urinalysis should be performed prior to every mAb infusion. All testing recommended in the package insert for the patient's prescribed therapy should be performed.

The patient's history of asthma and his chronic vaping predisposed him to respiratory infections. In mice studies, exposure to e-cigarette vapor has been shown to be cytotoxic to airway cells and to decrease macrophage and neutrophil antimicrobial function.[2] Exposure also alters immunomodulating cytokines in the airway, increases inflammatory markers seen in BAL and serum samples, and increases the virulence of *Staphylococcus aureus*.[2]

TREATMENT AND PATIENT EDUCATION

The PCP's treatment plan included patient education about the importance of infection control measures when receiving a mAb; this includes practicing good hand and environmental hygiene, maintaining vacci-

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International Organization of Multiple Sclerosis Nurses (IOMSN) is the first and only international organization focusing solely on the needs and goals of nurses involved with the care, education, research, and advocacy for multiple sclerosis and related autoimmune disorders of the central nervous system. For more information on IOMSN, visit www.iomsn.org. MS Consult is edited by **Colleen J. Harris, MN, NP, MSCN,** Nurse Practitioner/Manager of the Multiple Sclerosis Clinic at Foothills Medical Centre in Calgary, Alberta, Canada, and **Bryan Walker, MHS, PA-C,** who is in the Department of Neurology, Division of MS and Neuroimmunology, at Duke University Medical Center in Durham, North Carolina.

nations, avoiding or reducing exposure to individuals who have infections or colds, avoiding large crowds (especially during flu season), and following recommendations for nutrition and hydration. The PCP also discussed how to recognize the early signs and symptoms of an infection—and the need for vigilant safety monitoring. The PCP described available options for smoking cessation, including nicotine replacement products, prescription non-nicotine medications, behavioral therapy, and/or counseling (individual, group or telephone) and discussed the risks associated with consuming nicotine and/or marijuana/THC and using electronic vaporizing devices.

The PCP emphasized the importance of completing the entire course of the oral antibiotics prescribed at discharge. The patient and the PCP agreed to the following plan of care: appointments with a pulmonologist and a neurologist within the next 2 weeks, and follow-up visits with the PCP every 6 months (or more frequently, as needed) and with a neurologist at least every 6 months (or as indicated by his medication's prescribing recommendations). **CR**

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