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Brain death in a vaccinated patient with COVID-19 infection

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ABSTRACT

We present a case of brain death in a vaccinated, immunocompromised patient who presented with COVID-19 pneumonia. Imaging was characterized by diffuse cerebral edema, pseudo-subarachnoid hemorrhage, and no antegrade flow above the terminal internal carotid arteries. To our knowledge, this is the first case report with such findings in a vaccinated patient.

1. Introduction

It has become increasingly evident that COVID-19 is not just a respiratory illness, but is implicated in severe vascular disease that can affect many organ systems including the brain, heart, and kidneys. While the exact mechanism for increased stroke risk among hospitalized patient with COVID-19 is unknown, there is amassing data that shows this patient group as having a uniquely elevated stroke risk, even when compared to patients with similar infectious conditions such as influenza infection and sepsis [1–5]. In a study published earlier in the pandemic, which included 214 patients from Wuhan, China, 5.7% of patients with severe infection, as defined by the American Thoracic Society and Infectious Disease Society of America Criteria [6], suffered from acute cerebrovascular disease (CVD), and 14% from impaired consciousness including somnolence, stupor, and coma [7]. More recent data collected as part of the American Heart Association COVID-19 cardiovascular disease registry, which included data on over 20,000 hospitalized patients with COVID-19 across the United States, found that 1.4% of all hospitalized patients with COVID-19 had a stroke confirmed by diagnostic imaging, with 52.7% of the patients experiencing ischemic stroke, 2.5% with transient ischemic attack, and 45.2% with hemorrhagic or unspecified stroke type [8].

Neuroimaging plays a vital role in determining not only the diagnosis of patients with acute CVD, but also in the prognosis determination of patients with acute CVD. In the setting of suspected brain death, CT angiography demonstrating both arrest of contrast medium at the level of the internal carotid and vertebral arteries and associated absence of venous blood return is sufficient to pronounce brain death in certain countries [9–12]. Diagnostic imaging also has the benefit of simplicity and rapidity, unlike conventional clinical testing that often requires numerous reassessments conducted hours apart and aerosolizing procedures such as apnea testing [9,13–16].

In this report, we detail the clinical course and neuroimaging findings of a critically ill COVID-19 pneumonia patient, who ultimately suffered catastrophic intracranial events and imaging and clinical findings compatible with brain death.

2. Case description

A 60-year-old woman with medical history notable for type II diabetes, hypertension, atrial fibrillation on apixaban, and systemic lupus erythematosus, treated with a combination of steroids, rituximab, and methotrexate (25 mg per week, held upon hospital admission), presented on May 2, 2021 with a one-week history of fever (T_{max} 104 F) and productive cough. Notably, the patient had been vaccinated with an mRNA vaccine (Pfizer, New York, NY) receiving the second dose on February 18, 2021. She underwent routine COVID testing in anticipation of screening colonoscopy procedure and tested positive on April 1, 2021; she was asymptomatic at that time. She subsequently developed the aforementioned symptoms on April 24, 2021 prompting hospital presentation. PCR testing for COVID-19 on day of hospital presentation returned positive. The patient was negative for SARS-CoV-2 antibodies upon hospital admission on May 3, 2021. Blood cultures taken at admission and on hospital day 6, 9, 14, 18, 21, 23, 25, 27, 29 were all negative.

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