

Brain death evaluation during the pandemic

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Abstract

Coronavirus disease 2019 (COVID-19) may pose unique challenges to clinicians attempting to diagnose brain death in patients infected with the SARS-CoV-2. Among these challenges is the risk of aerosol generation during the traditional apnea testing using the insufflation technique in addition to the risk of complications due to SARS-CoV-2-related lung disease. In this article, we discuss these challenges and provide further guidance to minimize such risks to ensure safety of healthcare professionals and other patients. We also emphasize the importance of maintaining the standards of brain death determination in this critical time.

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Introduction

Since the onset of the coronavirus disease 2019 (COVID-19) pandemic in December 2019, more than 17 million individuals around the world have been infected, with a death toll surpassing 680,000 patients as of August 1, 2020.¹ In addition to the direct impact of COVID-19 on patients infected with the virus, the pandemic has been connected with a collateral increase in the number of deaths related to reduced exposure of patients to urgent and necessary health care. Such delays in evaluation of serious medical conditions such as cardiac arrest, stroke, and sepsis may put patients at a higher risk of irreversible neurologic injury and, subsequently, brain death. However, brain death determination may be challenging or unsafe in the setting of COVID-19 infection because of the risk of aerosol generation during traditional apnea testing (AT) using the oxygen insufflation technique.

The American Academy of Neurology (AAN) carefully outlines the prerequisites and steps necessary to diagnose brain death in adults.² These guidelines require the diagnosis of irreversible coma of a known etiology in the absence of confounders, a clinical examination consistent with brain death, and an apnea test that confirms the absence of a spontaneous breathing drive despite an adequate rise in partial pressure of arterial CO₂. The most common method of performing the AT is by disconnecting the patient from the ventilator while providing oxygen support via a suction catheter inserted in the endotracheal tube (ET) or by providing continuous positive airway pressure (CPAP) through a T-piece connected to a positive-end expiration pressure valve. After the AT is concluded, the patient is reconnected to the ventilator. When coupled with adequate preoxygenation and adherence to the AAN guidelines, the AT is generally safe; however, complications such as hypoxemia, hypotension, and arrhythmias may occur.³ Although ancillary studies are not mandatory if the AT is positive, they are required if the AT cannot be performed or completed because of hemodynamic/pulmonary status or other confounding factors.

Performing the AT in a safe manner is more relevant than ever during a pandemic, with a readily transmissible agent such as SARS-CoV-2. In patients who have SARS-CoV-2 infection and progress to develop a catastrophic irreversible neurologic injury (often due to cardiac arrest or stroke), clinicians may feel hesitant performing the apnea test because of the potential for aerosol generation or because of the severe pulmonary impact of the virus, making the AT potentially unsafe. The clinical determination of brain death (including the AT) should be attempted, even in patients infected with virus, and ancillary studies should not be used to replace the apnea test in patients who tolerate it because ancillary studies can provide false positive and false negative

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results.⁴ The AT as recommended by the AAN may generate aerosols by the oxygen insufflation technique (catheter supplying oxygen down the ET tube) or via CPAP with a T-piece after disconnecting the ventilator^{5,6}; thus, it is advisable to avoid these approaches in patients infected with the SARS-CoV-2. Instead, the apnea test can be performed in one of 2 ways: (1) switching the ventilator to spontaneous mode of respiration while providing CPAP without a T-piece (which allows for adequate oxygenation but requires a patient-initiated breath) or (2) performing the test via the oxygen insufflation technique, or with a T-piece, but with bedside clinical team wearing full personal protective equipment as recommended by the Center for Disease Control.⁶ If the patient is kept on the ventilator during the apnea test, clinicians should pay attention to small changes in the ventilator circuit pressure as they may auto-trigger the ventilator and falsely indicate a patient-initiated breath, and the rescue breath mechanism on the ventilator, if present, must be disabled.⁷ If the apnea test cannot be performed or completed because of severe pulmonary or hemodynamic complications, ancillary studies must be obtained, but the clinical examination must still be performed to the fullest extent possible, including testing for the presence of any other brain function.²

Since the emergence of the pandemic, several health policies focusing on the safety of healthcare personnel have emerged to minimize the risk of exposure and infection among caregivers directly involved in the care of patients with COVID-19. Strategies for performing brain death determination in the COVID-19 pandemic era should include steps to promote the safety of patients and healthcare professionals, particularly during apnea testing, where it is essential to prevent aerosol generation or pulmonary instability.

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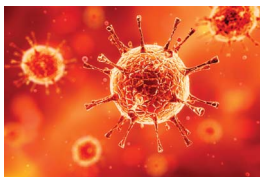
Appendix Authors

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Ibrahim Migdady, MD	Massachusetts General Hospital, Boston	Design and concept and drafting the manuscript for intellectual content
Alexander Rae-Grant, MD	Cleveland Clinic, Cleveland	Design and concept and revision of the manuscript for intellectual content
David M. Greer, MD	Boston University Medical Center	Design and concept and revision of the manuscript for intellectual content

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