Too Hot to Handle: Early Temperature Management and Unique Treatment of Hyperpyrexia in SARS-CoV2 Encephalopathy

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ABSTRACT A 45-year-old otherwise healthy active duty male was admitted to the medical intensive care unit for severe acute respiratory syndrome-coronavirus 2 (SARS-CoV2) encephalopathy associated with hyperpyrexia. Magnetic resonance imaging findings demonstrated cytotoxic lesions primarily at the midline of the splenium of corpus callosum (CLOCC). Similar cases involving hyperpyrexia in the setting of SARS-CoV2 infection have demonstrated exceedingly high-mortality outcomes. Three mechanisms exist as to the likely underlying pathophysiology of SARS-CoV2-induced hyperpyrexia: direct brain injury, persistent immune dysregulation of cytokines, and vascular thrombosis. To date, no cases have reported imaging findings consistent with SARS-CoV2-induced brain injury leading to hyperpyrexia. Magnetic resonance imaging findings in this case, however, may finally elucidate the underlying mechanism for hyperpyrexia in this population. Magnetic resonance imaging findings in this case show diffusion restriction of the corpus callosum without evidence of any Central Nervous System (CNS) vessel abnormality. Given that hyperpyrexia has a clear association with increased mortality and morbidity in the SARS-CoV2 infected population, the decision to initiate steroids and remdesivir regardless of respiratory status was made for the concern for severe SARS-CoV2 infection as demonstrated by the CLOCC. Additional cases will be needed to assess their potential use as a radiological marker of disease burden.

CASE A 45-year-old otherwise healthy active duty male was admitted to the medical intensive care unit for severe acute respiratory syndrome-coronavirus 2 (SARS-CoV2). A computerized tomography (CT) scan of the chest was performed with no evidence of pulmonary emboli or infiltrates; however, a CT of the head demonstrated evidence of cerebral edema. He was admitted to the intensive care unit neurologically intact with no deficits, although complained of intermittent blurred vision. On his second hospital day, he developed a mild oxygen requirement of 41 nasal cannula along with a fever of 106.2◦F (41.2◦C) without compensatory tachycardia (heart rate remained 76-104). A subsequent magnetic resonance imaging showed cytotoxic lesions primarily at the midline of the splenium of corpus callosum (CLOCC) (Fig. 1). The patient was started on dexamethasone 4 mg every 6 hours as well as remdesivir (Veklury) loading dose of 200 mg IV on day 1 followed by 100 mg IV every 24 hours for a total of 4 days. For his fever, he was started on cold IV fluids, Tylenol 1,000 mg IV every 8 hours. The patient was also started on a non-invasive targeted temperature management system, Arctic Sun (ARCTIC SUN 5,000 Temperature Management System, Medivance, Inc., Louisville, Colorado, USA), for external cooling and skin counter warming along with initiating buspirone 30 mg every 8 hours. He defervesced after 24 hours on the third hospital day after continued aggressive hyperthermic and SARS-CoV2 medical management and was discharged without an oxygen requirement on hospital day 6.

DISCUSSION Similar cases involving hyperpyrexia in the setting of SARS-CoV2 infection have demonstrated exceedingly high-mortality outcomes. A previous case series by Suwanwongse documented hyperpyrexia as a marker for high mortality and morbidity in SARS-CoV2-infected patients. In such a series, a sample of six patients, all above 60 years of age, all died shortly after developing a high fever above 106◦F.1 A case report by Nuckchady discussed a 20-year-old female with a past medical history of bronchial asthma admitted for acute decompensated respiratory failure secondary to SARS-CoV2 infection who also died after developing fever ranging 107.6◦F-111.2◦F despite aggressive medical management.2 Lastly, a case by Jeong et al. discussed a 58-year-old female with SARS-CoV2 who developed hyperpyrexia and oxygen dependence who survived after she was started on the Arctic Sun as the sole therapeutic temperature management intervention.3

Three mechanisms exist as to the likely underlying pathophysiology of SARS-CoV2-induced hyperpyrexia: direct brain injury from the virus, persistent immune dysfunction and dysregulation of cytokines, and vascular thrombosis. To date, no cases have reported imaging findings consistent with SARS-CoV2-induced brain injury leading to hyperpyrexia. Magnetic resonance imaging findings in this case, however, may finally elucidate the underlying mechanism for hyperpyrexia in this population. Magnetic resonance imaging findings in this case show diffusion restriction of the corpus callosum (CLOCC). Additional cases will be needed to assess their potential use as a radiological marker of disease burden.

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FIGURE 1. 3D T2 FLAIR Axial magnetic resonance imaging, brain with contrast. Magnetic resonance findings consistent with cytotoxic lesion of the corpus callosum. This finding is nonspecific but may be seen in various infectious processes and has been associated with coronavirus disease-19.

callosum without evidence of any CNS vessel abnormality. Thus, discovery of CLOCC in the SARS-CoV2 encephalopathic patient population may be a marker of impending central hyperthermia (and additional associated brain injury).

CONCLUSION

Given that hyperpyrexia has a clear association with increased mortality and morbidity in the SARS-CoV2 infected population, the decision to initiate steroids and remdesivir regardless of respiratory status was made for the concern for severe SARS-CoV2 infection as demonstrated by the CLOCC. Although the exact mechanism of these medications in the CNS is unknown, our patient fared exceedingly well compared to his cohort in the existing literature, indicating these (and potentially additional) medications may have a role in atypical SARS-CoV2 presentations. Early recognition and intervention with temperature control is also of high clinical value in reducing mortality risk in this patient population. Lastly, physicians must keep in mind that CLOCC may also be an early atypical imaging finding of severe SARS-CoV2 encephalopathy. Additional cases will be needed to assess their potential use as a radiological marker of disease burden. Blood cultures and respiratory PCR panel had been negative thus far for other etiologies other than SARS-CoV2.

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CONFLICT OF INTEREST STATEMENT

None declared.

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