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A Case Series of Hyperglycemic Hyperosmolar State during the Global COVID-19 Pandemic

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Research Abstract Title

Submitting/Presenting Author (must be a trainee): Benjamin D. Hoag M.D.
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- Medical Student
- Resident/Psychology Intern (≤ 1 month of dedicated research time)
- Resident/Ph.D/post graduate (> 1 month of dedicated research time)
- Fellow

Primary Mentor (one name only): Emily Paprocki D.O.
Other authors/contributors involved in project: Michelle Knoll M.D., Vincent Staggs PhD.

IRB Number: STUDY00001481

Describe role of Submitting/Presenting Trainee in this project (limit 150 words):
Dr Hoag and Dr Knoll developed the IRB protocol, collected the retrospective data collection, and worked with statisticians for data analysis. Work was divided equally between the two trainees and overseen by Dr Paprocki.

Background, Objectives/Goal, Methods/Design, Results, Conclusions limited to 500 words

Background:

Hyperglycemic hyperosmolar state (HHS) is rare in pediatrics, particularly in patients with antibody positive diabetes mellitus (DM). Recent literature has implicated COVID-19 in the reported increase in new onset DM cases, as well as mixed diabetic ketoacidosis (DKA) and HHS cases; however, a rise in HHS cases alone has not been well reported [1,2]. We noted an anecdotal increase in the frequency of HHS cases in our pediatric tertiary care center following the onset of the global COVID-19 pandemic.

Objectives/Goal:

To investigate further, a retrospective chart review evaluating all patients with DM admitted in the first 6 months of 2019 and the first 6 months of 2020 was conducted.

Methods/Design:

A diagnosis of HHS was defined as a blood glucose over 600 mg/dL with a serum osmolality (calculated or measured) greater than 320 mmol/kg on initial laboratory evaluation. Patients with DKA, defined as a serum bicarbonate level less than 16 mmol/L with evidence of significant ketosis (serum ketones greater than 3 mmol/L), were excluded from the study.

Results:

During the first 6 months of 2019, 1 patient met inclusion criteria. However, the diagnosis of HHS was complicated by a concurrent diagnosis of diabetes insipidus, which may have contributed to the hyperosmolar state, and a nonketotic lactic acidosis. Five HHS cases were noted in the first 6 months of 2020, 4 of which occurred in May and June. For the 2020 HHS cohort, the average patient age \pm SD was 12 ± 3.34 years, bicarbonate was 18.2 ± 1.64 mmol/L, serum blood glucose was 776.8 ± 30.75 mg/dL, calculated serum osmolality was 328 ± 4.18 mOsm/kg, and HgA1C was $12.72 \pm 1.16\%$. All 5 patients in the 2020 cohort had new-onset DM, with 4 of the 5 patients having at least 1 positive DM antibody (GAD antibodies were positive in 3, ICA/IA-2 antibodies in 2, and Zinc Transporter 8 antibodies in 1). No patients displayed COVID-19 symptoms, and only 1 patient was tested for COVID-19 by PCR, which returned negative. However, SARS-CoV2 antibody testing was not available, and it is unknown if these patients had prior COVID-19 illness.

Conclusions:

In conclusion, we noted an increased incidence of HHS at our hospital, particularly among new onset, antibody positive DM patients during the initial months of the COVID-19 pandemic. Further study and investigation are needed to determine the cause of this increased local incidence, and if infectious, social, or economic influences related to the COVID-19 pandemic contributed.

References:

1. Chan, K.H., et al., *Clinical characteristics and outcome in patients with combined diabetic ketoacidosis and hyperosmolar hyperglycemic state associated with COVID-19: A retrospective, hospital-based observational case series*. *Diabetes Res Clin Pract*, 2020. 166: p. 108279.
2. Unsworth, R., et al., *New-Onset Type 1 Diabetes in Children During COVID-19: Multicenter Regional Findings in the U.K.* *Diabetes Care*, 2020.