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Acute Kidney Injury in Youth with Diabetes Admitted with Isolated Diabetic Ketoacidosis, Isolated Hyperglycemic Hyperosmolar State, and Hyperosmolar Diabetic Ketoacidosis: A Single Center Experience

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Acute Kidney Injury in Youth with Diabetes Admitted with Isolated DKA, Isolated HHS, and Hyperosmolar DKA: A Single Center Experience

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Background

Diabetic ketoacidosis (DKA), hyperglycemic hyperosmolar state (HHS), and mixed DKA and HHS (hyperosmolar DKA) are severe hyperglycemic emergencies for which children with diabetes mellitus (DM) are admitted to the hospital. The objective of this study is to compare acute kidney injury (AKI) between youth with isolated DKA to those with hyperosmolarity and explore associations to the risk of AKI.

Methods

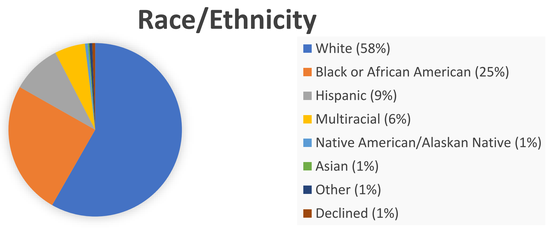
- Medical records reviewed from 01/2019 through 12/2020.
- Youth admitted to tertiary care facility with DKA (serum bicarbonate ≤16 mEq/L) and/or HHS (blood glucose ≥600 mg/dL and osmolality ≥320 mOsm/kg).
- Youth transferred from an outside facility were excluded.
- Isolated HHS was combined with hyperosmolar DKA for analysis.
- Acute kidney injury (AKI) defined as elevated creatinine for age.
- Total amount of isotonic fluids administered, both as bolus or continuously within the first 12 hours after DKA and/or HHS confirmation, was collected.
- Use of angiotensin-converting enzyme inhibitor (ACEI) was a marker for microalbuminuria.
- P-values generated via two-sample Wilcoxon rank-sum (Mann-Whitney), Fisher's exact, or chi-square tests.
- All analyses were conducted using Stata/SE 15.1.

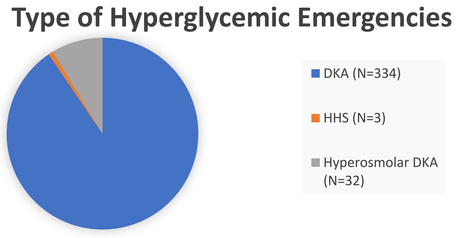
Demographics & Characteristics

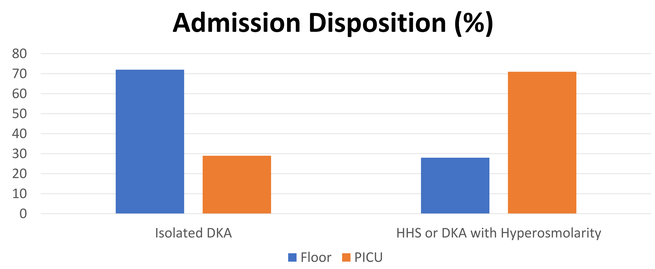
- Average age of admission was 14 years, 60% female, 69% new onset diabetes mellitus, and 96% T1DM.
- Average osmolality calculated at admission was 299 in isolated DKA group and 327 in hyperosmolar group (p=<0.001).
- Criteria for admission to the Pediatric Intensive Care Unit (PICU):

  1)Children ≤5 years with serum bicarbonate ≤10 mEq/L

  2)Children >5 years with serum bicarbonate ≤5 mEq/L, significantly elevated BUN, altered mental status, or significant risk for cerebral edema







Results

- Compared to isolated DKA youth, hyperosmolar youth had increased risk of AKI (p=<0.001).
- Both groups received similar total volume of fluids. For isolated DKA, median was 33.6 ml/kg (IQR=28.0,39.5) and 38.5 ml/kg (IQR=29.1,45.4) for hyperosmolar (p=0.09).
- Increased serum osmolality associated with increased odds of having AKI (**OR 1.11**).
- Odds of having AKI for youth with new onset DM was lower compared to those with a known DM diagnosis (**OR 0.68**).
- Of the 17 youth (5%) taking an ACEI during admission, three had AKI.
- No association was found between AKI and microalbuminuria.

Conclusions

- In children with DM, higher serum osmolality or non-new onset DM are associated with increased odds of having AKI.
- Findings are useful to identify youth at risk for AKI and to guide interventional studies for those with AKI and hyperosmolarity.

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