Clinical Outcomes Of Euglycemic Diabetic Ketoacidosis (euDKA) Treated With a Computerized Insulin Algorithm: Descriptive Analysis of a Nationwide Cohort

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BACKGROUND

Euglycemic DKA (euDKA) is an underdiagnosed endocrine emergency and may not be treated appropriately treated due to lower than expected glucose levels. EuDKA has been increasing in prevalence due to the increased use of SGLT2-inhibitors. Glycemic or insulin outcomes for hospitalized patients with euDKA have been limited to case reports and series and have not been reported in a large cohort. Treatment of euDKA can be complicated by hypoglycemia and early discontinuation of insulin infusion before resolution of ketogenesis. We assessed the safety and efficacy of a computerized continuous insulin infusion algorithm for the treatment of euDKA. Similar studies with Glucommander IV in patients with DKA have shown time to reach HCO3 >18 mmol/L (13.6 hours), with a higher time for acidosis resolution for conventional protocol (17.3 hours) compared to Glucommander IV.

METHODS

Individual-level data were extracted from the Glytec Inpatient Database from 154 hospitals across the United States from (2017-2021). All patients were on Glucommander™ IV, a computerized continuous insulin infusion (CII) algorithm, for at least 1 hour. EuDKA was defined as patients with age $\geq$ 18 years with a BG < 250 mg/dl and who met the following criteria on admission: bicarbonate <18 mmol/L, pH <7.3, with ketones present in serum or urine. Diabetes was confirmed by ICD of E10 or E11 or A1c >6.5%. The outcomes were related to time metrics, glucometrics, insulinometrics, and mortality rate.

SUMMARY OF RESULTS

533 patients with euDKA (Table) all treated with computerized CII were identified. T1D was diagnosed by ICD 10 in 28%, T2D in 33%, and 39% were unknown. The time to HCO3 > 18 mEq/L was 14.1 hours with a median length of hospital stay of 3.2 days. The incidence of hypoglycemia was extremely low. The inpatient mortality rate was 1.3%.
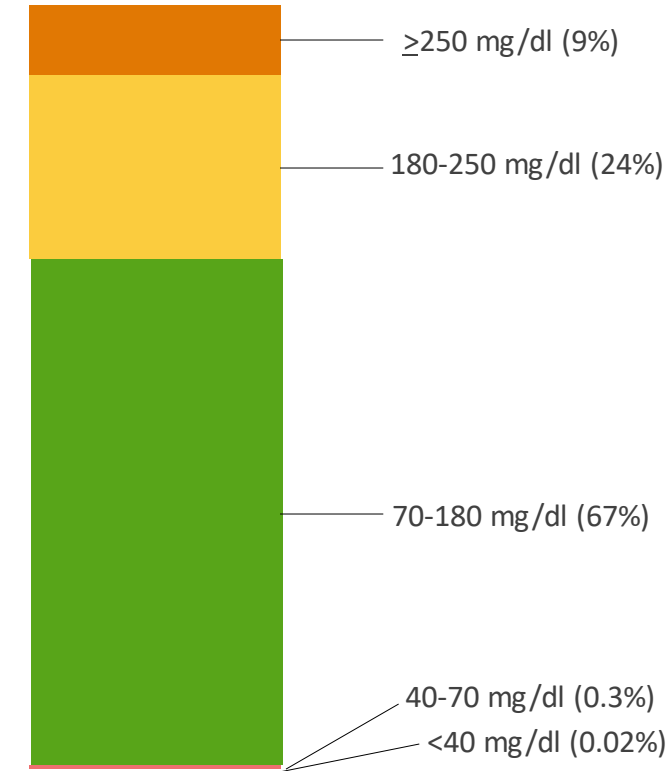
CONCLUSION

In this largest descriptive analysis of a nationwide cohort in the United States shows that euDKA can be safely and effectively treated with a computerized algorithm in the hospital, as patients achieved rapid time to target, rapid resolution of DKA, and a low mortality rate.

REFERENCES

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Table: Baseline Characteristics and Outcomes	
Patients, n	533
Male Gender, n (%)	257 (48)
Median Age in years (range)	44 (18-93)
Mean BMI, kg/m2 (SD)	27.3 ($\pm$7.3)
Mean A1C, % (SD)	9.5 ($\pm$2.3)
Admission Labs	
Mean Glucose, mg/dL (SD)	186 ($\pm$47)
Mean Sodium, mEq/L (SD)	135 ($\pm$5)
Mean Potassium, mEq/L (SD)	4.5 ($\pm$1.0)
Mean HCO3, mEq/L (SD)	9.9 ($\pm$4.0)
Mean Anion Gap, mEq/L (SD)	23.8 ($\pm$7.3)
Mean Creatinine, mg/dL (SD)	1.6 ($\pm$2.3)
Mean pH (SD)	6.7 ($\pm$0.8)
Time Metrics	
Median Hospital Length of Stay, days (range)	3.2 (0.2-39.9)
Median Time Until Glucommander Treatment Started, hours (range)	3.9 (0-216)
Median Length of Glucommander Treatment, hours (range)	22.9 (1-211)
Median Time to BG < 180 mg/dL, hours (range)	2.6 (0-74.4)
Median Time to HCO3 $\geq$ 18 mEq/L after Glucommander Started, hours (range)	14.1 (0-135)
Insulinometrics	
Median IV Insulin Infusion Rate, units/hr (range)	1.8 (0-100)
Percent of Patients with Mild Hypokalemia (K<3.5 mEq/L) during first 48 hours (n)	48% (255)
Percent of Patients with Severe Hypokalemia (K< 2.5 mEq/L) during first 48 hours (n)	3.2% (17)
Percent of blood glucose < 70 mg/dL during first 48 hours (n)	0.33% (46)
Percent of blood glucose < 40 mg/dL during first 48 hours (n)	0.02% (3)
Mortality rate (n)	1.3% (7)

Breakdown of glucose values while on IV insulin

- $\geq$250 mg/dl (9%)
- 180-250 mg/dl (24%)
- 70-180 mg/dl (67%)
- 40-70 mg/dl (0.3%)
- <40 mg/dl (0.02%)