

BACKGROUND

- The presence of diabetes mellitus (DM) increases the probability of severe disease, admission to intensive care unit, and mortality from COVID-19.
- Angiotensin-converting enzyme 2 (ACE2) serves as the entry point for SARS-CoV-2. Downregulation of ACE2 following endocytosis of the virus leads to unopposed angiotensin II, impeding insulin secretion.¹
- Pro-inflammatory state of COVID-19 → insulin resistance + acute insulin dependency from islet damage → rapid deterioration of hyperglycemia and increased predisposition to ketosis → life threatening DKA in patients both with type 1 (DM1) and type 2 (DM2).^{1,2}
- We hypothesize worse clinical outcomes with an increased mortality in patients with DKA precipitated by COVID-19.

OBJECTIVES

- To determine the incidence of DKA among patients with COVID-19 and DM.
- To determine the contributing factors for their predisposition to DKA and mortality.

METHODS

- Retrospective, single-center, cohort study.
- For the period from 03/2020 to 06/2020, a total of 301 patients with COVID-19 (positive nasopharyngeal RT-PCR) and DM were obtained from electronic health record using their ICD-10 codes.
- Patients with serum glucose >250 mg/dL and serum bicarb <21 mEq/L (or pH <7.3) and anion gap >10 mEq/L with either ketonemia or ketonuria were considered to have **DKA**.
- Patients with serum glucose >600 mg/dL and serum bicarb >21 mEq/L were considered to have **HHS** and were *excluded*.
- T- test for comparison of continuous data (reported as mean ± standard deviation) and χ^2 test for comparison of categorical data (reported as counts and percentages) between the cohorts. A p value < 0.05 was considered significant. All data were analyzed with the software Stata/SE version 16.1.

RESULTS

- Out of 301 patients with COVID-19 and DM –
 - ✓ 43 (**14.3%**) had DKA, of which 8 (18.6%) diagnosed after admission
 - ✓ 3 (1%) had HHS and were excluded
- There were no statistically significant differences in co-morbidities including CHF, COPD, asthma, CKD and malignancy between both groups.
- In the DKA cohort, 17 (39.5%) had concurrent lactic acidosis at presentation, 20 (46.5%) had concurrent uremia at presentation and 22 (51.2%) had AKI either at presentation or during hospital course.
- A significant proportion of patients with DKA received steroids, out of whom 23.8% developed DKA after admission.
- Mortality was observed in 14 (**32.5%**) patients with DKA, out of whom 13 (92.8%) had AKI.

DISCUSSION

- Our study demonstrates that COVID-19 infection is associated with high incidence of DKA in patients with both DM1 and DM2, however, majority were DM2 patients (11.6% vs. 76.7%).
- Patients with DKA were predominantly insulin dependent, non-compliant with medications, and poorly controlled with mean A1C of 12.5.
- The pro-inflammatory milieu of COVID-19 could play a predisposing role for DKA as indicated by higher levels of CRP in this cohort.²
- Current literature shows a transient increase in insulin requirement (up to 4 units/kg/day) in critically ill patients with COVID-19.³
- The significant need for intubation and vasopressors in this cohort demonstrates a trend towards worse mortality warranting future research on a larger cohort to determine true statistical significance.
- Limitations were due to the retrospective design → a) causality could not be assigned, b) some laboratory data were not available for all patients.

CLINICAL IMPORTANCE

- Physicians must be vigilant at all times to diagnose DKA with high degree of clinical suspicion in patients with COVID-19 to decrease worse clinical outcomes by a timely management.
- Further analysis on the pathophysiology of COVID-19 and DKA can facilitate insights into disease treatment.

Parameters	DKA (n=43)	only DM (n=255)	p
DEMOGRAPHIC FACTORS			
Age	55.5 ± 13.6	63.2 ± 14.9	<0.01
Male	33 (76.7%)	145 (56.9%)	0.01
BMI	28.4 ± 4.6	30.6 ± 7.6	0.08
MEDICAL HISTORY			
Newly diagnosed DM	7 (16.3%)	23 (9%)	0.14
Type of DM			
Type 1	5 (11.63%)	2 (0.8%)	<0.01
Type 2	33 (76.7%)	235 (92.2%)	
Medication non-compliance	4 (9.3%)	7 (2.75%)	0.03
Insulin-dependence	21 (48.8%)	76 (29.8%)	0.01
LABS			
CRP	183.8 ± 94.7	134.9 ± 87.7	<0.01
LDH	571.8 ± 535.9	386.3 ± 252.1	<0.01
D dimer	1020 ± 1125.1	1045.3 ± 1158.4	0.91
Creat	1.4 ± 1.2	1.8 ± 2.5	0.34
Urea	27 ± 23	25.8 ± 23.3	0.76
Lactate	2.9 ± 2.3	1.7 ± 1.6	<0.01
A1C	12.5 ± 3.1	9.8 ± 2.9	<0.01
HOSPITAL COURSE			
≥ 2 SIRS upon presentation	29 (67.4%)	119 (46.7%)	0.01
ICU stay	27 (62.8%)	46 (18%)	<0.01
Hypoxic respiratory failure	28 (65.1%)	158 (61.9%)	0.69
Need for intubation	14 (32.6%)	36 (14.1%)	<0.01
Need for vasopressors	10 (23.3%)	25 (9.8%)	0.01
Steroids	21 (48.8%)	64 (25.2%)	<0.01
Tocilizumab	12 (27.9%)	32 (12.5%)	<0.01
Convalescent plasma	8 (18.6%)	18 (7%)	0.01
OUTCOME			
Mortality	14 (32.6%)	50 (19.6%)	0.056

Table 1. Comparison between patients with DKA and patients without

REFERENCES

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