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ORIGINAL ARTICLE

Incidence and Risk Factors of Acute Kidney Injury In Diabetic Ketoacidosis Patients

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ABSTRACT

Keyword: Diabetes mellitus, acute kidney injury, Diabetic Ketoacidosis

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Background: Dehydration severity varies among patients. Hypovolemia can lead to prerenal acute kidney injury (AKI), which, if severe, can progress to acute tubular necrosis. Recent DKA care guidelines recommend conservative rehydration with iso-osmotic fluids and continuous intravenous insulin to prevent renal hypoperfusion**. Goals and Objectives:** To evaluate the frequency and risk factors of AKI in DKA individuals and investigate their correlations**. Methods and Subjects:** Cross-sectional research was performed on 100 cases of DKA admitted to the Internal Medicine Department of Aswan University Hospital.
Findings: The severity of AKI and its primary causes were assessed. Only 3% had severe AKI, 19% had mild, 13% had moderate, and 65% had non-azotemic severity. The causes of AKI included: 4% with additional causes, 44% with missed medication, 34% with infection, and 18% with other diagnoses. **Conclusion:** Several variables, such as age, glucose, white blood cell counts, sulfate, pH, serum alkaline phosphatase, coma, and pre-existing chronic kidney disease, are linked to AKI in DKA. There is a correlation between AKI, particularly severe ones, and rapid progression of CKD. The early identification and prevention of AKI in individuals with DKA are essential for the preservation of renal function.

INTRODUCTION

The condition known as diabetes mellitus (DM), which is an endocrine illness, is the cause of the improper metabolism of blood glucose. As a result of this chronic disease, an individual may experience difficulties in both the short term and the long term. The condition known as DKA and hyperosmolar hyperglycemic state (HHS) are two of the problems that can arise as a consequence of diabetes (4).

Between four percent and forty percent of deaths in developing countries are attributable to hyperglycemic emergencies (5).

DKA is associated with a significant mortality and morbidity rate, making it the most serious hyperglycemic emergency in individuals with type 1 or type 2 DM (6). Ketosis (presence of ketones in blood and urine), Acidosis (venous blood pH < 7.3 or HCO3 < 15 mmol/L), as well as hyperglycemia (blood glucose > 200 mg/dl) are the three conditions that are considered to be the hallmarks of DKA, according to the guidelines issued by the International Society for Pediatric and

Adolescent Diabetes (ISPAD) in 2014. The severity of the condition is determined by the following criteria: a venous pH below 7.3 or HCO3 below 15 mmol/L is considered mild; a pH below 7.2 or HCO3 below 10 mmol/L is considered moderate; as well as a pH below 7.1 or HCO3 below 5 mmol/L is considered severe (7).

Reduced urine production (oliguria) and increased serum creatinine levels (a marker of renal excretory function) are quantifiable indicators of AKI, which is defined as an abrupt loss of kidney function that lasts no more than seven days. Reduced urine production (oliguria) and increased serum creatinine levels (a marker of renal excretory function) are quantifiable indicators of AKI, which is defined as an abrupt loss of kidney function that lasts no more than seven days. Furthermore, Kidney Disease Improving Outcomes (KDIGO) recommends that AKI be staged according to severity, as illustrated in Table 1 (8).

Table 1: Although renal injury is frequently encountered in hyperglycemic hyperosmolar state, it is not so well reported in DKA *(Zeitler et al., 2011).*

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline or ≥0.3 mg/dl (≥26.5 µmol/l) increase	<0.5 ml/kg/h for 6–12 h
2	2.0–2.9 times baseline	<0.5 ml/kg/h for ≥12 h
3	3 times baseline or ≥4.0 mg/dl (≥353.6 µmol/l) increase or initiation of RRT or in patients <18 years a decrease in eGFR <35 ml/min/1.73 m²	<0.3 ml/kg/h for ≥24 h or anuria ≥12 h

PATIENTS AND PROCEDURES

A total of 100 DM cases with DKA who were admitted to the prior study setting over the study period (one year) were chosen to participate in this cross-sectional investigation. At Aswan University Hospital's Department of Internal Medicine, Faculty of Medicine, all of the included patients underwent investigations into arterial blood gases, serum urea and creatinine, and full blood counts.

Inclusion criteria Age: above 16, sex: both male and female, and diabetes patients with AKI and DKA.

Exclusion criteria: patients with chronic renal disease who are less than 16 or older than 60.

Methods A thorough medical history, a clinical examination, and laboratory testing were performed on each study participant.

Informed consent

A participant's informed consent form was kept in the same way as other documents and was considered a permanent part of their research records.

Statistical analysis

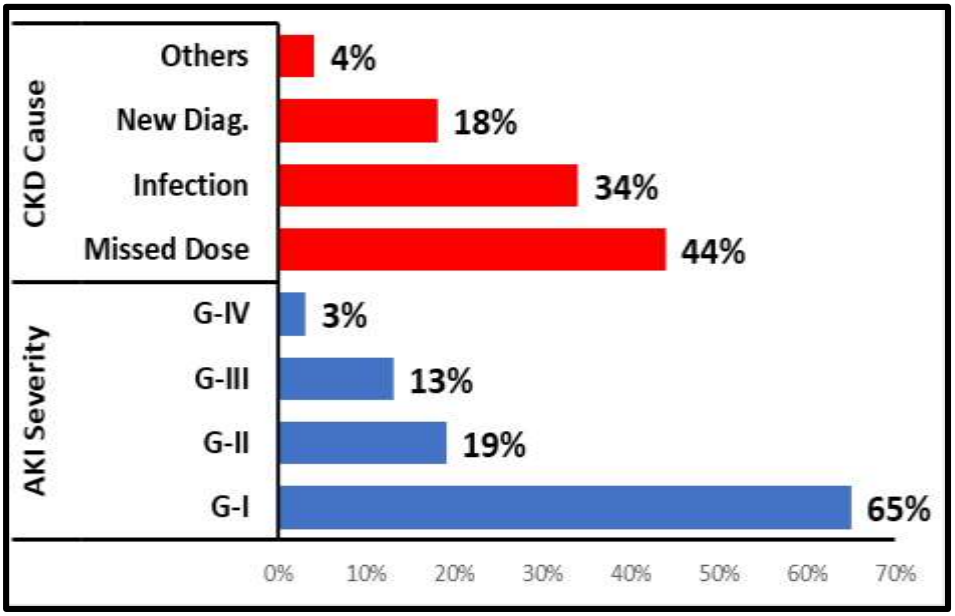
IBM-SPSS 21.0 (IBM-SPSS Inc., Chicago, IL, United States) was utilized by the researcher in order to verify, code, and analyze the data. Descriptions based on statistics: It was determined how to compute the standard deviations, means, and percentages. Evaluation of the significance test: For the purpose of determining the degree of dissimilarity in frequency distributions among the various groups, the Chi square, Fisher's exact, and Monte Carlo exact tests were utilized. For the purpose of determining whether or not there was a difference in the frequency distribution among the members of the group, the McNemar test was utilized. The Shapiro-Wilk test was employed to ascertain the normal distribution of continuous variables. Independent sample t-tests were conducted on continuous variables with two categories to ascertain the mean differences between the groups. A

one-way analysis of variance (ANOVA) was conducted to ascertain the mean differences among groups and repeated measures for continuous variables with multiple categories. The RM-ANOVA test was carried out in order to evaluate the mean differences in data that exhibited a normal distribution and contained repeated measures (between groups, within groups, and overall differences). The two research groups were compared pairwise using Bonferroni adjustments and a post-hoc test. A p value of 0.05 or less is statistically significant. Multivariate logistic regression was used to identify MR-influencing factors. The odds ratio (OR), 95% CI, and p-value were analyzed. A p-value below 0.05 was significant.

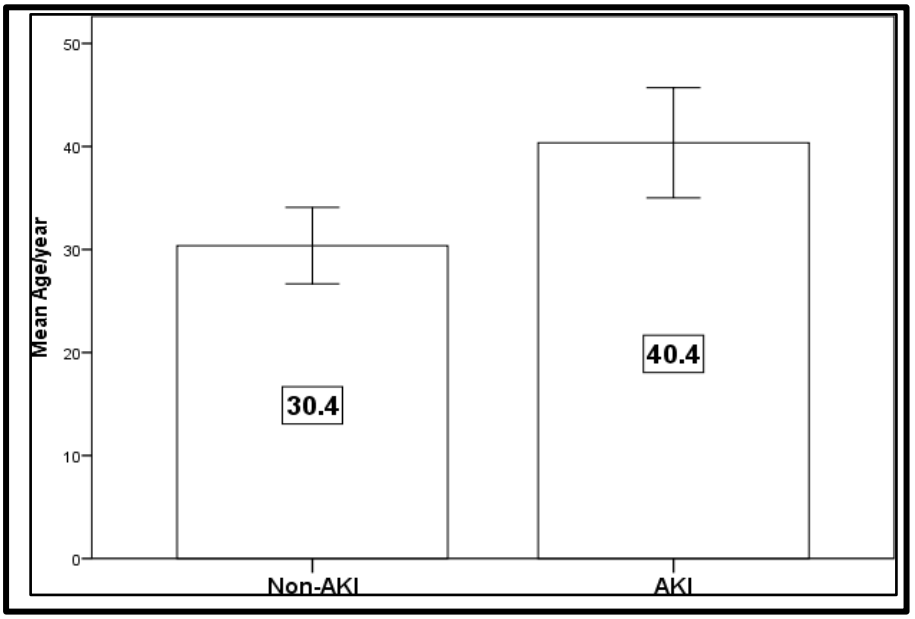
Results

The incidence of AKI in DKA was about (n= 44) 44$%.

The Grades of severity of AKI are about two- thirds (n=65) had non-azotemic severity, about one-fifth had mild (n=19), 13% (n=13)had moderate and only 3% had severe AKI.



the variances in the baseline characteristic among the examined groups. AKI cases were significantly (p=0.002) older (40.4 ± 6.1 years) than non-AKI (30.4 ± 8.4) (Fig. 6). As regard patient's sex, both groups were matched for sex (p = 0.284)



DISCUSSION:

The current research did not find a statistically significant distinction in the frequency of AKI among participants with newonset DM and those withestablished diabetes mellitus. However, the study found that all participants with grade-III AKI were newly diagnosed with diabetes mellitus. Delayed diagnosis of new-onset DM and delayed medical consultation might result in hospital admission with severe degrees of dehydration and acidosis with subsequent development of AKI, These findings confirmed the results of previous studies that reported more frequent AKI among patients with severe volume depletion. (9)

This study found that clinical markers of volume depletion at hospital admission were significantly associated with development of AKI. Participants with AKI had significantly higher pulse rate and respiratory rates and significantly lower systolic and diastolic blood pressure at hospital admission. Moreover, severe dehydration at hospital admission was significantly more frequent among participants with AKI.

The study found that disturbed conscious level was significantly more frequent among participants with AKI and that GCS at hospital admission was significantly lower in participants with AKI. Moreover, multivariate regression analyses revealed that the odds for development of AKI was increased by 2.7 times if the patient had GCS below 14 at hospital admission and that the odds for development of severe AKI was increased by 4.6 times in the patient had GCS below 14 at hospital admission. In a study on adult patients with DKA conducted by (10), Coma at admission was significantly more frequent Discussion in patients with AKI compared to participants with no AKI. Furthermore, (11) reported that GCS scores decreased below14 in 1.8% of DKA episodes in participants with no AKI and in 5.9% of DKA episodes in participants with AKI. However, these differences were not significant in multivariate analysis. Severe dehydration and volume depletion that affect the cerebral blood flow and induce disturbed conscious level are likely to affect the renal blood flow and induce AKI (11).

CONCLUSION:

AKI is a serious consequence of DKA related to age, glucose levels, sulfate levels, white blood cell (WBC) counts, pH, serum alkalinity, coma, and prior CKD. In persons with DKA, AKI and severe stages of AKI are associated with the accelerated progression of CKD and increased long-term mortality. In hospitals, the early identification and prevention of AKI are

paramount, as is the consistent monitoring aimed at safeguarding renal function in DKA cases with AKI.

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