Original Article

Impact of Different Regimes in Treatment of Diabetic Ketoacidosis and Outcome of Liver Function Test

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ABSTRACT

Objective: Comparing the impact of different regimes in treating diabetic ketoacidosis and evaluating the liver function test

Study Design: Experimental study

Place and Duration of Study: This study was conducted at the Emergency Department of Ziauddin hospital Karachi from December 2022 to May 2023.

Materials and Methods: 128 patients with confirmed diagnosis were selected for the study and divided into two groups each containing 64 patients each. In Group A, the interventional group patients were treated with both basal insulin and intravenous insulin infusion, while Group B, was only treated with intravenous infusion of insulin. Data was collected from all the patients which analyzed using SPSS version 22 and the p-value of less than 0.05 was set to be significant.

Results: The mean age of these patients was 32.2±9.9 years ranging from 18 to 50 years. There were 69 (54%) male patients and 59 (46%) females. The median duration of resolution of DKA was 3.2 hours/day in group A and 3.8 hours/day in group B with a non-significant p-value of 0.068. Resolution in DKA was seen in 56% of cases in Group A and only in 47% of cases in Group B. The bilirubin test showed a statistically significant result with a p-value of <0.001 as the increased median value was noted in group A as compared with group B 1.5 mg/dL and 1.1 mg/dL respectively. Other values of liver function test such as ALT and ALP were not significantly altered.

Conclusion: This study shows that the safe and efficient therapy of DKA may involve the addition of basal insulin (glargine) to intravenous insulin infusion. Remarkable effective in the treatment of DKA as compared to other therapeutic infusion, while there were no significant impact on liver function test.

Key Words: Diabetes, Diabetic ketoacidosis, Insulin.

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INTRODUCTION

An endocrine disorder that is found all across the globe, diabetes mellitus (DM) results in elevated levels of glucose in the blood which then leads to the development of various signs and symptoms that ultimately lead to development of complications that can turn out to be potentially fatal. According to the international diabetes federation (IDF), a global population of 700 million will be suffering from diabetes mellitus[1]. The increase in the incidence of the disease just doesn't have an impact on the health care along, but also the economy of the country. The global costs of diabetes is expected to rise exponentially by 2030, even if many countries around the world are to achieve desired targets in the mitigation of the disease [2]. DM can lead to a wide range of complications, one of them being diabetic ketoacidosis (DKA), which occurs in the body when there is a severe lack of insulin to be found in the body [3]. In DKA, the blood becomes acidic and there is a buildup of ketone in the body, leading to various symptoms such as nausea, vomiting, stomach upset, dizziness, and shortness of breath [4]. DKA is an critical emergency as it can result in the patient going into coma or in extreme circumstances even death [5]. The amount of cases of DKA are more commonly seen in patients suffering from DM type I, as it is the type in

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which there is insulin deficiency present, but it doesn't mean that it doesn't occur in patients with type II diabetes either. This means that DKA have other causes other than insulin deficiency as well, such as sickness, infection, trauma, and insulin pump malfunction [6]. Treatment for DKA involves maintaining electrolytic balance again, correction of the acidosis, and the administration of insulin to establish baseline blood sugar levels [7]. Insulin glargine, a long-acting basal insulin is commonly used in managing diabetes it works by imitating basal insulin secretion that takes place in the body. In the case of DKA however, the primary mode of treatment is intravenous insulin infusion for the correction of the ketoacidosis and hyperglycemia. However, with the intravenous infusion of insulin, basal insulin is also administered to improve further upon the glycemic control and help in reducing hospitalization [8]. In light of this, an experimental study was conducted to see the outcome and resolution of diabetic ketoacidosis along with its effect on liver parameters.

MATERIALS AND METHODS

This quasi experimental study from December 2022 to May 2023 conducted at the accident and emergency department of Ziauddin University, Karachi. The data will be collected from three different hospitals of Ziauddin, Kemari Campus, Clifton Campus, and North Campus. The selected sample for the study was obtained through non-probability consecutive sampling technique and were those patient aging 13 years or above irrespective of gender presenting to the emergency department and have been diagnosed with diabetic ketoacidosis. Using the open EPI software, 128 was the sample size which was determined and the patients dividied into two groups each of 64 patients. Two groups were made in which the following parameters were applied:

A. **Experimental group: (Interventional)** (treated with standard treatment along with insulin Glargine in dose of 0.4U/kg within 3 hours of initiation of IV insulin infusion).
B. **Control group: (treated with standard treatment)**

Patients that were pregnant, had other endocrine disorders, were currently pregnant, had renal insufficiency, or were hemodynamically unstable were not included in the study. Permission and approval of the study would be sought from the hospital ethical and scientific board. Patients will be enrolled from the Emergency department. A written informed consent will be taken from every patient or relative. Patients in the study will be closely observed to assess various outcomes, including the resolution of diabetic ketoacidosis (DKA), the time required to transition to subcutaneous insulin, discharge from the hospital, glycemic control, glycemic variability, and any associated side effects. As part of the intervention, Group A received subcutaneous injections of long-acting insulin Glargine (0.4 units per kilogram of body weight) within three hours of receiving regular insulin infusion, in addition to the conventional DKA treatment. This dose of Glargine insulin was repeated every 24 hours until DKA recovery. In contrast, Group B, the control group, received the standard DKA treatment regimen. The following measurements will be carried out on the patient:

1. Glucose: Bedside glucometer hourly basis.
2. pH: Venous/ Arterial blood gases. 2 hourly.
3. Ketones: Serum. 12 hourly.
4. Liver Function Tests (L.F.T's): to be repeated 6 hourly.

All the data will be analyzed using Statistical Package for Social Science (SPSS) version 22. Continuous variables such as age, BMI, and lab investigations will be expressed as mean and standard deviation. Data that is categorical such as gender, and resolution of DKA will be expressed in the form of frequency and percentage. Independent t-test was carried out for determining comparison of continuous data between groups. Non-parametric continuous data was obtained using Mann Whitney U test, while Chi-square was applied for association of all categorical variables between the groups. Significant was defined as a p-value less than 0.05.

RESULTS

A total of 128 patients were selected for the study, who were suffering from DKA. The mean age of the patients was 32.2±9.9 years ranging from 18 to 50 years. There were 69 (54%) male patients and 59 (46%) females. These 128 DKA patients were divided into two equal groups of 64 patients based on the intervention group of Glargine insulin with regular insulin infusion and the control group of regular insulin infusion alone.

Table 1: Represents the age in terms of mean and standard deviation along with BMI. Significant difference is observed in both Age and BMI between the two groups

Table 2: Represents the gender distribution. No significant difference was observed.

Table No. 1: Normality assessment of all continuous variables

Variable	Group A (Insulin Glargine + Regular insulin infusion)	Group B (Regular insulin infusion)	p-value
Age	30.3±15	34.0±9	0.001*
BMI	20.8±2.7	22.4±1.3	<0.001*

Statistically significant value by Shapiro Wilk test for non-parametric data

Table 3: Represents the blood glucose value of the patients in both of the groups. No significant difference was observed

Table 4: Represents the resolution and outcome of DKA. No statistically significant difference was observed.

Table 5: Represents the comparison of liver function tests results in both groups. Significant difference was only seen in the laboratory value of bilirubin.

Table No. 2: Gender distribution

Variable	Group A (Insulin Glargine + Regular insulin infusion)	Group B (Regular insulin infusion)	p-value
Gender Male Female	 31 (48%) 33 (52%)	 38 (59%) 26 (41%)	 0.215

Table No. 3: Comparison of Laboratory Findings of Patients in both Groups

Lab investigations	Group A (Glargine insulin + Regular insulin infusion)	Group B (Regular insulin infusion alone)	p-value
Blood glucose	29 (5)	29 (4)	0.281

Table No. 4: Outcomes and Resolution of DKA

Outcomes		Group A (Glargine insulin + Regular insulin infusion)	Group B (Regular insulin infusion alone)	p-value
Resolution of DKA	Present Absent	28 (44%) 36 (56%)	34 (53%) 30 (47%)	0.289
Time to resolution	Hour/day	3.2 (2.4)	3.8 (3.3)	0.068

Table No. 5: Liver Function Tests

Outcomes	Group A (Glargine insulin + Regular insulin infusion)	Group B (Regular insulin infusion alone)	p-value
Bilirubin	1.5 (0.5)	1.1 (0.2)	<0.001 *
ALT	216 (118)	223 (86)	0.263
Alk.Phosphatase	2 (1.8)	2.3 (1.5)	0.164

DISCUSSION

The exact prevalence of DKA is still yet to be determined, due to different circumstances. However, it is said that DKA is affecting 1-5% of all hospital admissions that are diabetes-related. The American diabetes associations states that of all hospitalizations of patients that have diabetes, DKA is responsible for 4-9% of them, furthermore, it is also the primary cause of death under the age of 24 with patients suffering from DM type I [9]. DKA affects 2/3 of all people that are type I diabetic and 34% of type II diabetes as well [10]. Severe studies have been done that have shown that analogue insulins are extremely helpful in treatment of DKA [11]. The present study was designed to assess that if a combination of basal insulin with insulin infusion is more effective than insulin infusion alone or not. Although no significant difference was encounter in terms of resolution of DKA, a combination of both basal insulin and infusion of insulin helped in resolving DKA more than the regular intravenous insulin. The resolution time in the experimental group was also less than the control group. This finding is similar to another study in which the average time for recovering of DKA was 13.77±6 [10] in the group with insulin glargine and insulin infusion combined as compared to intravenous insulin infusion alone which was only 16.91±6.49 hours [11]. Another study found that the DKA resolution time, insulin infusion duration, and length of admission in an intensive care unit was increased by 26 minutes for every 6 hours of delay in the introduction of insulin glargine [12]. Another systemic review and meta-analysis related to treatment of DKA found that using basal insulin in addition to intravenous insulin infusion can significantly reduce the duration of the insulin infusion therapy when comparing with intravenous infusion insulin alone [13]. The liver function tests of both groups were insignificant but significant difference was encountered in the values of bilirubin. In both the groups the LFT values were raised with ALT being the most raised. Future studies can be designed to incorporated renal function tests, measurement of different types of electrolytes, as well as complications that a patient might experiment when being given this regime.

CONCLUSION

The management of diabetic ketoacidosis appears to be improved by the addition of basal insulin (glargine) to intravenous insulin infusion rather than by the use of this treatment alone. LFTs were found to be raised but showed no significant impact of therapy.

Author's Contribution:

Concept & Design of Study:	Muhammad Wajahatullah
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Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Belete R, Ataro Z, Abdu A, Sheleme M. Global prevalence of metabolic syndrome among patients with type I diabetes mellitus: A systematic review and meta-analysis. Diabetol Metabolic Syndrome 2021;13(1):1-3.
2. Bommer C, Sagalova V, Heesemann E, Manne-Goehler J, Atun R, Bärnighausen T, et al. Global economic burden of diabetes in adults: projections from 2015 to 2030. Diabetes care 2018;41(5): 963-70.
3. Westerberg DP. Diabetic ketoacidosis: evaluation and treatment. Am Family Physician 2013;87(5): 337-46.
4. Duggan E, Chen YJCdr. Glycemic management in the operating room: screening, monitoring, oral hypoglycemics, and insulin therapy 2019;19:1-13.
5. Elgenidy A, Awad AK, Saad K, Atef M, El-Leithy HH, Obiedallah AA, et al. Incidence of diabetic ketoacidosis during COVID-19 pandemic: A meta-analysis of 124,597 children with diabetes. Pediatr Res 2023 ;93(5):1149-60.
6. McCulloch A, Bansiya V, Woodward JMJJoP, Nutrition E. Addition of insulin to parenteral nutrition for control of hyperglycemia 2018; 42(5):846-54.
7. Sayed MH, Hegazi MA, Abdulwahed K, Moussa K, El-Deek BS, Gabel H, et al. Risk factors and predictors of uncontrolled hyperglycemia and diabetic ketoacidosis in children and adolescents with type 1 diabetes mellitus in Jeddah, western Saudi Arabia 2017;9(2):190-9.
8. Oko APG, Ali FKZ, Mandilou SVM, Kambourou J, Letitia L, Poathy JPY, et al. Diabetic ketoacidosis in children: epidemiological and prognostic aspects 2018;31:167-.
9. Haluzík M. News and perspectives in insulin treatment. Vnitrni Lekarstvi 2014;60(9):705-11.
10. Bode BW. Use of rapid-acting insulin analogues in the treatment of patients with type 1 and type 2 diabetes mellitus: insulin pump therapy versus multiple daily injections. Clin Therapeutics 2007;29:S135-44
11. Libman IM, Miller KM, DiMeglio LA, Bethin KE, Katz ML, Shah A, et al. Effect of metformin added to insulin on glycemic control among overweight/obese adolescents with type 1 diabetes: a randomized clinical trial 2015;314(21):2241-50.
12. Vranas KC, Jopling JK, Sweeney TE, Ramsey MC, Milstein AS, Slatore CG, et al. Identifying distinct subgroups of intensive care unit patients: a machine learning approach 2017;45(10):1607.
13. Porcellati F, Lucidi P, Candeloro P, Cioli P, Marinelli Andreoli A, Curti G, et al. Pharmacokinetics, pharmacodynamics, and modulation of hepatic glucose production with insulin glargine U300 and glargine U100 at steady state with individualized clinical doses in type 1 diabetes. Diabetes Care 2019;42(1):85-92.