

Frequency and Outcome of Diabetic Ketoacidosis in Newly Diagnosed Type-1 Diabetic Children

Diabetic
Ketoacidosis in
Children

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ABSTRACT

Objective: To determine the frequency and outcome (mortality) of DKA in newly diagnosed cases of T1DM of one to 15 years of age.

Study Design: Cross sectional study

Place and Duration of Study: This study was carried out at the Pediatrics Unit-I, Bahawal Victoria hospital Bahawalpur from 1st January 2011 to 30th March 2014.

Materials and Methods: The study was conducted on newly diagnosed cases of T1DM with or without DKA in children of one to 15 years of age admitting in pediatrics unit-I. The children with DKA were managed in the Pediatric Intensive Care Unit according to the standard DKA protocol of International Society of Pediatric and Adolescent Diabetes. Patients were examined at 96 hours after admission to see the outcome in term of death and survival. The data about the age, sex, severity of the disease and outcome was collected.

Results: There were 65 cases of T1DM in the study; 60% were males. Out of 65 cases of T1DM 56 were cases of DKA; 59% were male. The frequency of DKA was 86.15%. The frequency of DKA among males and females was 84.61% and 88.46% respectively but the difference was statistically insignificant. Out of 56 cases of DKA, 25% were mild in severity, 32.14% moderate and 42.86% severe. The case fatality in DKA was 5.36%. The mortality was only among severe form of DKA.

Conclusion: DKA is common among T1DM with mortality among severe cases of DKA.

Key Words: Type 1 Diabetes Mellitus, Diabetic Ketoacidosis, Outcome; Mortality

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INTRODUCTION

Type 1 diabetes mellitus (T1DM), one of the most common chronic diseases in childhood, is caused by insulin deficiency following destruction of the insulin-producing pancreatic beta cells. The incidence of childhood T1DM varies worldwide but is rising rapidly¹. Its incidence in Pakistan is about 1/100000 per year².

The most life threatening acute complication of T1DM is diabetic ketoacidosis (DKA) which is characterized by the triad of hyperglycemia, acidosis and ketosis in the presence of low levels of insulin. It is the leading cause of mortality in children with T1DM^{3,4} and is associated with increased morbidity and healthcare expenditure.

The frequency of DKA at diagnosis ranges from 12.8% to 80%, with highest frequencies in the United Arab Emirates, Saudi Arabia and Romania, and the lowest in Sweden, the Slovak Republic and Canada⁵. The mortality varies from 0%-11.7%^{6,7,8,9}.

DKA is one of the major neglected health issues in Pakistan. There is very little data available on frequency and outcome of DKA in children with T1DM in Pakistan. The study conducted at the Aga Khan University Hospital, Karachi showed 3.4% mortality in DKA¹⁰. There is no study conducted in this area on frequency and outcome of DKA in children.

So it was planned to conduct this study to see the frequency and outcome of DKA so that some practical recommendations could be provided for early detection of DKA and subsequent better management to reduce morbidity and mortality in children with DKA in Pakistan.

The objective of this study is to determine the frequency and outcome (mortality) of DKA in newly diagnosed cases of T1DM of one to 15 years of age.

MATERIALS AND METHODS

This cross sectional study was conducted on newly diagnosed cases of T1DM with or without DKA in children of one to 15 years of age admitting in pediatrics unit-I, Bahawal Victoria hospital Bahawalpur from 1st January 2011 to 30th March 2014. The verbal consent from the parents/guardian was taken.

A diagnosis of T1DM was made on one of the three glucose abnormalities that might need to be confirmed

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by repeat testing¹¹:

1. Fasting plasma glucose concentration ≥ 126 mg/dL,
2. A random plasma glucose ≥ 200 mg/dL with symptoms of hyperglycemia (polyuria, polydipsia and loss of weight),
3. An abnormal oral glucose tolerance test (OGTT) with a 2-hour postprandial plasma glucose concentration ≥ 200 mg/dL.

The children having age more than 15 years or less than one year or known case of T1DM or newly diagnosed case of diabetes with initial management in some other center, case of diabetes having obesity, child with acanthosis nigricans, hypertension, or dyslipidemia or hyperglycemia secondary to steroids, renal failure, sepsis or poisoning, child with co-morbid conditions like valvular heart disease, chronic liver disease and pulmonary disease or child having family history of diabetes mellitus were excluded from the study.

The biochemical criteria for the diagnosis of DKA¹² were: hyperglycemia (plasma glucose > 200 mg/dL), venous pH < 7.3 or bicarbonate < 15 mmol/L, and the presence of ketonemia or Ketonuria. The severity of DKA was categorized into mild (PH between 7.2 to 7.3 and HCO_3^- between 11 to 15 meq/L), moderate (PH between 7.0 to 7.1 and HCO_3^- between 6 to 10 meq/L) and severe (PH < 7 and $\text{HCO}_3^- \leq 5$ meq/L). The outcome was measured in term of mortality during first 96 hours of hospital admission.

The children with DKA were managed in the Pediatric Intensive Care Unit according to the standard DKA protocol of ISPAD (International Society of Pediatric and Adolescent Diabetes). Patients were examined by researcher herself at 96 hours after admission to see the outcome in term of death and survival. The data about the age, sex, severity of the disease and outcome was collected.

The data was entered and analyzed by using computer software SPSS version-14. The qualitative data was calculated as percentages and compared with Chi square test. P value < 0.05 was taken as significant.

RESULTS

There were 65 cases of T1 DM in the study; 39 (60%) males and 26 (40%) were females. There were 56 cases of DKA, 33 (59%) were male and 23 (41%) were females.

Out of 65 children were admitted 56 were in the DKA giving frequency of 86.15%. The frequency of DKA among males and females was 84.61% and 88.46% respectively but this difference in frequency was statistically insignificant (Table-I). The frequency of DKA among children < 8 years and ≥ 8 years of age was 85.71% and 86.36% respectively but the difference was statistically insignificant (Table-I).

Out of 56 cases of DKA, 14 (25%) were mild in severity, 18 (32.14%) moderate and 24 (42.86%) were severe.

The case fatality rate in DKA was 5.36% (Table-2). The case fatality among males and females DKA cases was 3.03% and 8.7% respectively but this difference was statistically insignificant (Table-II). The case fatality among < 8 years and ≥ 8 years DKA cases was 5.55% and 5.26% respectively but this difference was statistically insignificant (Table-II).

The mortality among severe form of DKA was 12.5% while there was no mortality among cases of mild and moderate form of DKA but this difference was statistically insignificant (Table-2).

Table No.1: Frequency of DKA in relation with Age and Sex

Characteristic	Total cases	Cases with DKA	Frequency of DKA	P value
SEX				
Male	39	33	84.61%	0.7307
Female	26	23	88.46%	
AGE				
< 8 years	21	18	85.71%	1.0000
≥ 8 years	44	38	86.36%	
Total	65	56	86.15%	

Table No.2: Outcome of DKA

Characteristic	Total cases of DKA	Deaths with DKA	Case fatality	P value
SEX				
Male	33	1	3.03%	0.5619
Female	23	2	8.7%	
AGE				
< 8 years	18	1	5.55%	1.0000
≥ 8 years	38	2	5.26%	
SEVERITY				
Mild	14	0	0%	0.12085
Moderate	18	0	0%	
Severe	24	3	12.5%	
Total	56	3	5.36%	

DISCUSSION

The available studies done on DKA in T1DM did not reveal uniform results. There were 60% males in this study while Ugege O et al 2013¹³ showed male to female ratio 1:1 in T1DM. The reason may be male sex preference in our society.

The frequency of children admitted in the DKA was 86.15% in this study which was higher than any other study available. Onyiriuka AN et al 2013⁷ showed that 77.1%, Ugege O et al 2013¹³ 62.5%, Choleau C et al 2014¹⁴ 43.9%, Fritsch M et al 2013¹⁵ 37.2%, Klingensmith GJ et al 2013¹⁶ 34%, Ješić MD et al 2013¹⁷ 32.9%, Jefferies C et al 2015¹⁸ 27% while Razavi Z 2010¹⁹ showed 24% children were having DKA at the time of admission.

This study showed that 59% of cases of DKA were male and 41% females. The study done by Syed M et al 2011¹⁰ showed that 66% cases of DKA were males while the study conducted by Lone SW et al 2010²⁰ showed female dominance i.e. 59.8% cases of DKA were females. The study done by Ugege O et al 2013¹³ showed 60% of DKA were males while Kanwal SK et al 2012²¹ and Klingensmith GJ et al 2013¹⁶ showed equal sex distribution. The study done by Jefferies C et al 2015¹⁸ showed 48%, Onyiriuka AN et al 2013⁷ showed 40.5% and Razavi Z 2010¹⁹ showed 39.6% of patient with DKA were males.

The frequency of DKA among children <8 years and ≥8 years of age was 85.71% and 86.36% respectively but the difference was statistically insignificant. Lone SW et al 2010²⁰ showed that 61% cases of DKA were >10 years of age. Jefferies C et al 2015¹⁸ showed that increasing age at diagnosis was associated with greater likelihood of DKA at presentation ($p = 0.025$). Ugege O et al 2013¹³ showed no patient of DKA was less than 8 years. Fritsch M et al 2013¹⁵ showed that frequency of DKA was negatively associated with age at onset.

As for the severity of DKA was concerned, 42.86% were severe in this study. Kanwal SK et al 2012²¹ showed that nearly two third presented with severe DKA. Razavi Z 2010¹⁹ observed severe DKA in 54.5%, Jefferies C et al 2015¹⁸ in 26%, Syed M et al 2011¹⁰ in 20.5%, Choleau C et al 2014¹⁴ in 14.8%, Fritsch M et al 2013¹⁵ in 11.2% and Ješić MD et al 2013¹⁷ in 9.6% cases.

The case fatality rate of DKA was 5.36% in this study. Kanwal SK et al 2012²¹ showed that 12.72% had fatal outcome. Syed M et al 2011¹⁰ showed 3.41% mortality. Lone SW et al 2010²⁰ showed no mortality. Onyiriuka AN et al 2013⁷, Ugege O et al 2013¹³, Razavi Z 2010¹⁹ showed no mortality.

All mortalities were among severe form of DKA in this study. Syed M et al 2011¹⁰ and Kanwal SK et al 2012²¹ also gave the same results.

The results of this study are not the same as of other studies. The reasons of this difference might be due to the study design, selection of age group, type of diabetes mellitus included for the study, level of care, early diagnosis and racial differences. So multicenter study is needed to know the effect of these factors on frequency and outcome⁵.

CONCLUSION

DKA is common among T1DM with mortality among severe cases of DKA.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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