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Original Research Article

Clinical Characteristics and Outcome of Children Presenting with Diabetic Ketoacidosis at Tertiary Care Hospital

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Abstract

Background and Aim: Diabetic ketoacidosis is a significant consequence of type 1 diabetes in children and is linked to a higher risk of morbidity and mortality. Present study describes out experience of DKA management and outcome in a pediatric population at a tertiary care hospital in India.

Material and Methods: The current analysis is a cross-sectional study conducted in the medical college's affiliated hospital in collaboration with the pediatric intensive care unit department. Two years were spent doing the study. The investigation was conducted on patients who had been hospitalized and had been diagnosed with diabetic ketoacidosis. A total of 104 children presented with diagnosis of DKA admitted in the hospital were included in the study. All patients were observed for clinical characteristics every hour, blood sugar every two hours, arterial/venous blood gas analysis every four hours, and serum electrolytes every hour. Every 12 hours, renal function tests were measured. When the blood sugar at admission was >250 mg/dl with acidosis, diabetic ketoacidosis was identified.

Results: The most common presenting complaints were polyuria and polydipsia in 84 patients, loss of weight was noted in 96 patients, fever was noted in 62 patients, and vomiting and abdominal pain was found in 56 patients. The children included in the study were divided into three groups the majority of the children (56) presented with severe DKA, the moderate DKA was noted in 28 children and in 20 patients there were mild DKA.

Conclusion: DKA can develop in persons with diabetes mellitus that has already been diagnosed or it might be the first sign of the condition. Osmotic symptoms such polyuria, polydipsia, and fatigue are the most prevalent at the time of admission, followed by vomiting and abdominal pain. This study highlights the need for creating awareness, early referral and timely management of T1DM presenting not only in DKA but also during the ambulatory management.

Keywords: Blood Sugar, Children, Diabetic Ketoacidosis, Polyuria.

Introduction

The most prevalent endocrine-metabolic illness in children and adolescents is type 1 diabetes mellitus. A potentially fatal complication in children with diabetes

mellitus is diabetic ketoacidosis. It is responsible for a sizable share of paediatric diabetes hospital admissions. At the time of a pediatric diabetes diagnosis, diabetic ketoacidosis occurs 10%–70% of the time. Geographical region has a significant impact on the frequency of new-onset diabetes manifesting as DKA, which is inversely correlated with regional incidence.[1,2]

The result of metabolic problems brought on by a substantial insulin deficit or insulin inefficiency is diabetic ketoacidosis (DKA). The latter happens under stressful circumstances because the hormones released prevent insulin from working correctly.[3,4] While the probability of developing DKA in children with existing T1DM is 1-8% per patient per year, between 25–40% of children with newly diagnosed T1DM exhibit DKA. DKA is a significant consequence of type 1 diabetes in children and is linked to a higher risk of morbidity and mortality.[5,6] Infection and stress are frequent reasons in newly diagnosed diabetics, while a missing insulin dose in already-diagnosed diabetics. In wealthy nations, the mortality rate of DKA in children has decreased to 0.15%-0.31%.[7]

To diagnose DKA, a high degree of clinical suspicion is required. Careful replacement of fluid and electrolyte deficits, intravenous insulin administration, and constant monitoring of clinical and biochemical markers are all necessary for management. These measures are intended to help identify problems including hypokalemia, hypoglycemia, and cerebral edoema early on. There is a dearth of information from India regarding the clinical profile and prognosis of DKA in kids.[8,9]

Although it occurs more frequently in type 1 diabetes mellitus, diabetic ketoacidosis can also occur in type 2 diabetes mellitus under specific conditions and with certain triggering factors. Mortality will be decreased if these triggering events are recognised and promptly treated with appropriate treatments. Insulin insufficiency is the main pathophysiology underlying diabetic ketoacidosis.[10] Lack of insulin encourages lipolysis and ketogenesis. Increased levels of counter-regulatory hormones and insulin insufficiency both encourage hepatic glucogenesis. The process of ketogenesis involves consuming fatty acids and amino acids. Low pH and metabolic acidosis are caused by the production of keto acids like acetoacetic acid and beta-hydroxybutyric acid.[11,12]

However, in places with less developed medical facilities, the risk of death from DKA is greater, and children may die before receiving appropriate treatment. Present study describes out experience of DKA management and outcome in a pediatric population at a tertiary care hospital in India.

Material and Methods

The current analysis is a cross-sectional study conducted in the medical college's affiliated hospital in collaboration with the pediatric intensive care unit department. Two years were spent doing the study. The investigation was conducted on patients who had been hospitalized and had been diagnosed with diabetic ketoacidosis. Prior to the study's launch, the ethics committee was made aware of it and a clearance certificate was obtained.

The case files of kids who were hospitalized for DKA over a two-year period were examined. All patients were observed for clinical characteristics every hour, blood sugar every two hours, arterial/venous blood gas analysis every four hours, and serum electrolytes every hour. Every 12 hours, renal function tests were measured. When the blood sugar at admission was >250 mg/dl with acidosis, diabetic ketoacidosis was identified. One U/kg/day of regular insulin was given 30 minutes before the insulin infusion was stopped. Once the blood sugar level had

stabilised, mixed insulin (30/70) was substituted for regular insulin. When necessary, potassium replacement or restriction was administered. Until the blood/urine cultures were shown to be sterile, prophylactic ceftriaxone (75 mg/kg/day) was administered to all children.

The therapeutic regimen that was used has been previously documented. Children who presented with shock were swiftly administered a 10ml/kg bolus of normal saline. Severe dehydration was thought to be present in children with moderate to severe DKA. Over the course of 48 hours, the shortfalls and maintenance fluid for 48 hours were distributed equally. A 0.1 unit/kg/hour of insulin was started as an infusion. When the kids were awake, able to tolerate oral feedings, and metabolically stable, the infusion was withdrawn, regular insulin was given in 4 split doses at 1 U/kg/day, 30 minutes before the insulin infusion was stopped. Once the blood sugar level had stabilized, mixed insulin (30/70) was substituted for regular insulin. When necessary, potassium replacement or restriction was administered. Until the blood/urine cultures were shown to be sterile, prophylactic ceftriaxone (75 mg/kg/day) was administered to all children.

Data's were analyzed using statistical package for the social sciences (SPSS) v.23 software continuous variables and expressed as mean and standard deviation.

Results

A total of 104 children presented with diagnosis of DKA admitted in the hospital were included in the study. The median age at presentation of the included patients was analysed to be 8.35 years. The male:female ratio of the included patients was found to be 1.5:1; the mean duration of symptoms before hospitalization was 7.5 days, the range of hospitalization of the children admitted in the hospital was recorded as 1 to 30 days.

Of the total included patients in the study, 84 patients were newly diagnosed with type 1 DM and in rest 20 patients the diabetes was known from before admission. Owing to the socio economic status of the patients, 92 patients did belong to the lower socio economic status. The most common presenting complaints were polyuria and polydipsia in 84 patients, loss of weight was noted in 96 patients, fever was noted in 62 patients, and vomiting and abdominal pain was found in 56 patients.

The children included in the study were divided into three groups the majority of the children (56) presented with severe DKA, the moderate DKA was noted in 28 children and in 20 patients there were mild DKA. Twenty children presented with shock requiring a fluid bolus (10 ml/kg of normal saline). A total of 20 children required mechanical ventilation.

Table 1: Clinical Profile of children with DKA admitted in hospital

Severity of DKA	Number of cases	Type 1 Diabetic Mellitus	
		Known Case	New Case
Severe	56	4	52
Moderate	28	8	20
Mild	20	8	12

Table 2: Showing clinical features with DKA in hospital admitted children

Symptoms in children	No. of patients
Polyuria & Polydipsia	84
Abdominal pain	36
Vomiting	20

Fever	62
Loss of weight	96
Diarrhea	54

Discussion

The most frequent metabolic emergency in diabetics is DKA. DKA is caused by a lack of insulin and a rise in the hormones that counteract it, which leads to hyperglycemia, ketonemia, and metabolic acidosis. DKA can develop in persons with newly diagnosed diabetes as well as those with pre-existing diabetes. DKA is a decompensated form of diabetes that necessitates hospitalisation.[13,14] Finding out a child's history of polyuria, polydipsia, and weight loss becomes more challenging the younger the child is. Infants and toddlers who appear with DKA may receive incorrect treatment because they were thought to have a respiratory infectionThe general public and medical professionals are not aware of the vague and subtle signs of newborn and early child diabetes, which delays diagnosis and increases the likelihood of developing DKA.[15,16]

During the course of the current investigation, there were 104 instances of diabetic ketoacidosis. Female to male ratio of our subjects was 1.5:1, with girls making up 62.5% of the group. Studies by Satti Abdulrahim Satti et al. and Dr. Sudhir Mehta likewise revealed a female preponderance. In this study, the early adolescent group (48.1%) had ketoacidosis more frequently. At presentation, the average age was 8.37 years. The mean age at presentation for 16-year-olds in the study by Adriana Yock-Corrales et al. was 8.6 years, while it was 10.2 in the study by Clarice L. S. Lopes et al. No correlation between age and the severity of DKA was found in our investigation.

From the data analysed of the study 24.1% of the patients had mild ketoacidosis, 23.3% had moderate ketoacidosis, and 52.6% had severe ketoacidosis. However, more patients who fell into the category of known T1DM cases had mild DKA, suggesting that they may have self-referred early due to a pre-existing condition, similar to Basavanthappa et al., who found that 53.8% of patients had severe, 26.9% had moderate, and 19.2% had mild DKA.

Our patients tended to have new-onset DM. Infections (most frequently viral fever, peritonitis, pneumonia, and urinary tract infections), forgetting to take insulin, and inadequate insulin administration while suffering from a concurrent illness are the main triggering factors for DKA. Better results are related to the provision of the proper intravenous fluids, the prudent use of sodium bicarbonate, and continuous rather than bolus insulin infusion. The gold standard of care is insulin infusion. As severe acidosis causes cutaneous vasoconstriction and lowers insulin absorption, continuous insulin infusion is advised rather than subcutaneous insulin.

Conclusion

DKA can develop in persons with diabetes mellitus that has already been diagnosed or it might be the first sign of the condition. Osmotic symptoms such polyuria, polydipsia, and fatigue are the most prevalent at the time of admission, followed by vomiting and abdominal pain. This study highlights the need for creating awareness, early referral and timely management of T1DM presenting not only in DKA but also during the ambulatory management.

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