

Research Article

Clinical profile and outcome of diabetic ketoacidosis in a tertiary care hospital in South India

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ABSTRACT

Background: There is little information on the clinical profile and outcome of children with diabetic ketoacidosis in India. We analysed the data of children managed by us at a tertiary care hospital in order to study the clinical profile of the children admitted with DKA.

Methods: This descriptive retrospective study was conducted in pediatric ICU of tertiary level care hospital at Chitradurga, Karnataka (between June 2011 and May 2014). The case records of 52 children admitted with DKA were reviewed and information with respect to the personal details, clinical features, laboratory parameters, management and outcome was recorded using a predesigned proforma. The data was analyzed using SPSS VS-21.

Results: The median age at presentation was 7.52 years (range: 2-14 years) with a male:female ratio of 1.3:1. 80.7% were newly diagnosed type 1 DM. 46(88 %) of the cases belonged to lower socio economic status. 41 (78%) were from rural areas. The most common presenting complaints were polyuria and polydipsia in 42 cases (80.7%). Twenty eight children (53.8%) presented with severe DKA. The most common presenting complaints were polyuria and polydipsia (80.7%). The average length of stay in the ICU was 3.5 days. The mortality rate was 11.5% (6 cases). Cerebral edema was the commonest cause for fatality. The prevalence of DKA amongst all pediatric admissions was higher than that estimated in previous studies (1 in 419 cases).

Conclusions: The outcome of active management of diabetic ketoacidosis in children is rewarding. Diabetic ketoacidosis is a life threatening complication of diabetes mellitus in children. Boys and girls were equally affected. Early identification and careful monitoring of fluids, electrolytes and renal function are the cornerstones of successful DKA management.

Keywords: Diabetes, Ketoacidosis, Hypokalemia, Cerebral edema, Insulin

INTRODUCTION

Diabetic ketoacidosis (DKA) is a common and serious complication of insulin dependent Diabetes Mellitus (DM). DKA is the presenting feature in majority of the cases of type 1 DM in children. It may occur later also in association with infection, other stress or non-compliance with treatment. Diabetic ketoacidosis (DKA) is the most common and serious metabolic disturbance leading to

hospitalization of children with Diabetes Mellitus (DM). The annual incidence of DKA among children with type I DM is 1%-5%¹ in western series and accounts for 8%-28%² of all primary admissions for DM to a hospital. DKA occurs in 20%-40% of children with known DM who omit insulin doses or who are not managed appropriately during an intercurrent illness.³

Hyperglycemia, metabolic acidosis, ketonemia, dehydration and various electrolyte abnormalities result from a relative or absolute deficiency of insulin with or without an excess of counter-regulatory hormones. A high index of clinical suspicion is necessary to diagnose DKA. Management requires careful replacement of fluid and electrolyte deficits, intravenous administration of insulin, and close monitoring of clinical and biochemical parameters directed towards timely detection of complications, including hypokalemia, hypoglycemia and cerebral edema.

There is a paucity of data from India on the clinical profile and outcome of DKA in children. We retrospectively analysed our data of 3 years at a tertiary care hospital.

METHODS

Basaveshwara medical college hospital is a tertiary care hospital located in Chitradurga, Karnataka. The pediatric ICU is a 12 bedded with facilities for mechanical ventilation. The case records of children hospitalized with DKA from June 2011 to May 2014 were reviewed.

All patients were monitored every hour for clinical features (heart rate, respiratory rate, blood pressure, urine output, oxygen saturation, sensorium, headache, vomiting), every 2 hours for blood sugar, every 4 hours for arterial/venous blood gas analysis, serum electrolytes. Renal function test were measured every 12 hours.

Diabetic ketoacidosis was diagnosed when the blood sugar at admission was >250 mg/dl with acidosis (pH <7.3 or plasma bicarbonate <15 mmol/L) and positive urine ketones. Patients were considered to have newly diagnosed diabetes if they were previously undiagnosed and had presented with DKA. The severity of DKA was graded as mild, moderate and severe.

The treatment protocol followed has been reported previously.⁴ Briefly, children presenting with shock were given a 10ml/kg bolus of normal saline. Children with moderate to severe DKA were considered to have severe dehydration (a deficit of 80-100 ml/kg). The deficit along with maintenance fluid for 48 hours were given evenly over a period of 48 hours. Insulin infusion was started at a rate of 0.1 unit/kg/hour. The infusion was stopped when the children were alert, able to tolerate oral feeds, metabolically stable (blood pH >7.3 , plasma bicarbonate >15 mmol/L and blood sugar around 250 mg/dl). Regular insulin (Human actrapid) at 1 U/kg/day (in 4 divided doses) was administered 30 minutes before stopping the insulin infusion. Regular insulin was replaced with mixed insulin (30/70) once the blood sugar had stabilized. Potassium replacement/restriction was given as required. All children were given prophylactic ceftriaxone (75 mg/kg/day) till the blood/urine cultures were reported to be sterile.

RESULTS

Of the 21,803 hospital admissions from June 2011 to May 2014, a total of 52 children presented with DKA (1 in 419 hospital admissions). The median age at presentation was 7.52 years (range: 2-14 years) with a male:female ratio of 1.3:1; the mean duration of symptoms before hospitalization was 9.6 days (range: 1-30 days). 42 (80.7%) were newly diagnosed type 1 DM. 88% (46) of the cases belonged to lower socio economic status. 78% (41) were from rural areas.

The most common presenting complaints were polyuria and polydipsia in 42 (80.7%), loss of weight in 48 (92.3%), fever in 31 (59.6%), and vomiting and abdominal pain in 28 (53.8%). A majority 53.8% (28) presented with severe, 26.9% (14) with moderate and 19.2% (10) with mild DKA (Table 1). Ten children presented with shock requiring a fluid bolus (10 ml/kg of normal saline). A total of 10 (83% of severe DKA) children required mechanical ventilation.

Table 1: Clinical Profile of children with DKA.

Severity of DKA	Number of cases	Percentage %	Type 1 DM	
			Known case	New case
Mild	10	19.2	4	6
Moderate	14	26.9	4	10
Severe	28	53.8	2	26
Total	52		10	42

Hypokalaemia was the common therapy-related complication observed in 14 children. The median time for the arterial blood gas to normalize was 26 hours.

Six deaths occurred (11 % mortality rate). Death occurred within 12 hours of hospital admission in 4 cases. The cause of death was cerebral edema in 4 of the cases and renal failure in 1 case and sepsis/peritonitis in 1 case. Three children required peritoneal dialysis. Out of the total 52 cases, 10 cases were known cases of Type 1 DM. The cause for readmission was infection in 5 of the case (50%), skipping of insulin in 3 cases (30%), improper storage of insulin in 1 case. In one particular case the cause of readmission was due to stoppage of insulin and administration of oral hypoglycemic by a local doctor.

The average length of stay in the ICU was 3.5 days and for discharge from hospital (discharged when alert, able to take oral feeds well, the technique of insulin therapy taught/reinforced and warning signs explained) was 8.5 days.

DISCUSSION

Diabetic ketoacidosis is a life-threatening condition caused by an imbalance between effective circulating insulin and the counter-regulatory hormones (glucagon,

catecholamines, cortisol and growth hormone) leading to hyperglycaemia, hyperosmolarity, increased lipolysis, ketonaemia and metabolic acidosis.⁴

The median age at presentation in our series was 7.52 years whereas two earlier studies have reported it to be 6.9 and 7.9 years.^{6,7}

The frequency of DKA is higher among boys than among girls as reported in earlier studies, except in the study by Neu et al.⁸ who reported the frequency to be higher among girls.

The admission rate of DKA was 1 in 419 as compared to earlier studies who reported it to be 1 in 1747.¹¹ This large difference in prevalence rates can be explained by differences in geographical and cultural aspects. It is probably much higher in our study as our hospital is the only tertiary care hospital in a radius of 60 square kilometers.

Most of our patients had new-onset DM. The major precipitating factors for DKA are infections (most commonly viral fever, peritonitis, pneumonia and urinary tract infections), omitting insulin, inadequate insulin administration during an intercurrent illness.

The administration of appropriate intravenous fluids, rational use of sodium bicarbonate, continuous rather than bolus insulin infusion is associated with better outcomes.

Insulin infusion is the gold standard for treatment. Continuous insulin infusion rather than subcutaneous insulin is recommended as severe acidosis leads to cutaneous vasoconstriction thereby reducing the absorption of insulin.¹⁰

Hypokalaemia was the most common complication observed in our series as in other studies.⁶ In our study cerebral edema was the cause of death in 66% (4) of the deaths. Cerebral oedema accounts for 57%-87% of all deaths due to DKA and typically occurs 4-12 hours after the onset of treatment, though it can be present before treatment has commenced or at any time during treatment.^{8,9}

CONCLUSION

Diabetic ketoacidosis is a life threatening complication of diabetes mellitus in children. Boys and girls were equally affected. Newly diagnosed diabetics constituted more >80% of total DKA admissions. Majority presented with severe DKA. Renal failure, cerebral edema and sepsis contributed to adverse outcome. Early identification and careful monitoring of fluids, electrolytes and renal

function are the cornerstones of successful DKA management.

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