

## Original Research Article

# Clinical features and risk factors for diabetic ketoacidosis in type 1 diabetes mellitus at tertiary care centre, Maharashtra, India

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### ABSTRACT

**Background:** Diabetes Mellitus is increasing in incidence, prevalence and importance as a chronic disease throughout the world. The International Diabetes Federation projects that by 2030 there will be 438 million people with diabetes on a global scale. Three essential components of Diabetic Ketoacidosis are hyperglycemia, ketosis, and resultant metabolic acidosis. 4% of all patients with diabetes and 20% of those with Type 1 Diabetes are admitted to hospital with manifestations of ketoacidosis. Objectives was to study clinical profile of patients presenting as Diabetic Ketoacidosis.

**Methods:** It is a descriptive observational study was conducted at Department of Medicine, Dr. Shankarrao Chavan Medical College and Hospital, Nanded. The study included 77 patients of diabetic ketoacidosis (DKA) from Male Medicine ward, Female Medicine ward, Medical Intensive Care Unit. The study was carried out during Jan 2012 to October 2013. The data was analyzed using SPSS 24.0 version.

**Results:** Majority of the subjects were from 10-20 years age group i.e. 31(40.3%). 51.9% were males and 42.9% were females. 38(49.4%) have onset of Diabetes type 1 between 10- 20 years of age and mean±S.D.20.11±7.09yrs. Most common symptoms at the time of admission were abdominal pain in 54(70.1%), vomiting in 52(67.5%), nausea in 41(53.2%) and fatigue in 40(51.9%) patients. Most common risk factor for DKA was found to be infections in 36(46.8%) patients.

**Conclusions:** Most common clinical features of Diabetic Ketoacidosis were abdominal pain, vomiting, nausea and fatigue. Most common risk factor for Diabetic Ketoacidosis was infection followed by omission of treatment or irregular treatment. The most common infections were due to urinary tract & respiratory tract infections.

**Keywords:** Clinical features, Diabetic ketoacidosis, Risk factors, Type 1 diabetes mellitus

### INTRODUCTION

Diabetes Mellitus is increasing in incidence, prevalence and importance as a chronic disease throughout the world. The International Diabetes Federation projects that by 2030 there will be 438 million people with diabetes on a global scale. In the United States, the Centre for

Disease control calculates that 25.8 million people (8.3 % of the population) have diabetes and nearly 2 million Americans develop diabetes every year.<sup>1</sup> There are now 70 million people with diabetes in south east Asia and this number is expected to increase by 2030 to 121 million according to new estimates from the International Federation on 14th Nov world diabetes day 2012. One in

four of all diabetes deaths occur in south east Asia and it is estimated that by the end of 2012, 1.1 million people will have died from the disease.<sup>2</sup> IDF estimates that India alone has 63 million people living with diabetes and is only second to China in terms of global diabetes cases.<sup>2</sup> Type 1 Diabetes accounts for 5 to 10% of all diagnosed cases of diabetes and is the leading cause of diabetes in children.

Diabetes Mellitus is a heterogenous chronic metabolic disorder principally characterized by persistent hyperglycemia resulting from defects in insulin action and or insulin secretion. The disease burden of diabetes mellitus is primarily due to the burden of its many complications. By now several carefully conducted, prospective, randomized clinical studies like Diabetes complications and control trial (DCCT), United Kingdom Prospective Diabetes study (UKPDS) and the Kumamoto study have clearly shown that strict control of glycemia prevent complications in both Type 1 and 2 diabetes.<sup>3</sup>

Three essential components of Diabetic Ketoacidosis are hyperglycemia, ketosis, and resultant metabolic acidosis. 4% of all patients with diabetes and 20% of those with Type 1 Diabetes are admitted to hospital with manifestations of ketoacidosis. It mainly affects type 1 patients.<sup>4</sup> With many improvements in the treatment of DKA and in understanding of the metabolic and electrolyte changes and their treatment, it is possible to prevent and treat this condition.

Therefore, study was undertaken to learn the clinical profile and risk factors of the patients presenting with ketoacidosis at the tertiary care centre, Dr. Shankarrao Chavan Medical College, Nanded.

Objectives was to study clinical profile of patients presenting as Diabetic Ketoacidosis.

## METHODS

The present prospective observational study was conducted at Department of Medicine, Dr. Shankarrao Chavan Medical College and Hospital, Nanded. The study included 77 patients of diabetic ketoacidosis (DKA) from Male Medicine ward, Female Medicine ward, Medical Intensive Care Unit. The study was carried out during January 2012 to October 2013.

### Inclusion criteria

- All patients presenting in DKA satisfying criteria for diagnosis as per Joint British Diabetes Societies guidelines.<sup>4</sup>
- Those patients who were known diabetics type 1 with diabetic ketoacidosis.
- Patients who will present with diabetic ketoacidosis for the first time without any history suggestive of diabetes.

- Those patients with accidental detection of diabetic ketoacidosis but primarily admitted for other diseases.
- Those who are willing to participate in the study after consent
- For the admission, to the protocol, patient had following criteria- Hyperglycemia- >200mg /dl, Urine positive for ketones, Serum bicarbonate level- <15mEq/L and Acidosis with blood pH - <7.3
- The diagnostic criteria for diabetic ketoacidosis are:<sup>4</sup>
  - Ketonemia 3 mmol/l and over or significant ketonuria (more than 2 + on standard urine sticks);
  - Blood glucose over 200 mg/dl or known diabetes mellitus;
  - Venous bicarbonate (HCO<sub>3</sub><sup>-</sup>) below 15 mEq/L;
  - Venous pH less than 7.3

### Exclusion criteria

- Diabetic Ketoacidosis in type 2 diabetes mellitus.
- Type1 diabetes mellitus patients without diabetic ketoacidosis.
- Those who are not willing to participate in the study.

On admission a careful and detail history recorded and thorough clinical examination was conducted. All the points mentioned in the proforma were recorded and the following investigations will be carried out at the time of admission.

### Statistical analysis

Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analyzed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions. Quantitative data was expressed in terms of mean and standard deviation.

## RESULTS

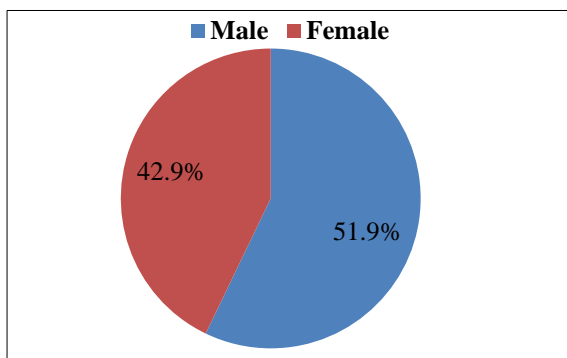
In this study, majority of the subjects were from 10-20 years age group i.e. 31(40.3%), followed by 29(37.7%) from 21-30 years and least i.e. 17(22.1%) from 31-40 years age group (Table 1).

**Table 1: Distribution according to age group.**

Age group in years	Frequency	Percent
10 to 20	31	40.3
21 to 30	29	37.7
31 to 40	17	22.1
Total	77	100.0

Out of total 77 subjects, 51.9% were males and 42.9% were females (Figure 1).

It was observed that maximum patients 38(49.4%) have onset of Diabetes type 1 between 10- 20 years of age and mean  $\pm$  S.D.20.11 $\pm$ 7.09yrs. Onset of type 1 Diabetes is less common in age group <10 years 5(6.5%) and above 30 years 3(3.9%) (Table 2).



**Figure 1: Distribution according to gender distribution.**

**Table 2: Distribution according to age of onset of DKA.**

Age of onset	Frequency	Percent
<10	5	6.5
10 to 20	38	49.4
21 to 30	31	40.3
31 to 40	3	3.9
Total	77	100.0

**Table 3: Distribution according to clinical features of DKA patients.**

Clinical features	Frequency	Percent
Abdominal pain	54	70.1
Vomiting	52	67.5
Nausea	41	53.2
Fatigue	40	51.9
Polydypsia	39	50.6
Breathlessness	37	48.1
Polyuria	31	40.3
Fever	31	40.3
Anorexia	14	18.2
Burning micturition	10	13.0
Cough	10	13.0
Loose motions	7	9.1
Sore throat	4	5.2
Hematemesis	1	1.3
Convulsions	1	1.3

Most common symptoms at the time of admission were abdominal pain in 54(70.1%) patients and vomiting in 52(67.5%) patients. Nausea was found in 41(53.2%) patients whereas fatigue was found 40(51.9%) patients. Polydypsia and polyuria found in 39(50.6%) and 31(40.3%) patients respectively. 37(48.1%) patients were

dyspneic whereas 31(40.3%) patients had fever at the time of admission. Other symptoms which were found in patients include Anorexia in 14(18.2%), Burning micturition and cough in 10 (13%), Loose motions in 7(9.1%), sore throat 4(5.2%), Hematemesis and convulsions in 1(1.3%) each (Table 3).

Patients status was normal in 63 i.e. 81.8% whereas in 13 i.e. 16.9% patients were drowsy and one (1.3%) was in coma (Table 4).

**Table 4: Distribution according to patient status.**

Patients status	Frequency	Percent
Normal	63	81.8
Drowsy	13	16.9
Coma	1	1.3
Total	77	100.0

Most common risk factor for DKA was found to be infections in 36(46.8%) patients. Amongst infections, majority patients 12(15.6%) had urinary tract infections and 7 (9.1%) patients had respiratory tract infections. 34(44.2%) patients had either omitted treatment or were on irregular treatment 1(1.3%) patient had pregnancy as risk factor 1(1.3%) patient had inappropriate storage of insulin as risk factor 1(1.3%) patients were of new onset DKA (Table 5).

**Table 5: Distribution according to presence of risk factors.**

Risk factors	Number	Percent
Infections	36	46.8
UTI	12	15.6
AGE	6	7.8
URTI	4	5.2
LRTI	3	3.9
PTB	2	2.6
Bed Sore	2	2.6
Diabetic foot	2	2.6
Enteric fever	1	1.3
Parotitis	1	1.3
Gluteal ulcer	1	1.3
Infected ulcer at venesection site	1	1.3
Perineal Abscess	1	1.3
Non-Compliance	34	44.2
Others	7	9.1
Pregnancy	1	1.3
Storage	1	1.3
New onset	1	1.3

**DISCUSSION**

The mean age of the patients in the study was 25.17 $\pm$ 8.74 yrs. The maximum number of patients were found in the age group 10-20 yrs. Average age was slightly higher as reported by Matto VK et al (21 $\pm$ 4.2 yrs) and slightly less

than that reported in study by Christopher.<sup>5,11</sup> However, the age group is not important as pointed out in consensus statement from the American Diabetic Association that the Fundamental pathophysiology & presentation of this potentially life-threatening complication is similar in children and adults.<sup>21</sup>

In the present study females were 42.67% while the males were 57.35%. Female preponderance has been reported in many studies.<sup>5,6</sup> While in some studies males were predominating.<sup>7,8</sup> However, the discrepancy in the sex ratio is probably multifactorial and depends on environmental, genetic and social differences between the groups studied.<sup>9</sup> Out of 75 patients, 4 patients presented first time in DKA. Percentage of the first-time presenting patient comes to around 5.3%. This finding is not consistent with the reports from studies by Zahra Razavi et al (Iran) (25%), Neu et al in Germany (26.3%), Rewers in the USA (25.5%) & Jasinsky in Poland (25%). While in studies by Sue Fu Lin, Rao D et al.<sup>10-15</sup>

Higher incidence in these studies may be due to inclusion of pediatric group in studies. Lower incidence may also be due to geographical, racial and environmental variations.

#### **Clinical features at admission**

It was observed that the maximum patients 37(49%) had onset of type 1 DM between 10 and 20 yrs of age and 5.34% of the patients first time presented first time with DKA. We observed the precipitating factor as infection in 48% (36) of the cases. It is reported in almost all the studies as common precipitating factors.<sup>8,16</sup>

The common infections observed were UTI (Urinary Tract infections (16%), acute gastroenteritis (8%) and respiratory tract infection both upper and lower (9.33%) in total. Urine tract infection was diagnosed from the clinical symptoms and presence of pus cells in the urine. X-rays from lower respiratory tract infection revealed pneumonitis in three patients and pulmonary tuberculosis in two patients. The other more common precipitating event was noncompliance i.e. discontinuation of insulin was observed in 44% of the patients. This has been shown as common cause in many studies.<sup>5,11,14,17</sup> It is also mentioned in DKA guidelines by American Diabetes Association.<sup>18</sup>

#### **CONCLUSION**

Diabetes below 20 years constituted 40% of patients developing ketoacidosis. Almost all the patients were below 40 years of age at the time of diagnosis of diabetes. Most common clinical features of Diabetic Ketoacidosis were abdominal pain, vomiting, nausea, fatigue, polydipsia, polyuria, breathlessness and fever. Most common risk factor for Diabetic Ketoacidosis was infection followed by omission of treatment or irregular treatment. The most common infections were due to

urinary tract and respiratory tract infections. No unusual precipitating factor was observed.

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