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Seasonal trends and laboratory markers of Diabetic Ketoacidosis in type 1 Diabetes: A descriptive study from Maharashtra

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ABSTRACT

Introduction: Defined by the triad hyperglycemia, acidosis, and ketonuria, DKA can be inaugural or complicate known diabetes. 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.

Objectives: To assess the seasonal trends laboratory profile of patients presenting as Diabetic Ketoacidosis (DKA).

Methodology: 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: 40.3% patients were from 10-20 years age group. Overall incidence of DKA was 0.33% and slightly more in males (0.35%) than in females (0.30%). Cases were more in summer and spring especially high summer i.e. 18.66%. Maximum patients i.e. 47% have blood sugar level above 600 mg/dl. 38(49%) patients showed sodium level slightly lower than normal. Hypokalemia was observed in 13(17%) patients.

Conclusion: Cases were more in summer and spring especially during high summer i.e. 18.66%. BSL was above 600 mg/dl in almost half of the DKA patients. Hyponatremia and hypokalemia were predominant findings in our study.

Keywords: Diabetes ketoacidosis, type 1 DM, seasonal trends, investigations

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.[1]

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.2 IDF estimates that India alone has 63 million people living with diabetes and is only second to China in terms of global diabetes cases. [2]

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.[3]

Defined by the triad hyperglycemia, acidosis, and ketonuria, DKA can be inaugural or complicate known diabetes.[4] Although DKA is evidence of poor metabolic control and usually indicates an absolute or relative imbalance between the patients requirements and the treatment, DKA-related mortality is low among patients who receive standardized treatment, which includes administration of insulin, correction of hydroelectrolytic disorders, and management of the triggering factor (which is often cessation of insulin therapy, an infection, or a myocardial infarction. [5,6] 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 the seasonal trends and laboratory profile of the patients presenting with ketoacidosis at the tertiary care centre, Dr. Shankarrao Chavan Medical College, Nanded.

Objectives:

- To assess the seasonal trends of patients presenting as Diabetic Ketoacidosis (DKA).
- To study laboratory profile of DKA patients

Materials and 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 Jan 2012 to October 2013

Inclusion criteria:

- All patients presenting in DKA satisfying criteria for diagnosis as per Joint British Diabetes Societies guidelines[7]
- 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—
- Hypergycemia-- >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:[7]

a. Ketonemia 3 mmol/l and over or significant ketonuria (more than 2 + on standard urine sticks);

b. Blood glucose over 200 mg/dl or known diabetes mellitus;

c. Venous bicarbonate (HCO3-) below 15 mEq/L and/or

d. 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 plan: 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 our 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)**

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

In our study, incidence of DKA was 0.33% among total hospital admissions, incidence was slightly more in male admissions (0.35%) than in female admissions (0.30%). Cases were more in summer and spring especially high summer i.e. 18.66% **(Table 2)**

In our study, maximum patients 36 (47%) observed to have blood sugar level 600 mg/dl-700mg/dl. 14(18%) patients have blood sugar in the range of 300-400mg/dl and 500-600mg/dl. 13(17%) patients have blood sugar in the range 400-500mg/dl. Only 2(2%) patients have blood sugar level less than 300mg/dl. In this study, BSL level ranged from 257-683, with mean and SD of 535±118. **(Table 3)**

In our study, urine examination showed 4+ sugar in 41(53%) patients, 3+ sugar in 30(39%) patients, 2+ sugar in 5(7%) patients. **(Table 4)**

In the study, large ketones were present in urine of 66(86%) patients whereas 11(14%) patients showed moderate ketones in urine. **(Table 5)**

In our study, Sodium level in patients ranged from 116-157 with mean and S.D. of 135± 6.57. Maximum 37(48%) patients showed sodium in normal range 136-145mEq/L. 38(49%) patients showed sodium level slightly lower than normal range whereas 2 (2.59%) patients showed hypernatremia, sodium level more than 145meq/L. **(Table 6)**

In our study, Potassium level in patients ranged from 1.20-6.20 with mean and SD of 3.92±0.77. Hypokalemia was observed in 13(17%) patients, out of which 3(4%) patients with potassium level <2.5mEq/L and 10(13%) patients with potassium level between 2.5-3.4mEq/L. Hyperkalemia was observed in 3(4%) patients with potassium level> 5.5 mEq/L. **(Table 7)**

List of Tables and Figures:

Table 1: Distribution according to age group

Age group in years	Frequency	Percentage
10 to 20	31	40.2
21 to 30	29	37.7
31 to 40	17	22.1
Total	**77**	**100.0**

Fig. 1: Distribution according to gender

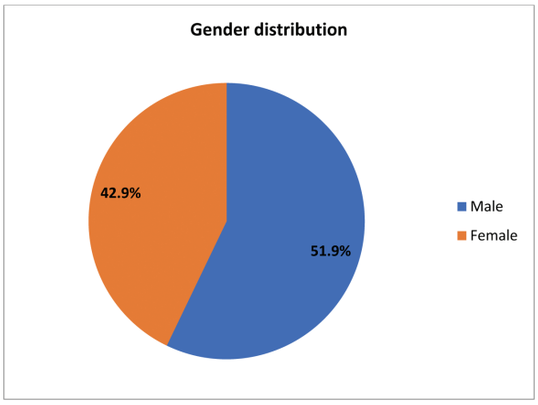

Table 2: Seasonal trends in DKA patients

Season	Season	No. of patients	Percentage
Jan-Feb 2012	Early Spring	3	4.0
March-April2012	Spring	6	8.0
May-June2012	High Summer	14	18.66
July-August2012	Late Summer	4	5.33
Sept-Oct2012	Autumn	4	5.33
Nov-Dec2012	Hibernal	2	2.67
Jan-Feb2013	Early Spring	8	10.67
March-April2013	Spring	13	17.33
May-June2013	High Summer	10	13.33
July-August2013	Late Summer	8	10.67
Sept-Oct2013	Autumn	3	4.0

Fig 2: Seasonal trends in DKA patients

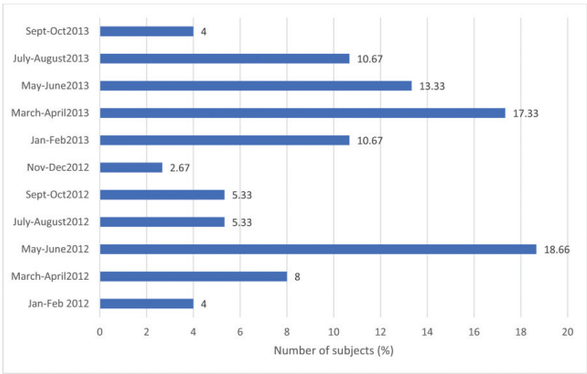

Table 3: Distribution according to blood sugar level

Blood Sugar Level	Count	Percentage
200 to 300	2	2.0
300 to 400	12	16.0
400 to 500	13	17.0
500 to 600	14	18.0
600 to 700	36	47.0
Total	77	100.0

Table 4: Distribution according to urine sugar level

Urine Sugar Level	Count	Percentage
1+	1	1.0
2+	5	7.0
3+	30	39.0
4+	41	53.0
Total	**77**	**100.0**

Table 5: Distribution according to urine ketone level

Urine Ketones Level	Count	Percentage
Nil	0	0.0
Small	0	0.0
Moderate	11	14.0
Large	66	86.0
Total	**77**	**100.0**

Table 6: Distribution according to Na level

No Level	Count	Percentage
116 to125	6	8.0
126 to 135	32	42.0
136 to 145	37	48.0
146 to 155	1	1.0
156 to 165	1	1.0
Total	**77**	**100.0**

Table 7: Distribution according to potasium level

K Level	Count	Percentage
0.5 to 1.4	1	1.0
1.5 to 2.4	2	3.0
2.5 to 3.4	10	13.0
3.5 to 4.4	50	65.0
4.5 to 5.4	11	14.0
5.5 to 6.4	3	4.0
Total	**77**	**100.0**

Discussion:

Age and gender:

The mean age of the patients in the study was 25.17 ±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[8] (21±4.2 yrs) and slightly less than that reported in study by Christopher.[9] However, the age group is not important as pointed out in consensus statement from the American Diabetic Association[10] that the Fundamental pathophysiology & presentation of this potentially life-threatening complication is similar in children and adults.

In the present study females were 42.67% while the males were 57.35%. Female preponderance has been reported in many studies.8,11 While in some studies males were predominating.12,13 However, the discrepancy in the sex ratio is probably multifactorial and depends on environmental, genetic and social differences between the groups studied.[13]

Biochemical abnormalities -

The range of blood sugar level was 257 to 694 mg/dl. The maximum patients were observed to have BSL 600 ml/dl-700mg/dl (40%). The 25 patients (33%) had blood sugar between 400 to 600 ml/dl (33%) this was comparable to the studies by Sue Fu Len[14], Rao and Pradhan[15].

In 37 (49.33%) patients serum sodium levels were in the normal range of 136-145 mEq/L. 36(48%) patients showed sodium level slightly lower than normal range whereas 2 (2.67%) patients showed hypernatremia, sodium level more than 145meq/L.

Although serum sodium levels might be expected to be increase in a dehydrated state, the osmotic effect of glucose draws water into the extra cellular space and intravascular space and tends to reduce the sodium concentration. For every 100mg rise in glucose over100mg/dl, there is drop in sodium by 1.6 mEq/L. Also, as there is hyperlipidemia, lipids reduce aqueous compartment of blood and tend to reduce serum sodium.[16] In the study by Christopher A 2004. A most of the patients the sodium level were within normal level. In the study by Rao[15], sodium levels were low in 72% of the cases, the study by Sue Fu Lin[14] as pointed out serum sodium levels in the normal range of 135±5 in both groups of 2001 & 1981.

Maximum number of patients 48(44.0%) had Eukalemia. Only 10 patients 13.32% had had hypokalemia. Potassium levels could be normal, high or low depending on the factors like osmotic loss through kidneys, vomiting which decrease potassium and metabolic acidosis causing increase in potassium.[17] My results are comparable to the finding by Sue Fu Lin.[14]

All the patients got well after treatment and were discharge. There was no mortality in the cases studied.

Conclusion:

Cases were more in summer and spring especially high summer i.e. 18.66%. BSL was above 600 mg/dl in almost half of the DKA patients. Hyponatremia and hypokalemia were predominant findings in our study.

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