

## DKA has a common occurrence in Type2 Diabetes Mellitus, first study in north east India to show this

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**Abstract -Introduction** – it was a common observation in our setup that Diabetic Ketoacidosis patient mostly are T2DM. This study done in 77 admitted patients of DKA showed that DKA was a common occurrence with T2DM rather than with T1DM in Jharkhand.

**Objective** – study the DKA patients admitted in medicine department RIMS with respect to type of DM.

**Methods** - 77 diabetic ketoacidosis proven patients admitted in the medicine department of Rajendra Institute of Medical Sciences ,Ranchi were selected for the study. Patients were selected by simple random sampling.

**Results** - Out of 77 cases in the present study, majority of the patients i.e. 69 patients (89.6%) were of type 2 diabetes mellitus and 5 patients (6.5%) were of type 1 diabetes mellitus.

**Discussion** – Type 2 DM was more commonly associated with DKA in this study. This may be due to more prevalence of type 2 DM & poor control. KPDM may also be the reason but it needs more elaborative study in this region.

**Keywords**- DM 1 & 2, DKA, KPDM(ketosis prone DM)

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### I. Introduction

Studies from Urban India suggests that one in four adults over the age of 20 years has IGT or DM<sup>1</sup>. In India the projected increase of diabetes is from 20 to 62 million<sup>2,3,4</sup>. Diabetic keto-Acidosis (DKA) and hyperglycaemic hyperosmolar state (HHS) are acute, severe disorders directly related to diabetes. DKA was formerly considered a hallmark of type 1 DM, but also occurs in individuals who lack immunologic features of type 1 DM and who can sometimes subsequently be treated with oral glucose lowering agents (these obese individuals with type 2 DM are often of Hispanic or African-American descent). HHS is primarily seen in individuals with type 2 DM. Both disorders are associated with absolute or relative insulin deficiency, volume depletion, and acid base abnormalities. DKA and HHS exist along a continuum of hyperglycaemia, with or without ketosis<sup>5</sup>.

Pathophysiology of DKA<sup>6</sup>- DKA results from relative or absolute insulin deficiency combined with counter regulatory hormone excess (glucagon, catecholamine's, cortisol , and growth hormone).Both insulin deficiency and glucagon excess, in particular, are necessary for DKA to develop. Inverse ratio of hormones leads to glycogenolysis and gluconeogenesis in the liver and kidney resulting in marked hyperglycemia. Insulin lack and counter regulatory hormone excess activate the hormone sensitive lipase leading to lipolysis, the FFA thus released are taken to liver and serve as substrate for ketogenesis.The end result is rapid increase in  $\beta$  hydroxybutyrate and acetone. Brain and skeletal muscles can metabolise ketone bodies normally, but it is impaired in DKA.Acetoacetate and  $\beta$  hydroxy butyrate are strong acids and are fully associated at body pH consuming body buffers and resulting in acidosis.Marked hyperglycaemia causes osmotic diuresis, increased extracellular osmolarity shifting water from cells leading to cellular dehydration.

In this study insulin deficiency we will asses through measuring the levels of c peptide Because C peptide is cleared more slowly than insulin, it is a useful marker of insulin secretion and allows discrimination of endogenous and exogenous sources of insulin in the evaluation of hypoglycaemia.

### II. Aims and objectives

1. Study the occurrence of diabetic ketoacidosis in type 1 & type 2 diabetes mellitus.
2. Correlation of c peptide levels in DKA.
3. Correlation of HbA1c levels in DKA.

### III. Material And Methods

This is a cross sectional observational study .77 diabetes mellitus patients admitted in the medicine department of Rajendra Institute of Medical Sciences , Ranchi were selected for the study. The duration of this study was 1.5 year.

#### Inclusion Criteria

- Diabetic patients presenting with DKA (ph<7.3,RBS >250MG/dl,urine for ketones positive,HCO<sub>3</sub><15meq/l)

#### Exclusion Criteria

- Patients having HbA1c <6.5
- Patients doing prolonged fasting ,starvation ,hyper emesis gravidarum, pregnant woman.

In DKA patients (proven by ABG , RBS ,Urine for ketones) we will do investigation for C peptide & HbA1c levels. Based on history, previous diagnosis & clinical features we will classify the cases in two groups of diabetes type 1 &2. In both group of patients HbA1c level & duration of diabetes commonly associated with DKA will be studied as well as occurrence of DKA in both types of diabetes in our study.

Study requiring other investigations or interventions to be conducted on patients Complete blood count,Chest x ray,Urine for ketones & routine examination,ABG (arterial blood gas analysis),RBS,Blood urea,Serum creatinine, Serum electrolytes,

#### Criteria for diagnosis of DKA

pH <7.3, RBS >250 mg/dl, Urine for ketones –positive, Serum bicarbonate(HCO<sub>3</sub>) <15meq/l

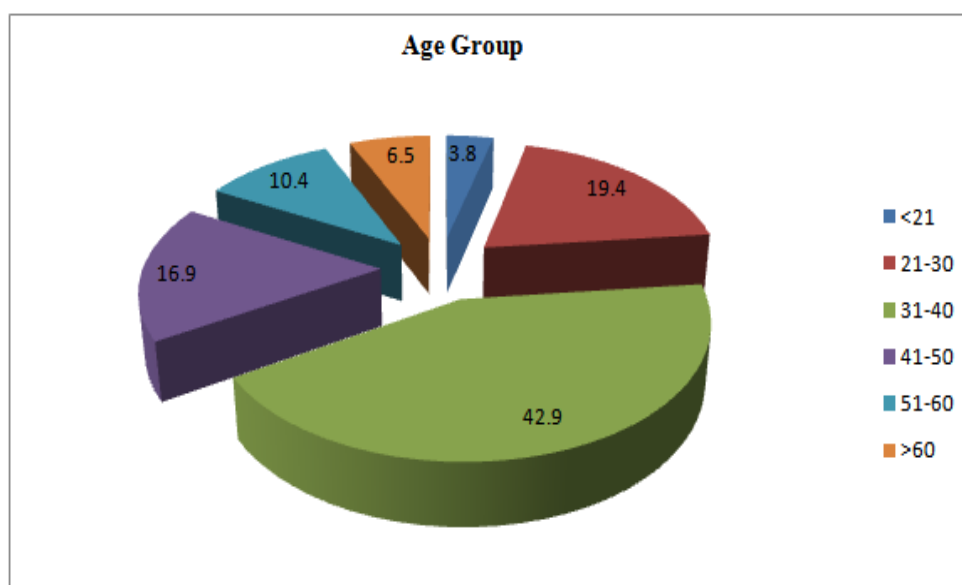
### IV. Observation And Results

A cross-sectional observational study with 77 cases of diabetes mellitus was done to observe the pattern of DKA and its relation with age, type of DM, HbA1C levels and C peptide levels in Medicine Department of Rajendra Institute of Medical Sciences.

Observation of this study is presented in following tables and graphs

**Table No 01:** Age Distribution of The Cases

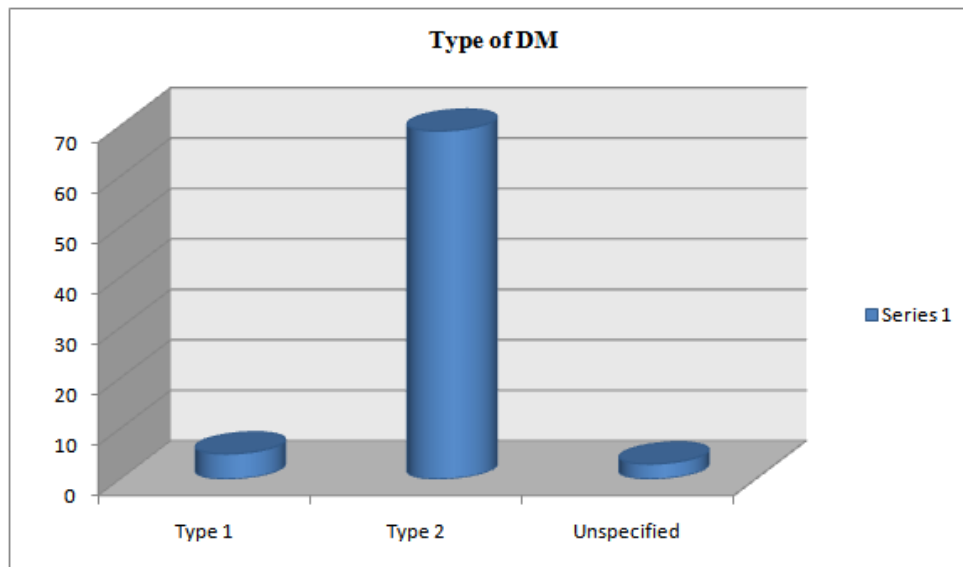
Age group	No of patients	Percentage
<21	3	3.9
21-30	15	19.4
31-40	33	42.9
41-50	13	16.9
51-60	8	10.4
>60	5	6.5
<b>Total</b>	<b>77</b>	<b>100</b>



In the present study Patients were in the age group of 16-75years with mean of 38.88 years (S.D ±12.37).

**Table no. 02:** Distribution of cases on the basis of type of dm

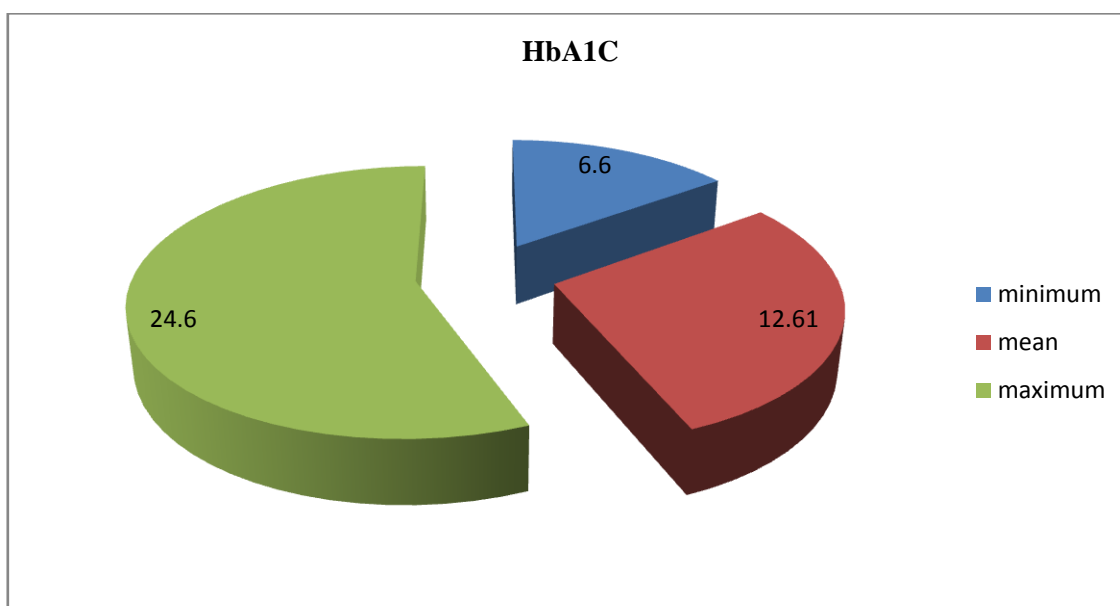
Type of DM	No of cases	Percentage
1	5	6.5
2	69	89.6
Unspecified	3	3.9



Out of 77 cases in the present study, majority of the patients i.e. 69 patients (89.6%) were of type 2 diabetes mellitus and 5 patients (6.5%) were of type 1 diabetes mellitus & 3 patients (3.9%) were of unspecified type of DM.

**Table No. 03:** Hba1c Distribution

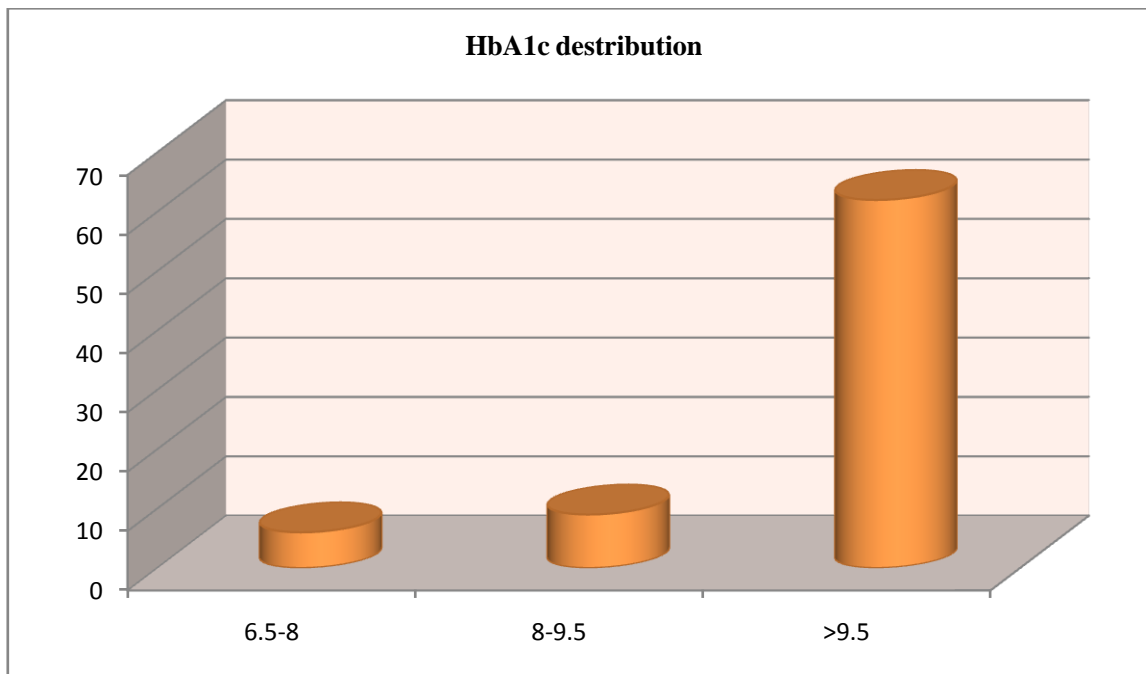
	Total	mean	Std deviation	minimum	Maximum
HbA1C levels	77	12.61	3.77	6.6	24.8



HbA1c was in range of 6.6 – 24.8% with mean of 12.61% (SD ± 3.7%).

**Table No. 04:** Distribution of Patients On The Basis Of Hba1c Levels

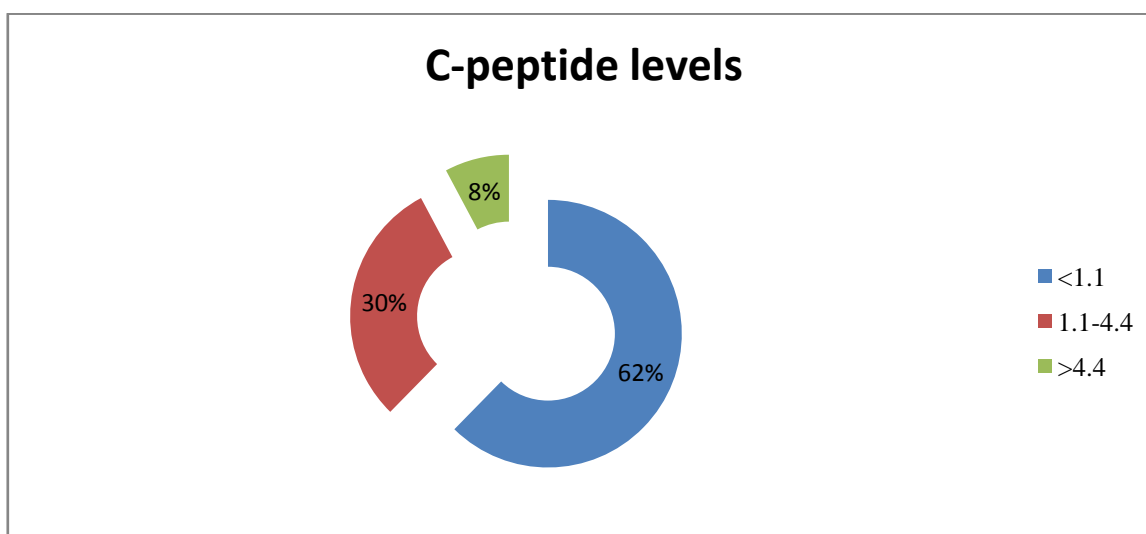
HbA1c range	No of patients	Percentage
6.5-8	6	7.8
8-9.5	9	11.7
>9.5	62	80.5
total	77	100



In our study out of 77 patients 62 patients(80%) HbA1c was >9.5 %,9 patients (11%) were in the range of 8-9.5 %,6 patients (7.8%) were in the range of 6.5 -8%.

**Table No. 05:** Distribution of Patients On The Basis Of C Peptide Levels

C peptide levels	No of patients	Percentage
<1.1	48	62.3
1.1-4.4	23	29.9
>4.4	6	7.8
Total	77	100.0



In our study majority of patients that is 42 patients (62%) C peptide levels was below 1.1 ng/ml,23 patients (30%) were in the range of 1.1 -4.4 ng/ml, where as 6 patients (8%) were above the 4.4ng/ml.

## V. Discussion

A cross-sectional observational study was conducted for type of diabetes commonly associated with DKA. In DKA patients who were admitted in Rajendra Institute of Medical Sciences.

### Age Distribution

In the present study Patients were in the age group of 16-75years with mean of 38.88 years (S.D ±12.37). This is similar to the study carried by D Rao V & B Pradhan et al<sup>7</sup> in 2012 where the mean age of the patients was 45.3 years.

### Distribution On The Basis Of Type Of Dm

In the present study 69 patients (90%) were of type 2 diabetes mellitus and 5 patients (8%) were of type 1 diabetes mellitus. Thus this study reflects the prevalence of type of diabetes in India. In a study conducted by S. agrawal et al.<sup>8</sup> in 2011, 74% were of NIDDM and 26% of IDDM.

### Distribution Of Patients On The Basis Of C Peptide Levels

In our study the majority of patients (62%) were having C peptide levels below 1.1ng/ml, 30% patients were in the range of 1.1-4.4 ng/ml. This data is similar to study C peptide levels in hyperglycaemic emergency at Lagos<sup>9</sup> which was having mean C peptide levels 0.9mg/ml. P value was calculated which came out to be .03 which was statistically significant.

### Correlation Of Hba1c And C Peptide Levels With Dka

In our study DKA was having more common with higher HbA1c values, the mean HbA1c was 12.61% and out of 77 patients 62 were having HbA1c >9.5 %. In similar study carried by Bing Zhu et al<sup>10</sup> where mean HbA1c value associated with DKA was 10.1%.

It signifies that poorly controlled DM patients are more prone for DKA occurrence in type 2 DM patients, where as we had inadequate data regarding type 1 DM to comment as our study was done in adult population at medicine department where type 1 Diabetics young patients are less encountered.

C peptide is marker of insulin secretion as with respect to DKA occurrence insulopenia and increased counter regulatory hormones are necessary; the C peptide levels are markedly reduced in DKA. In our study the 48 patients (62%) were having low C peptide levels <1.1 ng/ml , below biological reference range. these observations are similar to study C peptide levels in hyperglycaemic emergencies at Lagos<sup>9</sup> where mean C peptide levels was 0.9mg/ml. so the study suggests that low C peptide levels are harbinger of DKA in type 2 DM patients. Where as these results can not be applied to type 1DM patients as they are already having low C peptide levels from the very onset of DM. based on this study it may be recommended that C peptide assessment is crucial in DM management as well as it may be used as predictor of DKA when associated with low levels in poorly controlled type 2 DM patients. As it was small scale study a large population based study is recommended to establish further establishment of association & formulation of guidelines regarding routine assessment of C peptide levels in Type 2 DM patients.

## VI. Conclusion

This study was aimed to find prevalence of diabetic ketoacidosis and its different parameters in the diabetic patients admitted in Rajendra Institute of Medical Sciences.

To summarize finding of this study,

- Patients were in age group of 16-75 years with mean of 38.88 years (S.D ±12.37), with most of the patients (43%) in age group 31-40 years.
- Majority of the cases i.e. 69 patients (89.6%) were of type 2 diabetes mellitus and 5 patients (6.5%) were of type 1 diabetes mellitus & 3 patients (3.9%) were of unspecified type of DM.
- HbA1c was in range of 6.6 – 24.8% with mean of 12.61% (SD ± 3.7%).
- Out of 77 patients 62 patients (80%) HbA1c was >9.5 %.
- Out of 77 patients 42 patients (62%) C peptide levels was below 1.1 ng/ml .
- Prevalence of DKA was higher in Type2 DM 69 patients(90%) than Type1 DM patients in our study.
- Most common precipitating factor of DKA in our study was infection LRTI 29% followed by sepsis 22%.
- There were 4 patients who were not a diagnosed case of DM and presented first with DKA of adult age of 36 ,27 ,23 and 32 years. These may be cases of ketosis prone type 2 DM; as on further testing for antibody they were found to be negative.
- The prognosis of disease was good with almost 100% response to treatment, early diagnosis & prompt treatment with iv fluids and insulin was associated with early favorable outcomes.

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Though the present study was conducted with some limitations like inadequate history by patients, lack of antibody testing for every patient, many patients with left out treatment and poor adherence, some important inferences were drawn from the study.

- All patients with diabetes should be screened for HbA1C and C peptide levels irrespective of age, sex, type and duration of DM.
- The screening for DKA precipitating factors should be done at the time of diagnosis of DM & patients should be counseled regarding its symptoms.
- As traditional teaching states that DKA occurs in Type 1 DM and HHS in Type 2DM but it's not true, in this study most of the patients were type 2 DM (90%) who presented with DKA .
- Patients with high HbA1c and low C peptide levels are prone to develop DKA so should be counseled and treated more aggressively.

Further research exploring the natural history of DKA, better understanding of DKA pathogenesis in type 2 DM and cheaper investigations for diagnosis DKA is required in order to develop disease modifying treatments

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