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Research Article

AN OBSERVATIONAL STUDY ON CLINICAL AND BIOCHEMICAL PROFILE OF PATIENTS WITH DIABETIC KETOACIDOSIS

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A R T I C L E I N F O

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A B S T R A C T

Diabetes is considered the fifth leading cause of death, and it is a leading cause of morbidity and mortality in the developed world, as well as in many developing countries. Diabetic ketoacidosis (DKA) is one of the life-threatening acute complications of diabetes mellitus (DM) that mainly occurs in type 1 diabetes patients, as well as in some patients with type 2 diabetes. In developing countries like India poor socioeconomic status in patients with diabetes incline to have poor compliance and poor glycemic control so any precipitating Factor tends to land them in state of DKA. Early diagnosis and early management avoids morbidity and mortality. Hence the study was undertaken. Methodology 100 diagnosed DKA patients were included in the study during 6 months of period. based on inclusion and exclusion criteria patients were selected and various clinical and biochemical parameters were collected for the study.

Result and conclusion: Diabetic ketoacidosis remains major cause of emergency among diabetic patients. Noncompliance or inadequate or inappropriate insulin administration and infection remains the most common precipitating causes for DKA. Hence early diagnosis and prompt treatment can reduce the mortality in DKA. Patient education is the most important factor to reduce occurrence of DKA in diabetic patients.

INTRODUCTION

Diabetes is considered the fifth leading cause of death, and it is a leading cause of morbidity and mortality in the developed world, as well as in many developing countries. Diabetes prevalence (in adults) is reported to be 31% in India,[1]which is higher than that reported in the developed countries. According to the International Diabetes Federation, the diabetes rate in 2015 was 17.6%.[1]

Diabetic ketoacidosis (DKA) is one of the life-threatening acute complications of diabetes mellitus (DM) that mainly occurs in type 1 diabetes patients, as well as in some patients with type 2 diabetes. It tends to present under stressful conditions or in association with illnesses that feature metabolic decompensation. DKA is characterized by hyperglycemia, ketoacidosis, and ketonuria.[2] DKA affects both children and adults and requires immediate attention. The true annual incidence rate for DKA is difficult to establish, but population-based studies have reported ranges from 4.6 to 8 cases per 1,000 patients with diabetes.[3] DKA rates may be between 5% and 7% in individuals aged ,18 years.[4] The global incidence of DKA is influenced by various factors and is reflective of the prevalence of diabetes in that population.[5]

Mortality due to DKA is,5% according to the American Diabetes Association (ADA).[5]Most cases of DKA arise due to missed insulin doses, either as a result of negligence or poor socioeconomic status.[6] Other precipitators of DKA include infections, cerebrovascular accidents, alcohol/drug abuse, pancreatitis, myocardial infarction, and trauma. Simple lifestyle modifications, such as educating the patients about not missing any insulin doses especially during illness and providing the patients with an adequate insulin regimen, can greatly reduce DKA occurrence.

Diabetic education and the importance of correct medication should be taught from the beginning of diabetes diagnosis, especially for type 1 diabetes patients, in order to identify DKA symptoms at the earliest possible time.

Aims and objectives

- To evaluate clinical and biochemical profile in patients with DKA admitted to Department of Medicine, SAMC & PGI-Indore
- To estimate proportion of different presenting symptoms of DKA.
- To assess Random blood sugar level at the time of presentation.
- To estimate proportion of different underlying precipitating factors for diabetic ketoacidosis.
- To assess Outcome in patients presented with DKA.

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REVIEW OF LITERATURE

Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic syndrome (HHS) are the most serious and life-threatening complications of diabetes. Although significant overlap exists between these two entities, the present study is specific to DKA. DKA is a syndrome characterized by hyperglycemia, ketosis, and acidosis that occurs as the result of a relative or absolute insulin deficiency and an excess of insulin counter-regulatory hormones (ICRH).[7]

History and epidemiology

The earliest documented description of diabetes was found in a 1552 BCE gyptian papyrus.[8] In 1886, Dreschfeld provided the first description of diabeticketoacidosis in the modern medical literature.[9] In 1971, Roger Ungerdescribed DKA as a bihormonal disorder involving insulin deficiency and glucagon excess.

Before the discovery of insulin by Dr. Frederick Banting in 1921, the mortality of DKA was 100%. After this landmark discovery and the institution of insulin therapy, the mortality began to decrease significantly. Currently, mortality is approximately 4% to 10%.[10] The incidence of DKA is between 4.6 and 8.0 per 1000 person-years among patients with diabetes. DKA most commonly occurs in patients with insulin-dependent diabetes but may also occur in patients with non insulin-dependent diabetes.[11]

Pathophysiology of diabetic ketoacidosis

The basic metabolic derangements in DKA arise secondary to a relative lack of insulin and an excess in insulin counter-regulatory hormones (ICRH). Even in the absence of changes in insulin administration, ICRHs are elevated during times of stress and may outweigh the effects of insulin.

Hyperglycemia

The hyperglycemia seen in DKA results from a combination of glucose underuse and overproduction. Insulin promotes the uptake and storage of glucose in the liver through glycogenesis (incorporation of glucose into glycogen) and lipogenesis (formation of fatty acids). Insulin is necessary for the uptake of glucose into muscle and fat cells.

Ketogenesis

In the presence of insulin, triglycerides are incorporated into fat cells, and breakdown and release of triglycerides from fat cells are inhibited. In DKA, the combined relative insulin deficiency and ICRH excess promote the breakdown of triglycerides and the release of free fatty acids into the blood
Patients with moderate-to-severe DKA require admission to a bed where frequent monitoring is possible, hourly glucose measurements can be obtained, there is a rapid turn around time for laboratory services, and nurses are able to administer intravenous insulin infusions. In most cases this requires admission to a step-down or intensive care unit (ICU). Admission to a ward bed may be possible if the hospital has a general ward unit where the following are in place:

- A protocol for managing DKA
- An on-site blood glucose monitoring system
- Available nursing coverage that allows for frequent patient monitoring and hourly glucose measurements
- A rapid turn around of laboratory values[10]

METHODS AND MATERIALS

Study design: The cross-sectional observational study was conducted in Department of Medicine, SAMC& PGI-Indore from December 2020 to June 2021.

Sample Size: Total 100 patients already diagnosed with diabetes ketoacidosis were enrolled.

Inclusion criteria

- Patients who are >18 years age.
- Patients who have given written and informed consent and having DKA.

Patients admitted in SAMC & PGI-Hospital medicine wards during December, 2020 to June, 2021 and having diagnosis of diabetic ketoacidosis were included in the study till his/her hospitalization after taking Informed and written consent in vernacular language.

Detailed history has been taken regarding chief complaints, past history of similar complaints, associated comorbidities, family and drug history and compliance to treatment and examination will be conducted for vital signs, consciousness and orientation or any associated skin changes (DM foot/ ulcer)or any other local source of infection.

RESULT

The present study was undertaken to evaluate clinical and biochemical profile in patients already diagnosed with diabetic ketoacidosis. Total 100 subjects with DKA were taken for this study.

Table 1 Age Wise Distribution

Age (years)	No of patients (n=100)
18-30	41 (41%)
31-40	21 (21%)
41-50	17 (17%)
51-60	12 (12%)
> 60	9 (9%)
Mean Age (years)	37.75 ± 13.19

In the present study, the maximum numbers of patients 41 (41%) were in the age group of 18-30 years followed by 21 (21%) belongs to 31-40 years age group. The mean age was 37.75 ± 13.19 years.

Table 2 Gender Wise Distribution

Gender	No of patients (n=100)
Male	57 (57%)
Female	43 (43%)

In the present study, Out of 100 patients, 57 (57%) were males and females 43 (43%).

The male: female ratio was 1.32:1

Table 3 Type of DM Wise Distribution

Type of DM	No of patients (n=100)
Type 1 DM	78 (78%)
Type 2 DM	22 (22%)

In the present study, Out of 100 patients, 78 (78%) patients belong to type 1 diabetes mellitus and 22(22%) patients belong to type 2 diabetes mellitus.

Table 4 Duration of diabetes mallitus

Duration of DM	No of patients (n=100)
<1 yrs	19 (19%)
1-5 yrs	33 (33%)
6-10 yrs	20 (20%)
11-15 yrs	26 (26%)
> 15 yrs	1 (1%)
Mean duration (years)	6.35 ± 5.14

In present study 19 (19%) patients were freshly diagnosed with DM.20(20%) patients had duration of diabetes between 6-10 years, and 27(27%) patients had duration of diabetes more than 10 years. The mean duration of diabetes was 6.35 ± 5.14 years.

Table 5 Ongoing treatment of dm at the time of admission

Ongoing treatment	TYPE 1 DM (n=70)		TYPE 2 DM (n=20)	
	On treatment	Drug defaulter	On treatment	Drug defaulter
INSULIN	38(55%)	27(38%)	0	2(10%)
INSULIN + OHA	3(4%)	2(3)	4(20%)	1(5%)
OHA	0	0	8(40%)	5(25%)
TOTAL	41(59%)	29(41%)	12 (60%)	8(40%)

In present study, maximum patients of type 1 DM were on insulin (55%) among them 38% of patients were drug defaulter followed by insulin + OHA (4%) among them 3% were drug defaulter. In type 2 DM maximum number of patients were on OHA(40%) among them 25% of patients were drug defaulter followed by insulin + OHA (20%) among them 5% were drug defaulter and only insulin (10%) among them both were drug defaulter.

Table 6 Pre-Existing Comorbidities

Comorbidities	No of Patients (n=16)
HTN	10(62%)
IHD	3(19%)
CVA	2(13%)
COPD	1(6%)
TOTAL	16 (100%)

In present study, out of 100 patients 10 (62%) had history of HTN, 3 (19%) had IHD, 2 (13%) had CVA, 1 (6%) had COPD.

Table 7 Outcome of Patients

Outcome	No of patients (n=100)
Survived	94 (94%)
Expired	6 (6%)

In the present study, the overall mortality in present study was 6%. While 94 (94%) patients were survived.

DISCUSSION

The present study was conducted to study the clinical profile, biochemical parameters and outcome in patients with diabetic ketoacidosis.

Table 8 Incidence of Type of DM in DKA

	Present study	Sreekumar ST *et al*[14]	Singh H *et al*[14]	ChristopherA[13]
Type 1 DM	78%	51%	74%	78%
Type 2 DM	22%	49%	26%	25%

In our study, out of 100 patients (78%) patients belong to type 1 diabetes mellitus and (22%) belong to type 2 diabetes mellitus, it is because prevalence of type 1 diabetes mellitus is much higher in DKA patients than type 2 diabetes.[12] their study also showed predominance of type 1 diabetes mellitus (51%) as compared to type 2 diabetes mellitus (49%) who presented with DKA. Similarly[13] also showed predominance of type 1 diabetes (78%). However, DKA is most prevalent in type 1 diabetes when blood glucose is too high and can arise from a lack of insulin. Although rare, DKA is possible in type 2 diabetes if ketones are too high. When DKA occurs in patients with type 2 diabetes, the presumed mechanism of ketoacidosis is the combination of relative insulin deficiency and increased secretion of glucagon (as well as other counter regulatory hormones such as cortisol, catecholamines, and growth hormone) in response to stress from 1) overwhelming infection, 2) infarction of tissue, or 3) other severe illness. The elevated catecholamines further suppress insulin secretion to perpetuate a downward spiral. The increased glucagon-to-insulin ratio causes a mismatch that promotes unregulated lipolysis and proteolysis with subsequent uninterrupted formation of ketoacids.

Table 9 Age and gender distribution

	Mean Age	Male	Female
Present study	37.75 ± 13.19	57%	43%
Singh H *et al*[14]	29.4 ± 14.4	60%	40%
Nazneen S *et al*[15]	48.35±16.76	57.1%	41.8%
Sankar S *et al*[16]	47.38 ± 15.87	64%	36%
ChristopherA[13]	32.5±11.2	56%	44%

The mean age in the present study was 37.75 ± 13.19years and maximum numbers of affected individuals (41%) were between 18-30 years of age which is similar to[13] .Study in which mean age was 32.5±11.2.type 1 Dm is more commonly seen in younger age as there is environmentally triggered autoimmune destruction of pancreatic beta cells and also due to genetic factors. DKA is more common in patients with type 1 DM because this patients are having absolute insulin deficiency and any minor infection can cause ketogenesis and precipitate DKA. present study is slightly different from[14] study, in which the mean age was 29.4 ± 14.4years.[16] studies reported that the mean age of patients admitted for DKA were 48.35±16.76and 47.38± 15.87years, respectively.

Outcome

The overall mortality in present study was 6% which is quite lower to other studies such as.[17] reported the mortality of 11.5% and 25.7% respectively. Major cause of mortality in present study was delayed and severe presentation which includes severe metabolic acidosis, ARDS and shock.

CONCLUSION

DKA remains a frequently observed hyperglycemic emergency with high mortality rate among diabetic patients. A significant proportion of DKA occur in patient with Type 1DM and many of those can be prevented with proper patient education and effective communication along with quite efficient management.

Despite India often being considered as the diabetic capital of the world, studies on DKA are few, especially from the parts of west India. In the present study, we aimed to investigate the clinical and biochemical profile of DKA patients admitted in sir T. hospital, Bhavnagar, as well as underlying precipitating factors and outcome. As study has been conducted during

covid pandemic, covid pneumonia remains the major precipitating factor for DKA among all the infections. Early detection of diabetes before patients presents first time with complications of DKA is utmost important to reduce morbidity and mortality in such patients.

Life style modifications and patient educations are significant factors to reduce complications of DM such as DKA and HHS. Therefore education of diabetic patient about adequate, proper and regular administration of pharmacotherapy and regarding working symptoms of Ketoacidosis such as weakness abdominal pain, nausea vomiting and drowsiness are mandatory for early diagnosis and treatment.

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