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Original Research Article

A Study to Evaluate the Cause and Outcome of Acute Metabolic Emergencies in Patients of Diabetes Mellitus Presenting to Emergency Medicine Department

Revant Agarwal[1], Abhay Kumar Nahar[2], Chirag J Patel[3], Srishti Singh[4], Dhaval K Rojmala[5], Mehul Ladumor[6]

[1,2]Assistant Professor, Department of Emergency Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur

[3]Professor and Head, Department of Emergency Medicine, B. J. Medical College, Ahmedabad

[4,5,6]Junior Resident, Department of Emergency Medicine, B. J. Medical College, Ahmedabad

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Corresponding Author: Dr. Revant Agarwal

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Abstract:

Aim: Diabetes mellitus patients have four visits to emergency department due to acute metabolic complications of the disease. These include Hypoglycaemia, DKA (Diabetic Ketoacidosis), HHS (Hyperglycaemic Hyperosmolar State) and recently focused EDKA (Euglycemic Diabetic Ketoacidosis). The objectives of the study are to determine the causes and precipitating factors of acute metabolic complications of diabetes mellitus and to determine their outcome.

Material and Methods: We conducted a prospective observational study on 200 patients coming to the Trauma Centre of Civil Hospital, Ahmedabad, Gujarat. Patients with features and lab investigations suggestive of acute metabolic complications of Diabetes Mellitus were studied. Patients eligible for inclusion were aged > 12years, Known and Newly diagnosed patients of both type I and type II diabetes with documented blood reports of hypoglycemia or abnormal hyperglycemia with positive glycosuria and or ketonuria. Patients were divided into 4 groups DKA, HHS, Hypoglycemia and others. Patients with aged <12years or diagnosed with starvation and alcoholic ketoacidosis were excluded.

Result: Most common complication of diabetes in the present study was found to be hypoglycaemia (66%), followed by Diabetic Ketoacidosis (32%) and HHS (2%). 81.5% number of patients had complaint of breathlessness and 74.5% had vomiting and most were on Oral Hypoglycaemic Agents (63%). Overall infection was the most common inciting factor followed by Non-compliance to treatment while in hypoglycaemia decreased dietary intake was most common. 58% of patients had comorbidities and maximum were known case of respiratory diseases. Hyponatremia was the most common electrolyte abnormality observed. About 86.5% were discharged from the hospital while 15% were shifted to ICU. Overall mortality rate of 7% was observed. Hypoglycaemia is associated with lowest mortality while HHS had the highest mortality.

Conclusion: Metabolic Complications of diabetes mellitus contributes significantly to ED visits. Early diagnosis and management of Diabetes Mellitus helps in preventing these complications and subsequently reduce the morbidity and mortality.

Keywords: Diabetes Mellitus, Acute Metabolic Emergencies, Hypoglycemia, Hyperglycemia.

Introduction

Diabetes mellitus is the most common endocrine disease. It comprises a heterogeneous group of hyperglycemic disorders characterized by a high serum glucose concentration and disturbances of carbohydrate and lipid metabolism [1]. Most of the untreated or inadequately treated patients develop acute metabolic complications. Diabetes is frequently ranked as one of the five major chronic diseases that account for a significant proportion of our health care spending [2]. The number of people with diabetes in India increased from 26·0 million in 1990 to 65·0 million in 2016 [3]. The prevalence of diabetes in adults aged 20 years or older in India increased from 5·5% in 1990 to 7·7% in 2016. The most important risk factor for diabetes in India was overweight to which 36·0% of the diabetes DALYs (Disability-Adjusted Life Year) in 2016 could be attributed [4]. Diabetes mellitus patients have hospital admission rates that are four times higher and patients [5]. The cause of these emergency department visits is majorly due to acute metabolic complications of the

disease. The acute metabolic complications of diabetes include Hypoglycaemia, DKA (Diabetic Ketoacidosis), HHS (Hyperglycaemic Hyperosmolar State) and recently focused EDKA (Euglycemic Diabetic Ketoacidosis) [6]. DKA and HHS are the two most common hyperglycaemic emergencies [7]. These are associated with high mortality and morbidity despite being adequate treatment options available [8]. Early diagnosis and management of Diabetes Mellitus helps in preventing these complications. The objectives of the study are to determine the causes and precipitating factors of acute metabolic complications of diabetes mellitus and to determine their outcome.

Methods

Study Design: We conducted a prospective observational study. This study is approved by the institutional ethics committee.

Study Setting and Population: This study was conducted on patients coming to the Trauma Centre of Civil Hospital, Ahmedabad which is the Level 1 level trauma centre and the largest hospital in the state of Gujarat in India. A total of 200 patients presenting to Emergency Medicine Department with features and lab investigations suggestive of acute metabolic complications of Diabetes Mellitus were studied.

Selection of Participants: Patients eligible for inclusion were aged > 12years, Known and Newly diagnosed patients of both type I and type II diabetes with documented blood reports of hypoglycemia or abnormal hyperglycemia with positive glycosuria and or ketonuria. Patients with aged <12years or diagnosed with starvation and alcoholic ketoacidosis were excluded.

Study Protocol: All patients matching to inclusion criteria will be primarily clinically assessed in the emergency medicine department and will be immediately taken to resuscitation room, thorough primary and secondary survey will be done in all study patients. They would be subsequently diagnosed with acute metabolic emergency of Diabetes Mellitus according to relevant clinical history given by either self or the accompanying person and the investigations will be sent simultaneously.

The investigations include Random blood sugar, Arterial blood gases analysis, complete blood count, lipid profile and serum electrolytes, blood ketone levels. If random blood sugar > 600mg/dL in absence of ketosis and acidosis serum osmolarity will be checked. According to clinical presentation and prognosis of the patient he / she will be treated. After initial stabilization and observation in ER patients will be disposed according to patient's clinical status. All the patients will be followed-up until discharge from hospital or in-hospital death. All the data was arranged in a tabulated form and analyzed using Microsoft Excel. The results were expressed as percentage of total and mean with standard deviation was calculated using SPSS software. All tests were two-sided and p-values < 0.05 were considered statistically significant. p-values were not adjusted based on multiple comparisons.

Definition of different metabolic complications as per NCBI (National Centre for Biotechnology Information)

1. **Diabetic Ketoacidosis:** ketones >5meq/L, bicarbonate level < 18 mEq/L, RBS> 250mg/dl, Arterial blood pH < 7.3, Ketonemia and Ketonuria
2. **Hyperosmolar Hyperglycemic Syndrome:** RBS 600mg/dl or greater, Serum Osmolality of 320 mOsmol/kg or greater, Serum pH > 7.3, Serum Bicarbonate level > 15 mEq/L, Small Ketonuria or low to absent Ketonemia
3. **Hypoglycemia:** RBS less than 70mg/dl, Mild hypoglycemia- 60-69 mg/dl, Moderate hypoglycemia- 40-59mg/dl and Severe hypoglycemia-less than 40mg/dl.
4. **Lactic Acidosis:** Serum Lactate >2 mOsmol/L, Acidosis pH<7.3 and no Ketoacidosis. To be included in overlapping picture of the study
5. **Hyperglycemia:** Diabetic patients who present to Emergency Department only with elevated random blood sugars and no other signs or symptoms of DKA and HHS
6. **Overlapping Picture:** Diabetic patients who present with symptoms and sign not limited to the above complications.
7. **Not defined:** Diabetic patients who couldn't be diagnosed with above complications.

Any Precipitating factor or cause as follows would also be documented: Drug overdose/non-compliance/therapeutic Error, dietary error, fever and any Infection.

Results

Out of 200 patients, 119 patients were male (59.5%) while 81 patients were female (40.5%). Patients were of age group of 40-60 years (47.5%) and ranged from 14-85 years of age, with mean of 48.3 years and standard deviation of 16.56. Most common complication was Hypoglycemia (66%), followed by Diabetic Ketoacidosis (32%) and lastly HHS (2%). Most of the patients were of Type 2 Diabetes (83%) who had acute metabolic complications while only 17% of patients of Type 1 Diabetes developed complications. Maximum number of patients had complaint of breathlessness (81.5%) and vomiting (74.5%). Abdominal pain (54.5%) and dehydration (66.5%) were the next common complaints. **(Table-1)**

Table 1: Clinical Presentation

Clinical Presentation	Complication	Z Score	P Value
Fever	DKA	3.6132	**0.0003**
	HHS	-0.1566	0.87288
	Hypoglycemia	-3.5117	**0.00044**
Dehydration	DKA	2.0683	**0.03846**
	HHS	-1.7764	0.07508
	Hypoglycemia	-1.5117	0.13104
Abdominal Pain	DKA	2.8035	**0.00512**
	HHS	-0.1826	0.85716
	Hypoglycemia	-2.9796	**0.00288**
Vomiting	DKA	2.4276	**0.0151**
	HHS	0.0232	0.98404
	Hypoglycemia	-0.8014	0.42372
Tachypnoa	DKA	0.3279	0.7414
	HHS	-0.3382	0.72786
	Hypoglycemia	-0.223	0.82588

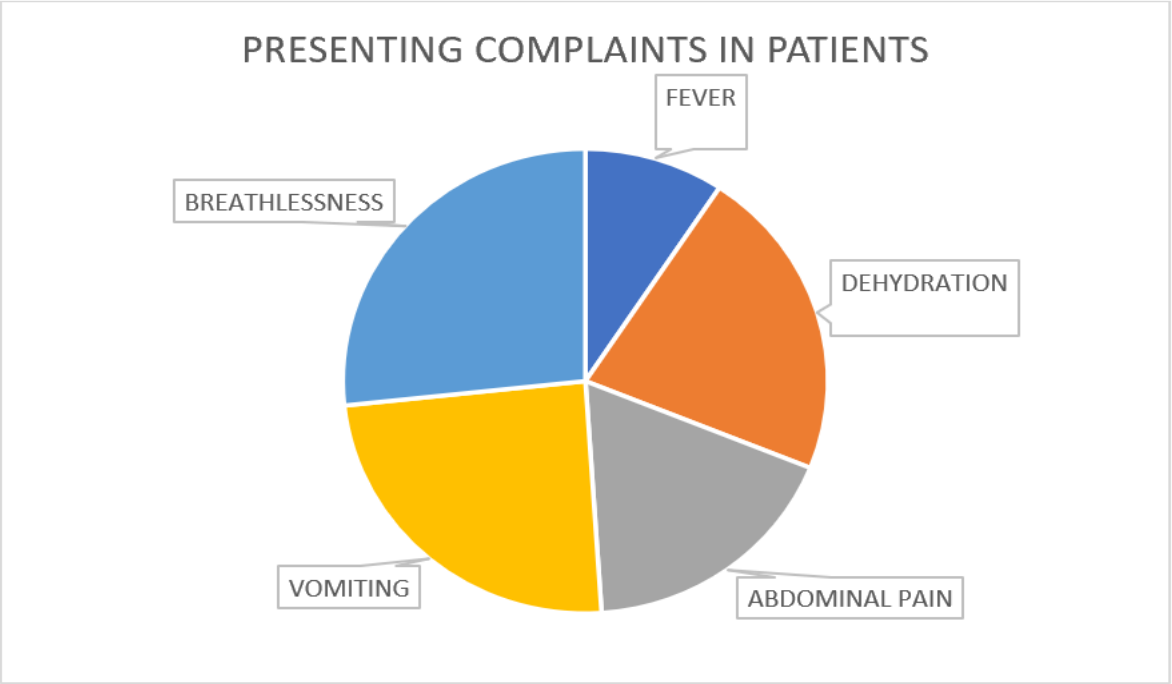

Figure 1: Presenting Complaints

Fever- Statistically significant difference was found between febrile patients and non-febrile patients in relation to DKA (z score=3.6132 and p value of 0.0003), Hypoglycaemia (z score = -3.5117 and p value of 0.00044) and HHS (z score = -0.1566 and p-value of 0.87288). Dehydration- Statistically significant difference was found between patients who had dehydration and those who didn't, in relation to DKA (z score = 2.0683 and p value of 0.03846). Abdominal Pain- Statistically significant difference was found between patients with abdominal pain and those who didn't in relation to DKA(z score = 2.8035 and p value of 0.00512) and Hypoglycemia(z score = -2.9796 and p value of 0.00044).Vomiting- Statistically significant difference was found between patients who had vomiting and those who didn't, in relation to DKA(z score = 2.4276 and p value of 0.0151). Tachypnoea- No Statistically significant difference was found between tachypnoea and complication of diabetes.

Patients who had less than 5 years of diabetes history (53.5%), experienced more complications of diabetes while patients who had greater than 10 years of diabetes history experienced lower complication rate. 44.5% of patients were chronic tobacco chewer, 23% were chronic smokers,17% were chronic alcoholics and only 1% of patients had substance abuse history.

With regards to relationship of ongoing treatment and development of acute complications of diabetes **(Table 2)** most of the patients on Oral Hypoglycemic Agents (63%) had complications while only 24.5% of patients on insulin and 12.5% patients on Insulin + OHA developed complications. Patients

who had less than 5 years of diabetes history (53.5%), experienced more complications of diabetes while patients who had greater than 10 years of diabetes history experienced lower complication rate.

Table 2: Treatment

Treatment	Number of Patients	Percentage
DKA	**64**	**32.00%**
I	16	8.00%
I+O	7	3.50%
O	41	20.50%
HHS	**4**	**2.00%**
O	4	2.00%
Hypoglycemia	**132**	**66.00%**
I	33	16.50%
I+O	18	9.00%
O	81	40.50%
Grand Total	**200**	**100.00%**

As Seen on Table 3 Overall, infection (29%) was the most common cause of precipitating complications of diabetes in patients, but no statistically significant difference was found. Non-compliance to medication was the most common cause in precipitating DKA and HHS in patients while decreased diet was the most common cause in precipitating hypoglycemia, followed by infection and treatment induced. Alcohol- Statistically significant difference was found between alcoholics and non-alcoholics in relation to their chance of getting DKA (z score = -2.2257 and p value of 0.02574) and Hypoglycaemia (z score = 2.3287 and p value of 0.0198) as a complication.

Decreased Diet- Statistically significant difference was found between patients who had decreased diet and who didn't in relation to their chance of getting DKA (z score = -5.1523 and p value of < 0.00001) and Hypoglycaemia (z score=5.3907 and p value of < 0.00001) as a complication. Infection- No statistically significant difference was found in patients who had infection in getting metabolic complications of diabetes. Non-compliance- Statistically significant difference was found between patients with non-compliance to medications and with compliance to medications in relation to their chance of getting DKA (z score=9.65 and p value of <0.00001), Hypoglycaemia (z score = 3.74 and p value of 0.00018) and HHS (z score = -10.61 and p value of < 0.00001) as a complication.

Treatment Induced- Statistically significant difference was found between in relation to their chance of getting DKA (z score = -5.0771 and p value of < 0.00001) and Hypoglycaemia (z score = 5.3121 and p value of < 0.00001) as a complication.

Table 3: Precipiating Factors

Precipitating Factors	Complication	Z Score	P Value
Alcohol	DKA	-2.2257	**0.02574**
	HHS	-0.4635	0.64552
	Hypoglycemia	2.3287	**0.0198**
Decreased Diet	DKA	-5.1523	**< .00001**
	HHS	1.073	0.28462
	Hypoglycemia	5.3907	**< .00001**
Infection	DKA	1.4832	0.13888
	HHS	-1.2912	0.19706
	Hypoglycemia	-1.079	0.28014
Non-Compliance	DKA	9.65	**<0.00001**
	HHS	3.74	**0.00018**
	Hypoglycemia	-10.61	**< .00001**
Treatment Induced	DKA	-5.0771	**< .00001**
	HHS	-1.0573	0.28914
	Hypoglycemia	5.3121	**< .00001**

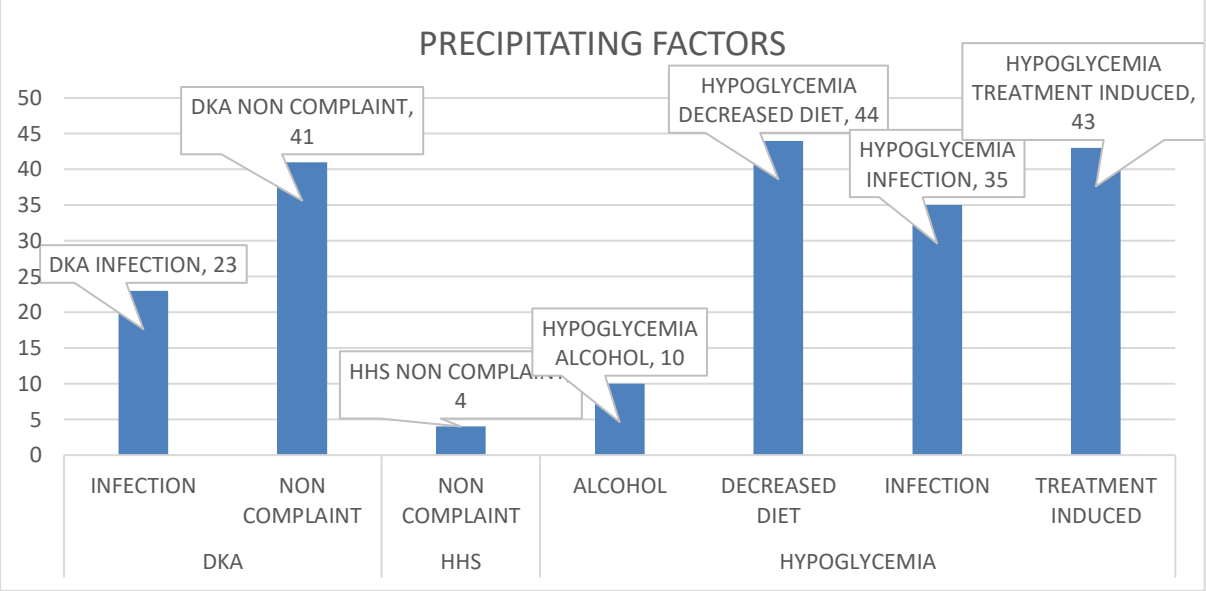

Figure 2: Precipiating Factors

Out of total 200 patients, 116 patients had some form of comorbidities associated along with diabetes. About 17% of patients had history of heart disease and about 19% of patients were known case of Asthma/COPD, while only 9% of patients had history of CV Stroke.

As seen in Table 4 10 patients with heart disease developed DKA while 30 patients with Asthma/COPD and 24 patients with heart disease developed hypoglycemia. It was evident that about 44.5% of patients were chronic tobacco chewer, followed by people who were chronic smokers (about 23%) and chronic alcoholics (17%). Only 1% of patients had substance abuse history.

It is evident that 51% of patients (102 patients) suffered from hyponatremia and about 14% of patients (28 patients) suffered from hypokalaemia and 1.5% patients suffered from hyperkalaemia.

Mean pH of all the patients was 7.28 with a standard deviation of 0.14 and mean bicarbonate was 21.74 with a standard deviation of 6.56. Mean sodium value was 135.03 with a standard deviation of 2.9 while mean potassium was 3.95 with standard deviation of 0.39.

Table 4: Diagnosis

Diagnosis	Renal Disease	Asthma/COPD	Heart Disease	CV Stroke	Total
DKA	7	7	10	5	29
HHS	1	1	0	0	2
Hypoglycemia	18	30	24	13	85
Grand Total	**26**	**38**	**34**	**18**	**116**

Outcome of patients is shown in Table 5. 86.5% were discharged, 80.5% patients were shifted to the ward while 15% patients had to be intubated and afterwards were shifted to ICU,6.5% of patients took Leave against Medical Advice and 7% of patients died in emergency room.

Table 5: Outcome

Outcome	Complication	Z Score	P Value
Discharged	DKA	-1.934	**0.0053**
	HHS	-3.6359	**0.00028**
	Hypoglycemia	2.9791	**0.00288**
Shifted to Ward	DKA	-0.9641	0.33706
	HHS	-4.1049	< **0.00001**
	Hypoglycemia	2.1626	**0.03078**
Intubated and Shifted to ICU	DKA	0.6487	0.5157
	HHS	-4.0691	**0.00001**
	Hypoglycemia	-1.7098	0.08726
LAMA	DKA	-0.0984	0.92034

	HHS	-0.5327	0.59612
	Hypoglycemia	0.2543	0.80258
Death	DKA	2.7017	**0.00694**
	HHS	-3.705	**0.0002**
	Hypoglycemia	-4.2357	< **0.00001**

Discharged- Statistically significant difference was found between discharged patients and non-discharged in relation to DKA (z score=-1.934 and p value of 0.0053), Hypoglycaemia (z score= 2.9791 and p value of 0.00288) and HHS (z score=-3.6359 and p-value of 0.00028) as a complication. Shifted to Ward- Statistically significant difference was found between patients who were shifted to the wards and those who weren't in relation to HHS (z score=-4.1049 and p value of < .00001) and Hypoglycaemia (z score=2.1626 and p value of < .03078) as a complication. Statistically significant difference was not found in patients with DKA. Intubated and Shifted to ICU- Statistically significant difference was found between patients who were intubated and shifted to ICU and those who weren't in relation to HHS (z score=-4.0691 and p value of < .00001) as a complication. LAMA- No statistically significant difference was found in patients who had taken leave against medical advice and those who didn't in getting metabolic complications of diabetes. Death- Statistically significant difference was found between patients who died and those who didn't die in relation to DKA (z score=2.7017 and p value of 0.00694), Hypoglycaemia (z score= -4.2357 and p value of <0.00001) and HHS (z score=-3.705 and p-value of 0.0002) as a complication.

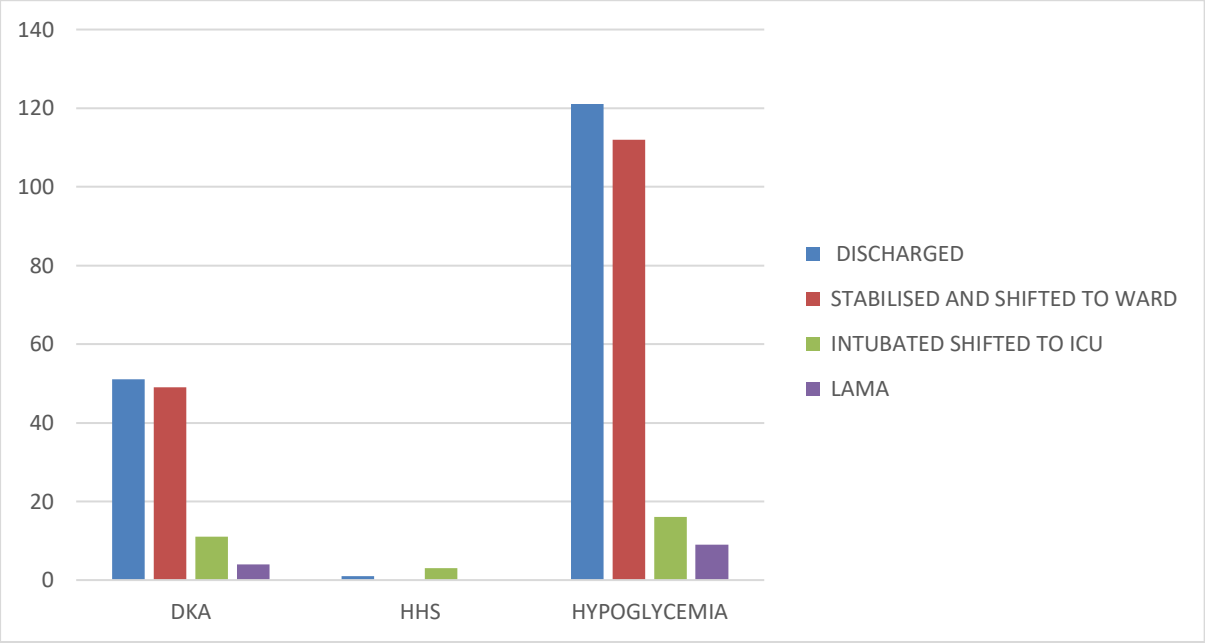

Figure 3: Outcome

Discussion

This study is done to analyze the causes and outcome of the acute metabolic emergencies in patients of Diabetes Mellitus presenting to Emergency Medicine Department. Its aim is to study the precipitating cause of acute metabolic emergencies and its subsequent clinical outcome in terms of length of hospital stay and mortality.

1. Gender

Table 6: Comparing Gender

Study Name	**Result**	
	Male	**Female**
Present Study	59.50%	40.50%
Negera et al [9]	64.70%	35.30%
Thakwani et al [10]	57.69%	42.31%
Salini et al [11]	58%	42%
Santosh et al [12]	50%	50%

In present study, about 59.50% patients were male while 40.50% patients were females. In study done by Negera et al [9] percentage of male patients were higher (64.70%) and percentage of females were lower (35.30%). Other studies done by Thakwani et al, Salini et al and Santosh et al had similar results to present study.

2. Age

Table 7: Comparing Age

Study Name	Mean±SD
Present Study	48.3±16.56
Negera et al [9]	46±15.5
Thakwani et al [10]	60±16.16
Salini et al [11]	47.2±18.5
Santosh et al [12]	43.63±5.6

Maximum number of people suffering from acute metabolic complications of Diabetes belonged to Age group of 40-60 years (47.5%) with a mean of 48.3 years and standard deviation of 16.56. Other studies done by Negera et al [9], Salini et al [11] and Santosh et al [12] also found that mean age of patients were around 46,47.2 and 43.63 respectively.

3. Type of Diabetes

Table 8: Type of Diabetes

Study Name	Type of DM	
	Type1	Type 2
Present Study	17%	83%
Negera et al [9]	19.30%	80.70%
Thakwani et al [10]	30%	70%
Salini et al [11]	60%	40%
Kerekou et al [13]	40%	60%
Edo et al [14]	11.90%	88.10%
Pankaj et al [15]	20%	80%

It was evident that more people who were known case of Type 2 Diabetes (83%) suffered more from acute metabolic complications of diabetes as compared to type 1 Diabetes patients. Negera et al [9], Thakwani et al [10], Kerekou et al [13], Edo et al [14], Pankaj et al [15] had similar findings where majority of patients were of Type 2 DM with about 80.70%, 70%, 60%, 88.10% and 80% patients respectively. Only in study conducted by Salini et al, 60% of the patients were of Type 1 DM while 40% patients were of Type 2 DM.

4. Clinical Presentation

Table 9: Clinical Presentation

Presenting Complaint	Present Study	Santosh et al [12]	Edo et al [14]	Pankaj et al [15]
Fever	28.5%	-	31%	-
Dehydration	66.5%	83.30%	32.20%	60%
Abdominal Pain	54.5%	40%	10.71%	43.30%
Vomiting	74.5%	73%	8.35%	63.30%
Breathlessnes	81.5%	80%	50.10%	16.66%

In the present study, it was evident that vomiting (74.5%) and breathlessness (81.5%) was the most common complaint. This was followed by dehydration which occurred in 66.5% of the patients and abdominal pain which was present in about 54.5% of the patients. In studies conducted by Santosh et al. [12] and Edo et al. [14] dehydration and breathlessness were the 2 most common presenting complaints. Dehydration was present in 83.30%, 32.20% and 60% of patients in studies conducted by Santosh et al [12], Edo et al [14] and Pankaj et al [15] respectively.

5. Relationship of Ongoing Treatment with Acute Complications of Diabetes

Table 10: Relationship

On Treatment	Present Study	Negera et al [9]	Thakwani et al [10]	Salini et al [11]	Santosh et al [12]
Insulin	24.5%	26%	7.69%	31%	16.67%
OHA	63%	56%	76.92%	49%	60.00%
Insulin+OHA	12.5%	17.50%	11.50%	15%	23.33%

It was evident from the present study that patients on Oral Hypoglycaemic agents (63%) suffered the most complications of diabetes while patients on combined Insulin and Oral Hypoglycaemic agents (12.5%) suffered least complications. Other studies reported similar results. In only study conducted by Santosh et al [12] it was found that combined users of insulin and OHA had more complications than that of patients on insulin.

6. Duration of Diabetes

Table 11: Duration of Diabetes

Duration of Diabetes	**Present Study**	**Negera et al [9]**	**Salini et al [11]**	**Santosh et al [12]**
1-5 Years	53.5%	69%	58%	50.44%
6-10 Years	26.5%	17%	32%	30.43%
>11 Years	20%	14%	10%	19.13%

It was evident from the all the studies that most patients (53.5%) had recent history of diabetes of less than 5 years while the patients with longer history of diabetes of greater than 11 years suffered least complications. Similar results were obtained in other studies.

7. Preciptating Factors

Table 12: Comparing Precipitating Factors

Precipitating Factors	**Present Study**	**Thakwani et al [10]**
Infection	29.00%	15.37%
Non-Complaint	22.50%	19.22%
Alcohol	5.00%	1.92%
Decreased Diet	22.00%	19.23%
Treatment Induced	21.50%	25%
DKA		**100%**
Infection	36%	25%
Non-Complaint	64%	75%
HHS		**100%**
Non-Complaint	100%	100%
Hypoglycemia		**100%**
Alcohol	7.58%	3.33%
Decreased Diet	33.33%	33.33%
Infection	26.52%	20%
Treatment Induced	32.58%	43.33%

It is important to understand the precipitating factors leading to acute complications in diabetic patients. In our study, overall, it was evident that infection (29%) was the most common inciting factor followed by Non-compliance to treatment (22.50%), decreased dietary intake (22%) and treatment induced (21.50%). In only 5% of the patient's alcohol was found to be precipitating factor. Similar results were found in study done by Thakwani et al where infection (15.37%), Non-compliance to treatment (19.22%) and decreased dietary intake (19.23%) were the majority of factors leading to the complications but the most common cause was found to be treatment induced (25%). Amongst Diabetic ketoacidosis patients, non-compliance to treatment was the common cause of precipitation amounting to about 64%% of the DKA patients while infection was cause in amongst 36% of DKA patents. The study done by Thakwani et al also concluded that non-compliance (75%) was the most common cause followed by infection amongst DKA patients (25%). Amongst HHS Patients, Non-compliance to treatment was the only cause found leading to complication of diabetes, same was concluded in study done by Thakwani et al. Amongst Hypoglycaemia patients, decreased diet (33.33%) and treatment induced hypoglycaemia (32.58%) were the two most common causes while alcohol was found to be cause in only 7.58% of the patients. Thakwani et al also found that decreased dietary intake (33.33%) and treatment induced hypoglycaemia (43.33%) were

the two most common causes while alcohol (3.33%) was the least.

8. Comorbidities

Table 13: Comorbidities

Comorbidities	**Present Study**	**Salini et al [11]**	**Santosh et al [12]**	**Kerekou et al [13]**
Renal Disease	13.00%	22.50%	15%	29.82%
Asthma/COPD	19.00%	25%		
Heart Disease	17.00%	30%	46%	
CV Stroke	9.00%	17.50%	7.70%	

In the present study, out of total 200 patients, 116 patients (58%) had some form of comorbidities associated along with diabetes. While in study by Nega et al [9] 42.96% patients had comorbidity along with diabetes. Maximum number of patients (19%) were known case of Asthma and COPD in the present study while in study done by Salini et al [11] it was about in 25% of patients. 2nd most common disease was heart disorder. In the present study it was 17% of patients while study done by Salini et al [11], Santosh et al [12] and Kerekou et al [13] it was about 30%, 46% and 29.82% respectively. CV Stroke was seen in least number of patients across all the studies

9. Personal History

Table 14: Personal History

Personal History	**Present Study**	**Negera et al [9]**
Smoking	23%	12.10%
Tobacco Chewer	44.50%	62.60%
Alcohol	17%	

Tobacco was the most common addiction amongst the patients in present study (44.50%) as well as in study done by Negera et al [9] (62.60%). Habit of smoking was present in 23% of patients in present study and in about 12.10% of patients in Negera et al [9] study.

10. Electrolyte Abnormalities

Table 15: Electrolyte Abnormalities

Electrolyte Abnormalities	**Present Study**	**Salini et al [11]**	**Kerekou et al [13]**
Hyponatremia	51%	11%	36.95%
Hypokalemia	14%	17%	25%
Hyperkalemia	2%	4%	3.60%

Hyponatremia was the most common electrolyte abnormality observed in our study. About 51% of patients in our study had hyponatremia and similarly 36.95% of patients in study by Kerekou et al [13] had hyponatremia, but this was only 11% in study by Salini et al. [11] Hyperkalaemia was the least common electrolyte derangement in all the studies.

11. Distribution of Metbolic Complications of Diabetes

Table 16: Distribution of Metbolic Complications of Diabetes

DIAGNOSIS	**Present Study**	**Thakwani et al [10]**	**Kerekou et al [13]**	**Hanumanthaiah et al [16]**
DKA	32.00%	15.38%	55%	52.18%
HHS	2.00%	7.69%	25%	16.59%
Hypoglycemia	66.00%	76.92%	20%	27.16%

Most common complication of diabetes in the present study was found to be hypoglycaemia (66%), followed by Diabetic Ketoacidosis (32%) and HHS (2%). Similar result was obtained in a study done by Thakwani et al [10] where majority of patients had hypoglycaemia (76.92%), followed by Diabetic Ketoacidosis (15.38%) and HHS (7.69%). On the contrary, other studies done by Kerekou et al [13] and Hanumanthaiah et al [16] had majority patients of DKA (55%, 52.18% respectively), followed by hypoglycaemia and HHS.

12. Outcome of Patient

Table 17: Outcome

Outcome Overall	Present Study	Thakwani et al [10]	Santosh et al [12]	Kerekou et al [13]	Edo et al [14]	Hanumanthaiah et al [16]
Death In ED	7%	6.45%	3.11%	25%	3.57%	10%
diagnosis	**DKA**	**HHS**	**Hypoglycaemia**			
Death In ED	14%	75%	1.51%			

It is important to understand the mortality rate occurring in metabolic complications of diabetes. Amongst DKA Patients 14% of mortality rate was seen and in hypoglycaemia patients only 1.51% mortality rate was seen. High mortality rate of 75% was seen in HHS patients. Wade, K. A., et al. found 17.3% of deaths in their series for diabetic ketoacidosis. Regarding hypoglycaemia, results are in good agreement with what is described in the literature. Indeed, the mortality rate ranges from 0.2% to 5% irrespective of sex and diabetes type. In our study overall mortality rate was around 7% which is quite comparable to other studies done by Thakwani et al [10] (6.45%), Santosh et al [12] (3.11%), Edo et al [14] (3.57%) and Hanumanthaiah et al [16] (10%). In contrast study done by Kerekou et al [13] 25% mortality rate was seen.

Conclusion

A total of 200 patients with complications of diabetes were included in this study. The summary of our study is the following-Male gender is associated with higher risk of metabolic complications of diabetes, maximum number of people belonged to Age group of 40-60 years (47.5%) with mean of 48.3 years and standard deviation of 16.56 and type 2 Diabetes (83%) patients are at greater risk.

Patients presented with symptoms like fever, dehydration, abdominal pain, vomiting and breathlessness and maximum number of patients had complaint of breathlessness (81.5%) and vomiting (74.5%). Most of the patients who had complications were on Oral Hypoglycaemic Agents (63%). Most patients (53.5%) had recent history of diabetes of less than 5 years while the patients with longer history of diabetes of greater than 11 years suffered least complications. Overall, it was evident that infection was the most common inciting factor followed by Non-compliance to treatment.

Amongst DKA and HHS patients Non-compliance to treatment was the common precipitating factor while in hypoglycaemia decreased dietary intake was most common. 58% of patients had some form of comorbidities associated along with diabetes and maximum were known case of respiratory diseases. Tobacco addiction was seen in maximum number of patients, followed by smoking and alcohol. Hyponatremia was the most common electrolyte abnormality observed in our study and Hyperkalaemia was the least. Most common complication of diabetes in the present study was found to be hypoglycaemia (66%), followed by Diabetic Ketoacidosis (32%) and HHS (2%). About 86.5% were discharged from the hospital. 15% patients had to be intubated and shifted to ICU. Overall mortality rate of 7% was observed in the study. Hypoglycaemia is associated with lowest mortality while HHS had the highest mortality. Diabetic Ketoacidosis had mortality rate of 14%.

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