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To study risk factors and biochemical profile of diabetic ketoacidosis patients with special emphasis on serum amylase

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ABSTRACT

Background: Diabetes mellitus (DM) is a complex endocrinological disorder with altered metabolism of blood glucose. Diabetic ketoacidosis (DKA) is one of the life-threatening acute complications of DM that mainly occurs in type 1 diabetes patients, as well as in some patients with type 2 diabetes. The mortality rate associated with DKA depends on the experience of the treating hospital in dealing with this condition; thus, it is critical that patients detect DKA and get medical help as soon as possible. **Aims and Objectives:** To study risk factors for DKA, clinical and biochemical profile of DKA patients. Correlation between serum amylase level, serum bicarbonate level and mean duration of hospital stay. **Materials and Methods:** A cross-sectional analytical study was carried out on 100 DKA patients in the Department of Medicine, SGMH Rewa, Madhya Pradesh from January 2021 to June 2022. The data extracted included clinical presentation, precipitating factors, laboratory profile, complications, and hospitalization outcomes. **Results:** Of the 100 patients admitted for DKA; 70 had type 2 diabetes (70%) and 30 (30%) were type I diabetes. The average age at the time of presentation was 48.61 ± 19.59 years. The commonest precipitating factor was infection (38%) followed by other factors (62%). The most common clinical features at the time of presentation were altered sensorium, fever, vomiting, polyuria, polydipsia, weakness, lethargy, myalgia, headache, anorexia, abdominal pain, and orthopnea. The values for RBS, HCO_3, and pH were 525.0 ± 62.4, 12.6 ± 2.69, and 7.14 ± 0.31, respectively. There was no significant difference in clinical and biochemical profile of patients with type 1 and type 2 diabetes. The mortality rate was 3% and factors found to be significant predictors were comorbid condition, severity of mental status, severity of dehydration, RBS at the time of presentation, and severe acidosis. **Conclusion:** The most common precipitating factors are infection and omission of insulin or irregular treatment. The most common clinical features at the time of presentation are nausea, vomiting, abdominal pain, headache, and dehydration. There is no significant difference in the clinical and biochemical profile of patients with type 1 and type 2 diabetes. The mortality rate in DKA is 3% and the most notable predictors of poor prognosis are; severity of altered sensorium, severity of comorbid condition, severe dehydration, severe acidosis, and identification and treatment of precipitating factors are more important. Patient education plays a crucial role in the prevention of DKA.

Key words: Clinical and biochemical profile; Diabetic ketoacidosis; Mortality and morbidity

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INTRODUCTION

Diabetes mellitus (DM) is a complex endocrinological disorder with altered metabolism of blood glucose. It is a long-standing disease with both short-term and long-term complications. The most intense acute complication of diabetes includes hyperglycemic hyperosmolar state and diabetic ketoacidosis (DKA). Both conditions require urgent medical interventions.[1] The mortality ratio with hyperglycemic emergencies has been variable depending

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on the geographical location. In developing countries, the incidence of mortality may range from 4% to 40%.[2-5]

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 24% in Saudi Arabia,[6] which is higher than that reported in the developed countries. According to the International Diabetes Federation, the diabetes rate in Saudi Arabia in 2015 was 17.6%.[7]

DKA is one of the life-threatening acute complications of DM that mainly occurs in type 1 diabetes patients, as well as in some patients with type 2 diabetes. 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.[9,10] DKA rates may be between 5% and 7% in individuals aged 18 years.[11] The global incidence of DKA is influenced by various factors and is reflective of the prevalence of diabetes in that population.[12]

The mortality rate associated with DKA depends on the experience of the treating hospital in dealing with this condition; thus, it is critical that patients detect DKA and get medical help as soon as possible. The management of DKA has improved over the years, as evidenced by the decrease in the death rate.[14]

Diabetic education and the importance of correct medication should be taught from the beginning of diabetes diagnosis, especially for type 1 diabetes patients, to identify DKA symptoms at the earliest possible time. Accordingly, we propose to perform a retrospective cohort study of the clinical and biochemical characteristics of DKA in diabetic patients presenting to a tertiary center in Riyadh, KSA. These risk factors will be analyzed by studying their association with DKA.

Aims and objectives

To study risk factors for diabetic ketoacidosis, clinical and biochemical profile of diabetic ketoacidosis patients. Correlation between serum amylase level between serum bicarbonate level and mean duration of hospital stay.

MATERIALS AND METHODS

The present study "To study risk factors and biochemical profile of DKA Patients with special emphasis on serum amylase" was carried out in 100 DKA patients in Department of Medicine, SGMH Rewa, Madhya Pradesh from January 2021 to June 2022. All patients admitted to the Intensive Medical Care Unit in whom a diagnosis of DKA was made based on clinical features, with diabetes and elevated random blood sugar, and urine ketone positive were considered for the study. Patients were included in the study based on inclusion and exclusion criteria.

A study conducted after approval and clearance from institutional ethics committee.

Sample size

100 cases.

The details of the patients regarding age, sex, presenting symptoms, risk factors such as non-compliance, infections, and other drugs were recorded. The vital signs like pulse and blood pressure, respiratory rate, and temperature were recorded and the Body mass index was calculated. All the patients were subjected to routine laboratory investigations such as CBC, urine analysis, urine ketones, RBS, RFT, and electrolytes. Arterial blood gas analysis. Chest X-ray, ECG, and USG abdomen were done according to the patient symptoms. Continuous monitoring of RBS, electrolytes was done. The patient was treated with adequate IV fluids and insulin infusion. Precipitating factors were identified and treated.

The following patients were included in the study:-

Inclusion criteria

1. Those patients who were known diabetics either type 1 or type 2 presented with DKA
2. Those patients with accidental detection of DKA but primarily admitted for other diseases
3. All type 2 diabetic patients are under stressful conditions like stroke, MI, sepsis
4. Patients with high blood sugar values on irregular medication.

Exclusion criteria

1. Patient with pancreatitis/abdominal trauma/pancreatic tumor
2. Patient with intestinal obstruction/bowel perforation
3. Patients with cholecystitis.

Criteria for DKA

1. Hyperglycemia >250 mg/dL
2. Acidosis with blood pH <7.3/Serum bicarbonate <15 mEq/L
3. Urine positive for ketones.

Serum bicarbonate

It is measured in mEq/L. Normal value is 22–26 mEq/L

1. Mild DKA >15 mEq/L

2. Moderate DKA 10–15 mEq/L
3. Severe DKA <10 mEq/L.

Statistical analysis

Data were collected and managed on an Excel worksheet. All values are expressed as mean. Data were calculated by SPSS 12 version software was appropriate statistical test.

RESULTS

100 patients admitted with biochemical risk factors, raised blood sugar values, and urine ketone positive were selected.

100 patients were 58 males and 42 females, so males were commonly affected. 100 patients 30 had type 1 diabetes, 70 had type 2 diabetes. 9 patients were new-onset diabetes. New onset type 2 were 8 patients, 1 patient had new-onset type 1. In the present study, the youngest patient was a 14-year-old male and the oldest patient was 82-year-old male. 30 cases were younger than 40 years, mostly type 1 patient. 70 cases were above 40 years with type 2 patients. The mean age group was 46.09 years. Among type 2 diabetes patients DKA mostly seen among age between 51 and 60 years (Table 1).

Symptoms include vomiting, fever, and altered sensorium headache. Among that 38% had focus of infection like symptoms. 37 patients had altered sensorium, 30 patients had fever as a symptom. Among that 13 (34.21%) have urinary tract infection, 10 (26.31%) had soft tissue infections, 7 (18.42%) had lower respiratory tract infections. 8 (21.05%) had acute diarrheal illness. 40 patients were Coronary artery diseases-12, Cerebrovascular accident-7, Hypertension-2, Chronic kidney diseses-9, Chronic obstructive pulmonary disease-10. 58% had diabetes of <5 years duration, 32% had 5–9 years duration; 10% had diabetes of more than 10 years. New patients were included in <5 years. DKA had multiple risk factors like noncompliance, infections, sepsis, MI, stroke, and alcoholism. Among that 48% had noncompliance, 38 patients had infections, 14 had sepsis, and 10 patients were on steroids. 5 patients had acute stressful condition like MI, 3 had stroke. Overall risk factors had P<0.001; so each risk factor had a significant association with DKA. 100 patients were 66% -normal BMI, 25% overweight category, 5% obese I category. The mean body mass index around 21.7±2.53 (Table 2).

Pulse rate ranged from 68 to 108; mean 87.00±7.50. The respiratory rate ranged between 14 and 28 mean values 19.00±2.90. The average blood sugar value was 523.0±62.2 mg/dL with a ranged between 380 mg/dL and 659 mg/dL. The mean urea values were 50.0±13.0 mg/dL.

Table 1: Demographic data

Sex	Cases, n (%)
Male	58 (58)
Female	42 (42)
Male to female ratio	1.38:1
Ratio of type 1 to type 2 diabetes in DKA	
Type 1	30 (30)
Type 2	70 (70)
Age distribution (years)	
20–30	19 (19.0)
31–40	11 (11.0)
41–50	11 (11.0)
51–60	29 (29.0)
61–70	19 (19.0)
Above 70	11 (11.0)
Total	100 (100.0)
Range (years)	14–82
Years, mean±SD	49.59±16.87

SD: Standard deviation, DKA: Diabetic ketoacidosis

Table 2: Clinical characteristics of patients

Symptoms	Number of cases (%)
Vomiting	30 (30.0)
Fever	30 (30.0)
Altered sensorium	37 (37.0)
Polyuria	56 (56.0)
Polydipsia	48 (48.0)
Weakness	32 (32.0)
Lethargy	48 (48.0)
Myalgia	52 (52.0)
Headache	100 (100.0)
Anorexia	30 (30.0)
Abdominal pain	80 (80.0)
Orthopnea	1 (1.0)
Paroxysmal nocturnal dyspnea	-
Types of focus of infection (n=38)	
UTI	13 (34.21)
LRI	7 (18.42)
Soft tissue infections	10 (26.31)
Acute gastroenteritis/ADD	8 (21.05)
Associated comorbidities	
Coronary artery disease	12 (5.0)
Chronic kidney disease	9
COPD	10 (58.0
Stroke (CVA)	7 (32.0)
Hypertension	2 (10.0)
Neuropathy	47
Retinopathy	51 (48.0)
Nephropathy	34 (38.0)
Sepsis	14 (14.0)
Steroids	10 (10.0)
Alcoholic	8 (8.0)
Myocardial infarction	5 (5.0)
Stroke	3 (3.0)
BMI	
<18	4 (4)
18–25 (normal)	66 (66)
25–30 (over-weight)	25 (25)
30–35 (obese I)	5 (5)
35–40 (obese II)	0

P<0.001. UTI: Urinary tract infection, COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, BMI: Body mass index, LRI: Lower respiratory tract infection, ADD: Acute diarrhoea disease

The average mean creatinine values were 1.61±0.56 standard deviation (SD) was calculated. The average potassium value 4.33±0.734, ranged between 2.8 and 6.2. Sodium levels ranges between 124 and 136 mEq/L. Average values of serum sodium 133.24±0.734 ABG; pH Value ranged between 6.02 and 7.30, mean pH 7.13± 0.31. Bicarbonate ranged between 6 and 17 mean bicarbonate 12.56±2.69 (Table 3).

DKA had many complications. In this study, among 100 patients most of the patients had more than one complication. Three patients died due to various complications. Morbidity assessed by prolonged hospital stay > 2-week duration with various complications. 27 patients had prolonged hospital stay. Electrolyte disturbances such as hypokalemia, hyponatremia, and hyperkalemia were occurred among 32 patients. Respiratory failure was seen in 03 patients. 14 patients had developed altered sensorium, and metabolic encephalopathy. 14 patients had developed severe sepsis (Table 4).

Based on pH value patients were classified into mild, moderate, and severe acidosis. pH <7 with severe acidosis observed in 8 patients. 57 patients had pH ranged 7–7.25 and grouped into moderate acidosis. pH value >7.25 with mild acidosis were 35 patients. pH value ranged from 6.02 to 7.30. Moderate-to-severe acidosis can cause more mortality and morbidity. Hence, there is a significant association between mortality with the severity of acidosis, P<0.001 was statistically significant (Table 5).

Among 100 DKA patients, 91 DKA patients had serum amylase level <140 IU/L (71.98+35.19). in 9 DKA patient serum amylase level >140 IU/L (248.22+169.73) with P<0.0001. The mean duration of hospital stay in DKA patient with Serum Amylase level <140 U/L was 10.56+5.04 Days while DKA patients with Serum Amylase level >140U/L was 23.75+1.66 Days with the P<0.0001. The mean duration of hospital stay in DKA patients. Patients that belongs to serum bicarbonate levels 16–18 mEq/L, Serum bicarbonate level 10-15mEq/L and Serum bicarbonate level <10 mEq/L having mean hospital stay was 4.0±0.93 Days, 11.54±4.12 Days and 20.11±3.90 Days, respectively combined P=0.0001 (Table 6).

Table 3: Vitals activity

Vitals	Range	Mean±SD	P
Pulse rate	68–108	87.00±7.50	$\chi 2$=84.56
Respiratory rate	14–28	19.00±2.90	P<0.0001
Blood sugar, urea and creatinine levels			
Blood sugar (mg/dL)	380–659	523.0±62.20	0.0001
Urea (mg/dL)	34–94	50.0±13.0	0.0001
Creatinine (mg/dL)	0.8–3.9	1.61±0.56	0.0001
Electrolyte and PH, bicarbonate levels			
Potassium (K+) mEq/L	2.8–6.2	4.34±0.734	
Sodium (Na+) mEq/L	124–136	133.24±2.86	
pH	6.02–7.30	7.13±0.31	
Bicarbonate mEq/L	6–17	12.56±2.69	

SD: Standard deviation

Table 4: Complications

Complications	Number of cases
Death	3
Prolonged hospital stay >2 weeks	27
Electrolyte abnormalities	32
Respiratory failure	3
Severe acidosis	7
Altered sensorium with encephalopathy	14

DISCUSSION

DKA- a hyperglycemic emergency which is an important cause of morbidity and mortality in patients with diabetes. This study has been done with regard to risk factors in the predominantly rural population.

In the present study male to female ratio 1.38:1. DKA was commonly seen among males. Among 58 males; 16 had type 1 diabetes, 42 had type 2 diabetes. Among 42 females; 14 had type 1 diabetes, 18 had type 2 diabetes. A similar

Table 5: Severity of acidosis based pH value and its association with mortality

Type of acidosis	Number of patients	Death	Percentage
Mild (pH >7.25	35	0	5.7
Moderate (pH 7–7.25)	57	1	17.5
Severe (pH <7)	8	2	50
Total	100 Range: 6.02–7.3 Mean: 7.13±0.31	03	3.0

P<0.001.

Table 6: Serum amylase

Serum amylase	Number of patients (%)	Mean±SD
Serum amylase (IU/L)		
<140	91 (91.0)	71.98±35.19
>140	9 (9.0)	248.22±169.73
Serum amylase level and mean duration of hospital stay (U/L)		
<140	91 (91)	10.56±5.04
>140	9 (9)	23.75±1.66
Serum bicarbonate level and mean duration of hospital stay (mEq/L)		
Mild (16–18)	18 (18)	4.0 days±0.93
Mod (10–15)	54 (64)	11.54 days±4.12
Severe (<10)	18 (18)	20.11 days±3.90
Duration of diabetes (years)	Serum amylase <140 IU/L, n (%)	Serum amylase >140 IU/L, n (%)
<5	54 (60.0)	4 (44.44)
5–9	30 (33.33)	5 (55.56)
≥10	7 (7.77)	0

P<0.001. SD: Standard deviation

Table 7: Over all mean comparison of index according to gender

Index	Over all (n=100)	Male (n=58)	Female (n=42)
Age	48.61±19.59	48.8±20.42	44.79±20.56
DM duration	4.64±3.36	4.74±3.41	4.40±3.40
BMI	21.4±2.53	21.0±1.94	22.7±2.89
Pulse rate	86.8±7.42	86.0±7.0	88.0±8.0
Respiratory rate	19.0±2.9	18.0±2.9	19.0±2.9
TLC	9532±3891	9920±4626	9222±2977
RBS	524.3±62.19	524.0±61.0	527±64.9
Urea	49.6±13.2	51.0±12.0	50.0±15.0
Creatinine	1.57±0.57	1.6±0.52	1.63±0.63
Na+	133.0±2.88	133.0±2.8	133.0±2.98
K+	4.39±0.73	4.37±0.71	4.28±0.77
Serum HCo_3	11.84±3.19	12.5±2.47	12.6±3.0
pH	7.14±0.31	7.17±0.27	7.1±0.36
Amylase	78.0±97.85	116±80.6	118.0±89

DM: Diabetes mellitus, TLC: Total leukocyte count, RBS: Random blood sugar, BMI: Body mass index

study conducted by sonwani et al., having 72% male in DKA.[15] Similar study conducted by Chandra et al., having there were 60 males (54.54%) with male: female ratio of 1.2:1.[16]

In the present study, 70 patients had type 2 diabetes; 30 patients had type1 diabetes. Among 100 patients 9% of patients (9 cases) had new onset of diabetes presented as DKA. Among Type 2 DM patients DKA were common between 50 and 60 years. Among type 2 DM cases 59% were below 70 years. Similar study conducted by Seth et al., this study out of 60 patients, 12 were type 1 and 48 were type 2 DM.[17]

A study conducted by Chandra et al., having 81.81% DKA Patient <60 years of age.[16] Similar study conducted by sonwani et al., having DKA was in the range of 51–55 years (21%) (mean age being 56.10±10.40 years).[15]

In the present study, Most of the patients had more than one symptom. With regard to presenting complaints 38% had symptoms specific to focus of infection such as dysuria, cough, loose stools, no healing ulcers and 37% of patients had altered sensorium, 30% of patients had fever as presenting symptom.

A similar study conducted by Seth et al., in Kasturba Medical College, Manipal Karnataka having Nausea and vomiting (63.33%) were the most common sumptoms.[17] Similar study conducted by Sonwani et al., having Nausea and Vomiting (86%), abdominal pain (58%) are most common presenting symptoms.[15] Similar study conducted by Ranjan et al., presenting complain was Vomiting in 43.23% of patients followed by abdominal pain.[19]

In the present study among the focus of infections, 13 had symptoms urinary tract infection, 7 had lower respiratory tract infections, 10 patients were suffered from soft tissue infections. 8 had acute gastroenteritis/acute diarrheal disease. Diabetes was more prone to common infections such as urinary tract infections and soft-tissue infections.

In Nigerian study conducted by Andrew about DKA common symptoms observed; fever, altered sensorium, breathlessness, etc.[21]

A similar study conducted by Gavrielatos et al., about clinical and laboratory characteristics of DKA in adult diabetic patients having result. The most common presentation was gastrointestinal symptoms, including vomiting (n=55; 91.7%) and abdominal pain (n=50; 83.3%) and followed by other symptoms include dyspnea (n=17; 28.3%), fever (n=19; 31.6%) and hypotension (n=8; 13.3%). Altered sensorium (altered consciousness, disorientation, or stupor/coma) was reported in 22 patients (36.6%).[22]

In the present study, among 70 patients with type 2 diabetes, 55 patients were on oral antidiabetic drugs, 14 patients were on insulin, and oral antidiabetic drugs 1 patient on insulin. Among 30 type 1 diabetes patients all were taking insulin only. Among diabetes patients most of them not taking treatment regularly. In this study, 48% DKA patients were not on regular treatment.

Similar study conducted by Seth et al., 23.3% of patients taking regular treatment for DM whereas 53.33% of patients were on irregular treatment and 13.33% were not taking any treatment.[17] Similar study conducted by Sonwani et al., show those 70% patients on oral hypoglycemic drugs.[15]

In the present study, drug noncompliance (48%) was the most common Risk factor for DKA. Many patients

had more than one risk factors. Among 100 patients; 38 had infections, 14 had sepsis, 10 patients were on steroids. Acute stressful condition such as MI,[23] strokes were precipitating factors among 8% of patients. Among alcoholics, 8% patients led to DKA. Noncompliance in rural population was due to low socioeconomic status and lack of knowledge. Most of the diabetic patients had no proper follow-up; and also unaware of complications.

A similar study conducted by Maskey et al., in a study of urban African Americans with DKA in 1995, reported that 75% of cases occurred in patients with known diabetes, and, of those patients, stopping insulin therapy was the precipitating cause in 67% of cases.[24]

In the present study among 100 patients most of the patients had more than one complication. Three patients died due to various complications. Morbidity is assessed by prolonged hospital stay (>2 weeks) duration with various complications. 26 patients had prolonged hospital stays. Electrolyte disturbances such as hypokalemia, hyponatremia, and hyperkalemia were occurred among 32 patients. Respiratory failure was occurred in 03 patients. 14 patients had developed altered sensorium due to metabolic encephalopathy. 14 patients had developed severe sepsis. In a similar study conducted in Nigeria by Hockenhull et al., hyponatremia, hyperkalemia, and hypokalemia were commonly observed.[26]

In the present study, comorbidities like coronary artery disease was found in 12% of the cases and chronic kidney disease in 9% of patients stroke in 7% cases, 2% hypertension 10% of patient had COPD. Associated comorbidities and complications led to more mortality.

In the present study, 58% had diabetes of <5 years duration, 32% had 5–9 years duration; 10% had diabetes of more than 10 years. New-onset diabetes was included in < 5-year duration category.

In the present study, diabetes with more than 5 years; 02 deaths occurred. 14 patients had prolonged hospital stay. Patients with prolonged duration of diabetes have more mortality and morbidity.[28] They had prolonged hospital stay due to more complications.[29] This association was statistically significant with P<0.001.

In the present study, patients with oral anti-diabetic drugs had mortality and prolonged hospital stay (>2 week) and complications. Among the total 03 deaths, 01 were on oral diabetic drugs. No death was observed in patients were taken both insulin and oral drugs. Patients were on insulin; 2 death observed. Hence, patients with oral antidiabetic drugs had 1 mortality compared to insulin. The association was statistically significant with P<0.001. In a similar study; DKA and clinical outcome conducted by the Department of Family Medicine Israel; results were obtained. Patients with oral drugs were prone to more complications

In the present study, among patients with DKA blood sugar values ranged from 380 to 659. Mortality increased with high blood sugar value. More death were observed when blood sugar value more than 500 mg/dL. 03 deaths occurred in patients with RBS more than 500 mg/dL. Prolonged hospital stay was observed in 17 patients with RBS value more than 500 mg/dL. Relationship between RBS and mortality was statistically significant with P<0.001.

In the present study, according to serum bicarbonate levels, patients were classified into mild, moderate, severe acidosis. Serum bicarbonate <10 meq/L was found in 18 patients having a mean duration of hospital stay 4.0±0.93 days. Serum bicarbonate 10–15 meq/L was found in 64 patients having mean duration of hospital stay 11.54±4.12 days. Serum bicarbonate 16–18 meq/L found in 19 patients having a mean duration of hospital stay 20.11±3.90 days. A decrease in serum bicarbonate is directly related to the duration of hospital stay.

Similar study was done by Rodríguez-Gutiérrez et al., in DKA Mean in-hospital stay was 5.0±4.1 days. The time from admission until resolution of acidosis (pH >7.3 and HCO_3- >8 mm/L) was 16.6±9.9 h.[20]

In the present study, 9 DKA patients having serum amylase level >140IU/L (248.22±169.7) range from 142 to 961 IU/L While in 91 DKA patient having serum amylase level <140IU/L (71.98±35.19) range from 15 to 138 IU/L. A similar study conducted by Chandra et al., among 50 cases studied, 9 cases (18%) with DKA are showing an elevation of serum amylase levels.[16] similar study conducted by Yadav et al., found in DKA nonspecific elevations of amylase and lipase occur in 16–25% of cases.[30]

There may be many shortcomings in this study. However, this study will definitely give us a fair idea of the risk factors and prognosis of DKA in the rural Indian population.

Limitations of the study

Short duration of study and limited number of cases.

CONCLUSION

DKA is an important acute complication of diabetes. Presentation of DKA is nausea vomiting abdominal pain. Precipitating factors include omission of insulin, noncompliance to drugs, infections, sepsis, myocardial infarction, stroke, other drugs like steroids, alcoholism etc.

DKA have multiple complications; that can lead to death and prolonged hospital stay. Complications include sepsis, respiratory failure, electrolyte abnormalities, acidosis, altered sensorium etc. Serum bicarbonate is inversely proportion to duration of hospitalization. Serum amylase level increase in DKA patients. Serum amylase level is directly related to the stay in hospital. Treatment mainly includes adequate fluid management, insulin administration, and correction of electrolyte abnormality. Identification and treatment of precipitating factors are more important. Patient education plays a crucial role in prevention of DKA.

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