ORIGINAL ARTICLE

To Evaluate Various Precipitating Factors for Diabetic Ketoacidosis

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ABSTRACT

Background: Diabetic ketoacidosis is a serious and life threatening metabolic complication of diabetes mellitus. Being a third world country with less resources and minimal health cover for a huge population, Pakistan is expected to host a reasonable number of cases with diabetic ketoacidosis. The purpose of this study, therefore, is to give some insight into the problem and provide local statistical data for comparison with international data.
Aim: To evaluate various precipitating factors for diabetic ketoacidosis.
Methods: This descriptive one time observational study was conducted in Mayo Hospital, Lahore. Patients and their relatives were selected for interview on the basis of convenient sampling. The data was collected on a specially designed proforma. Fifty patients were included in the study and the proforma was filled for each patient. All patients were investigated with various blood tests, urine tests, ECG and chest x-rays. The data was analysed using SPSS 10.
Results: The mean age was 29.9 years. 64% of the patients were males. Diabetes mellitus was newly diagnosed at presentation in 12% patients. Vomiting was present in 40% patients, altered conscious level was observed in 40% patients. Mean blood sugar level was 466.36mg/dl (360-620mg/dl). Mean arterial pH value was 7.05 (6.9-7.2). Infection (50%) and non-insulin compliance (45%) were the most common precipitating factors. Poor knowledge about disease, treatment and follow up was also noted.
Conclusion: Infection and poor medication compliance are major precipitating factors for diabetic ketoacidosis. Level of health education is very poor, so more emphasis should be given to the health education of the diabetics.
Keywords: Diabetic ketoacidosis, precipitating factors.

INTRODUCTION

Diabetic ketoacidosis is an important and serious complication of diabetes mellitus. It is a significant cause of morbidity and mortality among patients with diabetes mellitus[1]. Diabetic ketoacidosis is classically associated with type I diabetes mellitus but it can occur in some patients with type II diabetes mellitus also. It may be the presenting manifestation of insulin dependent diabetes mellitus.

Factors that have been incriminated as precipitating events for diabetic ketoacidosis include insulin non-compliance, infection, surgery, medical and emotional stress. Urinary tract infections (UTIs) are the single most common infection associated with diabetic ketoacidosis, but many other associated illnesses need to be considered as well. Young patients with recurrent episodes of DKA may have an underlying eating disorder, or may be using insufficient insulin for fear that it will cause weight gain[4]. In a recent study it was seen that amongst the precipitating factors, 34% had missed insulin, 23.4% had overt infection and only 6.4% had both infection and missed insulin injections[1]. Common infection sites included respiratory, genitourinary and septicaemia. Diabetic ketoacidosis is a common complication that can occur in about 8% of the hospitalised diabetic patients[1].

Diabetic ketoacidosis develops as a consequence of metabolic derangements resulting from the combination of absolute or relative insulin deficiency and increased levels of counter-regulatory hormones (glucagon, catecholamines, cortisol, and growth hormone[2]. Diabetic ketoacidosis is a life threatening condition with a mortality rate of around 5%[3] Overall mortality is higher in patients >70 years than in patients < or =70 years. So older patients with diabetic ketoacidosis differ from younger patients in having a higher mortality and a larger proportion of these patients is classified as Type 2 diabetes[4].

The diagnostic triad of diabetic ketoacidosis is hyperglycemia, metabolic acidosis and ketonemia. Diabetic ketoacidosis affects both genders equally; males being affected at an earlier age group. Most frequent presenting complaints are vomiting, abdominal pain, dehydration and respiratory distress[5]. Alteration in central nervous system function may be seen. Cerebral edema is often

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unpredictable. Patient may have prodromal headache, confusion, incontinence, changes in behavior, papillary changes, blood pressure changes, bradycardia, disturbed temperature and frank seizures. The development of headache or confusion during the course of therapy suggests incipient cerebral edema and need for aggressive intervention. Small children with DKA are relatively prone to cerebral edema (swelling of the brain tissue), which may cause headache, coma, loss of the pupillary light reflex, and progress to death. It occurs in 0.7–1.0% of children with DKA, and has been described in young adults, but is overall very rare in adults[6,7,8]. It carries a 20–50% mortality[9].

The main aims in the treatment of diabetic ketoacidosis are replacing the lost fluids and electrolytes while suppressing the high blood sugars and ketone production with insulin. Admission to an intensive care unit or similar high-dependency area or ward for close observation may be necessary[6].

Diabetic ketoacidosis occurs in 4.6–8.0 per 1000 type 1 diabetics annually. In the United States, 100,000 hospital admissions occur annually as a result of DKA, at an estimated cost of $1 billion or half the total cost of caring for type 1 diabetics. Since the 1980s there has been a documented increasing trend to hospital admissions. The risk is increased in those with an ongoing risk factor, such as an eating disorder, and those who cannot afford insulin[6]. About 30% of children with type 1 diabetes receive their diagnosis after an episode of DKA[10].

With modern fluid management, the mortality rate of diabetic ketoacidosis is about 2% per episode. Before the discovery of insulin in 1922, the mortality rate was 100%. No sex predilection exists for diabetic ketoacidosis. Diabetic ketoacidosis tends to occur in individuals younger than 19 years, but it may occur in patients with diabetes at any age.

Pakistan, being a third world country with limited resources and minimal health cover for a huge population, is expected to host a large number of cases with diabetic ketoacidosis. The purpose of my study is to provide local statistics of precipitating factors of diabetic ketoacidosis that can be used to predict the onset and better management of this life threatening condition.

The purpose of this study is to give some insight into the diabetic ketoacidosis. This study will provide local statistical data and will be helpful for the better management of this life threatening condition.

MATERIAL AND METHOD

This descriptive case series was conducted in Emergency Department and Medical Floor of Mayo Hospital Lahore during a period of 6 months. The study was carried out on a single group of 50 patients with diabetic ketoacidosis admitted through emergency department on medical floor, Mayo Hospital, Lahore. Sampling technique was non-probability purposive sampling.

Inclusion Criteria: Diabetic ketoacidosis diagnosed in both male and female patients at first presentation or previously diagnosed cases of type 1 and type 2 diabetes mellitus were included.

Exclusion Criteria

Patients having comorbid conditions like

1. Metabolic acidosis with acute and ch renal failure
2. Lactic acidosis and drugs
3. Alcoholic ketosis
4. Starvation
5. Non-ketotic hyperosmolar coma

Data collection procedure: The cases included on the basis of the inclusion criteria were asked about their background information. The family members or the patients were interviewed in detail and a Proforma was filled in order to evaluate different precipitating factors of diabetic ketoacidosis. All patients were explained about the study and an informed consent was taken. All necessary investigations like blood glucose level, arterial blood gas analysis, serum electrolytes, urinary ketones, complete blood count liver function tests, urea, creatinine, urine complete examination, chest X-Ray and electrocardiography were carried out. The data analysis by SPSS 10.

RESULTS

A total of 50 patients, who visited Mayo Hospital from areas in and around Lahore, were studied. The mean age of these patients was 29.90±15.36 (14-70). 32(64%) of them were males and 18(36%) were females. Abdominal pain was present in 28(56%) patients. Vomiting was present in 20(40%) patients. Conscious level was altered in 20(40%) patients. The mean temperature of these patients was 99.12±1.41 (98-102F). Infection was seen in 25(50%) patients. The compliance of medicine was poor in 24 (48%) patients. The mean blood sugar level was 466.36±74.64 (360-620). Mean pH was 7.05±0.11 (6.9-7.2). 44(88%) patients were already diagnosed diabetics and 6(12%) patients presented first time with diabetic ketoacidosis. The standard of knowledge about their disease and level of health education was very poor among majority of the patients. 40(80%) patients were of type 1 diabetes and 10 (20%) patients were of type 2 diabetes.

In 40 (80%) patients of type 1 diabetes compliance of medicine was poor in 18(45%) patients. The mean blood glucose level was 475.22±78.97 (360-620). Urinary ketones were ++ in

5(12.5%) patients, +++ in 20(50%) patients and ++++ in 15 (37.5%). Mean pH was 7.04±0.12 (6.9-7.2).

The mean serum sodium was 137.60±8.05 (124-150). Mean serum potassium was 3.53±0.56 (2.9-5.2). The mean hemoglobin was 10.75±2.38 (8-13). The mean total leukocyte count was 10328.25±3366.22 (5500-15500). The mean serum bilirubin was 0.88±0.20 (0.6-1.2). The mean SGPT was 39.17±8.13 (20-50). The mean blood urea was 48.17±14.54 (24-76). The mean serum creatinine was 1.23±0.35 (0.7-2.4). The respiratory tract infection was diagnosed in 10 (25%) patients. No significant abnormality in ECG was noted in these patients. Urinary sugar was + in 4 (10%) patients, ++ in 10 (25%) patients, +++ in 20 (50%) patients and ++++ in 6 (15%) patients. Urinary tract infection was diagnosed in 8 (20%) patients.

Insulin was not available to 7 (17.5%) patients. 6 (15%) left insulin due to quack's advice and 4 (10%) wrongly switched to tablets. Infection was present in 17 (42.5%) patients. Evidence of infection along with poor insulin compliance was seen in 11 (27.5%) patients.

The compliance of medicine was poor in 6 (60%) patients of type 2 diabetes. The mean blood sugar level was 430.90±39.46 (375-490) in these patients. The mean serum sodium was 136.70±8.77 (124-150). The mean serum potassium was 3.50±0.66 (2.7-5.0). The mean hemoglobin was 11.46±1.50 (9-13.2).

The mean total leukocyte count was 12360±3773.06 (5600-16900). The mean serum bilirubin was 0.80±0.23 (0.5-1.1). The mean SGPT was 40.10±8.54 (28-55). The mean blood urea was 44±17.82 (29-80). The mean serum creatinine was 1.12±0.49 (0.6-2.4). The mean pH was 7.10±8.16 (7.0-7.2). The urinary ketones were ++ in 3(30%) patients, +++ in 4 (40%) patients and ++++ in 3(30%) patients. The respiratory tract infection was diagnosed in 4(40%) patients. ECG showed significant abnormality in 4(40%) patients. The urinary sugar was + in 2(20%), ++ in 3(30%) and +++ in 5(50%) patients. Urinary tract infection was diagnosed in 5(50%) patients. Overall infection was present in 9(90%) patients. Poor drug compliance along with evidence of infection was seen in 4(40%) patients.

DISCUSSION

The objective of this study was to evaluate various precipitating factors for diabetic ketoacidosis. Multiple studies were carried out on this topic earlier in different parts of the world with varying results. The methods employed to evaluate the precipitating factors were also different.

The age in our group ranged from 14-70 years (mean 29.90±15.36). A similar study conducted locally, carried out by Bashir et al[11] on diabetic ketoacidosis showed a mean age of 40 years. Other study showed even lower mean age like Zafar et al[12] (22 years). Another international study showed mean age of 40 years like Harris et al[13].

32(64%) of our patients were male. Similar trend was seen in various other studies. Zafar et al[12] reported 58.8% males, Mahmood et al[14] reported 65.7% males and Newton et al[15] reported 58% male patients. Diabetes mellitus was newly diagnosed in 6(12%) patients in our study, which was comparable to the observation made by Bashir et al[11] (10%) and Seyoum et al[17] (23%).

In our study, vomiting was present in 20(40%) patients and abdominal pain was reported in 28 (56%) patients. Bashir et al[11] reported vomiting 76% and abdominal pain 52%.

Conscious level was altered in 20(40%) patients in our study, Bashir et al[11] reported even higher percentage (68%) and Wallace et al[18] reported 10%. The mean blood sugar level was 466.36±74.64 (360-620) in our study. Yousuf et al[23] reported mean blood sugar level of 610.2. The mean pH in our study was 7.05±0.11 (6.9-7.2). Similarly Yousuf et al[23] reported mean pH of 7.1.

In our study infection was the most common precipitating factor (50%) being responsible for diabetic ketoacidosis. Respiratory tract infection was diagnosed in 10(25%) patients of type 1 diabetes and in 4(40%) patients of type 2 diabetes. Similarly urinary tract infection was diagnosed in 8(20%) patients of type 1 diabetes and in 5(50%) patients of type 2 diabetes mellitus. As this study was conducted on medical floor, no patient with soft tissue infection, osteomyelitis or diabetic carbuncle etc. was included. Other studies also reported similar finding. Bashir et al[11] reported that infection was the most common precipitating factor (40%). Mahmood et al[14] reported infection (41.1%). Newton et al[15] reported 38% cases with infections. Mbugua et al[1] reported that 23.4% infection was observed. Kitabchi et al[24] reported infection as second most common precipitating factor (33%) in their study.

Non-compliance of medicines, especially insulin, was the other frequent precipitating factor (45%) noted in our study. Similar observation was made in various other studies. Harris et al[12] reported (59%) insulin non-compliance, Kitabchi et al[23] reported 47% insulin non-compliance.

The overall standard of knowledge about the disease and level of health education was very poor in our study group. The possible explanation for this is because of our poor educational status of the population and non-availability of proper health

education. Many patients complained about the general attitude of the doctors that they had not given them proper instructions regarding their disease process, treatment and follow up. Similar level of health education among diabetics in Quetta was reported by Ali et al[21] and in Karachi by Jabbar et al [101]. In an Indian study Miglani et al[18] reported that a proforma guided survey was conducted in young diabetics and 43% of the subjects had received instructions from some quack to stop all treatment shift to household remedies.

Umpierrez et al[25] reported that diabetic ketoacidosis is largely preventable by the education of patients, healthcare professionals, and the general public. Jacobson et al[16] reported that irregular clinical follow up was a risk factor for diabetic complications like diabetic ketoacidosis, especially, in insulin dependent diabetics. Chaudry et al[22] emphasized the need of health education and establishment of diabetic clinics at community level in Pakistan. Fasanmade et al[26] reported that many cases of DKA can be prevented by better access to medical care, proper education, and effective communication with a health care provider during intercurrent illness.

CONCLUSION

- Infection and poor medication compliance, especially insulin, are the major precipitating factors for diabetic ketoacidosis in our diabetic population.
- Poor knowledge about the disease and poor level of health education is of great concern among diabetics. So more emphases should be given to health education of diabetics along with pharmacological therapy.

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