ORIGINAL ARTICLE

FREQUENCY OF RISK FACTORS ASSOCIATED WITH DIABETIC KETOACIDOSIS IN PATIENTS PRESENTING AT KHYBER TEACHING HOSPITAL PESHAWAR

Muhammad Asim, Aliena Badshah, Durkho Atif, Wazir Mohammad

Department of Medicine, Khyber Teaching Hospital, Peshawar - Pakistan

ABSTRACT

Objectives: To determine the frequency of risk factors associated with diabetic ketoacidosis in patients presenting at Khyber Teaching Hospital Peshawar.

Materials and methods: Patients of either gender, aged between 18 and 60 years, with either type I or type II diabetes mellitus presenting with diabetic ketoacidosis with the duration of diabetes > 1 year were included in the study. DKA was diagnosed based on the clinical presentation of respective patients, serum Random Blood Sugar (RBS), and urinary ketones. Careful scrutinization was done for the detection of common risk factors for DKA like infections, stroke, myocardial infarction, and pancreatitis. Based on the clinical examination for Stroke and acute pancreatitis, CT imaging of the brain and CT of the abdomen with pancreatic protocol were performed.

Results: Among 111 DKA patients, the mean age was 43 years with standard deviation ± 12.05. 63(57%) patients were male while 48(43%) were female. Infection was found in 54(49%) patients, stroke in 4(4%) myocardial infarctions in 3(3%), and pancreatitis was found in 7(6%) patients.

Conclusion: The most common risk factor for diabetic ketoacidosis is infections in half of the participants while stroke was 4%, myocardial infarction was 3% and pancreatitis was 6%.

KEYWORDS: diabetic ketoacidosis; type I diabetes; type II diabetes

This article may be cited as: Asim M, Badshah A, Atif D, Mohammad W. Frequency of risk factors associated with Diabetic Ketoacidosis in patients presenting at Khyber Teaching Hospital Peshawar. J Med Sci 2023 October;31(4):296-299

INTRODUCTION

Diabetes Mellitus [DM] is a disease of altered glucose metabolism resulting in hyperglycemia and glucose intolerance due to absolute or relative deficiency of insulin with the presence of clinical features of polyuria, polydipsia, and polyphagia in the majority of cases. It has affected the life of modern man and has taken the shape of an epidemic of this century and is still on the rise. The prevalence of diabetes globally according to a 2019 report was 9.3% (463 million people), escalating to 10.2% (578 million) by 2030 and 10.9% by 2045. [1] Diabetes Mellitus has a range of complications. These lead to increased mortality and morbidity of patients.

One of the serious complications of diabetes is Diabetic Ketoacidosis (DKA) with mortality reaching up to 15.9% (according to a 2005 local study in Mayo Hospital Lahore). [2] Internationally, the mortality rate is much lower, overall, 0.2% to 2%, with individuals under 40 years of age having mortality of 5% and elderly or those with serious illnesses of 20%. [3] DKA usually occurs due to non-compliance with insulin administration, infections, dehydration, or poorly controlled diabetes with inadequate insulin leading to ketosis and acidosis. Recent studies have demonstrated infection as the most common cause of precipitating DKA (30-50%). Among these infections, urinary tract infections and respiratory tract infections contribute a major percentage of infections. [4] Acute pancreatitis may also be associated with severe DKA. [5]

The diagnosis of DKA requires the presence of hyperglycemia as is evident by a random blood sugar of more than 200mg/dl (11.1 mmol/l), plasma beta-hydroxybutyrate concentrations of $\geq$ 3.0 mmol/l, or urine ketones of more than 2+, and the pH must be less than 7.3 or serum bicarbonate level be less than 15 mmol/l. [6] Proper management of DKA needs admission into a hospital for aggressive intravenous fluids, insulin therapy, electrolyte replacement, and management of the underlying cause of DKA. Frequent monitoring is also required of the patient's health status. [7]

There is no doubt that the management of DKA is a challenging process for the physician, but it leads to a

Correspondence
Dr. Aliena Badshah
Assistant Professor
Department of Medicine, Khyber Teaching Hospital,
Peshawar - Pakistan
Cell: +92-335-5950615
Email: alienabadshah@yahoo.com
Date Received: 12-01-2023
Date Revised: 29-3-2023
Date Accepted: 14-10-2023

fruitful outcome if the physician is committed and dedicated to the patient's treatment. Our present study aims to find the frequency of common risk factors associated with DKA in patients presenting to Khyber Teaching Hospital, Peshawar. This will provide us with a general idea of the common risk factors and we might be able to help the patients through the prevention of such catastrophic episodes by counseling them. The results of our study vary from other studies due to different cultural, and socioeconomic conditions and education levels.

MATERIAL AND METHODS

This descriptive study was carried out at the Department of Khyber Teaching Hospital, Peshawar from 17 July 2021 to 17 Jan 2022. The sample size was calculated using the WHO formula for sample size calculation keeping an 11.73% prevalence of pancreatitis in patients presenting with diabetic ketoacidosis, a confidence level of 95%, and a margin error of 6%. The sample size was 111 and the sampling technique was non-probability consecutive sampling. Male and female patients aged between 18 and 60 years with either type I or type II diabetes, presenting with diabetic ketoacidosis with a duration of diabetes > 1 year were included in the study.

Patients with metabolic acidosis related to any other cause e.g. Chronic renal failure, Hyperosmolar non-ketotic coma (which is serum glucose >600 mg/dl, arterial pH >7.3, serum bicarbonate >15 mEq/l, which is confirmed on Arterial blood gases and minimum to none ketone bodies on urine examination), Ethanol poisoning, Salicylate poisoning, Type 2 respiratory failure, and lactic acidosis were excluded from the study. The above-mentioned conditions were excluded based on confounding results when included.

All 111 patients fulfilling the inclusion criteria were enrolled in the study through OPD of the Department of Khyber Teaching Hospital, Peshawar. Patients were recruited to the study after ethical approval from the hospital's ethical committee and informed consent from patients or their first-degree relatives in case patients were not in a state to make informed decisions. The diagnosis of DKA was made according to serum RBS, urinary ketones, and clinical presentation. Detailed history was taken from all patients followed by clinical examination. This was followed by routine baseline investigations; patients were carefully scrutinized for detection of common risk factors like infections, stroke, myocardial infarction, and pancreatitis. Blood and urine cultures were sent. ECG and Chest X-ray were performed. Based on the clinical examination for Stroke and acute pancreatitis, CT of the Brain and CT of the abdomen with pancreatic protocol were performed if needed. All the demographic data including name, address, age, gender, duration of disease, and type of diabetes were recorded on proforma. Exclusion criteria were followed strictly to avoid bias in the study.

All the recorded data was entered into the statistical software SPSS version 23 and descriptive analysis were performed. Quantitative variables including age, and duration of disease were expressed in terms of mean and standard deviation while categorical variables including gender, type of diabetes, and common risk factors (infection, stroke, myocardial infarction, pancreatitis) were described in terms of frequencies and percentages. Common risk factors (infection, stroke, myocardial infarction, pancreatitis) were stratified for age, gender, duration of disease, and type of diabetes mellitus to see the effect modifiers. Post-stratification chi-square test was applied in which a P value of 0.05 was considered a significant value.

RESULTS

Our study shows that age distribution among 111 patients was analyzed as: 36 (32%) patients were in the age range 18-40 years, and 75 (68%) patients were in the age range 41-60 years. The mean age was 43 years with a standard deviation ± 12.05. Gender distribution among 111 patients was analyzed as: 63 (57%) patients were male while 48 (43%) patients were female. Duration of diabetes mellitus among 111 patients was analyzed as: 64 (58%) patients had a duration of diabetes ≤12 years and 47 (42%) patients had a duration of diabetes >12 years. Type of diabetes mellitus among 111 patients was analyzed as 26: (23%) patients had type I diabetes while 85 (77%) patients had type II diabetes.

The frequency of risk factors among 111 patients was analyzed as follows: infection was found in 54 (49%) patients, stroke was found in 4 (4%), myocardial infarction was found in 3 (3%) patients, and pancreatitis was found in 7 (6%) patients. (table No 1) Stratification of risk factors concerning age, gender, duration of disease, and type of diabetes mellitus is given in tables 2,3,4,5 respectively.

DISCUSSION

Diabetes Mellitus [DM] is a disease of altered glucose metabolism resulting in hyperglycemia and glucose intolerance due to absolute or relative deficiency of insulin with the presence of clinical features of polyuria, polydipsia, and polyphagia in the majority of cases. [8] One of its life-threatening complications is diabetic ketoacidosis which is precipitated by several factors, including infections, non-compliance with insulin administration[9], dehy-

Table 1: Risk factors in diabetes mellitus patients (n=111)

Risk Factors	Frequency	Percentage
Infection	54	49%
Stroke	4	4%
Myocardial infarction	3	3%
Pancreatitis	7	6%
Total	111	100%

Table 2: Stratification of risk factors with respect to age (n =111)

Risk Factors		18-40 years	41-60 years	P Value
Infection	Yes	19(53%)	35(47%)	0.5464
	No	17(47%)	40(53%)	
Stroke	Yes	1(3%)	3(4%)	0.7463
	No	35(97%)	72(96%)	
Myocardial infarction	Yes	0(0%)	3(4%)	0.2237
	No	36(100%)	72(96%)	
Pancreatitis	Yes	2(6%)	5(7%)	0.8216
	No	34(94%)	70(93%)	

Table 3: Stratification of risk factors with respect to gender

Risk Factors		Male	Female	P Value
Infection	Yes	32(51%)	22(46%)	0.6044
	No	31(49%)	26(54%)	
Stroke	Yes	2(3%)	2(4%)	0.7811
	No	61(97%)	46(96%)	
Myocardial infarction	Yes	2(3%)	1(2%)	0.7254
	No	61(97%)	47(98%)	
Pancreatitis	Yes	4(6%)	3(6%)	0.9830
	No	59(94%)	45(94%)	

Table 4: Stratification Of Risk Factors With Respect To Duration Of Diabetes Mellitus (n =111)

Risk Factors		≤ 12 years	>12 years	P Value
Infection	Yes	32(50%)	22(47%)	0.7395
	No	32(50%)	25(53%)	
Stroke	Yes	2(3%)	2(4%)	0.7522
	No	62(97%)	45(96%)	
Myocardial infarction	Yes	1(2%)	2(4%)	0.3873
	No	63(98%)	45(96%)	
Pancreatitis	Yes	3(5%)	4(9%)	0.4129
	No	61(95%)	43(91%)	

Table 4: Stratification Of Risk Factors With Respect To Duration Of Diabetes Mellitus (n =111)

Risk Factors		Type I	Type II	P Value
Infection	Yes	12(46%)	42(49%)	0.7711
	No	14(54%)	43(51%)	
Stroke	Yes	1(4%)	3(4%)	0.9395
	No	25(96%)	82(96%)	
Myocardial infarction	Yes	0(0%)	3(4%)	0.3314
	No	26(100%)	82(96%)	
Pancreatitis	Yes	2(8%)	5(6%)	0.7397
	No	24(92%)	80(94%)	

dration, or poorly controlled diabetes. [4, 10] Previously many studies have been done to identify risk factors for DKA. A UK-based evaluation from 2000 to 2009 showed that mortality with DKA was significantly associated with age, presence of co-morbidities and diabetic complications, non-compliance with medications, female gender, no follow-up with physician, and psychological problems all of which increase the risk for recurrent DKA. [11] According to a 2019 study of 93 patients, infections (36.5%) and inadequate insulin doses (22.5%) were commonly seen as the precipitating factors for DKA. The rate of mortality was recorded to be 23.6%. [12] One analysis of 45 published cases even identified the use of atypical antipsychotics as a risk factor for DKA. [13] Previous reporting about pancreatitis as a consequence of diabetic ketoacidosis has been done, with a prevalence of 15.53%. [14, 15, 16] Severe hypertriglyceridemia from insulin deficiency causes pancreatitis in type 1 diabetic patients. [17] DKA can also occur in diabetic patients with acute pancreatitis. Our study counts pancreatitis as a precipitating factor for DKA. Myocardial infarction is another documented rare, but renowned risk factor for DKA. Both these disorders can trigger each other and it is often difficult to conclude which disorder appears first. A 2019 article suggested that the elevation of troponin levels in a DKA patient should always prompt the physician to think of coronary abnormality until proven otherwise.[18] Same is the case for strokes. They are counted as one of the risk factors for the development of DKA and DKA itself is a risk factor for stroke. A substantial intersection of signs and symptoms and laboratory findings in both conditions makes it difficult to interpret which condition is the primary cause, especially in elderly and less expressive patients. However, quick and efficient investigation can lead to a certain diagnosis. [19]

The study conducted in Khyber Teaching Hospital to find out the frequency of common risk factors in DKA patients found that infections were the mainstream cause of DKA (just like previously done international studies), maintaining the majority of the proportion. Less common causes are acute pancreatitis, stroke, and myocardial infarction. We need to educate the patients regarding infection control to prevent further episodes of DKA as it is a life-threatening condition and late management can lead to high-rate mortality.

CONCLUSION

The most common risk factor for diabetic ketoacidosis is infections in half of the participants while stroke was 4%, myocardial infarction was 3% and pancreatitis was 6%.

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CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Asim M:	Main idea, data collection
Badshah A:	Literature search, formatting of article, final review
Atif D:	Data compilation, discussion writing
Mohammad W:	Proofreading

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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