

MORTALITY REVIEW OF DIABETIC KETOACIDOSIS IN MAYO HOSPITAL, LAHORE - PAKISTAN

ZAFAR NIAZ, ANJUM RAZZAQ, U. J. CHAUDHARY, MEHRAN AWAS, M. A. YASEEN
IMRAN NASEER, USMAN GHANI, JAWAD ZAHEER, SAJID ABADULLAH AND MUMTAZ HASAN
East Medical Ward, Mayo Hospital, Lahore - Pakistan

Diabetic ketoacidosis is a known complication of diabetes mellitus. The annual incidence of diabetic ketoacidosis (DKA) among subjects with type 1 diabetes is between 1% and 5% in European and American series respectively. This incidence appears to have remained relatively constant over the last decade in western countries whereas 20-30% of cases occur in newly diagnosed patients. Mortality rate is reported less than 5% in experienced centres whereas internationally overall mortality is 1-10 percent. The objective of this study was to find out mortality rate in patients of diabetic ketoacidosis admitted to east medical ward of Mayo Hospital, Lahore. A descriptive retrospective study was conducted on patients admitted to East medical ward with the diagnosis of DKA. There were 44 patients included in this study. Regarding outcome of patients 84.1% of patients were discharged. The mortality was found to be 15.9% that is much higher as compared to other studies where it was around 5%.

INTRODUCTION

Diabetic ketoacidosis, a known complication of diabetes mellitus caused by the build up of by-products of fat metabolism (ketones), that occurs when glucose is not available as a fuel source for the body¹. It is defined as hyperglycaemia (blood sugar > 250mg/dl), acidosis (pH < 7.3), ketonaemia (positive at 1:2 dilution), ketonuria and dehydration (approx. 6L loss)². Its incidence varies among developed and underdeveloped countries. The annual incidence of DKA among subjects with type 1 diabetes is between 1% and 5% in European and American series³⁻⁶ respectively. This incidence appears to have remained relatively constant over the last decade in Western countries whereas 20-30% of cases occur in newly diagnosed patients⁷. Mortality rate is reported less than 5% in experienced centres⁷⁻¹², but with increase in age, this approaches 50% in patients over the age of 80¹³. Internationally overall mortality is reported between 1-10 percent¹⁴. In a survey by WHO, it was shown that in 1995, Pakistan was 8th on the list of top ten countries with high prevalence of diabetes and had 4.3 million people with diabetes mellitus. However it is estimated that in the year 2025, Pakistan will be 4th on the list with 14.5 million diabetics¹⁵. Common causes of diabetic ketoacidosis include infection, particularly pneumonia, urinary tract infection, and sepsis, inadequate insulin treatment or non-compliance, new-onset diabetes, cardiovascular disease particularly myocardial infarction^{16,17}. Diagnosis is suspected

on clinical history and examination even in the unconscious patients where history of diabetes may be available², but to confirm the diagnosis, investigations including blood sugar level, pH, serum bicarbonate, urinary ketones and serum ketones are required¹⁸. The aims of DKA management are to correct the acidosis, hyperglycaemia, dehydration and electrolyte disturbance associated with the condition and to identify and treat any associated co-morbid events. This requires appropriate and rapid clinical assessment and frequent monitoring of the patient¹⁹.

MATERIAL AND METHODS

A descriptive study was conducted on patients admitted to East Medical Ward of Mayo Hospital, Lahore from January 2004 to July 2005 with a diagnosis of diabetic ketoacidosis. There were 44 patients included in this study fulfilling the following criteria.

- Patients between the ages of 13-80 years.
- Patients whose blood sugar level was > 250 mg/dl.
- Patients whose blood pH was < 7.3.
- Patients who had positive urinary ketones.

Patients who had initial blood sugar level more than 250 mg/dl and later found to have negative urinary ketones were excluded from the study.

Data was collected on a predesigned proforma and was analysed by the programme SPSS version 10.

RESULTS

We found that mean age of the patients was 35.39 ± 18.26 years including 21 (47.7%) males and 23 (52.3%) females. Fourteen (31.8%) patients had their first presentation as diabetic ketoacidosis whereas rest of the patients were known diabetics including 56.8% diabetics for less than 10 years and 11.4% diabetics for more than 10 years. Blood sugar level of all the patients was checked at presentation and none of them had blood sugar level less than 250mg/dl. Urinary ketones of 44 patients were found to be positive with a max.no. 20 (45.5%) having 4+ ketones. Arterial blood gases of all the patients were checked and none of them had pH >7.3.

Table 1: Blood sugar level on presentation.

Blood sugar In mg./dl. in	Frequency	Percent
201-300	4	9.1
301-400	13	29.5
401-500	15	34.1
501-600	9	20.5
>600	3	6.8
Total	44	100.0

Table 2: Ketones on presentation.

Severity of Ketones	Frequency	Percent
urine ketones 1+	1	2.3
urine ketones 2+	10	22.7
urine ketones 3+	13	29.5
urine ketones 4+	20	45.5
Total	44	100.0

Precipitating factors were also looked for, it was found that infection was the most common cause of ketoacidosis. Other causes included myocardial infarction, non compliance and surgery where as in 25% cases the cause was not known (table 3).

Antibiotics were administered to all the 44 patients depending upon the cause of infection suspected on history and clinical examination as blood culture of none of the patient was sent.

Table 3: Precipitating Factors.

Factors	Frequency	Percent
not known	11	25.0
Infections	20	45.5
Myocardial Infection	2	4.5
Non-compliance	5	11.4
Surgery	1	2.3
Others	5	11.4
Total	44	100.0

Regarding outcome of patients 84.1% of patients were either discharged, discharged on request or left against medical advice where as 15.9% patients expired.

DISCUSSION

Diagnosis of diabetic ketoacidosis is based upon the diagnostic criteria shown in table 4^{2,3} and the therapeutic goals for diabetic ketoacidosis consist of improving circulatory volume and tissue perfusion, reducing blood glucose and serum osmolality towards normal levels, clearing ketones from serum and urine at a steady rate, correcting electrolyte imbalances and identifying the precipitating factors as per recommendations of American Association of Diabetes^{2,3} where as mortality is less than 5%⁷⁻¹².

Table 4: Diagnostic criteria for diabetic Ketoacidosis^{2,3}.

Blood Glucose >250mg/dl
pH<7.3
Serum Bicarbonate <15mEq/L
Urinary Ketones positive
Serum Ketones positive at 1 in 2 dilution
Plasma osmolality variable

The commonest precipitating factor was infection (45.5%) that is the same as in other studies conducted in USA (30-50%)²⁰, Pakistan Institute of Medical Sciences Islamabad (40%)²¹, Lady Reading Hospital and Khyber Teaching Hospital, Peshawar (28%)²², but it is less than

what was found in Chang Gung Memorial Hospital, Taipei (70%)²³. The mortality at our centre was found to be 15.9% which is much higher as compared to other studies where it was around 5%²⁰⁻²³.

As a **conclusion** the mortality in our centre was found to be 15.9% which is much higher than in other studies. To decrease the mortality, management should be done more effectively and vigilantly according to the International Standards of American Association of Diabetes. All the patients of DKA should be subjected to infection screening including blood culture, urine culture and sputum culture. More stress should be laid on patient education regarding compliance and early recognition of signs and symptoms of DKA.

REFERENCES

- Sidhaye A R. DKA; Ketoacidosis; Diabetic coma. 8/6/2004. <http://www.nlm.nih.gov/medlineplus/article/000320.htm# Alternative % 20 Names>.
- Kitabchi AE, Wall BM. Management of Diabetic Ketoacidosis. *Am Fam Physician* 1999;60:455-64.
- Kitabchi AE, Umpierrez GE, Murphy MB. Management of hyperglycemic crises in patients with diabetes. *Diabetes Care* 2001; 24: 131-53.
- Johnson DD, Palumbo PJ, Chu CP. Diabetic ketoacidosis in a community-based population. *Mayo Clin Proc* 1980; 55: 83-8.
- Schiel R, Muller UA, Sprott H. The JEVIN trial: a population-based survey on the quality of diabetes care in Germany: 1994/1995 compared to 1989/1990. *Diabetologia* 1997; 40: 1350-7.
- Snorgaard O, Eskildsen PC, Vadstrup S. Diabetic ketoacidosis in Denmark: epidemiology, incidence rates, precipitating factors and mortality rates. *J Intern Med* 1989; 226: 223-8.
- Ellemann K, Soerensen JN, Pedersen L. Epidemiology and treatment of diabetic ketoacidosis in a community population. *Diabetes Care* 1984; 7: 528-32.
- Faich GA, Fishbein HA, Ellis SE. The epidemiology of diabetic acidosis: a population-based study. *Am J Epidemiol* 1983; 117: 551-8.
- Bagg W, Sathu A, Streat S. Diabetic ketoacidosis in adults at Auckland Hospital, 1988-1996. *Aust N Z J Med* 1998; 28: 604-8.
- Basu A, Close CF, Jenkins D. Persisting mortality in diabetic ketoacidosis. *Diabet Med* 1993; 10: 282-4.
- Carroll P, Matz R. Uncontrolled diabetes mellitus in adults: experience in treating diabetic ketoacidosis and hyperosmolar nonketotic coma with low-dose insulin and a uniform treatment regimen. *Diabetes Care* 1983; 6: 579-85.
- Wagner A, Risse A, Brill HL. Therapy of severe diabetic ketoacidosis. Zero-mortality under very-low-dose insulin application. *Diabetes Care* 1999; 22: 674-7.
- Krentz AJ, Natrass M. Acute metabolic complications of diabetes: diabetic ketoacidosis, hyperosmolar non-ketotic hyperglycaemia and lactic acidosis. In: Pickup JC, Williams G, eds. *Textbook of diabetes*. 4th Ed. Oxford: Blackwell Science Ltd, 2003: 32.1-32.24.
- Hamdy O. Diabetic ketoacidosis. June 2004. <http://www.emedicine.com/Specialties/Medicine/Endocrinology>
- World Health Report 2003. World Health Organization (WHO).1211 Geneva 27, Switzerland.
- Hamblin PS, Topliss DJ, Chosich N, Lording DW, Stockigt JR. Deaths associated with diabetic ketoacidosis and hyperosmolar coma. 1973-1988. *Med J Aust* 1989; 151: 439-44.
- Pinhas-Hamiel O, Dolan LM, Zeitler PS. Diabetic ketoacidosis among obese African-American adolescents with NIDDM. *Diabetes Care* 1997; 20: 484-6.
- Ennis ED, Stahl EJ, Kreisberg RA. Diabetic ketoacidosis. In: Porte D Jr, Sherwin RS, eds. *Ellenberg and Rifkin's Diabetes mellitus*. 5th ed. Stamford, Conn.: Appleton and Lange, 1997: 827-44.
- English P and Williams G. Hyperglycaemic crises and lactic acidosis in diabetes mellitus. *Postgraduate Medical Journal* 04; 80: 253-261.
- Umpierrez GE, Kitabchi AE. Diabetic ketoacidosis: risk factors and management strategies. *Treat Endocrinol*. 2003; 2 (2): 95-108.
- Bashir T, Zafar J, Sharif M, Qazi R A, Siddiqui S, Ambreen S et al. Diabetic ketoacidosis: clinical presentations and precipitating factors *J Pakistan Inst Med Sci Jul* 04; 15 (1): 857-61.
- Ahmed F, Zafar S, Khan H. Precipitating factors for Diabetic Ketoacidosis *Med Channel Sep* 2004; 10 (3): 48-50.
- Lin SF, Lin JD, Huang YY. Diabetic ketoacidosis: comparisons of patient characteristics, clinical presentations and outcomes today and 20 years ago. *Chang Gung Med J*. 2005 Jan; 28 (1): 24-30.