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DIABETIC KETOACIDOSIS;

EVALUATING OUTCOMES IN THE MANAGEMENT OF DIABETIC KETOACIDOSIS AMONG ESTABLISHED AND NEWLY DIAGNOSED TYPE 1 DIABETICS

Muhammad Imran Hassan Khan[1], Junaid Mushtaq[2], Ibtesaam Amjad[3], Israr ul Haque Toor[4], Ghias un Nabi Tayyab[5]

1. MBBS, FCPS (Medicine), MRCP (UK), MRCPS (Glasg), FRCP (Edin), FRCP (Glasg); FRCP (London); Associate Professor Department of Medicine PGMI / AMC / LGH, Lahore.
2. MBBS, FCPS Postgraduate Resident, Medical-1 PGMI / AMC / LGH, Lahore.
3. MBBS, FCPS Postgraduate Resident, Medical-1, PGMI / AMC / LGH, Lahore.
4. MBBS, FCPS (Medicine), Associate Professor, Medical-1, PGMI / AMC / LGH, Lahore.
5. MBBS, FCPS (Medicine), MRCP (UK), Professor and Principal Ameer ud Din Medical College, PGMI / AMC / LGH, Lahore.

Correspondence Address:
Dr. Muhammad Imran Hassan Khan
Department of Medicine
Incharge Medical Unit 2,
PGMI / AMC / LGH, Lahore.
mimranhkhan@hotmail.com

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ABSTRACT… Objectives: To observe the frequency, precipitating factors and outcome of diabetic ketoacidosis (DKA) in adults with established and newly diagnosed type 1 diabetes at a tertiary care hospital. **Study Design:** Retrospective study. **Setting:** Lahore General Hospital, Lahore. **Period:** From January 2013 through December 2015. **Methods:** Patients who were admitted with a diagnosis of DKA. The clinical presentations, laboratory investigations, management, time of recovery and outcome were compared. Data were collected via retrospective chart review. **Results:** A total of 202 patients were included who fulfilled the criteria of DKA, of which 160 (79.2%) were less than 26 years of age with a male predominance of 156 (97.5%). Out of all cases 72 (35.6%) had established Type 1 diabetes and 130 (64.4%) were newly diagnosed. The most common presenting complaints in both groups were sepsis 105 (52%). The comparison of clinical improvement and laboratory investigations between the two groups showed that newly diagnosed Type 1 diabetes patients had lower pH, low bicarbonate and high BSR at presentation as compared to those with established type 1 diabetes. The patients with established diabetes improved earlier, required lesser duration of intravenous fluids and IV insulin was changed to subcutaneous in less time. Hospital stay of more than 7 days was observed in patients with new diagnosis. **Conclusion:** It can be concluded from the above data that earlier diagnosis of type 1 diabetes mellitus, appropriate treatment, regular screening for complications and infections will result in less hospital admissions and better outcome.

Key words: Diabetes, Ketoacidosis, Precipitating Factors.

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INTRODUCTION

Diabetic ketoacidosis is a potentially fatal metabolic disorder that possibly due to insulin deficiency or peripheral resistance to insulin, leading to hyperglycemia, ketosis and electrolyte imbalance. It is associated with significant morbidity and mortality in this population. DKA is seen in all age groups, adolescent to elderly. A study conducted in 4,807 cases of DKA episodes showed that 14 percent occurred in above 70 years, 23 percent in 51 to 70 years age group, 27 percent in 30 to 50 years of age, and 36 percent in younger than 30 years.[1] The case fatality for DKA is 1 to 5 percent.[2,3] It is the leading cause of death in persons younger than 24 years with diabetes, mostly because of cerebral edema. The most common precipitant of DKA is missing the dose of insulin. Other precipitating factors include medications, psychological problems, eating disorders, insulin pump dysfunction, and illegal substance use.[4,5] Mostly DKA is seen in type 1 diabetes but type 2 diabetes patients can also present with it. Diagnostic criteria include blood glucose >250 mg/dL, arterial pH of ≤7.30, bicarbonate level of ≤18 mEq/L, and anion gap of >10–12 adjusted for albumin.[6]

Diabetic ketoacidosis management is based on correcting the underlying electrolyte imbalance, highlighting the precipitating factors and management based on the laboratory results. Most important part of treatment is IV fluid therapy which greatly influences the positive outcome in patients.

Appropriate education about this health problem

is very important. It is observed that if patient is knowledgeable about the features of DKA, it is likely that there is less chance of complication, emphasizing the importance of health education in type 1 diabetics.[7]

The objective of this observational study was to identify the precipitating factors in our population, outcome of management and stay in hospital, making two groups and comparing them for the management outcomes. It can help us in improving patient care for future.

METHODS

Retrospective data of patients admitted with a diagnosis of DKA, established and new cases based on the diagnostic criteria for DKA, at a tertiary care hospital from January 2013 through December 2015. Two groups were made, including those with Established and Newly diagnosed Type 1 diabetics. The established type 1 were those who were known to have this disease, and now admitted with DKA. The newly diagnosed were those who did not know they had Diabetes, and presented with DKA for the first time. The clinical presentations, laboratory investigations, duration of stay in hospital, the treatment required and outcome were compared in both these groups. Statistical analysis was made by calculating percentages.

RESULTS

A total of 202 patients were included who fulfilled the criteria of DKA, of which 160 (79.2%) were less than 26 years of age with a male predominance of 156 (77.2%). Out of all cases 72 (35.6%) had established Type 1 diabetes and 130 (64.4%) were newly diagnosed. The most common presenting complaint in both groups was sepsis 105 (52%). The comparison of clinical improvement and laboratory investigations between the two groups showed that newly diagnosed Type 1 diabetes patients had lower pH, low bicarbonate and high BSR at presentation as compared to those with established type 1 diabetes. Patients with established diabetes improved earlier, required lesser duration of intravenous fluids and IV insulin was changed to subcutaneous in shorter time. Hospital stay of more than 7 days was observed in patients with newly diagnosed type 1 diabetes. Mortality rate was 14 (6.9%) and higher ratio was seen in newly diagnosed patients. Figure-1,2,3,4,5,6

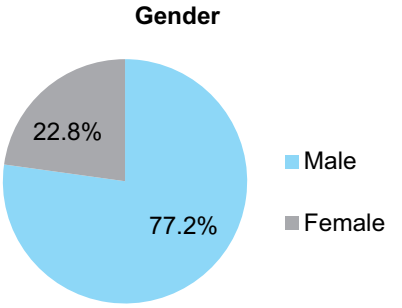

Figure-1

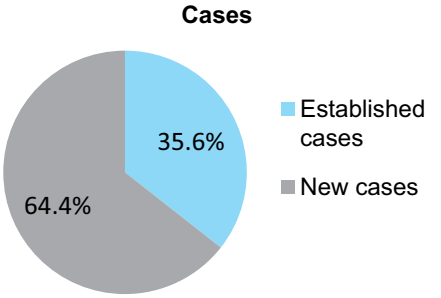

Figure-2

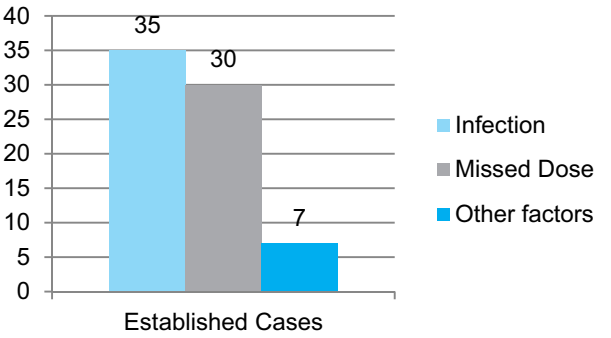

Figure-3. Precipitating factors

DISCUSSION

In this study, 202 patients presenting with DKA were involved, both established and new cases. Most of them were less than 26 years of age and a large proportion were newly diagnosed cases, presenting for the first time with classical symptoms. Lesser number had already known to have this disease.

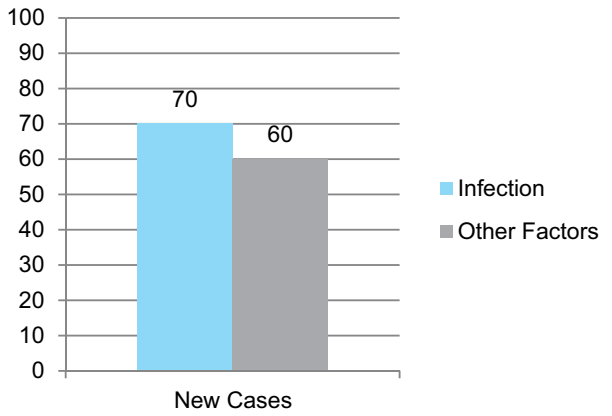

Figure-4

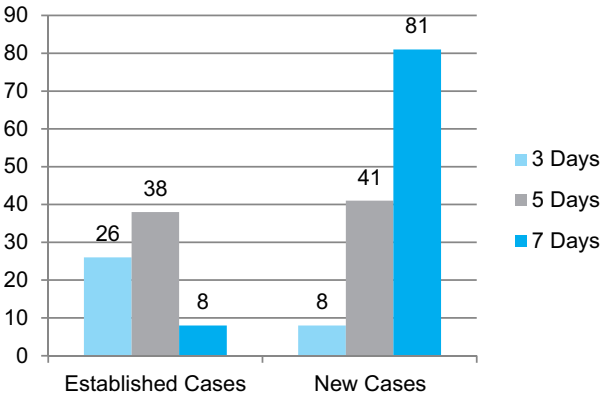

Figure-5. Duration of stay in hospital

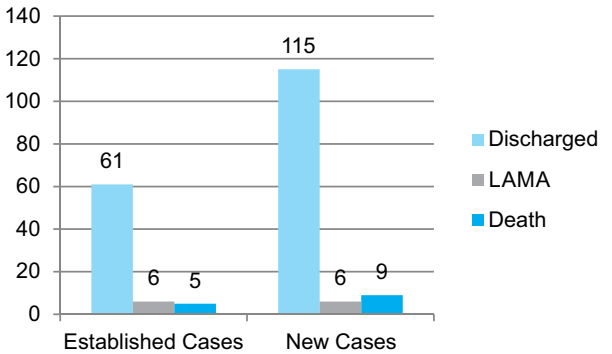

Figure-6. Outcome of patients

In patients with established Type 1 diabetes, commonest precipitating factor was infection (48.6%). It was followed by missed dose of insulin injection (41.7%). Even in newly diagnosed patients, observation was made that infection was most common precipitating factor (53.8%). The study disclosed that in infection, the most common was pneumonia, which comprised 65% of cases. It was followed by urinary tract infection in both groups. A similar study conducted by Umpierrez GE et al showed that 20%–25% of cases had infections as the first manifestation in a previously undiagnosed diabetes mellitus cases.[8] In 2%–10% cases, no obvious precipitating factor was be identified.[8]

Another important concern was the health education and knowledge regarding the Type 1 diabetes. In our study, majority of the patients were newly diagnosed and they had no knowledge that this condition can occur in a young patient with some serious consequences. Even the patients who were on Insulin, did not possessed correct knowledge regarding the importance of injecting insulin on time. Nearly half of our patients presented with DKA after missing insulin dose. The lack of compliance was due to many factors, but most common was limited financial resources and lack of awareness. Musey VCet al and Maldonado MR et al also conducted a similar study in African-American patients. They studied inner city and minority populations. Their conclusion was similar to ours, showing that insulin discontinuation and history of poor compliance is responsible for more than half of DKA admissions in this set of patients.[9,10]

Conclusion from our study was that infections were the main offender, precipitating DKA, leading to the inference that patients with diabetes should be closely monitored for this source. Ennis EDet al carried out a study with similar results in hyperosmolar hyperglycemic patients. Their most common precipitating factor was also infection.[11] Hence it can be deducted that it is important to emphasize health education regarding infection preventive measures, to avoid such episodes. It will reduce the burden on health care expenditure, especially in developing country like Pakistan. In another study by Kim S et al and Agency for Healthcare Research and Quality, their database showed that approximately 2.4 billion US dollars are spent annually on hospitalization of patients with DKA.[12,13] It emphasizes the need to address prevention of this cause.

Secondly, it showed that large number of patients presented for the first time with DKA. It was mainly due to the fact that most of them were unaware that diabetes can happen in adolescence. In the newly diagnosed, it was observed that the most common symptom was weight loss, which was not properly worked up for cause. It eventually led to DKA and hospital emergency admissions. Most of such patients belonged to rural areas, where there was no proper screening and education about these conditions.

Based on the information for established and new cases, different management plan was executed, which resulted in difference in hospital stay and outcome of the patients. It was observed that newly diagnosed cases had a management plan which was more aggressive. Their hospital stay was also prolonged at 7 days, when compared to established cases, where the mean duration was 5 days. According to 2011 National Diabetes Fact Sheet Atlanta, GA, in 2009 there were 140,000 hospitalizations for diabetic ketoacidosis (DKA) with an average length of stay of 3.4 days.[14] The morbidity rate was higher in newly diagnosed patients. Although the mortality rate was the same in both the newly diagnosed cases and established cases presenting with DKA (6.9% vs 6.9%). Wang Jet al and Kitabchi AE et al, DKA has a case fatality rate of 1 to 5 percent with a higher rate in elderly patients. It was different in our study. Possible reason for this higher mortality in our study could be that we need better services for in patient care, which are lacking. Also patients do present late and are less than 26 years of age.

Golden SHet al and Peyrot Met al documented in their study that emphasis should be on creating awareness for the prevention of DKA. It is only possible with better access to health care facilities, education on relevant knowledge for both family members and patients, and modern and effective communication between all stake holders during an illness. Another important issue is the compliance of patients with prescription medicine, especially during an infection. Regular monitoring of glucose with patient empowerment at home, and maintaining glucose level within the reference range also helps in prevention of such episodes. Regular glucose monitoring has the benefit of indicating the patients that early detection of glucose abnormality will allow time for appropriate intervention.[15,16] Robbins JM et al showed in their study that nutritional education can result in reduced hospitalization, especially if specialist care is available.[17] Funnell MMet al showed in the guidelines for diabetes self-management education that detailed standards for diabetes self-management education can improve patient health.[18] We can adopt these suggestion easily, as shown in our study, because the risk factors are similar.

CONCLUSION

Diabetic Ketoacidosis is a preventable condition, the rate of morbidity and mortality can be reduced by building awareness in the community, approachability to health care facilities, disabling financial barriers and timely management of coexisting infections. Not only will it help to reduce medical overheads, but also a better outcome for the diabetic patients. Nonetheless, health education is the most important factor.

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REFERENCES

1. Henriksen OM, Røder ME, Prahl JB, Svendsen OL. **Diabetic ketoacidosis in Denmark incidence and mortality estimated from public health registries.** Diabetes Res Clin Pract. 2007; 76(1):51–56.

2. Wang J, Williams DE, Narayan KM, Geiss LS. **Declining death rates from hyperglycemic crisis among adults with diabetes,** U.S., 1985–2002. Diabetes Care. 2006; 29(9):2018–2022.

3. Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN. **Hyperglycemic crisis in adult patients with diabetes.** Diabetes Care. 2009; 32(7):1335–1343.

4. Kitabchi AE, Nyenwe EA. **Hyperglycemic crises in diabetes mellitus: diabetic ketoacidosis and hyperglycemic hyperosmolar state.** Endocrinol Metab Clin North Am. 2006; 35(4):725–751. [PubMed]

5. Randall L, Begovic J, Hudson M, et al. **Recurrent diabetic ketoacidosis in inner-city minority patients:**

behavioral, socioeconomic, and psychosocial factors. Diabetes Care. 2011; 34(9):1891–1896.

6. Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN. **Hyperglycemic crises in adult patients with diabetes.** Diabetes Care. 2009; 32(7):1335–1343.

7. Schumann C, Faust M. **[Diabetic Ketoacidosis and Hyperosmolar Hyperglycemic State].** Dtsch Med Wochenschr 1946. 2018 Mar; 143(6):384–91.

8. Umpierrez GE, Khajavi M, Kitabchi AE. **Review: diabetic ketoacidosis and hyperglycemic hyperosmolar nonketotic syndrome.** Am J Med Sci 1996; 311: 225-33.

9. Musey VC, Lee JK, Crawford R, Klatka MA, McAdams D, Phillips LS. **Diabetes in urban African-Americans. I. Cessation of insulin therapy is the major precipitating cause of diabetic ketoacidosis.** Diabetes Care1995; 18: 483– 489 [PubMed].

10. Maldonado MR, Chong ER, Oehl MA, Balasubramanyam A. **Economic impact of diabetic ketoacidosis in a multiethnic indigent population: analysis of costs based on the precipitating cause.** Diabetes Care 2003; 26: 1265– 1269 [PubMed].

11. Ennis ED, Stahl EJVB, Kreisberg RA. **The hyperosmolar hyperglycemic syndrome.** Diabetes Rev 1994; 2: 115–126.

12. Kim S. **Burden of hospitalizations primarily due to uncontrolled diabetes: implications of inadequate primary health care in the United States.** Diabetes Care 2007; 30: 1281– 1282 [PubMed].

13. **Agency for Healthcare Research and Quality Databases and related tools from the healthcare cost and utilization project (HCUP) [article online]. National Center for Health Statistics, Centers for Disease Control.** Available from www.hcup-us.ahrq.gov/reports/statbriefs Accessed 24 January 2009.

14. 2011 National Diabetes Fact Sheet. **Atlanta, GA: Centers for Disease Control and Prevention; 2011.** [Accessed April 7, 2014]. Available from: http://www.cdc.gov/diabetes/pubs/factsheet11.htm.

15. Golden SH, Sapir T. **Methods for insulin delivery and glucose monitoring in diabetes: summary of a comparative effectiveness review.** J Manag Care Pharm. 2012; 18(Suppl 6):S1–S17. [PubMed].

16. Peyrot M, Rubin RR. **Patient-reported outcomes for an integrated real-time continuous glucose monitoring/ insulin pump system.** Diabetes Technol Ther. 2009; 11(1):57–62. [PubMed].

17. Robbins JM, Thatcher GE, Webb DA, Valmanis VG. **Nutritionist visits, diabetes classes, and hospitalization rates and charges: the Urban Diabetes Study.** Diabetes Care 2008; 31: 655– 660 [PMC free article] [PubMed].

18. Funnell MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B, Maryniuk M, Peyrot M, Piette JD, Reader D, Siminerio LM, Weinger K, Weiss MS. **National Standards for Diabetes Self-Management Education.** Diabetes Care 2009; 32(Suppl. 1): S87– S94 [PMC free article] [PubMed].

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	M. Imran Hassan Khan	Research idea, Supervision, Review of Literature, Write up and Final review of the manuscript.	
2	Junaid Mushtaq	Data collection, Write up, Literature Review, result writing, statistical analysis.	
3	Ibtesaam Amjad	Data collection, Statistical Analysis, Write up.	
4	Israr ul Haque Toor	Write up, Literature Review Supervision.	
5	Ghias un Nabi Tayyab	Literature Review, Supervision.