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Original Research Article

Diabetic Ketoacidosis-Prospective Study of Clinical Profile and Outcome in a Tertiary Care Hospital

Rajendra Chaudhary[1], Rajkishore Singh[2], Pranesh Nigam[3]
[1]Professor of Medicine, Baba Raghav Das Medical College, Gorakhpur-273013, UP, India
[2]Assistant Professor of Medicine, Baba Raghav Das Medical College, Gorakhpur-273013, UP, India
[3]Ex. Professor of Medicine, Baba Raghav Das Medical College, Gorakhpur-273013, UP, India

***Corresponding author**
Rajendra Chaudhary
Email: rajendra.chaudhary099@gmail.com

Abstract: Diabetic-Ketoacidosis (DKA) is a life threatening complication of diabetes mellitus [DM]. It classically occurs in young patient with Type 1DM However it occurs in patients with Type 2 DM and In India. Its incidence is increasing. This study was undertaken to analyse the clinical profile and its outcome of DKA mainly in adults in a tertiary care hospital. This study was under taken in Gorakhpur on 52 cases from January 2014 to December 2015. Diagnosis [10, 11] was made by the presence of hyperglycemia (Blood sugar >250 mg), acidosis (Arterial pH≤7.3) serum carbonate (≤15mEq) and ketonemia. All relevant investigations were performed and patients were treated with the aim to achieve ketone free condition and euglycemia. Fifty two cases (61.2%) out of 85 cases who had fulfilled the DKA diagnostic criteria [10, 11] constituted the clinical material whose age varies from 15 to 75 year(42.5±8.3 year) with male and female ratio of 1:1.08, Ten patient (17.0%) were of Type1DM of whom 3 (5.78) were below 20 years of age. Most of the female were from 4th(8 out of 12 cases 66.0%) and 5th (8 out of 14 cases 57.2%) decade of life. 26 cases(50%) had infection as precipitating factor. The main infection was lobar pneumonia [19.2%] pulmonary tuberculosis (15.5%) and urinary tract infection (9.6%). In Type 1DM cases the main cause of DKA was irregular and discontinuation of insulin therapy otherwise in Type 2 DM cases the irregular treatment, lack of diet control and exercise. The main presenting features were dehydration [76.9%] nausea vomiting [59.6%] and hypotension [42.3%]. Characteristic Kusmauli breathing with sweet odor (17.2%). Poor compliance was main feature for the severity of DKA. The average length of hospital stay was longer in Type1 DM [9 days] Mean fluid requirement on first day was 3.5 liter and insulin 112 IV for clearing ketonurea and acidosis. The overall mortality was 10.3%. Diabetic ketoacidosis is a fatal acute metabolic complication of diabetes mellitus with heterogeneous clinical presentation Poor compliance was associated with severity of DKA and infection precipitate the DKA easily The timely early diagnosis and treatment can avoid morbidity and mortality.

Keywords: Diabetic Ketoacidosis, Diabetes Mellitus, Hyperglycemia, Metabolic Acidosis, Poor compliance, Infection

INTRODUCTION

Diabetic Ketoacidosis (DKA) a biochemical triad of hyperglycemia, ketonemia, (Ketonurea) and acidosis (acidemia) is the most serious hyperglycemic emergency in patient with Type1 and Type2 diabetic mellitus (IDM) [1]. In general DKA is always described to be closely associated with Type1 DM. The occurrence of DKA has been thought to indicate the underlying significant and irreversible cell damage that classifies these diabetic patients as type 1 DM. However many DKA patient do have clinical course and metabolic features of Type 2 DM There is a strong almost dogmatic errant perception by clinician that DKA is a complication that occurs mainly in patient with Type 1 DM but in fact DKA does occur in type 2 DM and is mainly associated with precipitant events.

Recently it has been observed the increased incidence of DKA during the past two decades [2] which is related to increase prevalence of type 2 DM. With the change in the frequency of DKA and the increased incidence of DKA in patient with Type 2 DM the question arises whether there has been any change in the clinical and/or laboratory characteristics of patient with DKA who present to the emergency department

There are very few reports focusing on the Type 2 DM. Patients who suffered from DKA episodes. The present study was an effort to explore the clinical and laboratory characteristics of diabetics' who are admitted with DKA episode in the hospital.

MATERIALS AND METHODS

Eighty five patient of age 12 year and above included in this study who were admitted in emergency during the period of Jan 2014 to Dec 2015 They were classified as Type 1 and Type 2 DM and NIDDM on the basis of history and available record. Diabetic ketoacidosis (DKA) was diagnosed on the following criteria of International Society of Pediatrics and adolescence diabetes (ISPAD) [10, 11]

1. Blood sugar >250 mg%
2. Blood PH ≤7.3
3. Serum bicorbonate≤15 mEq/L
4. Kitonurea and Kitonemia

The severity was based on degree of acidosis [11-13]. First degree or Mild PH 7.2-7.3, Bicarbonate 15-18mEq/L, second degree or moderate PH 7.1-7.2, bicarbonate 10-14mEq/L. Third degree or severe PH <7.1, bicarbonate <15mEq/L. Fifty two cases who were fulfilling the criteria of DKA were subjected to detailed history and physical examination with routine and relevant laboratory investigation following ADA criteria [11]. The treatment was started promptly with insulin infusion and other supportive measures. The aim was to achieve ketone free urine with near normal acid-base balance and electrolytes. The insulin infusion was discontinued, 2 hours after administration of subcutaneous insulin. Once patient had resolution of their metabolic status including the ketone free urine and were able to tolerate oral feeding. The stressful event where defined by (1) clinical and/or biochemical, evidence of any infection (2) inflammatory, painful or physically traumatic process and (3) use of any drug likely to elevate plasma cortisol or catecholamine. Infection was either clinically or microbiologically documented e.g. urinary tract infection (UTI) by dysuria increased frequency and burning etc. Respiratory infection by cough with or without sputum pain in chest and presence of crepts and other systemic infection. The evidence of infection was documented with appropriate investigation as and when needed

OBSERVATION AND RESULT

Amongst the 85 cases attending or admitted in emergency 52 of them fulfilled the DKA criteria [10-13] was included in this study. Their age range of from 15 to 72 year with Mean ± SD=42.5±8.3 year and male to female ratio of 1:1.08 (Table 1). Most of them from 4^{th} (23.1%) and 5^{th} (26.9%) decade of life .Ten patient (17.2%) were of Type1DM and 4 of them were below 20 year of age. Females predominated the series and most of were from 4^{th} (8 out of 12 cases, 66.6%) and 5^{th} (8 out of 14 cases 57.1%) decade of life. Precipitating factor were enlisted in Table-2 and most important precipitating factor was infection (50%) which were in the form of lung infection as lobar pneumonia (19.2%) and pulmonary tuberculosis (15.3%) and urinary tract infection (9.6%) Amongst 5 cases of unknown precipitating factor they were of Type1 DM and had discontinued therapy or irregular therapy. The freshly diagnosed cases were 6 (9.6%) with duration of disease less than 3 years.

Table 1: Age and Sex distribution of DKA patients (n=52)

Age group in Years	Male	Female	Total	%
<20	2	1	3	5.7
21-30	4	5	9	17.3
31-40	4	8	12	23.1
41-50	6	8	14	26.9
51-60	6	3	9	17.3
>60	3	2	5	8.6
Total	25	27	52	100
Male:Female	1	1.08	-	-
Minimum Age	16	15	15	-
Maximum Age	72	68	72	-
Age=Mean±SD	42.6±8.8 yrs	58.6±7.6 yrs	42.5±8.3 yrs	-

As depicted in Table 3 the main presenting features were dehydration (76.9%) nausea and vomiting (59.6%) Hypotension (42.3%) Hypotension (42.3%) was the main feature of Type 1DM who was associated with polyurea, dehydration and characteristic Kasmaul breathing.

Laboratory investigations (Table 4) revealed blood sugar 446.2±87.5mg but in Type1 DM it was 532.5±4.8. Mean pH 7.12±0.11, while 3 cases (one of Type1 DM and 2 of Type 2DM) revealed severe acidosis i.e. arterial pH 0f<7. On the basis of pH value they were graded as mild moderate and severe degree of severity (Table 5) and most of them were of moderate (46.1%) degree of severity.

The average length of hospital stay was slightly longer in Type 1 DM as compared to Type 2 DM i.e. 9 days and 7 days respectively (insignificant p=0.49). Mean fluid requirement on first day of therapy was 3.5 liters and mean insulin required for clearance of ketone bodies was 112 I.V. and mean time taken was

34.5 hrs. Six patients (2 of Type 1DM and 4 of Type 2DM expired before the clearance of kitone bodies. Other complication noted were hypoglycemia (blood sugar <70mg% in 6 cases) during insulin infusion, Hypokalemia in 8 cases (13.8) and there were manage accordingly.

Table 2: Precipitating factors (n=52)

Lobar	No. of Cases	%
Infection-Pneumonia	10	19.2
Pulmonary Tuberculosis	8	15.3
Urinary Tract Infection	5	9.6
Diabetic foot	3	5.5
Stressful condition	5	9.6
Non-Compliance of Treatment	10	19.2
First Presentation	6	9.6
Unknown	5	8.6

Table 3: Clinical Manifestations (n=52)

	No. of Cases	%
Dehydration	40	76.9
Nausea/Vomiting	31	59.6
Polyurea/Polydypsia	18	34.6
Pain in Abdomen	12	23.1
Hypertension	22	42.3
Kussmaul Breathing	10	19.2
Altered Sensorium	7	13.4
Weakness	14	26.9
Constitutional Symptoms	26	50.0

Table 4: Biochemical Profile at the time of admission (n=52)

Biochemical Findings	Values (Mean±SD)
Blood Sugar (mm/dL)	44.62±87.5
Arterial pH	7.12±0.11
Arterial Bicarbonate (mEq/L)	9.4±4.9
S. Sodium (mEq/L)	132.1±6.8
Serum Potassium (mEq/L)	4.6±1.04
Blood Urea (mg/dL)	52.5±12.6
S. Creatinine (mg/dL)	1.7±0.8

Table 5: Severity of Diabetic ketoacidosis (n=52)

Grade	No. of Cases	%
Mild-Arterial pH 7.2-7.3	12	23.1
Moderate-Arterial pH 7.1-7.2	24	46.1
Severe-Arterial pH <7.1	16	30.8

DISCUSSION

DKA is life threatening condition caused by a decrease in effective circulatory insulin along with an increase in counter-regulatory hormones (glucagon, catecholamine, cortisol and growth hormone) leading to hyperglycemia, hyperosmolarity, increased lipolysis, ketonemia and metabolic acidosis [12].

The incidence of DKA in Type 2DM varied from 21.7% to 80% [13, 14]. Moreover in developing countries like India due to poor socioeconomic status many patient of Type 2 DM tend to poor compliance and poor glycemic control which precipitate DKA National Centre of Health Statics [5] and Adhikari *et al* [17] stressed the same. Fifty-two out of 85 diabetics were admitted in Emergency and fulfilled the DKA criteria [10]. Amongst these 52 cases, 10 of them (17.4%) were of Type1DM and four of them were below 20 year of age and 2 were above 60 year of age. These were labeled as insulin dependent DM rather Type 1 DM. They were taking Insulin irregularly leading to DKA. Mean age of presentation in present study was 42.5±8.3 year and mainly of type 2 DM as their number is more (42 cases, 80.78). In literature it

varies from 40 year to 51.4 year 15-19. We noticed the predominance of females with male to female ratio of 1:1.08 (female 51.9%) This same was observed by Onyiriuka [20] who reported the female incidence of 59.5%. The predominence of females can be explained on the basis of harmonal changes i.e. level of estrogen in female. In addition cytokines e.g. 1L-1, 6 and TNF-Produced during stress, which antagonise the effect of insulin leading to DKA [21]. This stress will decrease the affectivity of circulating insulin with an elevation in the serum the counter regulatory hormone [12]. The freshly diagnosed cases of DM with DKA were 9.6% in our series and the same variation of 10 to 27% has been reported in literature [23, 26, 27]. Weakness (26.9%) nausea, vomiting (59.6%) and hypotension (42.3%) was the common presenting feature with dehydration (76.9%) and polyurea polydepsia (34.6%). Ten (19.2%) patented typical Kausmaul breathing with fruity (sweet) smell, representing respiratory acidosis as desorbed in literature [17, 22, 23]. Infection (50%) was the main precipitating cause of which lobar pneumonia (19.2%) and pulmonary tuberculosis (15.3%) were leading factor. Other factors noticed were hyperglycemia, leucocytosis, dysfunction macro vascular disease and acidosis [17, 22, 23]. Apart from infection as a major precipitating cause (50%) the omission of insulin therapy for a variety 0f reason has also been shown to be the leading precipitating cause of DKA [29]. In the present study the patient below 20 years of age (3 cases) and few of them above 20 year (10 cases) were using insulin, but due to some reasons or other they discontinue or became irregular in taking insulin developed DKA. In Type 2 DM the patient who omitted the oral anti diabetics lead to hyperglycemia and afterward the DKA. Other factors may also be responsible for the development of DKA were lack of exercise, not following diet restriction etc. Table 4 depicts the laboratory finding of DKA are consistent with literature [24, 25]. Potassium level will lend to be high because of the physio pathological hyper osmolarity and insulin deficiency although it is known that total body store of potassium is depleted in DKA [24, 26].

The overall mortality in present study was 11.5% which is quite similar to other studies [26, 28]. Westphal reported low mortality of 5.3%, while Adhikari *et al* [17] and Matoo *et al* [28] reported the mortality of 16.3% and 25.7% respectively. This reflects that Type 2 DM is more serious disease with worst outcome as compared to Type 1 DM. Most of the Indian studies report the mortality ranging from 20-30% [17, 27-29].

CONCLUSION

DKA remains a frequently observed hyperglycemic emergency with high totality rate. A significant proportion of DKA occur in patient with Type 2DM and many of those can be prevented with proper patient education and effective communication along with quite efficient management.

Therefore education of diabetic patient about working symptoms of Ketoacidosis such as weakness abdominal pain, nausea vomiting and drowsiness are mandatory for early diagnosis and treatment.

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