Turkish Journal of Endocrinology and Metabolism, (1998) 4 : 221-224 **ORIGINAL ARTICLE**

Analysis of Diabetic Ketoacidosis and Hyperosmolar Nonketotic Coma Cases

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In this ret rospective study, diabetic ketosis (DK), ketoacidosis (DKA) and hyperosmolar nonketotic coma (HONC) cases were analysed in a 15 year period (1980-1995).

File documents of patients admitted to Hacettepe University Hospital were evaluated. Based on the medical records, clinical history and laboratory features, patients were classified to have DK, DKA and HONC.

Of 82 cases evaluated, 47 of them fulfilled the criteria for DKA, 23 cases for diabetic ketosis and the remaining 12 cases for HONC. Of 47 cases with DKA, 66% had juvenile onset (<30 years) type I diabetes, 14.9% had adult onset (≥30 years) type I diabetes and the remaining 19.1% had type II diabetes mellitus. Of patients with diabetic ketosis, 78% had type II, 13 % had juvenile onset, 4.3% had adult onset type I and 4.3% had secondary diabetes. All cases with HONC were diagnosed as having type II. Ketoacidosis was found as the initial clinical presentation in 13.4% of cases. In the whole group, the most common precipitating factor was infection (32.9%). Omission of insulin therapy (9.8%), trauma (4.9%), myocardial infarction (2%) and cerebrovascular accident (1%) were other precipitating factors. In 25.6% of patients, the cause of ketoacidosis was unknown. As to DKA cases, urinary tract infection in two patients (4.3 %), hypoglycemia in five patients (2.1%), thrombophlebitis in one patient (2.1%), acute renal failure in two patients (4.3%) and for diabetic ketosis cases, hypoglycemia in 4 patients(17.3%) and sepsis in 2 patients(8.7%) developed as a complication during the treatment.. In HONC cases, sepsis, brain edema, thrombophlebitis and mesenteric vascular disease were seen in one patient (8.3%) for each. Mortality rates for DKA, diabetic ketosis and HONC cases were 6.4%, 8.7% and 33.3% respectively.

The data suggest that DKA and HONC are still major problems in diabetic patients despite the adv ance in diagnosis and treatment.

KEY WORDS Diabetic ketoacidosis, hyperosmolar nonketotic coma

Introduction

Diabetic ketoacidosis (DKA) and hyperosmolar nonketotic coma (HONC) are states of severe metabolic derangement that may be fatal despite the advance in diagnosis and treatment. In this retrospective study, we examined the clinical characteristics of diabetic patients who presented with diabetic ketosis (DK), DKA and HONC.

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Patients and Methods

DK, DKA and HONC cases admitted to Hacettepe University Hospital in a fifteen year period (1980-1995) were analysed. Diagnosis of DKA was based on the fulfillment of each of the following criteria: Plasma glucose on admission >250 mg/dl, plasma HCO_3 <15mEq/L, pH <7.3, ketonemia and an elevated anion gap. Patients with a plasma glucose level >250 mg/dl, blood pH in the normal range and with positive urine keton reaction were accepted as diabetic ketosis cases. For HONC cases; plasma glucose level>450 mg/dl, mental disturbance with serum osmolarity >320 mOsm/L were taken as criteria for diagnosis. Based on

medical records, clinical history and laboratory features, patients were classified to have type I (juvenile: with features of ketotic onset, starting at <30 years, immediate insulin requirement to avoid ketosis, BMI<25kg/m^2 at diagnosis; and adult onset: with features of requirement of insülin within 2 years after the diagnosis, BMI<25kg/m^2 and age >30 years at diagnosis) and type II diabetes mellitus (according to National Diabetes data group criteria).

Results

Of 82 cases evaluated, 47 of them fulfilled the criteria for DKA, 23 cases for DK and the remaining 12 cases for HONC. Of 47 cases with DKA; 66% had juvenile onset, 14.9 % had adult onset type I DM and the remaining 19.1% had type II DM. As to cases with DK, 78% had type II DM, 13% had juvenile and 4.3% had adult onset type I and 4.3% had secondary DM. All cases with HONC were diagnosed as having type II DM.

The mean age of patients with DKA, DK and HONC cases was 39.45 (17-78), 51.13 (17-79) and 62.67 (45-80), and the mean duration of the diabetes mellitus was 61.04 (0-240), 98.57 (0-360) and 85.50 (0-240) months respectively. For 14.9% of patients with DKA, the diagnosis of DKA was made concurrently with a diagnosis of DM.

For ketoasidotic episodes, the mean glucose level on admission was 480.11 mg/dl (224-890); 396.30 mg/dl (202-872) for ketosis cases and 672.58 (450-1000) mg/dl for HONC cases. Clinical characteristics of groups were summarized in Table 1.

As to the whole group (DKA, DK, HONC), the most common precipitating factor was infection (32.9%), mainly urinary tract infection (44%) and respiratory tract infection (11%). Insulin withdrawal (9.8%), trauma (4.9%), myocardial infarction (2%) and cerebrovascular accident (1%) were other precipitating factors. In 25.6 % of cases the cause was unknown which may reflect a substantial loss of β cell function for which insulin therapy is needed for the rest of the patient's life (Table 2).

Treatment: Individualized therapy was applied with bolus insulin injection in the earlier phase, followed by smaller doses of insulin by IV infusion until ketosis was corrected. Deficits of water, Na and K were replaced parenterally. Precipitating factors were analysed and treated vigorously. Correction of ketosis (disappearence of ketonuria) occurred on the average after 28.71 hours.

For the mental status of 23 patients with DK, only 1 patient was stuporous and the remaining were alert, where as for DKA cases; of 47 patients, 13 (27.7%) of them were lethargic, 7 (14.9%) were stuporous, 4 (8.15%) of them were comatous and the remaining 23 (48%) of the cases were alert. As to HONC cases; of 12 patients, 4 of them were lethargic (33.3), 6 were stuporous (50%) and the remaining 2 were comatous (16.7%).

Table 1. Clinical and laboratory features of cases on admission to hospital.

	Diabetic ketoacidosis	Diabetic ketosis	Hyperosmolar nonketotic coma
Age	39,45 (17-78)	51,13 (17-79)	62,67 (45-80)
BMI (kg/m^2)	23,29 (14-43,6)	24,25 (15-35,1)	26,26 (20-32)
Duration of DM (month)	61,04 (0-324)	98,57 (0-360)	85,50 (0-240)
Pulse	96,32 (72-132)	93,48 (60-140)	98,42 (72-130)
Temperature (C)	36,86 (36-39,3)	36,97 (36-39,5)	37,17 (36-40,2)
Blood pressure (mm/Hg)	125,85/77,55	130,43/79,57)	129,17/84,58)
Glucose (mg/dl)	480,11 (224-890)	396,30 (202-872)	672,58 (450-1000)
Na (mEq/L)	136,37 (120-151)	137,83 (129-151)	146,50 (125-169)
K (mEq/L)	4,57 (2.5-6.80)	4,44 (3,7-5,5)	4,73 (3,3-6,3)
Cl (mEq/L)	101,88 (87-124)	102,13 (93-117)	100,42 (85-120)
BUN	28,15 (8-128)	17,74 (8-59)	38,36 (16-75)
pH	7,16 (6,10-7,27)	7,41 (7,33-7,50)	7,35 (7,30-7,40)
Osmolarity (mosm/L)	309,47 (280-347)	302,48 (273-347)	341,92 (326-382)

Table 2. Precipitating factors for the whole group.

Precipitating factors	Frequency (number)	Percent (%)
Infection	27	32,9
Unknown	21	25,6
Insulin deficiency	11	13,4
Insulin withdrawal	8	9,8
Trauma	4	4,9
Myocardial infarction	2	2,4
Acute abdomen	2	2,4
Infection+insulin withdrawal	2	2,4
Operation	1	1,2
Cerebro vascular accident	1	1,2
Tooth extraction	1	1,2
Infection + operation	1	1,2
Pregnancy and hyperemesis gravidarum	1	1,2
Total	82	100

There are a number of complications that accompanied or followed the treatment of the cases. As to DK cases; hypoglycemia in three patients (13%), sepsis in two patients (8.7%), for DKA cases urinary tract infection in two patients (4.3%), hypoglycemia, thrombophlebitis, acute renal failure in one patient (2%) for each, developed during the treatment. For HONC cases; sepsis, brain edema, thrombophlebitis and mesenteric vascular accident developed in one patient for each (8.3%) (Table 3).

Mortality rates for DK, DKA, HONC were 8.7, 6.4, 33.3% respectively. Sepsis was the main factor related with the mortality for DK and DKA cases.

Conclusion

Our results confirm that, HONC is the major problem of patients with type II DM, while DKA is the problem of patients with type I DM. A significant number of cases with HONC occurred in the older age group, while DKA occurred in the younger group, which is in agreement with the previous report (1).

For all cases, infection was the main precipitating factor. Mortality rate was higher with increased age and correlated with serum glucose and osmolality especially for HONC cases. Similar associations, particularly with age have been noted in other series (2,3).

The mortality figure for DKA was found to be 6.4%, while it was 33.3% for HONC. These findings are also in agreement with the previous study, in which the figures were reported in the range of 1-10% for DKA and 30-70% for HONC cases (4). High mortality rate implies that, hyperosmolar state rather than DKA is the primary cause of coma and death. Myocardial infarction, brain edema and in one patient mesenteric vascular occlusion were the major causes of death in HONC cases in our study. Vascular occlusion related with the hyperosmolarity and poor cardiac status of older patients might have a role in this high mortality rate. Also the period before admission to hospital was longer for HONC cases probably related with their age and their social life. This may result in delayed recognition of the symptoms of hyperglycemia or inability to use water, which leads to severe dehydration.

Table 3. Frequency of complications for each group.

Groups	Diabetic ketoacidosis	Diabetic ketosis	Hyperosmolar-nonketotic coma
		number of cases (%)	
Hypoglycemia	1 (2,1)	3 (13)	-
Sepsis	-	2 (8,7)	1 (8,3)
Urinary-tract infection	2 (4,3)	-	-
Thrombophlebitis	1 (2,1)	-	1 (8,3)
Acute renal failure	2 (4,3)	-	-
Brain edema	-	-	1 (8,3)
Mesenteric vascular occlusion	-	-	1 (8,3)

In conclusion, DKA and HONC are serious complications in diabetic patients of all ages. Our observations confirm that despite the advance in diagnosis and treatment, DKA and HONC are still major problems facing the physician.

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