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ANALYSIS OF FREQUENCY OF HYPOMAGNESAEMIA IN PATIENTS PRESENTING WITH DIABETIC KETOACIDOSIS

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Abstract:

Introduction: *Diabetic ketoacidosis (DKA) is a frequent abnormal metabolic entity seen in high-dependency units such as critical care units and in the emergency department. Having an understanding of its pathophysiology, a consequence of absent to low insulin levels, delineates the clinical presentation.* ***Aims and objectives:*** *The basic aim of the study is to analyze the frequency of hypomagnesaemia in patients presenting with diabetic ketoacidosis.* ***Material and methods:*** *This study was conducted in BHV hospital, Bahawalpur during 2018 with the permission of ethical committee of hospital. Two hundred patients that were hospitalized with DKA over a period of 2 years were evaluated clinically and by laboratory tests. Serial assays of serum electrolytes, glucose, and blood pH were performed, and clinical outcome was noted as either discharged to home or death. Although the diagnoses of DKA and HHS can be suspected on clinical grounds, confirmation is based on laboratory tests.* ***Results:*** *The data were collected from 100 patients. The ages of study subjects ranged between 13 to 80 years with a mean±SD of 38.99±18.32 years and a median of 39 years. The majority of patients were younger than 40 years (54.4%) and were male (51.1%). At the final evaluation, a total of 189 patients were discharged (70.0%), while 81 patients were deceased (30.0%). The final outcome was not associated with age (χ^2=5.98, P=0.112), although favorable outcome was 23.8% more frequent in the lower age (<40 years) group than the higher age (≥40 years) group.* ***Conclusion:*** *It is concluded that DKA is characterized by a biochemical triad of hyperglycemia, acidosis, and ketonemia. It continues to be a life-threatening condition despite improvements in diabetic care. Timely identification and intervention are imperative for adequate treatment.*

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INTRODUCTION:

Diabetic ketoacidosis (DKA) is a frequent abnormal metabolic entity seen in high-dependency units such as critical care units and in the emergency department. Having an understanding of its pathophysiology, a consequence of absent to low insulin levels, delineates the clinical presentation.

The condition develops when body can't produce enough insulin [1]. Insulin normally plays a key role in helping sugar (glucose), a major source of energy for your muscles and other tissues enter your cells. Without enough insulin, your body begins to break down fat as fuel. This process produces a buildup of acids in the bloodstream called ketones, eventually leading to diabetic ketoacidosis if untreated [2].

Ketoacidosis can be caused by not getting enough insulin, having a severe infection or other illness, becoming severely dehydrated, or some combination of these things [3]. It can occur in people who have little or no insulin in their bodies (mostly people with type 1 diabetes but it can happen with type 2 diabetes, especially children) when their blood sugar levels are high [4].

The prevalence of DKA type 1 diabetic youth was stable having a P-trend=0.42 (CI=95%) with prevalence of 30.2%, 29.1% and 31.1% during the years 2002-2003, 2004-2005 and 2008-2010, respectively) [5]. Prevalence was notably higher in those diagnosed at a younger age (P<0.0001), with the overall prevalence being highest in those between the ages of 0 and 4 (~39%) and lowest in those between the ages of 15 and 19 years old (~23%). Researchers found the prevalence of diabetic ketoacidosis to be higher in those of minority race (P=0.019) and low income (P=0.019). In household earning between $25,000 and $49,000, the odds of having diabetic ketoacidosis were significantly higher compared to households earning between $50,000 to $74,000 [6]. Depending on the specific population studied and the definition of DKA used, the reported prevalence of DKA in children under 5 years of age at diagnosis varies between 17.3 and 54.5% [7].

Aims and objectives

The basic aim of the study is to analyze the frequency of hypomagnesaemia in patients presenting with diabetic ketoacidosis.

MATERIAL AND METHODSL

This study was conducted in BHV hospital, Bahawalpur during 2018 with the permission of ethical committee of hospital. Two hundred patients that were hospitalized with DKA over a period of 2 years were evaluated clinically and by laboratory tests. Serial assays of serum electrolytes, glucose, and blood pH were performed, and clinical outcome was noted as either discharged to home or death. Although the diagnoses of DKA and HHS can be suspected on clinical grounds, confirmation is based on laboratory tests. The syndrome of DKA consists of the triad of hyperglycemia, hyperketonemia, and metabolic acidosis. Although the diagnoses of DKA and HHS can be suspected on clinical grounds, confirmation is based on laboratory tests. The syndrome of DKA consists of the triad of hyperglycemia, hyperketonemia, and metabolic acidosis. Post cardio-pulmonary resuscitated patients, other hyperglycemic states (impaired glucose tolerance, stress hyperglycemia), and other ketotic states (alcoholic ketosis, starvation ketosis), other metabolic acidotic states (lactic acidosis, hyperchloremic acidosis, salicylism, uremic acidosis, drug-induced acidosis) and patients that did not consent were not included.

Statistical analysis

Continuous data were summarized as mean±SD, while discrete (categorical) data are reported as number and percentage. Two continuous independent groups were compared by parametric independent Student *t* test, and the significance of the parametric *t* test was validated with the nonparametric alternative Mann-Whitney *U* test, where appropriate.

RESULTS

The data were collected from 100 patients. The ages of study subjects ranged between 13 to 80 years with a mean±SD of 38.99±18.32 years and a median of 39 years. The majority of patients were younger than 40 years (54.4%) and were male (51.1%). At the final evaluation, a total of 189 patients were discharged (70.0%), while 81 patients were deceased (30.0%). The final outcome was not associated with age (χ^2=5.98, *P*=0.112), although favorable outcome was 23.8% more frequent in the lower age (<40 years) group than the higher age (≥40 years) group.

Table 1. Demographic Characteristics of the Patients

Characteristic	Discharged	Deceased	χ^2 value	*P* value
Age, yr			5.98	0.112
≤20	39 (20.6)	15 (18.5)		
20–40	78 (41.3)	15 (18.5)		
40–60	48 (25.4)	39 (48.1)		
>60	24 (12.7)	12 (14.8)		
Sex			20.34	<0.001
Female	63 (33.3)	69 (85.2)		
Male	126 (66.7)	12 (14.8)		
Values are expressed as number (%).				

Biochemical features of blood urea, serum creatinine, serum magnesium, serum phosphate, SGOT, SGPT, and serum albumin were found to be significantly ($P<0.05$, $P<0.01$, or $P<0.001$) associated with the final outcome or differed significantly between the two outcomes. However, hemoglobin, platelet count, hematocrit, HbA1c, serum sodium, serum potassium, serum calcium (total), serum calcium (ionic), CRP, T3, T4, TSH, serum cholesterol, triglycerides, serum high density lipoprotein, serum low density lipoprotein, serum very low density lipoprotein, serum bilirubin, serum alkaline phosphatase, and serum protein were similar ($P>0.05$) between the two outcomes, i.e., did not differ statistically.

Table 2: Associations between Continuous Biochemical Profiles and Final Outcome

Variable	Discharged	Deceased	*t* value	*P* value
Hemoglobin, g/dL	11.09±2.80	10.59±2.76	0.78	0.437
Platelet count	2.15±1.29	2.23±1.26	0.27	0.789
Hematocrit, %	42.73±9.81	42.24±12.34	0.20	0.840
Hemoglobin A1c, %	11.85±3.38	12.12±2.87	0.37	0.716
Serum urea, mg/dL	59.17±35.83	111.32±66.61	4.82	<0.001
Serum creatinine, mg/dL	1.51±0.80	2.41±1.29	4.04	<0.001
Serum sodium, mmol/L	124.41±11.65	123.41±14.90	0.34	0.732
Serum potassium, mmol/L	4.88±1.38	5.00±1.46	0.38	0.702
Serum calcium (total), mmol/L	2.09±0.22	2.01±0.21	1.54	0.127
Serum calcium (ionic), mmol/L	0.77±0.22	0.83±0.19	1.33	0.187
Serum magnesium, mg/dL	2.18±0.45	2.51±0.53	3.04	0.003
Serum phosphate, mg/dL	4.38±3.07	6.04±2.73	2.43	0.017
CRP, mg/dL	52.55±58.56	68.63±60.55	1.18	0.241

DISCUSSION:

In our study, sepsis was the most common precipitating factor of DKA and was identified in 60% of cases. Pneumonia (34%) and urinary tract infection (20%) accounted for the majority of infections [8]. Other conditions that precipitated DKA were non-compliance (18.9%), acute pancreatitis (8.9%), myocardial infarction (6.7%), stroke (4.4%), and others (1.1%). Umpierrez et al. also stated that "infection is the most common precipitating factor for DKA, occurring in 30% to 50% of cases. Urinary tract infection and pneumonia account for the majority of infections," which supported the results of this study [9]. However, in a study conducted by Randall et al., insulin discontinuation (non-compliance) was the leading precipitating cause in 68% of patients; other causes were new-onset diabetes (10%), infection (15%), medical illness (4%), and undetermined causes (3%) [10].

Patient age in the present study ranged between 13 to 80 years with a mean±SD of 38.99±18.32 years. In

addition, 54.4% of the patients were younger than 40 years, and subjects were predominantly male (51.1%). Kitabchi et al. found that most patients with DKA were between the ages of 18 and 44 years (56%) and 45 and 65 years (24%), with only 18% of patients <20 years of age [11]. Patients with DKA may present with altered sensorium. In this study, GCS score was not significantly associated with final outcome; however, the *P* value was 0.076, which indicated that there is a trend toward better outcome if GCS is high [12].

CONCLUSION:

It is concluded that DKA is characterized by a biochemical triad of hyperglycemia, acidosis, and ketonemia. It continues to be a life-threatening condition despite improvements in diabetic care. Timely identification and intervention are imperative for adequate treatment.

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