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Full Length Research Paper

Clinical presentation of diabetic emergencies in university hospital

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One of the acute complications of Diabetes Mellitus (DM) is Hyperglycemic Emergencies (HEs), they are widespread in nature. There are only few studies in relation to DM complication in Saudi Arabia. The present study focused on the clinical characteristics which is associated with this DM complication. Present study focused on DM patients with (HEs) patients admitted in an urban hospital in Saudi Arabia. Laboratory data and hospitalization outcome data were pooled, where the outcome measures such as case fatality rates, mortality rates, and predictive factors for HEs mortality were monitored in order to identify the predictors of HEs. The statistical tools like χ^2, t test and logistic regression were employed. In the current, a total of 117 subjects with HEs were include, among which 97 (82.9%) patients were female, were as 20 (17.1%) patients were male. Type I DM were observed in 88.9 % of the subject and 13 (11.1 %) were diagnosed with Type II DM. out of 97 females, 88 (90.7%) had type 1 DM while 9 (9.3%) had type 2 DM. On the other hand, 20 male with HEs consequences, 16 (80%) had type 1 DM while 4 (20%) of them had type 2 DM. Hyperosmolar Hyperglycemic State (HHS) and Diabetic ketoacidosis (DKA) were documented in 117 study subjects. On the basis of biochemical parameters of HEs shows a significant difference in the mean of Blood Sugar (p=0.00) and plasma Osmolality (p=0.05). Both the DKA and HHS electrolyte's subject shows a statistically significant difference in the mean pH (p=0.01), Urea (p=0.01), Creatinine (p=0.00), and HCO3 (p=0.00). HHS Shows higher rate than DKA in both Type I and Type II DM patients in Saudi Arabia.

Keywords: Diabetes Mellitus (DM), HEs, HHS, DKA

INTRODUCTION

In developing countries, Diabetes mellitus (DM) is one of the common chronic biochemical abnormalities affecting highly in adults and has a greater impact on the community (Elhadd and Al-Amoudi, 2007). This situation creates a big economic load on both sides (national healthcare systems and individual) of the countries (World Health Organization, 2010). In specific, the burden of this disease is highly prevalent in areas with poor health facilities. Globally, DM is considered as one of the costliest disorder, because of its complications, which has the ability to exhaust, health resource of the particular country. Middle East and Saudi Arabia is not an exception to this, for instance, many studies have shown that medical expenses of DM patients is 2.4 time s higher than normal people's expenses (El-Hazmi et al., 1998; Fatani and Mira, 1985). The direct and indirect costs of diabetes in Saudi Arabia are currently 23% of its total healthcare expenditure and 17% of total direct medical

service costs, totalling over US$1.3 billion/year (Al Rubeaan, 2010). In Saudi Arabia peoples with DM spend ten time more ($3,686 vs. $380) than the normal person (Alhowaish, 2013) and the prevalence of DM is 23.7 % in adults (Nozha et al., 2004). Earlier studies showed that the prevalence of DM is increasing, hence it is considered as the epidemic health hazard (El hadd and Al-Amoudi, 2007) and now gradually obtaining pandemic proportions.

Two major common complications of DM are Hyperglycaemic Hyperosmolar State (HHS) and Diabetic ketoacidosis (DKA), if both conditions were not properly treated it may lead to life threatening problem (Kitabchi, 1999). DKA is characterised with hyperglycaemia, hyperketonemia and metabolic acidosis which is the most prevalent HEs in DM (Otieno et al., 2005). In Saudi Arabia, the economic burden of this syndrome continue to be high and given this scenario, the impact of an increasing prevalence of DM and its' associated complications in Saudi Arabia will result in high unacceptable disease burden. In Arab countries, Hyperglycaemic emergencies are important causes of DM; therefore, aim of the present research is document the clinical, biochemical, socio-demographic, laboratory characteristics associated with DM.

MATERIALS AND METHODS

In a prospective study design, patients admitted from the Emergency unit of university to the Medical wards, Saudi Arabia were recruited for the study during the period of April 2013 to April l2014 . One hundred and seventeen samples were collected belonging to both Saudi and non-Saudi patients. Patients who were admitted in the Emergency unit and fulfilling all the criteria for hyperglycemic emergencies were included in the study. Samples were selected based on the (non-probability) sampling technique.

The data collected from the patients includes socio-demographic and clinical parameters. The clinical parameters included in the study were blood Sugar, Hemoglobin (Hb), Hematocrit (Hct), plasma glucose and electrolyte level like sodium, potassium, urea, creatinine etc. duration of DM, levels at presentation, laboratory data as well as previous treatment type prior to the admission. The detection of Ketonuria by using Ketosis was performed for the determination of the ketones.

Operational definitions

The DM duration is categorized into three durations, one is DM for less than 10 years is referred to as short term duration, DM duration of 10–19 years is referred to as, medium term duration, and DM duration of equal to 20 years is indicated as long term duration. The classification of Diabetes Ketoacidosis (DKA) referred to the presence of metabolic acidosis (bicarbonate levels of <10 mmol/L-18 mmol/L) and the presence of ketonemia or ketonuria and or blood glucose levels >13.8 mmol/L (Stoner, 2005; Kitabchi et al., 2006). Hyperosmolar Hyperglycemic State (HHS) indicated to bicarbonate levels of >18 mmol/L and plasma glucose levels of >33.3 mmol/L with or without the presence of ketonuria (Stoner, 2005; Kitabchi et al., 2006). In addition to that, patients with cardiac failure, end stage renal disease, pregnant women, dementia patients and hepatic failure were excluded from the study. An ethical approval was accomplished from the Ethics and Research committee of the University Hospital in before conducting the study.

After confirmation of the diagnosis, therapy was started using intravenous fluids and electrolytes were replaced using isotonic saline and subsequently 5% dextrose saline when a blood sugar level was less. The regular monitoring of capillary blood using glucose meter and the venous blood were also monitored at the interval of 0, 6, 12 and 24th hour to compare it with glucose level. Beside this urine samples were also collected for the estimation of, glucose, nitrite, leucocytes, pH, and protein, moreover the urine output was also monitored. In laboratory analysis osmolality, the anion gap, plasma glucose, electrolytes and packed cell volume were calculated for further analysis.

Statistical Analysis

The hyperglycemic emergencies were computed and compared in three age groups via- the lowest recorded age up to 34 years (Young), those who were aged between 35 – 64 years (Middle aged) and those who were aged = 65 years (Elderly). Standard deviation and Mean is used for continuous variables while frequency as well as percentages for categorical variables was reported. Independent sample t-test with 95% confidence interval was utilized as suitable. $P<0.05$ was considered significant. Overall statistical analysis was carried out using IBM Corp. Released 2011.IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.

RESULTS

Demographic characteristics

Out of the 117 patients included in the study, 97 (82.9%) were female while 20 (17.1%) were males. One hundred and four subjects (88.9%) had type 1 DM and 13 (11.1%) had type 2 DM (Table 1). Of 97 females studied, 88

Table 1. Demographic characteristics of the respondent

Demographic Characteristics	N (%)
Sex	
Male	20 (17.1)
Female	97 (82.9)
Total	**117 (100.0)**
Nationality	
Saudi	68 (58.1)
Non-Saudi	49 (41.9)
Total	**117 (100.0)**
Age group	
<=34 (Young)	101 (86.3)
35-64 (Middle aged)	14 (12.0)
>=65 (Elderly)	2 (1.7)
Total	**117 (100.0)**
Duration of DM	
<10 yrs.(Short term duration)	85 (72.6)
10-19 yrs.(Medium term duration)	29 (24.8)
>=20 yrs.(Long term duration)	3 (2.6)
Total	**117 (100.0)**
Hyperglycemic groups	
DKA	97 (82.9)
HHS	20 (17.1)
Total	**117 (100.0)**

DKA= Diabetic Ketoacidosis, HHS= Hyperosmolar Hyperglycemic State

Table 2. Hyperglycemic groups by DM type

DM type	Hyperglycemic groups	N (%)
Type 1	DKA	91 (87.5)
	HHS	13 (12.5)
	Total	**104 (100.0)**
Type 2	DKA	6 (46.2)
	HHS	7 (53.8)
	Total	**13 (100.0)**

DKA= Diabetic Ketoacidosis, HHS= Hyperosmolar Hyperglycemic State

(90.7%) had type 1 DM while 9 (9.3%) had type 2 DM. On the other hand, among 20 male subjects participated in the present study, 16 (80%) had type 1 DM while 4 (20%) of them had type 2 DM (Table 2). The Eighty five (72.6%) patients had DM for less than 10 years duration while 29 (24.8%) of the patients has had DM for 10-19 years duration. and 3 (2.6%) of the patients had DM for more than 20 years duration. According to the type of diabetes mellitus, below distribution of subjects was illustrated in Figure 1.

Among the Hyperglycemic patients (grouped by DN type), the prevalence of DKA was higher in Type I whereas in HHS, the prevalence of Type II was higher. (Table 2)

In the comparison between male and female of DKA and HHS among 117 subjects, 35 % of the males were affected with HHS and 65% with DKA, whereas 13.45 of the females were affected by HHS and 86% with DKA.

Out of 117 patients, 104 subjects with Type 1 DM, 86.5% of the patient's showed a clinical symptom of Nausea followed by 90 (86.5%) patients with vomiting, 85 (81.7%) patients with abdominal pain and 32 (30.8%) patients with Dizziness. Among the 13 patients of Type 2 DM, 9 (69.2%) patients with Nausea followed by 9

Table 3. Comparison of hyperglycemic groups between Sexes

Hyperglycemic groups	Sex	
	Male (n=20)	Female (n=97)
	n (%)	
DKA	13 (65.0)	84 (86.6)
HHS	7 (35.0)	13 (13.4)
Total	20 (100.0)	97 (100.0)

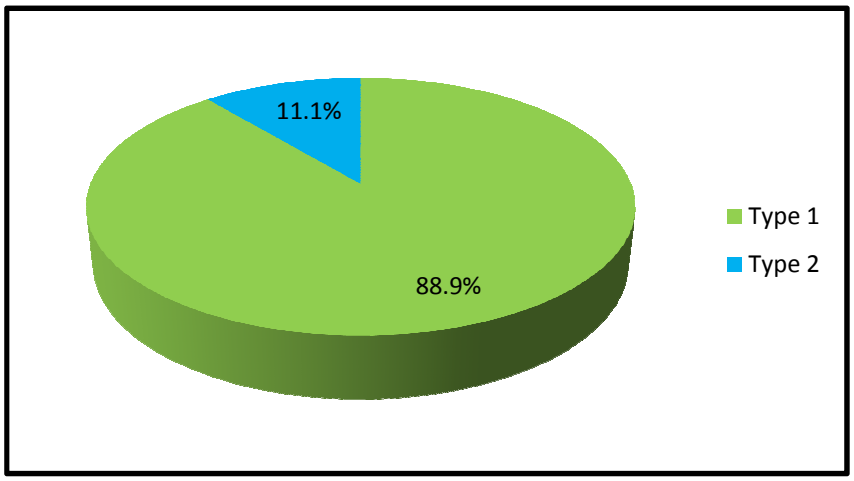

Figure 1. Distribution of subjects according to the type of diabetes

(69.2%) patients with vomiting, 8 (61.5%) with Abdominal pain and 3 (23.1%) patients with Dizziness.

BI Sugar= Blood Sugar, Hb= Hemoglobin, Hct=Hematocrit, Dias BP =Diastolic Blood Pressure, Temp=Temperature, Sys BP = Systolic Blood Pressure, SD= Standard Deviation.

A comparison of means of biochemical parameters of subjects with the HEs shows a statistically significant difference in the mean BI Sugar (p=0.00) and Plasma Osmolality (p=0.05). However there was no statistical significant difference in the Temp (p=0.55), Sys BP (0.13), Diast BP (p=0.40), Pulse (p=0.92), Hct (p=0.63), and mean Hb (p=0.60) between hyperglycaemic emergencies.

The highest mean of BI Sugar of patients with HHS hyperglycaemic emergency is (46.60±11.0) while the lowest mean of BI Sugar of patients with DKA is (33.29±13.9). In HHS patients, plasma osmolality was observed which is high as (316.8±37.3l) where as in DKA had the lowest mean Plasma osmolality is (304.9±21.8). When the mean of Hb was compared, the HHS (12.9±2.2) had the lowest than the DKA (14.9±16.8), patients. The mean Hct for HSS (39.5±9.4) detected to be lowest than DKA (44.1±42.4). Mean Temp was highest in patients with DKA (37.4±6.6) while the lowest mean Temp was documented in patients with HHS (36.5±0.3). The mean pulse was higher in patients with HHS (116.3±26.0), while patients with DKA had the lowest mean pulse (115.8±20.8). HHS had the highest mean Sys BP with (130.4±34.6) and DKA had the lowest mean Sys BP with (122.0±19.0). Mean Diast BP was reported to be higher in patients with HHS (75.1±27.0) while the lowest mean Diast BP was documented in patients with DKA (71.7±13.4).

DKA= Diabetic Ketoacidosis, HHS= Hyperosmolar Hyperglycaemic State, Na= Sodium, K= Potassium, HCO3=Bicarbonate, SD=Standard Deviation.

The range of electrolytes of the patients between DKA and HHS shows a statistically significant difference in the mean pH (p=0.01), Creatinine (p=0.00), Urea (p=0.01) and HCO3 (p=0.00). However, there was no statistically significant difference in the mean Sodium (p=0.10) and Potassium (p=0.64) between hyperglycaemic emergencies.

The mean pH of HHS patients is (7.3±0.1) where as DKA patients had the lowest mean pH is (7.2±0.1). Patients with HHS hyperglycaemic emergency had the highest mean Creatinine (176.2±145.4) while patients

Table 4. Comparison of Clinical symptoms with types of DM

Clinical symptoms		Types	
		Type1	Type2
		n (%)	
Nausea	Yes	90 (86.5)	9 (69.2)
	No	14 (13.5)	4 (30.8)
	Total	**104 (100.0)**	**13 (100.0)**
Vomiting	Yes	90 (86.5)	9 (69.2)
	No	14 (13.5)	4 (30.8)
	Total	**104 (100.0)**	**13 (100.0)**
Abdominal pain	Yes	85 (81.7)	8 (61.5)
	No	19 (18.3)	5 (38.5)
	Total	**104 (100.0)**	**13 (100.0)**
Dizziness	Yes	32 (30.8)	3 (23.1)
	No	72 (69.2)	10 (76.9)
	Total	**104 (100.0)**	**13 (100.0)**

Table 5. Comparison of means of biochemical parameters of subjects with Hyperglycemic Emergencies

Parameter	DKA (n=97) Mean±SD	HHS (n=20) Mean±SD	t-value	P-value
Bl Sugar	33.2±13.9	46.6±11.0	-4.03	**0.00****
Hb	14.9±16.8	12.9±2.2	0.53	0.60
Hct	44.1±42.4	39.5±9.4	0.49	0.63
Temp	37.4±6.6	36.5±0.3	0.60	0.55
Pulse	115.8±20.8	116.3±26.0	-0.10	0.92
Sys BP	122.0±19.0	130.4±34.6	-1.54	0.13
Diast BP	71.7±13.4	75.1±27.0	-0.85	0.40
Plasma Osmolality	304.9±21.8	316.8±37.3	-1.94	**0.05***

***** P<0.01; * P<0.05***

Table 6. Electrolytes of subjects in various Hyperglycaemic groups

Parameter	DKA (n=97) Mean±SD	HHS (n=20) Mean±SD	t-value	P-value
pH	7.2±0.1	7.3±0.1	-2.72	**0.01****
Creatinine	101.5±47.4	176.2±145.4	-4.15	**0.00****
Urea (mmol/L)	8.0±7.2	13.1±10.9	-2.62	**0.01****
Na (mmol/L)	131.9±5.4	129.6±6.0	1.67	0.10
K (mmol/L)	4.5±0.9	4.6±1.1	-0.47	0.64
HCO3 (mmol/L)	13.5±2.2	23.2±5.6	-13.03	**0.00****

***** P<0.01; * P<0.05***

with DKA had the lowest mean Creatinine (101.5±47.4). The mean Urea of Patients with HHS had the highest (13.1±10.9) and DKA had the lowest (8.0±7.2). The HHS's mean of sodium in patients was low (129.6±6.0) where as the DKA had an high sodium of (131.9±5.4). Patients with HHS had the high potassium (4.6±1.1) while patients with DKA had the lowest mean Potassium (4.5±0.9). The HSS patients has the highest mean HCO_3 of (23.2±5.6) during the patients with DKA had the lowest mean HCO_3 (13.5±2.2) (Table 6).

DISCUSSION

DM is a metabolic disorder which is characterised by the presence of Hyperglycaemia due to the impairment in the insulin secretion or action. The overall prevalence of DM in Saudi Arabia was 23.7%, with the adjusted age prevalence of 21.9% (Nozha et al., 2004). The Worldwide severity and prevalence of DKA vary significantly (HS, 2005). The prevalence of type I diabetes in Saudi differ from western countries (Kulayat, 2001). In the current study, the prevalent of DKA is higher in Type I DM and HHS in Type II DM. A Similar pattern was observed in the previous study where 67.2% DKA was diagnosed in type I DM (Salman et al., 1991). In the current study the prevalence DM is higher in males when comparing to that of females. A Similar gender base prevalence is document in the previous studies (El-Hazmi et al., 1995). Moreover, the result of other studies representing Saudi population depicts the higher frequency of DKA in females (Yousuf, 1994). In the contradictory study by Balasubramanyam et al., (1999) shows an equal ratio of DM in Saudi Arabia. Perhaps it is known that the general life expectancy of male is lesser than females. Many studies from Saudi shows that 55% - 77% of DM patients are suffering from DKA (Kulayat, 2001). Previous studies which focused on DM and its implication influences the awareness in health care centres, these study reports were especially from developing countries (Akbar, 2000).

The clinical symptoms like Nausea, vomiting, abdominal pain and Dizziness were seen in both types of DM; perhaps these symptoms were significantly higher in Type I DM. Even though there are a considerable number of patients with the symptoms in both types of DM, there are a small number of patients representing without any clinical symptoms in both types of DM. A few studies reported that clinical pattern in type I DM in Saudi where DKA is most prevalent (Kalaylat and Narchi, 2001) Nausea, vomiting and abdominal pain (86%, 86%, 81% respectively) were frequent in type I DM. thus by creating the awareness among public and health care centers in relation to these symptoms and the possibility of DM and the routines analysis (blood sugar and urine) when encountering these symptoms may decrease the severity and prevalence of DKA (Roche et al., 2005).

In the current study among biochemical parameters such as blood sugar and plasma Osmolality shows a significant difference between DKA and HHS. Blood sugar declines in peoples with Type II diabetics patients due to impairment in the production of insulin. Electrolytic imbalance was the major consequence in the DKA and HHS conditions. In the present study the biochemical parameters recorded were pH, K (mmol/L), HCO3 (mmol/L), Creatinine, Urea (mmol/L), and Na (mmol/L). These biochemical parameters were significantly higher (P-0.01) for pH, Creatinine, Urea (mmol/L) in HHS when comparing to DKA. Electrolyte imbalance in HHS was most prevalent than DKA in the present study. The bicarbonate level plays a significant role in determination of DKA. After analysing risk and benefits in bicarbonate therapy, there is a clear indication that it should be used only for hyperkalemia (Matz, 1977). Another study shows that in the presence of bicarbonate there is a delayed metabolism of Ketoanion, perhaps there is no significant difference between bicarbonate and non bicarbonate groups (Hale and Crase, 1984). In HE treatment by using hydration and insulin the rapid decrease in potassium level is resulted, which enable it to re-enters in the intracellular compartments (Kitabchi et al., 2001).

In the comparison between DKA and HSS, present study shows that DKA's respondents is 18% whereas 35% was observed in HSS. Our findings are in consonance with the general findings of higher case fatality rates of HHS compared with those of DKA Chung et al., 2006; MacIsaac et al., 2002. In fatal outcomes of HEs report some of the predictive factors like low duration of DM diabetes foot ulceration, being an elderly person, and sepsis. In the present report interpreted the classification of type 1 and type 2 DM, the report does not performed the assessment of C-Peptide levels.

CONCLUSION

In Saudi Arabia still HE remains as the primary cause with Diabetes Mellitus. HE prognostic factors are readily modifiable so it is the focus points of health care providers. To conclude in present study adds knowledge on the increasing burden of DM in Saudi Arabia. The present study provides a clear understanding of the biochemical parameters in patients in the emergency care with hyperglycaemic emergencies. The findings of the present study revealed that the blood sugar and plasma Osmolality were higher in HHS patients than patients with DSK and similar pattern were observed in electrolytes. Thus in order to reduce the risk of HHS and DKA, Saudi Arabian health care facilities should introduce a comprehensive and continuous service to reduce the risk and complications of DM. In addition, the present study has provided the pattern of HEs in Saudi Arabia. Thus, prevention of DM's macro and micro vascular complications is important part for the future public health strategy in Saudi Arabia.

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