



Prognostic indices for hospital mortality among Libyan diabetic patients

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Introduction

The economic growth and development over the past three decades have been dramatic in Libya. This socio-economic development has brought about benefits such as improved access to health care, education, safe drinking water and sanitation. However, it has also brought about undesirable changes in lifestyle, nutrition, and traditional social and family structures. Chronic diseases, such as diabetes mellitus, which are linked both directly and indirectly to behavioural, nutritional and environmental factors, have emerged as the leading cause of morbidity and mortality in the Arab countries in recent years.^{1,2} Diabetes is one of the most significant health problems that face health care providers in both primary and secondary care sectors throughout the world, for three important reasons:³ first, the sheer number of patients; second, long-term vascular complications that account for the vast majority of morbidity and mortality as well as health care utilisation; and, third, cost.⁴

Adults with diabetes have an annual mortality rate of 5.4% (twice the mortality rate of age matched adults without diabetes) and their life expectancy is decreased, on average, by five to 10 years.⁵ The reduced life expectancy is mainly due to atherosclerotic vascular complications, especially coronary heart disease and stroke. It has been demonstrated that the risk of microvascular complications of diabetes increases steeply at a glucose concentration of around 11.1 mmol/L,⁶ while the risk of cardiovascular complications increases

ABSTRACT

The pattern of diabetic deaths in the medical wards of Tripoli Medical Centre was retrospectively studied. During a three-year period, 575 diabetic deaths occurred, accounting for 26.2% of all medical deaths. The mean age at death was 65.33±12.7 years. Cardiovascular disease (183 [31.8%]), cerebrovascular accidents (102 [17.7%]) and infection (83 [14.4%]) were the most common complications associated with diabetic deaths. Other causes were malignancy (10%), liver cirrhosis (5.6%), and acute diabetic complications (5%). Forty-five (7.8%) deaths unaccountable for may be due to other unknown causes.

Factors predictive of mortality, such as admission diagnosis of hyperosmolar non-ketotic state, cerebrovascular disease, acute coronary syndromes or infection were associated with poor prognosis. Admission hyperglycaemia, old age, renal dysfunction and prior stroke were also associated with poor admission outcome. The excess mortality, mainly due to atherosclerotic complications, is potentially preventable through implementation of serious approaches to the management of cardiovascular risk factors. Copyright © 2010 John Wiley & Sons.

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KEY WORDS

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gradually across the whole range of glycaemic control.⁷ More recently, diabetes has been placed as the fifth cause of death, ranking after communicable diseases, cardiovascular disease (CVD), cancer, and injuries.⁸ Hypertension, obesity, hyperlipidaemia and smoking are important atherosclerotic risk factors which are more prevalent in diabetic patients and contribute to their high mortality compared with non-diabetic patients.⁹

Although the data available on the prevalence of diabetes mellitus in Libya are still limited, diabetes seems to be a significant problem at 14%.¹⁰ It has been reported by the World Health Organization that there were 88 000 people with diabetes in Libya in the year 2000. This prevalence is estimated to reach 245 000 by the year 2030.¹¹ Furthermore, Libya has the highest prevalence of type 2

diabetes in North Africa and in the Arab world.¹² Data on mortality and serious complication rates among Libyan people with diabetes are limited. A better understanding of the burden of diabetes might guide decisions about treatment and prevention at the individual level, and about allocation of public health resources at the national level.

Against the above background, it was decided to undertake a research work with the aim to determine the mortality causes among diabetic people admitted to Tripoli Medical Centre (TMC) over a three-year period, and to evaluate the determinants of in-hospital mortality.

Method

The TMC, although it is a tertiary referral centre, operates an active primary care centre with 24-hour emergency coverage accessible to

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anyone, and from which appropriate patients are admitted to the hospital's medical wards.

In this study, we retrospectively studied and analysed the clinical case files of all diabetic patients who had died in the medical wards, including the intensive care units of TMC, during the period January 2005 to December 2008.

The TMC authorities allowed us to access patients' medical notes and important data for analysis were extracted from the case files onto a pre-designed protocol data sheet (Appendix 1, available online at www.practicaldiabetesinternational.com). Such data included the age, sex, diabetic medications (none, oral hypoglycemic agents, and/or insulin), duration of diabetes, history of hypertension, current smoking status, the cause of admission and the primary cause of death. Before being considered for analysis, the data were checked and matched against the patients' medical notes, as part of the training in community medicine undertaken by the second author who is an endocrinologist at the TMC.

Other data included blood pressure, and duration of hospitalisation as well as the first blood glucose and urea result obtained upon admission to hospital. A history of chronic renal failure, malignant disorders, or CVD was also taken into consideration.

Quantitative data are presented as means \pm standard deviation (SD). Student-t test was employed for comparison of paired variables. Levels of significance were set at the 0.05 level.

Results

During the 36-month study period (January 2005 to December 2008) a total of 30 907 medical admissions were studied, of which 5797 (18.8%) were for people with diabetes. A total of 2195 (7.1%) deaths occurred in the medical wards (including the ICU) of which 575 were diabetic deaths. Thus, 26.2% of deaths in the medical wards during the period of study might have a significant relationship to diabetic complications. The mortality rates among non-diabetic and diabetic patients were 6.5% (1620 out of 25 110) and 9.9% (575 out of 5797), respectively. Such a difference was a statistically significant ($p < 0.05$).

Table 1. Frequency and proportion of complications associated with deaths among the 575 patients included in the study

Mortality causes	Frequency	Percentage
Cardiovascular disease	183	31.8
Cerebrovascular accident	102	17.7
Infection	83	14.4
Malignancy	57	10
Liver cirrhosis	32	5.6
Acute diabetes complication	29	5
Arrived dead	17	3
Gastrointestinal tract bleeding	16	2.8
Chronic renal failure	7	1.2
Pulmonary thromboembolism	4	0.7
Other	45	7.8
Total	575	100

Table 2. Mortality causes among patients admitted with infection as the main diagnosis

Mortality causes	Frequency	Percentage
Septicaemia	35	42.2
Pneumonia	25	30.1
Acute gastroenteritis	5	6.0
Diabetic foot	5	6.0
Ascending cholangitis	3	3.6
Meningitis	3	3.6
Bed sores	3	3.6
Other	4	4.8
Total	83	100

Of the 575 diabetic deaths, 292 (50.8%) were males and 283 (49.2%) were females, with a male to female ratio of 1.03:1. The mean age was 65.33 ± 12.73 years (range 18–95) and 88% were over 50 years at death. The duration of diabetes was 10.3 ± 9.31 years (range 0–40).

The overall admission mean random blood glucose was 277.04 ± 160.3 mg/dl, though the range was very wide (7–1000 mg/dl). The hospitalisation period prior to death was between 0–68 days. The mean stay time was 5.7 ± 7.92 days.

Complications associated with deaths

CVD (183 [31.8%]) was the most frequently encountered complication associated with diabetic deaths. The second most common cause of deaths was due to cerebrovascular accidents (102 [17.7%]), of which 74.5% were hypertensive. Other related acute complications, such as

ketoacidosis, hyperosmolar non-ketotic state (HONK) and hypoglycaemia, caused 29 (5%) deaths. Fifty-seven (10%) diabetic inpatients died because of malignancy, while 32 (5.6%) deaths were due to liver cirrhosis (Table 1). Infection was the cause of 83 (14.4%) diabetic deaths. Table 2 summarises the mortality causes among patients admitted with infection as the main diagnosis.

Hyperosmolar state, cerebrovascular disease, infection, as well as HONK were significantly associated with mortality risk ($p < 0.0001$). Acute coronary syndrome was also associated with a significant mortality risk ($p < 0.05$). (Table 3.)

Hospital admissions due to other cardiovascular diseases were not associated with increased mortality risk. There was, however, a higher overall mortality of 11.03% in males compared with 8.98% in females ($p < 0.05$).

Age also carried a poor prognosis for death where mortality for patients



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55 years of age and above was almost 12% compared with almost 6% in those below 55 ($p < 0.0001$). Prior history of stroke or chronic renal failure was also associated with a poor prognosis ($p < 0.0001$).

The mortality rate among those who presented with blood glucose >350 mg/dl was 16.1% and for those with blood glucose <40 mg/dl was 16.5%. In addition, the mortality among those with urea levels ≥ 50 mg/dl was 23.3% compared with 5.2% in those with <50 mg/dl. Admission blood pressure may also have had an impact, where mortality among those with systolic blood pressure at presentation >90 mmHg was 52.5% compared to 8.7% for those with systolic blood pressure of ≤ 90 mmHg. A past medical history of ischaemic heart disease, heart failure and/or hypertension was not predictive of mortality. Table 3 summarises the factors associated with high mortality among the Libyan diabetic inpatients included in the study.

Discussion

Increased mortality in patients with diabetes in general and in an elderly subgroup has been well established.^{13–15} This study showed that diabetes contributes significantly to mortality in the hospital medical wards included in the study, where 26.2% of all deaths were due to diabetic complications. The high mortality associated with diabetes is well known and reflects the increased atherogenic complications associated with diabetes.^{14,16} In a study from Benghazi, Libya, 24.2% of all deaths were among diabetic patients.¹⁷ The results of the present study show that CVD followed by cerebrovascular accident were the most common causes of inpatient mortality among the diabetic patients under investigation. These results, in addition to the finding that infection was the third cause of mortality among hospitalised diabetic patients, were similar to those reported in the Benghazi study.¹⁷

Although atherosclerotic complications were the leading cause of death in our diabetic inpatients, infection is still a serious contributor to mortality. Diabetic patients are at higher risk for infection with a higher case fatality rate from serious

Table 3. Factors associated with high mortality among Libyan inpatients with diabetes

Admission diagnosis		Total	Died (%)	P-value
Hyperosmolar non-ketotic state	Yes	21	8 (38.1)	<0.0001
	No	5776	567 (9.8)	
Cerebrovascular accident	Yes	594	101 (17.00)	<0.0001
	No	5203	474 (9.11)	
Infection	Yes	369	82 (22.22)	<0.0001
	No	5428	493 (9.08)	
Myocardial infarction	Yes	589	73 (12.39)	<0.05
	No	5208	502 (9.64)	
Gender	Female	3151	283 (8.98)	<0.05
	Male	2646	292 (11.03)	
Age (years)	<55	1695	101 (5.96)	<0.0001
	≥ 55	4102	474 (11.56)	
Prior history of stroke	Yes	417	90 (21.58)	<0.0001
	No	5380	485 (9.01)	
History of chronic renal failure	Yes	165	33 (20.00)	<0.0001
	No	5632	542 (9.62)	
Admission blood glucose (mg/dl)	Not available	405	37 (9.14)	<0.0001
	<40	103	17 (16.50)	
	40–350	4386	376 (8.57)	
	>350	903	145 (16.06)	
Admission blood urea (mg/dl)	Not available	1168	90 (7.71)	<0.05
	<50	3275	169 (5.16)	
	≥ 50	1354	316 (23.34)	
Admission systolic BP (mmHg)	≤ 90	5635	490 (8.70)	<0.05
	>90	162	85 (52.47)	

infections caused by altered host defences and/or the increased presence of underlying disorders that predispose to mortality.¹⁸ Pneumonia and sepsis were among the leading infections which caused patient mortality in the present study. Infection was the cause of 83 (14.4%) deaths in the diabetic patients under investigation. This is similar to the findings of previous studies,^{18,19} which demonstrated that mortality varied by pneumonia aetiology, ranging from $<2\%$ to $>30\%$, that diabetic adults are at greater risk for infection-related mortality, and that the excess risk may be mediated by CVD. However, in a study from Nigeria the mortality of diabetic patients was 21.8%, with septicaemia being the most common

cause of death as it constituted 34% of total diabetic mortality, followed by stroke at 16%.²⁰

This study examines the role of a number of contributing factors to in-hospital mortality in diabetic patients. Admission diagnosis of HONK, cerebrovascular disease, acute coronary syndromes or infection was associated with poor prognosis. A number of studies have demonstrated the poor prognostic impact of admission hyperglycaemia, old age, renal dysfunction and prior stroke on admission outcome.^{14–16,21} People with diabetes and renal impairment are at extremely high risk of death; CVD was an important contributor and might benefit from early identification and treatment of risk factors.¹⁶

