Original Article:

Prevalence of long-term complications among Type 2 diabetic patients in Benghazi, Libya.

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Abstract:

Aim of the study was to find out the prevalence of long-term diabetic complications among type 2 diabetic patients in Benghazi. It was a cross-sectional study and included 952 type 2 diabetic patients (410 male subjects) aged 29-85 years. The patients were examined for evidence of coronary heart disease, diabetic retinopathy, macroproteiuria, peripheral arterial disease, peripheral neuropathy, cataract and amputations due to diabetes and diabetic foot. Hypertension was present in 33.4% of the subjects. The majority of the patients (58.3 %) were on oral hypoglycemic drugs, and only 3 patients were on diet control. About eighty per cent of the patients were poorly controlled. 27.7% percent of the patients were current smokers. 68.7% of the patients had complications, while 31.3% percent did not have any complication. 36.7% had one, 20.1 % had two, 9.6 % had three and 2.3 % had four or more complications. The overall prevalence of coronary heart disease was 14.9%, diabetic retinopathy 30.6%, peripheral neuropathy 47.1%, macroalbuminuria 25.8%, peripheral arterial disease 15.2% and cataract 13.1%, 1.1% of patients had their legs amputed below knee and 0.7% of them were blind. The prevalence of long-term diabetic complications was higher among poorly controlled than well-controlled patients. Stepwise logistic regression analysis showed that the age of the patients and duration of diabetes were independent risk factors for the development of long term diabetic complications. This study provides a baseline data on long term complications of diabetes, among Libyans. Age, duration of diabetes and poor glycemic control were independent risk factors for the development of long-term diabetic complications.

Key words: Libya, diabetes-complications, glycemic control.

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Introduction

Libya is situated on the north coast of Africa, along the Mediterranean seaboard. The total population according to the year 2006 census is estimated to be 5323991 with 1:1 male: female ratio (1). Prevalence of diabetes in people over 20 years of age was 14.1% in the year 2000 (2). A Libyan national diabetes program is operating since 1984. It consists of diabetic centers in Tripoli and Benghazi and diabetic clinics in other cities. Insulin and oral hypoglycemic drugs are provided free of charge. Benghazi Diabetic Centre (BDC) was established by one of us (OAK) in 1969. It is an outpatient diabetic clinic, serving Benghazi area and administrating a number of diabetes clinics in Eastern Libya. All patients are registered. Daily attendance rate at BDC is around 250 patients. About 5% of patients are non-Libyans. A total of 41987 (18294 males) patients had been registered by the end of the year 2009.

Data on chronic complications of diabetes in Arab populations are scarce. In this cross-sectional study, we have presented the prevalence of long-term diabetic complications among 952 type 2 diabetic patients, in Benghazi (Libya).

Methodology

The study population consisted of 952 Libyan patients with type 2 diabetes (410 male subjects). The study protocol was approved by the Ethics Committee of the Libyan Syndicate. It was well explained to and accepted by all participating patients. Diagnosis of diabetes was based on World Health Organization (WHO) criteria. All patients underwent clinical examination by one of us (RBR). Eyes were examined by experienced ophthalmologists. Family history of diabetes was defined as positive if a parent and/or a sibling was diagnosed as diabetic. Smoking status was defined as smoking one or more cigarettes per day. Average fasting plasma glucose ≤ 120mg/dl and/or post-prandial plasma glucose ≤ 150mg/dl during the previous three months was considered as indicators of good glycemic control.

Patients were examined for the evidence of coronary heart disease (CHD), diabetic retinopathy (DR), macroproteinuria (Macro), peripheral arterial disease (PAD), peripheral neuropathy (PN), cataract and amputations due to diabetes and diabetic foot. Blood pressure in the sitting position was measured on the right arm, by a standard mercury sphygmomanometer twice with an interval of rest of about five minutes and the two measurements were averaged. Hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg or current use of antihypertensive medication. Vibratory sensation perception was examined twice with the "on-off" method, using 128-Hz tuning fork, placed on the bony prominence at the dorsum of the great toes and on both the malleoli. Superficial pain sensation was tested with disposable dressmaker's pins, on the dorsal and plantar aspects of the foot. PN was defined as decrease of vibratory sensation and/or pin prick sensitivity. Physical examination included: palpation of peripheral pulses; the femoral, popliteal and pedal vessels. The absence of both pedal pulses or presence of peripheral revascularization or gangrene or an amputation done because of ischemia was considered as an evidence of PAD. The eyes were examined for cataract and the fundi were examined after mydriasis for retinopathy. DR was classified as non-proliferative (NPDR) and proliferative (PRODR). NPDR was labeled when there was the presence of microanurisms, hemorrhages or exudates. PRODR was labeled when there was presence of neovascularization, vitreous hemorrhages or retinal detachment and/or laser coagulation scars. Electrocardiograms were taken for each patient. The presence of CHD was assessed by history of coronary heart disease (angina, myocardial infarction, coronary artery bypass graft or coronary angioplasty) or positive 12 leads ECG according to Minnesota code (3). All individuals were tested for proteinuria by dip stick examination (Uripath Plasmatec, UK) in a morning urine sample.

Statistical Analysis

Values have been expressed as means ± standard deviation (± S D). Statistical significances were done by Chi-squire test. A probability value of < 0.05 was considered significant. Stepwise logistic regression analysis was used to investigate the independence of risk factors associated with the development of chronic complications of diabetes.

Results:

Mean age of patients and mean duration of diabetes were 56.04 ± 9.14 years (males 59.49 ± 8.58, females 53.43 ± 8.68) and 9.25 ± 5.48(males 9.70 ±5.61, females 8.91 ±5.36) years respectively. Family history of diabetes in the first degree relatives was positive in 37.5% (males 32.0%, females 41.7%). 58.3% percent of the patients were on oral hypoglycemic therapy, 41.4% on insulin treatment and only 0.3% on diet control. 79.8% percent of the patients had poor glycemic control. Hypertension was detected in 33.4% of the patients (males 30.0%, females 35.1%). 27.7% percent of the patients were current smokers.

A total of 654 patients (68.7) had complications. CHD was present in 14.9%, DR in 30.6%, PN in 47.1%, Macro in 25.8%, PAD in 15.2% and Cataract in 13.1% (table 1). 1.1% percent of the patients had below knee amputations and 0.7% of patients were blind. About one third (31.3%) of patients had no chronic complications of diabetes. Among the remainder, 36.7% had one, 20.1% had two, 9.6% had three and 2.3% had ≥4 complications. Age specific prevalence rates of long-term diabetic complications for 35-54 years age group are presented for comparison with international studies (table 2).

Microvascular complications (DR, Macro) were approximately similar in occurrence in both sexes. Frequency of CHD was significantly higher among females ($p<0.05$). Higher occurrence of PAD among male and that of PN among females was not significant ($p > 0.05$). Cataract was significantly frequent among males ($p<0.05$). Patients with poor glycemic control (table 3) had higher risk for complications than the well-controlled patients.

Stepwise logistic regression analysis showed that duration of diabetes and ages of patients were independent risk factors for long-term complications among type 2 diabetic patients. Patients with duration of diabetes of 7-14 and ≥14 years had nearly twofold and threefold increase in complications than patients with duration of <7 years (OR=2.90) (table 4). Subjects with ≥50 years of age had nearly double risk of complications than those with <50 years of age (OR= 1.82).

Table 1: Prevalence of diabetic complications (per 100) among type 2 diabetic patients in Benghazi Libya

Complications	Males			Females			Total
	35-54 (n = 115)	>=55 (n = 293)	Total	35-54 (n = 282)	>=55 (n = 255)	Total	
Coronary Heart Disease	7(6.1 %)	42 (14.3 %)	49(12.0 %)	41 (14.5 %)	52 (20.4 %)	93(17.2 %)*	142(14.9 %)
Non-Proliferative Retinopathy	24(20.9%)	100(34.1%)	124(30.2 %)	58(20.6 %)	103(40.4 %)	161(29.7 %)	285(29.9 %)
Proliferative Retinopathy	1(0.9)	4(1.4 %)	5(1.2 %)	0(0.0%)	2(0.8 %)	2(0.4 %)	7(0.7 %)
Proteinuria	25(21.7)	82(28.0 %)	107(26.1 %)	60 (21.3 %)	79(31.0 %)*	139(25.6 %)	246(25.8 %)
Peripheral Neuropathy	39(33.9 %)	148(50.5 %)*	187(45.6 %)	115(40.8 %)	146(57.3 %)*	261(48.2 %)	448(47.1 %)
Peripheral Arterial Disease	16(13.9 %)	56(19.1 %)	72(17.6 %)	36 (12.8 %)	37 (14.5 %)	73(13.5 %)	145(15.2 %)
Cataract	2(1.7 %)	64(21.8 %)*	66(16.1 %)	9 (3.2 %)	50 (19.6 %)*	59 (10.9 %)*	125(13.1 %)

*** P < 0 .05**

Table 2: Prevalence of diabetic complications (per 100) among people with type 2 diabetes by duration (35-54 years age group).

Complications	Males (n = 115)			Females (n =282)			Total (n = 397)
	1-6 (n = 49) No (%)	7-13 (n = 49) No (%)	14+ (n = 17) No (%)	1-6 (n =129) No (%)	7-13 (n =122) No (%)	14+ (n =31) No (%)	
Ischemic Heart Disease	2(4.1)	3(6.1)	2(11.8)	17(13.2)	18(14.8)	6(19.4)	48(12.1 %)
Non-Proliferative Detinopathy	1(2.0 %)	14 (28.6 %)	9(52.9 %)	3(2.3 %)	33 (27.0 %)	22 (71.0 %)*	82 (20.7 %)
Proliferative Detinopath	0(0.0%)	0(0.0%)	1 (5.9 %)	0(0.0%)	0(0.0%)	0(0.0%)	1(0.3 %)
Proteinuria	3(6.1)	14(28.6)	8(47.1)*	22(17.1)	27(22.1)	11(35.5)	85(21.4 %)
Peripheral Neuropathy	9(18.4)	21(42.9)	9(52.9)*	39(30.2)	59(48.4)	17(54.8)*	154(38.8 %)
Peripheral Arterial Disease	2(4.1)	10(20.4)	4(23.5)*	14(10.9)	15(12.3)	7(22.6)	52 (13.1 %)
Cataract	1(2.0))	0(0.0%)	1(5.9)	3(2.3)	5(4.1)	1(3.2)	11(2.8 %)

*** P < 0 .05**

Table 3: Prevalence of diabetic complications (per 100) by glycemic control.

	Good Control	Poor Control	Total
Coronary Heart Disease	30(15.6%)	112(14.7%)	142(14.9%)
Proteinuria	45(23.4%)	201(26.4%)	246(25.8%)
Diabetic Retinopathy	51(26.6%)	241(31.7%)	292(30.7%)
Peripheral Neuropathy	77(40.1%)	371(48.8%)	448(47.1%)
Peripheral Arterial Disease	28(14.6%)	117(15.4%)	145(15.2%)
Cataract	34(17.7%)	91(12.0%)	125(13.1%)

Table (4) Prevalence of diabetic complications (per 100) by duration of diabetes.

	< 7y ears	7-13 years	≥14 years
Coronary Heart Disease	44(12.0%)	65(17.0%)	33(16.3%)
Diabetic Retinopathy	18(4.9%)	127(33.2%)	147(72.7%)
Proteinuria	60(16,3%)	107(28,0)%	79(39.1%)
Peripheral Neuropathy	123(33.4%)	194(50.8%0	131(64.8%)
Peripheral Arterial Disease	41(11.1%)	61(15.9%)	43(21.3%)
Cataract	46(12.5%)	46(12,0%)	33(16.3%)

Discussion

The prevalence of long term diabetic complications was assessed in a large sample of type 2 Arab diabetic patients. In consistence with international studies (4-6) there was a linear increase in long-term diabetes complications in both sexes with increasing age and duration of the disease. However, duration of the disease is in part age related. Duration is defined as the period between the year of diagnosis of the disease and the year of clinical examination. Unlike type 1 diabetes, type 2 diabetes is a slow onset disease and most of type 2 patients are unaware of the symptoms of diabetes. They seek medical advice after many years of the onset of the disease or when they develop long term diabetes complications, particularly diabetic foot or erectile dysfunction.

Suboptimal glycemic control has consistently been related to the development & progression of diabetic complications (7,8). Eighty per cent of our patients were poorly controlled and had higher rates of complications than well controlled patients.

There is a wide variability in the prevalence of DN, reported from different countries. In this study DN was the most frequent long-term complication. The prevalence of DN in Arab populations are around 40%; 41.1% in Tunisia (9), 34.3% in United Arab Emirates (10), 38% in Saudi Arabia (11) and 36.6% in Bahrain (12). A lower figure of 22% has been reported by Herman et al in Egypt (8). The prevalence rate of DN of 47.1% in this study is relatively higher as compared with other Arabic Countries.

Diabetes obliterates the sex difference of CHD observed in the general population (13). The prevalence of CHD in our population was 14.9% and was more prevalent among females. This rate approximates the reported prevalence of 14.5% from Tunisia (14) and 10.5% from Al Ain, United Arab Emirates (10). Rates higher than 25% have been reported from other populations (15-17). The World Health Organization (WHO) study of vascular disease in diabetes in 14 centers reported a prevalence of CHD of about 30% in males and females (18). Low prevalence rates of 5-8% have been reported from Sub-Saharan Africa (19).

Duration of diabetes increases the risk of CHD death independent of coexisting risk factors (5-9). There was a linear increase of studied complications with increasing duration of diabetes except for CHD where the prevalence decreased in patients with duration of ≥ 14 years. This was most likely due to high mortality from CHD with increasing duration of diabetes.

Greater occurrence of CHD among females in our population is unexplained. Females in Libya do not smoke cigarettes and do not use tobacco in any other form. In meta-analysis of 37 studies, Huxley et al (20) concluded that the risk of coronary death among diabetic patients was significantly higher in women than in men. In Canada, the relative risk of coronary death from diabetes was 2.58 for women and 1.85 for men (21).

The prevalence of DR in our patients detected by using direct ophthalmoscopy was 30.6%. It increased from 21.8% in males and 20.6% in females in 35-54 years age group to 35.5% in males and 41.2% in females in patients aged 55 years and more (table 2).

The prevalence of DR in Arab countries varied from high rates of 54.2% in United Arab Emirates (10), 42.4% in Oman (22), 42% in Egypt (8), 40% in Kuwait(7) and 45% in Jordan (23) to law rates of 16.8% in Lebanon(24) and 18.3% in Tunisia (9).

Many factors may contribute to these variations including duration of diabetes, ethnicity, metabolic control, skill of the examiner and methodology of examination. To exemplify moderate or severe DR was more common in Polynesians than Europeans (25). Retinal photography with a sensitivity of 89% (CI 80%-98%) is more accurate and reproducible procedure for the detection of DR than direct ophthalmoscopy, with a sensitivity of only 65 % (CI 59%-79%) (26). Hence, our estimate of prevalence of DR may be an underestimation. Sampling is also an important determinant for the prevalence of DR, for example in the United Arab Emirates the prevalence of DR ranged from 19 to 54.2% (4, 10). Both of these studies used direct ophthalmoscopy.

Diagnosis of cataract was based on morphologic changes. Hyperglycemia leads to cataract formation in diabetic rats (27). Diabetes is cited as a factor for cataractogenesis in humans (28). The prevalence of cataract in one or both eyes in this study was 13.1%. The prevalence of cataract varies in different populations, 16% in the Sudan (29), 20.5% in Norway (30), 44.9% in West Africans (31), and 50% in Korea (32). All studied complications except cataract were frequent among poorly controlled patients. It seems that the development of cataract is unrelated at least partly, to the risk factors for long term complications of diabetes. The higher prevalence of cataract in males in this study is similar to the findings in Sweden (33). In Lithuania, Cataract is more frequent among women (34).

Diabetes is a risk factor for both PAD and PAD associated mortality (35) and contributes to approximately half of all the amputations in individuals with diabetes (36).

Frequency of PAD in our population assessed by the absence of peripheral pulses was 15.2%. However, pulse assessment has a high degree of interobserver variability. Ankle Brachial index (ABI) is more accurate and reproducible measurement for the detection of PDA (37). The prevalence of PDA in this study was higher in males than females. This is in contrast to higher prevalence of PAD among females in China and India (38,39). The low prevalence of 0.7% of amputations due to diabetes in this study is similar to the rate of 1% in Saudi Arabia and lower than the rates in western countries (11).

Sensitive techniques for determining protein concentration in urine are not available at our clinic. The prevalence of Macro in this report estimated with dip stick was 25.8 %, approximately similar to reported rates from Egypt (8), Ethiopia (40), South Africa (41), and Black population of USA (42). Relatively low rates have been reported from European patients (43). The prevalence of Macro is only 13% in the population of Nauru with high prevalence of type 2 diabetes (44).

In this study age, duration and the use of insulin were independent risk factors for the development of Macro. Patients aged 60 years or more had a higher nonsignificant risk for proteinuria than those aged less than 40 years (OR=1.36, p > 0.05). Diabetes duration of 14 years or more was associated with three fold increase in the risk of proteinuria as compared to the duration of less than 7 years(OR=3.32, P<0.05).

Well controlled patients in our population had lower prevalence of proteinuria than poorly controlled patients (22.8 vs.26.3%).

Glycemic control in this study was assessed by average plasma glucose or/and post-prandial plasma glucose. HbA1C levels correlate closely with the average glycaemia over the preceding 8–12 weeks. The average glucose level is feasible for reporting and management of diabetes in case of the nonavailability of HbA1C levels. (45). Only twenty per cent of our population had optimal glycemic control. The supply of insulin is erratic and insufficient in most developing countries. In Libya insulin and oral hypoglycemic drugs are free of charge. Factors contributing to poor control in our patients include inadequate management of diabetes by junior doctors, lack of health education leading to poor attendance and poor compliance, lack of home blood glucose monitoring and high illiteracy rate in most of the patients.

The main limitations of this study are the use of dipstick to test the concentration of protein in urine, the use of direct ophthalmoscopy to detect retinal changes and the use of plasma glucose levels as indicators for glycemic control. However, in spite of these limitations this study provides a baseline data about long term complications of diabetes in Libya.

Health care givers in most developing countries are largely unaware of the magnitude of the problem of noncommunicable diseases and diabetes ranks low in their priority list. This study provides evidence to health care givers in Libya that diabetes care in Libya is suboptimal.

It should be emphasized to health care givers that there is an urgent need for an integrated Libyan program that addresses type 2 diabetes and other major noncommunicable diseases.

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Competing interests

None declared

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