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Hawa Juma El-Shareif
Endocrine Department, Tripoli Medical Center (Tripoli University for Medical Sciences, Faculty of Medicine), Tripoli, Libya

Quality of care for type 2 diabetes mellitus in Tripoli Medical Center: a retrospective study of 628 patients

ABSTRACT

Introduction. Diabetes mellitus (DM) is a major public health problem. Evidence has shown that aggressive control of hyperglycemia and associated risk factors reduces the risk of both macrovascular and microvascular complications. The aim of this study was to determine the proportion of diabetes patients reaching the targets recommended by The American Diabetes Association (ADA) standards for diabetes care.

Methods and materials. This is a retrospective study, conducted at the diabetes outpatient clinics at TMC. For 628 patients with diabetes with at least two clinic visits in the 24 months before August 2010, we assessed measurement and control of HbA_{1c}, blood pressure, and lipid, the data were collected in a specially designed data sheet, and analyzed using SPSS program.

Results. 628 patients were studied. The mean age was 49.6 ± 11.8 years; average duration of diabetes was 6.5 ± 5.0 years. The mean last HbA_{1c} was 8.2 ± 2.4%. 75.1% attained a systolic blood pressure of < 140 and 75.7% attained a diastolic blood pressure of < 90 mm Hg. Only 30.8% had LDL cholesterol of < 100 mg/dL and 49.0% had a triglyceride level of < 150 mg/dL. The rate of annual foot examination, retinal examination screening, and urine microalbumin screening were low.

Conclusions. This study demonstrates a low rate of diabetes care targets achievement among patients with type 2 diabetes treated at TMC. (Clin Diabetol 2017; 6, 6: 204–210)

Key words: glycemic control, diabetes type 2, Libya, TMC, targets, standards, quality of care, tertiary care

Introduction

Diabetes mellitus (DM) is a major public health problem that is growing rapidly throughout the world, and its incidence is approaching epidemic proportions [1]. According to the International Diabetes Federation's (IDF) statistics released, as many as 80% of people with diabetes live in developing countries, where, population growth, ageing and, urbanisation with dramatic changes in lifestyle all contribute to the dramatic pace of the epidemic [2].

The prevalence of diabetes mellitus in Libya is not precisely known, although it has been estimated to be as high as 14.1% [3]. The prevalence of type 2 diabetes and impaired glucose regulation reported in a Libyan population based stepwise survey, which assessed the prevalence of cardiovascular risk factors among Libyans aged 25–64 was 23.7% [4].

Diabetes has been associated with chronic metabolic conditions such as obesity and metabolic syndrome, as well as related macrovascular and microvascular complications, such as coronary artery disease, peripheral vascular disease, stroke, diabetic neuropathy, renal failure and blindness [5, 6]. Diabetic complications result in significant disability, reduce life

Address for correspondence:
Professor Hawa Juma El-Shareif
Endocrine Department, Tripoli Medical Center
(Tripoli University for Medical Sciences, Faculty of Medicine),
Tripoli, Libya
e-mail: hawa_elsharif@yahoo.com
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expectancy and impose an enormous burden on socio-economic and public health care systems [7–10]. Direct medical costs consist of resources used to manage the disease. Indirect costs include lost productivity caused by morbidity, disability and premature mortality [9, 10].

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 [11, 12]. Several clinical trials have demonstrated that intensive glycemic control effectively delays the onset and slows the progression of diabetic complications, such as nephropathy, retinopathy, and neuropathy [13, 14]. Likewise, strong evidence has shown that aggressive control of associated risk factors such as hypertension, and hyperlipidemia reduces the risk of both microvascular and macrovascular complications [15, 16]. In addition, early detection of complications, by systematic annual screening, allows early diagnosis and early intervention [17–20]. The American Diabetes Association (ADA) recommends a set of diabetic care standards that advocate aggressive management of hyperglycemia, hypertension, and hyperlipidemia for patients with diabetes [21]. Despite the publication of the ADA and other guidelines, several studies have reported suboptimal target achievement and care provided to people with diabetes based on evidence-based quality of care standards [22, 23].

The aim of this study was to determine the proportion of diabetes patients reaching the targets recommended by the ADA standards for diabetes care.

Methods and materials

This is a retrospective study, conducted at the diabetes outpatient clinics at the Tripoli Medical Center (TMC), a tertiary care center. Data collection was carried out in August and September 2010. The records of the first registered diabetic patients at the TMC diabetes clinic were reviewed. Patients were eligible for inclusion if they were of Libyan nationality, had type 2 diabetes, according to their medical records, and had at least two visits to the study clinic in the 24 months before August 2010. A total of 713 patients was included.

Information about patient demographic characteristics, smoking history, education, employment, duration of diabetes, presence of complications and the prescribed medication including lipid-lowering therapy and aspirin usage. Data for the most recent clinic visit were obtained using a chart review form. The following variables were assessed: height, weight, and blood pressure measurements during the most recent visit. Body mass index (BMI) was calculated using the formula: weight (kg)/height (m^2). Aoutcome of foot examination, retinal examination, and urine microalbumin screening performed in the prior year were recorded. The last measured value of HbA_{1c}, creatinine level, LDL cholesterol (LDL-C), HDL cholesterol (HDL-C), triglyceride, and total cholesterol were collected. Also, frequency of performing these measurements within the prior year follow-up was assessed.

The targets used for this study were those specified by the ADA guidelines, namely $HbA_{1c} < 7\%$, LDL-C ≤ 100 mg/dL, HDL-C ≥ 40 mg/dL, total cholesterol ≤ 200 mg/dL, triglycerides ≤ 150 mg/dL, systolic blood pressure ≤ 130 mm Hg, and diastolic blood pressure ≤ 80 mm Hg, fasting blood glucose (FBG) ≤ 130 mg/dL.

Data were analyzed using the Statistical Package for Social Science (SPSS Inc., IBM, US), 19^{th} version. Continuous variables are expressed as mean ± standard deviation (SD) and range. Categorical data are expressed as numbers and percentages. Student's t-test was used to compare continuous variables and qualitative variables were analyzed with the chi-square test or Fisher's exact test. This study was carried out in accordance with the principles of the Helsinki Declaration. A formal approval was obtained from institutional authorities.

Results

The clinical characteristics of the 628 patients is as follows: mean age was 49.6 ± 11.8 years (18–81), 294 (46.8%) were males, the mean disease duration was 6.5 ± 5.0 years (range 1–34) and 300 (47.8%) had a positive family history of diabetes.

Smoking history was available for 442 (70.4%) of patients, where 69 (15.6%) were current smoker, 28 (6.3%) were ex-smoker and 345 (78.1%) were non smokers. 67 (97.1%) of current smokers were males.

Body weight and height were documented for 370 (58.9%) patients, mean BMI was 30.8 ± 8.4. Only 76 patients (20.5%) had a BMI < 25 kg/m^2, 118 patients (31.9%) were overweight with a BMI between 25–29 kg/m^2 and 176 patients (47.6%) were obese with a BMI ≥ 30 kg/m^2.

Approximately 204 (32.5%) of patients had been on insulin, either alone or in combination with oral hypoglycemic agents (OHA), 292 (46.5%) were on metformin either alone or in combination with insulin and/or sulfonyleurea. 238 (37.9%) were on sulfonyleurea either alone or in combination with basal insulin and/or metformin.

Table 1 summarize the proportion of patients for whom the aspect of care have been documented in their medical records.

The mean fasting blood sugar was 195.0 ± 79.5 mg/dL (range 31–721). HbA_{1c} results in the previous

Table 1. The aspect of care documented in medical records at last visit

Variable	No. (%)	Variable	No. (%)
Weight	543 (86.5)	Triglyceride	404 (64.3)
BMI	370 (58.9)	LDL cholesterol	312 (49.7)
Systolic blood pressure	569 (90.6)	HDL cholesterol	311 (49.5)
Diastolic blood pressure	569 (90.6)	Urea and/or creatinine	319 (50.8)
Fasting blood glucose	519 (82.6)	Microalbuminuria	43(6.8)
HbA_{1c}	371 (59.1)	Annual dilated fundus examination	20 (3.2)
Total cholesterol	393 (62.6)		

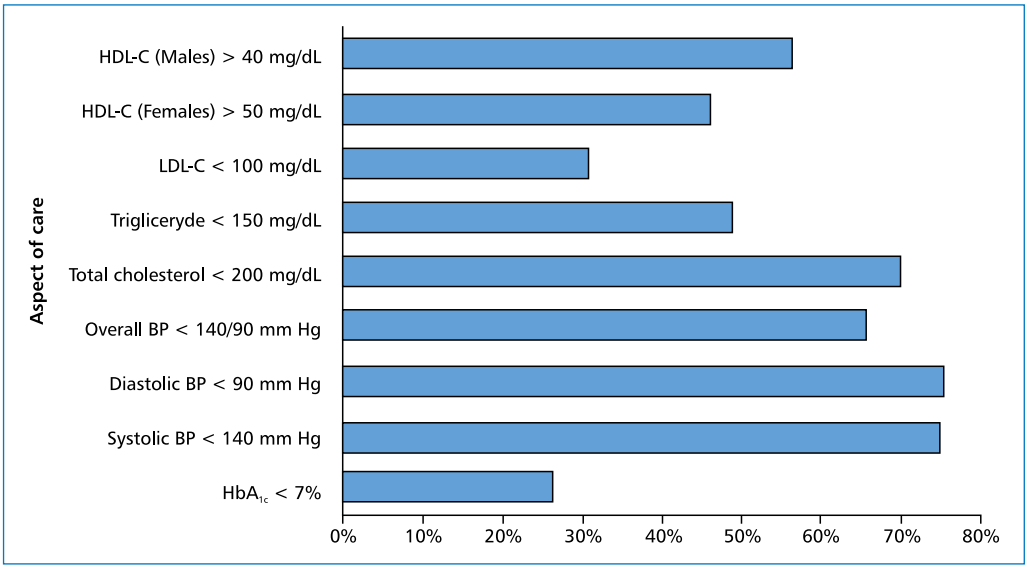

Figure 1. Proportion of patients with type 2 diabetes mellitus reaching the targets of ADA standards of medical care in diabetes at Tripoli Medical Center. BP — blood pressure

year were available for 371 (59.1%) patients and a mean frequency of testing was 1.5 ± 0.8 (range 1–5). The mean last HbA_{1c} carried out for them was 8.2 ± 2.4% (range 4.0–16). 98 (26.4%) achieved the recommended goals for both blood glucose (HbA_{1c} < 6.5%), 57 (15.4%) achieved HbA_{1c} < 7.5%, but more than 6.5%, and 62 (16.7%) achieved HbA_{1c} 7.5 – < 8.5 and in 154 (41.5%) the HbA_{1c} > 8.5%.

Documentation of blood pressure measurement was available for 570 (90.8%). The mean systolic blood pressure was 125.9 ± 17.2 (range 85–200) mm Hg, and the mean diastolic blood pressure was 79.6 ± 9.4 (range 50–110) mm Hg.

The distribution of patients' systolic blood pressure was: 428 (75.1%) ones with < 140 mm Hg, and 142 (24.9%) ones with > 140 mm Hg (Fig. 1). The distribution of patients' diastolic blood pressure was: 431 (75.7%) ones with < 90 mm Hg and 138 (24.3%) ones with ≥ 90 mm Hg.

110 (17.5%) were on statins, 287 (45.7%) were on aspirin and 62 (9.9%) were on ACE inhibitors. The number of follow up in the previous year was 1.4 ± 1.6 (range 0–7); 64 (10.2%) had peripheral neuropathy (PNP) based on symptoms or clinical examinations, 27 (4.3%) had retinopathy, documentation of annual eye's fundus examination available in 20 (3.2%). Symptoms of claudication were present among 14 (2.2%) patients. Examination of peripheral blood vessels done among 4 (0.6%) patients. Two patients (0.3%) had a history of amputations and 28 (4.5%) ones had ischaemic heart disease in the form of stable angina. Annual testing for protein urea was available among 43 (6.8%) patients. Results of blood urea and creatinine levels was available among 319 (50.8%) patients.

Results of total cholesterol, TG, HDL-C, LDL-C were available among 393 (62.6%), 404 (64.3%), 311 (49.5%), 312 (49.7%) of patients' files respectively. In those with available results, the mean serum total cholesterol was 187.4 ± 72.5 (101–973) mg/dL. 277 patients (70.0%) had a total cholesterol < 200 mg/dL. The mean total serum triglyceride value was 170.4 ± 104.9 (40–937) mg/dL. 196 patients (49.0%) had a triglyceride level of < 150 mg/dL. Mean high density lipoprotein cholesterol (HDL) level was 47.4 ± 12.9 (14.5–84.6) mg/dL. Only 80 female patients (46.2%) and 78 male patients (56.5%) had HDL level above the recommended of 50 mg/dL and 40 mg/dL. Low density lipoprotein cholesterol (LDL) level was 123.4 ± 50.6 (37.4–452) mg/dL. Only seventy 96 patients (30.8%) had LDL cholesterol of < 100 mg/dL (Figure 1).

Discussion

Diabetes is a chronic metabolic condition, which is associated with increased morbidity, disability, and mortality, largely due to microvascular complications such as nephropathy, retinopathy and neuropathy and macrovascular complications such as coronary artery disease, peripheral vascular disease and stroke [6, 7].

Several clinical trials have shown that intensive glycemic control and the associated CV risk factors such as hypertension, and hyperlipidemia in diabetic patients reduces the risk of both microvascular and macrovascular complications [13–16].

Despite the broadly distributed diabetes care guidelines, which give clear recommendations to the glycemic, blood pressure and lipid targets in diabetic patients, several studies have indicated that achievement of these targets is suboptimal [22–25].

In the present study, only 59.1% of patients had at least one HbA_{1c} test results available in their files, during the year prior to last visit. The frequency of testing during that year was 1.5 ± 0.8.

Regular HbA_{1c} measurement is important for effective diabetes management. HbA_{1c} reflects the average level of blood glucose over approximately 3 months and has strong predictive value for diabetes complications. ADA recommendation is to perform the A1C test at least two times a year in patients who have stable glycemic control and more frequently in patients who are not meeting glycemic goals. HbA_{1c} measurement is an essential indicator for optimal quality of diabetes care. Studies have found an association between adherence to HbA_{1c} measurement and quality outputs [26–28].

Data from Kuwait found that doubling of the HbA_{1c} measurements (from 30% to 63%) between 2010 and 2012, was associated with a decrease in the rate of poorly controlled HbA_{1c} from around 80% to 55% [29]. Our findings regarding glycemic control are comparable with those of studies in other Arab countries, 26.4% patients achieved HbA_{1c} < 6.5% and 41.8% ones achieved HbA_{1c} < 7.5%. In a study from a university health center in Lebanon, target goal for HbA_{1c} of < 7% was met in 28.4% individuals [30]. In a study from Saudi Arabia tertiary care hospital in Riyadh only 21.8% patients achieved HBA_{1c} < 7% [31]. Another study conducted in 28 Saudi health centers, all over the country, only 27% of patients achieved the target level of HbA_{1c} of < 7% [32]. A study from a tertiary care setting in UAE in 2008, found that only 20% achieved the target of HbA_{1c} in that year [33].

In the present study, 41.5% of patients had HbA_{1c} above 8.5%, this is less than the 54% reported in a study looking at diabetics in primary care settings in Saudia, and the 55.4% reported rate for poor control in Kuwait [29, 34].

Major clinical trials have shown that the target HbA_{1c} goal, is difficult to maintain in clinical practice. According to the National Health and Nutrition Examination Survey (NHANES IV) 1999–2000, only 37% of participants with previously diagnosed diabetes achieved the target HbA_{1c} goal of less than 7.0% [35]. In the United Kingdom Prospective Diabetes Study (UKPDS) HbA_{1c} of 7.0% was achieved in only 50% of patients [36].

Barriers to achieving optimal glycemic goal include poor-compliance to diet, exercise and medications, lack of educations as well as cultural barriers. Clinical inertia may also contribute to it [37, 38].

In Tripoli medical center, diabetes outpatient clinic, the nurses are responsible for blood pressure and body weight measurement, on each visit before the consultation. 570 (90.8%) of our patients had their BP documented, this rate is comparable to other studies, where more than 85% of patients attending the diabetic clinic had their blood pressure checked regularly [22, 23, 30, 39].

Blood pressure control is associated with significantly lower risk of mortality, cardiovascular events, coronary heart disease, stroke, albuminuria, and retinopathy [6, 12, 15, 17, 19]. Previous ADA guidelines recommended strict blood pressure target of < 130/80 mm Hg in diabetic patients. In the Action to Control Cardiovascular Risk in Diabetes Blood Pressure (ACCORD-BP) trial, blood pressure reduction to < 120 mm Hg compared with < 140 mm Hg, did not reduce mortality or overall cardiovascular outcomes, but significantly reduce stroke risk [40]. The current ADA recommendation is to achieve blood pressure levels < 140/90 mm Hg to reduce cardiovascular disease (CVD) mortality and slow chronic kidney disease progression [21].

In the present study, the overall, systolic and diastolic blood pressure goals of < 140/90 mm Hg were achieved in 65.8%, 75.1%, 75.7% patients respectively. 29.0% patients achieved both systolic and diastolic blood pressure targets of < 130/80 mm Hg. In a study from Lebanon systolic and diastolic blood pressure goals of 135/85 mm Hg were met in 55.4%, 65.7%, of their studied patients [30]. In a study from a tertiary care center in Saudi Arabia, involving 1188 diabetic patients the overall, systolic and diastolic blood pressure goals of < 130/80 were achieved in 39.0, 47.6 and 74.6% of diabetic patients respectively [31].

Blood pressure control in diabetic patients is often challenging, and most patients with diabetes and hypertension require multiple-drug therapy to achieve blood pressure treatment goals [15, 21]. Only 35.8% of the people with diabetes that participated in the NHANES 1999–2000 survey reached the target of systolic blood pressure ≤ 130/80 mm Hg [35].

Several factors can contribute to poor blood pressure control, clinical inertia, with the failure of the healthcare professionals to initiate or optimize drug therapy to achieve blood pressure targets [37, 38]. Poor compliance with prescribed medication is another important factor. Education and identifying and addressing the reasons for poor compliance is important to enhance medication adherence [37, 38].

In the present study, 62.6%, 64.3% of patients have documented total cholesterol and triglyceride measurement respectively, and about 49% had documented HDL or LDL measurement. Annual lipid measurement was documented in 34% in Kuwait, 58% in Abu Dhabi, and 87% in Saudi Arabia [29, 31]. About 51% of patients had their triglyceride above the target level, and 53.8% of female patients and 43.5% of male patients had their HDL cholesterol below the recommended target level. Only 30.8% of our diabetics had LDL cholesterol of < 100 mg/dL, which meets the ADA goals for LDL cholesterol in diabetics.

Similar rates have been reported from a retrospective study from the United States of America, including data of 7.114 diabetic patients, with goal attainment rates for LDL < 100 mg/dL, HDL > 45 mg/dL, and for triglycerides < 150 mg/dL at 23%, 37%, and 33.8% respectively [39].

In a retrospective study from Oman including 430 diabetic subjects from six general health centers, the proportion of patients meeting internationally recognized goals for LDL cholesterol, HDL cholesterol and triglycerides were 15%, 32%, and 68% respectively [41].

Despite the evidence base and guideline recommendations for specific preventive screening, such as ophthalmological examination, foot examinations, and screening for microalbuminuria, the documentation of foot examination, eye examination, and screening for microalbuminuria were low, annual testing for protein urea available in only 6.8% and dilated eye's fundus examination in 3.2% of patients.

Diabetes needs a multidisciplinary team care approach to improve glycemic control. Nurses can play an important role in patient-oriented care, through education and facilitating of patient adherence to treatment and annual screening procedures.

Diabetes mellitus is a major health problem. International guidelines and evidence recommended standards of care and targets for better outcomes. Challenges for good control lie with effectively implementing them across the population. Continuing audit of diabetes services is an important tool to assess the current practice and highlighting deficiencies and thereby implement strategies to achieve the management goals of a good quality care.

Limitations of this study

First, the retrospective nature of the study, and the use of medical records to evaluate the care provided and patients' outcomes, depend on the quality of documentation, and may underestimate the actual frequency of screening procedures due to lack of documentation.

Second, factors that influence the outcome like patient's compliance was not evaluated in this study.

Conclusion

Despite the adaptation of ADA standards of diabetes care at our centre, this study showed that a large number of patients were not achieving the recommended treatment targets. Further studies are needed to find out the causes of the gap between guidelines and practice and help in identifying the barriers to optimal diabetes care. Using a diabetes flow-sheet, which includes all the required targets of diabetes care, as advised by guidelines, would facilitate documentation and disease management.

The role of nurses in diabetes care should be enhanced and nurses involvement in ordering routine laboratory and screening procedures would help ensure that, by the time patients are seen by the doctor, a number of recommended screening procedures have been done.

Conflict of interest

The authors have no conflicts of interest.

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