The Review of DIABETIC STUDIES

ORIGINAL DATA

Prevalence of Type 2 Diabetic Patients Within the Targets of Care Guidelines in Daily Clinical Practice: A Multi-Center Study in Brazil

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Abstract

Major clinical studies have shown that the targets for blood glucose, lipid profile and blood pressure in type 2 diabetic patients are difficult to maintain in clinical practice. However, there are few data concerning South American populations. Using guidelines represented by the Brazilian Diabetes Society, we evaluated cardiovascular (CV) risk factors, glycemic control and the availability of screening for diabetes complications in 2233 (60% females) outpatients with type 2 diabetes aged 59.2 ± 11.3 yr and with a known duration of diabetes of 9.2 ± 7.2 yr, collected from 8 Brazilian cities. The outcome showed that less intensive clinical care available for diabetic patients in Brazil compared to western industrialized countries leads to widespread poor metabolic control and health status. Less than 30% of the patients reached the target for systolic (28.5%, < 130 mmHg) and diastolic (19.3%, < 80 mmHg) blood pressure, BMI (24.6%, < 25 kg/m^2), LDL cholesterol (20.6%, < 2.6 mmol/l) and only 46% reached the goal for HbA1c (one % point above the upper limits of normality for the method used). Only 0.2% of patients reached all the targets. A lower number of women reached the targets for HbA1c, LDL and HDL cholesterol than men ($p < 0.001$). Women were less likely than men to have funduscopy examinations and urine albumin testing ($p < 0.001$). We conclude that the national goals for glycemic control, blood pressure and lipid levels are rarely achieved in clinical practice, and that the availability for diabetic complication screening is low. The quality of diabetes care, in particular for women, is poor and should be further reviewed in developing countries.

Keywords: glycemic control · type 2 diabetes · blood pressure control · guidelines · diabetic complications

Introduction

Diabetes has emerged as a major health problem in developing countries, where non-communicable conditions are rapidly outrunning communicable diseases as the most common cause of death. Recent World Health Organization (WHO) projections suggest that, over the next two decades, the largest increase in the number of people with diabetes will be seen in people of working age in developing countries

[1]. Today there is strong evidence that supports both the efficacy and cost-effectiveness of programs directed towards an improvement of glycemic control and other cardiovascular risk factors in patients with type 2 diabetes [2, 3]. The realization of such programs has contributed to a decrease in the prevalence of chronic complications. However, most patients with type 2 diabetes never achieve the goals established by guidelines issued by diabetes societies [4-9].

According to a Brazilian survey, diabetes is the fifth most common reason for hospitalization, and is among the top ten major causes of mortality [10]. One of the main problems is that diabetic patients do not have regular access to health programs. In addition, the supply of glucose strips for self-monitoring, oral hypoglycemic agents (OHA), and sometimes even insulin made available by the National Brazilian Health Care System (NBHCS), is irregular. The aim of our study was therefore to examine the outcome of diabetic disease management and to determine the proportion of type 2 diabetic patients who meet the targets of good clinical practice in a national multi-center study during routine endocrine care. The study sheds some light on the association between clinical practice granted to diabetic patients in developing countries and poor health status relating to metabolism and risks of diabetic complications.

Research design and methods

This cross-sectional multi-center study was conducted between May 2000 and May 2001 in thirteen public endocrine clinics from eight Brazilian cities. Each clinic provided data from at least 100 consecutive routinely attending outpatients with type 2 diabetes (diagnosed at age ≥ 30 yr, without insulin use in the first year after diagnosis and without a history of ketonuria). We limited our study to those patients who had at least one visit, mainly within the last six months, and who had been followed at each center for at least one year. For each patient, data from the most recent clinic visit (defined as a visit with a physical examination by a physician) were collected using standardized chart review forms. The following variables were assessed: age, duration of diabetes (yr), body mass index (BMI in kg/m^2), blood pressure (systolic and diastolic in mmHg), HbA1c (%), fasting (FPG) and postprandial glucose (PPG), total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, treatment for diabetes (diet, OHA as monotherapy, combination of OHA, insulin as monotherapy and combination of insulin plus OHA). Additionally, funduscopy, microalbuminuria, and a foot examination in the prior year, as recommended by the Brazilian Diabetes Society (BDS), were evaluated [11].

We used the recommendations for criteria of good metabolic control and management of diabetes represented by the BDS to assess if our patients reach the goals in the different treatment groups. BDS defines the targets for metabolic control of diabetic patients as follows:

1. HbA1 or HbA1c at most 1% point above the upper limit of the normal range, i.e. ≤ 7%.
2. Systolic blood pressure (sBP) < 130 mmHg.
3. Diastolic BP < 80 mmHg.
4. BMI < 25 kg/m^2.
5. FPG < 6.1 mmol/l.
6. PPG < 7.8 mmol/l.
7. Total cholesterol < 5.2 mmol/l.
8. HDL cholesterol > 1.0 mmol/l for men; > 1.3 mmol/l for women.
9. LDL cholesterol < 2.6 mmol/l.
10. Non-HDL cholesterol < 3.3 mmol/l.
11. Triglycerides < 1.7 mmol/l.

Hypertension was defined as systolic blood pressure (sBP) > 140 mmHg and/or diastolic blood pressure dBP > 90 mmHg [11] or any value in patients under anti-hypertensive treatment. We determined HbA1 or HbA1c using high pressure liquid chromatography (8 centers, normal range 4.5 - 6.2%), electrophoresis (4 centers, normal range 6.5 - 9.0%), and ion exchange chromatography (2 centers, normal range 6.2 - 8.5%). Plasma glucose, triglycerides, HDL and total cholesterol levels were measured by enzymatic techniques. The study was approved by the local ethics committee.

The statistical analyses were performed using SPSS (Statistical Package for the Social Science) for Windows, version 13.0. The results are expressed as mean ± SD. Continuous normally distributed variables were compared by Student's *t* test and the analysis of variance. Variables not normally distributed were compared by the Mann-Whitney and Kruskal-Wallis test. Proportions were compared using χ^2 tests. Variables without Gaussian distribution were log-transformed before analysis. The analyses were adjusted for gender, age and duration of diabetes. p-values < 0.05 were considered as significant.

Results

Data from 2,233 patients (60% female) were analyzed. Mean ± SD of age and duration of diabetes were 59.2 ± 11.3 yr and 9.2 ± 7.2 yr, respectively. All patients received health care from the NBHCS and

had a low income and education level, similarly to those in another Brazilian survey [12]. Table 1 shows the proportion of patients who had a clinical and laboratory evaluation and who achieved the BDS criteria. Two-thirds of the patients were overweight (42.1%) or obese (33.3%). A similar proportion of women and men reached the goal for BMI (Table 2), but nevertheless women had a significantly higher BMI (28.8 ± 5.5 kg/m²) than men (27.7 ± 4.6 kg/m²) ($p = 0.001$) and a higher prevalence of obesity (37.9% vs. 26.6%, $p < 0.001$).

The therapeutic prescription by the time of the last clinic visit was not documented in 14.1% of the clinical files. Diet alone (11.6%), one OHA (33.2%), combination therapy, and insulin as monotherapy (55.2%), were the therapeutic regimens applied for 85.9% of the patients.

A significant shorter duration of diabetes could be observed in patients treated with diet alone (7.4 ± 6.2 yr), one OHA (8.3 ± 7.0 yr) and OHA combination (7.5 ± 5.7 yr) in comparison with patients treated with insulin plus OHA (10.4 ± 6.5 yr) and insulin as monotherapy (11.8 ± 8.2 yr), $p < 0.001$. This may be regarded as an expected result as insulin is mostly taken later in the course of the disease. However, we could also observe an association between treatment groups and the prevalence of patients within glycemic control goals. Patients treated with diet (67%), one OHA (56.4%) or combination of OHA (43.4%) reached the targets better than those treated with insulin as monotherapy (35.3%) or a combination of insulin and OHA (39%). In a comparison of treatment groups diet, OHA and OHA combination with insulin monotherapy, we observed a significant lower ($p < 0.001$) rate of achievement of objectives in the insulin group. No significant difference was found between patients treated with insulin monotherapy and combination of insulin plus OHA (Table 3). These results endured even after adjustment for age and gender. It is surprising that a significant higher fraction of patients treated with diet or OHA reached the BDS criteria for metabolic control than those treated with insulin. This result may be attributed to problems with insulin dose adjustments on the part of the patients and the poor health care that is granted to these patients.

Only 0.2% of the patients reached all targets and 11.4% did not reach any. Fewer women than men reached the targets for glycemic control. The values for HbA1c (42.8% vs. 50.9%), total cholesterol (39.2% vs. 48.3%), LDL (17.2% vs. 25.7%) and HDL (30.8% vs. 49.8%) were significant ($p < 0.001$). Furthermore, women (43.8%) had less frequent eye examinations than men (51.5%) (OR 1.35, 95% CI 1.14-1.60, $p < 0.001$) and less urine albumin screenings (34.3%) than men (45.9%): OR 1.62, 95% CI 1.36-1.93, $p < 0.001$. No significant differences in other variables could be observed (Table 2).

Table 1. Control of diabetes-related and cardiovascular risk factors in type 2 diabetic patients

Parameter	T2DM	Measured in prior yr, n (%)	Patients at goal, n (%)#
HbA1 or HbA1c (%)		1883 (84.3)	866 (46.0)
BMI (kg/m²)	28.3 ± 5.20	2076 (93.0)	511 (24.6)
FPG (mmol/l)	9.6 ± 4.22	2189 (98.0)	738 (33.0)
PPG (mmol/l)	12.2 ± 5.35	1314 (58.8)	307 (13.7)
Systolic BP (mmHg)	140.2 ± 22.70	2187 (97.9)	623 (28.5)
Diastolic BP (mmHg)	85.4 ± 4.40	2187 (97.9)	423 (19.3)
Total cholesterol (mmol/l)	5.4 ± 1.15	2072 (92.8)	888 (42.9)
Triglycerides (mmol/l)	1.97 ± 1.45	2055 (92.0)	1127 (54.8)
HDL (mmol/l)	1.16 ± 0.32	1721 (77.1)	664 (38.6)
Non-HDL cholesterol (mmol/l)	4.97 ± 1.30	1706 (76.4)	174 (10.2)
LDL cholesterol (mmol/l)*	3.39 ± 1.00	1606 (71.9)	331 (20.6)
Hypertension (Y)‡		1447 (66.2)	
Foot examination		1300 (58.2)	
Fundoscopy		1047 (46.9)	
Urine albumin screening		869 (38.9)	
Smoking status		1216 (54.5)	

Legend: Data are mean ± SD as well as numbers (n) and fractions (%) of patients who either had a control in the prior year or who reached the targets. BMI: body mass index. BP: blood pressure. FPG: fasting blood glucose. PPG: postprandial glucose. HDL: high-density lipoprotein. LDL: low-density lipoprotein. # For this analysis we considered the BDS criteria for metabolic control among patients with measured risk factors as follows: HbA1c or HbA1 was 1% above the upper limits of normality of the method used for determination, BMI < 25 kg/m2, sBP < 130 mmHg, dBP < 80 mmHg, FPG < 6.1 mmol/l, PPG < 7.8 mmol/l, total cholesterol < 5.2 mmol/l, HDL > 1.0 mmol/l (men) or > 1.3 mmol/l (women), LDL < 2.6 mmol/l, non-HDL cholesterol < 3.3 mmol/l, triglycerides < 1.7 mmol/l. ‡ Hypertension was defined as a sBP >140 mmHg and/or a dBP > 90 mmHg, or any value in patients being treated (Y). * LDL was not calculated if triglycerides were > 4.5 mmol/l (n = 83).

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Table 2. Number and proportion of male and female patients who reached the targets for metabolic control and screening for diabetic complications

Parameter	Women# (n = 1339)	Men# (n = 894)	p
HbA1 or HbA1c (%)	487 (42.8)	378 (50.9)	< 0.001
BMI (kg/m²)	294 (23.6)	217 (26.1)	n s
FPG (mmol/l)	433 (33.0)	305 (34.8)	n s
PPG (mmol/l)	140 (26.2)	167 (21.4)	0.04
Systolic BP (mmHg)	362 (27.6)	261 (29.8)	n s
Diastolic BP (mmHg)	260 (19.8)	163 (18.6)	n s
Total cholesterol (mmol/l)	483 (39.2)	405 (48.3)	< 0.001
Triglycerides (mmol/l)	667 (54.6)	460 (55.2)	n s
HDL (mmol/l)	314 (30.8)	350 (49.8)	< 0.001
Non-HDL cholesterol (mmol/l)	17 (1.7)	157 (22.5)	< 0.001
LDL cholesterol (mmol/l)*	162 (17.2)	169 (25.7)	< 0.001
Hypertension (Y)‡	760 (52.5)	687 (47.5)	n s
Foot examination	775 (57.9)	525 (58.7)	n s
Fundoscopy	587 (43.8)	460 (51.5)	< 0.001
Urine albumin screening	459 (34.3)	410 (45.9)	< 0.001
Smoking status	517 (42.6)	699 (57.4)	< 0.001

Legend: Data are numbers (n) and fractions (%) of patients who reached the targets. BMI: body mass index. BP: blood pressure. FPG: fasting blood glucose. PPG: postprandial glucose. HDL: high-density lipoprotein. LDL: low-density lipoprotein. # For this analysis we considered the BDS criteria for metabolic control among patients with measured risk factors (see legend of Table 1). ‡ Hypertension was defined as a sBP >140 mmHg and/or a dBP > 90 mmHg, or any value in patients being treated (Y). * LDL was not calculated if triglycerides were > 4.5 mmol/l (n = 83).

Discussion

A high number of patients with type 2 diabetes advised by endocrinologists in our sample, comprising data from public institutions, received annual cardiovascular diabetes risk factor (CVD) measurements. However, only 0.2% of the patients attained all of the recommended targets.

Although the BDS recommended at least one determination of glycated hemoglobin per year, about one-sixth of our patients had not done so because the kits were not provided routinely by the NBHCS. It is important to emphasize that different methods for measurement of HbA1c are used across the country. Despite the facts regarding poor metabolic control in Brazil mentioned above, the BDS decided to define the criterion of 1% above the upper reference level of the method used for HbA1c determination as the target for glycemic control. Although this is not an ideal criterion, it will be used until the standardization of HbA1c determination is better defined in this country.

Even though the majority of our patients were using complex therapeutic regimens, less than half of them met the goal for glycemic control. The latter particularly applies for the groups using insulin as treatment, i.e. less patients treated with insulin reached the targets compared to patients treated with diet or OHA. This phenomenon could be attributed to the long delay in applying insulin in the treatment of patients with poor glycemic control [4, 7], and to problems with insulin dose adjustments and the diabetic disease management in developing countries such as Brazil.

Today there is compelling evidence that intensive management of weight, cholesterol and blood pressure is effective in delaying or preventing microvascular and macrovascular complications. Although the majority of our patients were tested few met the goals, similar to patients in other studies [4, 7, 13, 14]. It is important to note that approximately 75% had a BMI > 25 kg/m², more than one third were obese. This fact is very significant because, until some years ago, undernutrition was one of the greatest problems. However, our results suggests that overweight and obesity can become an additional major health problem, which corresponds to another Brazilian survey [12].

Although the BDS guidelines recommend aggressive treatment of dyslipidemia and hypertension in all patients with diabetes, patients face the problem that the supply of drugs by the NBHCS for both treatments is irregular. Therefore, we could not guarantee that patients who reached the goals for both LDL cholesterol and blood pressure were under treatment at the time of our study.

We also observed that women were less likely than men to meet the goals for LDL cholesterol and glycemic control. Some studies showed similar results related to less aggressive treatment in women [15, 16]. Although other biological factors could account for these differences, the high cardiovascular mortality observed in women in the San Antonio study [17] should focus on gender-specific treatment and health goals.

Table 3. Association of the kind of treatment with duration of diabetes and glycemic control

Parameter	Treatment groups					p
	Diet alone	OHA monotherapy	OHA combination	Insulin monotherapy	Insulin plus OHA	
Duration of diabetes (yr)	7.4 ± 6.2	8.3 ± 7.0	7.5 ± 5.7	11.8 ± 8.2	10.4 ± 6.5	< 0.001*
Patients within glycemic control targets (%)	67	56.4	43.4	35.3	39	< 0.001#

Legend: OHA: oral hypoglycemic agents. * Diet alone plus OHA monotherapy plus OHA combination vs. insulin monotherapy plus insulin/OHA. # Diet alone plus OHA monotherapy plus OHA combination vs. insulin monotherapy.

The screening for diabetic complications did not meet BDS guidelines. Approximately half of the patients had a documented funduscopy, foot examination and smoking assessment similar to other studies [7]. In addition, only one third were tested for urine albumin, a lower proportion than previously described [7, 8], probably because this test is not regularly done in public hospitals. Women were less likely to have funduscopy examinations and urine albumin testing than men. Although it is difficult to confirm that women receive poorer healthcare, some studies conducted in general clinics, which have related the quality of diabetes care to socio-economic status, ethnicity, and sex, confirm this result [18, 19].

A limitation of our study may be related to the selection of patients. As the patients in our study lived in large cities of the country, the rural population was not included. However, in Brazil there were no data available regarding the prevalence of type 2 diabetes in the rural population.

We conclude from our study that the national goals for glycemic control, blood pressure and lipid levels are difficult to achieve in daily endocrine clinical practice in patients with type 2 diabetes. Multiple cardiovascular risk factors are found in most patients. The quality of diabetes care, particularly in women, must be addressed more carefully.

The doctors' and patients' expectations with regard to illness and health not always correspond to the objectives and expectations of the BDS treatment proposals. The_motivation of the physician to achieve a good result may be in conflict with the patient's own motivation and the supply of strips for glucose self-monitoring and medication by the NBHCS. Thus our findings are alarming in several respects and provide data to elaborate a necessary shift to a model to fulfill the multidisciplinary and patients' perspectives in Brazil. Furthermore, allocating more NBHCS resources for patient education and treatment may have the potential to improve the quality of diabetes care in developing countries, even though a general gap between the reality of routine diabetes care and the guidelines in the majority of the countries worldwide can be observed.

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