PATTERN OF GLYCEMIC, LIPID AND BLOOD PRESSURE CONTROL AMONG A COHORT OF DIABETIC PATIENTS WITH EVIDENCE OF CORONARY ARTERY DISEASE

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ABSTRACT

Objective: To identify the pattern of glycemic, lipid and blood pressure control among a cohort of diabetic patients referred to Queen Alia Heart Institute for further evaluation of coronary artery disease.

Methods: This is a descriptive study conducted at Queen Alia Heart Institute between 1/12/2004 and 1/9/2005. All newly referred diabetic patients (N=112) to Monday official referral clinic at the centre during this period were enrolled. A specially designed record form was completed including demographics, risk factors for coronary artery disease, medications, diabetes care giver name and the type of culprit cardiovascular event. Blood pressure was measured, and fasting lipid panel, blood sugar, and HbA1c were drawn.

Results: Only about one fourth of the study population had optimal glycemic and blood pressure control. Optimal body mass index was present in only 13.9% of patients (lower in females 7.5%). Smoking was prevalent in our study population (41.1%). Optimal low density lipoprotein, high density lipoprotein and triglyceride levels were obtained only in 33%, 22% and 34% of patients, respectively. Usage of recommended medications for secondary prevention was relatively low: aspirin (52.7%), angiotensin converting enzyme inhibitors, angiotensin receptor blockers (55.4%), beta blockers (59.8%) and HMG-coA reductase inhibitors (statins) (79.5%). Over half of the patients (51%) could not name their diabetes care-giver.

Conclusion: Diabetic patients referred to Queen Alia Heart Institute for further evaluation of coronary artery disease have poor glycemic, blood pressure and lipid control prior to their referral. More emphasis on these issues at the level of primary as well as secondary health care levels is imperative to delay the progression of atherosclerosis and reduce adverse cardiovascular events in these patients.

Key words: Coronary artery disease, Diabetic patients, Glycemic control

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Introduction

Diabetes mellitus (DM) affected approximately 171 million patients worldwide in 2000 (2.8% of the population). The large majority of these patients are type 2 diabetics (90-95%). By the year 2030, the diabetic population is expected to reach 366 million (4.4%). The projected increase is attributed to demographic changes as well as the increasing rate of obesity.[1-3]

The adult treatment panel of the National

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Cholesterol Education Program (NCEP) considered type 2 diabetes as a coronary artery disease (CAD) risk equivalent.[4,5] Both accelerated atherosclerosis and the increased adverse outcomes after coronary intervention have been attributed to various physiological mechanisms related to diabetes.[6-8] A growing body of evidence has demonstrated an association between tight glycemic controls on macrovascular endpoints, although the effect was unclear in the United Kingdom Prospective Diabetes Study.[9-13] Moreover, recent studies have demonstrated that aggressive treatment of DM may improve the clinical outcome after PCI.[14,15] In fact, the reduction of the increased cardiovascular risk in diabetic population requires a multifactorial approach in addition to glycemic control. There is substantial amount of evidence in the literature demonstrating the beneficial effects of tight control of multiple risk factors in them. These modifiable factors include: blood pressure, dyslipidemia, anti-platelet therapy, obesity and smoking status.[16]

The objective of this study was to identify the pattern of glycemic, lipid and blood pressure (BP) control among a cohort of diabetic patients referred to Queen Alia Heart Institute (QAHI) for further evaluation of their CAD. This study represents an essential step in evaluating and promoting the proficiency of diabetic patient care among primary and secondary care physicians in Jordan.

Methods

This is an observational study conducted in Monday referral cardiology clinic at QAHI – Amman /Jordan. The study enrolled 112 consecutive diabetic patients (59 males, 53 females) referred for further evaluation of CAD who were seen d between 1/12/2004 and 1/9/2005 and evaluated by one consultant (OA) and three cardiology specialists covering the mentioned clinic. Diabetic patients were identified as patients undergoing treatment with diet, insulin or oral hypoglycemic medications. Exclusion criteria include only patients who could not offer complete information and those with uncertain diagnosis for DM.

Data collected included risk factors for CAD and clinical characteristics (age, gender, history of hypertension, dyslipidemia, smoking, family history of CAD and type of clinical presentation, previous history of stroke or transient ischemic attack). Patients were also asked whether they knew the name of their diabetes care-giver. The prior use of statins, β blockers, ACEI and/or ARB, and aspirin were also evaluated.

During clinical examination, measurement of blood pressure (BP) was performed using a standard cuff technique using mercury sphygmomanometer to the nearest 5mmHg for all subjects. Weight and height were measured with ordinary scales to the nearest kilogram and centimeter, without footwear and in standing position. Body mass index (BMI) was then calculated using this formula (BMI= weight in Kg/height in m^2. Finally, blood was withdrawn for all patients regarding HBA1C and fasting blood sugar (FBS) to assess glycemic control and for lipid panel to assess control of dyslipidemia. The following parameters were used to define optimal treatment in these patients according to recent guidelines.[17,18]

- Optimal glycemic control: HBA1C≤7%.
- Optimal lipid control: LDL-C≤100 mg/dl, TG ≤ 150mg/dl, and HDL-C≥40 mg/dl (50mg/dl in women).
- Blood pressure ≤130/80mmHg in diabetic patients (≤120/80 after MI).
- Prophylactic daily therapy with aspirin for diabetic patients with CAD.
- BMI≤25 Kg/m^2.
- Current non-smoking status.

Continuous variables were expressed as mean values ± SD and discrete variables as absolute values and percentages.

Results

The percentages of those who achieve optimal as well as suboptimal goals for various studied factors are shown in Fig. 1. Demographic data (Table I) reveal the high frequency of many traditional risk factors among our study population: hypertension (63.4%), smoking (41.1%), overweight (36.6%) and obesity (50%). Positive family history for CAD was present in one third of patients while previous history of stroke and TIAs was infrequent (6.3%). Fifty seven patients (51%) were unaware of their diabetes care-giver's name.

The overall mean BMI was 30.2 ± 5.6 Kg/m^2 (29.1± 5.1 in males, 30.4 ± 6.1 in females). Optimal BMI ≤ 25 were obtained only in 13.4% of patients (18.6% in males, 7.5% in females), as demonstrated in Table II.

Only about a quarter of the study population had optimal glycemic control prior to presentation as clearly shown in Tables III and IV.

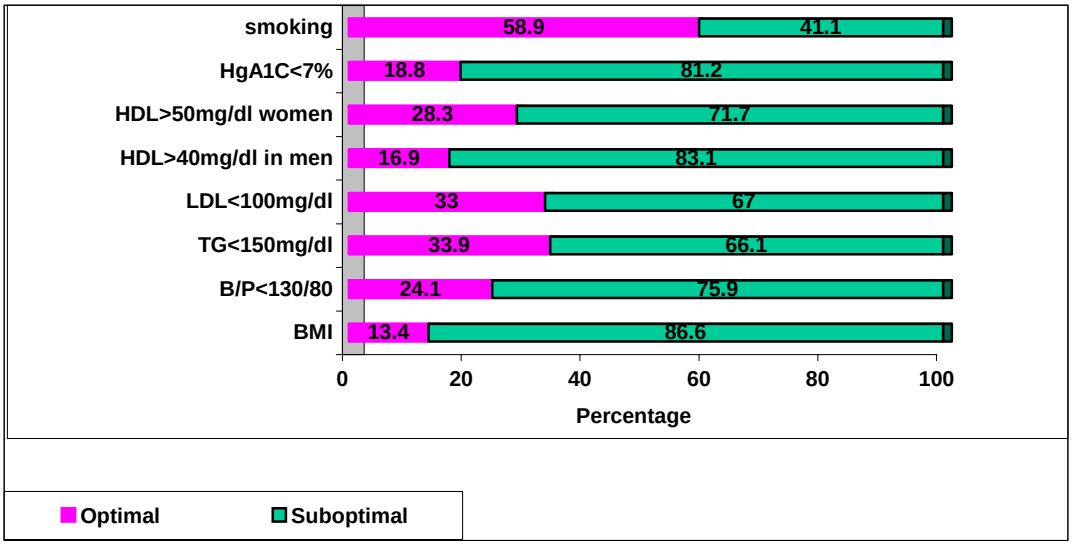

Fig. 1. The percentage of patients who achieved optimal or suboptimal treatment goals

Table I. Risk factors and clinical characteristics of our study population.

Item	Male	Female	Total
Total No. of patients	59	53	112 (100%)
Age (yrs)	59 ± 7.9	62 ± 9.1	60 ± 8.7
BMI (Kg/m2)	29 ± 5.1	30.4 ± 6.1	30.2 ± 5.6
Current smoking	38 (64.4%)	8 (15.1%)	46 (41.1%)
Family history of CAD	20 (33.9%)	16 (30.2%)	36 (32.1%)
Hypertension	34 (57.6%)	37 (69.8%)	71 (63.4%)
Previous stroke	5 (8.5%)	2 (3.8%)	7 (6.3%)
Angina	20 (33.9%)	25 (47.2%)	45 (40.2%)
Unstable angina	15 (25.4%)	10 (18.9%)	25 (22.3%)
Post-MI	15 (25.4%)	7 (13.2%)	22 (19.6%)
Other presentation	9 (15.3%)	11 (20.7%)	20 (17.9%)
Treatment with diet alone	3 (5%)	4 (7.5%)	7 (62.5%)
Insulin	14 (23.7%)	10 (18.9%)	24 (21.4%)
Oral agents	36 (61.0%)	29 (54.7%)	65 (58.0%)
Insulin and oral agents	6 (10.2%)	10 (18.9%)	16 (14.3%)

Very bad control (A1C > 9.5%) was observed in around a third of the study population.

Table V shows that only 24.1% of patients had optimal B/P control (less in females). The overall mean SBP was 149 ± 24.8 mmHg and DBP 87 ± 11.3 mmHg. The mean values in previously known hypertensive patients were 153 ± 25.5 mmHg for SBP and 88.2 ± 12.7 mmHg for DBP (males: 148.6 ± 29.2/ 86.1 ± 11.7, females : 157.0 ± 21.4 / 90.1 ± 12.7). Among the 24 patients who denied having hypertension, 10 patients (40.2%) were hypertensive (BP ≥ 160/90) during clinical examination.

Optimal LDL, HDL and triglyceride levels were noted in 37 patients (33%), 25 patients (22.3%) and 38 patients (33.9%) respectively. See Tables IV, IIV, IIIV.

Many medications shown to decrease the total and cardiac mortality in such a subset of patients were under-prescribed. Aspirin, ACE inhibitors, β blockers and statins were not administered in 52.7%, 55.4%, 59.8% and 79.5% of patients, respectively (See Table IX).

Discussion

Only around a quarter of the study population had optimal glycemic control prior to presentation. Similar bad control was seen in previously reported trials.[19-21]

A growing body of evidence has shown recently an association between tight glycemic control and macrovascular endpoints.[9-13]

Table II. Values of body mass indices of our study population

Value Kg/m2	< 25 Optimal (%)	25.1-29.9 Overweight (%)	> 30 Obese (%)	Total (%)
Male	11(18.6)	25(42.4)	23 (39)	59 (100)
Female	4 (7.5)	16 (30.2)	33 (62.3)	53 (100)
Total	15 (13.4)	41 (36.6)	56 (50)	112 (100)

Table III. Level of hyperglycemic control according to values of HBA1C

HbA1C	< 7% Optimal Control (%)	> 7%-<8.5% Good (%)	>8.5-<9.5% Fair (%)	> 9.5 Uncontrolled (%)	Total(%)
Male	10 (16.9)	15 (25.4)	16 (27.1)	18 (30.5)	59 (52.7)
Female	11 (20.8)	15 (28.3)	10 (18.9)	17 (32.1)	35 (47.3)
Total	21 (18.8)	30 (26.8)	26 (23.2)	35 (31.3)	112 (100)

Table IV. Level of hyperglycemic control according to values of fasting blood sugar

FBS Mg/dl	<126 (%)	126-155 (%)	> 155 (%)	Total (%)
Male	11 (18.7)	15 (25.4)	33 (55.9)	59 (100)
Female	14 (26.4)	10 (18.9)	29 (54.7)	53 (100)
Total	25 (22.3)	25 (22.3)	62 (55.4)	112 (100)

Khaw and his colleagues[10] demonstrated that a 1% increase in HbA1C was associated with 38% increase in cardiovascular mortality. During 10 years of post United Kingdom Prospective Diabetes Study follow-up, Holman and his colleagues[12] observed emergent risk reductions for MI and death from any cause despite modest differences in glycated hemoglobin. Moreover, recent studies showed that aggressive treatment of diabetes to achieve HBA1C levels ≤ 7% has a significant role in reducing the risk of restenosis and rates of target vessel revascularization and may improve the clinical outcome after PCI.[14,15]

Demographic data clearly demonstrated the high frequency of smoking habit among our male population (41.1% who were current smokers). Multiple large prospective trials have demonstrated a two-fold increase in the relative risk for all-cause mortality in the smoking versus non-smoking diabetic population.[22-23]

Optimal BMI was found in only in 13.4% of patients. This low percentage is an extremely important issue, as numerous studies have demonstrated increased mortality rates in individuals with a BMI ≥ 30 Kg/m^2.[19, 24,25]

To alter what is otherwise a fairly dismal prognosis, out-patient education programs should be used as an integral part of patient-care in DM, aiming at encouraging lifestyle modification (cessation of smoking, weight reduction and promotion of physical activity), in addition to coordination of nutritional therapy with dieticians.

Systemic hypertension was very frequent in our study population (63.4%), far exceeding the previously reported prevalence rates of 39-42%.[26-28] The current antihypertensive treatment targets are < 130/80 mmHg in diabetic patients and < 120/80 after myocardial infarction.[29-32] From the 24 patients who denied having prior history of hypertension, 10 patients (40.2%) were found hypertensive (BP ≥ 160/90) during clinical examination. Only 24.1% of patients had optimal B/P control (less in females). Current guidelines recommend the use of ACE inhibitors or ARB's as first line therapy in hypertension treatment in diabetic patients.[17,18,33] Unfortunately, more than half of the patients were neither on these medications nor on β blockers upon referral.

Poor BP control demonstrated among our hypertensive diabetic patients is similar to previously reported international and regional studies.[19-21,34,35] Although we did not look for the non-compliance rate which is the greatest obstacle to good BP in hypertensives[36] our findings strongly suggest that referring physicians are underutilizing appropriate medical therapies and therefore we recommend the implementation of management guidelines in order to achieve the required objective.

There is compelling evidence from literature that suggests that statins confer cardiovascular risk reduction to both high and low-risk diabetic patients.[37] The HPS (Heart Protection Study) demonstrated that cholesterol-lowering therapy was beneficial for people with DM even if they did not already have a history of CAD or high cholesterol concentrations.[38] Both the STEMI and the NSTEMI/UA ACC/AHA guidelines consider statin drugs class I recommendation regardless of baseline

Table V. Distribution of patients according to blood pressure readings

B/P Range	< 130/80 (%)	130-160 /80-90 (%)	> 160/> 90	> 160/< 90	<160/>90	Total
Male	17 (28.8)	32 (54.2)	7 (11.9)	2 (3.4)	2 (1.7)	59
Female	10 (18.9)	23 (43.4)	13 (24.5)	3 (5.7)	4 (7.5)	53
Total	27 (24.1)	55 (49.1)	20 (17.8)	5 (4.5)	5 (4.5)	112

Table VI. Low density lipoprotein levels in our study population

LDL level mg/dl	< 100 (%)	100-129 (%)	>130 (%)	Total (%)
Male	21 (35.6)	18 (30.5)	20 (33.9)	59 (100)
Female	16 (30.2)	10 (18.9)	27 (50.9)	53 (100)
Total	37 (33)	28 (25)	47 (42)	112 (100)

Table VII. High density lipoprotein levels in our study population

LDL level mg/dl	> 40 males & > 50 females (%)	> 40 males & > 50 females (%)	Total (%)
Male	10 (16.9)	49 (83.1)	59 (100)
Female	15 (28.2)	38 (71.7)	35 (100)
Total	25 (22.3)	87 (77.7)	112 (100)

Table VIII. Triglyceride levels

TG level mg/dl	<150 (%)	> 150 (%)	Total
Male	22 (37.3)	37 (62.7)	59 (100)
Female	16 (30.2)	37 (69.8)	35 (100)
Total	38 (33.9)	74 (66.1)	112 (100)

Table IX. Underpresciption of medications

Item	Yes (%)	No (%)
ACEI intake	50 (44.6)	62 (55.4)
B-Blockers	45 (40.2)	67 (59.8)
Statins	23 (20.5)	89 (79.5)
Aspirin intake	53 (47.3)	59 (52.7)

LDL Cholesterol. LDL targets of less than 70 mg/dl are also considered reasonable.[39-41] Unfortunately, despite the effectiveness of statins in altering cardiovascular mortality, several prior studies have documented low treatments rates in patients with established CAD.[19, 42-44]

In our study statins were prescribed only to about one fifth of our patient population. Only about one third of patients achieved the target LDL values (<100 mg/dl), a finding that is in other similar studies.[21,37,45,46] Moreover, only 22 % and 34% of patients met the existing guidelines for HDL levels and TG levels respectively.

Contemporary guidelines recommend prophylactic therapy with aspirin for diabetic patients with CAD[6, 17,18] unfortunately, fewer than half of the patients with CAD in this study were treated with aspirin suggesting, again, deficiencies in applying the appropriate guidelines by referring physicians.

Our data suggest that both glycemic control as well as numerous modifiable cardiovascular risk factors in diabetic patients referred to our centre are not adequately treated according to current guidelines and may highlight deficiencies in cardiovascular risk factor modification in the diabetic population as a whole. The low level of control reported is a clear signal that current paradigms of care delivery are inadequate.

Despite being a single centre observational study, we feel that our findings are broadly applicable because our institution has a very broad patient base. In this study, the patient sample was drawn from out-patients of a tertiary care centre in a metropolitan city of the country, where it may be expected that patients have access to higher standards of care than the rest of the country, but many of the patients were living outside the city and had attended

The relatively small sample size is a limitation to generalize our results to the community, but nevertheless we feel that important information is gathered from this subset, which is fairly typical regarding the type of patients we come across.

To promote patient-care in diabetic patients, combining strategies to combat more effectively cardiovascular disease is extremely essential.

We should encourage out-patient education programs that aim at increasing patient knowledge about the disease, motivating the patient to comply with complex treatment scheme, encouraging lifestyle modification and better coordination with dieticians.

From physician standpoint, we should urge primary as well as secondary care physicians to read and follow the guidelines that are generally published after a body of evidence is present in the literature. Lastly, the deficiencies in diabetic patient's care can be controlled by introducing a checklist (flow sheet) or electronic medical records as reminders to referring physicians.

Conclusion

Our efforts to face the current epidemic of DM and its cardiovascular consequences must include improved compliance to lifestyle measures and drug therapy through patient and community counselling as well as sensibilization of the medical profession to the importance of primary and secondary CAD prevention through appropriate long-term prescription of evidence-based therapies.

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