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Quality of medical management in coronary artery disease

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BACKGROUND AND OBJECTIVES: Patients with coronary artery disease (CAD) are at high risk of recurrent adverse cardiac events. Such risk can be diminished through a guideline-recommend optimal medical therapy (OMT), defined as adherence to appropriate antiplatelet therapy, lipid-lowering agents, beta-blockers and angiotensin-converting enzyme inhibitors, blood pressure <140/90 mm Hg (<130/80 mm Hg in diabetics and renal disease patients), low-density lipoprotein (LDL) <2 mmol/L, smoking cessation and aerobic physical activity, and hemoglobin (Hb) A1c <7%. Unfortunately, preliminary data suggest a wide gap between recommended and actual practices. The study aims to estimate the rate of achieving of OMT in CAD patients in Qassim Province.

DESIGN AND SETTINGS: This observational study enrolled 207 consecutive CAD patients seen in cardiology clinic in Prince Sultan Cardiac Center in Qassim between January 2012 and May 2012.

METHODS: Eligible participants were over the age of 18, with CAD documented by either noninvasive testing or by coronary angiogram. We collected the demographic, medications, laboratory, and clinical data through in-person interviews, medical records, and an electronic patient database.

RESULTS: OMT was achieved in only 10.4% of CAD patients. The rate of achievement of target systolic blood pressure was 76.5%, target diastolic blood pressure 88%, target LDL 68%, adherence to medications 91%. Diabetes was common (64% of all patients), and only 24% of these patients achieved the target HbA1c.

CONCLUSION: The poor achievement of optimal medical therapy in CAD patients contributes to preventable mortality, morbidity, and health care costs. The observed shortcomings warrant investment in strategies to achieve OMT in these high-risk patients.

Coronary artery disease (CAD) creates an enormous worldwide burden, including substantial problems in personal, societal, and economic terms. Although CAD occurs in both developing and industrialized countries, it is particularly problematic in rapidly developing middle-income nations such as Saudi Arabia due to rapid declines in physical activity levels and increasing availability of inexpensive, high-calorie foods. The likelihood of recurrent cardiac events mandates aggressive risk factor control in this high-risk population through optimal medical therapy (OMT). As defined by The American Heart Association and American College of Cardiology,[1] OMT includes adequate control of cardiovascular risk factors and adequate adherence to proven, recommended pharmacotherapy (**Table 1**).

Such medical therapy produces better long-term outcomes and is strongly recommended by all cardio-vascular societies around the globe. OMT reduces the occurrence of myocardial infarction, revascularization, hospitalizations and stroke, and also reduces mortality.[2] Unfortunately, research in the US and at the global level suggest that OMT is achieved in less than 50% of patients with CAD.[3,4] Preliminary data from Saudi Arabia suggests an even wider gap between achieved and recommended practices.

This study examined the patterns of suboptimal heart disease care in Qassim. It elucidated risk factor profiles among CAD patients in the Qassim region and measured the extent to which OMT was achieved. We hypothesized that OMT will be achieved in less than half of CAD patients and that patients with diabetes and/or obesity will be less likely to achieve OMT.

METHODS

We enrolled a total of 207 consecutive patients attending

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Table 1. Components of Optimal Medical Therapy (OMT).

(a) Blood pressure control: BP < 140/90 mm Hg (lower for patients with diabetes mellitus or chronic kidney disease where the target BP < 130/80 mm Hg)

(b) LDL-cholesterol control: Through life-style changes and medication therapy with LDL goal <2 mmol/L (100 mg/dL)

(c) For patients with diabetes mellitus, hyperglycemia control: Indicated by a hemoglobin A1c <7.0%

(d) Absence of cigarette smoking and minimized exposure to environmental tobacco smoke

(e) Adequate physical activity: Consisting of aerobic physical activity of moderate exertion occurring 30 min/d on most days of the week

(f) Adequate adherence to cardiac medications:
An antiplatelet agent, usually aspirin, sometimes combined with clopidogrel in the case of percutaneous coronary intervention (PCI). The latter for 1-y duration
Lipid-lowering agents, beta-blockers, and either an ACE inhibitor or ARB

the outpatient clinic at Prince Sultan Cardiac Center in Qassim (PSCCQ), Saudi Arabia, between January 2012 and May 2012. Eligible participants were over the age of 18, with documented CAD (coronary catheterization, coronary computed tomography, or nuclear stress test). We excluded patients who refused or were unable to sign the consent form.

We collected the demographic data through in-person interviews, and clinical data through the medical record, electronic database, and the PSCCQ cath laboratory database. Adult cardiologists performed patients' interviews. Blood chemistry results were obtained within 1 month of the clinic visit (26 patients, 13%) or at the time of clinic visit (181 patients, 87%).

To avoid potential errors in assessing what medications the patient was taking, we asked all the patients to bring their own medications to study appointments, rather than rely on the medical record or patient recall. Patient adherence to medications was assessed using the following 2 methods: (1) pill counts and (2) prescription claims. It has been suggested that the latter method is more accurate to assess adherence to medication.[5] It was very difficult to define the benchmarking of adherence, but we opted to use the strictest definition, more than 95% of the doses of CAD medications.[6]

The primary outcome of this study is the rate of achievement of all components of OMT (blood pressure control; low-density lipoprotein [LDL] <2 mmol/L [100 mg/dL]; hemoglobin [Hb] A1c <7%; smoking cessation; physically active; adherence to all cardiac medications, namely aspirin, statin, beta-blocker, angiotensin-converting enzyme (ACE) inhibitor, and clopidogrel if indicated).

The secondary outcomes are the individual components of OMT.

Statistical analysis
This is a descriptive analysis to determine the under-

lying risk factors and adequacy of medical therapy among patients with CAD in Qassim province, Saudi Arabia. The descriptive analysis enabled the testing of the study's Hypothesis 1 that posits that OMT was achieved in less than 50% of CAD patients. The study's Hypothesis 2 suggests that diabetes and obesity were more common among those patients who fail to achieve OMT. Enrolment of 207 CAD patients provided adequate statistical power to reliably estimate the rate of OMT and to determine the statistical predictors of achieving OMT. The 95% confidence interval for estimating OMT that turns out to be 50% will be 43.8% to 56.2%. As an example of examining factors associated with greater or lesser likelihood of OMT, it was assumed that if patients with diabetes comprise 40% of the CAD patients, then a 20% absolute difference in OMT between diabetes (e.g., 30%, N=100) and no diabetes (e.g., 50%, N=100) would be detected at a statistical power of 88% at a 2-tailed P value of less than .05.

RESULTS
A total of 207 eligible patients with documented CAD over a period of 5 months were enrolled from outpatient clinic in PSCCQ. A total of 194 patients (94%) had documented CAD by coronary angiogram and 13 patient (6%) confirmed by non-invasive stress testing. The mean age was 60 (20) years and 28% were female. The majority of the patients underwent revascularization; 134 patients (65%) had percutaneous coronary intervention and 33 patients (16%) had coronary artery bypass graft surgery (CABG). Patients with diabetes were 132 (64%) in number, and only 30% were physically active (walking > 30 minutes/d). The baseline characteristics are shown in **Table 2**.

The primary outcome (achievement of optimal medical therapy) was achieved in only 10.4% (**Table 3**). The target blood pressure was achieved in 76.5% and 88% for systolic and diastolic blood pressure, respec-

tively. Approximately 68% achieved treatment targets for low-density lipoprotein <2 mmol/L. Among the 132 diabetic patients, only 24% achieved the target HbA1C less than 7% and only 2 patients achieved the primary outcomes.

There were a high rate of achieving the target for smoking cessation; 90% of patients were non-smoker or ex-smoker. The adherence to medications was excellent as shown in **Figure 1**, where the adherence to aspirin, clopidogrel, beta-blocker, ACEI/angiotensin receptor blocker (ARB), and statin showed 95%, 95.5%, 94.4%, 94.3%, and 94.3%, respectively. The adherence to all 5 cardiac medications was 91%.

Among the OMT components, the worst were achievement of target HbA1c and physical activities as shown in **Figure 2**. When we exclude physical activities, the achievement of OMT was higher (25.5%). In addition, the achievement of OMT in diabetic patients was also higher (13.7%) when we exclude adherence to physical activities.

CAD risk factors and OMT achievement
Among the risk factors for CAD patients, dyslipidemia and hypertension were most prevalent, which were present in 194 patients (95%) and 144 patients (70%), respectively (**Figure 3**). However, diabetes (132 patients [64%]) and physical inactivity (146 patients [70.5%]) were considered the main uncontrolled risk factors (**Figure 4**).

DISCUSSION

Despite having OMT recommended by all contemporary guidelines, it is hard to be achieved by most of real-life registries including our study. We found, among 207 screened CAD patients, only 10.4% of patients achieved OMT. This poor performance in medical therapy will make the extrapolation from different clinical trials more difficult.[7,8] We have also found a different risk factor profile in our cohort as compared to the published studies in different countries. Two thirds of the CAD population in our study included patients with diabetes (64%). The prevalence of dyslipidemia is difficult to analyze because most patients think that they are dyslipidemic as they were on lipid-lowering agents. Lipid-lowering agent, namely statin therapy, is standard to all CAD patients regardless of their lipid profile.

Among the most important findings in our study were the increased prevalence of diabetes among CAD patients and high rate of suboptimal therapy (only 32 patients [24%] achieved the target HbA1c and only 2 patients [1.5%] achieved optimal medical therapy).
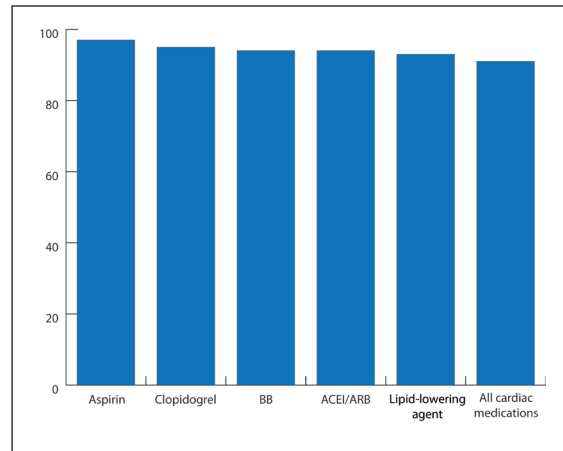

Figure 1. Adherence to cardiac medications.

Table 2. Baseline characteristics.

Sex	
Male, % (n)	72 (149)
Female, % (n)	28 (58)
Age, mean (SD)	60.0 (10.9)
Education	
Educated, % (n)	13 (24)
Illiterate, % (n)	87 (164)
Nationality	
Saudi, % (n)	91 (188)
Non-Saudi, % (n)	9 (18)
Current smoker, % (n)	11 (22)
Diabetes, % (n)	64 (132)
Hypertension, % (n)	70 (144)
Dyslipidemia, % (n)	95 (194)
Obesity (BMI > 30), % (n)	44 (83)
Family history of premature CAD, % (n)	7 (14)
History of ACS, % (n)	50 (103)
History of PCI, % (n)	65 (134)
History of CABG, % (n)	16 (33)
Angina, % (n)	19 (40)
LVEF, mean (SD)	11.3 (48.0)
LVEF = <30%, % (n)	9 (17)
Significant valvular lesion, % (n)	6.3 (13.0)
PVD	4 (8)
CVA	7 (16)
CKD	4 (9)
Heart rate, beats/min, mean (SD)	74.3 (11.7)
SBP, mm Hg, mean (SD)	125.3 (13.6)
DBP, mm Hg, mean (SD)	74.7 (8.3)
BMI, mean (SD)	29.6 (5.7)
Total cholesterol, mmol/L, mean (SD)	4.18 (1.1)
LDL, mmol/L, mean (SD)	1.89 (0.8)
HDL, mmol/L, mean (SD)	1.0 (0.5)
Triglycerides, mmol/L, mean (SD)	1.5 (0.7)
CrCL, mL/min, mean (SD)	96.0 (41.1)

Values are % (n=number) or mean (SD= standard deviation).

ACS: acute coronary syndrome; BMI: Body mass index; CABG: coronary artery bypass grafting; CAD: coronary artery disease; CKD: chronic kidney disease; CrCL=creatinine clearance; CVA: cerebrovascular accident; DBP: diastolic blood pressure; HDL: high-density lipoprotein; LDL: low-density lipoprotein; LVEF: left ventricular ejection fraction; PCI: percutaneous coronary intervention; PVD: peripheral vascular disease; SBP: systolic blood pressure.

Al-Nozha et al showed that the prevalence of diabetes increased from 19% to 24% from 1990s to 2000s, respectively.[9-11] Similar poor control of diabetes was seen in other studies in Saudi Arabia.[12] This poor control might be secondary to multiple reasons including (1) unhealthy life style, (2) little access to medical education, (3) limited access to diabetes specialists, (4) changing dietary habits to carbohydrate-rich diet, particularly dates (Qassim is a well-known area of specific brand of date),[5,13] and (5) genetic predisposition to type 2 diabetes producing more resistant type of diabetes.

The LDL goal was achieved in 68% of patients. However, we noticed during data collection that only 13% of patients had the latest lipid profile. The majority of patients had no lipid profile in their medical files for more than 1 year. This poor medical assessment of CAD patient mostly related to physicians and not patients because no order was found for reviewing medical files.

The adherence to medications was achieved in 91% of patient as compared to <50% in multiple other studies.[3,4] Our excellent performance on adherence to medication was most likely related to the traditions in Gulf states, as family bonds are very strong and the illness of one family member involves the rest of the family. CAD generally affects an old person, who might be a father or a mother, and children seek reward from the Almighty by attending to their parents and serving them well. So, one of the family members is responsible to be with the patient and ensure timely medication.

The overall performance to achieve OMT is poor, particularly among patients with diabetes and those who are physically inactive. The prevalence of physical inactivity was high in Saudi Arabia.[14,15] The potential reasons of physical inactivity given by patients are varied, including (1) high prevalence of osteoarthritis, (2) hot weather, and (3) unavailability of walking spaces nearby; however, the majority did not give a specific reason. As a policy implication, we suggest that greater attention be paid to increasing patient physical activity level. Both CAD patients and their physician may need to be reminded of the important benefits of physical activity. In addition, providing better access to physical activity opportunities should be undertaken. We have noticed that building such facilities outside the housing areas might not be beneficial because most of the patients prefer to exercise near home.

The observed shortfalls in OMT may be due to a number of factors, including (1) inadequate knowledge of clinical goals on the part of both patients and physicians, (2) lack of close follow-up, (3) an inadequate health care system that emphasizes technologically ad-
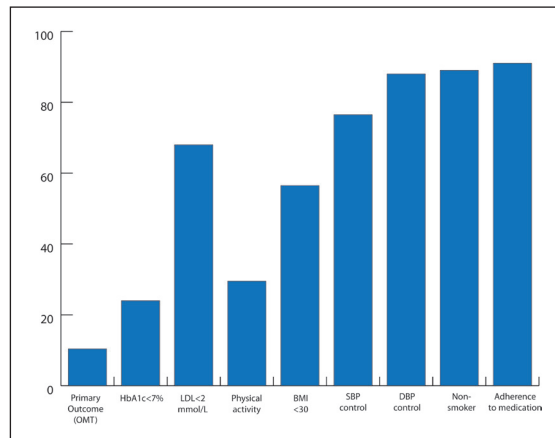

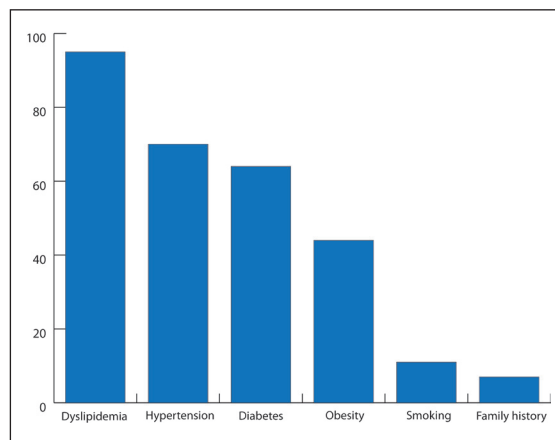**Figure 2.** Primary outcome and secondary outcome.

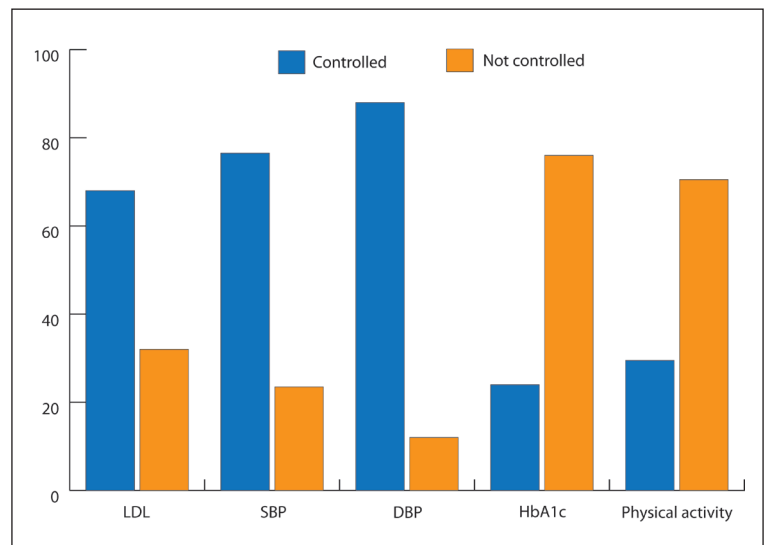**Figure 3.** Risk factors in coronary artery disease patients.

Figure 4. Comparing controlled risk factors with non-controlled risk factors.

Table 3. Primary outcomes and secondary outcomes.

Primary outcomes, % (n)	
Achievement of OMT	10.4 (15.0)
Secondary outcomes, % (n)	
Primary outcomes with or without physical activities	25.5 (37)
LDL	68 (98)
HbA1c < 7%	24 (12)
Physically active	29.5 (61)
SBP control	76.5 (153)
DBP control	88 (182)
Non-smoker, or ex-smoker	89.4 (185)
Adherence to ASA	96.5 (197)
Adherence to Clopidogrel	95 (118)
Adherence to beta-blocker	94 (169)
Adherence to ACEI	94 (167)
Adherence to lipid-lowering agents	93 (176)
Adherence to cardiac medications	91(188)

vanced acute care services, and (4) human resource limitations. Our findings suggest multiple potential reasons of our shortfalls in OMT and how we can improve the knowledge on the part of both patients and physicians and how we can optimize the health care system in all aspects. These issues need to be explored in future research applying similar strategies to other epidemic noncommunicable diseases.[16-19] Among these strategies is the casemanagement strategy that acts as a focused cardiac rehabilitation and education strategy.[20-26] The cost of such intervention may be more cost effective in reducing adverse cardiac event in such high-risk patients.[27,28]

The limitations of our study are as follows: (1) a small cross-sectional sample in 1 cardiac center; (2) one-third of the patients resided in a different province called Hail, 300 km away, which made a close follow-up almost impossible; and (3) lipid profiles of most of the patients from Hail were not obtained and were omitted from the denominator while calculating the achievement of LDL target. Interestingly, we found that the medical files of 87% of patients did not have the lipid profiles, and we suggested them to get their lipid profile done at the time of their first encounter.

We recommend careful monitoring of lipid profile and HbA1c every 6 months. However, lipid profiles and HbA1c should be assessed after 6 weeks of any change in medical therapy. Adequate medical education and adherence to medical therapies are the primary determinants of treatment success.

In conclusion, the poor achievement of OMT in CAD patients (10.4%) contributes to preventable mortality, morbidity, and health care costs. The high prevalence of diabetes in CAD patients with poor glycemic control is an example among the observed shortcomings that warrant investment in strategies to achieve OMT in these high-risk patients.

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