



Diabetes Awareness Among Coronary Artery Disease Patients Is Higher in Women Than in Men

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The risk of diabetes complications can be attenuated by appropriate diabetes management. Unfortunately, many patients with type 2 diabetes mellitus (T2DM) are unaware of their condition (1) and therefore cannot receive appropriate treatment.

Diabetes in various populations is similarly prevalent in men and women, but important sex differences exist with regard to the impact of diabetes on patient outcomes (2). In this context, it appears important to understand how diabetes awareness, i.e., the proportion of patients with diabetes knowing that they have the condition, differs between men and women. Importantly, sex differences in diabetes awareness have not yet been investigated in the extremely high-risk patients with both T2DM and established coronary artery disease (CAD).

We therefore investigated 1,209 unselected consecutive Caucasian patients, 422 women and 787 men, who were referred to coronary angiography for the evaluation of established or suspected stable CAD. Patients with type 1 diabetes (C-peptide negative) were not enrolled. A total of 292 women and 706 men had CAD at angiography and were included in the present analysis.

Overall, 114 women and 288 men had T2DM according to American Diabetes Association Criteria; diabetes prevalence did not significantly differ between women and men (32.2 vs. 27.3%; $P = 0.125$). In those with diabetes, the condition was newly diagnosed in 17.5% ($n = 20$) among women and in 33.0% ($n = 95$) among men. Thus, diabetes awareness, i.e., the proportion of previously diagnosed diabetes was significantly higher in women than in men (82.5 vs. 67.0%; $P = 0.002$).

Table 1 compares characteristics of women and of men who were aware of their condition to those in whom diabetes was newly diagnosed. Both among women and among men, those who were aware of having diabetes were younger and had higher HbA_{1c} and fasting glucose and lower LDL cholesterol. The use of ACE inhibitors/angiotensin receptor blockers was higher in women with T2DM aware of having diabetes.

In logistic regression analysis, female sex was strongly associated with diabetes awareness univariately (odds ratio [OR] 2.31 [95% CI 1.34–3.97]; $P = 0.002$), after adjustment for age (OR 2.76 [95% CI 1.57–4.82]; $P < 0.001$), after additional

adjustment for HbA_{1c} as well as fasting glucose (OR 2.96 [95% CI 1.60–5.45]; $P = 0.001$), and after further adjustment for hypertension, total cholesterol, and LDL cholesterol, i.e., for all variables that either among women or among men differed between those aware and those unaware of having diabetes (OR 3.39 [95% CI 1.77–6.51]; $P < 0.001$).

Our observations for the first time show that among patients with established CAD, diabetes awareness is higher in women than in men and that female sex is an independent predictor of diabetes awareness in these extremely high-risk patients.

This finding is clinically important. Given the preponderance of male sex in CAD populations, the majority of CAD patients with T2DM are men, many of whom have undiagnosed diabetes. Microvascular diabetes complications can largely be prevented by lowering HbA_{1c} values $<7.0\%$ (3). The mean HbA_{1c} among our patients unaware of having diabetes was 6.6%, but still approximately one out of five patients had HbA_{1c} values $\geq 7.0\%$. Considering macrovascular complications, glucose-lowering treatments are available that improve cardiovascular

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Table 1—Characteristics of women and of men who were aware of their condition versus those who were not aware of having diabetes

	Women			Men		
	Aware	Unaware	<i>P</i>	Aware	Unaware	<i>P</i>
<i>n</i>	94	20		193	95	
Age (years)	68 ± 9	73 ± 8	0.044	63 ± 10	67 ± 11	0.012
BMI (kg/m ²)	29.7 ± 5.6	27.5 ± 5.4	0.115	28.3 ± 3.8	28.0 ± 4.1	0.488
HbA _{1c} (%)	7.6 ± 1.4	6.6 ± 0.6	0.002	7.6 ± 1.4	6.6 ± 0.6	<0.001
HbA _{1c} ≥7% (%)	62.8	30.0	0.001	62.2	20.0	<0.001
Fasting glucose (mg/dL)	156 ± 48	124 ± 33	0.006	162 ± 57	128 ± 26	<0.001
Postchallenge glucose (mg/dL)	258 ± 77	217 ± 83	0.086	274 ± 84	209 ± 79	<0.001
Hypertension (%)	86.1	60.0	0.006	74.6	69.5	0.356
Smoking (%)	28.7	30.0	0.909	81.9	80.0	0.703
Triglycerides (mg/dL)	157 ± 86	153 ± 89	0.877	180 ± 126	183 ± 103	0.812
Total cholesterol (mg/dL)	194 ± 49	217 ± 46	0.060	184 ± 45	201 ± 50	0.005
LDL cholesterol (mg/dL)	116 ± 38	138 ± 46	0.048	112 ± 36	128 ± 41	<0.001
HDL cholesterol (mg/dL)	54 ± 15	52 ± 12	0.746	46 ± 13	46 ± 14	0.650
Statins (%)	68.1	60.0	0.486	51.3	42.1	0.142
ACE inhibitors/AT II RBA (%)	57.5	49.5	0.197	60.6	35.0	0.036
β-Receptor blocking agents (%)	54.3	65.0	0.379	55.4	55.8	0.995
ASA (%)	73.6	65.0	0.436	72.5	67.0	0.342
Previous myocardial infarction (%)	36.3	35.0	0.916	37.0	35.1	0.751

Data are means ± SD unless otherwise indicated. To convert values for fasting plasma glucose to mmol/L, multiply by 0.0555; to convert values for triglycerides to mmol/L, multiply by 0.0113; and to convert values for total cholesterol, LDL cholesterol, or HDL cholesterol to mmol/L, multiply by 0.0259. ASA, aspirin; AT II RBA, angiotensin II receptor blocking agents.

outcomes in patients with established CAD that are recommended in current guidelines (4) but that patients with diabetes not diagnosed as such will not receive. Further, the American Association of Clinical Endocrinologists guidelines already demand a very low LDL cholesterol goal of <55 mg/dL in patients with CAD plus diabetes compared with <70 mg/dL in those with CAD only (5).

In conclusion, in light of our observations, increasing diabetes awareness in CAD patients appears warranted, especially among men.

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References

- Gregg EW, Sorlie P, Paulose-Ram R, et al. Prevalence of lower-extremity disease in the U.S. adult population ≥40 years of age with and without diabetes: 1999–2000 National Health and Nutrition Examination Survey. *Diabetes Care* 2004;27:1591–1597
- Madonna R, Balistreri CR, De Rosa S, et al. Impact of sex differences and diabetes on coronary atherosclerosis and ischemic heart disease. *J Clin Med* 2019;8
- American Diabetes Association. 6. Glycemic targets: Standards of Medical Care in Diabetes–2019. *Diabetes Care* 2019;42(Suppl. 1):S61–S70
- American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes–2019. *Diabetes Care* 2019;42(Suppl. 1):S90–S102
- Jellinger PS, Handelsman Y, Rosenblit PD, et al. American Association of Clinical Endocrinologists and American College of Endocrinology guidelines for management of dyslipidemia and prevention of cardiovascular disease. *Endocr Pract* 2017;23(Suppl. 2):1–87