Screening for Glucose Perturbations and Risk Factor Management in Dysglycemic Patients With Coronary Artery Disease—A Persistent Challenge in Need of Substantial Improvement: A Report From ESC EORP EUROASPIRE V

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OBJECTIVE

Dysglycemia, in this survey defined as impaired glucose tolerance (IGT) or type 2 diabetes, is common in patients with coronary artery disease (CAD) and associated with an unfavorable prognosis. This European survey investigated dysglycemia screening and risk factor management of patients with CAD in relation to standards of European guidelines for cardiovascular subjects.

RESEARCH DESIGN AND METHODS

The European Society of Cardiology's European Observational Research Programme (ESC EORP) European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) V (2016–2017) included 8,261 CAD patients, aged 18–80 years, from 27 countries. If the glycemic state was unknown, patients underwent an oral glucose tolerance test (OGTT) and measurement of glycated hemoglobin A_{1c}. Lifestyle, risk factors, and pharmacological management were investigated.

RESULTS

A total of 2,452 patients (29.7%) had known diabetes. OGTT was performed in 4,440 patients with unknown glycemic state, of whom 41.1% were dysglycemic. Without the OGTT, 30% of patients with type 2 diabetes and 70% of those with IGT would not have been detected. The presence of dysglycemia almost doubled from that self-reported to the true proportion after screening. Only approximately one-third of all coronary patients had completely normal glucose metabolism. Of patients with known diabetes, 31% had been advised to attend a diabetes clinic, and only 24% attended. Only 58% of dysglycemic patients were prescribed all cardioprotective drugs, and use of sodium–glucose cotransporter 2 inhibitors (3%) or glucagon-like peptide 1 receptor agonists (1%) was small.

CONCLUSIONS

Urgent action is required for both screening and management of patients with CAD and dysglycemia, in the expectation of a substantial reduction in risk of further cardiovascular events and in complications of diabetes, as well as longer life expectancy.

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**A complete list of the EUROASPIRE V investigators is provided in the Supplementary Data online.*

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Cardiovascular disease (CVD) remains as the leading global killer and represents one of the major challenges to health care systems (1). Among common cardiovascular risk factors, type 2 diabetes and its preceding state, impaired glucose tolerance (IGT), designated together as dysglycemia, increase the risk for CVD by two to four times (2). Moreover, future morbidity and mortality of patients with coronary artery disease (CAD) is considerably higher in the presence of dysglycemia, including newly detected glucose perturbations (3–5). Nonetheless, type 2 diabetes and IGT remain unrecognized in approximately two-thirds of coronary patients (6,7).

To improve cardiovascular prevention, the European Society of Cardiology (ESC) has developed professional guidelines and educational programs for patients with diabetes or prediabetes (8–10). In this framework, the EUROASPIRE (European Action on Secondary and Primary Prevention by Intervention to Reduce Events) cross-sectional surveys have described the European prevention picture in the cardiovascular field for >20 years by comparing diagnostic and therapeutic strategies to the standards of care recommended by guidelines (5,11–15).

Since type 2 diabetes and CVD share several pathophysiological mechanisms leading to vascular alterations, guidelines recommend that patients with CAD should be screened for glucose perturbations to offer them a multifactorial management addressing all important risk factors, including lifestyle, hypertension, dyslipidemia, and dysglycemia (9). Indeed, therapeutic strategies according to such a multitargeted approach proved advantageous in reducing cardiovascular morbidity and mortality in people with type 2 diabetes as shown by the Steno-2 (Intensified Multifactorial Intervention in Patients With Type 2 Diabetes and Microalbuminuria) trial and by observational data from Euro Heart Survey on Diabetes and the Heart and the Swedish National Diabetes registry (16–19). Nevertheless, the burden of cardiovascular events and deaths in patients with type 2 diabetes remains significantly higher compared with the general population, and one reason is persistent suboptimal treatment (18,20,21). The EUROASPIRE IV (EAIV) survey underlined the need for further improvement in glucose perturbation screening, in lifestyle and risk factor improvements, and in pharmacological treatment (5,13).

This EUROASPIRE V (EAV) survey describes the prevalence of known and newly detected dysglycemia and its management in patients with CAD in relation to the European Guidelines on Diabetes and Prediabetes issued by ESC and partner societies.

RESEARCH DESIGN AND METHODS

Study Design

ESC European Observational Research Programme (EORP) EAV is a cross-sectional study conducted in 2016–2017 in 131 centers across 27 countries within the ESC. A full description of the study protocol has been given elsewhere (15). Patients aged 18–80 years old with a first or recurrent clinical diagnosis or treatment of *1*) elective or emergency coronary artery bypass grafting, *2*) elective or emergency percutaneous coronary intervention, *3*) acute myocardial infarction (ICD-10 I21), or *4*) acute myocardial ischemia (ICD-10 I20) were selected 6–24 months before the date of the present investigation. Of 16,208 patients who were invited to attend a study visit, 8,261 (51.1%) accepted and constitute the current study population.

Data collection, including personal and demographic details, smoking status, history of obesity, hypertension, dyslipidemia, glucose metabolism, and medication, was obtained from a standardized interview and bioclinical examination by trained technicians. The median time between the index event and the interview was 1.1 years (interquartile range 0.8–1.6).

Methods

Smoking was defined as self-reported smoking and/or a breath carbon monoxide exceeding 10 ppm by means of Smokerlyzer (Model Micro+; Bedfont Scientific, Model Micro+) at the time of interview. Persistent smoking was defined as smoking at time of interview among those who smoked in the month prior to the index event.

Height and weight were measured in light indoor clothes without shoes (SECA scales 701 and measuring stick model 220).

Waist circumference was measured with the patient standing, by means of a metal tape placed horizontally in the midaxillary line midway between the lowest rim of the rib cage and the superior iliac crest (22).

The physical activity target was defined by the question: "Do you take regular physical activity of at least 30-min' duration on average five times a week?"

Blood pressure was measured twice on the right upper arm in a sitting position using an automatic digital sphygmomanometer (Omron M6).

Venous (fasting) blood was drawn for measuring serum total and HDL-cholesterol (HDL-C), triglycerides, and glycated hemoglobin A_{1c} (HbA_{1c}). The LDL-cholesterol (LDL-C) was calculated by the Friedewald formula (23).

The central laboratory was in the National Institute for Health and Welfare (Helsinki, Finland), accredited by the Finnish Accreditation Service and fulfilling requirements of the standard SFS-EN ISO/IEC 17025:2005. Venous blood was taken into a tube containing clot activator (Vacutainer SST II Advanced; Becton Dickinson) for lipid assays and into a potassium EDTA tube (Vacutainer K2EDTA) for HbA_{1c} assay. Samples were stored locally at −70°C. All measurements were performed on a clinical chemistry analyzer (Architect c8000; Abbott Laboratories, Abbott Park, IL). Total cholesterol, HDL-C, triglycerides, and creatinine were analyzed in serum, and HbA_{1c} in whole blood.

An oral glucose tolerance test (OGTT) was performed using 75 g glucose in 200 mL water in the morning after at least 10 h of fasting. Plasma glucose (PG) was analyzed locally in the fasting state (FPG) and 2 h after the glucose load (2hPG) with a point-of-care technique (Glucose 201RT; HemoCue, Ängelholm, Sweden) (24). The HemoCue technique is cholesterol-sensitive; therefore, the glucose values were corrected for cholesterol according to the formula: HemoCue glucose + 0.15 × (total cholesterol − 5). HemoCue automatically converts the venous blood glucose to PG by the use of the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) recommendation: PG = 1.11 × whole blood glucose (25).

Definitions

Dysglycemia was defined as the presence of type 2 diabetes or IGT according to the World Health Organization (Supplementary Table 1) based on glucose levels obtained during the OGTT (26).

Overweight was defined as a BMI ≥25 to <30 kg/m^2 and obesity as ≥30 kg/m^2.

Central obesity was defined as a waist circumference of ≥88 cm for women and ≥102 cm for men.

Treatment attainment was assessed for blood pressure, LDL-C, and HbA_{1c} targets according to the 2012 European Guidelines on Cardiovascular Disease Prevention in clinical practice (27) and the 2013 European Guidelines for Diabetes, Pre-Diabetes and Cardiovascular Disease (9), as outlined in Supplementary Table 2.

The use of four cardioprotective drug therapies, consisting of antiplatelet drugs, β-blockers, renin-angiotensin-aldosterone system (RAAS) blockers (including ACE-inhibitors and angiotensin receptor antagonists), and lipid-lowering drugs was assessed at the interview visit.

The use of glucose-lowering medications, comprising metformin, sulfonylurea, incretins (including dipeptidyl peptidase 4 inhibitors and glucagon-like peptide 1 [GLP-1] receptor agonists), sodium-glucose cotransporter 2 (SGLT-2) inhibitors, glitazones, glinides, α-glucosidase inhibitors, and insulin, was assessed at the visits for patients with known diabetes.

Patient Groups

Previously known diabetes was defined as a self-reported history of type 2 diabetes or use of any glucose-lowering medication.

Newly detected dysglycemia was defined as the presence of IGT or type 2 diabetes according to the OGTT.

No dysglycemia was defined as the absence of IGT or diabetes according to the OGTT performed as part of the survey.

Data Management and Statistical Analyses

Electronically collected data were submitted online to the data management center (EURObservational Research Program, ESC, Sophia Antipolis, France).

Patients' demographics, risk factor profiles, and medication use were described according to means, SDs, and proportions.

To account for the clustering of patients within centers, distributions of characteristics across groups were compared according to linear mixed-model analysis for continuous outcomes and mixed logistic model analysis for binary outcomes. Models included age and sex as covariates. Goodness-of-fit statistics for all models demonstrated acceptable fit to the data. A level of $\alpha < 0.05$ was a priori chosen to indicate statistical significance. Data analyses were performed at the Department of Public Health and Primary Care, Ghent University, by means of SAS 9.4 statistical software (SAS Institute, Cary, NC).

Ethical Procedures

Local Ethics Committees approvals were obtained by National Coordinators. Each participant provided written, informed consent that was stored in the patient file.

RESULTS

Pertinent patient characteristics by glucose category at the time of the interview are presented in Table 1. Overall, the mean age at interview was 63.6 (SD 9.6) years and 26.4% were women.

Glucose Category

Among the 8,261 patients 2,452 (29.7%), of which 71% were men and 29% were women, had previously known diabetes. Of the remaining 5,809 patients, 537 were not eligible for an OGTT because they were not fasting ($n = 498$) or had a fasting glucose >11 mmol/L ($n = 39$), leaving 5,272 patients eligible for an OGTT, which was performed on 4,440 (84.2%), while 832 (15.8%) were left without an OGTT (Fig. 1).

The distribution of normal glucose metabolism, IGT, and type 2 diabetes is shown in Fig. 2 based on FPG, 2hPG, and HbA_{1c}, used for dysglycemia screening (including IGT) in patients unaware of their glycemic state. Of the 729 patients with newly diagnosed type 2 diabetes, the proportions identified were 58.5% by FPG, 52.5% by 2hPG, 19.2% by HbA_{1c}, 90.7% by FPG + 2hPG, and 70% by HbA_{1c} + FPG. The proportion having type 2 diabetes by all three methods was 6.3%. A total of 238 patients (30%) with type 2 diabetes based on the OGTT would not have been detected without this test, and the corresponding proportion for IGT patients would have been 69.8%.

The distribution of different glycemic categories within the present patient population, all with established CAD, showed that the presence of dysglycemia almost doubled from the self-reported 29.7% to the actual 58.8% following guideline-recommended screening (Supplementary Fig. 1). Indeed, 12% of the subjects (75% men and 25% women) were diagnosed with diabetes, 19% (71% men, 29% women) with IGT, and 41% did not have a dysglycemic condition (9% had impaired fasting glucose and 32% had normal glucose metabolism; overall proportions of normoglycemic men and women were 77% and 23%, respectively).

Anthropometrics and Lifestyle

Information on overweight, obesity, smoking habits, and physical activity is provided in Table 1. Overweight or obesity was most common in patients with known diabetes (88.5%). Smoking was less prevalent in patients with known diabetes (15.6%) than in those who were normoglycemic (20.7%). Approximately two-thirds of the patients did not practice physical activity for at least 30 min 5 times/week, and this rate was higher in the group of patients with known diabetes (72.2%).

Risk Factor Management

A combination of drugs from all four cardioprotective drug classes were prescribed to 49% of the normoglycemic patients, 52.9% of those with newly diagnosed dysglycemia, and 57.8% of the patients with previously known diabetes ($P < 0.0001$ after adjustment for age and sex). The proportion of patients with no dysglycemia, newly diagnosed dysglycemia, and known diabetes prescribed each different cardioprotective drug is shown in Supplementary Fig. 2.

The proportions of patients in the three glucose categories reaching different blood pressure, (<130/80, <140/90, <150/100 mmHg) and LDL-C levels (<1.8, <2.5, <3.0, ≥3.0 mmol/L) are presented in Fig. 3*A* and *B*, and Fig. 3*C* presents the glycemic levels reached in patients with known diabetes (<6, <7, <8, <9, ≥9% corresponding to <42, <53, <64, <75 and ≥75 mmol/mol).

Of the patients with established diabetes, 57% had been provided with lifestyle and dietary advice, and 75% were prescribed glucose-lowering agents. Among these, metformin was the most commonly prescribed (60%), followed by insulin (30%), sulfonylureas (19%), incretins (11%; dipeptidyl peptidase 4 inhibitors in 10% and GLP-1 receptor agonists in 1%), and SGLT-2 inhibitors, glitazones, glinides, and α-glucose oxidase inhibitors at 1% each.

Level of Care

Among patients with previously known diabetes, 79.8% reported to be under the care of a cardiologist and/or a general practitioner (63.4%), a diabetologist/endocrinologist (33.5%), and/or a specialist cardiac nurse (4.4%). Self-monitoring of plasma glucose was practiced by 73.3% of these patients, (88.8% of insulin users vs. in 67.2% of others), and 30.8% had been

Table 1—Pertinent clinical and lifestyle characteristics by glucose category at the time of the interview

	No dysglycemia* $n = 2,616$	OGTT eligible but not performed $n = 832$	Newly diagnosed IGT $n = 1,095$	Newly diagnosed diabetes $n = 729$	Previously known diabetes $n = 2,452$
Age (years), mean (SD)	61.8 (10.0)	62.9 (10.2)	64.4 (9.5)	64.6 (9.4)	64.9 (9.0)
<50	12.7 (331)	11.7 (97)	7.8 (86)	8.4 (61)	6.4 (156)
50–59	28.7 (751)	26.7 (222)	24.1 (264)	20.2 (147)	21.1 (517)
60–69	36.2 (947)	33.8 (281)	36.3 (397)	40.9 (298)	41.8 (1,025)
≥70	22.4 (587)	27.9 (232)	31.8 (348)	30.6 (223)	30.8 (754)
Sex					
Female	23.4 (613)	23.4 (195)	28.7 (314)	25.0 (182)	29.0 (712)
Education					
Low	11.7 (304)	16.1 (133)	13.9 (152)	15.7 (114)	18.0 (431)
Glycemic variables					
FPG (mmol/L), mean (SD)	5.56 (0.69)	5.94 (1.10)	5.89 (0.62)	7.15 (1.07)	8.67 (3.01)
HbA_{1c} (%), mean (SD)	5.51 (0.46)	5.66 (0.68)	5.63 (0.49)	5.86 (0.57)	7.21 (1.68)
HbA_{1c} (mmol/mol), mean	37	38	38	41	55
Smoking habits					
Currently smoking	20.7 (541)	22.1 (184)	17.2 (188)	17.4 (127)	15.6 (383)
Persistent smoking‡	54.9 (497/996)	55.2 (180)	51.9 (165/318)	48.9 (113/231)	55.6 (336/604)
Anthropometrics					
Overweight or obesity	76.9 (2,004/2,607)	77.5 (638)	82.7 (904/1,093)	83.9 (610/727)	88.5 (2,098/2,370)
Obesity	29.3 (764/2,607)	32.1 (264)	39.0 (426/1,093)	42.0 (305/727)	49.0 (1,162)
Abdominal obesity	47.7 (1,200/2,517)	55.3 (420)	59.8 (628/1,051)	62.3 (437/701)	70.3 (1,566/2,227)
Obese not attempting to lose weight last month	49.9 (370/741)	55.4 (143)	48.9 (202/413)	51.5 (152/295)	49.1 (556/1,132)
Obese with no:					
Weight measurement since hospital discharge	26.8 (205/764)	11.3 (27)	7.7 (31/403)	14.8 (43/290)	18.9 (219/1,162)
Advice to engage in regular physical activity	39.1 (293/749)	36.5 (93)	38.7 (163/421)	37.2 (113/304)	33.3 (377/1,133)
Advice to follow dietary guidelines	37.1 (277/746)	36.3 (94)	42.4 (179/422)	40.3 (122/303)	36.2 (412/1,138)
Physical activity					
No regular physical activity ≥30 min 5 times/week	60.4 (1,430/2,368)	63.6 (485)	65.1 (637/979)	67.7 (452/668)	72.2 (1,578/2,178)
No planned physical activity	34.0 (786/2,309)	40.5 (300)	44.3 (432/975)	47.3 (309/653)	48.6 (1,007/2,072)

If not stated otherwise data are % (*n*). Numbers in parentheses are the number of patients/total number of observations. If only one number is given, the number of observations corresponds to the total population within the group. *Including impaired fasting glucose. ‡Defined as smoking at time of interview among those who smoked in the month before the index event.

advised to attend a diabetes school or other diabetes educational program, but only 24.1% had actively taken part in such education.

As regards diabetes complications among patients with previously known diabetes, 18.8% reported retinopathy, 10.1% renal involvement, and 19.4% neuropathy.

CONCLUSIONS

The most important and alarming findings in this survey on screening for dysglycemia and management of patients with established CAD in relation to their glycemic state are:

1. Screening for dysglycemia is poorly practiced despite clear guideline recommendations to do so given that approximately two-thirds of coronary patients have IGT or diabetes.
2. The achievement of guideline-recommended lifestyle risk factor and pharmacological management is unacceptably poor considering the substantially higher cardiovascular risk of these cardiometabolic patients with newly detected dysglycemia and established diabetes.

Guidelines for the management of patients with diabetes, prediabetes, and CAD were first issued in 2007 (8), updated in 2013 (9), and recently in 2019 (28). With the release of these guidelines, efforts have been made to ensure their wide distribution and incorporation in educational programs. In EAIV, 5 years after the release of the 2007 edition of the European guidelines (10), screening and management of coronary patients with diabetes and its prestates was poor (13,14), an observation that unfortunately is replicated in the present survey. Indeed, comparing treatment target achievements among patients with previously known diabetes in EAIV and EAV in centers participating in both surveys, the overall impression was disappointing. The proportions of obese and overweight subjects was unchanged, the tendency toward too low physical activity had increased, and the proportion with an LDL-C <1.8 mmol/L was unchanged at ~48%. Slightly more (54% vs. 57%) patients had an HbA_{1c} <7% (53 mmol/mol), and the same was true for a blood pressure <140/85 mmHg (27% vs. 37%). Regarding all of these aspects, there were no major differences between men and women (Supplementary Table 3).

A continuing debate on the methods for screening for dysglycemia, either

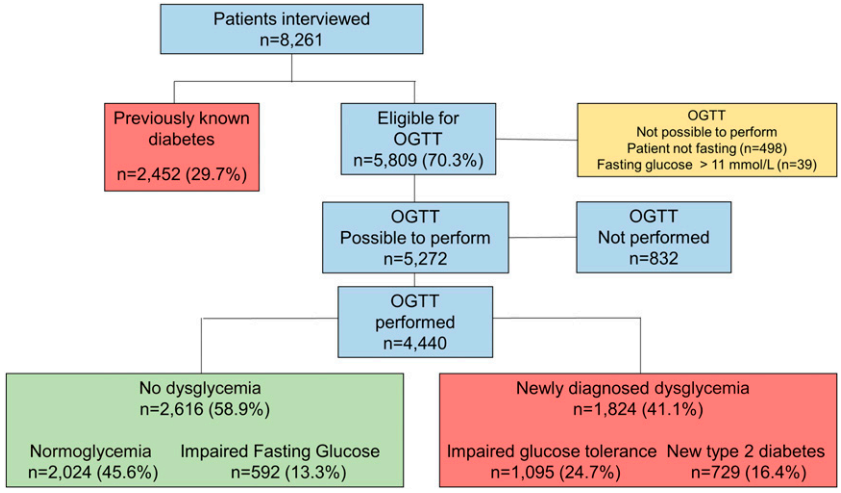

Figure 1—Flowchart of the patients by glucose category.

HbA_{1c} or an OGTT, including both an FPG and a 2hPG, may have contributed to the unwillingness to screen while waiting for a clearer message on how to do so. The OGTT is claimed to be time consuming, its prognostic value less well identified, and the accuracy of point-of-care methods used in the EA surveys less well documented (29). These concerns have all been addressed. Shahim et al. (30) concluded that the agreement between glucose measurements made by the point-of-care HemoCue Glucose 201 RT System, used in EAV, and local hospital laboratories is excellent. The application of an accurate, user-friendly point-of-care technology for glucose measurement saves time, reduces costs, and eliminates at least some of the preanalytical errors, in particular those related to delayed sample handling, while providing almost instantaneous information on the patient's glycemic state. In a follow-up of EAIV data, the prognostic value of the 2hPG was superior to that of an FPG, and when HbA_{1c} was included, it provided no further significant independent contribution to future cardiovascular events (5). A follow-up of the Silent Diabetes study, comparing the prognostic capacity of HbA_{1c} with that of an OGTT in 1,015 patients, all without previously known diabetes and undergoing coronary angiography, reported that a postload glucose was superior to FPG and closely related to the severity of CAD and future mortality, while there was no association with HbA_{1c} (31). Moreover, Chattopadhyay et al. (4) demonstrated that adding a postload glucose level, derived from an OGTT to the Global Registry of Acute Coronary Events (GRACE) score, improved the prediction of death and recurrent nonfatal myocardial infarction in survivors of an acute coronary syndrome without known diabetes. An FPG did not increase the prognostic information of the GRACE score, and HbA_{1c} was not included. Finally, an OGTT is the only method to diagnose IGT, a state that is almost as prognostically unfavorable as newly detected diabetes in patients with acute coronary syndromes (3,32) and accordingly included in the definition of dysglycemia in the present report. The yield of screening with an OGTT is therefore well established, and to spend 2 h to further characterize the future risk of coronary patients cannot be considered "a waste of time." It is just one crucial investigation to characterize the cardiometabolic risk of a vulnerable coronary patient population leading to appropriate lifestyle and therapeutic management to improve prognosis.

Sadly, the current pharmacological management of these patients falls far short of guideline recommendations. LDL-C was still above target in almost two-thirds of the patients, despite the availability of high-intensity statins in combination with ezetimibe if needed, further underlined in a detailed report on lipid management from EAV (33). Therapeutic control of hypertension also remains suboptimal, with almost one-half of all patients on antihypertensive drugs above the recommended target of blood pressure. Such findings appear even more daunting considering that more recent guidelines advocate stricter treatment targets for blood pressure and LDL-C and use of cardioprotective glucose-lowering drugs, further increasing management demands (28,34,35).

Most of the patients were prescribed acetylsalicylic acid, β-blockers, RAAS blockers, and statins, but even if more patients with diabetes had all of these cardioprotective drugs in combination than those with normal glucose metabolism or newly detected dysglycemia, 42% of them did not have this combination. This may be an important contributing factor to the failure to achieve risk factor targets in too many of the patients together with insufficient dose titration. The low use of glucose-lowering drugs with cardioprotective capacity, SGLT-2 inhibitors, and GLP-1 receptor antagonists, is perhaps easier to understand. The first trial data on the benefits of such drugs was published in 2015–2016 (36,37), and even if guideline recommendations on their use came soon afterward, widespread use when EAV was performed in 2016–2017 was not to be expected, and they may still not be reimbursed in all countries.

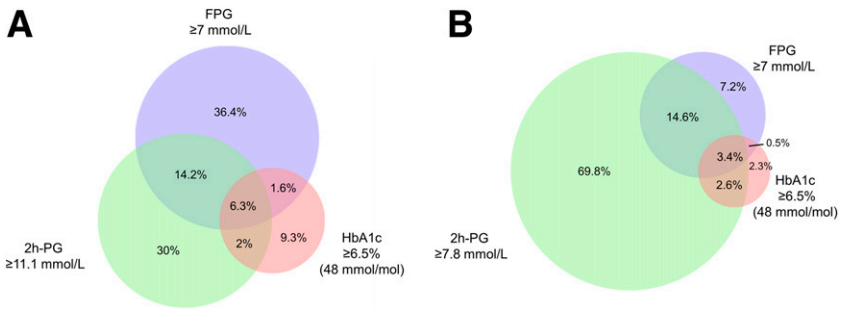

Figure 2—*A*: Proportions and their overlap between screening with FPG ≥7 mmol/L (n = 465), 2hPG ≥11.1 mmol/L (n = 417), HbA_{1c} ≥6.5% (48 mmol/mol) (n = 153), and combinations in the 729 patients with newly detected type 2 diabetes. *B*: Proportions and their overlap between screening with FPG ≥7 mmol/L (n = 465), 2hPG ≥7.8 mmol/L (n = 1,663), HbA_{1c} ≥6.5% (48 mmol/mol) (n = 153), and combinations in the 1,824 patients with newly detected dysglycemia.

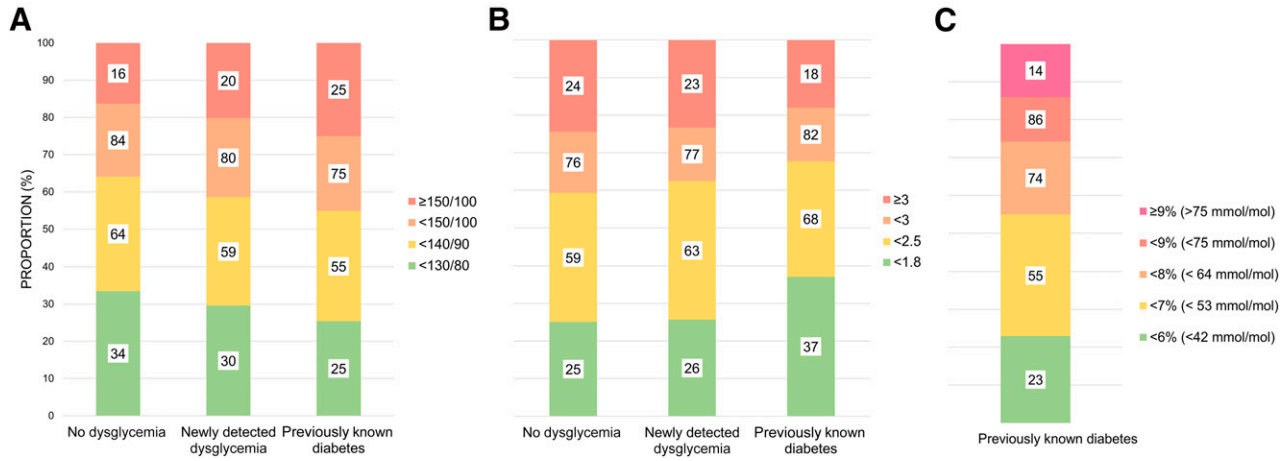

Figure 3—Proportion of patients reaching different blood pressure targets (*A*) and LDL-C targets (*B*) in the total cohort, and HbA_{1c} targets in patients with known diabetes (*C*).

However, reimbursement and the uptake of these drug classes in clinical practice should accelerate given the evidence of benefit from reduced major coronary events in clinical trials (38,39). The availability these new treatment modalities reinforces the importance of early detection of dysglycemic states among patients with CAD by screening with an OGTT all patients without self-reported diabetes (39).

Another important aspect of care is poor follow-up in relation to achieving healthy lifestyle changes, recording important indicators of quality of care, and proper dose titration of prescribed therapies. Striking examples are that almost 16% of the patients with CAD and diabetes smoked, with more than one-half being persistent smokers. Only one-third had been advised to attend a specialist diabetes service or other diabetes educational program, and only one in four patients with diabetes attended such services. The strikingly poor lifestyle outcomes reflect the absence of such professional services for most of these patients. The type of caregiver may also have been an obstacle to achieving good evidence-based management. Patients with a complex, multifactorial disease, such as type 2 diabetes, need to be cared for in a holistic manner addressing all aspects of lifestyle, risk factor, and therapeutic management, with one main responsible caregiver, who may consult specialists if needed, and with sufficient time to build up a comprehensive, individualized, preventive program together with the patient.

The value of such holistic management was illustrated by a recent Swedish cohort study in which ~270,000 patients with type 2 diabetes were matched with 1,355,870 control subjects by age, sex, and county and monitored for almost 6 years. Assessment included age and the presence of five risk factors (elevated HbA_{1c}, elevated LDL-C level, albuminuria, smoking, and elevated blood pressure). The excess risk of outcomes decreased stepwise for each risk factor falling within the target range. The hazard ratio for death from any cause, comparing patients with diabetes with control subjects, was 1.06 (95% CI 1.00–1.12), for acute myocardial infarction was 0.84 (0.75–0.93), and for stroke was 0.95 (0.84–1.07). An HbA_{1c} outside the target range was the strongest predictor of stroke and acute myocardial infarction, while smoking was the strongest predictor of death (19). The importance of a target-driven management of patients was also demonstrated by the Steno-2 trial, which randomized 160 patients with type 2 diabetes and microalbuminuria to intensive therapy at a specialized clinic or to conventional care. The patients in the intensive group were prescribed a combination of RAAS blockers and aspirin. Even if all treatment targets were not fully met, intensively treated patients had a considerably better outcome than those offered standard care. After 7.8 years of follow-up, there was a 50% reduction in micro- and macrovascular events in the intensively treated group (40). Follow-up continued for 13 years. By that time, patients originally allocated to the intensively managed group had an absolute mortality reduction of 20%, an absolute reduction of cardiovascular events of 29%, and diabetes-related nephropathy and progression of retinopathy was substantially less (16). These patients did not all have established CAD, but these examples indicate the excellent value of multifactorial, target-driven care, and demonstrate that this approach can be achieved in everyday practice in contrast to the negligent management of all too many patients with diabetes and coronary disease. As shown in the EAIV follow-up study for total mortality, poor management, especially in patients with diabetes, had a dismal influence on their prognosis (41).

Strengths and Limitations

A major strength of the EUROASPIRE Surveys is that all data are based on interviews with the patients and strictly standardized measurements by personnel trained for this purpose. Moreover, the survey provides information from a large number of countries and centers.

The relatively low numbers did not allow formal geographical comparisons, but there did not seem to be any major discrepancies in management regarding different European areas. In fact, within-country differences were as apparent as those in between countries. This favors the assumption that treatment should in general be available, confirming that clinical implementation of guidelines seems to be a primary issue.

The relatively low participation rate is a limitation. Considering that patients

unwilling to participate are usually sicker, with poorer risk factor control, this selection bias therefore overestimates the true quality of care; it is likely to be even poorer than described. Another potential bias is that centers willing to participate in research studies like this are more motivated as regards detection and treatment of cardiovascular risk. This will also lead to an overestimation of the true pattern of screening and management of the whole patient population. Finally, screening for dysglycemia was performed on one occasion only, while the diagnosis of diabetes requires two positive results. These data from one OGTT are still reliable because it is unusual for a patient with newly detected type 2 diabetes or IGT to revert to complete normality on a subsequent test done later. Changes between diagnostic categories are usually between IGT and type 2 diabetes, as shown by Wallander et al. (42) repeating an OGTT 3 months and 1 year after an acute coronary event.

Conclusion

There is a compelling need to improve both screening for and management of patients with dysglycemia and CAD. To issue one updated guideline after another without addressing implementation and ensuring that lifestyle, risk factor, and therapeutic targets are being achieved in every day practice is a job half done. Much more resource and effort needs to be invested in implementing what we already know. To do so will result in better future health for many cardiometabolic patients.

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