Assessment of diabetes screening by general practitioners in France: the EPIDIA Study.

Joël Cogneau, Beverley Balkau, Alain Weill, François Liard, Dominique Simon

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J. Cogneau, B. Balkau*, A. Weill†, F. Liard‡, D. Simon§

Réseau EPI Qualiso, 13 rue Fernand Léger, 75020 Paris, France

*INSERM U258, Villejuif, F-94807 France,

†Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (CNAMTS), 75 020 Paris, France,

‡Institut de Recherche en Médecine Générale (IRMG) 75015 Paris, France,
§Service de Diabétologie, Hôpital de la Pitié, 75013 Paris, France.

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Corresponding author
Dr J. COGNEAU
9 av. de Beaugaillard
37 550 Saint-Avertin
France
e-mail: j.cogneau@wanadoo.fr
tel: 33 2 47 28 94 69

Abstract

Aims To audit type 2 diabetes screening in General Practice in France and to evaluate the frequency of undiagnosed diabetes in patients at high risk, after systematic screening and diagnosis.

Methods For this study, 288 General Practitioners volunteered to include all consecutive non-diabetic patients under 65 years who had at least two risk factors for diabetes, whatever the reason for consultation. If a plasma glucose had not been recorded in the previous 12 months, a fasting plasma glucose (FPG) was prescribed, with a second test if FPG ≥ 7.0 mmol/l.

Results 5950 patients were included. The most frequent diabetes risk factors were: age ≥ 40 years, 92%; overweight (BMI ≥ 27 kg/m^2), 59%; treated hypertension, 48%; treated dyslipidemia, 37%; family history of diabetes, 24%. Of these subjects at high risk for diabetes, 88% had a FPG measurement in their medical record (75% measured during the preceding 12 months). Among the 1499 patients prescribed a FPG, diabetes was diagnosed in 40 patients (2.7% 95% CI: 1.9-3.5) and 22% had IFG. Thus the frequency of undiagnosed diabetes in the 5950 high risk patients was 0.67% (0.46-0.88).

Conclusion: Screening for diabetes by General Practitioners in France appears to be adequate and undiagnosed diabetes is rare in patients with risk factors for diabetes, at least in those consulting the General Practitioners studied.

Key words: diabetes screening, undiagnosed diabetes, impaired fasting glucose, diabetes risk factors, general practice

Introduction

Screening for type 2 diabetes is a hot topic for public health. The prevalence of diabetes is rapidly increasing all over the world, with diabetes becoming known as an "epidemic" disease [1]. Further, type 2 diabetes is often diagnosed years after onset [2], when micro- and macro-vascular complications are already present [3,4]. Although treating diabetes is effective in reducing diabetic micro-vascular complications [5], there are no randomized controlled clinical trials to evaluate the benefits and risks of screening and early treatment for type 2 diabetes. There is indirect evidence that treatment of diabetes and cardiovascular risk factors reduces severe retinal, renal and cardiovascular complications [6,7]. Preventing or delaying diabetic complications should improve patients' quality of life and reduce health care expenses [8]. Recommendations for opportunistic screening of type 2 diabetes have recently been published in France and in the United States [9,10]. In both cases, screening is targeted towards at risk subjects.

The EPIDIA Study was designed to audit type 2 diabetes screening in General Practice in France and to evaluate the frequency of undiagnosed diabetes in patients at high risk, after systematic screening and diagnosis.

Methods

Patient selection

From November 2002 to April 2003, General Practitioners, members of the EPI (epidemiology) network, sponsored by the FAQSV (Fonds d'Action pour la Qualité des Soins de Ville), included consecutive patients at high-risk for diabetes, whatever the reason for consultation, up to a maximum of 40 patients. These patients had at least two risk factors among: age ≥ 40 years, overweight (body mass index (BMI) ≥ 27 kg/m^2), treated hypertension, treated

dyslipidaemia, family history of type 2 diabetes in a first degree relative, personal history of either impaired fasting glucose (IFG: fasting plasma glucose (FPG) 6.1-6.9 mmol/l), transient diabetes and in women, gestational diabetes or delivery of a newborn weighing more than 4 kg. Patients with known diabetes were not included. The protocol and the methods for data collection and analysis were approved by the "Commission Nationale Informatique et Libertés" (CNIL). No individual patient consent and no approval by a formal Ethics Committee were required for this observational study.

Data collected

An on-line questionnaire was used to register diabetes risk factors and the last FPG value, if measured in the preceding 12 months, was noted. If there was no FPG recorded in the previous 12 months, a FPG was prescribed and repeated if ≥ 7.0 mmol/l, for the diagnosis of diabetes.

Outcome

A subject was diagnosed as a diabetic patient if FPG ≥ 7.0 mmol/l on both occasions. IFG was defined by a FPG ≥ 6.1 mmol/l at least once [11].

Statistical analysis

EpiInfo v6.0 software was used to describe the population sample, quantitative variables were compared with Student t-tests, qualitative variables with χ^2 or Fisher exact tests. Odds ratios quantified the presence of risk factors and of having had an FPG recorded in the preceding 12 months. The level for statistical significance was set at $p < 0.05$.

Results

A total of 5950 patients (49% men) were included in the study, by 288 General Practitioners. The most frequent diabetes risk factor was: age ≥ 40 years (92%), followed by overweight (59%) (more frequent in women ($p < 0.05$)), hypertension (48%) and dyslipidemia (37%) (both more frequent in men ($p < 0.001$)) (Table 1). A family history of diabetes was more frequent in women ($p < 0.001$) and a personal history of IFG more frequent in men ($p < 0.001$). The mean number of diabetes risk factors was 2.2 in patients under 40 years and 2.8 in those 40 years or over.

Of these subjects at high risk for diabetes, 88% had a FPG measurement in their medical record, 75% measured during the preceding 12 months (Fig.). They were two years older and had more diabetes risk factors, although fewer were overweight and fewer had a family history of diabetes (Table 2).

Among the 1499 patients prescribed a FPG (25%), a result was obtained in 88%. A second FPG was prescribed for the 75 patients with FPG ≥ 7.0 mmol/l and a result was obtained in 87%. Diabetes was diagnosed in 40 patients (Fig., Table 3), thus among these 1499 patients who were at high risk for diabetes but who had no recorded measure of FPG in the preceding 12 months, at least 40 (2.7%; 95% CI: 1.9-3.5) had type 2 diabetes. Among all 5950 patients at high risk of diabetes, the prevalence of undiagnosed diabetes was 0.67% (0.46-0.88).

Comparing the 40 newly diagnosed diabetic patients with the 1263 patients who followed the protocol, but who were not diagnosed as diabetic (Fig., Table 3), those diagnosed diabetic were more often men (68% vs 45%, $p < 0.009$), older (men by 3 years ($p < 0.07$) and women by 7 years ($p < 0.006$)), treated for hypertension (55% vs 34%, $p < 0.009$), more had a personal history of IFG (22% vs 8%, $p < 0.003$), but fewer had a FPG in their General Practitioner's records (32% vs 48%, $p < 0.09$) (Table 3). The newly diagnosed

diabetic patients had more risk factors for diabetes, 3.0 ± 1.0 vs 2.6 ± 0.8 (p < 0 .001).

Overall, at least 22% (1246/5764) of the patients at risk for diabetes had IFG, 29% in men and 17% in women, aged 54 ± 8 and 53 ± 8 years respectively.

Discussion

This study on diabetes screening shows that fasting plasma glucose is frequently assessed in at risk patients in routine general practice in France, which probably explains the low frequency: 0.67% (0.46-0.88) of undiagnosed diabetes in this high risk population. Other factors which influence this frequency are the method of diagnosis (FPG, not an oral glucose tolerance test (OGTT)), and the 65 year age limit for recruitment.

FPG had been measured in 75% of these patients in the previous 12 months. This high percentage concurs with data from the French National Insurance System: 19,559,071 FPG measurements were reimbursed in 2002 in non-diabetic patients [12]. Further, in a randomly selected sample of 65,000 affiliates of this Insurance System over the 2-year period (2000-2001), FPG was measured in 49% of the non-diabetic population, 71% in subjects over 45 years and 79% in those over 60 years [13]. In contrast in the UK, screening for diabetes appears to be rarely performed: in a general practice study, only 4% (103/2,481) of non-diabetic patients aged over 45 years had FPG measured in the previous three years [14]. This striking difference between the two countries is confirmed by comparison of circumstances of diabetes diagnosis: in France, diabetes was diagnosed because of a routine FPG in 71% of cases in a study on a random sample of type 2 diabetic patients from the Paris area in 1998 [15]. Similar figures had been found in previous older French studies [16]. In the UKPDS, only

30% of diabetic patients were diagnosed by routine FPG measurements [17], close to the 34% found in the WHO Multinational Study in 1978 in the United Kingdom [16].

Patients recruited because of treated dyslipidaemia or hypertension were more susceptible to have had FPG measured in the preceding 12 months, odds ratios 2.09 (1.83-2.39) and 1.85 (1.63-2.09) respectively. Probably, patients treated for hypertension or dyslipidaemia are more closely monitored by General Practitioners, but hypertension should be used more systematically to pick up diabetes cases more efficiently according to Table 3.

The proportion of newly diagnosed diabetic patients (0.67%) could be compared with the prevalence of pharmacologically-treated diabetes in France, estimated to be 3.3% in 2000 in the whole French population [18] but, as patients at high risk for diabetes were mostly aged over 40 years, this estimated prevalence of undiagnosed diabetes cannot be extrapolated to the general population. Our data can be better compared with the prevalence of new cases of diabetes found in general practice in the United Kingdom [14] in patients over 45 years with at least one risk factor for type 2 diabetes (hypertension, BMI > 27 kg/m^2, family history of diabetes). After a stepwise screening procedure (if a patient had IFG then an OGTT was prescribed) the prevalence was 2.8% (1.6%-4.7%), whereas, for diabetes diagnosed only on an FPG the prevalence was 1.2%. This difference could be due to the fact there is no official screening policy for diabetes in the UK, in contrast to France.

After age, overweight was the most frequent risk factor for diabetes, present in 59% of the recruited patients, even though a threshold of 27 kg/m^2 was chosen, instead of 25 kg/m^2 as often recommended [10]. Weight is known to be increasing in France: between 1997 and 2003, the prevalences of overweight (25 kg/m^2 ≤ BMI < 30 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) increased from 28% to 30%, and 8% to 11% respectively for adults over 18 years [19]. Many patients

treated for hypertension or dyslipidaemia were recruited. Both are frequent in France, as in many developed countries, and French patients are known to be heavy drug consumers [20].

Among this sample of patients at risk for diabetes, it is not surprising to find a high proportion of patients having IFG (22%). It is interesting to note that their mean age (53 years) is intermediate between the age of negative screenees (50 years) and newly diagnosed diabetic patients (55 years). This finding suggests that some of them may progress to diabetes in the near future [21].

Limitations of our study must be acknowledged. The panel of General Practitioners, although from all over France, were volunteers and they were not representative. They were recruited because of their interest in epidemiology and willingness to transmit data by internet. Probably such physicians would more often participate in continuing medical education programs than their colleagues, and be more prone to screen for diabetes in at risk patients, in accordance with the official French recommendations [9]. This recruitment bias could result in an overestimation of the prior assessment of FPG and so to an underestimation of the prevalence of undiagnosed type 2 diabetes. We are not able to calculate the ratio of known to undiagnosed diabetic patients among the patients of these General Practitioners, as the number of known diabetic patients consulting was not recorded. Further, we would have found a higher proportion of undiagnosed diabetic patients if we had not limited the screened population to subjects under 65 years. This age limit was chosen as it is important to screen for diabetes in younger subjects with a longer life-expectancy rather than in elderly people, given the time needed to develop hyperglycaemic diabetic complications [22]. Further, there were 196 subjects who did not follow the protocol; they were the same age as the 1303 who followed the protocol (51.1±8.5 vs 50.7±8.9 years, p=0.5), but had on average,

more risk factors (2.8±0.8 vs 2.6±0.8, p=0.01). This could lead to a small underestimation of diabetes and IFG prevalences.

In this study, diabetes has been diagnosed by fasting plasma glucose, an OGTT was not used as it is not recommended for diabetes screening [9]. This choice, as used in a recent UK study [23], was based on current practice in France, where the OGTT is rarely used (64,790 reimbursed in 2002 vs 19,559,071 for FPG [12]). Thus the prevalence of undiagnosed diabetes, 0.67%, is an underestimate.

Conclusion

Screening for diabetes by General Practitioners in France appears to be adequate and undiagnosed diabetes is rare in patients with risk factors for diabetes, at least in those consulting the General Practitioners studied. From our results, screening for diabetes in France should be targeted according to age and an additional risk factor which could be BMI $\geq$ 27 kg/m^2, as proposed in a recent UK study in primary care [23]. A cost-effectiveness analysis from the USA compared universal and targeted diabetes screening, targeting hypertensive subjects in the general primary care population: at all ages, targeted screening was superior [24]. In France, the recommendation is to screen for diabetes only in at risk patients [9], while the American Diabetes Association proposes screening all patients over 45 years, which could be justified given the epidemic obesity in the US population [10].

Competing interests: None

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Legend to Figure.

Figure The design of the EPIDIA Study, with results of the fasting plasma glucose (FPG) tests, with patients diagnosed as diabetic, as well as those classed as having impaired fasting glucose (IFG)

Table 1 Characteristics of patients at risk for diabetes. The EPIDIA Study. Values are means (SD) or percentages.

Variable	Men (n= 2935)	Women (n=3015)	*p*
Sex (%)	49	51	
Age (years)	52 (8)	52 (9)	0.3
Previous fasting plasma glucose (%)			
Unknown	11	13	
During previous 12 months	76	74	0.13
> 12 months	13	14	
Risk factors (%)			
Age ≥ 40 years	94	91	< 0.0001
Overweight	57	60	0.045
Hypertension	50	45	< 0.001
Dyslipidemia	45	30	< 0.001
Family history of diabetes	20	28	< 0.001
Personal history of IFG	14	10	< 0.001
Transient diabetes	1.8	2.3	0.2
Newborn > 4 kg	-	11	
Gestational diabetes	-	2.9	

Table 2 Comparing patients with and without a known fasting plasma glucose in the previous 12 months. The EPIDIA Study. Values are means (SD) or percentages.

	Fasting plasma glucose in previous 12 months		*p*
	recorded (n=4451)	none (n=1499)	
Age (years)	53 (8)	51 (9)	< 0.001
Men (%)	50	47	0.08
Number of risk factors	2.9 (0.9)	2.6 (0.8)	< 0.001
Risk factors (%)			
Age ≥ 40 years	93	90	< 0.001
Overweight	57	62	0.002
Hypertension	51	36	< 0.001
Dyslipidaemia	41	25	< 0.001
Family history of diabetes	22	29	< 0.001
Personal history of IFG	13	9	< 0.001
Transient diabetes	1.9	2.5	0.2

Table 3 Comparison between patients not diagnosed and diagnosed as diabetic, among patients who had no fasting plasma glucose recorded in the General Practitioner's records in the previous 12 months, and who followed the protocol. The EPIDIA Study.

	Non diabetic (n=1263)	New diabetic (n=40)	*P*
Age (years)	50 (9)	55 (7)	0.003
Men (%)	45	68	0.009
Age – men (years)	51 (8)	54 (8)	0.07
Age – women (years)	50 (9)	57 (5)	0.006
Fasting plasma glucose in Physicians' records	48	32	0.09
Risk factors (%)			
Age ≥ 40 years	90	100	0.03
Overweight	62	68	0.56
Hypertension	34	55	0.009
Dyslipidaemia	24	20	0.72
Family history of diabetes	30	30	0.89
Personal history of IFG	8	22	0.003
Transient diabetes	2.7	2.5	0.7
Total number of risk factors	2.6 (0.8)	3.0 (1.0)	0.001

Data are mean (SD) or percentage