Original article

GERODIAB: Glycaemic control and 5-year morbidity/mortality of type 2 diabetic patients aged 70 years and older: 1. Description of the population at inclusion

J. Doucet a,*, J.-P. Le Floch b, B. Bauduceau c, C. Verny d, the SFD/SFGG Intergroup

a Service de médecine interne gériatrie thérapeutique, hôpital Saint-Julien, Rouen University, CHU de Rouen, 76031 Rouen cedex, France

b Service de diabétologie-endocrinologie, clinique médicale de Villecresnes, 8, boulevard Richerand, 94440 Villecresnes, France

c Service d’endocrinologie, hôpital Bégin, 69, avenue de Paris, 94160 Saint-Mandé, France

d Service de gérontologie, CHU de Bicêtre, 12, rue Séverine, 94276 Le Kremlin-Bicêtre cedex, France

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Abstract

Aims. – The GERODIAB study is the first French multicentre, prospective, observational study that aims, through a 5-year cohort follow-up, to evaluate the link between glycaemic control and morbidity/mortality of type 2 diabetic (T2D) patients aged 70 years and older. This first report describes the study population at inclusion.

Patients and methods. – A total of 987 T2D autonomous patients, aged ≥ 70 years, were recruited between June 2009 and July 2010 at 56 investigator centres. Their general parameters, diabetes characteristics and standard geriatric parameters were recorded.

Results. – The patients’ mean age was 77 ± 5 years, with 65.2% aged 75 years or more. The mean BMI was close to 30 kg/m². Hypertension was found in 89.7% of patients, and 85.0% had at least one cholesterol abnormality. The mean duration of the diabetes was around 18 years, and the mean HbA1c level was about 7.5%. During the previous six months, 33.6% of patients had experienced one or several hypoglycaemias. Also, 26% of patients presented with diabetic retinopathy, 37.3% had a GFR < 60 mL/min, 31.2% had coronary insufficiency, 10.1% had heart failure, 15.8% had cerebrovascular involvement and 25.6% had peripheral vascular disease of the lower extremities. In addition, 30.5% of patients had orthostatic hypotension, 12.4% had malnutrition and 28.8% had cognitive impairment, all of which were often diagnosed at inclusion. Three-quarters of patients were taking an oral antidiabetic drug and nearly six in every 10 patients were using insulin.

Conclusion. – This population can be considered representative of elderly, autonomous T2D patients, and its follow-up should clarify the link between glycaemic control and mortality/morbidity.

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Keywords: Type 2 diabetes; Elderly patients; Geriatric tests; Cohort; Mortality; Morbidity; Epidemiology; GERODIAB

Résumé

GERODIAB : équilibre glycémique et morbi-mortalité à cinq ans des diabétiques de type 2 de 70 ans et plus : 1. Description de la population à l’inclusion.

L’étude GERODIAB est la première étude multicentrique française observationnelle prospective de suivi de cohorte dont l’objectif est d’évaluer le lien entre l’équilibre glycémique et la morbi-mortalité à cinq ans des diabétiques de type 2 de 70 ans et plus. Ce premier rapport décrit la population à l’inclusion.

Patients et méthodes. – Neuf cent quatre-vingt-sept patients diabétiques de type 2 âgés de 70 ans et plus, autonomes, ont été inclus de juin 2009 à juillet 2010 dans 56 centres investigateurs. Les paramètres généraux, les caractéristiques du diabète et les paramètres gériatrics habituels ont été enregistrés.

Résultats. – L’âge moyen était de 77 ± 5 ans et 65,2 % des patients avaient 75 ans ou plus. L’IMC moyen était proche de 30 kg/m². Une HTA était notée chez 89,7 % des patients et 85,0 % avaient au moins une anomalie du cholestérol. La durée moyenne d’évolution du diabète était proche de 18 ans. Le taux moyen d’HbA1c était proche de 7,5 %. Au cours du semestre précédant l’inclusion, 33,6 % des patients avaient eu une ou
plusieurs hypoglycémies. Vingt-six pour cent des patients présentaient une rétinopathie diabétique, 37,3 % avaient un DFG estimé inférieur à 60 ml par minute, 31,2 % avaient une insuffisance coronarienne, 10,1 % une insuffisance cardiaque, 15,8 % une atteinte cérébrovasculaire et 25,6 % une artériopathie oblitérante des membres inférieurs. Parmi les patients, 30,5 % avaient une hypotension orthostatique, 12,4 % une dénutrition protéino-énergétique et 28,8 % avaient une altération cognitive souvent diagnostiquée à l’inclusion. Trois quarts des patients recevaient un médicament antidiabétique oral et près de six sur dix de l’insuline.

Conclusion. – La population étudiée peut être considérée comme représentative des patients diabétiques de type 2 âgés autonomes. Son suivi pendant cinq ans devrait permettre de préciser le lien entre l’équilibre glycémique et la morbi-mortalité.

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Mots clés : Diabète de type 2 ; Patients âgés ; Évaluation gériatrique ; Cohorte ; Morbi-mortalité ; Épidémiologie ; GERODIAB

1. Introduction

The prevalence of diabetes in the elderly is growing due to increases in both life expectancy and incidence of diabetes in the general population [1–3]. Compared with younger diabetic patients, the consequences of diabetes and ageing accumulate in the elderly, and exacerbate degenerative complications and the effects of co-morbidities [4,5]. Elderly diabetic patients also constitute a heterogeneous population that cannot be compared with younger diabetic patients and requires ‘individualized’ management [6,7].

Most studies that have demonstrated the effects of glycaemic control on the morbidity/mortality of diabetes were conducted in diabetic patients <70 years of age [8–12]. There is therefore no clear evidence that elderly and younger diabetic patients should all share the same therapeutic targets [13,14], and recent studies of the potential risks of glycaemic control intensification have added further doubts [15–18]. Thus, it has yet to be determined whether glycaemic control in elderly diabetic patients plays a role not only in the acute and degenerative complications of diabetes, but also in the classical geriatric parameters used to evaluate risk factors for decreased autonomy [7,19,20].

The GERODIAB study is the first multicentre, prospective, observational study that aims, through a 5-year cohort follow-up, to evaluate the link between glycaemic control and the morbidity/mortality of type 2 diabetes (T2D) patients aged ≥70 years in France. The objective of this first report is to describe the study population at inclusion.

2. Patients and methods

T2D patients aged ≥70 years were included in the study irrespective of their treatment (for insulin-treated diabetic patients, the time between the diagnosis of diabetes and initiation of insulin therapy was at least 2 years). Diabetes had to have been diagnosed for at least 1 year, and the patients had to have sufficient autonomy, as defined by a score ≥3 out of 6 on the Activities of Daily Living (ADL) scale. They also all had to be available for follow-up on an outpatients basis for the next 5 years, and should all have agreed to participate in the study after being fully informed of the risks and benefits.

The reasons for patient exclusion included the presence of type 1 diabetes or secondary diabetes, loss of autonomy (ADL score <3/6), acute disease stage (transitory exclusion criterion) and refusal to participate in the study.

The primary endpoint of the study was the 5-year mortality in two patient subgroups compared according to their mean HbA1c levels over 5 years, using survival curves for those less than vs greater than, or equal to, 7.5% [21,22]. The secondary endpoint analyses included comparisons of the survival curves for each HbA1c subgroup, investigation of an optimal threshold and the influence of other individual parameters on mortality, as well as diabetes complications or worsening of geriatric functional assessment tests.

The number of subjects to be included was evaluated according to the primary endpoint, using a log-rank model with an estimated 20% mortality at 5 years in well-controlled diabetic patients, a risk ratio of 1.5 in poorly controlled diabetic patients with quarterly follow-up, a 5% α risk and 90% power [22–24]. Furthermore, the population had to be a representative sample able to describe events with sufficient accuracy (<5%). For this reason, a sample of 900 to 1000 patients, representing about 0.5% of diabetic patients aged 70 years or older, was selected. Information on the study was sent to members of the SFD (French-Speaking Diabetes Society) and the SFGG (French Society of Gerontology and Geriatrics). After a feasibility study and stratification according to geographical distribution, 56 centres were randomly selected for the study (Fig. S1; see supplementary material associated with this article online).

These centres were part of a network of diabetes/geriatric clinicians throughout the country, with each including a physician investigator and one or several physician co-investigators (with a total of 163 investigators and co-investigators). To maintain homogeneity and feasibility, only metropolitan centres were selected.

Each centre was initially asked to include between 10 and 30 patients (20 on average). Inclusion was systematically proposed to patients meeting the inclusion criteria in the sequential order in which they were seen as outpatients until the allocated number of subjects for each centre was reached. As some centres had difficulty in recruiting, other centres were authorized to include up to 40 patients to compensate.

At inclusion, three types of information were recorded to serve as a basis for comparisons throughout the follow-up:

- general parameters, including demographic data, socioeconomic level and cardiovascular risk factors;
- diabetes characteristics, such as time since diagnosis, glycaemic control, and treatment and specific complications of diabetes preexisting at inclusion or found during the initial
visit, with glomerular filtration rate (GFR) estimated by the Modification of Diet in Renal Disease (MDRD) formula; 

- geriatric parameters, including investigation for arterial hypotension (after 1, 3 and 5 min of standing), evaluation of autonomy for baseline activities (ADL) and instrumental activities of daily living (IADL), nutritional status (evaluated by body mass index [BMI], serum albumin and the Mini-Nutritional Assessment [MNA]), cognitive status (evaluated by the Mini-Mental State Examination [MMSE]) and mood status (evaluated by the mini Geriatric Depression Scale [mini GDS] for the investigation of signs suggestive of depression).

Patient follow-up was performed in accordance with the official French recommendations [25]. As the study was non-interventional, the objectives of glycaemic control, correction of risk factors and treatment management were left to the investigators to assess according to their usual practices. The descriptive results from the present population at inclusion were expressed as means ± SD, medians and quartiles, and as percentages.

3. Results

Between June 2009 and July 2010, 987 patients were recruited (52.1% of whom were women).

3.1. General parameters

The patients’ mean age was 77 years (Table 1), with 34.8% of patients aged < 75 years, 36.7% between 75 and 80 years, and 28.5% ≥ 80 years (Fig. S2; see supplementary material associated with this article online).

Past or present tobacco use was noted in 35.8% of patients, and 32.1% had stopped smoking for more than 5 years. Past or present alcohol consumption included 34.9% of patients, while 32.2% were still drinking alcohol at inclusion.

The mean BMI was close to 30 kg/m² (Table 1) with a wide range of distribution: 0.9 and 0.4% of patients had a BMI < 20 kg/m² and 18 kg/m², respectively; and 44.7% and 3.8% had a BMI > 30 and 40 kg/m², respectively (Fig. S3; see supplementary material associated with this article online).

The mean BMI was slightly higher in women than in men (30.3 ± 5.9 vs 29.2 ± 4.2 kg/m²; P < 0.01), with a more varied and extreme range of distribution for both high and low values (Fig. S3; see supplementary material associated with this article online).

Waist circumference was > 80 cm in women and > 94 cm in men in 86.4% of patients, while 68.1% had a waist-to-hip ratio > 0.8 in women and > 1.0 in men (Table 1).

3.2. Other cardiovascular risk factors

Hypertension had been previously diagnosed in 85.1% of patients, and an additional 4.6% were so diagnosed at inclusion. During the initial examination, 42.2% of patients had systolic blood pressure (BP) ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg (Table 1), and 21.5% of patients were considered to have severe hypertension (already known or with systolic BP > 160 mmHg at inclusion).

Also at inclusion, 75.2% of patients were known to have hypercholesterolaemia: 20.0% had serum cholesterol > 2 g/L; 4.8% had low-density lipoprotein (LDL) > 1.6 g/L; 20.2% had high-density lipoprotein (HDL) < 0.4 g/L; 19.0% had a cholesterol/HDL ratio > 4.4; 85.0% had at least one of the previously mentioned anomalies or were receiving statin treatment; and 13.1% had serum triglycerides at inclusion > 2 g/L and/or were taking fibrate treatment (Table 1).

The triglycerides/HDL ratio was > 2.27 in 50.8% of patients, which was suggestive of insulin resistance. When all patients with a BMI > 40 kg/m², and a waist circumference > 94 cm for men and > 80 cm for women, were also included, 90.8% of patients could be considered to have insulin resistance.

3.3. Diabetes complications and related diseases

The mean duration of diabetes was close to 18 years, with a quarter of the population having a known duration of 10 years or less, and another quarter having a duration of 25 years or longer (Table 1, Fig. S2; see supplementary material associated with this article online). The mean HbA₁c level was
Cardiovascular risk factors, diabetes complications and related diseases in the study population.

Table 2

<table>
<thead>
<tr>
<th>At inclusion</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>89.8</td>
</tr>
<tr>
<td>Coronary insufficiency</td>
<td>31.2</td>
</tr>
<tr>
<td>Heart failure</td>
<td>10.1</td>
</tr>
<tr>
<td>Cerebrovascular involvement</td>
<td>15.8</td>
</tr>
<tr>
<td>Peripheral vascular disease of the lower extremities</td>
<td>25.6</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>26.0</td>
</tr>
<tr>
<td>MDRD GFR ≤ 60 mL/min</td>
<td>37.3</td>
</tr>
<tr>
<td>Periperal neuropathy</td>
<td>28.2</td>
</tr>
<tr>
<td>Foot wound</td>
<td>5.1</td>
</tr>
<tr>
<td>Amputation</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Last 6 months

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoglycaemia</td>
<td>33.6</td>
</tr>
<tr>
<td>Ketosis</td>
<td>0.9</td>
</tr>
<tr>
<td>Hyperosmolarity</td>
<td>0.9</td>
</tr>
<tr>
<td>Infection</td>
<td>13.1</td>
</tr>
<tr>
<td>Other intercurrent infection</td>
<td>23.8</td>
</tr>
</tbody>
</table>

MDRD: Modification of Diet in Renal Disease; GFR: glomerular filtration rate.

about 7.5%, with significant interindividual variability (Table 2, Fig. S4; see supplementary material associated with this article online).

In the six months prior to inclusion, 33.6% of patients had experienced one or several episodes of hypoglycaemia (Table 2). In 29.7% of cases, hypoglycaemia was mild (mean number of events: 11.3 ± 13.7 per patient), whereas 3.3% had severe hypoglycaemia and six patients (0.6%) had fallen into coma. Ketosis was reported in 0.9% of patients, one of whom developed ketoacidosis, and 0.9% of the participants were found to have hyperosmolarity, two of whom had fallen into coma. More than one out of every eight patients had experienced one or several infections in the 6 months preceding inclusion (Table 2).

In addition, just over a quarter of patients had diabetic retinopathy (Table 2), which was already known previously (24.7%) or found at the time of the inclusion visit (23.4%); most cases were non-proliferative (16.9%), but a few (9.1%) were proliferative. Macular oedema was also present in 3.3%.

Kidney failure that was moderate (GFR 30–60 mL/min, as estimated by the MDRD) and severe (GFR < 30 mL/min, as per the MDRD) was observed in 33.5% and 3.8% of patients, respectively.

Coronary insufficiency was suspected in 31.2% of patients overall (at inclusion, a history of acute coronary syndrome or myocardial infarction, angina pectoris or Q wave on electrocardiography [ECG], or a region of ventricular hypokinesis or akinesis on echocardiography when this exam was performed), and 21.4% were cases of infarction (Table 2), of whom 28.4% were known at inclusion and 10.3% had presented with suspicious anomalies on ECG.

Other ECG anomalies also found included atrial fibrillation in 67 patients (6.8%), localized repolarization disorder in 138 patients (14%) and conduction disorders in 219 patients (22.2%).

Heart failure that was either already known or diagnosed at inclusion was present in 10.1% of patients. Left- and right-sided heart failure was noted in 2.7% of patients.

Cerebrovascular involvement was noted in 15.8% of patients, with a history of transient or definitive stroke (12.3%) and/or haemodynamic arterial stenosis on Doppler examination of the supra-aortic vessels (4.6%) when available. Also, 6.3% of patients had sequelae from an established stroke.

Peripheral vascular disease of the lower extremities was found in 25.6% of patients, with clinical signs in 10.6% and no symptoms in the remaining 15.0% (5.6% of whom had haemodynamic arterial stenosis on Doppler examination performed within the past 3 months).

3.4. Geriatric parameters

Nearly all patients (94.3%) lived at home, with 1.2% in senior housing and 2.3% in nursing homes; 12.7% of patients had completed higher education, 55.0% had a middle-school education or less and 94.0% had worked: 50.5% had been salaried employees in the private sector; 24.8% had been self-employed; and 24.7% had been civil servants.

Mean BP values taken after 1, 3 and 5 min of standing are shown in Table 1. Orthostatic hypotension, defined as a drop in systolic BP ≥ 20 mmHg and/or in diastolic BP ≥ 10 mmHg, was observed in 30.5% of patients.

Clinical geriatric assessment scale scores are presented in Table 3. The ADL score was 6/6 in 73% of patients, signifying complete autonomy for basic activities of daily living. As for cognitive status, 28.8% of patients had an anomaly due to either previously known dementia (2.6% of cases) or an unlabeled, but previously known, disorder, or because of an MMSE score at inclusion of ≤ 24/30 (25.9% of patients).

The total MNA score was < 17/30 in 0.4% of patients. When measured, serum albumin was < 30 g/L in 8.6% of patients, and > 30 g/L but < 35 g/L in 9.8% of patients; 6.99% of patients had protein-calorie malnutrition, defined as a BMI < 21 kg/m² or serum albumin < 35 g/L, while 5.4% had severe malnutrition (BMI < 18 kg/m² or serum albumin < 30 g/L).
Table 4
Medications taken by patients at inclusion.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dietary principles</strong></td>
<td>92.5</td>
</tr>
<tr>
<td><strong>Oral antidiabetic agents</strong></td>
<td></td>
</tr>
<tr>
<td>Biguanides</td>
<td>48.8</td>
</tr>
<tr>
<td>Glitazones</td>
<td>14.6</td>
</tr>
<tr>
<td>Glucose-dependent insulin secretors</td>
<td>7.3</td>
</tr>
<tr>
<td>Alpha-glucosidase inhibitors</td>
<td>5.0</td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>10.0</td>
</tr>
<tr>
<td>Sulphonylureas</td>
<td>28.6</td>
</tr>
<tr>
<td><strong>GLP-1 analogues</strong></td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Insulin</strong></td>
<td>57.5</td>
</tr>
<tr>
<td><strong>Capillary blood glucose monitoring</strong></td>
<td>95.7</td>
</tr>
<tr>
<td><strong>Cardiovascular drugs</strong></td>
<td></td>
</tr>
<tr>
<td>Calcium-channel blockers</td>
<td>36.5</td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>37.8</td>
</tr>
<tr>
<td>Diuretics</td>
<td>52.7</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>38.7</td>
</tr>
<tr>
<td>Nitrates</td>
<td>7.3</td>
</tr>
<tr>
<td>Sartans</td>
<td>40.0</td>
</tr>
<tr>
<td>Others</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>Statins</strong></td>
<td>62.9</td>
</tr>
<tr>
<td><strong>Fibrates</strong></td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Anticoagulants</strong></td>
<td>12.4</td>
</tr>
<tr>
<td><strong>Platelet aggregation inhibitors</strong></td>
<td>55.9</td>
</tr>
</tbody>
</table>

DPP-4: dipeptidyl peptidase 4; GLP-1: glucagon-like peptide 1; ACE: angiotensin-converting enzyme.

3.5. Treatment at inclusion

More than nine out of 10 patients allegedly followed healthy dietary principles. Nearly three out of four were taking an oral antidiabetic agent (OAD), and nearly six out of 10 were using insulin (Table 4). Monotherapy with OADs was prescribed in 39.3% of patients, and with glucagon-like peptide (GLP)-1 analogues in 0.1% and insulin in 24.9%. Combination therapy was prescribed in 3.1% with OAD/GLP-1 analogues, 28.9% with OAD/insulin and 0.3% with insulin/GLP-1 analogues. Triple combination therapy was used by 1.2% of patients. The prescribed OADs consisted mostly of metformin and non-glucose-dependent insulin secretors, sulphonylureas or glinides. Capillary blood glucose monitoring was carried out in 95.7% of patients (mean weekly number of such tests done: 13.4 ± 9.7; median: 14; quartiles 5–21). Nearly all patients (97.9%) were also taking other medications (Table 4).

4. Discussion

In Western countries, one out of every two diabetic patients is aged > 65 years, and one out of every four is > 75 years [2,3]. The prevalence of treated diabetes in France affects a maximum of 19.7% of men and 14.2% of women between the ages of 75 and 79 years [24]. However, the population of elderly diabetic patients is not comparable to that of younger diabetic patients in terms of frequency of diabetes type, associated cardiovascular risk factors, co-morbidities, and therapeutic objectives and risks [26]. In addition, a large number of elderly diabetic patients still appear to be inadequately managed [27].

The present study is the first to be performed in a cohort of T2D patients aged 70 years and older. The population under study constitutes a significant proportion of older diabetic patients, as it accounts for around 0.5% of the French population of patients in this age range. Patients from throughout metropolitan France were consecutively included in the study during their usual follow-up visits at one of the study centres.

The studied population was characterized by a mean age of 77.5 years, with nearly one-third of patients being > 80 years of age. Nearly all patients had multiple medical conditions, particularly other cardiovascular risk factors such as hypertension and hypercholesterolaemia, which were frequently present, as well as diabetic complications. Exclusion criteria were limited to those patients who had altered autonomy (ADL scores < 3/6) or an inability to comply with follow-up, or who refused to participate in the study. The studied population can therefore be considered representative of non-institutionalized elderly diabetic patients followed on an outpatient basis. These characteristics should enable the main study objective to be met.

Our patients were followed in a diabetology setting or by geriatricians well accustomed to the management of diabetes, which might explain some of the differences observed compared with the ENTRED study, particularly as regards treatment [24,26]. The population of institutionalized elderly diabetic patients is underrepresented due to their insufficient autonomy (exclusion criteria) and their generally limited access to specialists at medical visits. Nonetheless, the management of diabetes in institutionalized elderly diabetic patients is often less of a priority in comparison to other conditions they may have.

The large number of patients at inclusion with HbA1c levels > 7%, or even > 7.5%, despite being mostly followed in a diabetology setting, appears to contradict arguments supporting the predictive value of glycated haemoglobin levels for morbidity/mortality in the general diabetic population [28–32]. There are two possible explanations for this. First, the benefits of strict glycaemic control in elderly diabetic subjects have not been clearly demonstrated, as most studies followed patient cohorts aged ≤ 65 years [28–32], and the relationships between glycated haemoglobin and hypoglycaemia, renal alterations and cognitive disorders are complex [33–41]. A second explanation is the fear of exposing elderly diabetic patients to hypoglycaemia, the potential severity of which has been well described in this population, particularly with regard to cognition [35–39].

In addition, the large number of cardiovascular risk factors requires that elderly T2D patients be treated with a holistic approach, as the disease course of each patient is most likely linked to all of these factors as well as to those of other diseases. The potential morbidity/mortality among these patients is therefore multifactorial and probably not exclusively related to glycaemic control. While the presence of hypertension was consistently seen in nearly all patients, the presence of overweight was not, even with some patients having protein deficiency. The frequency of hypercholesterolaemia could have been overestimated due to taking account of statin treatment that may have
been started after a cardiovascular event, independent of lipid profile results.

Furthermore, insulin resistance was commonly present in our study population, according to information obtained from weight, waist-to-hip circumference ratio and triglyceride/HDL ratio (which was > 2.27) [42].

In fact, our present results show increased prevalences of cardiovascular diseases, alterations in renal function and retinopathy. While retinopathy is a specific complication of diabetes, it is not possible to find an exclusive link for cardiovascular diseases and renal alterations with only diabetes, given the frequent association of other cardiovascular risk factors, particularly hypertension. For this reason, these alterations were considered ‘associated complications or diseases’. This is also why no results for microalbuminuria are shown here, as it was not recorded in all patients, and its precise evaluation methods are not clear, not necessarily reliable and not unequivocal in elderly diabetic patients [4]. However, follow-up results could help in managing these data. As for foot examinations, the risk of such lesions was not assessed, and the prevalence of peripheral neuropathy was apparently low, probably because it was diagnosed only by the monofilament test.

Our study showed a significant prevalence of geriatric parameter anomalies, which are often underestimated, particularly with regard to alterations in cognition. It must therefore be emphasized that geriatric assessment in elderly diabetic patients is of considerable benefit as it frequently reveals alterations that can directly interfere with care management [43]. Therapeutic management can be hindered by cognitive or mood disorders that alter treatment compliance and patient self-care, and even by reduced autonomy and malnutrition, which limit physical activity, and require dietary adjustments, and the organization of help for hygiene and meals to be properly provided.

Our results also showed a clear difference between the prevalence of anomalies declared at inclusion and those observed after the examinations. This can explain in large part the differences noted compared with the ENTRED study. While small differences in the prevalence of standard diabetic parameters only provide evidence of the disease course compared with the previous diabetic workup, the frequency of cognitive disorders obtained by the MMSE was three times greater than that of the initial evaluation. On the other hand, some examinations performed more systematically, such as arterial Doppler examination, revealed complications that had previously gone undetected.

From a treatment perspective, our present results confirm the significantly increased prevalence of patients treated with insulin compared with earlier studies. This was partly related to the numerous situations in which insulin therapy is required by elderly diabetic patients, especially when OADs cannot be used. This can also be explained by the management method used by teams that are accustomed to the use of insulin. Furthermore, given the large number of associated cardiovascular diseases, the frequency with which cardiovascular drugs and statins were prescribed was not surprising.

In conclusion, this first descriptive study of a representative sample of T2D patients aged ≥ 70 years included in a cohort that will be followed for 5 years provides an opportunity to better know this population, which is often excluded from traditional clinical studies. It also highlights their distinctive features, particularly with regard to associated diseases and, therefore, to therapeutic targets, that need to take into account the medical–social context and risk of hypoglycaemia in particular, elements that correspond to the patient-centred approach of the recent American Diabetes Association (ADA) and European Association for the Study of Diabetes (EASD) position statements [44]. In addition, the extension of life expectancy demands greater efforts towards more rigorous glycaemic control, and a satisfactory quality of life in increasingly older and increasingly autonomous diabetic patients, thereby justifying the medium-term follow-up of this cohort and leading to the fundamental question that should be asked in this population: should there be a fixed HbA1c threshold in these older T2D patients and, if so, at what level and with the use of which therapeutic modalities?

Acknowledgments

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Appendix A. Authors

Appendix 1. Intergroup Scientific Committee


Appendix 2. Investigators in alphabetical order

Appendix B. Supplementary material

Supplementary material (Figs. S1–S4) associated with this article can be found at http://www.sciencedirect.com, at dx.doi.org/10.1016/j.diabet.2012.07.001.

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