Abstract

Objectives: Describe the sociodemographic and clinical features of elderly patients with diabetes who were admitted to an internal medicine and geriatrics department.

Patients and methods: In a retrospective study we collected the medical charts of patients admitted between 1 January, 2004, and 31 December 2007, to the Internal Medicine and Geriatrics Department of the Sainte Marguerite Teaching Hospital, Marseille, France. Patients aged 65 years or older who had diabetes according to the 1997 American Diabetes Association criterion of two fasting blood glucose levels equal to or greater than 1.26 g/L were involved in the study. We recorded the results of medical and the standardized geriatric evaluation routinely conducted in all patients admitted to our department. This evaluation includes assessments of depression, cognitive function, self-sufficiency, nutritional status, and co-morbidities through valided French version.

Results: We studied 145 diabetics on 1309 older patients (11.8%), average age to 79.6 years, the female was net, over three-quarters were dependent on their environment. In addition to Metabolic complications, falls and cardiovascular pathologies were frequent reasons for consultation. The standardized geriatric assessment find a cognitive impairment and dependence in respectively 61.5% and 60.7% of cases. Depression was found in 43.4% cases undernutrition in 25.5% of the cases. The co-morbidity were dominated by heart failure and pressure sores.

Conclusion: This comparative study shows differences in term of morbidity and mortality in two populations of older patients. Polypharmacy, hypoglycemia, falls and cognitive impairment higher in diabetic patients cause loss of autonomy. Geriatric evaluation and better management of diabetes is necessary in diabetic patients to prevent this situation.

Keywords: Diabetes, Elderly, Internal Medicine, Morbidity, Mortality.

Introduction

Diabetes in elderly individuals constitutes a major public health burden throughout the world, given its high prevalence and association with co-morbid conditions [1]. Among individuals older than 65 years of age, 10% may have diabetes (20% after 80 years of age) and a further 10% intolerance to glucose [2]. The number of elderly diabetic patients has risen in recent years as a result of both the aging of the population, since the risk of diabetes increases with advancing age, and a true increase in the incidence of diabetes. Diabetes is the sixth most common cause of death among older adults, with cardiovascular events contributing most of the diabetes-related deaths. A high cardiovascular risk strongly predicts loss of self-sufficiency and alterations in quality of life [3]. In elderly individuals, pre-existing or newly developed diabetes is often overshadowed by the presence of multiple co-morbidities and by the attendant polypharmacy. This situation may be particularly common among inpatients [4]. However, few studies have focused on elderly inpatients with diabetes. Whereas diabetes in younger patients is managed by specialists in the relatively narrow field of endocrinology, elderly diabetic patients are managed within the far broader field of internal medicine. This shift reflects...
the need for careful attention in older patients to associated effects, potential drug-drug interactions, the cascade effect, and other characteristics of the elderly. Thus, the management of diabetes in the elderly raises specific challenges.

To optimize the management of diabetes in the elderly, data on the specific features of this patient population are needed. We therefore designed a study to describe the sociodemographic and clinical features of elderly patients with diabetes who were admitted to an internal medicine and geriatrics hospitalization.

Patients and Methods
We retrospectively reviewed the medical charts of patients admitted between 1 January, 2004, and 31 December 2007, to the Internal Medicine and Geriatrics Department of the Sainte Marguerite Teaching Hospital, Marseille, France. We included consecutive patients aged 65 years or older who had diabetes according to the 1997 American Diabetes Association criterion of two fasting blood glucose levels equal to or greater than 1.26 g/L. Of the 1309 patients admitted during the study period and aged 65 years or older, 145 met this criterion.

Data on these 145 patients were abstracted from the medical charts using a standardized form. For each patient, we recorded age, sex, and living arrangements (healthcare institution / nursing home or home; and help from family, healthcare professionals, or assistants). We also recorded the results of the standardized geriatric evaluation routinely conducted in all patients admitted to our department. This evaluation includes assessments of depression, cognitive function, self-sufficiency, nutritional status, and co-morbidities. Depression was assessed using the Mini-Geriatric Depression Scale (Mini-GDS) (appendix 1) and defined as a score greater than 0 on the 0-1 scale. To assess cognitive function, patients completed the Mini-Mental State Examination (MMSE) or Folstein test (appendix 2), which assesses memory, orientation, concentration, mental arithmetic, language, and praxis [5,6]. Scores lower than 24/30 indicates significant cognitive impairment of variable severity. Two scales were used to assess self-sufficiency, the Activities of Daily Living scale (ADL), which evaluates the ability to perform the basic activities of daily living; and the Instrumental Activities of Daily Living scale (IADL) (appendix 3), which investigates everyday activities of greater complexity. Dependency was defined as an ADL score no greater than 3/6 or as an IADL score no greater than 2/4 [7-9]. The Mini Nutritional Assessment was used to assess nutritional status (appendix 4) [10]. With this simple and well validated tool, scores lower than 11/14 indicates malnutrition. Finally, cardiovascular risk factors were assessed and the patients were examined for co-morbidities associated with diabetes including chronic organ failures (congestive heart failure, kidney failure, and respiratory failure), solid cancer and haematological malignancies, systemic disorders, and pressure sores.

The group of diabetic patients was compared to a control group composed of 150 patients. These 150 patients were selected at random among the 1164 non-diabetic patients aged 65 years or older who were admitted to our department during the study period.

Statistical analysis
Percentages were compared using the chi-square test and means using Student’s test. Values of $p$ smaller than 0.05 were considered significant. Statistical tests were performed using SPSS version 10.1 on Windows (SPSS Inc., Chicago, IL, USA).

Results
Of the 1309 patients admitted during the study period, 145 (11.1%) had diabetes. Their mean age was 79.6 years (range, 65-101 years), compared to 81.2 years (65-105 years) in the control group ($p=0.238$). The distribution of the diabetic patients by age and sex is shown in (Table 1). The sex ratio was 0.58 in the group of diabetic patients and 0.72 in the control group ($p=0.338$).

Table 1: Distribution of diabetic patients by sex and age. The data are the numbers of patients (%).

| Age groups | Women n=92 (63.4%) | Men n=53 (36.6%) | Total n=145 (100%) |
|------------|-------------------|-----------------|-------------------|
| 65-74 years | 21 (22.8%)        | 19 (35.8%)      | 40 (27.6%)        |
| 75-84 years | 53 (57.6%)        | 21 (39.6%)      | 74 (51.03%)       |
| ≥ 85 years | 18 (19.6%)        | 13 (24.5%)      | 31 (21.4%)        |

The data on living arrangements by age in the diabetic patients are reported in (Table 2). The reasons for hospital admission in the group of diabetic patients and in the controls are reported in (Table 3). (Table 4) shows the age-related disorders and co-morbidities.

Table 2: Distribution of the 145 diabetic patients by living arrangements and by age. The data are the number of patients.

| Age groups | Institution, nursing home n=21 | At home, with help n=101 | At home, without help n=23 |
|------------|-------------------------------|--------------------------|---------------------------|
| 65-74 years | 3                             | 36                       | 7                         |
| 75-84 years | 11                            | 48                       | 12                        |
| ≥ 85 years | 7                             | 17                       | 4                         |

Table 3: Reasons for admission in the diabetic patients and controls. The data are the numbers of patients (%).

| Reasons for admission | Diabetic patients, n=145 | Non-diabetic controls, n=150 | $p$ value |
|-----------------------|--------------------------|-----------------------------|-----------|
| Falls                 | 20 (13.8)                | 11 (7.3)                    | <0.001*   |
| hypoglycemia          | 18 (12.4)                | 0                           | <0.0001*  |
| Neuropsychiatric disorders | 18 (12.4) | 22 (14.7) | 0.371       |
| Evidence of infection | 12 (8.3)                 | 12 (8.0)                    | 0.465     |
| Cancer                | 12 (8.3)                 | 15 (10.0)                   | 0.272     |
| Haematological disorders | -                      | 13 (8.7)                    | <0.0001*  |
| Decline in general health | 10 (6.9)               | 17 (11.3)                   | <0.001*   |
| Gastrointestinal disease | 9 (6.2)                | 3 (2.0)                     | <0.001*   |
| Malaise and dizziness | 8 (5.5)                  | 8 (5.3)                     | 0.47      |
| Respiratory disease   | 6 (4.1)                  | 14 (9.3)                    | 0.068     |
| Cardiovascular disease | 6 (4.1)                 | 2 (1.3)                     | <0.01*    |
| Pain syndromes        | 5 (3.5)                  | 6 (4.0)                     | 0.315     |
| Chronic kidney failure | 4 (2.8)                 | 0                           | <0.0001*  |
| Anaemia               | 4 (2.8)                  | 7 (4.7)                     | 0.07      |
| Water and electrolyte disturbances | 3 (2.1) | 3 (2.0) | 0.46        |
| Miscellaneous         | 10 (6.9)                 | 17 (11.3)                   | 0.082     |
Table 4: Age-related disorders and co-morbidities in the 145 diabetic patients and 150 controls

| Disorders               | Clinical characteristics | Diabetic Patients n=145 | Non-diabetic controls n=150 | p value |
|-------------------------|--------------------------|-------------------------|----------------------------|---------|
| Age-related disorders   |                          |                         |                            |         |
| Depression              |                          | 63 (43.4)               | 79 (52.7)                  | 0.113   |
| Cognitive impairment    |                          | 88 (61.5%)              | 63 (42%)                   | <0.001* |
| Dependency              |                          | 88 (60.7%)              | 76 (50.7%)                 | 0.083   |
| Malnutrition            |                          | 37 (25.5%)              | 68 (45.3%)                 | <0.0001*|
| Cardiovascular risk factors |                        |                         |                            |         |
| Hypertension            |                          | 93 (64.1%)              | 59 (39.3%)                 | <0.0001*|
| Dyslipidaemia           |                          | 68 (46.9%)              | 16 (10.7%)                 | <0.0001*|
| Obesity                 |                          | 68 (46.9%)              | 18 (12%)                   | <0.0001*|
| Current smoker          |                          | 26 (17.9%)              | 26 (17.9%)                 | 0.462   |
| Malignancies            | Haematological malignancies |                      |                            |         |
|                         |                          | 12 (8.3%)               | 9 (6%)                     | 0.237   |
| Malignancies            | Solid tumours            | 7 (4.8%)                | 16 (10.7%)                 | <0.001* |
| Chronic organ dysfunctions |                        |                         |                            |         |
| Congestive heart failure |                          | 32 (22.1%)              | 16 (10.3%)                 | 0.008*  |
| Renal failure           |                          | 23 (15.9%)              | 26 (17.3%)                 | 0.734   |
| Respiratory failure     |                          | 13 (9%)                 | 24 (16%)                   | 0.068   |
| Systemic diseasea       |                          |                         |                            |         |
| Pressure sores          |                          | 10 (6.9%)               | 7 (4.7%)                   | 0.198   |
|                         |                          | 15 (10.3%)              | 3 (2%)                     | <0.001* |

*Sarcoidosis, myasthenia, giant cell arteritis, thrombotic microangiopathy, dermatopolymyositis

The rate of cognitive impairment increased with disease duration but was independent from the HbA1c increase (Table 5). When we separated the diabetic patients in two groups based on disease duration of 20 years or less versus more than 20 years, we found that the rate of cognitive impairment was significantly lower in the shorter-duration group (56% vs. 75%, p=0.002). The rate of cognitive impairment was not significantly different between the two groups defined based on an HbA1c level lower than 8% or equal to or greater than 8% (62.8% and 53.1%, respectively; p=0.403) (Table 5).

Table 5: Influence of disease duration and metabolic control on the rate of cognitive impairments in the 145 older patients with diabetes. The data are the numbers of patients (%).

| Diabetes duration | Cognitive impairments n=88 | p value |
|-------------------|---------------------------|---------|
| ≤20 years         | 61 (69%)                  | 0.002   |
| >20 years         | 27 (31%)                  |         |

| HbA1c level       | Cognitive impairments n=88 | p value |
|-------------------|---------------------------|---------|
| ≤8%               | 71 (81%)                  | 0.403   |
| >8%               | 17 (19%)                  |         |

Discussion
Among our inpatients aged 65 years or older, 11.1% had diabetes. As expected in a population of older individuals, females predominated among the diabetic patients (sex ratio, 0.58). Although 85.5% of the diabetic patients lived at home, more than two-thirds of these patients reported needing outside help to manage their diabetes. The main reasons for admission were falls, hypoglycaemia, and neuropsychiatric disorders; whereas among the non-diabetic controls the main reasons for admission were neuropsychiatric disorders, a decline in general health, and cancer. Compared to the control group, the diabetic group was characterized by a higher rate of cognitive impairment and by lower rates of malnutrition and cancer.
was significantly more common in our patients with diabetes than in the controls. Although no such difference was noted in the PAQUID study, data from several observational and interventional studies indicate higher rates of cognitive impairment and dementia among diabetic patients [19].

Table 6: Prevalence of diabetes in older individuals (outpatients throughout the world)

| Geographic area | 1980  | 1990  | 2000  |
|-----------------|-------|-------|-------|
| Europe          | 11.2% | 16%   |       |
| France          | 10.3% |       |       |
| UK              | 10.5% |       |       |
| USA             | 11.3% | 16%   |       |
| Canada          | M: 12%| F: 7.8%| M: 15.8%| F: 12.8%|
| Asia            | M: 9.2-19.9%| F: 8.1%|       |
| Africa          | 5.2%-11.6%|       |       |

We found that the rate of cognitive impairment increased with disease duration but was unaffected by the HbA1c level, whereas earlier data suggest that the severity of the cognitive impairments may correlate with both disease duration and metabolic control [20]. Although the discrepancies across studies offer room for controversy, diabetes is a well-established risk factor for vascular dementia [21]. In contrast, there may be little or no association between diabetes and Alzheimer’s disease [22]. Malnutrition was significantly more common among our controls than among our diabetic patients. A possible explanation to this finding is the higher prevalence of obesity and overweight in the group of diabetics combined with the higher prevalence of solid cancers and declining general health among the controls. Older age is associated with depression, and the association is stronger in patients with than without diabetes. In our study, depression was found in similar proportions of diabetic and non-diabetic patients. Among our diabetic patients who lived at home, 69.7% reported being dependent on others to manage their diabetes. The proportions of patients with dependency were similar in the diabetic and non-diabetic groups. Factors that may have contributed to dependency in the diabetic patients include cognitive impairments and cardiovascular disease, most notably strokes and congestive heart failure. In the non-diabetic patients, dependency may have been related to poor general health, malnutrition, respiratory failure, and cancer.

Type 2 diabetes is usually associated with other cardiovascular risk factors such as hypertension, dyslipidaemia and, obesity. Thus, we found higher rates of hypertension, dyslipidaemia, obesity, and heart failure among our diabetic patients than among the non-diabetic controls. In the Framingham cohort, overweight was twice as common among diabetics than among non-diabetes after 60 years of age, with no difference between men and women [20]. A recent study showed that mortality decreased with increasing levels of BMI and physical activity. Chronic congestive heart failure, the leading co-morbidity in our study, was twice as common among diabetic patients than among controls. In a study of patients with congestive heart failure, 22% of men and 24% of women had diabetes [23]. The development of heart failure in patients with diabetes may correlate with the degree of metabolic control [23]. Diabetic heart disease is a form of cardiomyopathy that cannot be ascribed to hypertension, coronary artery disease, or other known heart diseases. This entity was described more than three decades ago but remains a focus of controversy [24]. Renal failure was present in similar proportions of patients in our two groups. Respiratory failure was less common in our diabetic patients than in our controls, although the proportion of smokers was similar in the two groups.

Among co-morbidities, systemic diseases were present in 6.9% and haematological malignancies in 8.3% of the diabetic patients in our study. Glucocorticoid therapy is needed to treat many of these diseases, most notably the vasculitides and lymphoma. Glucocorticoids increase the risk of poor metabolic control and may exacerbate the diabetes. Factors associated with the development of diabetes should be sought carefully before starting treatment with diabetes-inducing medications such as glucocorticoids. In our study, however, systemic diseases were found in similar proportions of diabetic and non-diabetic patients. Solid cancers were more common among the non-diabetic patients. In the PAQUID study, in contrast, cancer was more common among the diabetic patients, who had a higher mortality rate as a result [11].

Pressure sores were significantly more common in our group of diabetic patients than in the controls. The development of pressure sores in older individuals is a multifactorial process [25,26]. In addition to the diabetes itself, the higher rates of obesity and stroke in the group of diabetic patients may explain the higher rate of pressure sores. The geriatric assessment tools are essential for early diagnostic of frailty in patients with morbidity like diabetes; However a specific education program is also necessary in diabetic patients manage in geriatrics department [27-31].

The main weakness of our study is its retrospective single-centre design. However, our results are consistent with those found previously in larger prospective studies. An important strength of our study is the availability for all the diabetic patients and non-diabetic patients. Among our diabetic patients, diabetes-inducing medications such as glucocorticoids. In our study. Glucocorticoid therapy is needed to treat many of these diseases, most notably the vasculitides and lymphoma. Glucocorticoids increase the risk of poor metabolic control and may exacerbate the diabetes. Factors associated with the development of diabetes should be sought carefully before starting treatment with diabetes-inducing medications such as glucocorticoids. In our study, however, systemic diseases were found in similar proportions of diabetic and non-diabetic patients. Solid cancers were more common among the non-diabetic patients. In the PAQUID study, in contrast, cancer was more common among the diabetic patients, who had a higher mortality rate as a result [11].

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Conclusion
The 11.1% rate of diabetes in our study is at the lower end of the range reported in the literature. Falls and hypoglycaemia were among the main reasons for admission. This finding, together with the high rate of co-morbidities and polypharmacy, underlines the need for careful attention to hypoglycaemia prevention in older diabetic patients.

The significantly higher rate of cognitive impairment in our diabetic patients compared to our controls is clinically relevant, as cognitive impairment creates challenges for the optimal management of diabetes. Older individuals with diabetes should undergo a careful geriatric evaluation in addition to the diabetes itself, the higher rates of obesity and stroke in the group of diabetic patients may explain the higher rate of pressure sores. The geriatric assessment tools are essential for early diagnostic of frailty in patients with morbidity like diabetes; However a specific education program is also necessary in diabetic patients manage in geriatrics department [27-31].

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