RESEARCH LETTER

Management of elderly patients with type 2 diabetes in long-term care and skilled nursing facilities

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Introduction Type 2 diabetes (T2D) has become a major public health problem worldwide. Its prevalence has been growing in recent decades due to increasing obesity rates and population aging. More than a third of people over the age of 75 years have diabetes, and, this number is estimated to quadruple in the next 3 decades.[1]

Many patients admitted to long-term care (LTC) and skilled nursing facilities are very old; they also have multiple comorbidities and advanced chronic diseases, including T2D.[2] Glycemic management in elderly patients recommended by most current guidelines includes a comprehensive geriatric assessment in order to establish the most adequate therapeutic strategy with the lowest risk of drug-induced hypoglycemia.[3-5] Vulnerable elderly patients are less likely to experience benefits and more likely to suffer from adverse events related to tight glycemic control, particularly hypoglycemia.[5,6] In the recent years, several reports have emphasized that a substantial proportion of older patients with complex health status (CHS) and tight glycemic control are potentially overtreated with secretagogues or insulin therapies and are thus highly exposed to hypoglycemia.[7,8]

Considering these findings, recommendations from guidelines, and growing challenges in the treatment of elderly patients with T2D,[3-6] the aim of this study was to examine the management of these patients in LTC and skilled nursing facilities according to glycemic control and to identify factors associated with tight glycemic control.

Patients and methods We conducted a cross-sectional study of all patients with T2D admitted to LTC and skilled nursing facilities in Málaga, Spain, in April 2014. Patients with other types of diabetes or those in a palliative care program were excluded from the study.

All data were obtained from the electronic clinical record system of the Andalusian Health Service. The data were manually reviewed by investigators.

Sociodemographic and clinical data were collected. Moderate-severe dementia was defined as a Global Deterioration Scale and Functional Assessment Staging score of 4 to 7, and moderate--severe functional dependence, as a Barthel index score of less than 60. Comorbidities were classified according to the Charlson Comorbidity Index (CCI), with moderate and severe comorbidity defined as CCI scores of 3 to 4 and 5 or higher, respectively. Polypharmacy was defined as treatment simultaneously with 5 drugs or more, and extreme polypharmacy, as treatment simultaneously with 10 drugs or more.

Elderly patients were considered to have CHS if they had 1 or more of the following criteria: moderate-severe dementia, moderate-severe functional dependence, cardiovascular disease, or advanced renal disease. Patients were considered to have robust health status if they met none of these criteria.

Patients were grouped by glycemic control (hemoglobin A_{1c} [HbA_{1c}] level): tight control (HbA_{1c} <7%), moderate control (HbA_{1c}, 7%–9%), and poor control (HbA_{1c} >9%).

Data confidentiality and patient anonymity were maintained at all times, in accordance with Spanish legislation on observational studies. Patient-identifying information was deleted before the database was analyzed. It is not

TABLE 1 Clinical and sociodemographic characteristics of the whole study group and patients classified according to glycemic control

Parameter	All patients (n = 356)	Tight control (n = 238)	Moderate control (n = 91)	Poor control (n = 27)
Age, y, mean (SD)	82.8 (8.6)	82.6 (8.6)	83.8 (8.8)	82.0 (5.3)
Male gender, n (%)	132 (37.1)	87 (36.5)	35 (38.5)	10 (37.0)
Body Mass Index, kg/m^2, mean (SD)	29.0 (4.9)	28.0 (4.2)	29.9 (5.1)	29.1 (5.0)
Obesity, n (%)	73 (20.5)	47 (19.7)	20 (21.9)	6 (22.2)
Smoking history, n (%)	74 (20.8)	50 (21.0)	19 (20.9)	5 (18.5)
Hypertension, n (%)	278 (78.1)	177 (74.4)	81 (89.0)[a,c]	20 (74.0)[a]
Dyslipidemia, n (%)	173 (48.6)	114 (47.9)	45 (49.5)	14 (51.9)
Glycated hemoglobin A_{1c}, %, mean (SD)	7.6 (1.2)	5.9 (0.6)	7.6 (0.9)[b,c]	9.3 (0.2)[b]
Diabetes duration, y, mean (SD)	9.9 (5.5)	9.6 (5.2)	9.9 (5.5)	10.2 (5.8)
Macrovascular disease, n (%)	109 (30.6)	77 (32.4)	25 (27.4)[a]	7 (25.9)[a]
Microvascular disease, n (%)	102 (28.7)	64 (26.9)	30 (33.0)[a]	8 (29.6)[a]
Moderate-severe dementia, n (%)	178 (50.0)	130 (54.6)	39 (42.8)[b]	9 (33.3)[b]
Moderate-severe functional dependence, n (%)	218 (61.2)	155 (65.1)	50 (54.9)[b]	13 (48.1)[b]
Advanced kidney disease, n (%)	103 (28.9)	74 (31.1)	23 (25.3)[a]	6 (22.2)[a]
Complex health status, n (%)	293 (82.3)	204 (85.7)	71 (78.0)[b]	18 (66.6)[b]
Charlson Comorbidity Index, mean (SD)	7.3 (1.5)	7.8 (1.7)	7.0 (1.4)[b]	7.1 (1.5)[b]
Moderate-severe comorbidity, n (%)	326 (91.5)	229 (96.2)	77 (84.6)[b]	20 (74.0)[b]
Polypharmacy, n (%)	284 (79.8)	194 (81.5)	70 (76.9)[a]	20 (74.0)[a]
Extreme polypharmacy, n (%)	76 (21.3)	48 (20.2)	21 (23.1)	7 (25.9)
Number of antidiabetic agents, mean (SD)	1.5 (1.1)	1.8 (1.4)	1.5 (1.1)[a]	1.3 (1.0)[a]
Metformin, n (%)	154 (43.2)	96 (40.3)	42 (46.2)[b]	16 (59.3)[b]
Sulfonylurea, n (%)	52 (14.6)	38 (16.0)	11 (12.1)[a]	3 (11.1)[a]
Meglitinide, n (%)	22 (6.2)	16 (6.7)	4 (4.4)	2 (7.4)
Dipeptidyl peptidase-4 inhibitor, n (%)	25 (7.0)	17 (7.1)	6 (6.6)	2 (7.4)
Insulin, n (%)	110 (30.9)	80 (33.6)	23 (25.3)[a]	7 (25.9)[a]
Agents associated with high hypoglycemia risk, n (%)	174 (48.8)	135 (56.7)	28 (30.7)[b]	11 (40.7)[b]

Data were considered significant at a *P* value of less than 0.05 in the comparison analysis.

a Differences between tight-control group vs moderate-control and poor-control groups ($P < 0.05$)

b Differences between tight-control group vs moderate-control and poor-control groups ($P < 0.01$)

c Differences between moderate-control group vs poor-control group ($P < 0.01$)

possible to identify patients on an individual level either in this article or in the database. Due to the anonymous nature and mandatory collection of the information included in the dataset, informed consent from patients was not necessary.

Statistical analyses were performed using SPSS Statistics for Windows, version 15.0 (SPSS Inc., Chicago, Illinois, United States). Quantitative variables were expressed as means (SD), and qualitative variables, as an absolute value and percentage. The *t* test was used to compare quantitative variables, whereas the Pearson χ^2 and Mantel–Haenszel tests were used for qualitative variables. To determine the factors independently associated with tight glycemic control, a stepwise multivariate logistic analysis was performed using the tight HbA_{1c} category as the dependent variable and controlling for the confounding effect of other variables. A *P* value of less than 0.05 was considered significant.

Results Of the 456 patients with T2D admitted to LTC and skilled nursing facilities, 100 patients without electronic clinical records in the Andalusian Health Service system were excluded. In the end, 356 patients were included in the study.

The sociodemographic and clinical characteristics of the whole study group and patients classified according to glycemic control (tight, moderate, and poor) are summarized in **TABLE 1**. Most patients with T2D had tight glycemic control (66.8%). Patients with tight control less often had hypertension and microvascular diseases, and were more likely to have macrovascular diseases, moderate-severe dementia, functional dependence, advanced kidney disease, CHS, moderate-severe comorbidity with a higher CCI score, and polypharmacy than patients with moderate or poor glycemic control. The number of antidiabetic drugs used in the tight-control group was higher, with a greater proportion of patients

treated with metformin and sulfonylureas than among patients in the moderate- or poor-control groups. No differences between groups were observed for the use of meglitinides and dipeptidyl peptidase-4 inhibitors. No patient was treated with glucagon-like peptide-1 receptor agonists or sodium-glucose co-transporter 2 inhibitors. The use of insulin was higher among patients with tight glycemic control than those with moderate or poor control. The overall use of drugs that pose a high risk of hypoglycemia was significantly greater in the tight-control group than in the moderate- or poor-control groups.

In the multivariate logistic regression, the presence of macrovascular disease (odds ratio [OR], 1.89; 95% CI, 1.35–4.79; $P < 0.01$) and diabetes duration (OR, 1.73; 95% CI, 1.21–4.82; $P = 0.02$) were independently associated with greater odds of having tight glycemic control with drugs that pose a high risk of hypoglycemia. No other factors were significant.

Discussion This cross-sectional study found that most patients with T2D admitted to LTC and skilled nursing facilities have tight glycemic control and that a large proportion of patients are treated with agents that pose a high risk of hypoglycemia. This is despite the fact that patients are very old and have more advanced cognitive impairment, functional dependence, kidney disease, CHS, comorbidity, and polypharmacy. The presence of macrovascular diseases and diabetes duration were independently associated with greater odds of tight glycemic control with drugs that pose a high risk of hypoglycemia. This observation is in contrast to the guidelines, which recommend conservative management in vulnerable elderly patients and a comprehensive geriatric assessment.[3-5] These findings are important because they show that patients with T2D in LTC and skilled nursing facilities are potentially overtreated and at high risk of hypoglycemia without considering the advanced age and CHS.

T2D is a highly prevalent condition among residents of LTC and skilled nursing facilities. It is frequently associated with advanced age and the presence of multiple comorbidities, functional dependency, and frailty.[9] Although the harm of intensive glycemic control, severe hypoglycemia in particular, outweighs the benefits in elderly T2D patients with CHS and despite being contraindicated in the most recent guidelines, the use of intensive glycemic management in older adults with diabetes has been described in several recent studies.[2,8,10] Functional and cognitive status, comorbidities, and polypharmacy are factors that should be considered when tailoring glycemic management.[3-6] However, only a limited number of studies have described the management among institutionalized patients that would take their clinical characteristics into consideration. These studies emphasized that the main aim should be to prevent drug-induced hypoglycemia and acute metabolic decompensation, decrease the risk of complications and hospitalizations, and introduce timely end-of-life care and advanced care directives.[9,11,12] In our setting, only the macrovascular disease and diabetes duration were taken into account when tailoring glycemic management. Other clinical factors related to health status, frailty, and clinical vulnerability were not considered.

Metformin remains the most widely-used agent for most patients with T2D in LTC facilities. Owing to the benefit it offers of reducing major complications of T2D and its low risk of hypoglycemia, it has been recommended as a first-line drug for elderly patients with T2D.[4,5] In our study, most patients were treated with metformin, in accordance with the current guidelines.[3-5] However, 48.8% of patients were treated with agents associated with high risk of hypoglycemia, with the rate rising to 56.7% in patients who had tight glycemic control. The percentage of older patients treated with insulin therapies and secretagogues continues to be very high, even when HbA_{1c} levels are low.[8,10] The main guidelines and position statements recommend avoiding their use or a very cautious use in elderly patients due to high risk of hypoglycemia.[3-5] The results of our study suggest potential overtreatment of a significant proportion of elderly patients.

On the other hand, use of dipeptidyl peptidase-4 inhibitors in the institutionalized population in our study was quite low, despite the fact that these antidiabetic drugs have a few side effects and minimal hypoglycemia risk and have been proposed as a safe and effective treatment for elderly patients.[5,6,10]

This study is limited by several factors, including the relatively small number of patients and a retrospective design, given that unmeasured confounding factors cannot be excluded. In addition, hypoglycemia events were not recorded in the electronic system of the Andalusian Health Service. Further research is needed to develop appropriate management strategies for patients in LTC and skilled nursing facilities and to identify factors to consider when tailoring treatment targets.

In conclusion, this study shows that most patients with T2D in LTC and skilled nursing facilities have tight glycemic control and are at high risk of drug-induced hypoglycemia. Our findings suggest that treatment targets should be individualized according to age, CHS, cardiovascular burden, comorbidity, and polypharmacy.

CONTRIBUTION STATEMENT RG-H and JCM-H conceived the concept of the study. JCM-H, JMB-Y, LMP-B, and MRB-L contributed to the design of the research. All authors were involved in data collection. MRB-L, LMP-B, and IR-C analyzed the data. All authors edited and approved the final version of the manuscript.

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