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Prevalence, Quality of Care, and Complications in Long Term Care Residents With Diabetes: A Multicenter Observational Study

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A B S T R A C T

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Background: Few studies have reported on the quality of diabetes care and glycemic control adjusted for medication use in long term care (LTC) facilities.

Methods: This observational study analyzed diabetes prevalence and management and the impact of glycemic control on clinical outcome in elderly subjects admitted to 3 community LTC facilities.

Results: Among 1409 LTC residents (age 79.7 ± 12 years), the prevalence of diabetes was 34.2%. Subjects with diabetes were either on no pharmacological agents (10%) or were treated with sliding scale regular insulin (SSI, 25%), oral antidiabetic drugs (OAD, 5%), insulin (34%), or with combination of OAD and insulin (26%). Patients with diabetes had a mean daily BG of 156 ± 39 mg/dL and a mean admission HbA1c of $6.7\% \pm 1.1\%$. Compared with nondiabetes, residents with diabetes had higher number of complications (54% vs 45%, $P < .001$), infections (26% vs 21%, $P = .036$), emergency room (ER) and hospital transfers (37% vs 30%, $P = .003$), but similar mortality (15% vs 14%, $P = .56$). A total of 43% of residents with diabetes had a BG less than 70 mg/dL, and those with hypoglycemia had longer median length of stay (LOS, 52 vs 29 days, $P < .001$), more ER or hospital transfers (56% vs 69%, $P = .005$), and mortality (20% vs 10%, $P = .002$) compared with residents without hypoglycemia.

Conclusion: Diabetes is common in LTC residents and is associated with higher resource utilization and complications. Hypoglycemia is common and is associated with increased need of emergency room visits and hospitalization and higher mortality. Our findings emphasize the need for randomized trials evaluating the impact of different approaches to glycemic management on clinical outcome in LTC residents with diabetes.

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Diabetes afflicts more than 25% of adults aged 65 years and older in the United States.¹ Among all age groups, the elderly have the highest prevalence of diabetes, with diagnosed diabetes being 7 times more prevalent in individuals 65 years or older compared with those

aged 20 to 44 years.² The estimated prevalence of diabetes in long term care (LTC) facilities has been reported to be in the range of 15% to 30%.^{3–7} Management of hyperglycemia in LTC residents is similar to that recommended for ambulatory patients with diabetes^{8,9};

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however, several factors complicate the management of hyperglycemia in this population.¹⁰ Reviews on the subject have put forward various frameworks to assist with enhancement of the quality of care for elderly patients with diabetes and minimization of hypoglycemic risk.^{11,12} Elderly patients in LTC facilities often experience changes in their nutritional intake and organ dysfunction, which increase the risk of hypoglycemic events.¹⁰ The use of oral antidiabetic agents (OAD) in elderly patients has significant limitations, including a higher risk of hypoglycemia with the use of insulin secretagogues; gastrointestinal side effects, anorexia, and weight loss with metformin use; increased risk of peripheral edema, weight gain, and worsening heart failure with thiazolidinedione therapy; and limited hemoglobin A1c (HbA1c) reduction and high cost with DPP-4 inhibitors. Because of these limitations, insulin administration is frequently recommended for diabetes control in LTC residents.^{13,14} Most patients, however, are treated with sliding scale insulin (SSI) alone, a practice that is associated with poor glycemic control, which may increase the risk of complications.^{15,16}

The 2013 American Diabetes Association (ADA) guidelines recommend that older adults who are functional, cognitively intact, and have significant life expectancy should receive diabetes care with goals similar to those developed for younger adults.¹⁷ In these subjects, a HbA1c level lower than 7.0%, a fasting glucose between 90 and 130 mg/dL, and a random glucose lower than 180 mg/dL is recommended. For patients with advanced diabetes complications, life-limiting comorbid illness, or substantial cognitive or functional impairment, it is reasonable to set less-intensive glycemic target goals. Similarly, the American Geriatrics Society (AGS) recommends a goal HbA1c of 7.5% or less in healthy adults with intact cognitive and functional status; however, a higher HbA1c, ranging from 8.0% to 8.5%, may be more appropriate in the presence of comorbidities, frailty, impaired cognitive and functional status, and increased risk of hypoglycemia or drug side effects.¹⁸ The European Diabetes Working Party for Older People (EDWPOP) guidelines recommend choosing HbA1c targets based on existing cardiovascular risk, microvascular complications, and ability to self-manage. A target HbA1c of 7.0% to 7.5% is recommended for patients without major comorbidities, whereas a higher target of 7.6% to 8.5% is proposed for frail patients with high risk of hypoglycemia.^{11,19} More recently, the International Association of Gerontology and Geriatrics (IAGG), the EDWPOP, and the International Task Force of Experts in Diabetes recommended an HbA1c target of 7.0% to 7.5%, but emphasized the need to individualize glucose goals based on comorbidities, and cognitive and functional status.²⁰ Few studies, however, have analyzed the quality of diabetes care and glycemic control adjusted for medications and presence of comorbidities in LTC facilities. In addition, no randomized trials have demonstrated benefits of glycemic control on clinical outcome, quality of life, and rate of acute metabolic complications (hyperglycemia and hypoglycemic events) in LTC facilities. Accordingly, we reviewed the medical records in a large number of residents from different LTC facilities to determine the prevalence of diabetes, comprehensively describe the management of diabetes, and to evaluate the impact of glycemic control on quality of care and clinical outcome in elderly subjects admitted to 3 community LTC facilities.

Methods

Medical records from patients admitted to 3 academic urban LTC facilities affiliated with Emory University (Budd Terrace, A.G. Rhodes, and Veterans Administration) between January 1, 2008, and December 31, 2008, were included in the analysis. We included patients with a direct primary admission and those who were transferred from the hospital for subacute rehabilitation and for LTC.

We excluded patients with a length of stay less than 24 hours. The Emory University Institutional Board Review approved the study.

Patient information was extracted by chart review for up to 1 year from date of admission. We collected data on demographics, past medical history, reason for admission, inpatient laboratory values, admission blood glucose (BG) concentration, mean daily BG, hospital length of stay (LOS), type of diabetes treatment, blood pressure and lipid control, and mortality. In general, glucose was measured before meals and at bedtime or to rule out hyper- or hypoglycemia. The mean daily glucose concentration was determined by averaging all glucose measurements each 15-day period during the course of the study duration. An average of 3.28 ± 2.23 BGs were measured daily (median 3.75, range 2.0–4.0). Information was collected to determine the presence of comorbidities on admission, including hypertension, dyslipidemia, cardiovascular and cerebrovascular disorders, fractures, depression, dementia, and other psychiatric disorders. In addition, we collected information on number of medications, including antidiabetic regimens. There were no specific protocols in place for diabetes management at each facility and diabetes regimen during residents' stay was per LTC facility physician discretion. Data were compared between LTC residents with diabetes and those without diabetes. Residents were identified as having diabetes if they had a documented history of diabetes on admission or were receiving antidiabetic treatment.

The primary aim of the study was to determine the prevalence of diabetes, quality of diabetes care, and glycemic control as determined by mean HbA1c and daily BG among patients with diabetes. Secondary outcomes included prevalence of diabetes, use of antidiabetic therapy (oral antidiabetic therapy, basal and sliding scale regular insulin), frequency of hypoglycemic events (<70 mg/dL) and severe hypoglycemia (<40 mg/dL). We also compared differences in the frequency of emergency room visits and hospitalization, length of LTC facility stay, and mortality between patients with and without diabetes. In addition, we compared the frequency of infectious complications (urinary tract infection, pneumonia), cardiac complications (myocardial infarction, cardiac arrhythmia requiring medical treatment, congestive heart failure, or cardiac arrest), and renal failure (defined as an increment in serum creatinine of greater than 0.5 mg/dL from baseline).

Data Analysis

For comparison of baseline demographics and clinical characteristics between groups, we used 1-way analysis of variance tests, Kruskal-Wallis tests for continuous variables, and chi-square (or Fisher's exact) test for categorical variables with Bonferroni corrections when applicable. Survival analysis was conducted for the end point defined as age at death, which is subject to left-truncation by age at nursing home admission. Kaplan-Meier estimator and Cox proportional hazards analysis that adjust for left truncation²¹ were used to estimate the conditional survival probabilities and mortality hazard ratio between groups under comparison. A *P* value of .05 was considered significant.

Results

Patient Population

Clinical characteristics of study patients are shown in Table 1. The patient population included 1409 patients, 59% female with a mean age of 79.7 ± 12.0 years, and a mean body mass index (BMI) of 25.7 ± 7.0 kg/m². A diagnosis of diabetes on admission was recorded in 482 cases (34.2%); of them, 10 patients (2.1%) had type 1 diabetes and 472 (97.9%) had type 2 diabetes. Compared with patients without diabetes, patients with diabetes were younger, had higher BMI, and had

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