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Frequent hypoglycemia among elderly with poor glycemic control

Medha N. Munshi, MD[1,2,3], **Alissa R. Segal, PharmD**[1,4], **Emmy Suhl, RD**[1], **Elizabeth Staum, RD**[1], **Laura Desrochers, BS**[5], **Adrianne Sternthal, BS**[1], **Judy Giusti, RD**[1], **Richard McCartney, BA**[1], **Yishan Lee, MS**[1], **Patricia Bonsignore, MS**[6], and **Katie Weinger, EdD**[1,3]

[1]Joslin Diabetes Center

[2]Beth Israel Deaconess Medical Center

[3]Harvard Medical School

[4]Massachusetts College of Pharmacy and Health Sciences

[5]Northeastern University

[6]Valley Medical Group

Abstract

Hypoglycemia in elderly patients with diabetes increases the risk of cardiovascular and cerebrovascular events(1), progression of dementia(2), injurious falls(3), emergency department visits, and hospitalization(4). Hypoglycemic episodes are difficult to diagnose in this population and are easily missed by intermittent finger-stick measurements. Recent large studies(5) have shown lack of benefit and sometimes higher risk of morbidity and mortality with tight glycemic control, especially in older adults. Therefore, the American Geriatric Society and the American Diabetes Association recommend relaxing glycemic control for vulnerable patients(6) (A1C<8% instead of the usual <7%). However, whether relaxing the goal to A1C>8% improves the frequency of hypoglycemia in older patients remains unknown. Thus, we evaluated hypoglycemia in older diabetic patients with A1C>8% with continuous glucose monitoring (CGM)

Research Design and Methods

Community-living patients aged ≥69 years seen at a tertiary-care diabetes center with A1C>8% were evaluated with blinded CGM iPro™ The study was approved by the

Corresponding Author: Medha N Munshi, M.D., One Joslin Place, Boston MA 02215, Phone: 617-632-8696, Fax: 617-632-8968, medha.munshi@joslin.harvard.edu.
Author to receive reprint requests : Medha N Munshi, M.D.

Contribution:
M.M. researched data, contributed to discussion, wrote manuscript; A.S. researched data, contributed to discussion, edited manuscript; E. Suhl. researched data, contributed to discussion, edited manuscript; E. Staum. researched data, edited manuscript; A.S. researched data, reviewed manuscript; R.M. researched data, reviewed manuscript; L.D. researched data, reviewed manuscript; J.G. researched data, reviewed manuscript. P.B. researched data, reviewed manuscript; Y.L. researched data, reviewed and edited manuscript; K.W. researched data, contributed to discussion, edited manuscript.

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Committee on Human Subjects and all subjects provided written informed consent. CGM measured interstitial glucose levels at intervals of 5 minutes for a 3-day period in all patients while they continued their usual daily activities. Patients measured finger-stick glucose 4 times a day while wearing CGM and recorded symptoms suggestive of hypoglycemia. Patients completed demographic/treatment related questionnaire along with a modified clock-drawing test(7), Geriatric Depression Scale, Activities of Daily Living and Instrumental Activities of Daily Living, Six-Minute Walk Test, Tinetti Test, and Self-Care Inventory-Revised(8).

Statistical methods

Data are presented as mean±standard deviation (normally distributed), and as median(minimum-maximum) (when not normally distributed) for continuous data and as n (%) for frequency data. Between-group differences in patient characteristics are compared using Fisher's exact test for categorical variables and with the Wilcoxon-Mann-Whitney test for continuous variables.

We analyzed CGM data by measuring: 1) total hypoglycemic episodes (glucose <70 mg/dl); 2) nocturnal hypoglycemic episodes (10PM–6AM) which are dangerous due to patients' inability to recognize and treat them); 3) hypoglycemic episodes captured by CGM but unrecognized by finger-stick monitoring or symptoms; 4) duration(longer episodes are more dangerous), and 5) severity (glucose value<50 mg/dl, <60 mg/dl, and <70 mg/dl).

Results

Forty adults aged ≥69 years were evaluated. Sixty-five percent (26/40 patients) had at least one episode of hypoglycemia (median glucose 63 (42–69) mg/dl) over the 3-day period. The groups with and without hypoglycemia did not differ in patient characteristics, co-morbidities, exercise capacity, gait/balance, self-care frequency, or diabetes-related stress (all p values>0.05) (Table 1).

Among the 26 patients with hypoglycemia, 12 (46%) had an episode with glucose levels <50 mg/dl, and 19 (73%) had an episode with levels <60 mg/dl. The average number of episodes was 4 with an average duration of 46 minutes. Of a total of 102 hypoglycemic episodes, 95 (93%) were unrecognized, either by finger-stick monitoring or by symptoms. However, only 2 patients reported "hypoglycemia unawareness" in the questionnaire. Eighteen of 26 (69%) experienced ≥1 nocturnal episode (average duration 56 minutes). No nocturnal episodes were recognized by patients.

We evaluated CGM results by levels of glycemic control (by A1C) and type of diabetes in 26 patients with hypoglycemia. Fourteen patients had A1C levels between 8–9% and 12 had A1C >9%; the groups did not differ in frequency of hypoglycemic episodes (5 vs 2.7), duration (3.5 vs 2.4 hours), severity (1 vs 1.25 episode with glucose <50 mg/dl), or number of unrecognized episodes (2.5 vs 4.6). Similarly, 10 patients with type 1 and 16 patients had type 2 diabetes; and the group did not differ in frequency of hypoglycemic episodes (4.3 vs 3.7), duration (3.2 vs 2.9 hours), severity (1 vs 1.3 episode with glucose <50 mg/dl), and unrecognized episodes (3.7 vs 3.6).

We also evaluated patient characteristics according to the severity of hypoglycemic episodes. The groups with patients having no hypoglycemia, hypoglycemic episodes <50 mg/dl, and hypoglycemic episodes between 50–70 mg/dl did not differ in age, type of diabetes, duration of diabetes, A1C, treatment with insulin, presence of co-morbidities or living status.

Discussion

This study found an unexpectedly high frequency of hypoglycemic episodes in older adults even with poor glycemic control. This finding is critical in the debate over glycemic goals in older adults. Current guidelines based on expert opinions suggest relaxing A1C goals to <8% for vulnerable elders to avoid hypoglycemia-related morbidity. Here, 65% of patients with A1C >8% were found to have ≥1 hypoglycemic episode over a 3-day period. Importantly, 12 of 26 patients with hypoglycemia were found to have at least one episode of severe hypoglycemia (glucose level below 50 mg/dl). These results suggest that simply relaxing A1C goals may not be adequate to protect frail older adults against hypoglycemia.

In our study, not only patients with type 1 but also those with type 2 diabetes with poor glycemic control had frequent hypoglycemic episodes. This new information is important in considering recommendations of glycemic goals in the rapidly growing population of older patients with type 2 diabetes. Interestingly, we found that 4 times a day finger-stick glucose checks did not coincide with CGM-detected hypoglycemia. Most daytime episodes and all nighttime episodes were unrecognized both symptomatically and by a finger-stick glucose monitor. These results may partially explain the low incidence of hypoglycemia reported in previous studies. We did not observe a difference in co-morbidities and functionality between patients with and without hypoglycemia, perhaps due to small sample size. The association between different classes of oral medications and/or various insulin regimens and the frequency of hypoglycemia will require larger studies.

Recently, in a retrospective study, we showed that simplification of diabetes regimen in older adults with diabetes is associated with decreased frequency of self-reported hypoglycemia(9). Further studies are needed to see whether a simplified treatment regimen that better matches patients' self-care abilities also improve hypoglycemic episodes detected by CGM. Our findings raises caution in relying on A1C as the sole parameter for "good diabetes management" in elders with diabetes and recommend careful and in-depth assessment for hypoglycemia by both patients and providers.

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Table 1

Characteristics of patients with and without hypoglycemia detected by continuous glucose monitoring

	All Subjects N=40	No hypoglycemia N=14	≥1 episode of hypoglycemia N=26
Age (years)	75±5	76±5	74±5
A1C (%)	9.3±1.3	9.6±1.3	9.2±1.3
Diabetes duration (years)	22±14	22±10	22±16
Type 2 (%)	70	85	62
BMI	31±7	33±7	29±7
Treatment modality(%); Insulin only	58	57(	58(15/26)
Insulin + oral	38	38	38(10/26)
Metformin+ sufonylurea			4(1/26)
sufonylurea			
Living alone (%)	23	29	19
Number of daily medications	8.2±4	8.5±4	8.1±4
Cognitive dysfunction (%)	25	36	19
Depression (%)	11	23	4
Hypertension (%)	83	93	77
Recent falls (%)	33	29	35
Fear of falling (%)	59	69	54
Vision problems (%)	22	21	23
Hearing problems (%)	40	50	35