

# Treatment of Diabetes in Long-Term Care Facilities: A Primary Care Approach

Eric L. Johnson, MD; James D. Brosseau, MD, MPH; Matt Soule, MS-IV; and Jon Kolberg, MS-IV

Type 2 diabetes has reached epidemic proportions, afflicting 190 million people globally, with that number expected to exceed 300 million by 2025.<sup>1</sup> In long-term care facilities, ~25% of residents have diabetes, with a great majority having type 2 diabetes.<sup>2</sup> Of these residents with diabetes, 80% have cardiovascular disease, 56% have hypertension, and 69% have two more other chronic conditions.<sup>3,4</sup> A recent survey of four nursing homes in the Bismarck, N.D., area revealed a diabetes prevalence of 32%. In this particular population, hypertension was noted in 81%, chronic kidney disease in 34%, coronary artery disease in 42%, and stroke in 39%.

Guidelines exist for the management of diabetes in this population, but they do not have the evidence-based “weight” of similar guidelines for younger diabetic populations. Nursing home patients have unique characteristics not shared by younger patients. Declining renal function, dementia, incontinence, and other comorbidities can influence treatment decisions and goals.

Treatment goals for residents of long-term care facilities should account for life expectancy, cognition, established complications, polypharmacy, and other issues. The 2005 American Diabetes Association (ADA) clinical practice guidelines added recommendations for the treatment of older people with diabetes and suggested that those expected to live an additional

10 years or more would benefit from more intensive treatment.<sup>5</sup> Less stringent treatment would be warranted for those with limited life expectancy, hypoglycemic risk (particularly in patients with dementia), and multiple advanced comorbidities.<sup>6</sup>

In the U.K. Prospective Diabetes Study,<sup>7</sup> a clear and linear relationship was noted between A1C and micro- and macrovascular diabetes complications. For every 1% decrease in A1C, there was a 21% overall decrease for diabetes-related mortality and a 14% decrease in all-cause mortality. Thus, benefit can be realized even if less stringent treatment is appropriate for a given patient.

Treatment will need to be individualized, however, taking into account these factors as well as the wishes of the patient and family members. Patients in nursing homes can have variable life expectancies, many only for 3–4 years or less after

admission, and A1C reduction may be more meaningful for monitoring than actual complication reduction. In short-term management, avoiding hyperglycemia may be more important in terms of “comfort care,” such as reduction of incontinence, improvement of fatigue and mentation, and overall well-being. In addition, avoidance of hypoglycemia can be particularly important in those with dementia or other factors that may limit their ability to detect or report symptoms.

Of course, patients on admission to a long-term care facility should be evaluated by a team that ideally would include a physician or mid-level provider, a diabetes educator, a dietitian, nurses, and other appropriately timed ancillary service providers.

## Glucose Management

Current ADA recommendations for the diagnosis of diabetes are applicable to the long-term care population and are shown in Table 1.<sup>8</sup>

Many patients admitted to a long-term care facility with diabetes will have the diagnosis before admission, but certainly screening should be considered in those who are at risk or symptomatic. Likewise, screening in individuals with other comorbidities (i.e., recurrent infections) should be considered.

Many factors associated with aging can affect glucose metabolism in older adults (Table 2). Selecting

## IN BRIEF

The epidemic of type 2 diabetes now affects 190 million people globally, with numbers continuing to grow. In long-term care facilities, ~25% of residents have diabetes, a great majority with type 2 diabetes. Appropriate guidelines and medication use are examined for members of this population, accounting for their unique needs and comorbidities.

**Table 1. Criteria for Testing for Diabetes in Asymptomatic, Undiagnosed Individuals**

1. Testing for diabetes should be considered in all individuals  $\geq 45$  years of age, particularly in those with  $BMI \geq 25 \text{ kg/m}^2$  and, if normal, should be repeated at 3-year intervals.
2. Testing should be considered at a younger age or carried out more frequently in individuals who are overweight ( $BMI \geq 25 \text{ kg/m}^2$ ) and:
  - Have a first-degree relative with diabetes
  - Are members of a high-risk population (e.g., African American, Latino American, Native American, Asian American, Pacific Islander)
  - Have delivered a baby weighing  $> 9 \text{ lb}$  or have been diagnosed with gestational diabetes mellitus
  - Are hypertensive (blood pressure  $> 140/90 \text{ mmHg}$ )
  - Have a plasma HDL cholesterol level  $< 35 \text{ mg/dl}$  and/or a plasma triglyceride value  $> 250 \text{ mg/dl}$
  - Have, on previous testing, had impaired glucose tolerance or impaired fasting glucose
  - Have a history of vascular disease
  - Have polycystic ovary disease
  - Are habitually inactive

**Table 2. Aging-Related Factors Affecting Glucose Metabolism<sup>36</sup>**

- Increased insulin resistance
- $\beta$ -Cell dysfunction
- Changes in body composition: increased adipose tissue and reduced muscle mass
- Impaired mobility
- Comorbid health conditions
- Medications that impair insulin sensitivity, release, or action
- Alterations in food intake, timing, and composition
- Genetic and ethnic influences
- Psychosocial factors and exogenous stress

medications for these patients can be difficult based on the these factors.

Metformin, a commonly used medication for the treatment of type 2 diabetes, can be limited in this population by age- or disease-related declines in renal function. Other limitations to the use of metformin can be gastrointestinal side effects, hypoxic conditions, history of or risk factors for congestive heart failure, and infection. Although hypoglycemia is uncommon with metformin, lactic acidosis is a potentially fatal complication that can occur in the setting of infection, hypoxia, or congestive heart failure.<sup>9-13</sup>

Sulfonylureas, which are also oral hypoglycemic agents, are commonly used in the elderly, primarily because of their low cost. However, there also can be limitations with use of these medications in this population, primarily because of

alterations in metabolism resulting from declining renal and hepatic function. Profound hypoglycemia can occur with these agents. This can be difficult to ascertain in those with dementia and cognitive impairment; therefore, these agents should be used with caution and close monitoring, particularly in the setting of decreasing oral intake or other declines in status.<sup>9-13</sup>

Thiazolidinediones (TZDs) are insulin-sensitizing agents that can be effective in patients in long-term care facilities. Hypoglycemia with these agents is exceedingly rare, particularly as monotherapy. Furthermore, these agents may have some minor benefit with regard to lipids and endothelial function, although there may be some differences among the medicines within this class.<sup>14,15</sup> Fluid retention and edema are well-known side effects of TZDs, so they should

be used with caution in patients with liver or renal insufficiency. They are contraindicated in patients with New York Heart Association Class III or IV heart failure, and they should be used only with extreme caution in those at risk for congestive heart failure, particularly if combined with insulin.<sup>13-18</sup>

Dipeptidyl peptidase IV (DPP-IV) inhibitors, a newer class of medications, are oral agents that have also shown promise in the elderly. As with metformin and TZDs, hypoglycemia with monotherapy is very rare. These medications inhibit the breakdown of native glucagon-like peptide 1 (GLP-1), thereby enhancing glucose-dependent insulin secretion and decreasing A1C. Generally, these are well-tolerated medications; additionally, guidelines exist for dosing in those with renal insufficiency. Currently, the only agent in this class on the market is sitagliptin. Issues such as congestive heart failure and edema are not known to be observed with these drugs, and they are a once-daily therapy.<sup>16,18</sup>

Other agents can be used in the elderly, but may be limited by side effects and cost. Secretagogues, such as repaglinide and nateglinide, are nonsulfonylurea agents, but may still produce hypoglycemia. Still, they can be dosed with meals more effectively and can offer good postprandial control.  $\alpha$ -Glucosidase inhibitors (acarbose) can have significant gastrointestinal side effects, and this likely makes for limited use in the elderly.<sup>9-13</sup> GLP-1 analogs (exenatide) can offer good postprandial control but are administered by injection and are not a suitable replacement for patients who require insulin. Modest weight loss is a possible benefit of this class of agents.<sup>16</sup>

A major limitation to oral diabetes agents in the elderly long-term care population is the fact that

at least some of their respective mechanisms of action are predicated on adequate insulin secretion by the pancreas. Of patients who have been diagnosed with diabetes for a number of years, it is likely that a good portion will have diminished  $\beta$ -cell function requiring insulin replacement.<sup>19–21</sup> Older human insulins (NPH and regular) are low in cost but are limited by variability in serum stability, absorption, and potential hypoglycemia. Newer analog insulins appear to have few such issues, but their cost is somewhat higher.<sup>22</sup> Insulin, when used properly, has a high degree of safety and can be used in virtually all diabetes patients.<sup>23,24</sup>

In type 2 diabetic patients, a single daily injection of a basal analog (glargine or detemir) insulin as monotherapy can be a safe and effective choice for diabetes management. Hypoglycemia rates are somewhat lower with these products compared to older human insulin formulations.<sup>22</sup> In patients with dementia, whose signs and symptoms of hypoglycemia may be significantly impaired, this could be a very good management strategy. Additionally, these insulins are available in pen injector devices, which can increase the accuracy of dosing. Safety benefits from pen devices include the use of “auto-cover” needles, which can reduce needlestick injury to caregivers (and subsequent costs) and the fact that patients no longer need multi-dose vials.

More sophisticated regimens can be considered in more functional patients, such as the addition of a rapid-acting analog (aspart, lispro, glulisine) to a basal insulin for the coverage of meals and snacks, or an analogue premixed insulin to provide some of the benefits of analogue insulins (i.e., predictable action) and allow for convenient twice-daily dosing. Patients beginning or alter-

ing any insulin program will require close monitoring initially, but once patterns have been established, the frequency of monitoring can be decreased. If a change in status (such as decreased oral intake or illness) is noted, monitoring can easily be increased to match the patients’ needs and to adjust insulin dosing accordingly.<sup>23,24</sup>

### Hypertension Management

Blood pressure management is a key element in the management in most patients with diabetes, particularly those who are elderly. Currently, the ADA recommends a blood pressure of  $< 130/80$  mmHg<sup>8</sup> to minimize cardiovascular, renal, and other complications. A recent study, the Hypertension in the Very Elderly Trial, showed that blood pressure control to  $< 150/80$  mmHg in patients  $> 80$  years of age (treated with the diuretic indapamide, or the angiotensin-converting enzyme [ACE] inhibitor perindopril) led to a reduction of the risk of fatal or nonfatal stroke by 30%, a 39% reduction in the rate of death from stroke (95% CI 1–62;  $P = 0.05$ ), a 21% reduction in the rate of death from any cause, a 23% reduction in the rate of death from cardiovascular causes, and a 64% reduction in the rate of heart failure. Although not defined as a diabetic population, 11.8% of the study groups had cardiovascular disease.<sup>25</sup> Previous data, including the Swedish Trial in Old Patients with Hypertension (STOP-Hypertension),<sup>26</sup> have shown benefit of treated hypertension in older individuals.

The ADA recommends initial treatment of hypertension in patients with diabetes either with an ACE inhibitor or an angiotensin II receptor blocker (ARB).<sup>8</sup> Additionally, these agents can be used in the setting of micro- or macroalbuminuria. Prescribers should be aware of renal function and the possibility of renal

artery stenosis in patients receiving these agents because bilateral renal artery stenosis is an absolute contraindication for the use of either type of agent. Blood pressure reduction in elderly patients should be undertaken incrementally to lower the risk of complications (i.e., hypotension and falls). Hypertension therapy should be modified for coexisting factors, such as previous cardiovascular events or renal disease, as proposed by the Joint National Commission on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.<sup>27</sup> Gradual reduction of blood pressure may be recommended for increased tolerability for older patients.

### Lipid Management

Treatment of cholesterol disorders with HMG CoA reductase inhibitors, or “statins,” reduces the risk of first major coronary event by  $\sim 25\%$ .<sup>28,29,31,32</sup> The ADA recommends treatment of total cholesterol to  $< 200$  mg/dl, triglycerides to  $< 150$  mg/dl, HDL cholesterol to  $> 40$  mg/dl for men and  $> 50$  mg/dl for women, and LDL cholesterol to  $< 100$  mg/dl to reduce the risk of cardiovascular events in people with diabetes.<sup>8,28</sup> Evidence also exists that atorvastatin and simvastatin reduce the risk in type 2 diabetic patients regardless of their initial baseline LDL level.<sup>31–33</sup> A target LDL level of  $< 70$  mg/dl may be considered for high-risk individuals (i.e., those with previous cardiovascular events or multiple risk factors).<sup>8,29</sup>

In a nursing home environment, cardiovascular risk reduction has been shown to be beneficial. In one study,<sup>34</sup> nursing home residents with prior myocardial infarctions and an LDL level  $> 125$  mg/dl had a 20% incidence of new coronary events if treated with statins to lower LDL to  $\leq 90$  mg/dl and a 48% incidence of new coronary events if treated to

an LDL target of 90–99 mg/dl. In addition to coronary disease, reduction in stroke was also observed in patients up to 90 years of age with a 47% reduction in the LDL  $\leq$  90 versus 90–99 mg/dl. Combining cardiovascular risk reduction strategies to include medication and dietary management should be considered for appropriate long-term care facility residents.<sup>34</sup>

### Aspirin Therapy

Studies have shown an association between daily aspirin use and reduction of cardiovascular events in adults with diabetes, and this is a recommendation of the ADA.<sup>8</sup> Residents of long-term care facilities with diabetes should be candidates for daily aspirin prophylaxis of 75–325 mg daily unless contraindications exist.

### Summary

In appropriate long-term care residents, considerable reduction in complications can be effectively realized. In one study,<sup>35</sup> 89% of nonterminal residents with diabetes in an academic nursing home had an A1C < 7%; 84% had blood pressure levels of < 130/80 mmHg; and 89% had LDL cholesterol levels of < 100 mg/dl. When balanced against the individual needs and wishes of residents and family members, along with life expectancy and other comorbid conditions, logical treatment plans can be implemented within the guidelines of evidence-based algorithms for blood glucose, blood pressure, and lipid management in long-term care residents with diabetes.

### REFERENCES

- International Diabetes Federation: IDF Atlas [article online]. Available from www.idf.org. Accessed April 2008
- Omnicare, Inc.: Prevalence of diabetes in 500,000 nursing home residents in the United States (Proprietary data from Omnicare, Inc., 2004, cited in Zarowitz BJ, Tangalos EG, Hollenack K, O'Shea T: Application of evidence-based principles of care in older persons: Issue 3: management of diabetes mellitus. *J Am Med Direct Assoc* 7:234–240, 2006
- Haines ST: The diabetes epidemic: can we stop the spread? *Pharmacotherapy* 23:1227–1231, 2003
- Travis SS, Buchanan RJ, Wang S, Kim M: Analysis of nursing home residents on admission. *J Am Med Direct Assoc* 4:320–327, 2004
- American Diabetes Association: Standards of medical care in diabetes [Position Statement]. *Diabetes Care* 28 (Suppl. 1):S4–S36, 2005
- American Medical Directors Association: *Managing Diabetes in the Long-Term Care Setting: Clinical Practice Guideline*. Columbia, Md., American Medical Directors Association, 2002
- U.K. Prospective Diabetes Study Group: Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications with type 2 diabetes (UKPDS 33). *Lancet* 352:837–853, 1998
- American Diabetes Association: Standards of medical care in diabetes [Position Statement]. *Diabetes Care* 31 (Suppl. 1): S12–S54, 2008
- Misbin RI: Evaluating the safety of diabetes drugs: perspective of a Food and Drug Administration insider. *Diabetes Care* 28:2573–2576, 2005
- Mooradian AD: Drug therapy of non-insulin dependent diabetes mellitus in the elderly. *Drugs* 51:931–941, 1996
- Gregorio F, Ambrosi F, Filipponi P, Manfredi S, Testa I: Is metformin safe enough for aging type 2 diabetic patients? *Diabetes Metab* 22:43–50, 1996
- Jennings PE: Oral antihyperglycemics: considerations in older patients with non-insulin dependent diabetes mellitus. *Drugs Aging* 10:323–331, 1997
- Chipkin SR: How to select and combine oral agents for patients with type 2 diabetes. *Am J Med* 118 (Suppl. 5A):4S–13S, 2005
- Lincoff AM, Wolski K, Nicholls SJ, Nissen SE: Pioglitazone and risk of cardiovascular events in patients with type 2 diabetes mellitus: a meta-analysis of randomized trials. *JAMA* 298:1180–1188, 2007
- Nissen SE, Wolski K: Effect of rosiglitazone on the risk of myocardial infarction and death from cardiovascular causes. *N Engl J Med* 356:2457–2471, 2007
- Fonseca VA, Kulkarni KD: Management of type 2 diabetes: oral agents, insulin, and injectables. *J Am Dietetic Assoc* 4 (Suppl. 1):S29–S33, 2008
- Nesto RW, Bell D, Bonow RO, Fonseca V, Grundy SM, Horton ES, Le Winter M, Porte D, Semenkovich CF, Smith S, Young LH, Kahn R: Thiazolidinedione use, fluid retention, and congestive heart failure: a consensus statement from the American Heart Association and American Diabetes Association. *Diabetes Care* 27:256–263, 2004
- American College of Physicians: *ACP Diabetes Care Guide: A Team-Based Practice Manual and Self-Assessment Program*. Philadelphia, Pa., American College of Physicians, 2007
- Szoke E, Shrayef MZ, Messing S, Woerle HJ, van Haefen TW, Meyer C, Mitrakou A, Pimenta W, Gerich JE: Effect of aging on glucose homeostasis: accelerated deterioration of beta-cell function in individuals with impaired glucose tolerance. *Diabetes Care* 31:539–543, 2008
- DeFronzo R, Bonadonna R, Ferrannini E: Pathogenesis of NIDDM. In *International Textbook of Diabetes Mellitus*. 2nd ed. Alberti K, Zimmet P, DeFronzo R, Eds. New York, Wiley and Sons, 1997, p. 635–711
- Butler AE, Janson J, Bonner-Weir S, Ritzel R, Rizza RA, Butler PC: Beta-cell deficit and increased beta-cell apoptosis in humans with type 2 diabetes. *Diabetes* 52:102–110, 2003
- Meneghini LF, Rosenberg KH, Koenen C, Merilainen MJ, Luddeke HJ: Insulin detemir improves glycaemic control with less hypoglycaemia and no weight gain in patients with type 2 diabetes who were insulin naive or treated with NPH or insulin glargine: clinical practice experience from a German subgroup of the PREDICTIVE study. *Diabetes Obes Metab* 9:418–427, 2007
- Haas LB: Optimizing insulin use in type 2 diabetes: role of basal and prandial insulin in long-term care facilities *J Am Med Direct Assoc* 8:502–510, 2007
- Nathan DM, Buse JB, Davidson MB, Heine RJ, Holman RR, Sherwin R, Zinman B: Management of hyperglycemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy. *Diabetes Care* 29:1963–1972, 2006
- Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, Stoyanovsky V, Antikainen RL, Nikitin Y, Anderson C, Belhani A, Forette F, Rajkumar C, Thijs L, Banya W, Bulpitt CJ: Treatment of hypertension in patients 80 years of age or older. *N Engl J Med* 358:1887–1898, 2008
- Dahlöf B, Lindholm LH, Hansson L, Scherstén B, Ekblom T, Wester PO: Morbidity and mortality in the Swedish Trial in Old Patients with Hypertension (STOP Hypertension). *Lancet* 338:1281–1285, 1991
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 289:2560–2572, 2003
- National Cholesterol Education Program: Executive summary of the Third Report of the National Cholesterol

Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 285:2486–2497, 2001

<sup>29</sup>Grundy SM, Cleeman JI, Merz CN, Brewer HB Jr, Clark LT, Hunninghake DB, Pasternak RC, Smith SC Jr, Stone NJ: Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *Circulation* 110:227–239, 2004

<sup>30</sup>Cannon CP, Braunwald E, McCabe CH, Rader DJ, Rouleau JL, Belder R, Joyal SV, Hill KA, Pfeffer MA, Skene AM: Pravastatin or Atorvastatin Evaluation and Infection Therapy-Thrombolysis in Myocardial Infarction 22 Investigators: Intensive versus moderate lipid lowering with statins after acute coronary syndromes. *N Engl J Med* 350:1495–1504, 2004

<sup>31</sup>Nissen SE, Tuzcu EM, Schoenhagen P, Brown BG, Ganz P, Vogel RA, Crowe T, Howard G, Cooper CJ, Brodie B, Grines CL, DeMaria AN: Effect of intensive compared with moderate lipid-lowering therapy on progression of coronary atherosclerosis: a randomized controlled trial. *JAMA* 291:1071–1080, 2004

<sup>32</sup>Colhoun HM, Betteridge DJ, Durrington PN, Hitman GA, Neil HA, Livingstone SJ, Thomason MJ, Mackness

MI, Charlton-Menys V, Fuller JH; CARDS investigators: Primary prevention of cardiovascular disease with atorvastatin in type 2 diabetes in the Collaborative Atorvastatin Diabetes Study (CARDS): multicentre randomised placebo-controlled trial. *Lancet* 364:685–696, 2004

<sup>33</sup>de Lemos JA, Blazing MA, Wiviott SD, Lewis EF, Fox KA, White HD, Rouleau JL, Pedersen TR, Gardner LH, Mukherjee R, Ramsey KE, Palmisano J, Billheimer DW, Pfeffer MA, Califf RM, Braunwald E: Early intensive vs a delayed conservative simvastatin strategy in patients with acute coronary syndromes: phase Z of the A to Z trial. *JAMA* 292:1307–1316, 2004

<sup>34</sup>Aronow WS, Ahn C: Incidence of new coronary events and new atherothrombotic brain infarction in older persons with diabetes mellitus, prior myocardial infarction and serum low density lipoprotein cholesterol > 125 treated with statin. *J Gerontol Series A Biol Sci Med Sci* 57:M747–M750, 2002

<sup>35</sup>Joseph J, Koka M, Aronow WS: Prevalence of a hemoglobin A1C less than 7.0%, of a blood pressure less than 130/80 mm Hg, and of a serum low-density lipoprotein cholesterol less than 100 mg/dL in older patients with diabetes mellitus in an

academic nursing home. *J Am Med Direct Assoc* 9:51–54, 2008

<sup>36</sup>Rivzi AA: Management of diabetes in older adults. *Am J Med Sci* 333:35–47, 2007

---

*Eric L. Johnson, MD, is the assistant medical director of Altru Diabetes Center at Altru Health System and Valley Memorial Homes and an assistant clinical professor in the Department of Family and Community Medicine at the University of North Dakota School of Medicine and Health Sciences in Grand Forks. James D. Brosseau, MD, MPH, is the medical director of Altru Diabetes Center at Altru Health System and Valley Memorial Homes in Grand Forks, N.D. Matt Soule, MS-IV, and Jon Kolberg, MS-IV, are medical students at the University of North Dakota School of Medicine and Health Sciences in Grand Forks.*

---