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## PRODUCT BULLETIN

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### Insulin in Long-Term Care

Diabetes is prevalent in older adults, an increasing number of whom reside in long-term care (LTC) facilities.<sup>1</sup> Approximately 25% of LTC residents fit the diagnostic criteria for diabetes.<sup>1</sup> Managing diabetes in this population is complex because of diabetes-related complications and other comorbidities requiring multiple medications. As a result, LTC providers need to have a protocol-driven, team-based, and individualized approach to care with a focus on reducing potential risks for residents.<sup>1</sup>

Because the same glycemic goals cannot be adopted for all LTC residents with diabetes, the treatment approach should be individualized based on prognosis, functional status, and degree of cognitive impairment.<sup>2</sup> Type 2 diabetes, in particular, is a progressive disease that often requires an evolving treatment strategy to maintain glycemic control.<sup>3</sup> Therefore, LTC facilities need to consider certain criteria for insulin initiation and intensification when current treatment approaches are no longer effective.

Controlling all 3 members of the glucose triad—hemoglobin A1C (HbA1c), postprandial glucose (PPG), and fasting plasma glucose (FPG)—is key for achieving overall glycemic control.<sup>4</sup> When the combination of basal insulin and oral antidiabetic drugs is no longer sufficient or appropriate in treating LTC residents with diabetes, clinicians should consider adding mealtime or prandial insulin in residents whose fasting blood glucose has been nearly normalized by systematic titration of basal insulin, but whose PPG and HbA1c continues to be moderately elevated (7%-8%).<sup>3</sup> LTC facilities may want to consider substituting a more current methodology in lieu of sliding scale insulin (SSI) protocols, which were standard practice 75 years ago.<sup>2</sup> Despite the prevalence of SSI in LTC facilities, the American Diabetes Association (ADA), the American Association of Clinical Endocrinologists (AACE), and the American Medical Directors Association (AMDA) do not recommend the prolonged use of SSI.<sup>2,5,6</sup> AMDA recommends an insulin regimen that is proactive, approximating

physiologic insulin needs before meals and throughout the day to prevent between-meal and nocturnal gluconeogenesis and ketogenesis.<sup>2</sup>

#### CHALLENGES OF INITIATION AND INTENSIFICATION OF INSULIN THERAPY

Many elderly persons with type 2 diabetes will require insulin as their beta cell function declines over time. Initially these patients are treated with oral hypoglycemic agents, but as the disease progresses and acceptable glycemic control is not being achieved, many will require insulin to maintain glucose control. For a variety of reasons, insulin analogues increase the breadth of treatment options available to clinicians. These insulin analogues are designed in an attempt to match the normal glycemic state pharmacokinetically and pharmacodynamically, enabling patients to achieve improved glycemic control with lower propensity for side effects.<sup>7</sup>

Hypoglycemia occurs when blood glucose falls below normal levels (<70 mg/dL). Mild to moderate hypoglycemia has been defined as blood glucose levels of 40 and 69 mg/dL, respectively; severe hypoglycemia has been defined as <40 mg/dL.<sup>8</sup> Hypoglycemia is a common adverse event (AE) in individuals with diabetes, and there are numerous factors that can contribute to its occurrence—missing a meal, exercising more than usual, or using diabetes medications to increase insulin production.<sup>9</sup> Symptoms of hypoglycemia vary for each individual and include palpitations, tremor, hunger, sweating, behavioral changes, difficulty thinking, and confusion.<sup>10</sup> Hypoglycemia is harder to recognize in individuals with visual and cognitive impairment, anxiety and depression, and reduced manual dexterity.<sup>1</sup> Additionally, avoiding hypoglycemia may be particularly important in residents with dementia or other factors that may limit their ability to detect and report symptoms.<sup>11</sup> The goal of minimizing the risk of hypoglycemia while maintaining good glycemic control is feasible as long as a rational plan of insulin therapy is adopted, blood glucose is properly monitored, and blood glucose targets are individualized.<sup>12</sup>

Hyperglycemia is another concern when managing diabetes with insulin therapy. Symptoms of hyperglycemia can

include increased thirst, frequent urination, fatigue, and blurred vision.<sup>13</sup> Left untreated, hyperglycemia may lead to ketoacidosis, a life-threatening condition that requires immediate treatment.<sup>14</sup> Therefore, LTC providers need to regularly monitor residents' blood glucose levels and treat elevated levels early to help avoid problems associated with hyperglycemia.

When initiating and intensifying insulin therapy, LTC providers may also have to address resident concerns with taking multiple injections a day, AEs, and the difficulties of starting a new and potentially complex treatment.<sup>1</sup> Intensifying insulin therapy also puts an additional burden on LTC providers with administering the correct medications daily. This challenge is compounded by staff shortages, frequent staff turnover, and outdated or insufficient knowledge of diabetes.<sup>1</sup>

### TREATMENT REGIMENS

For residents with diabetes being treated in LTC facilities, insulin may be an effective therapy for managing diabetes. Basal insulin, SSI, premixed insulin, and basal-bolus therapy are treatment options, each with their own advantages and disadvantages.<sup>3</sup>

#### BASAL INSULIN

As diabetes progresses, typically between 5 and 10 years after diagnosis, maximum doses of oral agents are often insufficient to achieve and sustain evidence-based HbA1c target of <7%.<sup>3</sup> As a result, insulin therapy is often needed.

A simple and widely used method for initiating insulin therapy is to add an optimized dose of basal insulin to a pre-existing oral therapy regimen. Although the introduction of basal insulin therapy may achieve an effective control of fasting hyperglycemia, additional therapy may be needed to achieve an overall glycemic control.<sup>3</sup>

For some LTC residents, intensive insulin therapy may prove beneficial. Intensive insulin therapy usually entails utilizing basal insulin with multiple premeal injections of a rapidly-acting insulin to provide tighter glycemic control.<sup>7</sup> The decision to initiate and intensify insulin therapy is not without challenges for LTC facilities treating individuals with diabetes. Glycemic control is key when dosing insulin, particularly in LTC residents because the danger of hypoglycemia is ever-present.<sup>1</sup>

#### SSI

As mentioned earlier, SSI is still common in LTC facilities, despite recommendations from key organizations against its use. SSI is a less than ideal approach in managing hyperglycemia, and no standards exist for SSI regimens.<sup>2,15</sup> The 2011 ADA guidelines caution that prolonged therapy with traditional SSI regimens is ineffective as a monotherapy in the majority of individuals and is potentially dangerous in

individuals with type 1 diabetes.<sup>5</sup> Whereas SSI is the preferred inpatient treatment regimen because of its convenience, simplicity, and promptness of treatment initiation, the benefits of SSI in improving glycemic control have not been demonstrated in clinical studies.<sup>16</sup> In addition to an increased risk of hypoglycemia and medication errors, SSI uses hyperglycemia as a threshold. The treatment approach is reactive instead of proactive, provides no basal insulin, glycemic control is rarely assessed, and involves a "one-size-fits-all" approach.<sup>2,15,16</sup>

#### PREMIXED INSULIN

A practical and feasible approach to targeting both fasting and postprandial hyperglycemia for optimal blood glucose control is the use of premixed insulin.<sup>17</sup> Both human and analog insulin are available in premixed formulations. Insulin analogs are the derivatives of human insulin that have undergone one or more chemical modifications to alter the time-action profile of the insulin, resulting in different pharmacokinetic and pharmacodynamic profiles.

Premixed insulin therapy provides both basal and prandial coverage because of its biphasic pharmacokinetic properties. Studies have shown these agents also improve glycemic control, are associated with a low rate of severe hypoglycemia, and a greater degree of patient acceptance.<sup>17</sup> The drawbacks of premixed insulin include the inability to adjust the long- and short-acting components separately, to use a flexible regimen of self-titration and premeal bolus-insulin calculations, and to adequately treat post-lunch and early morning blood glucose elevations.<sup>17</sup>

#### BASAL-BOLUS THERAPY

The flexibility in dosing with basal-bolus therapy allows LTC providers to tailor treatment based on a resident's individual needs and treatment goals. Studies have shown that a basal-bolus insulin regimen may improve glycemic control and tolerability.<sup>2</sup> However, residents may be reluctant to begin insulin therapy with this intensive approach.<sup>6</sup> LTC residents may resist multiple daily doses due to needle anxiety or fear of AEs and may be unable to cope with what they perceive as a complicated new treatment.<sup>1</sup>

While there are no specific guidelines on how to manage this patient population, the ADA and AACE recommend aggressive management of diabetes and an individualized care plan. The preferred treatment protocol outlined in the ADA 2011 guidelines recommends the use of additional short- or rapid-acting insulin with scheduled insulin doses to treat blood glucose above desired targets.<sup>5</sup> Both organizations recommend that target fasting blood glucose levels should be 140 to 180 mg/dL for critically ill patients and that premeal blood glucose should be less than 140 mg/dL in conjunction with random blood glucose values of less than 180 mg/dL for noncritically ill patients.<sup>18</sup>

### BASAL-BOLUS THERAPY AS A VIABLE TREATMENT OPTION

The progressive nature of type 2 diabetes often results in individuals requiring an insulin regimen that addresses both components of glucose control with additional supplemental insulin doses, if needed, to reach treatment goals. LTC residents inadequately controlled on their current treatment regimen may benefit from switching to basal-bolus therapy.<sup>1</sup> Basal-bolus describes the concept of using a long-acting insulin for basal (FPG) control, as well as a rapid-acting insulin to cover mealtime (PPG) control. See Figure.

Basal-bolus therapy, a proactive approach to individualizing insulin treatment, is<sup>6,8,19,20</sup>:

- The most physiologic insulin regimen
- Includes basal, bolus, and supplemental components as the preferred method for achieving and maintaining glucose control in noncritically ill individuals
- Covers insulin needs at and between mealtimes
- Provides rapid and significant improvements in glycemic control in hospital patients throughout length of stay
- Insulin therapy can be matched or tailored to the specific clinical circumstance and must meet the individual needs of the patient

While data on this approach in LTC is limited, studies have suggested that basal-bolus regimens may be a more rational and reliable approach to glycemic control.<sup>2</sup> A study showed greater improvement in glycemic control in study subjects treated with basal-bolus insulin, compared with SSI.<sup>20</sup> Furthermore, glycemic control rapidly improved in all study subjects who did not respond to SSI after they were switched to a basal-bolus regimen.<sup>20</sup>

Several institutions have sought to eliminate SSI and improve glycemic control by managing blood glucose without SSI orders.<sup>19,21</sup> These institutions have developed and implemented specific strategies for insulin delivery using a basal-bolus approach.<sup>19,21</sup>

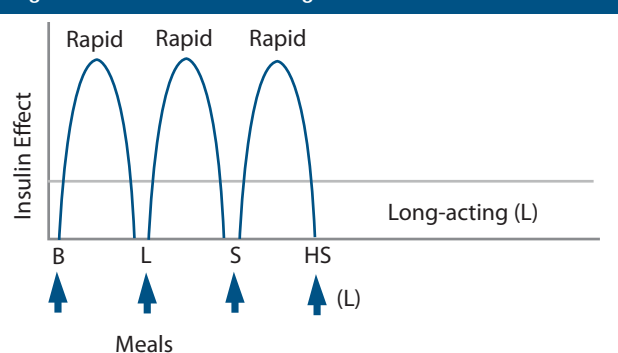
Basal-bolus therapy is a more proactive approach to reducing the occurrence of hyperglycemia in hospitalized patients, compared with SSI that treats hyperglycemia after it has already occurred. Implementing a basal-bolus regimen to manage hyperglycemia in noncritically ill individuals may result in significant improvement in glycemic control and fewer hyperglycemic and hypoglycemic episodes.<sup>16</sup>

### DOSING OPTIONS

The addition of bolus insulin to a basal regimen allows for greater flexibility at mealtimes, especially for LTC residents whose food consumption is often inconsistent or whose meals may be delayed due to circumstances beyond their control. Several organizations have created basal-bolus guidelines that LTC facilities may use as a guide to formulate a protocol for basal-bolus therapy.<sup>19,22,23</sup>

AMDA, for example, recommends a 4-step process of recog-

Figure. Basal-bolus insulin regimen



This Figure is a theoretical representation.

Reference: American Diabetes Association: *Practical Insulin: A Handbook for Prescribers*. Alexandria, VA: American Diabetes Association Inc.; 2002:23. Adapted from Figure 8.

nition, assessment, treatment, and monitoring for residents in LTC facilities.<sup>22</sup> The AACE recommends basal-bolus therapy as an option for intensification for individuals with type 2 diabetes who have titrated basal insulin and are still uncontrolled after 2 to 3 months. AACE also recommends adding a rapid-acting insulin analog to a long-acting insulin analog at the largest meal.<sup>6</sup> The recommendations for managing diabetes and hypoglycemia in hospitals outlined by Clement et al recommend evaluating patient status to determine the appropriate insulin dose. For example, it is appropriate to consider the basal and prandial components of the insulin requirement separately for individuals who are eating discrete meals.<sup>19</sup>

Basal-bolus insulin therapy begins with calculation of subcutaneous insulin.<sup>24</sup> To estimate insulin dose when no intravenous insulin therapy has been given, may be done with a 3-step process.<sup>24</sup> This process is one of several options in published literature on how to calculate the appropriate dose.

- Step 1: Calculate estimated total daily dose of insulin
- Step 2: Divide total daily dose of insulin into 50% basal (long-acting insulin analog or immediate-acting insulin) and 50% mealtime (rapid-acting insulin analog or short-acting insulin)
- Step 3: Divide mealtime insulin into 3 equal doses to be given with meals

If necessary, clinicians should supplement with a rapid-acting insulin analog.<sup>24</sup> A supplemental insulin scale is determined on the basis of multiple factors and may include type of diabetes, severity of hyperglycemia, insulin requirements, and concomitant medications.<sup>24</sup>

The primary goals for clinicians in managing diabetes with insulin therapy is optimal glycemic control to minimize the risk of hypoglycemia. The clinical benefits of insulin analogs, particularly in the LTC setting, may be an effective approach in treating this population.<sup>1</sup> Insulin analogs have pharmacokinetic and pharmacodynamic profiles that closely mimic those of endoge-

nous insulin resulting in a more consistent, predictable glycemic effect than human insulin. Compared with human insulin, use of insulin analogs also results in similar or improved HbA1c, better control of PPG and fasting glucose levels, and reduced risks of hypoglycemia.<sup>1</sup>

### USE OF INSULIN PENS

The use of pen devices as a method of insulin administration offers advantages for clinicians and patients, compared with vials/syringes, including patients' preference, dosing accuracy, and improved treatment adherence.<sup>25</sup>

Incorporating the syringe and insulin container into a single unit eliminates the need for balancing and inverting the syringe and vial.<sup>26</sup> Pen devices also offer greater dosing accuracy, compared with insulin syringes. Insulin pens have been shown to be significantly more accurate than syringes in measuring low insulin doses.<sup>26</sup>

A study showed nurse satisfaction with insulin pen devices in hospitalized patients. In comparison to vials/syringes, a majority of nurses agreed that insulin pens were more convenient and took less time to prepare and administer insulin.<sup>27</sup>

The convenience and improved accuracy of administration with insulin pens may help reduce hypoglycemia rates, increase treatment satisfaction, and improve treatment adherence.<sup>1</sup>

### MORE INFORMATION

For more information regarding healthcare professional and consumer resources, insulin options, and delivery devices available from Novo Nordisk Inc, please visit [novomedlink.com](http://novomedlink.com). To schedule an appointment to speak with your local Novo Nordisk representative, call 800-727-6200, option 1. ■

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