Case Study: A Patient With Type 1 Diabetes Who Transitions to Insulin Pump Therapy by Working With an Advanced Practice Dietitian

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Registered dietitians (RDs) who have earned the Board Certified–Advanced Diabetes Manager (BC-ADM) credential hold a master's or doctorate degree in a clinically relevant area and have at least 500 hours of recent experience helping with the clinical management of people with diabetes.[1] They work in both inpatient and outpatient settings, including diabetes or endocrine-based specialty clinics, primary care offices, hospitals, and private practices. Advanced practice dietitians provide all components of diabetes care, including advanced assessment (medical history and physical examination), diagnosis, medical management, education, counseling, and overall case management.

The role of RDs in case and disease management was explored in a recent article[2] that included interviews with three dietitians who work as case managers or disease managers. All three reported experiencing challenges in practice and noted that the meaning of "case management" varies from one health care setting to another. This is also true for RD, BC-ADMs. Advanced practice dietitians specializing in diabetes require case management expertise that stresses communication skills, knowing the limits of your own discipline, knowing how to interact with other health care professionals, and knowing when to seek the expertise of other members of the diabetes care team.

Clinical practice includes assessment and data collection, diagnosis and problem identification, planning, and intervention. In many cases, diabetes educators who are dietitians and those who are nurses are cross-trained to perform the same roles. The first one to meet with a client handles that client's assessment, and cases are discussed and interventions planned at weekly team meetings.

Assessment and Data Collection

For advanced practice dietitians, the first session with a client often involves a complete physical assessment, not just a nutrition history. This includes a comprehensive medical history of all body systems. The diabetes-focused physical examination, just as performed by clinicians from other disciplines, includes height and weight measurement, body mass index (BMI) calculation, examination of injection sites, assessment of injection technique, and foot assessment.

Assessment also includes reviewing which medications the client is taking, evaluating their effectiveness and side effects, and determining the need for adjustment based on lifestyle, dietary intake, and blood glucose goals.

When carbohydrate counting is added to therapy, dietitians calculate carbohydrate-to-insulin ratios and teach clients how to use carbohydrate counting instead of a sliding-scale approach to insulin. Medications are adjusted based on clients' lifestyles until blood glucose goals are achieved.

The therapeutic problem solving, regimen management, case management, and self-management training performed by advanced practice dietitians exceeds the traditional role of most dietetics professionals.[3]

Diagnosis and Problem Identification

A role delineation study for clinical nurse specialists, nurse practitioners, RDs, and registered pharmacists,[4] conducted in 2000 by the American Nurses Credentialing Center, reported equal findings among all four groups for the skills used to identify pathophysiology, analyze diagnostic tests, and list problems. Assessment for medical nutrition therapy typically includes evaluation of food intake, metabolic status, lifestyle, and readiness to change. For people with diabetes, monitoring glucose and measur-

ing hemoglobin A_{1c} (A1C), lipids, blood pressure, and renal status are essential to evaluating nutrition-related outcomes.

The U.S. Air Force health care system conducted a pilot test giving RDs clinical privileges and evaluating their clinical judgment in patient nutritional care. A protocol was approved, and dietitians were allowed to order and interpret selected outpatient laboratory tests independently. The higher-level clinical judgments and laboratory privileges were linked to additional certifications.[5]

The Diabetes Prevention Program (DPP) also provided a unique opportunity for dietitians to demonstrate advance practice roles.[6] Dietitians served as lifestyle coaches, contacting participants at least once a month to address intervention goals. As case managers, they interviewed potential volunteers, assessed past experience with weight loss, and scheduled quarterly outcome assessments and weekly reviews of each participant's progress at team meetings. Within the DPP's central management, dietitians served as program coordinators and served on national study committees related to participant recruitment and retention, quality control, the use of protocols, and lifestyle advisory groups.[7]

Dietitians now play key roles in translating DPP findings and serving as community advocates to reduce the incidence of obesity and the health care burden of type 2 diabetes. This includes serving in a consultative role to other health care team members on issues regarding weight loss and risk factor reduction.

Planning and Intervention

Advanced practice RDs offer comprehensive diabetes patient care services, including identifying patient goals and expected outcomes, selecting nonpharmacological and pharmacological treatments, and developing integrated plans of care. Problems discussed with patients range from acute and chronic diabetes complications to comorbid conditions, other conditions, preventive interventions, and self-management education. Advanced practice RDs also review patients' health care resources and order laboratory tests if information is not available from referral sources. They provide supportive counseling and referral to specialists, as needed. And, they provide a full report of their findings and any regimen changes and recommendations they make to referring clinicians after each visit.

These activities and responsibilities go beyond the scope and standards of practice for the RDs and for RD, CDEs.[8] They will be included in the scope of practice document for RD, BC-ADMs that is now being developed by the Diabetes Care and Education Practice Group of The American Dietetic Association.

The following case study illustrates the clinical role of advanced practice dietitians in the field of diabetes.

Case Presentation

B.C. is a 51-year-old white man who was diagnosed with type 1 diabetes 21 years ago. He believes that his diabetes has been fairly well controlled during the past 20 years and that his insulin needs have increased. He was recently remarried, and his wife is now helping him care for his diabetes.

His endocrinologist referred him to the RD for an urgent visit because 4 days ago he had a hypoglycemic event requiring treatment in the emergency room (ER). He has come to see the dietitian because his doctor and his wife insisted that he do so.

B.C. has had chronic problems with asymptomatic hypoglycemia. His last doctor's visit was 3–4 weeks ago, when areas of hypertrophy were found. His endocrinologist asked him to change his injection sites from his thigh to his abdomen after the ER incident.

He does not think he needs any diabetes education but would like help in losing 10 lb. His body mass index is 25 kg/m^2.

His medications include pravastatin (Pravacol), 10 mg daily; NPH insulin, 34 units in the morning and 13 units at bedtime; and regular insulin at breakfast and dinner following a sliding-scale algorithm. He also takes lispro (Humalog) insulin as needed to correct high blood glucose.

Before his ER visit, B.C. monitored his blood glucose only minimally, testing fasting and sometimes before dinner but not keeping records. Since his severe hypoglycemia 4 days ago, he has begun checking his blood glucose four times a day, before meals and bedtime.

Lab Results

B.C.'s most recent laboratory testing results were as follows:

- A1C: 8.3% (normal 4.2–5.9%)
- Lipid panel
  - Total cholesterol: 207 mg/dl (normal: 100–200 mg/dl)
  - HDL cholesterol: 46 mg/dl (normal: 35–65 mg/dl)
  - LDL cholesterol: 132 mg/dl (normal: <100 mg/dl)
  - Triglycerides: 144 mg/dl (normal: <150 mg/dl)
- Creatinine: 0.9 mg/dl (normal: 0.5–1.4 mg/dl)
- Microalbumin: 4 μg (normal: 0–29 μg)

Discussion

At his initial visit with the RD for crisis management of asymptomatic hypoglycemia, she examined his injection sites and asked if he had made the changes recommended by his clinician. She reviewed his injection technique, diet history, incidence of hypoglycemia, and hypoglycemia treatment methods. She discussed with B.C. ways to reduce his risks of hypoglycemia, including food choices, insulin timing, and absorption variations at different injection sites.

The RD reinforced his clinician's instruction to avoid old injection sites and added a new recommendation to lower insulin doses because of improved absorption at the new sites.

B.C. was now checking his blood glucose and recording results in a handheld electronic device in a form that could be downloaded, e-mailed, or faxed, but he was not recording his food choices. The dietitian asked him to keep food records and started his carbohydrate-counting education. A follow-up visit was scheduled for 1 week later.

At the second visit, B.C.'s mid-afternoon blood glucose was <70 mg/dl. He did not respond to treatment with 15 g carbohydrate from 4 oz. of regular soda. His blood glucose continued to drop, measuring 47 mg/dl 15 minutes later. He drank another 8 oz. of soda, and his blood glucose increased to 63 mg/dl 1 hour later. He then drank another 8 oz. of soda and ate a sandwich before leaving the dietitian's office. He called in 1 hour later to report that his blood glucose was finally up to 96 mg/dl.

B.C.'s records showed a pattern of mid-afternoon hypoglycemia. He was willing to add a shot of lispro at lunch to his regimen, so the RD recommended reducing his morning NPH to prevent lows later in the day.

The RD also calculated insulin and carbohydrate ratios for blood glucose

correction and meal-related insulin coverage using the "1500 rule" and the "500 rule."

The 1500 rule is a commonly accepted formula for estimating the drop in a person's blood glucose per unit of fast-acting insulin. This value is referred to as an "insulin sensitivity factor" (ISF) or "correction factor." To use the 1500 rule, first determine the total daily dose (TDD) of all rapid- and long-acting insulin. Then divide 1500 by the TDD to find the ISF (the number of mg/dl that 1 unit of rapid-acting insulin will lower the blood glucose level). B.C.'s average TDD was 41 units. Therefore, his estimated ISF was 37 mg/dl per 1 unit of insulin. The RD rounded this up to 40 mg/dl to be prudent, given his history of hypoglycemia.

The 500 rule is a formula for calculating the insulin-to-carbohydrate ratio. To use the 500 rule, divide 500 by the TDD. For B.C., the insulin-to-carbohydrate ratio was calculated at 1:12 (1 unit of insulin to cover every 12 g of carbohydrate), but again this was rounded up to 1:14 for safety. Later, his carbohydrate ratio was adjusted down to 1:10 based on blood glucose monitoring results before and 2 hours after meals.

The RD taught B.C. how to use the insulin-to-carbohydrate ratio instead of his sliding scale to adjust his insulin and asked him to try to follow the new recommendations. With his endocrinologist's approval, she reduced his NPH doses to 34 units and added a shot of lispro at lunchtime, the dose to be based on the amount of carbohydrate in the meal and his before-meal blood glucose level.

The RD asked B.C. to return in 1 week for evaluation and review of his new regimen. However, 3 days later, he returned after having had another severe episode of hypoglycemia.

In the course of these early visits, a good rapport developed between B.C. and the dietitian. B.C. learned that his judgment on how hypo- and hyperglycemia felt was often inaccurate and led him to make insulin adjustments that contributed to his hypoglycemia problems. By improving B.C.'s understanding of insulin doses and blood glucose responses, the RD hoped to help him become more skilled at making insulin dose adjustments. For the time being, however, he was still at risk for asymptomatic hypoglycemia. He had recently filled a prescription for glucagon, but the RD needed to review and encourage its proper use. She also provided literature to support his wife in case she needed to administer glucagon for him.

At this third visit, the RD reduced B.C.'s morning NPH dose to 22 units because of his rapid drop in blood glucose between noon and 1:00 p.m. This reduction finally eliminated his mid-afternoon lows.

B.C. had started using carbohydrate counting to make his decisions about lunchtime insulin doses. He liked carbohydrate counting because it gave him a more viable reason for testing his blood glucose frequently. Over the years, B.C.'s glycemia had become increasingly difficult to control. He had stopped checking his blood glucose because he felt unable to improve the situation once he had the information. In the early 1990s, his endocrinologist had started him self-adjusting insulin doses using the exchange system, but he found that he was always "chasing his blood sugars." Carbohydrate counting changed everything. He now knew what to do to improve his blood glucose levels, and that made him feel more in charge of his diabetes.

Still, although carbohydrate counting led to more frequent testing and better blood glucose control than his old sliding scale, it was not perfect. At home, he had mastered this technique, but he ate many of his meals in restaurants, where carbohydrate counting was more challenging.

B.C. found it difficult to carry different types of insulin. This and his lifestyle suggested the need to change his multiple daily injections from regular to lispro insulin. He continued checking his blood glucose before and 2 hours after meals. His insulin-to-carbohydrate ratio of 1:10 g and his ISF of 1:40 mg/dl allowed him to stay within his goal of no more than a 30-mg/dl increase in blood glucose 2 hours after meals. He continued to be asymptomatic of hypoglycemia, but lows occurred less frequently. The new goal of therapy was to recover his hypoglycemia symptoms at a more normal level of about 70 mg/dl. He was scheduled for another visit 2 weeks later.

Between visits to the RD, BC-ADM, his clinician identified problems with the timing of his long-acting insulin peak, resulting in early nocturnal lows. Based on the clinician's clinical experience of lente demonstrating a slightly smoother peak, she changed B.C.'s long-acting insulin unit-for-unit from NPH to lente.

At B.C.'s next visit, he and the RD reviewed his insulin doses of 22 units of lente in the morning and 11 units of lente at night. His TDD including premeal lispro now averaged 49 units. His average blood glucose levels were 130 mg/dl fasting, 100 mg/dl mid-afternoon, 127 mg/dl before dinner, and 200 mg/dl at bedtime.

The bedtime levels were higher because of late meals, the fat content of restaurant meals, his meat food choices, and his inexperience at counting carbohydrates for prepared foods. The dietitian suggested mixing regular and lispro insulin to try and get the average bedtime blood glucose level to 140 mg/dl. Mixing his calculated dose to be one-third regular and two-third lispro would provide coverage lasting a little longer than that of just lispro to cover higher-fat foods that took longer to digest. At the same time, the dietitian encouraged B.C. to choose lower-fat foods to help reduce his LDL cholesterol and assist with weight loss. B.C. now had an incentive to keep accurate food records to help evaluate his accuracy at calculating insulin doses.

B.C. and the RD also reviewed his decisions for treating lows. At his first meeting, B.C. ate anything and everything when he experienced hypoglycemia, which often resulted in blood glucose levels >400 mg/dl. Now, he was appropriately using 15–30 g of quick-acting glucose—usually 4–8 oz. of orange juice. He based this amount on his blood glucose level, expecting about a 40-mg/dl rise over 30 minutes from 10 g of carbohydrate. He checked his glucose level before treating when possible and always checked 15–30 minutes after treating to evaluate the results. Once his glucose reached 80 mg/dl or above, he either ate a meal or ate 15 g of carbohydrate per hour to prevent a recurrence of hypoglycemia until his next meal.

In completing her assessment during the next few meetings with B.C., the RD identified a problem with erectile dysfunction. She notifed his clinician and referred him to a urologist. Eventually, the urologist diagnosed reduced blood flow and started B.C. on sildenafil (Viagra).

B.C. wanted to resume exercise to help his weight loss efforts. Because exercise improves insulin sensitivity and can acutely lower blood glucose,

the dietitian taught B.C. how to reduce his insulin doses by 25–50% for planned physical activity to further reduce his risks of hypoglycemia. He learned to carry his blood glucose meter, fluids, and carbohydrate foods during and after exercise. His preexercise blood glucose goal was set at 150 mg/dl. The dietitian instructed B.C. to test his blood glucose again after exercise and to eat carbohydrate foods if it was <100 mg/dl.

She also gave instructions for unplanned exercise. He would require additional carbohydrate depending on his blood glucose level before exercise, his previous experience with similar exercise, and the timing of the exercise. Education follow-ups were scheduled with the dietitian for 1 month later and every 3 months thereafter.

At his next annual eye exam, B.C. discovered that he had background retinopathy. He also reported feeling that his daily injection regimen had become too complicated. Still feeling limited in his ability to control his diabetes and looking for an alternative to insulin injections, he wanted to discuss continuous subcutaneous insulin infusion therapy (insulin pump therapy).

He, his endocrinologist, and his dietitian discussed the pros and cons of pump therapy and how it might affect his current situation. They reviewed available insulin pumps and sets and agreed on which ones would best meet his needs. The equipment was ordered, and a training session was scheduled with the dietitian (a certified pump trainer) in 1 month.

B.C. started using an insulin pump 2 years after his first visit with the dietitian. His insulin-to-carbohydrate ratio was adjusted for his new therapy regimen, and a new ISF was calculated to help him reduce high blood glucose levels. His endocrinologist set basal insulin rates at 0.3 units/hour to start at midnight and 0.5 units/hour to start at 3:00 a.m. This more natural delivery of insulin based on B.C.'s body rhythms and lifestyle further improved his diabetes control.

One week after starting pump therapy, B.C. called the dietitian to report large urine ketones and a blood glucose level of 317 mg/dl. His endocrinologist had changed his basal rates, but he wanted to meet with the dietitian to review his sites, set insertion, troubleshooting skills, and related issues. Working together, they eventually discovered that problems with his pump sites required using a bent-needle set to resolve absorption issues.

B.C's relationship with his endocrinologist and dietitian was seamless. He met with the dietitian when his clinician was unavailable or when he needed more time to work through problems.

B.C. has met with the RD 15 times over 3 years. Eventually, he recovered symptoms of hypoglycemia when his blood glucose levels were 70 mg/dl. After 6 months of education meetings, his lab values had reached target ranges. Most recently, his LDL cholesterol was <100 mg/dl, his A1C results were <7%, his hypoglycemia symptoms were maintained at a blood glucose level of 70 mg/dl, and his blood glucose had been stabilized using the square-wave and dual-wave features on his insulin pump.

B.C. learned how to achieve recommended goals and to self-manage his diabetes with the help of his care team: endocrinologist, cardiologist, ophthalmologist, podiatrist, urologist, and advanced practice dietitian.

Summary

Advanced practice dietitians in diabetes work in many settings and see clients referred from many different types of medical professionals. They may see clients either before or after their appointments with other members of the health care team, depending on appointment availability and their need for nutrition therapy and diabetes education. Referring clinicians rely on their evaluations and findings. When necessary, clinician approval can be obtained for immediate interventions, enhancing the timeliness of care.

Why would an RD want to obtain the skills and certification necessary to earn the BC-ADM credential? The answer, as illustrated in the case study above, lies in their routine use of two sets of skills and performance of two roles: patient education and clinical management.

Dietitians who specialize in diabetes often find that their role expands beyond provider of nutrition counseling. As part of a multidisciplinary team, they become increasingly involved with patient care. As they move patients toward self-management of their disease, they necessarily participate actively in assessment and diagnosis of patients; planning, implementation, and coordination of their diabetes care regimens; and monitoring and evaluation of their treatment options and strategies. They find that their daily professional activities go beyond diabetes education, crossing over into identifying problems, providing or coordinating clinical care, adjusting therapy, and referring to other medical professionals. They often work independently, providing consultation both to people with diabetes and to other diabetes care team members.

The BC-ADM credential acknowledges this professional autonomy while promoting team collaboration and thus improving the quality of care for people with diabetes. The new certification formally recognizes advanced practice dietitians as they move beyond their traditional roles and into clinical problem solving and case management.

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