**Case Study 15-Type 1 Diabetes Mellitus in the Adult**

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1. Understanding the Diagnosis and Pathophysiology
2. *What are the differences among T1DM, T2DM, and LADA?*

Type 1 DM, or “juvenile” diabetes, is defined as the body’s inability to to synthesize enough insulin in the pancreas to properly function. This autoimmune disease causes the immune system to attack part of the body’s pancreas for unknown reasons. The insulin-producing cells, called beta cells in the islets of Langerhans, are not recognized by the immune system and therefore destroys them. T1DM is most common in children and teenagers, although, it can develop at any age. To supply the body with enough insulin, it is necessary to inject the body with insulin pens, syringes, or pumps (continuously running) multiple times a day. Insulin’s function is to allow glucose into the cells throughout the body to be used for energy. If insulin is not functioning properly, glucose builds up in the blood causing the cells to ‘starve’ from insufficient levels of glucose. The buildup of glucose can lead to damage of the eyes, kidneys, nerves, and heart leading to coma or death.

Type 2 DM, also known as “adult onset” diabetes, is the most prevalent form of diabetes. On average, most individuals develop type 2 DM around age 35, although it can develop at any age. Today, there are more and more cases of this disease is seen in children, which is a large concern to our population. Individuals are able to produce insulin, however, it is not enough. The body’s cells also become insensitive to insulin, preventing insulin from bringing glucose into the cell. Type 2 DM can develop over a longer period of time compared to T1DM. T1DM is most commonly described as an autoimmune disease, whereas T2DM is described as a lifestyle and nutrition related disease. Type 2 DM is typically is seen in individuals who are overweight or obese.

LADA, or Latent Autoimmune Diabetes of Adults, is a type of autoimmune diabetes that progresses slowly. Similar to T1DM, it occurs when the pancreas stops producing an adequate amount of insulin. It is usually diagnosed later than T1DM, however, it is not associated with weight and an unhealthy lifestyle like T2DM. Treatment is less aggressive than T1DM because the beta cells in the pancreas seem to function for a longer time. In the early stages it does not require insulin (several months to 1 year). In the early stages, LADA can be manageable through one’s diet and exercise, but as the pancreas stops producing insulin, injections are necessary.

**Sources:** What is Type 1/2 Diabetes? *Diabetes Research Institute Foundation.* Retrieved on 16 Nov from http://www.diabetesresearch.org/what-is-type-one-diabetes

Stenstrom, G., Gottsater, A., Bakhtadze, E., Berger, B., Sundkvist, G. Latent Autoimmune Diabetes in Adults (2005). *American Diabetes Association* 54 (S68-S62). Retrieved on 16 Nov 2014 from <http://diabetes.diabetesjournals.org/content/54/suppl_2/S68.full>. doi:10.2337/diabetes.54.suppl\_2.S68

1. *What are the standard diagnostic criteria for each of these diagnoses?*

The standard diagnostic criteria for diagnosis of diabetes mellitus includes (Nelms, 485)

Type 1 and Type 2

* symptoms of Diabetes plus casual plasma glucose >200 mg/dL (11.1 mmol/L)
* Fasting Plasma Glucose Test>126 mg/dL (7.0mmol/L)
* 2-Hour Postprandial Glucose Test >200 mg/dL during an OGTT
* 75-gram Oral Glucose Tolerance Test
* Hemoglobin A1c value of ≥ 6.5%

A positive result from any 2 of these tests can diagnose a patient with diabetes.

LADA

* Presence of circulating islet antibodies (including ICA, GADA, protein tyrosine phosphatase antibody)
* Age ≥ 30 years
* insulin independent for at least 6 months after being diagnosed

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. *Why do you think he was originally diagnosed with T2DM? Why does the MD now suspect he may actually have T1DM or LADA?*

When assessing Armando’s chart, one of the first things the doctor looked at was probably his age. Armando is a 32 year old male, which is right around the average age of most patients with T1DM. Furthermore, the doctors most likely saw that his blood glucose levels were extremely high at 683 mg/dL (normal 70-110) and his Hemoglobin A1C was high at 12.5% (normal 3.9-5.2). These are both grounds for diagnosing a person with T2DM with no need for further testing. The MD now suspects that he may have T1DM or LADA because the patient tested positive for ICA, GADA, and IAA, which denotes that the patient has one of these types of diabetes. Although the IAA is not always a clear indication because it decreases with age, GADA is a relatively stable indicator of T1DM and LADA for patients who are over the age of 25. In addition, the risk of T1DM and LADA increases in those with two or more islet autoantibodies than a single autoantibody.

**Source:** Autoantibody Markers (2014). *Diapedia.* Retrieved on 16 Nov 2014 from <http://www.diapedia.org/type-1-diabetes-mellitus/autoantibody-markers>. doi: <http://dx.doi.org/10.14496/dia.21040851461.17>

1. *Describe the metabolic events that led to Armando’s symptoms and subsequent admission to the ER (polyuria, polydipsia, polyphagia, fatigue, and weight loss), integrating the pathophysiology of T1DM into your discussion.*

T1DM is caused by a significant increase in blood sugar levels in response to the pancreas failing to produce insulin. This leads to a buildup of glucose in the blood without insulin allowing it into the cells. The first symptom that Armando experienced was polyuria, or excessive passage of of urine (more than 3 liters a day). Polyuria is common in patients with T1DM because when the kidneys filter blood to make urine, the glucose is reabsorbed and returned to the bloodstream. However, due to abnormally high blood sugar levels, excess sugar is excreted into the urine and drawing out more water. Polydipsia is increase in thirst and fluid intake, a common symptom of T1DM. Fluid is being drawn out of the cells, tissues, and organs towards the kidneys to excrete the excess sugar out of the body. Therefore, the body becomes dehydrated, resulting in Armando’s feeling of thirst.

Moreover, the patient stated that he was fatigued. Due to the lack of insulin production, there is no way of the glucose getting into the cell where it is converted into energy. In addition, glucose is rapidly being excreted from the body in the urine. To make up for this energy loss, the body’s cells are continuously looking to find another source of energy which exerts energy itself. Patients feel fatigued as a result. Unexplained weight loss occurs as a result of there being an insufficient amount of insulin to glucose into the cells to convert to energy. The body being to burn fat (adipocytes), tissue, and muscle in place of glucose, which contributes to the body’s overall weight loss. The body’s tissue breaks down due to gluconeogenesis to replace the carbohydrates that the body is not getting from glucose.

**Sources:** Unexplained Weight Loss. *Diabetes.co.uk.* Retrieved on 16 Nov 2014 from <http://www.diabetes.co.uk/symptoms/unexplained-weight-loss.html>

Polyuria-Frequent Urination. *Diabetes.co.uk.* Retrieved on 16 Nov 2014 from http://www.diabetes.co.uk/symptoms/polyuria.html

Diabetes Signs. *Diabetes.co.uk.* Retrieved on 16 Nov 2014 from http://www.diabetes.co.uk/The-big-three-diabetes-signs-and-symptoms.html

1. *Describe the metabolic events that result in the signs and symptoms associated with DKA. Was Armanda in this state when he was admitted? What precipitating factors may lead to DKA?*

Diabetic ketoacidosis (DKA) is a metabolic complication that mostly occurs in people with T1DM. These complications include hyperglycemia, hyperketonemia, and metabolic acidosis. Some symptoms that may occur include nausea, vomiting, abdominal pain, which can progress to edema, coma, and death. Several stresses that may lead to DKA include acute infection (i.e. pneumonia and UTI), Myocardial infarction, stroke, pancreatitis, and trauma. Some drugs can also trigger DKA, such as corticosteroids, thiazide diuretics, and sympathomimetics.

The body goes into this state when it uses lean tissue and fat stored in the body for energy to function other processes. After tissue and fat is broken down, they are converted into acetyl-CoA molecules and used in the citric acid cycle to produce energy. If the body overproduces acetyl-CoA, the fatty acids may be converted into ketones. Ketones are acidic, which can affect the pH of the blood if they are overproduced. DKA is caused by the blood reaching abnormally low pH levels, leading to brain damage and coma. Other processes besides ketogenesis, including the breakdown of lean muscle through gluconeogenesis and hydrolyzing triglycerides to produce glycerol. Both of these processes raise the blood glucose levels and further contribute to hyperglycemia, polyuria, polydipsia, weight loss, and fatigue.

Upon admittance, a friend of Armando stated that when he found him in his apartment, the patient was groggy and almost unconscious. The patient also had complained of not feeling well the previous day at work and “thought he was fighting off a virus”. The patient was experiencing early warning signs of DKA, grogginess, dry or flushed skin, fatigue, and difficulty breathing. The patient was experiencing all these symptoms, which confirms he was in the early stages of DKA.

**Sources:** DKA (Ketoacidosis) & Ketones (2013). *American Diabetes Association.* Retrieved on 17 Nov 2014 from <http://www.diabetes.org/living-with-diabetes/complications/ketoacidos> is-dka.html

Kishore, P. MD. Diabetic Ketoacidosis (DKA). (2014). *Merck Manuals.* Retrieved on 17 Nov 2014 from <http://www.merckmanuals.com/professional/endocrine_and_metabolic_disorder> s/diabetes\_mellitus\_and\_disorders\_of\_carbohydrate\_metabolism/diabetic\_ketoacidosis\_dka.html

1. *Armando will be started on a combination of Novolog prior to meals and snacks with glargine given in the a.m. and p.m. Describe the onset, peak, and duration for each of these types of insulin.*

Novolog is a fast acting insulin treatment taken prior to mealtimes. The onset action takes place within 10-20 minutes and the peak of action is reached within 40-50 minutes. The total duration for this insulin is 3-5 hours (Novolog). Glargine insulin is an extended long-acting analog. The onset of this insulin’s action is 2-4 hours, with no peak of action. The total duration for glargine is 20-24 hours and it is not recommended that this insulin be combined with other insulins (Nelms, 488).

## Sources: NovoLog® is designed to mimic the normal physiologic insulin profile. *Novolog.* Retrieved on 17 Nov 2014 from [https://www.novologpro.com/pharmacology/mechanism-of](https://www.novologpro.com/pharmacology/mechanism_of_)- action.html

Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. *Using his current weight of 165 lbs, determine the discharge dose of glargine as well as an appropriate ICR for Armando to start with.*

For an individual with Type 1 Diabetes and a moderate to large amount of ketones (+4), the daily insulin dose recommendation is 0.5-0.7 units/kg (Nelms, 488).

(75kg)(0.5 units/kg) to (75kg)(0.7 units/kg) = 37.5-52.5 units of glargine per day

ICR is an insulin to carbohydrate ratio, which helps to determine the dosage of insulin necessary to combat carbohydrate intake. The starting criteria is 1 unit for every 10-15 grams of carbohydrate. SMBG records adjust this criteria based on the insulin dosage prescribed (Nelms, 493).

450/37.5 to 450/52.5 = 9-12 grams of carb covered by 1 unit insulin

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. *Intensive insulin therapy requires frequent blood glucose self-monitoring. What are some of the barriers to success for patients who begin this type of therapy? Give suggestions on how you might work with Armando to support his compliance.*

Self monitoring blood glucose is daily at home blood glucose monitoring that provides immediate results into a patient’s blood glucose level. This treatment assists in meal and medication alterations to help a patient maintain glycemic control. This aids in prevention of hypo/hyperglycemia and long term diabetic complications. SMBG is typically taken 3+ times per day and more frequently for those administering insulin (Nelms, 494). The complications that arise with this self monitoring includes user error. In order to prevent these complications, a professional should assist and monitor a patient at the onset and at regular intervals. A medical professional can give Armando a schedule for when he needs to check his blood glucose levels and instructions on how to use the instrument to avoid confusion. Aside from instrumental use, Armando must also be instructed on how to adjust his food intake, medication, and physical activity based on his blood glucose level.

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. *Armando tells you that he is very frightened of having his blood sugar drop too low. What is hypoglycemia? What are the symptoms? What information would you give to Armando to make sure he is well prepared to prevent or treat hypoglycemia?*

Hypoglycemia is characterized by a low blood glucose level, which occurs when glucose is utilized too quickly, falling below tissue demands. Hypoglycemia can also occur when excess insulin is present in the bloodstream. In response to depleted glucose levels in the blood, glucagon releases glucose present in hepatic storage as well as epinephrine. Inflated insulin levels can be caused by over administration of insulin and other diabetic medications in reactive hypoglycemia. Reactive hypoglycemia can be mediated with food ingestion. Fasting hypoglycemia occurs when excess insulin is present due to external sources such as alcohol or drug intake.

Some symptoms of hypoglycemia include weakness, fatigue, sweating, and tachycardia. These symptoms become noticeable when glucose levels reach 70 mg/dL. These symptoms often develop when skipping meals, in the morning, or post physical activity. In order to prevent hypoglycemia, Armando should eat many small meals during the course of the day enriched with carbohydrates, fiber, and protein. Simple carbohydrates, alcohol, and caffeine do not benefit hypoglycemia and its symptoms. Carbohydrate counting can aid in monitoring carbohydrate intake to ensure blood glucose levels do not fall. In terms of medications used for treatment of hypoglycemia, anticholinergic agents can assist in delaying gastric emptying. Nondiuretic thiazides can inhibit insulin secretion. Armando should be taught frequency of meals as well as maintain food intake before exercise to prevent hypoglycemia (Nelms, 508-508).

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. *Armando’s mother has T2DM. She is currently having problems with vision and burning in her feet. What is she most likely experiencing? Describe the pathophysiology of these complications. You can tell that he is worried not only about his mother but also about his own health. Explain, using the foundation research of the Diabetes Control and Complications Trial (DCCT) as well as any other pertinent research data, how can he prevent these complications.*

Armando’s mothers is experiencing diabetic neuropathies which is causing her pain in her feet and problems with her vision. It can also cause loss of feeling or pain in the leg and fingertips. In other cases, people may experience problems with controlling blood pressure, heart rate, and digestion. The factors leading to the development of diabetic neuropathy may include a hyperglycemic state, elevated lipids, blood pressure, smoking, and exposure to toxins, such as ethanol. Increased levels of glucose in the nerves is the cause of the nerve cells breaking down. Moreover, diabetic retinopathy, a leading cause of blindness in Americans, is the damage to the blood vessels that leak blood into the center the retina causing blurred vision. The DCCT suggests prevention of future complications by controlling blood glucose, blood pressure, and blood lipid levels in people with type 1 and type 2 diabetes. Additionally, people must monitor blood glucose levels throughout the day (4-5 times), follow a regular diet plan, monitor intake of carbohydrates and exercise to sustain a healthy lifestyle.

**Sources:** DCCT and EDIC: The Diabetes Control and Complications Trial and Follow-Up Study (2008). *National Diabetes Information Clearinghouse (NDIC)* Publication No. 08-3874. Retrieved on 17 Nov 2014 from http://diabetes.niddk.nih.gov/dm/pubs/control/

Facts About Diabetic Eye Disease (2012). *National Eye Institute (NEI).* Retrieved on 17 Nov 2014 from https://www.nei.nih.gov/health/diabetic/retinopathy

1. Understanding the Nutrition Therapy
2. *Outline the basic principles of Armando’s nutrition therapy to assist in control of his DM.*

Nutrition therapy is incredibly beneficial for treating the complications associated with Type 1 Diabetes. The basis for nutrition therapy is to create a self-care treatment plan and knowledge on alterations that can mediate blood glucose levels. There are four main goals associated with diabetic nutrition care (Nelms, 493).

1. Attain and maintain optimal metabolic outcomes: glucose level in normal range, lipid profile that reduces risk for macrovascular disease, BP levels that reduce risk for vascular disease
2. Prevent and treat chronic complications such as obesity, dyslipidemia, cardiovascular disease, hypertension, and nephropathy
3. Enhance lifestyle with dietary choices and physical activity, achieve weight goals
4. Address individual nutritional needs and respect patients willingness to change

The ADA recommends that A1C levels be below 7%, BP below 140/80 mmHg, LDL below 100 mg/dL, triglycerides below 150 mg/dL, and HDL cholesterol above 40 mg/dL.

Meal Planning:

* Protein intake 15-20% of daily kcal (10% if neuropathy). Should be normal intake unless renal disease is present
* 130+ g/day carbohydrate, individualized based on blood glucose levels. Carbohydrate and monounsaturated fat together should provide 60–70% of energy intake
* Lower saturated fat and cholesterol intake to improve lipid profiles
* Adequate mineral supplementation (deficiencies in Mg, Zn, and K can cause carbohydrate intolerance)
* Reduce alcohol intake which can contribute to hypo/hyperglycemia (2 drinks for adult men)
* Carbohydrate counting (starches, fruits, low fat milk/yogurt, sweets), exchange lists

(Most dietary recommendations are the same as those for the general public)

Physical activity, if able, can be very beneficial to improving glycemic control and lessening the complications associated with diabetes mellitus.

http://care.diabetesjournals.org/content/27/suppl\_1/s36.full

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. Nutrition Assessment
2. *Assess Armando’s height and weight. Calculate his BMI.*

height: 5’11” = (71 in)(2.54 cm/in)(1m/100cm) = 1.8 m

weight: (165 lbs)(1 lb/2.2kg) = 75 kg

BMI (kg/m^2) = (75kg)/(1.8m)^2 = 23.1 kg/m^2

1. *Identify any abnormal laboratory values measured upon his admission. Explain how they may be related to his newly diagnosed DM.*

|  |  |  |
| --- | --- | --- |
| **Laboratory Value** | **Normal Range** | **Armando’s Value** |
| Sodium (mEq/L) | 136-145 | 130 |
| CO2 (mEq/L) | 23-30 | 31 |
| Glucose (mg/dL) | 70-110 | 683 |
| Phosphate (mg/dL) | 2.3-4.7 | 2.1 |
| Osmolality (mmol/kg/H20) | 285-295 | 306 |
| Cholesterol (mg/dL) | 120-199 | 210 |
| Triglycerides (mg/dL) | 40-160 | 175 |
| HbA1c (%) | 3.9-5.2 | 12.5 |
| C-peptide (ng/mL) | 0.51-2.72 | 0.09 |
| ICA | - | + |
| GADA | - | + |
| IAA | - | + |
| pH (urinalysis) | 5-7 | 4.9 |
| Protein (mg/dL) | - | +1 |
| Glucose (mg/dL) | - | +3 |
| Ketones | - | +4 |
| Prot chk | - | tr |
| pH (ABGs) | 7.35-7.45 | 7.31 |
| HCO3 (mEq/L) | 24-28 | 22 |

These laboratory values are indicative of Armando’s type 1 diabetes diagnosis. Armando’s deficiency in Na+ and phosphorus is caused by his total body water reduction which depletes potassium, sodium, magnesium, and phosphorus levels. His elevated CO2 levels is attributed to DKA. Armando’s extremely high blood glucose levels signify his inability to produce insulin to propagate the absorption of glucose. DKA and hyperglycemic conditions cause alterations in the bodies osmolality. Armando has an increased lipid profile due to his previous nutrition intake which consisted of some processed foods. HbA1c, C-peptide, IAA, GADA, and ICA are all markers for type 1 diabetes and are present because of insulin resistance. DKA causes an acidic profile in the urine. The presence of glucose, ketones, and protein in the urine can signify kidney damage (protein) and hyperglycemia (ketones). DKA also causes a slight decrease in blood pH and depleted levels of HCO3. All of these laboratory values clearly indicate Type 1 Diabetes for Armando.

1. *Determine Armando’s energy and protein requirements. Be sure to explain what standards you used to make this estimation. Would you recommend that he either gain or lose weight in the future?*

**Energy requirements**

REE= 10 x wt (kg) + 6.25 x ht (cm) - 5 x age (yrs) + 5

REE = 10 x 75 + 6.25 x 180 - 5 x 32 + 5 = 1,720 kcal

TEE= 1720 x 1.0 = 1720 kcal (resting) to 1720 x 1.4 = 2408 kcal (sedentary)

**Protein requirements**

Pro = 0.8g/kg

Pro = 0.8(75)= 60g of protein/day

Pro = 60g x 4 kcal = 240 kcal/day

Armando has a BMI of 23.1 kg/m^2 which is in the normal range. He does not need to lose weight, but he should alter his diet for nutritious content. He needs to increase his caloric intake by about 500 kcal, and his lipid profile is high, so the intake of “healthy” fats like avocados and peanut butter could decrease his saturated fat intake. Eating out 3-4 times per week should be reduced, as processed food is a source of elevated sodium and fat intake. He also should try to increase more fiber dense foods to help with his DM complications.

1. Nutrition Diagnosis
2. *Prioritize two nutrition problems and complete the PES statement for each.*
3. **P**: Altered nutrition-related laboratory values (NC-2.2) related to poor management of DM and improper medication use **E**: as evidenced by **S**: elevated serum glucose level of 610 mg/dL.
4. **P:** Food- and nutrition-related knowledge deficit (NB-1.1) related to **E:** lack of knowledge of T1DM after being diagnosed **S**: as evidenced by symptoms of polyuria, polydipsia, polyphagia, fatigue, and weight loss.
5. Nutrition Intervention
6. *Determine Armando’s initial CHO prescription using his diet record from home as a guideline, as well as your assessment of his energy requirements. What nutrition education material would you use to teach Armando CHO counting?*

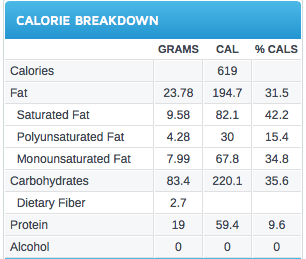
In Armando’s typical diet, he consumed about 83.4 grams/220 kcal of carbohydrate per day.

REE = 10 x 75 + 6.25 x 180 - 5 x 32 + 5 = (1,720 kcal)(1.4) = 2408 kcal

In patients with type 1 diabetes, at least 130+ grams of carbohydrate are recommended per day to prevent hypoglycemia. The medical professionals recommended that Armando stick to a consistent carbohydrate diet of 70-80 g breakfast + lunch, 85-95 g dinner, and 30 g PM snack. This consistency will introduce increased glycemic control. On average, Armando should aim to intake 195 grams of carbohydrate per day = 780 kcal carbohydrate per day (33% daily kcal).

1. *Armando’s usual breakfast consists of two slices of toast, butter, 2 tbsp jelly, 2 scrambled eggs, and orange juice (1 c). Using the ICR that you calculated in question #7, how much Novolog should he take to cover the carbohydrate in this meal?*

ICR: 9-12 grams of carbohydrates covered by each unit of insulin



(83.4 g carb)(1 unit insulin/9 g carb) to (83.4 g carb)(1 unit insulin/12 g carb) = 7-9 units

Armando should take 7-9 units of insulin (about 8 units) to cover the carbohydrate supplemented by his breakfast.

**Source:** fitday.com

1. *Using the ADA guidelines, what would be appropriate fasting and postprandial target glucose levels for Armando?*

The ADA recommends a preprandial glucose of 70-130 mg/dL or 5.0-7.2 mmol/L and a postprandial glucose of <180 mg/dL or <10.0 mmol/L (Nelms, 494).

**Source:** Nelms, M. N., Sucher, K., Lacey, K., & Roth, S. L. (2011). *Nutrition Therapy and Pathophysiology* (2nd ed.). Belmont, CA: Brooks/Cole Cengage Learning.

1. Nutrition Monitoring and Evaluation
2. *Write an ADIME note for your initial nutrition assessment.*

|  |  |
| --- | --- |
| **Assessment** | * 32 year old, male, hispanic, smoker 1 ppd x 10yr, works 8-7 M-F some weekends, daily alcohol usage * Family history: MI father, Ovarian cancer + T2DM mother * serum glucose of 610 mg/dL upon admittance, groggy and almost unconscious, Glasgow Coma Scale 13 * Vitals- 99.6 F, pulse 100, resp rate 24, BP 78/100, 5’11”, 165 lbs, tachycardia, rapid respirations * Lab data-sodium 130 mEq/L, Co2 31 mEq/L, Glucose 683 mg/dL, Phosphate 2.1 mg/dL, Osmolality 306 mmol/kg/H2O, Cholesterol 210 mg/dL, Triglycerides 175 mg/dL, HbA1c 12.5%, C-peptide 0.09 ng/mL, ICA/GADA/IAA +, Urine pH 4.9, Protein +1 mg/dL, Glucose +3 mg.dL, Ketones +4, Prot chk tr, ABG pH 7.31, HCO3 22 mEq/L * Medical dx: T2DM (1 yr ago)-improper metformin use |
| **Diagnosis** | Altered nutrition-related laboratory values (NC-2.2) related to poor management of DM and improper medication use as evidenced by elevated serum glucose level of 610 mg/dL.  Food- and nutrition-related knowledge deficit (NB-1.1) related to lack of knowledge of T1DM after being diagnosed as evidenced by symptoms of polyuria, polydipsia, polyphagia, fatigue, and weight loss.  (Type 1 Diabetes final diagnosis) |
| **Intervention** | -2400 kcal diet (increase prior kcal intake slightly)  -60 grams of protein/day  -Increase fiber intake through fruits and vegetables  -Consume less saturated fats/processed foods/cholesterol in order to get lipid profile into normal range  -eat small frequent meals (4-5 per day)  -monitor blood glucose 3x day  -37.5-52.5 units of glargine per day  -2200 mL fluid requirement  -begin to introduce light exercise (30 min/day) with proper monitoring  -70-80 g breakfast + lunch, 85-95 g dinner, and 30 g PM snack (carbohydrate counting)  -substitute whole grain carbohydrates, legumes  -decrease alcohol intake to 4 days/week instead of 7 days  Goal Lab Levels:  A1C levels be below 7%, BP below 140/80 mmHg, LDL below 100 mg/dL, triglycerides below 150 mg/dL, and HDL cholesterol above 40 mg/dL |
| **Monitor/Evaluation** | * SMBG- 3x a day * Lab values- blood glucose, ketones, lipids, protein, HbA1c, C-peptide, urinalysis, micronutrients * Food and exercise journal * Analyze adherence to diet and glycemic response |

1. *Armando comes back to the clinic 2 weeks after his diagnosis. List the important questions you will ask him in order to plan the next steps for providing the additional education that he might need.*

* Have you felt comfortable about self monitoring your glucose levels?
* Are there alterations needed in your diet to keep you blood glucose levels more stable?
* Are you able to exercise without your blood glucose levels decreasing rapidly?
* Have you felt dizzy, nauseous, or lethargic at any times during the day?
* Do you need extra guidance to plan your meals to meet your nutrition goals?
* Have you been able to count carbohydrates to keep your glucose levels adequate?
* Have you been selecting high fiber foods and controlling your fat intake?
* Has the insulin schedule been easy to follow and does it effectively lower your glucose?

1. *Armando states that he would like to start exercising again as he is feeling better. He is used to playing tennis several times per week as well as cycling at least 2 days per week for over 20 miles each time. Again, he expresses his concern regarding low blood sugar. How would you counsel Armando regarding his physical activity, his diet, and his blood glucose monitoring?*

Exercise can be very beneficial for establishing glycemic control and increasing glucose utilization in the muscles. Since Armando is motivated to begin exercising again, it is important that he monitor his blood glucose levels very carefully as to prevent hypoglycemia. Hypoglycemia consists of a blood glucose level below 70 mg/dL and correlates to symptoms such as sweating, nausea, and weakness. Physical activity drops blood glucose levels and the dangers are that the symptoms may be unrecognizable because they coincide with those that occur naturally in physical activity. Some efficient ways to control these levels are to eat several small meals throughout the day to keep levels mediated, as well as assure that a meal is eaten prior to physical activity that contains carbohydrates. A blood glucose of 100 mg/dL before exercise leaves a margin for the blood glucose to drop without developing hypoglycemia. Moderate-intensity exercise increases glucose uptake by 2–3 mg · kg−1 · min−1 above usual requirements (American Diabetes Association). It is also recommended to avoid exercising during the peak action of an insulin regimen as this lowers blood glucose levels. Armando can eat prior to exercise, monitor his blood glucose levels before exercising, and for emergencies sake always have carbohydrate/sugar sources on hand such as glucose tablets or gel, candy, fruit juices, and soft drinks. If these alterations still are not enough to prevent his anxiety, Armando should bike 10 miles instead of 20 minutes or just try to lessen the severity of his exercise to cater to his blood glucose levels.

**Source:** Avoiding Low Blood Glucose Levels During Exercise. *One Touch.* Retrieved on 17 Nov 2014 from http://www.onetouch.com/articles/lowbloodglucoselevels

1. *Armando states that one of his friends has talked about using the glycemic index as a way to manage his diabetes. He says that he has also seem some nutrition programs advertise their food products as being “low glycemic index” on TV. Explain glycemic index, glycemic load, and how he might use this information within his nutrition therapy plans.*

Glycemic index serves as a comparative measure between foods containing the same amount of carbohydrate and their potential to raise blood glucose levels. Describing different carbohydrates based on simple vs. complex was not an adequate description because their effect on blood glucose levels varies between carbohydrates deemed “complex.” Glycemic index is measured by pre and post blood glucose measurements before eating about 50 grams of a certain carbohydrate. The glycemic load quantifies the effect the amount of carbohydrate has on blood glucose levels, inclusive of the glycemic index of the given food. To calculate the glycemic load, the glycemic index is multiplied by the amount of carbohydrate in grams and divided by 100. It summarizes the quality and quantity of carbohydrates in an individual food as well as an entire diet.

Maintaining a low glycemic index is observed to improve blood glucose control in individuals with diabetes mellitus. In order to adequately decrease glycemic load, some strategies include (Higdon, 2005)

* Increasing the consumption of whole grains, nuts, legumes, fruits, and non-starchy vegetables
* Decreasing the consumption of starchy high-glycemic index foods like potatoes, white rice, and white bread
* Decreasing the consumption of sugary foods like cookies, cakes, candy, and soft-drinks

Some factors that can alter glycemic responses to foods, include “the amount of carbohydrate, type of sugar (glucose, fructose, sucrose, lactose), nature of the starch (amylose, amylopectin, resistant starch), cooking and food processing (degree of starch gelatinization, particle size, cellular form), and food form, as well as other food components (fat and natural substances that slow digestion—lectins, phytates, tannins, and starch-protein and starch-lipid combinations)” (American Diabetes Association). There is a table provided that details the serving side and glycemic index/load of several foods. Armando could utilize these recommendations, as well as the table to plan meals that will control his glycemic levels and ultimately suppress his diabetic complications.

**Source:** Higdon, J. PhD. Glycemic Index and Glycemic Load. (2005). *Linus Pauling Institute Micronutrient Information.* Retrieved on 17 Nov 2014 from <http://lpi.oregonstate.edu/infoce> neter/foods/grains/gigl.html

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