# Case Study: New-Onset Diabetes: How to Tell the Difference Between Type 1 and Type 2 Diabetes

Joseph Largay, PAC, CDE

## PRESENTATION

L.C., a 25-year-old white woman, presented to the Emergency Department reporting that she was in good health until ~ 3 weeks ago, when she began experiencing polyuria and polydipsia. She had had an unintentional weight loss of ~ 10 lb in the past 2 months.

She denied visual disturbances, nausea, vomiting, abdominal pain, dysuria, history of the same symptoms, and recent illness. She also denied alcohol, tobacco, and illicit drug use. Her medications included only oral birth control pills, and she was a competitive volleyball player. Family history was negative for diabetes, hypertension, coronary artery disease, and autoimmune diseases.

Physical exam revealed a blood pressure of 129/82 mmHg, pulse of 88 bpm, and respiration rate of 20 breaths per minute. L.C.'s weight was 62 kg, and her BMI was 21 kg/m$^2$. She seemed healthy and aware. Her eyes, throat, and thyroid were normal, and her neck was negative for lymphadenopathy. She had a regular heart rate and rhythm, negative for murmurs, rubs, or gallops, with normal first and second heart sounds. Lungs were clear with normal respirations. Abdominal exam revealed normal breath sounds and no tenderness, guarding, or rebound. Extremities were normal, and neurological motor and sensory functioning was intact.

Her fingerstick glucose on admission was 571 mg/dl, and subsequently measured serum glucose was 617 mg/dl. Testing revealed a sodium level of 133 mEq/l (normal 135–145), potassium of 4.0 mEq/l (normal 3.5–5.0), chloride of 99 mEq/l (normal 96–108), carbon dioxide of 25 mEq/l (normal 21–30), blood urea nitrogen (BUN) of 18 mg/dl (normal 7.0–20.0), and creatinine of 0.8 mg/dl (normal 0.4–10). Serum acetone was positive at 1:2. Urinalysis revealed a specific gravity of 1.010 (normal 1.005–1.300), glucose of 3+, ketones of 2+, and pH of 5.5 (normal 5.0–8.0), with other results normal. Arterial blood gas was not performed. A complete blood count was normal.

L.C. was treated with intravenous (IV) saline and insulin. Her glucose was corrected to 191 mg/dl. She was prescribed metformin, 500 mg twice daily, and was discharged and instructed to follow up with her primary care provider (PCP).

She returned to the Emergency Department 3 days later complaining of continued hyperglycemia with fingerstick readings > 400 mg/dl. She had not yet seen her PCP.

Physical exam revealed a blood pressure of 116/83 mmHg, pulse of 88 bpm, and respirations of 18 breaths per minute. She appeared otherwise healthy and alert, and the remainder of her physical exam was normal.

Her glucose on admission was 418 mg/dl, and laboratory test results included a sodium level of 133 mEq/l (normal 135–145), potassium of 3.2 mEq/l (normal 3.5–5.0), chloride of 98 mEq/l (normal 96–108), carbon dioxide of 26 mEq/l (normal 21–30), BUN of 12 mg/dl (normal 7.0–20.0), and creatinine of 0.7 mg/dl (normal 0.4–10). Urinalysis showed a specific gravity of 1.010 (normal 1.005–1.300), glucose of 3+, ketones of 1+, and pH of 6.0, (normal 5.0–8.0).

Again, L.C. was treated with IV saline and insulin. Her glucose was corrected to 216 mg/dl. Her metformin was increased to 1,000 mg twice daily, and she was discharged and instructed to follow up with her PCP.

She saw the PCP the next day and had glipizide added to her metformin. After 2 more days, her PCP added glargine insulin, 10 units at bedtime, and lispro insulin, 4 units before meals three times per day.

After insulin initiation, her fingerstick glucose levels were vastly improved, at 47–126 mg/dl. She was continued on metformin and referred to an endocrinologist.

At the endocrinology clinic, tests revealed an A1C of 9.5%, random glucose of 125 mg/dl, C-peptide level of 1.1 ng/ml (normal 1.1–4.4), glutamic acid decarboxylase-65 (GAD-65) antibodies of 0.28 nmol/l (normal < 0.02), total cholesterol of 156 mg/dl, HDL cholesterol of 71 mg/dl, and non-HDL cholesterol of 85 mg/dl. The endocrinologist stopped the metformin and educated L.C. about basal-bolus insulin and carbohydrate counting. After 3 months on insulin, her A1C was 5.8%, and she had regained 2 kg.

## QUESTIONS

1. What percentage of adults with newly diagnosed diabetes have type 1 diabetes?
2. What tests should be performed to confirm autoimmune diabetes?
3. What features are suggestive of type 1 diabetes or latent autoimmune diabetes in adults (LADA)?

## COMMENTARY

With the increase in the incidence of type 2 diabetes in children and adolescents and of type 1 diabetes in adults, making a correct diagnosis has become more challenging. Type 1 diabetes results from autoimmune destruction of the pancreatic β-cells that produce insulin and can occur at any age.[1] When it occurs in adults, type 1 diabetes can progress to total insulin deficiency at different rates. The slowly progressive form is known as LADA (sometimes called "type 1.5 diabetes"). There is also a more rapidly progressive form that mimics type 1 diabetes seen in children.

So how do clinicians distinguish between type 1 and type 2 diabetes? Many providers seem to make the diagnosis subjectively, perhaps only taking into account the patient's age. Researchers differ on whether clinical presentation is a reliable indicator of diabetes type.

Authors of one study[2] stated that clinical features that may aid in the diagnosis of type 1 diabetes include acute onset of polyuria and polydipsia, unintentional weight loss, personal or family history of autoimmune disorders, and a BMI < 25 kg/m². However, the authors of another study[3] concluded that neither age, BMI, nor clinical presentation should be used for diagnosis.

Diabetic ketoacidosis (DKA) is a common feature but may not be present early in the presentation, occurring in only 17–25% of those with new-onset diabetes.[4]

Patients with LADA appear to have a lower prevalence of the metabolic syndrome. While comparing patients with new-onset type 1 and type 2 diabetes, one study[5] found those with LADA had a lower BMI, lower triglycerides and total cholesterol, higher HDL, and a lower prevalence of hypertension than those with type 2 diabetes. At diagnosis, fasting C-peptide levels were lower in LADA than in type 2 diabetes, perhaps confirming the typical observation of little or no response to oral agents and the need for insulin earlier in the course of the disease.

Antibody testing can assist in diagnosis. Autoimmune antibodies associated with type 1 diabetes include GAD-65, islet cell antibodies (ICAs), insulinoma-associated antigen (IA-2A), and insulin antibodies (IAAs). Of these, GAD-65 and ICAs are more common in LADA, whereas IA-2A and IAAs are more common in children with type 1 and less prevalent in adult-onset type 1 diabetes.[3,6]

In one study of patients recently diagnosed clinically with type 2 diabetes,[3] 29% were found to be positive for at least one of four antibodies. Recently, antibodies against zinc transporter 8 have been shown to be significantly associated with the clinical onset of type 1 diabetes and may be positive in otherwise antibody-negative type 1 diabetes.[7]

## CLINICAL PEARLS

- LADA can be present in up to 30% of patients diagnosed clinically with type 2 diabetes.
- Many patients present like the one in this case, with typical symptoms of polyuria, polydipsia, and weight loss and with no signs of metabolic syndrome and no family history of type 2 diabetes. L.C.'s continued symptomatic hyperglycemia and lack of response to metformin should have led the clinician to consider the possibility of type 1 diabetes. Inappropriate diagnosis may lead to delayed initiation of insulin treatment and prolonged symptomatic hyperglycemia.
- Autoantibody testing can assist in obtaining a definitive diagnosis and should be performed more often.

## REFERENCES

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*Joseph Largay, PAC, CDE, is a clinical instructor in the Department of Medicine at the University of North Carolina in Chapel Hill.*