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Case Report

Double diabetes in a newly diagnosed 19-year-old female with obesity: Case report and treatment strategies

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Abstract

Double diabetes (DD) is a complex metabolic condition where characteristics of both type 1 diabetes (T1D) and type 2 diabetes (T2D) coexist. It typically presents in individuals with autoimmune diabetes who also display significant insulin resistance due to obesity or other metabolic factors. It is increasingly identified in young adults due to the global rise in obesity. This article describes the case of a 19-year-old female with obesity who presented with newly diagnosed diabetes, showing features of both T1D and T2D, focusing on diagnostic approaches, treatment strategies, and the critical role of healthy lifestyle interventions, including weight loss and the use of metformin. Laboratory investigations, clinical presentations, and treatment strategies are outlined to highlight the complexity of managing DD in adolescents.

Keywords: diabetes type 1, diabetes type 2, double diabetes, obesity, weight loss

Introduction

Double diabetes (DD) is an emerging clinical condition where features of both type 1 diabetes (T1D) and type 2 diabetes (T2D) coexist in the same patients. The rise in obesity among adolescents and young adults has blurred the classical distinctions between type 1 and type 2 diabetes. It typically occurs when individuals with autoimmune destruction, as seen in T1D, also develop insulin resistance, a hallmark of T2D [1, 2]. This phenomenon is becoming more common due to rising rates of obesity and sedentary lifestyles, particularly among adolescents and young adults [3].

The overlap of these two distinct diabetes types complicates diagnosis and treatment, as patients require both exogenous insulin to compensate for β-cell destruction and insulin sensitizers to manage insulin resistance. Failure to address both components can lead to poor glycemic control, increased insulin requirements, and a higher risk of long-term complications such as cardiovascular disease, neuropathy and nephropathy.

Diagnosing double diabetes involves a comprehensive evaluation that includes autoimmune markers to confirm type 1 diabetes (T1D) and metabolic indicators to identify insulin resistance [4, 5]. Accurate diagnosis and comprehensive treatment (multifaceted approach – insulin therapy, metformin), and lifestyle modifications aimed at improving insulin sensitivity and promoting weight loss are all essential to optimize outcomes and prevent long-term complications [6–8]

This article presents the case of a 19-year-old female newly diagnosed with double diabetes, highlighting diagnostic challenges, treatment strategies, and the importance of sustainable lifestyle modifications for optimal long-term outcomes [9].

Case presentation

A 19-year-old female presented to the clinic with a three-month history of fatigue, excessive thirst (polydipsia), frequent urination (polyuria), and unintentional weight loss of approximately six kilograms. Despite this weight loss, her body mass index (BMI) remained elevated at 34.2 kg/m^2, placing her in the obesity category (obesity class I). She had a strong family history of type 2 diabetes in both parents and reported a sedentary lifestyle with high consumption of processed foods and sugar-sweetened beverages. Physical examination revealed elevated blood pressure at 140/88 mmHg and hyperpigmented velvety plaques consistent with acanthosis nigricans on the neck and axillae. There were no signs of diabetic ketoacidosis.

Laboratory tests showed a fasting blood glucose level of 11.9 mmol/L and an HbA1c level of 9.8%. Her fasting C-peptide level was 2.5 ng/mL, and fasting insulin was 18 µU/mL, both at the upper limit of normal, indicating preserved insulin production but significant resistance to its effects. The HOMA-IR value was elevated at 4.5. Autoimmune screening revealed positive GAD-65 and islet cell antibodies, confirming autoimmune involvement. Lipid testing showed a total cholesterol level of 5.43 mmol/L, LDL cholesterol of 3.75 mmol/L, HDL cholesterol of 0.90 mmol/L, and triglycerides of 2.82 mmol/L. Urine ketones were absent, and microalbuminuria was within normal limits. The laboratory investigations are shown in Table 1.

Diagnosis

The diagnosis of double diabetes was made based on her clinical features, laboratory profile, and risk factors. The detection of autoimmune antibodies confirmed the presence of type 1 diabetes, while obesity, acanthosis nigricans, hyperinsulinemia, and a markedly elevated HOMA-IR index indicated insulin resistance characteristic of type 2 diabetes. The coexistence of these features distinguished her condition from either form in isolation and necessitated a dual therapeutic approach.

Treatment strategies

Management began with a basal-bolus insulin regimen to achieve rapid glycemic control. Basal insulin, initiated as glargine at a starting dose of 0.3 units per kilogram per day, was complemented by pre-meal bolus doses of rapid-acting insulin lispro, titrated according to carbohydrate intake and glucose monitoring. This allowed for precise glycemic targeting, with fasting glucose levels maintained between 4.4 and 7.2 mmol/L and postprandial levels below 9.99 mmol/L.

To address her significant insulin resistance, metformin therapy was introduced early. Starting at 500 mg daily, it was gradually increased to 1000 mg twice daily to minimize gastrointestinal side effects. The addition of metformin aimed to enhance hepatic and peripheral insulin sensitivity, decrease total insulin requirements, and support weight loss efforts.

Lifestyle modification formed the foundation of long-term care. She received tailored dietary counseling focused on creating a moderate caloric deficit with the goal of losing 10–15% of her body weight within the first year. Her diet emphasized low-glycemic-index carbohydrates, ample fiber from vegetables and whole grains, lean protein, and healthy unsaturated fats, while restricting saturated fats, refined sugars, and processed snacks. To increase physical activity, she was encouraged to engage in at least 150 minutes of moderate-intensity aerobic exercise per week, such as brisk walking or swimming, and to incorporate resistance

Table 1: Laboratory investigations.

Test	Result	Reference range
Fasting blood glucose	11.9 mmol/l	4.1–5.9 mmol/l
HgA1C	9.8%	<5.7%
Fasting C-peptide	2.5 ng/mL	0.8–3.1 ng/mL
Insulin level	18 uU/mL	2–20 uU/mL
GAD-65 Antibodies	Positive	Negative
Islet cell antibodies (ICA)	Positive	Negative

Table 1: Continued.

Test	Result	Reference range
HOMA-IR (insulin resistance index)	4.5	<2.0
BMI	34.2 kg/m²	18.5–24.9 kg/m² (normal)
Total cholesterol	5.43 mmol/L	4.1–5.2 mmol/L
LDL	3.75 mmol/L	2.2–3.7 mmol/L
HDL	0.90 mmol/L	1.0–2.0 mmol/L
Triglycerides	2.82 mmol/L	0.3–1.7 mmol/L
Urine ketones	Negative	Negative
Microalbuminuria	25 mg/L	<30 mg/L

training two to three times weekly to improve muscle mass and metabolic flexibility.

Cardiometabolic risk factors were addressed concurrently. Given her dyslipidemia, atorvastatin at 10 mg daily was prescribed to reduce LDL cholesterol and triglycerides. Blood pressure was monitored closely, with lifestyle measures prioritized before considering antihypertensive therapy. She was also provided with a continuous glucose monitoring device, which enabled her to track daily glucose trends and make informed adjustments to her insulin dosing and dietary choices.

Follow-up visits were scheduled every three months to review glycemic control, lipid levels, blood pressure, and adherence to lifestyle recommendations. These consultations also provided opportunities for ongoing diabetes education, psychological support, and reinforcement of self-management skills.

Follow-up and outcomes

At her six-month review, the patient demonstrated substantial improvement in metabolic control. Her HbA1c had fallen to 7.2%, fasting glucose levels averaged 5.0–7.0mmol/l, and postprandial peaks were significantly reduced. She had lost eight kilograms, which lowered her BMI and improved her waist-to-hip ratio. Her daily insulin requirement had decreased by almost 30%, reflecting improved insulin sensitivity, and lipid parameters showed a meaningful improvement, with LDL cholesterol reduced to 1.29 mmol/L and triglycerides to 1.8 mmol/L. She reported greater energy, improved dietary habits, and a consistent exercise routine.

Discussion

Double diabetes presents diagnostic and therapeutic challenges, as patients require management targeting both autoimmune β-cell destruction and insulin. Early introduction of insulin remains necessary to control hyperglycemia and prevent metabolic decompensation; however, the addition of insulin-sensitizing agents, such as metformin, can help reduce insulin doses and mitigate the weight gain associated with insulin therapy. Sustainable lifestyle modification is the cornerstone of long-term success, not only for glycemic control but also for reducing cardiovascular risk, which is significantly elevated in this population [1, 2].

The multidisciplinary approach used in this case—combining endocrinology, nutrition, physical activity planning, and cardiometabolic risk management—demonstrates that meaningful improvements are achievable within months when patients receive structured support. This case highlights the importance of recognizing double diabetes in obese adolescents with new-onset diabetes. Combining insulin therapy, metformin, and lifestyle modifications improves glycemic control while addressing underlying metabolic dysfunction [8]. However, ongoing follow-up is crucial, as the balance between insulin therapy and insulin resistance may shift over time, and cardiovascular risk factors require continuous monitoring. Early intervention can improve glycemic control and reduce long-term complications (such as cardiorenal metabolic complications) [6].

Key management principles:

1. Early combination therapy: use insulin to control hyperglycemia and metformin to combat insulin resistance;

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2. Personalized lifestyle changes: emphasize sustainable weight loss and physical activity;
3. Monitor for complications: screen for cardiovascular risks and microvascular complications regularly.

Learning points

1. *Diagnosis of double diabetes*

Recognize dual features: double diabetes involves both autoimmune markers (T1D – autoimmune markers GAD-65 and Islet cell antibodies (ICA) and clinical/metabolic features of insulin resistance (c-peptide, fasting insulin, HOMA-IR), together with the comprehensive metabolic panel: HbA1c, lipid profile and glucose monitoring.

2. *Understanding the pathophysiology*

Progressive loss of insulin production, due to autoimmune β-cell destruction in type 1 diabetes (T1D), obesity, and a sedentary lifestyle, increases peripheral insulin resistance, leading to hyperinsulinemia and metabolic dysfunction.

3. *Treatments strategies*

Combination therapy approach – Insulin therapy (Basal bolus regimen for glucose control and individualized insulin adjustments – based on carbohydrate counting and physical activity) together with metformin (reduces insulin resistance and lowers insulin requirements

4. *Role of lifestyle modification*

A healthy diet (low-glycemic index, high-fiber and portion-controlled meals), regular exercise (at least 150 minutes/week of aerobic exercise plus resistance training) and weight management (aim for 5–10%weight loss to improve insulin sensitivity)

5. *Monitoring and follow-up*

Regular HbA1c checks (every 3 months to assess glycemic control), continuous glucose monitoring (for better glycose tracking and pattern identification) and screening for complications (regular assessment of lipids, blood pressure, and microvascular risks – retinopathy, nephropathy, neuropathy)

6. *Multidisciplinary care approach*

Collaborations between endocrinologists, dietitians and exercise specialists to ensure comprehensive, patient-centered care, as well as patient education – empowering the patient to manage glucose levels, diet and physical activity effectively.

7. *Long-term considerations*

Cardiovascular risk reduction through monitoring and treatment of hypertension and dyslipidemia. Psychosocial support through addressing emotional and behavioral aspects of living with chronic conditions. Regular screenings and proactive management to prevent long-term complications.

These learning points emphasize the importance of early recognition, combined treatment strategies, and holistic lifestyle interventions for effectively managing double diabetes.

Conclusion

Double diabetes presents diagnostic and therapeutic challenges. This case highlights the need for early recognition of double diabetes, especially in young individuals with obesity who present with features of both type 1 and type 2 diabetes. A multidisciplinary, individualized approach that integrates insulin therapy, insulin sensitizers such as metformin, and intensive lifestyle modification can achieve significant improvements in glycemic control, weight, and cardiometabolic health. Early diagnosis and comprehensive management can significantly improve outcomes and reduce long-term complications in young adults with this complex condition. Given the rising prevalence of obesity worldwide, healthcare providers should be vigilant for this hybrid condition and address it proactively to prevent long-term complications. Further research is needed to optimize treatment strategies for this growing population.

Conflict of interest

The authors declare no conflict of interest.

Consent to participate

Written informed consent was obtained from all the participants.

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