

中文題目：生酮飲食導致之酮酸中毒 —— 一個罕見代謝性酸中毒的原因

英文題目：A rare cause of metabolic acidosis: ketoacidosis in non-diabetic patients with low carbohydrate diet

作者：張立昀¹，葉盈志³，黃道揚²，林麗玫²

服務單位：¹高雄醫學大學附設醫院內科部，²高雄醫學大學附設醫院腎臟內科，³安泰醫療社團法人安泰醫院腎臟內科

Abstract:

It is believed that low-carbohydrate diets work best in reducing body weight. However, prolonged lacking of glucose intake can force body into ketogenesis, causing high anion gap metabolic acidosis. It is a rare condition in non-diabetic patients.

Case presentation:

A 47-year-old male who denied any underlying disease started low-carbohydrate diet(LCHD) for sugar and weight control. He visited our hospital due to progressive shortness of breath and generalized edematous change. His initial serum pH was 7.145, bicarbonate (HCO_3^-) was 7.3 mmol/L and base excess of -19.9, combined with severe azotemia (BUN: 152.0 mg/dL, Creatinine: 16.09 mg/dL) and hyperkalemia (7.5 mmol/L). Point of blood sugar was 71 mg/dL and the blood HbA1c was 6.2%. Emergent hemodialysis was initiated, but following up arterial-blood gas(ABG) showed persisted metabolic acidosis (HCO_3^- : 17.3→9.8 mmol/L). Therefore, etiology of metabolic acidosis was surveyed, which were compatible with ketoacidosis (Table 1). He was then transferred to intensive care unit(ICU) for continuous veno-venous hemofiltration(CVVH) with glucose water and insulin prescribed intravenously. The severe metabolic acidosis was gradually recovered within 3 days after discontinuation of CVVH.

Discussion:

We reported a case of a non-diabetic young male who developed ketoacidosis because of abnormal diet choice. The risk factors^{1,2} of ketogenesis in non-diabetic patients include current illness such as infection, prolonged starvation, low carbohydrate intake, heavy alcohol intake, chronic substance abuse, intake of sodium-glucose cotransporter-2 inhibitors, physical or psychological trauma, ketosis-prone diabetes, and pregnant or lactating women in relative insulin insufficiency status.

The clinical symptoms of LCHD-associated ketoacidosis are similar to diabetic ketoacidosis(DKA)^{1,3}, including malaise, dyspnea, abdominal pain, nausea and

vomiting. The laboratory data of LCHD-associated ketoacidosis were described as: high anion-gap(AG) metabolic acidosis with elevated blood ketone level, varied in glucose level and acidemia.

The management to acidemia in all forms of ketoacidosis is to correct the related underlying disease, which slows the rate of ketosis and allows peripheral tissue and brain to metabolize ketone bodies.

In our case, the possibility of diabetic ketoacidosis was not initially considered because low point of finger sugar and relative low blood HbA1c level. He responded well under CVVH treatment and glucose water supplement.

Conclusion:

Ketogenic diet such as low-carbohydrate diet may induce ketoacidosis in persons with a pre-existing risk factor, and have adverse metabolic sequelae. Physician should keep high awareness on high risk population especially chronic kidney disease(CKD) patient since uremic status will complicate the detection of LCHD-associated ketoacidosis.

Keywords: Non-diabetic ketoacidosis, ketoacidosis, Low-carbohydrate diet, LCHD

Reference:

1. Ketoacidosis due to a Low-carbohydrate Diet in an Elderly Woman with Dementia and Abnormal Eating Behavior; Intern Med 56: 2671-2675, 2017
2. Ketoacidosis associated with low-carbohydrate diet in a non-diabetic lactating woman: a case report; von Geijer and Ekelund Journal of Medical Case Reports (2015) 9:224
3. A rare cause of metabolic acidosis: ketoacidosis in a non-diabetic lactating woman; ID: 17-0073; September 2017

Table 1: Blood test of this patient

	Reference range	Day 1 pre-HD	Day 1 post-HD	Day 2 pre-HD	Day 2 post-HD	Day 3 CVVHD
pH	7.35~7.45	7.145	7.282	7.196	7.296	7.357
pCO ₂ (mmHg)	35~48	21.6	37.5	26.0	24.7	33.4
pO ₂ (mmHg)	83~108	66.2	50.8	62.2	124.2	98.1
HCO ₃ ⁻ (mmol/L)	22~26	7.3	17.3	9.8	11.8	18.3
Base excess(mmol/L)		-19.9	-8.7	-16.7	-13.1	-6.1
Na (mmol/L)	136~144	134		138	139	137

K (mmol/L)	3.5~5.1	7.5	5.6	6.3	5.8	4.3
Cl (mmol/L)		105		103	105	107
Anion gap (AG)		21.7		25.2	22.2	11.7
Glucose (mg/dL)	65~109	71	76	72	86	59
BUN(mg/dL)	8~20	152.0	124.5	126.6		88.9
Creatinine(mg/dL)	0.64~1.27	16.09		13.56		9.91
Lactate(mmol/L)	0.5~2.2			0.5	0.7	
Ketone(mmol/L)	< 0.6				5.2	0.5