Acetone Breathing Measurement for Diagnosis of Diabetic Ketoacidosis

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Abstract

Diabetic ketoacidosis (DKA) is a life-threatening complication of diabetes. β -hydroxybutyrate are the main forms of ketone and followed by acetoacetic acid and acetone. Convenient and noninvasive methods such as ketone in breath are currently developing.

The aim of this study was to evaluate exhaled acetone as indicator for diagnosis of DKA and find the best cutoff point for diagnosis of DKA.

We use metal Oxide Semiconductor (MOS) methods called G-Breath for measurement of exhaled acetone compared with serum β –hydroxybutyrate, a gold standard for diagnosis of DKA, in patients with hyperglycemia and suspected DKA. Exhaled acetone concentration will be represent as two electrical signal parameters maximum voltage (Vmax) and ratio of electrical resistance under room air and targeted gas (Ra/Rg).

There were 76 cases of diabetes patient in this study (17.1 % in DKA group). The DKA group had significant higher serum β –hydroxybutyrate(5.221±1.20 vs. 0.152±0.22, p< 0.001).We found strong correlation between exhaled acetone parameters (Vmax/(Ra/Rg)) and DKA patients, mean Vmax/(Ra/Rg)(V; Volt) in DKA and simple hyperglycemia patients were 1.82(±0.31) vs. 1.29(±0.10), p =0.002 respectively. Exhaled acetone parameters (Vmax/ (Ra/Rg)) at 1.602 volt was the best cutoff point for diagnosis of DKA (AUC=0.913, 95%CI= 0.809:1.016, sensitivity 88.9%, specificity 88.5%, p < 0.001).

Exhaled acetone measurement by Metal Oxide Semiconductor method can be used for non-invasive and convenient to diagnosis DKA.

Noninvasive diagnosis, Metal oxide semiconductor (MOS), Breath biomarkers, Breath acetone, Diabetic ketoacidosis

Ketosis and ketoacidosis is a state that results from increased ketone level in blood. Diabetic ketoacidosis (DKA) is an emergency life-threatening complication of diabetes and a consequence of lack of or not enough insulin production by beta Islet cells. Diagnosis of DKA based on criteria of severe hyperglycemia defined as blood sugar more than 250 mg/dL, metabolic acidosis defined as pH less than 7.3, serum HCO3 less than 18 meq/L and ketonemia defined as serum ketone or β -hydroxybutyrate more than 3.0 mmol/L. A Simple hyperglycemia defined as severe hyperglycemia without ketonemia and metabolic acidosis.

DKA can be found in type 1 and 2 of diabetes but predominantly occurs in patients with type 1 diabetes and poorly controlled type 2 diabetes which precipitated by stress situation such as infection, surgery or certain drug and can cause multi-organ dysfunction, morbidity and mortality. In United States, the number of case is around 100,000 people per year eventhrought in Thailand, the incidence of DKA is 7.46%(1,2,3).

Ketone bodies consist of acetone, β –hydroxybutyrate and acetoacetic acid and can convert to other forms. In DKA, β-hydroxybutyrate are the main forms followed by acetoacetic acid and acetone. Serum beta-hydroxybutyrate is the standard methods for diagnosis of DKA but it is necessary need to draw the blood of patients in each test. Urinary ketone is easy methods but more sensitive to acetoacetic acid than acetone and less sensitive to beta-hydroxybutyrate due to acetone acetate is unstable. Convenient and noninvasive methods such as ketones in breath measurement are currently developing, people who have ketones in blood known to have ketone in breath as a fruit-like odor. Acetoacetate in blood can be decarboxylased to volatile acetone in breath so acetone was chosen to be indicator for ketone breath test

Biography:

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