



## **Topic- Euglycemic Diabetic Ketoacidosis in a Patient of Type 2 DM on Alternative Medicine Precipitated by Dengue Infection**

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### **Authors' contribution**

*This work was carried out in collaboration between all authors. Authors CK and MG involved in drafting the manuscript, editing the content for critical information and analysis and interpretation of data. Author UK involved in drafting the manuscript and analysis and interpretation of data. Author AKK revised the manuscript for critical information. All authors read and approved the final manuscript.*

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**Case Study**

## **ABSTRACT**

**Aim:** Diabetic ketoacidosis (DKA) is an acute complication of diabetes mellitus (DM) that can become life-threatening. DKA is recognized by hyperglycemia, metabolic acidosis and presence of serum and/or urine ketones. DKA can occur in the setting of normal glucose concentrations. This uncommon form of DKA is known as euglycemic DKA. The aim of this case report is to alert the physician to include euglycemic DKA in differential diagnosis for a patient presenting with dengue fever and metabolic ketoacidosis with a past history of diabetes on alternative medicine therapy.

**Presentation of Case:** A 70-year-old female presented to us with high grade (102 deg F), intermittent type fever for 3 days. She also reported nausea, vomiting and bilateral knee joint pain. She reported having diabetes for the last 10 years for treatment of which she was on alternative therapy medication. Laboratory workup showed dengue fever, severe metabolic acidosis and 3+ ketonuria. RBS was 186 mg/dl. She was treated with IV fluids for hydration, paracetamol

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(antipyretics), regular insulin and dextrose drip. Her health improved with the above-mentioned treatment.

**Discussion:** Euglycemic DKA is defined as DKA with BG concentration of <200 mg/d. DKA can go undiagnosed if the patient has blood sugar levels of <200 mg/dl at the time of initial presentation. Moreover, DKA occurs rarely in a patient presenting with dengue fever.

**Conclusion:** Euglycemic DKA is a rare presentation of DKA and thus can go undiagnosed at initial presentation. It may be seen in patients with diabetes (on alternative therapy medications) presenting with dengue fever.

**Keywords:** Diabetic ketoacidosis; euglycemic; dengue; alternative medicine.

## 1. INTRODUCTION

Diabetic ketoacidosis (DKA) is an acute complication of diabetes mellitus that can become life-threatening [1]. DKA is recognized by hyperglycemia, metabolic acidosis and presence of serum and/or urine ketones [2]. It occurs in diabetic patients with a profound deficiency of insulin action in the body who are subject to external stress such as infection, injury, or surgery [3]. DKA is usually associated with marked hyperglycemia but it can occur with only a moderate increase in blood glucose (BG) levels or, in rare instances, in the setting of normal glucose concentrations [4]. Euglycemic DKA is recognized with a BG concentration of <200 mg/d [3]. We report here a case of euglycemic DKA in a patient who is a known diabetic and presented with dengue fever. The patient was on alternative medicine for the treatment of diabetes. This case report highlights the fact that euglycemic DKA should be considered in the differential diagnosis of an ill patient with diabetes presenting with metabolic acidosis and normal BG concentration.

## 2. PRESENTATION OF CASE

A 70-year-old female presented to us with Fever for 3 days. Fever was of high grade (102 deg F) and intermittent type. She also reported nausea, vomiting and bilateral knee joint pain. There was no history of chest pain or abdominal pain or headache. She denied a history of loss of consciousness or change in bowel or bladder habits. She reported having diabetes for the last 10 years for treatment of which she was on alternative therapy medication. The composition of alternative medicine is not known as she took it from an unregistered AYUSH practitioner (AYUSH doctor is a registered medical practitioner of alternative medicine in India). There was no history suggestive of hypertension or bronchial asthma or tuberculosis.

On examination, she was oriented to time, place and person but was in a confused state. Her BP was 130/84 mm Hg, PR-115/min, Temperature - 102 deg F, Respiratory Rate -18/min and Oxygen saturation was 97 percent on room air. Pallor, Icterus, Clubbing, Cyanosis, Edema and Lymphadenopathy were absent.

On systemic examination, normal heart sounds were heard. There were no murmurs. Bilateral vesicular breath sounds of equal intensity were heard. There were no added sounds. The abdomen was non-tender. No organomegaly was present. Pupils were bilaterally normal in size and equally reactive to light. Superficial and Deep reflexes were normal bilaterally.

**Investigations:** At time of presentation -Hb-13.2 gm/dl, TLC-2600/mm<sup>3</sup>, RBC-4.5 lakhs/mm<sup>3</sup>, Platelets Count-30,000, RBS-186 mg/dl, HbA1C-10.

ABG- pH- 7.20 pO<sub>2</sub>- 88 mm Hg, pCO<sub>2</sub>- 25 mm Hg, Bicarbonate- 10 meq/l/USG whole abdomen was normal Urine Ketone Level - 3+ ketonuria was present NS1 Antigen test was positive for Dengue Fever.

Dengue infection with Euglycemic Diabetic Ketoacidosis was suspected. For dengue fever, she was administered IV Fluids to maintain hydration and was given antipyretic (Paracetamol) for fever. As per the common consensus, DKA was treated with Regular Insulin and Dextrose drip. Her health improved with the above-mentioned treatment. At the time of discharge, her vitals were stable, ABG report was normal and RBS was 110 mg/dl. Urine ketones were absent. TLC and Platelet count were normal.

## 3. DISCUSSION

The diagnostic criteria of DKA established by the American Diabetic Association consists of a

plasma glucose of >250 mg/dL, positive urinary or serum ketones, arterial pH of <7.3, serum bicarbonate <18 mEq/L, and a high anion gap [5,6]. Munro et al. in their study in 1973 included 211 episodes of DKA [7]. Jenkins et al. in their study in 1993 included 722 DKA episodes of DKA [8]. Euglycemic DKA is recognized at a BG level of  $\leq 200$  mg/dL [9,10]. Based on this, only 16 out of 211 episodes of DKA in the study by Munro et al. [7] and 6 of the 722 episodes of DKA in the study by Jenkins et al. [8] would be considered as euglycemic DKA representing 7.6% and 0.8% of DKA patients respectively.

Euglycemic DKA can occur due to partial treatment of DKA, food restriction and inhibition of gluconeogenesis. Studies have shown euDKA as a side effect of SGLT2 inhibitors. In Japan, 28 cases of DKA or ketoacidosis were reported by manufacturers in the postmarketing reports of adverse events of SGLT2 inhibitors [3]. 7 of these 28 cases had a BG of <200 mg/dl [11]. U.S. Food and Drug Administration reported 20 cases of euglycemic DKA associated with SGLT2 inhibitors from March 2013 (date of approval of the first drug in this class) through 6 June 2014 [12].

Euglycemic DKA may also be seen in patients on alternative therapy for the treatment of diabetes. The exact mechanism for this is difficult to explain due to the paucity of data available. It may be possible that mechanisms similar to that explained above for SGLT2 inhibitor may lead to the development of euDKA. We suspect that our patient with diabetes on alternative therapy medication for treatment developed euDKA that was precipitated by dengue fever.

Some of the alternative medicine options for treating diabetes include [13] –

- a) Yoga - Helps in decreasing insulin resistance and improve insulin sensitivity [14].
- b) Massage - Provides relaxation to the body, thus decreasing stress hormones and increasing effective utilisation of insulin [15].
- c) Acupuncture - It can act on the pancreas to enhance insulin synthesis and can also increase the number of receptors on target cells [16].
- d) Aromatherapy- Helps in decreasing the stress of coping with a chronic condition such as diabetes [17].

- e) Medicinal Herbs -Some herbs have found to have hypoglycaemic action and some help in regeneration of Beta cells in pancreas.eg) *Momordica charantia*, *Gymnema sylvestre* [18,19,20].
- f) L-Carnitine -Improves insulin sensitivity in insulin-resistant diabetic patients [21].
- g) Vitamin E - Has Antioxidant activity. It increases insulin sensitivity and secretion [22,23].

Thus patients with type 1 or type 2 diabetes (on alternate medicine therapy) who present with malaise, vomiting or metabolic acidosis should be evaluated for the presence of urine and serum ketones to rule out euDKA.

#### 4. CONCLUSION

Although euglycemic DKA is a rare entity, it must be diagnosed at earliest and appropriate therapy should be given. It should be included in the differential diagnosis of ketoacidosis in a patient with dengue fever since correction of fluid imbalance and IV insulin infusion and dextrose drip [3,5,6,14] are the mainstays of therapy for euglycemic DKA. The present case is additional evidence that DKA can occur in the setting of normal glucose concentration in a patient with dengue fever on alternative medicine for the treatment of diabetes.

#### CONSENT

Written Informed consent was obtained from the patient for this case report.

#### ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Demirci H, Coşar R, Çiftçi Ö, Sarı İK. (). Atypical diabetic ketoacidosis: Case report. *Balkan Medical Journal*. 2015;32(1):124-6.
2. Gosmanov AR, Gosmanova EO, Dillard-Cannon E. Management of adult diabetic ketoacidosis. *Diabetes, metabolic syndrome and obesity: Targets and Therapy*. 2014;7:255-64. DOI: 10.2147/DMSO.S50516

3. Ogawa W, Sakaguci K. Euglycemic diabetic ketoacidosis induced by SGLT2 inhibitors: Possible mechanism and contributing factors. *J Diabetes Invest.* 2016;7(2):135–8.
4. Liamis G, Liberopoulos E, Barkas F, Elisaf M. Diabetes mellitus and electrolyte disorders. *World Journal of Clinical Cases.* 2014;2(10):488-96.
5. Janna Prater, Joumana T. Chaiban. Euglycemic diabetic ketoacidosis with acute pancreatitis in a patient not known to have diabetes. *AACE Clinical Case Reports: Spring.* 2015;1(2):e88-e91.
6. Thawabi M, Studyvin S. Euglycemic diabetic ketoacidosis, a misleading presentation of diabetic ketoacidosis. *N Am J Med Sci.* 2015;7(6):291–4
7. Munro JF, Campbell IW, McCuish AC, Duncan LJ. Euglycaemic diabetic ketoacidosis. *Br Med J.* 1973;2:578-580.
8. Jenkins D, Close CF, Krentz AJ, Natrass M, Wright AD. Euglycaemic diabetic ketoacidosis: Does it exist? *Acta Diabetol.* 1993;30:251-253.
9. Joseph F, Anderson L, Goenka N, Vora J. Starvation-induced true diabetic euglycemic ketoacidosis in severe depression. *J Gen Intern Med.* 2009;24: 129–131.
10. Davies RG, De P, Child DF, Gemmell L, Rincon C. Euglycaemic diabetic ketoacidosis. *Hosp Med.* 2003;64:557–558.
11. Hayami T, Kato Y, Kamiya H, et al. Case of ketoacidosis by a sodium-glucose cotransporter 2 inhibitor in a diabetic patient with a low-carbohydrate diet. *J Diabetes Investig.* 2015;6:587–590.
12. Euglycemic Diabetic Ketoacidosis: A Predictable, Detectable, and Preventable Safety Concern With SGLT2 Inhibitors Julio Rosenstock, Ele Ferrannini *Diabetes Care Sep.* 2015;38(9):1638-1642.
13. Pandey A, Tripathi P, Pandey R, Srivatava R, Goswami S. Alternative therapies useful in the management of diabetes: A systematic review. *J Pharm Bioallied Sci.* 2011;3:504–12.
14. Sahay BK. Role of yoga in diabetes. *J Assoc Physicians India.* 2007;55:121–6.
15. Ezzo J, Donner T, Cox M. Is massage useful in the management of diabetes? A systematic review. *Diabetes Spectr.* 2001; 14:223.
16. Hu H. A review of treatment of diabetes by acupuncture during the past forty years. *J Tradit Chin Med.* 1995;15:145–54.
17. Grey M. Coping and Diabetes. *Diabetes Spectrum.* 2000;13:167–169.
18. Akhtar MS, Athar MA, Yaqub M. Effect of *Momordica charantia* on blood glucose level of normal and alloxan diabetic rabbits. *Planta Med.* 1981;42:205–12.
19. Puri D, Prabhu KM, Murthy PS. Mechanism of action of a hypoglycemic principle isolated from fenugreek seeds. *Indian J Physiol Pharmacol.* 2002;46:457–62.
20. Kanetkar P, Singhal R, Kamat M. *Gymnema sylvestre*: A Memoir. *J Clin Biochem Nutr.* 2007;41:77–81.
21. Giancaterini A, De Gaetano A, Mingrone G, Gniuli D, Liverani E, Capristo E, et al. Acetyl-L- Carnitine infusion increases glucose disposal in type-2 diabetes patients. *Metabolism.* 2000;49:7047.
22. Belinda S. O’Connell. *Select Vitamins and Minerals in the Management of Diabetes.* *Diabetes Spectrum Aug.* 2001;14(3):133-148.
23. Mooradian AD, Failla M, Hoogwerf B, Marynuik M, Wylie-Rosett J. Selected vitamins and minerals in diabetes. *Diabetes Care.* 1994;17:464–79.

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