

Diabetic Ketoacidosis and Thyroid Storm Presentation of Two Jeopardies Concurrently in a Young Female

Sir,

The coexistence of glucose intolerance with hyperthyroidism is known since 1960, but clinical presentation with diabetic ketoacidosis (DKA) and thyroid storm (TS) is rare and challenging to diagnose.^[1] Both the endocrine emergencies are life-threatening independently and when concomitantly present can rapidly lead to mortality if not identified and managed early.

We present a case of a young female who came to our emergency with clinical manifestations of both DKA and TS. To our knowledge, only 26 cases globally and only one previous case from India have been reported so far.^[2,3]

CASE REPORT

A 21-year-old woman presented to our emergency room with intractable nausea, 8–10 episodes of non-bilious vomiting, palpitations and generalised abdominal pain for one day. She had similar complaints two and a half months back when she was first diagnosed with hyperthyroidism and type 1 diabetes at a private hospital. She was discharged on insulin injections and antithyroid medication (records unavailable), which she discontinued the latter. She also gave a history of significant weight loss (around 15–20 kilograms) since then. Her family history was unremarkable for any autoimmune or endocrine disorders.

On examination, she was dizzy, severely dehydrated, lethargic and tachypnoeic with a blood pressure of 182/50 mmHg, a heart rate of 170 beats/min, an axillary temperature of 37.3°C, a respiratory rate of 40 breaths/min and an oxygen saturation of 98% on room air. She had a grade 1 palpable, diffuse, painless and firm thyroid swelling. She also had ophthalmic manifestations associated with hyperthyroidism including exophthalmos. Chest examination was unremarkable initially, but fine crackles were heard on auscultation at bilateral lung bases after 1 litre of normal saline. She had hyperdynamic heart sounds with no murmur or jugular venous distension. Abdominal examination showed slight diffuse tenderness. The random blood sugar was 378 mg/dl, and arterial blood gas analysis revealed high anion gap metabolic acidosis with respiratory compensation (pH 7.036; pCO₂ 17 mmHg; HCO₃ 4.7 mmol/L; lactate 1.1 mmol/L and an anion gap of 25).

She was shifted to the adult intensive care unit and started on intravenous (IV) human insulin infusion. Other laboratory tests revealed HbA1c 10.3%, marked leucocytosis 31.87 × 10³/μL, haemoglobin 10.1 g/L, platelets 518 × 10³/μL, serum creatinine 0.89 mg/dL and serum urea 38 mg/dl. Urine analysis reported 3+ ketonuria. Electrocardiography (ECG) revealed sinus

tachycardia. and transthoracic ECG was unremarkable except for moderate mitral regurgitation.

The patient was diagnosed with diabetic ketoacidosis (DKA) in the setting of marked hyperglycaemic, high anion gap metabolic acidosis and ketonaemia. She was managed with judiciously administered IV fluids, IV insulin infusion and electrolyte replacement. Given the background of hyperthyroidism, associated ophthalmic manifestations and the presence of tachycardia (155 beats per minute), despite appropriate IV hydration, the concomitant presence of TS was suspected. With a Burch–Wartofsky score of 55, a clinical diagnosis of TS was made, and the patient was empirically treated with IV propranolol, propylthiouracil (PTU) and a low dose of glucocorticoids (dexamethasone 2 mg 12 hourly). The thyroid function test later revealed thyroid stimulating hormone (TSH) <0.0040 mIU/l, free T3 of 11 pg/ml, and free T4 to be 87.9 Ng/dl.

The patient responded well to treatment, the vital signs stabilised and she was discharged to the ward after 6 days of intensive care unit stay on a subcutaneous insulin regimen, propranolol, and propylthiouracil.

DISCUSSION

DKA and TS are both endocrine emergencies with thyroid storms being more infrequent than DKA. DKA is a condition of severe insulin deficiency and usually presents as a triad of ketonaemia, hyperglycaemia and a high anion gap metabolic acidosis.^[4] In addition, TS manifests with multiorgan dysfunction including thermoregulatory, cardiovascular and central nervous systems.^[5,6] The presence of both these predicaments is rare, and middle-aged females are the most commonly affected group. Poor adherence to treatment and/or under-treatment of any one disorder is the most commonly cited reason in the literature and is also supported by the fact that almost all patients have elevated HbA1c (10.5% in our patient) and low to undetected TSH (<0.004 mIU/l in our patient).^[7]

Though it is difficult to establish which of the two endocrinopathies is the inciting event precipitating the other, commonly described pathology includes uncontrolled hyperthyroidism leading to diabetic ketoacidosis which subsequently leads to TS.^[8] It is well known that glycaemic control is worsened by hyperthyroidism because of its effect on intermediate metabolism. Thyroid hormone decreases insulin levels by increasing renal excretion and itself causes increased insulin resistance.^[9,10] The resulting state of insulin deficiency causes hyperglycaemia, unchecked lipolysis and production of ketone bodies which when surpasses the body's limit of buffering precipitates DKA. The excess thyroid hormone levels also lead to augmented hepatic glucose

output by enhancing non-oxidative glucose metabolism that leads to increased lactate which, ultimately enters the Cori cycle.^[8] Additionally, thyroid hormone leads to altered glucose metabolism via an increase in hepatocyte plasma membrane concentration of glucose transporter 2, thereby further adding to the stress of hyperglycaemia.

A stressful stimulus such as discontinuation of antithyroid drugs, surgery, trauma or infection usually precedes a TS.^[11] It carries a mortality rate of 10–30% attributed to shock, multiorgan failure and disseminated intravascular coagulation.^[12] Diagnosis of thyroid storm is based on clinical presentation and not on T3/T4/TSH levels which may not be available immediately. The Burch–Wartofsky scoring system is commonly used to calculate the probability of a TS by assigning a numerical value to specific clinical signs and symptoms.^[13] Four body systems (thermoregulatory, central nervous system, gastrointestinal–hepatic, and cardiovascular) and a precipitating history are included in the score. With a <25 score, a TS is unlikely, 25–45 means an impending storm and a >45 score is likely a TS. Our patient had a score of 55 and was promptly started on antithyroid medications and beta blocker to which she responded well. Importantly, there is a significant overlap between DKA and TS presentation including nausea, vomiting, abdominal pain, tachycardia, confusion and coma. Though our patient had a clear history, signs and symptoms were suggestive of thyrotoxicosis; sometimes, the patient may present without any previous association with thyrotoxicosis. In these cases, the persistence of tachycardia in the absence of any infection and altered mental status after improvement in other metabolic parameters should alert the clinician of possible thyrotoxicosis [Box 1]. Prompt initiation of treatment is life-saving.

To conclude, DKA and TS are life-threatening emergencies which may present together. Awareness of simultaneous presentation should be bought in mind if the overall condition does not improve on initial resuscitation. We emphasize strict adherence to treatment and educating the patient regarding the same.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Box 1: Factors favouring diagnosis of concomitant diabetic ketoacidosis and thyroid storm

Background of diabetes mellitus and thyroid disorder
Presence of inciting event
Persistence of tachycardia in the absence of any infection after initial resuscitation
Altered mental status

Conflicts of interest

There are no conflicts of interest.

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