Case Report

Type 1 diabetes mellitus presenting as distal renal tubular acidosis (type 1)

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ABSTRACT

A 42-year-old male patient known case of type 1 diabetes mellitus for last 15 years got admitted with bilateral lower limb swelling and poorly controlled diabetes. He was found to have alkaline urinary pH, persistent metabolic acidosis even after the correction of blood sugars without ketonuria or diabetic ketoacidosis and nephrocalcinosis thus he was diagnosed as distal renal tubular acidosis (RTA Type 1) and managed by alkali replacement with blood sugar control. The association of type-1 diabetes mellitus with type-1 RTA has been rarely reported in the literature, but there are various case reports which had linked with distal RTA with autoimmunity and destruction of DCT. As our case which was unusual as every type-1 diabetes doesn’t have acidosis due to DKA focused research is required in this field.

Keywords: Type 1 diabetes mellitus, Ketonuria, Distal renal tubular acidosis, Diabetic ketoacidosis, Nephrocalcinosis

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is an auto-immune disease which is characterized by immunological destruction of beta cells leading to absolute insulin deficiency.1 Insulinopenia is characterized by dysmetabolism and generation of lactic acid which is a high anion gap metabolic acidosis. Patients with T1DM generally presents with diabetic ketoacidosis (DKA) in which acidosis is due to high ketones in body. We present a case that had normal anion gap acidosis in T1DM with uncontrolled hyperglycemia. Distal renal tubular acidosis (dRTA) commonly occurs in condition like amyloidosis, Sjogren syndrome, systemic lupus erythematosus (SLE) and sickle cell disease. Distal RTA presents as nephrocalcinosis and normal anion gap hyperchloremic acidosis that occurs due to inability of distal convoluted tubule to secrete hydrogen (H+) ions.2 This in turn leads to accumulation of H+ and subsequently loss of potassium (K+) from the body causing hypokalemia and alkaline urine. This alkaline urine causes precipitation of calcium stones in urine and patients presents as having asymptomatic/ symptomatic nephrolithiasis.

CASE REPORT

A 42-year male presented to emergency with complaint of swelling of bilateral lower limb associated with pain/tingling and numbness for 3 months duration. Swelling in bilateral lower limb was gradual, extending up to ankle. He was a known case of T1DM for 15 years and was currently on inj. insulin mixtard twice daily regimen with fluctuating blood sugar levels. No history of pain abdomen, nausea, vomiting, chest pain, shortness of breath, syncope, palpitation, sweating, burning micturition or decreased urine output. No history of hypertension, tuberculosis, asthma in past. Family history was also not significant. Patient left inj. insulin for the past 3 days due to unavailability. Patient was admitted and investigation was sent to rule out the possibility of DKA. Investigations send at the time of admission were Hb-7.49g/dl, Sr. Na+/K- 124/5.5mEq/L and HbA1c – 12.7; the laboratory reports of day 04 of admission were listed in (Table 1).
Patient was started on intravenous (IV) fluids and in the lines of DKA protocol as the patient was having a very low bicarbonate (HCO₃⁻) and high dextrose. He was managed in the ward and overdue course patient improved of symptoms. After 2 days in hospital, patient’s repeat ABG was done, showed persistent low HCO₃⁻, so urine pH was advised and reported to be 6.0.

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Table 1: The laboratory investigations at day of admission and day-4 of admission.

| Date          | 24/01/2019 (28/01/2019) | 28/01/2019 (30/01/2019) | 04/02/2019 |
|---------------|------------------------|-------------------------|------------|
| Hemoglobin    | 7.49g/dl               | 7.3g/dl                 |            |
| Total leucocyte count | 11340/mm3            | 8500/mm3                |            |
| Differential Leucocyte count | N89L5M5             | N78L20M2                |            |
| Platelets     | 1.46 lak/2mm3         | 1.56 lak/2mm3          |            |
| Hematocrit    | 23.7                   | 21.3                    |            |
| Blood urea    | 81mg/dl                | 22mg/dl                 |            |
| Serum creatinine | 1.96mg/dl            | 0.96mg/dl              |            |
| Serum Na      | 124mEq/L               | 137mEq/L                |            |
| Serum K       | 5.5mEq/L               | 3.2mEq/L                |            |
| Serum Cl      | 98mEq/L                | 106mEq/L                |            |
| Serum calcium | 7.6mg/dl               | 7.7mg/dl                |            |
| Serum phosphorus | 3.9mg/dl              | 3.4mg/dl               |            |
| Total bilirubin | 0.46mg/dl             |                         |            |
| Direct bilirubin | 0.12mg/dl            |                         |            |
| SGPT          | 15U/L                  |                         |            |
| SGOT          | 36U/L                  |                         |            |
| ALP           | 168U/L                 |                         |            |
| Total Protein | 5.3gm/dl               |                         |            |
| Albumin       | 3.2gm/dl               |                         |            |
| Globulin      | 2.1gm/dl               |                         |            |
| pH            | 7.32                   |                         |            |
| HCO3          | 11.1mEq/L              |                         |            |
| Anion gap     | 11mEq/L                |                         |            |
| RBS           | High                   |                         |            |
| HbA1C         | 12.7                   |                         |            |
| Urine R/M     | Glucose ++, protein + and ketones absent | | |

Patient USG was done in view of deranged kidney function and reported - multiple hyper-echoic calculi seen in upper pole with largest measuring 7.8 mm in the right kidney. Left kidney size normal with multiple hyper-echoic calculi in lower pole and posterior pole longest 9 mm.

Ophthalmology evaluation suggested bilateral moderate non proliferative diabetic retinopathy (NPDR). 2D echo was normal. Patient’s periodic special investigations after the admission in hospital are enclosed in Table 2.

**Table 2: Periodic special investigations after the admission in hospital.**

| Date          | 28/01/2019 | 30/01/2019 | 04/02/2019 |
|---------------|------------|------------|------------|
| Urine pH      | 6.0        | 6.0        | 6.0        |
| Urine R/M     | Glucose-nil, protein-nil, ketone-nil | Protein+, glucose-nil | Proteins+, glucose-nil |
| pH            | 7.29       | 7.41       |            |
| HCO3          | 15.6 mEq/L | 18.8       |            |
| Anion Gap     | 9 mEq/L    | 5 mEq/L    |            |
| iPTH          | 14.9 (11-79)|           |            |

Patient was evaluated for low HCO3 with high urinary pH. Patient had kidney stones despite low serum calcium. iPTH in our patient was also low which showed that it cannot be due to secondary hyperparathyroidism. We searched literature for the same and most common cause for this presentation was distal RTA.

We finally made the diagnosis of type1 DM with diabetic neuropathy, retinopathy and nephropathy with distal RTA causing nephrocalcinosis.

**DISCUSSION**

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease with genetic susceptibility and progressing to complete destruction of β-cells. Auto-antibodies against the pancreatic cells like islet cell antibodies (ICA) and glutamic acid decarboxylase (GAD) are detected in childhood in T1DM patients. It is usually a disease of childhood/young. According to 2009 census, 6666 of 3.4 million youth were diagnosed with type 1 diabetes for a prevalence of 1.93 per 1000. The highest prevalence of T1DM (2014 census) was 2.55 per 1000 among white youth and the lowest was 0.35 per 1000 in American Indian youth.²

Distal renal tubular acidosis is a syndrome of systemic hyperchloremic acidosis with alkaline urine pH, hypocitraturia and hypercalciuria due to reduced secretion of H⁺ ions by the cells of the distal convoluted tubules.³,⁴ Metabolic acidosis in distal renal tubular acidosis contributes as a predisposing factor to recurrent nephrolithiasis and bone loss. Patients with distal RTA are unable to lower urine pH normally in the presence of systemic metabolic acidosis regardless of its severity.⁵
15-30% of subjects with T1DM have autoimmune thyroid disease, 4–9% had celiac disease, and 0.5% had Addison’s disease. Distal RTA is also multifactorial; it can develop as a consequence of autoantibodies, most commonly with Sjögren’s syndrome and systemic lupus erythematosus (SLE). There are various case reports which had linked distal RTA with autoimmunity and destruction of distal convoluted tubules. There are only few case reports with patients of T1DM who develop distal RTA, in which one patient had due to autoimmunity and other patient had Sjogren syndrome and no cause could be found in some other.

Our patient had all features of distal RTA in the form of nephrocalcinosis, acidic urine, low bicarbonate, metabolic acidosis which persist even after the correction of blood sugars. He had proteinuria and slightly deranged creatinine which suggested diabetic kidney disease (DKD); but destruction of glomeruli alone cannot explain the development of distal RTA in our patient. Various studies previously had already shown that diabetic patient have interstitial and tubular injury along with glomerular injury.

Additional investigation like kidney biopsy could have been for further confirmation of destruction of distal convoluted tubules to prove tubular damage but our patient refused for procedure.

CONCLUSION

Distal RTA patient improves with alkali therapy and it also prevents the formation of renal stones. Our patient already has developed renal stones; still alkali therapy will prevent the progression of stones. We hence conclude our case which was unusual as every T1DM doesn’t have acidosis due to DKA. Also we suggest that if a patient had hypokalemia and nephrocalcinosis, distal RTA should be ruled out by urine pH and blood HCO3 levels. More focused research is required in this field.

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