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SUMEJ
Sumatera Medical Journal
Journal homepage: https://talenta.usu.ac.id/smj

Case Report

Diabetic Ketoacidosis in Type 1 Diabetes Mellitus

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ARTICLE INFO

Article history:
Received 14 April 2023
Revised 20 December 2023
Accepted 4 December 2023
Available online 1 January 2024

E-ISSN: 2622-1357
P-ISSN: 2622-9234

How to cite:
Lukman Nurhakim, Rudy Afriant, Dinda Aprilia, "Diabetic Ketoacidosis in Type 1 Diabetes Mellitus", SUMEJ, Vol. 07, No. 01, January 2024.

https://doi.org/10.32734/sumej.v7i1.11837.

ABSTRACT

Background: Diabetic ketoacidosis (DKA) is a state of metabolic decompensation/disorder characterized by the triad of hyperglycemia, acidosis and ketosis, caused by absolute or relative insulin deficiency and increased counter-regulatory hormones. **Objective:** To report a case of diabetic ketoacidosis (DKA) in a young adult patient with type 1 diabetes mellitus and scalp abscess, emphasizing the importance of early diagnosis and prompt management to achieve clinical improvement. **Methods:** This case report describes the clinical presentation, diagnostic approach, and therapeutic management of a 19-year-old male with DKA. **Results:** A 19-year-old male treated in the internal medicine ward of Dr. M djamil Padang with diabetic ketoacidosis, type 1 DM, and Abscess capitis. The patient was treated with rehydration and intravenous insulin infusion can show clinical improvement. **Conclusion**: The diagnosis in patients is based on anamnesis, physical examination and supporting examinations. Immediate therapy is needed in the management of DKA in patients. After DKA is resolved, look for the causes of the risk of DKA. On the third day of treatment the patient's condition improved clinically and the laboratory.

Keywords: diabetic ketoacidosis, diabetes mellitus type 1, insulin, hormones

1. Introduction

Diabetic ketoacidosis (DKA) is a state of metabolic decompensation/disorder characterized by the triad of hyperglycemia, acidosis, and ketosis, caused by absolute or relative insulin deficiency and increased counter-regulatory hormones. Diabetic ketoacidosis is one of the acute complications of diabetes that is closely related to the quality of education in people with type 2 diabetes mellitus (DM) and is often the starting point for the diagnosis of type 1 DM [1, 2].

The most common precipitating factor that plays a role in the occurrence of DKA is infection. Other triggers include stopping or reducing insulin doses, myocardial infarction, acute pancreatitis, and the use of drugs. Data from RSCM showed that infection accounted for 80% of DKA cases, with urinary tract infections and pneumonia being the most common, while other studies reported causes such as inappropriate insulin doses (48.6%), gastroenteritis (14.1%), technical problems with the insulin pump (12.7%), infections (13.4%), social problems (1.4%), and idiopathic causes (5.6%).

2. Case Presentation

19-year-old male patient with loss of consciousness since 4 days ago. Often feel thirsty, hungry and urinate since 2 years ago. Shortness of breath since 5 days before admission to the hospital. Heartburn since 5 days before admission to the hospital. Pain accompanied by nausea. There is vomiting, the frequency is 2 times filled with liquid and food. The patient also complained of a lump on his head and pus coming out since 1

month ago. The patient also complained of fever 1 week ago. On physical examination the patient looked seriously ill with sopor, BP 80/50 mmHg, pulse 110x/minute, respiratory rate 26x/minute, Kussmaul breathing pattern. There is a mass measuring 4x4 cm in the frontoparietal region, fluctuating

Laboratory tests were carried out with leukocytes 18,470/mm3, GDS 496 mg/dL. Urinalysis showed glucosuria (+2) and proteinuria (+1), and urine ketones +2. Blood gas analysis obtained pH 7.00; HCO3- 5.3 mmol/L with the impression of metabolic acidosis and hypernatremia (Na 162 mmol/L). There was also an increase in D-dimer 3545 ng/mL, creatinine 2.1 mg/dL, HbA1c > 15. HOMA-IR and C-peptide examination with low C-peptide results and high HOMA-IR due to bias in the use of insulin, an impression of type 1 diabetes mellitus.

Based on the anamnesis, physical examination and support, the patient was diagnosed with decreased consciousness ec diabetic ketoacidosis, type 1 diabetes mellitus, sepsis ec Abeses capitis a/r frontotemporalis, acute on CKD, hypernatremia ec dehydration and high risk of VTE. Patients are treated according to the diabetic ketoacidosis protocol until the patient is conscious, GDS is controlled, urine ketones are negative, and insulin is then given. long acting and short acting and given antibiotics in the form of Metronidazole 3x500 mg IV, Cefepime 3x2 gram IV and Levofloxacin 1x750mg IV.

3. Discussion

Diabetic ketoacidosis (DKA) is an emergency in internal medicine characterized by hyperglycemia, acidosis, and ketosis. The diagnosis of DKA is established according to the DKA triad. The patient had a blood sugar level of 497 mg/dL, acidosis indicated by shortness of breath with a Kussmaul breathing pattern, confirmed by blood gas analysis showing pH 7.0, serum bicarbonate 5.3 mmol/L, and a high anion gap of 55.3 mEq/L, along with positive urine ketones (+2). This is consistent with the criteria of the American Diabetes Association that DKA is diagnosed when blood sugar >250 mg/dL, pH <7.35, serum bicarbonate <18 mEq/L, and ketosis [2].

Diabetic ketoacidosis is defined as a decompensated metabolic disorder mainly caused by insulin deficiency, along with an increase in counter-regulatory hormones such as glucagon, catecholamines, cortisol, and growth hormone. These result in increased glucose production, decreased peripheral glucose uptake, increased lipolysis, and enhanced ketogenesis. Hyperglycemia arises from hepatic and renal glucose production through gluconeogenesis and glycogenolysis and impaired peripheral glucose use. The hyperglycemic state and elevated ketones cause osmotic diuresis, leading to hypovolemia and decreased glomerular filtration rate, exacerbating hyperglycemia [1, 2].

Diabetic ketoacidosis occurs in both type 1 and type 2 diabetes mellitus, but it is more than twice as common in type 1 diabetes mellitus. In type 2 diabetes, DKA usually occurs due to inappropriate treatment or complications like infection and dehydration. In type 1 diabetes, DKA is often the first presentation, with about one-third of children showing DKA at the time of diagnosis [3].

The most common clinical manifestations of DKA are nausea, vomiting, and abdominal pain [4] reported nausea, vomiting, and abdominal pain as the most frequent presentations. Similarly, found that severe vomiting and abdominal pain were the most common symptoms [5]. Catabolic stress and acidosis cause extreme vomiting, and dehydration occurs in around 30% of DKA patients due to osmotic diuresis [4, 5]. Common precipitating factors for DKA in diabetes patients include nonadherence to therapy, newly recognized diabetes, and acute illnesses. In this case, an abscess infection in the frontotemporal region was found and drained, and the patient was newly diagnosed with type 1 DM [6].

The patient's C-peptide level was 0.21 ng/dL, indicating low endogenous insulin production. Confirmation of type 1 DM can be made by examining autoantibodies such as anti-islet cell antibodies (ICA), GAD65 autoantibodies, IA2, insulin autoantibodies (IAA), and ZnT8 autoantibodies [7]. Management of DKA includes rehydration, insulin therapy to suppress gluconeogenesis and lipolysis, and close monitoring of metabolic parameters. Kitabchi et al. stated that DKA improvement criteria include glucose <200 mg/dL, serum bicarbonate ≥18 mEq/L, venous pH >7.3, and resolution of ketosis [8]. Fluid therapy is prioritized to improve organ perfusion, with 0.9% NaCl as the initial fluid. In this case, rehydration was adjusted due to hypernatremia (sodium 162 mmol/L) using 0.45% NaCl, followed by intravenous insulin infusion. By the second day, the patient showed clinical and laboratory improvement with blood glucose <250 mg/dL, pH 7.409, and negative urine ketones. In type 1 diabetes mellitus, DKA is often the initial presentation at diagnosis. According to the American Diabetes Association, DKA is confirmed by blood sugar levels >250 mg/dL, pH <7.35, serum bicarbonate <18 mEq/L, and the presence of ketosis [2]. The precipitating cause in this patient was a sepsis infection from a capitis abscess. Proper management of DKA and infection led to the patient's recovery [9-11].

4. Conclusion

Diabetic ketoacidosis (DKA) can be the first clinical manifestation in patients with newly diagnosed type 1 diabetes mellitus. The diagnosis of DKA is based on clinical signs of hyperglycemia, metabolic acidosis, and the presence of ketosis. In this case, infection, specifically from a capitis abscess, served as the precipitating factor. Careful and appropriate management, including fluid resuscitation, insulin therapy, and infection control, led to a successful recovery. Early recognition and treatment of DKA, along with identifying and managing underlying triggers, are crucial in improving patient outcomes.

5. Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical considerations but are available from the corresponding author upon reasonable request.

6. Ethical Statement

Sumatera Medical Journal (SUMEJ) is a peer-reviewed electronic internationaljournal. This statement clarifies ethical behavior of all parties involved in the act of publishing an article in Sumatera Medical Journal (SUMEJ), including the authors, the chief editor, the Editorial Board, the peer-reviewer and the publisher (TALENTA Publisher UniversitasSumatera Utara). This statement is based on COPE's Best Practice Guidelines for Journal Editors.

7. Author Contributions

All authors contributed to the design and implementation of this case report, data analysis, and finalizing the manuscript.

8. Funding

No funding.

9. Acknowledgements

The authors thank to the staff and member for their valuable assistance during data collection and analysis.

10. Conflict of Interest

Authors declares no conflict of interest.

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