Sepsis in Type 1 Diabetes Mellitus with Diabetic Ketoacidosis

Dinda Aprilia[1*], Eva Decroli[1], Alexander Kam[1], Afdol Rahmadi[1], Asman Manaf[1] and Syafril Syahbuddin[1]

[1]*Departement of Internal Medicine, Faculty of Medicine, Universitas Andalas- M. Djamil General Hospital, Padang, Sumatera Barat, Indonesia.*

Keywords: Diabetic Ketoacidosis, Diabetes Mellitus, Sepsis.

Abstract: **Introduction:** Infection is the most common predisposing factor for the development of a hyperglycemic crisis, which is diabetic ketoacidosis (DKA). Type 1 diabetes mellitus patients have a higher risk of infection than type 2 diabetes mellitus patients. **Method:** Case report **Results:** A 19-year-old man presented with decreased consciousness. Before he was unconscious, the patient complained of vomiting, breathlessness, cough, and fever. There was no family history of diabetes mellitus. On general examination, he appeared with soporous, Kussmaul breathing with the respiratory rate was 34 times/minute, blood pressure was 130/80 mmHg, pulse rate was 115 beats/minute, and the temperature was 38.4˚C. His body mass index was 18.49. There were rales in the pulmonary examination. Laboratory investigation results were as follows: hemoglobin 13.8 gr/dl; white blood cell count 16.900/ mm^3; random blood glucose 589 mg/dl; HbA_1c 14.06%; C-peptide 0.2 ng/ml; creatinine 1,0 mg/dl; metabolic acidosis in arterial blood gas; ketouria +++. Thorax x-ray confirmed pneumonia in this patient. Patient treated with DKA management and sepsis. On the second day, the treatment of DKA was resolved and continued with the administration of short-acting insulin and regular long acting. **Conclusion:** Type 1 diabetes mellitus patients are more susceptible to infection than type 2 diabetes mellitus patients. Education and management strategies with both patients and their caregivers are important to improve the glycemic control and reduce the risk of developing severe infections and poor treatment outcomes.

1 INTRODUCTION

Infection is the most common predisposing factor for the development of a hyperglycemic crisis, which is diabetic ketoacidosis (DKA) (Azoulay, 2001). Among the predisposing factors for DKA, infection is the most common cause of death (Duca, 2017). Commonly reported bacterial infections in diabetes patients in Japan have included infections of the respiratory system, kidney and urinary tract, and skin and soft tissue (Shizuma, 2016).

Type 1 diabetes mellitus patients have a higher risk of infection than type 2 diabetes mellitus patients (Carey, 2018). Poor glycemic control is susceptible to severe bacterial infections and complications such as DKA, which may in turn further exacerbate the bacterial infection (Decroli, 2018). DKA is precipitated or complicated by infections in 75% of the cases. The mortality rate of patients with DKA and infections is 43% (Simonsen, 2015).

1.1 Case Summary

A 19-year-old man presented with decreased consciousness in the last 1 hour before admission. Before he was unconscious, his family told that the patient complained of vomiting, breathlessness, cough, and fever. His body weight was decreased by 10 kilograms in 1 month. There was no family history of diabetes mellitus.

On general examination, he appeared with soporous, Kussmaul breathing with the respiratory rate was 34 times/minute, blood pressure was 130/80 mmHg, pulse rate was 115 beats/minute, and the temperature was 38.4˚C. His body mass index was 18.49. There were rales in the pulmonary examination. There were no cardiovascular abnormalities and no peripheral edema found.

Laboratory investigation results were as follows: hemoglobin 13.8 gr/dl; white blood cell count 16.900/ mm^3; random blood glucose 589 mg/dl; HbA_1c 14.06%; C-peptide 0.2 ng/ml; creatinine 1,0

Aprilia, D., Decroli, E., Kam, A., Rahmadi, A., Manaf, A. and Syahbuddin, S.
Sepsis in Type 1 Diabetes Mellitus with Diabetic Ketoacidosis.
DOI: 10.5220/0009859200720074
In *Proceedings of the 2nd International Conference on Tropical Medicine and Infectious Disease (ICTROMI 2019)*, pages 72-74
ISBN: 978-989-758-469-5

mg/dl; metabolic acidosis in arterial blood gas; ketouria +++. Thorax x-ray confirmed pneumonia in this patient.

The patient was hospitalized with a diagnosis of sepsis because of community-acquired pneumonia, diabetic ketoacidosis, and type 1 diabetes mellitus. Broad spectrum antibacterial therapy was initiated to treat sepsis and pneumonia. Diabetic ketoacidosis was treated with administration of saline hydration and continuous insulin infusion. Bicarbonate was administered to treat acidosis. The patient has responded to the therapies. Several hours after admission, the patient began to conscious, the respiratory rate was down to the normal rate, acidosis has been treated, and the blood glucose level has been controlled. The day after admission, saline hydration and insulin infusion were discontinued. Intensive control of blood glucose was achieved with subcutaneous injection of short-acting insulin before each meal and long-acting insulin at bedtime. Dietary and patient education for self-administration of insulin injection was done.

2 DISCUSSION

Diabetes is one of the leading causes of morbidity and mortality across the globe, and the burden of disease is projected to increase from 425 to 629 million adults between 2017 and 2045 (Decroli, 2019). The association between diabetes and infection is well known clinically and has been linked to a number of the causal pathway. Patients with diabetes are susceptible to infection because of the decreased migratory ability of neutrophils, decreased phagocytic activity, impaired humoral immunity, increased adherence of microorganisms to diabetic cells, neuropathy, and microangiopathy (Hong, 2015).

Organ systems where bacterial infections predominate as well as fungal diseases were associated with substantial increases in magnitude among patients with both T1DM and T2DM, but risks were consistently higher for T1DM. Patients with T1DM are at approximately double the risk of patients with T2DM for infection-related to death. Bacterial eradication is needed to treat the infection. Antibiotic regimens are not different in a patient with or without diabetes (Azoulay, 2001).

Lung infections suffered by these patients trigger sepsis which then increases the risk of diabetic ketoacidosis. DKA management must be carried out quickly and precisely given the high mortality rate. DKA management protocols are replacement of lost fluids and salts, administration of insulin and management of infection. Considering that severe acidosis can interfere with the balance of homeostasis, it is reasonable to treat patients with pH <7.0 using sodium bicarbonate. DKA in these patients can be resolved well because of the provision of therapy in accordance with the protocol, which are fluid resuscitation, blood sugar control and infection management with the administration of broad-spectrum antibiotics, which is the third generation of cephalosporin (Cheng, 2016).

After DKA is controlled, the important thing to trace is diabetes newly known by the patient. The classification of diabetes suffered by patients must be traced in view of management strategies that must be prepared to prevent recurrent DKA. Type 1 DM usually occurs at the age of children (<12 years), while type 2 DM usually occurs in adults (> 40 years). Therefore, in tracing the diagnosis we need to ascertain the cause of diabetes in these patients whether due to absolute insulin deficiency or because of insulin resistance (Carey 2018).

Further examination is needed to rule out the possibility of other types of diabetes, which are HOMA-IR, C-peptide, and pancreatic x-ray. HOMA-IR examination is performed to assess the presence of insulin resistance. C-peptide to assess insulin deficiency. Pancreatic x-ray to see calcification in the pancreas that appears in malnutrition-related diabetes mellitus (Cheng, 2016).

From the results of the examination, normal HOMA-IR was obtained which means there was no insulin resistance in the patient and low C-peptide which illustrates the low insulin secretion due to damage to the pancreatic beta cells. This removes the diagnosis of type 2 diabetes in these patients. On examination of pancreatic X-ray, no calcification was found in the pancreatic projection, so the diagnosis of malnutrition-related diabetes mellitus was also excluded. However, the diagnosis of other types of diabetes in these patients still cannot be excluded because genetic testing is still needed (Carey, 2018).

The management of type 1 DM includes administration of insulin, dietary management, exercise, and education. The entire component must run in an integrated strategy to get good metabolic control. The main goal of managing diabetic patients is the ability to manage the disease independently. Good glycemic control is needed to reduce the risk of infections that have threatened type 1 DM patients (Simonsen, 2015).

3 CONCLUSION

Type 1 diabetes mellitus patients are more susceptible to infection than type 2 diabetes mellitus patients. Education and management strategies with both patients and their caregivers are important to improve the glycemic control and reduce the risk of developing severe infections and poor treatment outcomes.

CONFLICT OF INTEREST

None.

REFERENCES

Amiel S, Lawrence, RD, Pursey, N, Higgins, B, Dawoud, D. 2015. Diagnosis and management of type 1 diabetes mellitus: summary of updated NICE guidance. British Medical Journal. 351:h4188.

Azoulay E, Chevret S, Didier J, Neuville S, Barboteu M, Bornstain C, *et al*. Infection as a trigger of diabetic ketoacidosis in intensive-care-unit patients. 2001. Clinical Infectious Diseases. 32(1):30-5.

Carey IM, Critchley JA, DeWilde S, Harris T, Hosking FJ, Cook DG, *et al*. 2018. Risk of infection in type 1 and type 2 diabetes compared with the general population: a matched cohort study. Diabetes Care. 41(3):513-21.

Cheng Y, Huang C, Lin W, Lu P, Chang K, Tsai J, *et al*. 2016. Clinical outcomes of septic patients with diabetic ketoacidosis between 204 and 2013 in a tertiary hospital in Taiwan. Journal of Microbiology, Immunology, and Infection. 49(5):663-71.

Decroli E, Manaf A, Syahbuddin S, Syafrita Y, Dillasamola D. 2019. The correlation between malondialdehyde and nerve growth factor serum level with diabetic peripheral neuropathy score. Open Access Macedonian Journal of Medical Sciences. 7(1):103-6.

Decroli E, Manaf A, Syahbuddin S, Waspadji S, Dillasamola D. 2018. The role of surviving and raf-1 kinase against enhancement of pancreatic beta-cell apoptosis in patients with type 2 diabetes mellitus. Asian Journal of Pharmaceutical and Clinical Research. 11(11):344-7.

Duca LM, Wang B, Rewers M, Rewers A. 2017. Diabetic ketoacidosis at diagnosis of type 1 diabetes predicts poor long-term glycemic control. Diabetes Care. 40(9):1249-55.

Hong JY, Jalaludin MY, Adam BM, Fuziah MZ, Wu LL, Rasat R, *et al*. 2015. Diabetes ketoacidosis at diagnosis of type 1 diabetes mellitus in Malaysian children and adolescents. Malays Fam Physician. 10(3):11-8.

Shizuma T, Fukui S, Todoroki K. 2016. A case of the back abscess and diabetic ketoacidosis in a patient with type 2 diabetes mellitus. Diabetes Care Rep. 1(2):1-3.

Simonsen JR, Harjutsalo V, Jarvinen A, Kirveskari J, Forsblom C, Groop P, *et al*. 2015. Bacterial infection in patients with type 1 diabetes: a 14-year follow-up study. BMJ Open Diabetes Research & Care. 3:e000067.