Case Report

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Internal Medicine Section

Management of Diabetic Ketoacidosis Complicated by Invasive Systemic Candidiasis in Type 1 Diabetic Patient: A Case Report

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ABSTRACT

Diabetic Ketoacidosis (DKA) is a severe metabolic complication commonly associated with Type 1 Diabetes Mellitus (T1DM), characterised by hyperglycaemia, metabolic acidosis and ketonaemia, leading to significant morbidity and mortality if not promptly treated. Invasive systemic fungal candidiasis, caused by *Candida* species, is a critical opportunistic infection that can complicate DKA. This case report discusses a patient with type 1 diabetes who developed DKA, which was subsequently complicated by invasive systemic fungal candidiasis and multiorgan dysfunction. A 19-year-old female patient presented with complaints of vomiting, dyspnoea on exertion, swelling of the vagina, and left hypochondriac pain for two days. The patient had T1DM for two years and had missed her insulin doses, after which she developed DKA along with a vaginal Bartholin's cyst that tested positive for fungi. She went into sepsis and septic shock. Subsequently, this developed into Multiple Organ Dysfunction Syndrome (MODS) after initially presenting as a local illness and then spreading to systemic invasive fungal candidiasis. The patient ultimately succumbed to the illness following a protracted stay in the Intensive Care Unit (ICU), despite receiving larger doses of antibiotics and antifungals, undergoing tracheostomy and mechanical ventilation, and having returned of spontaneous circulation, repeated Cardiopulmonary Resuscitation (CPR) cycles, as well as support from inotropic agents and vasopressors. This case highlights the necessity of early diagnosis and intervention with prompt action to prevent delayed diagnosis and complications that may arise. Serum 1,3 Beta-D-Glucan was positive, while Galactomannan was negative. Blood cultures were positive for *Klebsiella pneumoniae*. A vaginal swab culture from the Bartholin cyst revealed *Candida albicans* with pseudohyphae and budding yeast cells.

Keywords: 1,3 Beta D-glucan, Bartholin cyst, *Candida albicans*, Galactomannan

CASE REPORT

A 19-year-old female patient presented to the emergency room with complaints of vomiting, dyspnoea on exertion, swelling in the vaginal area, and left hypochondriac pain that began two days ago. She had a known history of T1DM for the past two years and was on regular medication but had missed two doses of insulin injections (human Actrapid insulin three times a day and Glargine 20 units every night subcutaneously). The patient did not have any history of hypertension, thyroid disease, tuberculosis, kidney dysfunction, or any other co-morbidities. Her father has been receiving maintenance haemodialysis for 20 years and has a known case of chronic renal disease.

Pallor was observed during the general examination, as seen in [Table/Fig-1]. There were no signs of icterus, cyanosis, clubbing, lymphadenopathy, or oedema of the feet. Blood pressure was 100/60 mmHg in the right arm while in the supine position, with a pulse rate of 138 beats per minute, regular. The respiratory rate was 24 breaths per minute, with SpO_2 of 94% on room air.

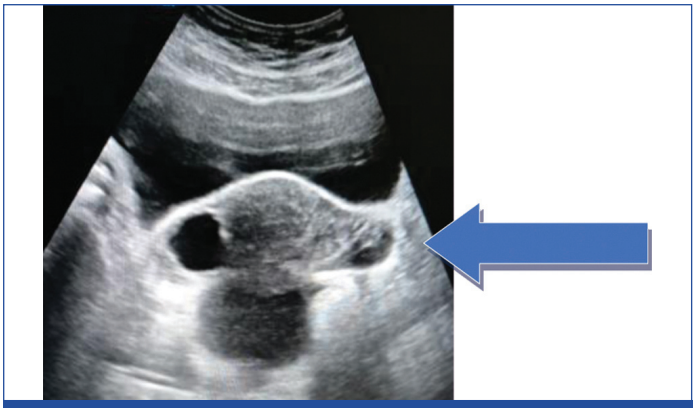
[Table/Fig-1]: Pallor seen in lower palpebral conjunctiva.

On systemic examination, the patient was drowsy and confused regarding the Central Nervous System (CNS). The Glasgow Coma Scale score was E4V4M5. Auscultation of the lung areas revealed bilateral crepitations in the lower basal regions, in addition to diffuse abdominal tenderness upon abdominal examination. The random serum blood glucose concentration at presentation was 300 mg/dL, with a high level of urine ketones. The results of the Arterial Blood Gas (ABG) analysis revealed metabolic acidosis.

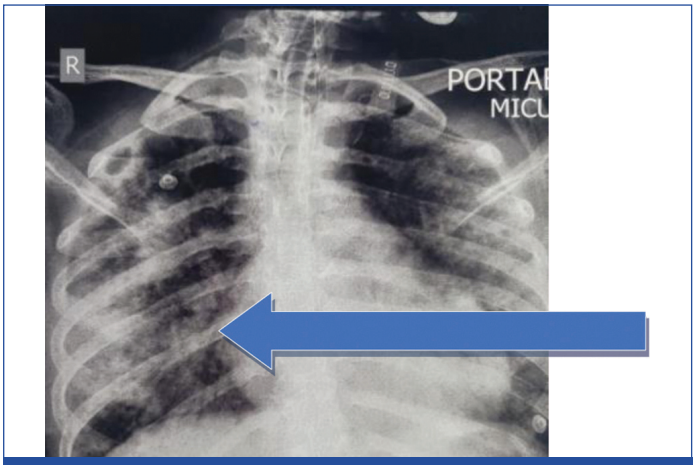
Haemoglobin was 13.4 grams per dL, Total Leukocyte Count (TLC) was 24,400 cells/mm^3, with platelets at 218,000/mm^3. Liver function tests were within normal limits. Amylase was 109 units per liter, lipase was 509 units per liter, serum creatinine was 1.84 milligrams per deciliter, and procalcitonin levels were 8.73 micrograms per liter. Renal function tests revealed derangement, with serum urea at 11 milligrams per deciliter and serum creatinine at 4 milligrams per deciliter. Serum sodium was 130 milliequivalents per liter, and serum potassium was 3.40 milliequivalents per liter.

Urine routine microscopy showed pH 5, protein 2+, glucose trace, acetone trace, RBCs 6-8, and pus cells 4-5. Blood cultures (anaerobic and aerobic) were positive for *Klebsiella pneumoniae*, while the urine culture was positive for *Enterococcus faecium* and budding yeast cell growth. Endotracheal tube secretions showed growth of *Steatothermophilus mobilensis*. The vaginal swab culture from the Bartholin cyst was positive for *Candida albicans*, with pseudohyphae and budding yeast cells. Serum 1,3 Beta D-Glucan was positive, while serum Galactomannan was negative.

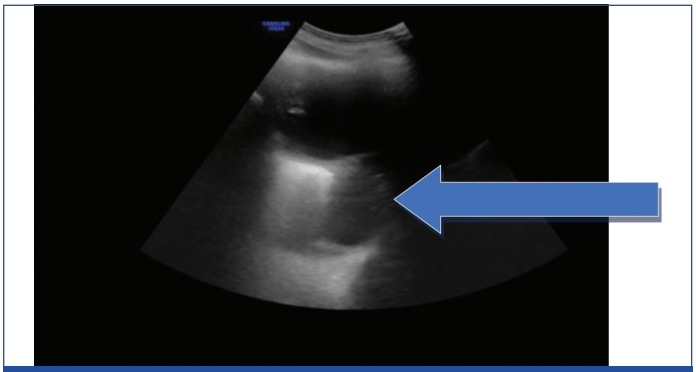
Ultrasonography (USG) of the abdomen and pelvis revealed minor ascites, a small-sized uterus, a mildly enlarged cervix (as seen in [Table/Fig-2]), and bilaterally elevated renal cortical echogenicity, along with right-sided minor pleural effusion. The chest X-ray in the anteroposterior view suggested a loss of the right costophrenic angle [Table/Fig-3] and right-sided pleural effusion, [Table/Fig-4].



[Table/Fig-2]: USG abdomen and pelvis showing small sized uterus and minor ascites.



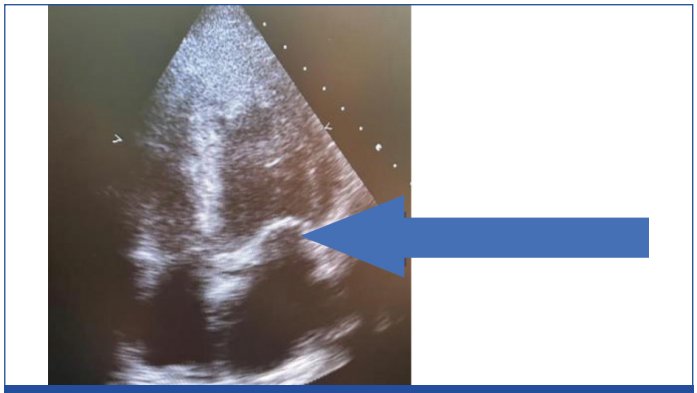
[Table/Fig-3]: Chest X-ray Antero-posterior view suggestive of loss of right costophrenic angle suggestive of mild right pleural effusion.



[Table/Fig-4]: USG thorax suggestive of right sided pleural effusion.

USG of the thorax revealed 200-400 cc of fluid with consolidation and collapse of the underlying lung parenchyma, accompanied by right-sided pleural effusion. Two-Dimensional Echocardiography (2D ECHO) revealed an ejection fraction of 40% with global wall hypokinesia, mild tricuspid regurgitation, and mild pulmonary artery hypertension, as seen in [Table/Fig-5]. There were no clots, vegetation, or effusion.

Higher doses of antibiotics were used to treat the patient, which included stat doses followed by loading doses of intravenous injections: Meropenem 500 mg three times a day, Teicoplanin 400 mg twice daily, Tigecycline 50 mg twice a day, Linezolid 600 mg twice a day, Colistin three million units three times a day, Levonadifloxacin 1000 mg twice a day, Aztreonam 1 gram three times a day, Polymyxin B 15,000 units per kilogram of body weight twice a day, Anidulafungin 100 milligrams per day for 14 days, and Liposomal amphotericin B 200 milligrams once a day. The creatinine clearance was used to titrate each dose. The patient received haemodialysis for ten cycles and underwent a tracheostomy on day 15 of the illness. She received CPR five times during the course of her ICU stay. Despite all efforts, she developed MODS, and on day 16 of her illness, she passed away.



[Table/Fig-5]: A 2D ECHO showing reduced ejection fraction of 40% with global LV hypokinesia.

DISCUSSION

Patients with T1DM have complete insulin insufficiency due to the destruction of the beta cells in the islets of Langerhans in the pancreas; therefore, exogenous insulin replacement therapy is necessary, as indicated in studies by Atkinson MA et al., and Patterson CC et al., Worldwide, the prevalence of T1DM is rising at a rate of 3% annually, with young people being the most affected [1,2]. Due to poor lifestyle choices and insufficient diabetes control techniques, 42.5% of individuals did not have a family history of diabetes, which is a substantial risk factor for systemic fungal infections in diabetes, as seen in a study by Cavet HM and Yoshikawa TT [3]. Fungal infections can occur in the foot, sinuses, lungs, mucous membranes, and warm, damp skin folds. Women are more likely to develop fungal infections [4]. In terms of fungal infection incidence, *Aspergillus flavus* is more commonly found in the air than *Aspergillus fumigatus* and constitutes the majority of fungal isolates (17.5%). Due to immunosuppression following liver transplantation, invasive aspergillosis is a potentially lethal consequence of severe liver disease [5].

Several risk factors are common in critically ill patients, such as debility, underlying malignancy, blood and bone marrow transplantation, Acquired Immunodeficiency Syndrome (AIDS), prolonged stays in ICUs and hospitals, neutropenia, the use of antibiotics and corticosteroids, and parenteral alimentation, are linked to the higher isolation of *Candida* species compared to other fungal isolates. In summary, diabetes mellitus increases the risk of fungal infections in patients due to insulin resistance, which can be exacerbated by medication overuse and non adherence, as noted in a study by Pappas PG et al., [6].

Cell wall polysaccharides, such as 1,3 Beta D-Glucan (BDG) and galactomannan, are examples of serum indicators that can be used to diagnose invasive fungal candidal infections. 1,3 BDG has a sensitivity of 92% and specificity of 81% as a biomarker for invasive fungal candidiasis. Positive cultures submitted for histopathological, microbiological, and biochemical investigation are the gold standard for diagnosing systemic invasive fungal candidiasis, as seen in studies by Fredheim S et al., Cho SM et al., and Krishka AM et al., [7-9].

Early patient screening is crucial for managing and controlling infections. If not, patients may end up with DKA, MODS, or invasive systemic infections. Individuals may exhibit altered mental status, hyperglycaemia, metabolic acidosis, hypotension, tachycardia, elevated TLC and procalcitonin levels, and acute renal damage [8,9].

When a patient is admitted to the ICU, they are often treated with close monitoring, intravenous fluid therapy, antibiotics, antifungals, insulin infusion, electrolyte management, inotropic and vasopressor support, oxygen therapy, and mechanical ventilation [10]. To maximise long-term outcomes and prevent recurrence, a multidisciplinary team approach involving endocrinology, infectious disease, nephrology, and dietetics is utilised. Following recovery, patients receive diabetes management education, with a focus

on the importance of regular follow-ups and adherence to insulin therapy [11].

CONCLUSION(S)

Patients with diabetes mellitus require special attention due to the high rate of fungal infections in this population. One major cause of death in diabetics is the high prevalence of mycosis. It is important to keep in mind the limited sensitivity to common agents, such as fluconazole. Every case of mycosis needs to be accurately diagnosed in order to prevent treatment resistance. This example illustrates the serious side-effects, including DKA, MODS, and invasive fungal infections, that can result from poorly controlled T1DM. Early recognition and comprehensive management are essential. Managing such severely ill patients requires the convergence of multidisciplinary support, targeted antimicrobial therapy, and intensive care.

REFERENCES

[1] Atkinson MA, Eisenbarth GS, Michels AW. Type 1 diabetes. The Lancet. 2014;383(9911):69-82.
[2] Patterson CC, Harjutsalo V, Rosenbauer J, Neu A, Cinek O, Skrivarhaug T, et al. Trends and cyclical variation in the incidence of childhood type 1 diabetes in 26 European centres in the 25-year period 1989–2013: A multicentre prospective registration study. Diabetologia. 2019;62:408-17.
[3] Calvet HM, Yoshikawa TT. Infections in diabetes. Infect Dis Clin North Am. 2001;15(2):407-21.
[4] Ashu EE, Korfanty GA, Xu J. Evidence of unique genetic diversity in *Aspergillus fumigatus* isolates from Cameroon. Mycoses. 2017;60(11):739-48.
[5] Donato-Santana C, Theodoropoulos NM. Immunization of solid organ transplant candidates and recipients: A 2018 update. Infect Dis Clin. 2018;32(3):517-33.
[6] Pappas PG, Kauffman CA, Andes DR, Clancy CJ, Marr KA, Ostrosky-Zeichner L, et al. Clinical practice guideline for the management of candidiasis: 2016 update by the Infectious Diseases Society of America. Clin Infect Dis. 2016;62(4):e1-50.
[7] Fredheim S, Johannesen J, Johansen A, Lyngsøe L, Rida H, Andersen ML, et al. Diabetic ketoacidosis at the onset of type 1 diabetes is associated with future HbA 1c levels. Diabetologia. 2013;56:995-1003.
[8] Cho SM, Farrokh S, Whitman G, Bleck TP, Geocadin R. Intracranial hemorrhage occurs early in patients with severe respiratory failure requiring venovenous extracorporeal membrane oxygenation. The authors reply. Crit Care Med. 2020;48(4):e340-e341.
[9] Kriska AM, Rockette-Wagner B, Edelstein SL, Bray GA, Delahanty LM, Hoskin MA, et al. The impact of physical activity on the prevention of type 2 diabetes: Evidence and lessons learned from the diabetes prevention program, a long-standing clinical trial incorporating subjective and objective activity measures. Diabetes Care. 2021;44(1):43-49.
[10] Kitabchi AE, Umpierrez GE, Murphy MB, Barrett EJ, Kreisberg RA, Malone JI, et al. Management of hyperglycaemic crises in patients with diabetes. Diabetes Care. 2001;24(1):131-53.
[11] Seymour CW, Rosengart MR. Sepsis and multiple organ dysfunction syndrome: The impact of diabetes mellitus. Critical Care Clinics. 2018;34(2):253-69. Doi: 10.1016/j.ccc.2017.11.004.

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