IBOM MEDICAL JOURNAL
Vol.17 No.3 | September - December, 2024 | Pages 598 - 601
www.ibommedicaljournal.org

Malnutrition-related diabetes mellitus in a destitute male Nigerian

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Abstract

Background: Malnutrition-Related Diabetes Mellitus (MRDM) formerly called "Tropical Diabetes" is a rare type of diabetes mellitus (DM), associated with long-term malnutrition.
Objective: To create awareness about this rare disease in the phase of a dwindling global economy and the need for a more focused screening in vulnerable groups.
Methodology: We reviewed the case records of the patient in terms of clinical presentation, imaging and laboratory parameters.
Case Summary: A 19-year-old destitute male, resident in a rural-community in Nigeria, presenting with abdominal pains for 6 months, bilateral leg swelling for 5 months and lower limbs paresthesia for a month. He was diagnosed with DM a year previously, took insulin for a month, thereafter resorted to herbal remedies due to financial constraints, but later left home to beg in the streets due to hunger.
Examination: Chronically-ill looking, markedly dehydrated and pale, with fluffy and pluckable hairs, peripheral oedema, multiple oral ulcers and bilateral parotid fullness. Weight was 35kg, height 1.65m and BMI was 12.9 kg/m^2.
Laboratory parameters: Marked glycosuria, absent ketonuria, beside random blood glucose (RBG) was unrecordably high (> 33 mmol/L), laboratory RBG was 63mmol/L, normal E/U/Cr and lipid profile, HbA1c of 13.8%, elevated alanine transaminase, low total serum proteins and albumin. Abdominal USS revealed normal-sized pancreas with diffuse echogenicity and multiple faint calculi. Plain abdominal x-rays showed multiple pancreatic calculi. A diagnosis of MRDM, fibro-calculous pancreatic (FCPD) type was made.
Treatment: Insulin, antibiotics, anti-neuropathic drugs, high-calorie/high-protein diet were given, with good clinical improvement within two months
Conclusion: Regular screening for MRDM in vulnerable groups will allow early detection and treatment of affected individuals.

Keywords: Malnutrition, diabetes, destitute

Introduction

Malnutrition is a nutritional condition which results from the imbalance of energy, protein and other nutrients which adversely affects the composition and function of body tissues and form.[1,2] Malnutrition-related diabetes mellitus (MRDM) is a rare type of DM associated with chronic malnutrition.[1] It was formerly called "Tropical Diabetes" because of its increased prevalence in the tropics.[3,4] The characteristic feature of MRDM is that these patients have both endocrine and exocrine

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DOI: 10.61386/imj.v17i3.

pancreatic insufficiency with the endocrine deficiency due to a lack of both insulin and glucagon.[5,6] The American Diabetes Association(ADA) reclassified MRDM into 2 subgroups for research purposes namely fibro-calculous pancreatic DM (FPDM) and protein-deficient DM (PDDM).[7,8] It has similar clinical symptoms with type 1 DM but has a history of chronic childhood malnutrition with a major marker being absent ketosis despite severe hyperglycaemia.[2] This type of DM is mostly a diagnostic challenge and is often confused with the other two main types.[1] Although it is uncommon, it must get properly diagnosed as that has a great impact on its prognosis and management in affected individuals.

Case presentation

A 19-year-old male, resident with his mother in a rural community of Akwa Ibom State, Nigeria was admitted to our emergency unit with a 6-month history of abdominal pains, 5-month history of bilateral leg swelling and a month history of pin and prick sensation in the toes. Abdominal pain was gradual in onset and located in the epigastrium. It was sharp in nature and non-radiating. He had suprapubic pains with urinary frequency, urgency and urge incontinence. Bilateral leg swelling was progressive with abdominal and facial swellings, no undue frothiness of urine. He had polyuria, polydipsia and diarrhoea alternating with constipation. He had no blurring of vision. He was diagnosed with diabetes a year earlier while living as a house help in Calabar, Nigeria and was admitted in a health facility, where he was managed for a month. The caregiver later sent him back to his mother, in the rural community. His mother could not afford the recommended medications, so she resorted to giving him local herbal preparations, with no relief of symptoms. He later left his home to beg in the streets and market because of hunger. He however was dropped at the gate of our facility, by an unknown taxi driver, whom he pleaded with to take him to the hospital, and a concerned nurse on duty helped him to the emergency unit of our facility.

Examination revealed a young lethargic male, in painful and respiratory distress, pale, severely dehydrated with a tinge of jaundice and bilateral pitting leg edema, periorbital edema, bilateral parotid fullness, geographic tongue, dry pale skin and fluffy/pluckable hairs. Anthropometry: weight: 35kg, height: 1.65 m. BMI: 12.9 kg/m^2 Abdomen was distended with epigastric, suprapubic and right renal angle tenderness. Cardiovascular system examination revealed tachycardia of 148 b/m and BP of 90/70 mmHg. An urgent bedside RBG done was unrecordably high (>33mmol/L). Working diagnoses of (1). Type 1 DM with acute and chronic complications and (2). Protein Energy malnutrition (PEM) were made

Investigations

Packed Cell Volume was 20% urinalysis showed marked glycosuria and no ketonuria. Glycosylated haemoglobin level (HbA1C) was 13.8%. Electrolytes, urea, creatinine and fasting lipid profile were all within normal ranges. Liver function test showed mildly elevated alanine transaminase (ALT). Urinalysis showed marked glycosuria and no ketonuria, while urine Microscopy, Culture and Sensitivity yielded E. coli sensitive to Ceftriaxone. Serum total protein was low at 44g/L (62-82) and serum albumin was 20g/L (36-52). Plain abdominal X-ray showed multiple pancreatic calculi, while abdominopelvic ultrasound scan (USS) revealed chronic pancreatitis features in a young adult.

A final diagnosis of MRDM, fibro-calculous pancreatic DM (FPDM) type was made.

Treatment

Active management of hyperglycemic crisis with intravenous fluids and soluble insulin was

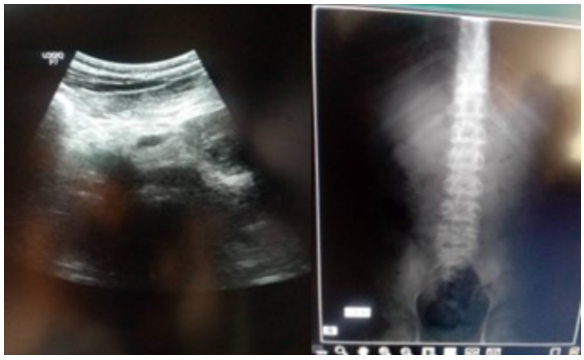

Fig 1: Abdominal ultrasound scan showing faint pancreatic calculi (a) and plain abdominal xray, showing multiple pancreatic calculi (b)

Fig 2: Index case at 2 weeks of in-patient care (a) and at discharge from in-patient care (b)

commenced. Intravenous antibiotics, anti-neuropathic drug (biopentin), haematinics, anti-helminthics, omeprazole and furosemide were also given. High calorie, high protein diet was recommended and commenced by the dieticians. He was discharged in a stable clinical state 12 weeks post admission with good glucose control and weight of 43kg. He went home on premixed insulin (16IU am and 8IU pm) and haematinics. A glucometer was provided for him for self-monitoring of blood glucose. He was enrolled in his village primary school to complete his study, which was affected by his ill-health. He was counselled on high protein, high calorie diet. A four weekly follow up visit was scheduled for him. Weight at last follow-up clinic visit, (5 months' post discharge) was 57kg with a BMI of 20.9 kg/m^2

Discussion

Malnutrition is a nutritional condition which results from an imbalance of energy, protein and other nutrients which adversely affects the composition and function of body tissues and form.[1,2] Malnutrition-related diabetes mellitus is an uncommon type of DM associated with long-term malnutrition. Like type 1 DM patients, these patients have hyperglycaemia and are insulin-dependent. However, unlike type 1 DM, they are ketosis-resistant and rarely develop DKA.[7,8] This is because they lack glucagon.[7,8] Similarly, the index case did not develop DKA, despite being off insulin and other therapy for DM, for over a year. ADA reclassified it into 2 subgroups for research purposes namely FPDM and PDDM.[7] The FPDM type is characterized by socioeconomic background of poverty and malnutrition as seen in most rural communities in sub-Saharan Africa and other poor regions 2-4 and is mostly observed in young adults below 30 years. It is ketosis-resistant and there is radiological evidence of pancreatic calcification and pancreatic exocrine dysfunction.[6,8] The PDDM differs from the FPDM by the absence of clinical and radiological evidence of pancreatic calcification and dysfunction.[7] The prevalence is high especially in South India (Kerala), Indonesia, Nigeria and Congo Republic.[3,4] It affects mostly those below 30 years of age and has a male/female ratio of 2.5:1. However, it has been shown to have equal gender distribution in Africa.[3] The exact aetio-pathogenesis of MRDM remains controversial. Globally, many factors have been implicated like PEM, infection, environmental factors like increased cassava consumption as seen in most rural communities of Nigeria and micronutrient deficiencies which all eventually lead to destruction of the pancreatic β cells.[5] Protein-Energy Malnutrition causes structural changes in the β cells which is often irreversible and results in β cells dysfunction, insulin deficiency and glucose intolerance.[7] Pathology of FPDM reveals a shrunken and fibrotic pancreas with dilated ducts containing calculi and no evidence of inflammation.[6,8] Patients with MRDM are typically underweight or cachectic and exhibit hair and skin changes, parotid gland enlargement typical of severe malnutrition before the onset of symptoms. They often present with osmotic symptoms and require high dose of insulin to control the hyperglycemia initially[1] These features were also observed in our index patient. As their weights increase, their high insulin requirement falls and glucose level normalizes.[4] However, MRDM patients do not develop ketosis even after stopping insulin for prolonged periods due to glucagon deficiency. The natural history is that of attacks of abdominal pain at a young age(<10yrs), DM diagnosis during the following 5-10 years and DM complications by age 30.[1,3]

Laboratory investigations usually reveal marked hyperglycemia, glycosuria with no ketonuria, normal kidney function, subnormal basal insulin and glucagon levels. Pancreatic exocrine function tests are abnormal. Also, there is hypoproteinaemia and severe hypoalbuminemia as was seen in our

patient. Glycosylated Haemoglobin levels are also often very high as observed in the index patient. Radiological investigations include Abdominal imaging like x-ray, USS, computerized tomographic scan as well as Endoscopic Retrograde Cholangiopancreatography (ERCP) and often show presence of intraductal calculi and fibrosis/ductal changes like dilatation characteristic of the FPDM type.[6,8] Management is multidisciplinary and involves the endocrinologists, dieticians, radiologists and gastroenterologists.[6] It is multifaceted and involves nutritional support, pain relief, management of diabetes and exocrine insufficiency. Medical Nutrition Therapy (MNT) remains the cornerstone of management of MRDM. Calorie restriction is prohibited as most patients are lean. A balanced diet with adequate carbohydrates, fats and proteins must be ensured. A dietitian should be invited to prescribe a dietary plan for the patients.[4,6,8]

Non-opioid analgesics are ideal for the abdominal pains although opioids can be used in low doses. Micronutrients supplementation can also help in pain control by reducing oxidative stress on the pancreatic cells. Pancreatic enzyme replacement therapy (PERT) given at optimal doses at the right time is necessary to ensure adequate nutrient absorption and prevent downstream effects like PEM and vitamin malnutrition. It is often combined with H^2 receptor blockers like ranitidine or protein pump inhibitors like rabeprazole to reduce acidic degradation of the formulations.[6,7]

A balanced and healthy diet with whole grains and adequate micro- and macronutrient intake is essential for optimizing glycaemic control.[1] Insulin is the antidiabetic drug of choice with basal-bolus insulin therapy the ideal for glycaemic control in FPDM[8] Glycaemic targets are similar to that recommended for type 1 and type 2 DM. Optimization of blood pressure and blood lipids is essential to reduce cardiometabolic risks.[4]

Conclusion

Malnutrition-Related Diabetes Mellitus is a unique form of diabetes often seen in the tropics and in people with low socioeconomic status. Management includes lifestyle modification and medications. Early detection and appropriate treatment are keys in reducing mortality and morbidity associated with it. Poor socio-economic status may hinder early/adequate medical care as seen in this patient. Patients with this condition may not be able to afford adequate medical care due to poor socioeconomic background as observed in our patient. Screening for this type of diabetes should be carried out among rural residents of sub-Saharan African region and other regions who constitute major vulnerable groups, due to poor socioeconomic status, especially in the phase of worsening inflation and food shortages.

Inability to assay for C-peptide and serum insulin were the limitations encountered in this case report.

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