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Managing Type 2 Diabetes Mellitus in Adolescent- Case Report

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Abstract: ***Introduction: The incidence of type 2 diabetes mellitus (T2DM) in adolescents has increased in the last few decades and childhood obesity turns out to be the most important risk factor. The incidence varies between 0.5 to 1.0 in the age group of 10-19 years per 1000 individuals. Case Report: Master XX, 14 years old boy presented with complaints of increased thirst for around 2 weeks. He was having high blood sugar on random blood glucose testing. On investigation HbA1c was high. Patient was managed on insulin till hospital stay. On follow up other forms of diabetes were ruled out after thorough investigations and type 2 diabetes was confirmed. The patient was started on Metformin and long-acting insulin for further management along with counselling for diet and exercise. Discussion: Type 2 diabetes mellitus is a chronic disease almost exclusively found in adults, except for a few cases of in young population. Managing the patient is a challenge as during initial encounter it is difficult to classify into other causes of diabetes apart from type 1 due to its prevalence in young population. Conclusion: This case affirms the rising presence of type 2 diabetes mellitus in young population and asserts on the need of hour to control childhood obesity. It also asserts for need of a uniform algorithm for diagnosis of diabetes subtype in young population.***

Keywords: Type 2 Diabetes mellitus, Young, Adolescent, Children, Obesity

1. Introduction

According to general notion diabetes in young (children and adolescents) presents with acute deterioration in clinical status after presenting with polyuria, polydipsia, dehydration and ketosis. Few children present with an insidious onset form of thedisease and is not always accompanied by ketosis. This set of children consists of only aminority of cases.During the initial phases of the disease, they do not depend upon insulin therapy for survival.In the later part of last century research in the areas of genetics, immunology andmetabolism were able to differentiate and individualize hyperglycemic symptoms in children and adolescents. American diabetes association has divided diabetes into type 1, type 2, specific types (also containing monogenic diabetes, also known as maturity onset diabetes of young) and gestational diabetes mellitus.(1)

Recently studies have shown that in USA every 3rd youth younger than 18 years of age diagnosed with diabetes is suffering from type 2 diabetes mellitus. Studies in India have demonstrated that there has been a shift in the age (<30 years) for the onset of T2DM. The risk factors for the above trend were found to be obesity, decrease in physical activity, family history, sedentary lifestyle, prenatal factors and urban stress.(2)

The etiopathogenesis of development of T2DM in young population are similar to those in older patients but the onset, severity and interaction of reduced insulin sensitivity anddefective insulin secretion is different in patients whodeveloped the disease during childhood or adolescence. According to studies theloss of β-cell function is increased in type 2diabetes occurring in young patient which is 20–35%annual decline as compared to 7% declinein adults. These changes in β cell function suggests that that T2DM in adolescents andchildren might have a more aggressive course in comparison with people developing the disease late in adulthood.(2)

Differentiating type 2 diabetes mellitus from other forms of diabetes is a challenge in young as there are overlapping features with the condition called monogenic diabetes, also known as maturity onset diabetes in young (MODY). Both the conditions have familial predilection but it is much more in MODY due to strong penetrance of the autosomal dominant condition. The presence of early onset diabetes in two consecutive generations is a strong indicator. Thus, a youthidentifiedas diabetic before the age of 25 years with a clear familyhistory of diabetes in one of the parental lines and presence of signs of ongoing insulin secretion indicated by the absence ofketoacidosisat the time of onset and later on presence of detectable C-peptide for years and obvious low doses of insulin requirementshould raise thesuspicion of MODY and molecular genetic testing should be recommended. It occurs especially whenislet autoimmunity and insulin resistance are not simultaneously present, so the patient cannot be diagnosed witheither type 1 or type 2 diabetes.(3)

There are tests present to differentiate between type 1 diabetes mellitus (T1DM) from T2DM. Allyoung patients should be tested witha panel of pancreatic autoantibodies even if the patient is having a classicalT2DM presentation. The panel should include anti-glutamic aciddecarboxylase (GAD) and tyrosine phosphatase insulinoma-associated antigen 2(IA2) antibodies. Insulin autoantibodies (IAA) should be included only ifinsulin therapy has not started or it has been used for lessthan two weeks. Testing for autoantibody to zinc transporter 8(ZnT8) is becoming more widely available. On uncertain diagnosis C-peptide level and/or aserum insulin level (only if insulin therapy has not

yet been initiated) can be tested afterglycaemic control has been established.Low level of C-peptide supports the diagnosis of T1DM but should beone should be cautious as levels can be low at time of diagnosis of T2DM.(4)

2. Case report

The14 years old boy who is resident of Meghalaya, Indiawas referred by private clinic for high blood sugar to our hospital on 31st March, 2021. The boy came was accompanied to the hospital with complaints of increased thirst for 2 weeks and history of rashes on hands and arms for the last 10-12 days.He did not have any history of altered sensorium, upper abdominal pain, polyuria, burning micturition, nocturia or fever.

He did not have any significant past medical history. He was not on any prescribed drugs. On enquiring he said he was obese and weighed around 100kgs six months back and has lost weight with diet control and physical activity. On further questioning the relatives revealed that the boy's mother as well as grandmother were both diagnosed with type 2 diabetes mellitus in adulthood.The boy's mother was first diagnosed with diabetes during pregnancy and was initially diagnosed with gestational diabetes mellitus. He takes mixed diet in adequate amount.There was no history of alcohol intake.

On examination the patient was afebrile, blood pressure was 130/90mmHg in sitting position, heart rate was 80/min, weight was 73 kgs and height was 173 cm. Calculated BMI was 24.39kg/m^2. There was no pallor, icterus, cyanosis, clubbing, edema.Further examination was within normal limits.

The patient was admitted in medicine ward and was evaluated further. HbA1c was sent after random blood sugar was high which came out to be 16.3. Glucose was present in routine urine.Renal function tests,ultrasound of whole abdomen and lipid profile were within normal limits.

The patient was started with basal bolus insulin regimen suspecting type 1 diabetes mellitus considering the age of the patient. The insulin requirement was around 68 units per day (16 units each given before the three meals, while 20 units for basal maintenance). Patient was discharged after improvement and was asked to come for follow up with panel of pancreatic autoantibodies.

On subsequent follow up on OPD basis the islet cell antibody and Anti GAD 65 were found to be negative.Fasting C-peptide was 2.49 ng/ml. The diagnosis was reconsidered. After consideration of all the factors diagnosis of type 2 diabetes mellitus was made.

On subsequent OPD visits the patient's insulin requirements were tapered and oral hypoglycemic drugs were added according to the guidelines. Presently as on recent OPD visit i.e., 9th February, 2022 the patient is managed on 2000mg of metformin, 10mg of Dapagliflozin and 20 units of Inj. Insulin glargine. Further patient was counselled about weight management and dietary habits.

3. Discussion

Patients with T2DM are usually obese. In contrast, children with T1DM are notoverweight and usually have a recent history of weight loss. The age an adolescent with T2DM generally presents is after the onset of puberty, as for this patient who presented at age of 14 years. By contrast, approximately half of youth with T1DM present before the age of 10 years.(4)This patient is at risk-overweight (as BMI is 24.39 kg/m^2) according to the WHO Asia pacific guidelines.(5)Thus the factor of obesity has caused a modest increase in chance of T2DM.The association of obesity and T2DM is much stronger in youth in comparison to adults. The pathophysiology of obesity leading to diabetes lies in increase in the peripheral resistance to insulin-mediated glucose uptake.(4)

An adolescent should be screened for T2DM if he/she is overweight or obese (body mass index [BMI] ≥85percentile) andthere are one or more ofrisk factors such as T2DM mellitus in a first- or second-degree relative, member of a high-risk racial/ethnic group, history of maternal diabetes or gestational diabetes during the child's gestation, signs of insulin resistance or conditions associated with insulin resistance (e.g.,hypertension, dyslipidaemia, acanthosis nigricans, polycystic ovary syndrome[PCOS], or small for gestational age birth weight and/or length body habitus).(4)

Around 40 percent of adolescents with T2DM areidentified when they are asymptomatic.Most of them are diagnosed on routine testing. Further 60 percent of adolescents with T2DMare having symptoms at the time of presentation. The symptoms may include polyuria, polydipsia, and nocturia which are similar to those in patients with type 1diabetes mellitus (T1DM) and as in this case. Most patients who first present with Diabetic Ketoacidosis have T1DM rather than T2DM, unlike this case.(4)

Family history – 75 to 90 percent of those with T2DM have an affected first- orsecond-degree relative as it was found with this case on questioning, whereas only up to 10 percent of patients with T1DM havean affected first- or second-degree relative.

According to study done by Katzeff et al., analysing C-peptide levels in between twodifferent groups of children, one with DM 2 and theother with DM 1, reported that urine or plasma testing for C-peptide was sufficient todiscriminate between the two groups. The low values of c peptide were found reflecting insulinopenia typical of T1DM, while T2DM reported normal levels even when of early onset. C-peptide values more than 0.6 ng/ml or, withoral nutritional supplements, greater than 1.5 ng/ml demonstrate significant insulin reserves. For patient in this case report the c peptide levels were elevated and hence further supporting the diagnosis of T2DM and eliminating T1DM and monogenic diabetes.In obese adolescents with featuressuggestive of T2DM, who develop ketoacidosis at the time of presentation, the prevalence of pancreatic auto-antibodies is around 15%.The frequency ofauto-antibodies in healthy adolescents is between 1 and 4%, and therefore presence of auto-antibodies is not the sole criteria sufficient to rule out T2DM of the young, or toconfirm a diagnosis of T1DM.(6)

One should eye forimproved glycaemic control by harmonizingthe food intake and physical activity. Patients with T2DM should be provided with small meals to avoid wide glycaemic excursions.The diet should reduce caloric intake but also meetthe desired quality for normal health and growth.In adolescents with T2DM, the goal should be around 10percent decrease in body weight in those who have already completed their linear growth, or a bodymass index (BMI) <85percentile in those who are still growing.(7)

Metforminis the first-line therapy for most adolescents. Insulin is used for patients who present with features of ketosis or severehyperglycemia, or for those adolescents who have mixed features of T1DM and T2DM. Guidelines recommends use of insulin whenrandom plasma glucose is ≥250 mg/dL or hemoglobin A1cis >9percent. Most of the individuals with T2DM require insulin therapy later in life.GLP-1 agonists are approvedfor use in paediatric patients with more than 10 years of T2DM. They promote modest weight loss and hence ideal for therapy.Sodium-glucose co-transporter 2 inhibitors increase urinary glucose excretion, reduce blood glucose levels, and improve A1C. Further, there is an associated decrease in body weight. Therefore use of SGLT2 inhibitors isindication in cardiovascular disease due to improved survivaland benefits on renal outcomes. (7)

The recommended goal of strict glycaemic control is defined ashemoglobin A1c less than 7 percent, for children and adolescents. Elevated fasting plasma glucose (FPG) levels as an indication to intensify therapy.A target of FPG less than 130 mg/dL should be maintained. More stringent targets HbA1c<6.5 percent and FPG <110mg/dL may be appropriate in those with shorter duration of diabetes or those who have achieved weight loss. (7)

4. Conclusion

The overlapping features of different types of diabetes makes it difficult to classify the patient. A uniform diagnostic algorithm is need of hour. The detailed evaluation of history, examination and laboratory parameters has to be done before starting the patient on a therapy. Early detection of diabetes in young carries utmost importance to avoid vascular and renal complications later in life.

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