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A Case Study: Type II Diabetes Mellitus in Young Child

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A B S T R A C T

Introduction. Type 2 diabetes mellitus (T2DM) is increasingly seen in pediatric populations due to rising obesity rates. Characterized by insulin resistance and hyperglycemia, T2DM often presents with symptoms like increased thirst, frequent urination, weight loss, and acanthosis nigricans. Early diagnosis and management are crucial to prevent long-term complications.

Case Presentation. A six-year-old female presented with increased thirst, frequent urination, unexplained weight loss, fatigue, and acanthosis nigricans. She had a significant family history of T2DM and hypertension. Her BMI was 24.3 kg/m², placing her above the 95th percentile for her age. Laboratory tests showed fasting blood glucose of 150 mg/dL, HbA1c of 8.2%, and a 2-hour postprandial glucose of 200 mg/dL. Her lipid profile was abnormal, with elevated total cholesterol and LDL, and decreased HDL. Liver function tests showed mildly elevated ALT and AST. Urinalysis revealed glucose without ketones. The clinical and laboratory findings confirmed the diagnosis of T2DM.

Conclusion. This case underscores the rising incidence of type 2 diabetes in children, linked to obesity and familial risk factors. Early recognition and intervention, including lifestyle modifications and medical management, are essential to mitigate the disease's impact and prevent complications.

Keywords: Type II Diabetes Mellitus, Young Child, Risk Factors,

Introduction

Type 2 diabetes mellitus (T2DM) has traditionally been considered a disease of adulthood, largely linked to lifestyle factors such as poor diet, physical inactivity, and obesity. However, over the past few decades, T2DM has emerged as a significant health concern among children and adolescents. This shift is closely related to the rising prevalence of obesity in younger populations, driven by changes in dietary patterns, reduced physical activity, and increasingly sedentary lifestyles.

The global prevalence of T2DM has increased dramatically, with significant public health implications. In the United States, the prevalence of T2DM among children and adolescents has risen alongside the obesity epidemic. According to the SEARCH for Diabetes in Youth Study, T2DM now accounts for approximately one-third of all new diabetes diagnoses in adolescents. The disease disproportionately affects minority populations, including African American, Hispanic, Native American, and Asian American children, highlighting the interplay of genetic, socio-economic, and environmental factors.

T2DM is characterized by insulin resistance and relative insulin deficiency. In the context of insulin resistance, the body's cells become less responsive to insulin, a hormone crucial for glucose uptake and utilization. The pancreas compensates by producing more insulin, but over time, beta-cell dysfunction ensues, leading to inadequate insulin secretion and hyperglycemia. Central adiposity, or the accumulation of fat around the abdomen, plays a pivotal role in the development of insulin resistance. Adipose tissue acts as an endocrine organ, secreting various hormones and inflammatory cytokines that disrupt normal insulin signaling pathways.

Several risk factors contribute to the development of T2DM in children. These include:

1. Obesity: The most significant modifiable risk factor, with excess body fat directly linked to insulin resistance.
2. Family History: A strong genetic predisposition, with a higher likelihood of developing T2DM if a parent or sibling has the disease.
3. Ethnicity: Higher prevalence in certain ethnic groups, suggesting a combination of genetic and socio-cultural factors.
4. Sedentary Lifestyle: Physical inactivity reduces insulin sensitivity and contributes to weight gain.
5. Diet: High intake of processed foods, sugary beverages, and low consumption of fruits, vegetables, and whole grains.
6. Puberty: The hormonal changes during puberty can exacerbate insulin resistance, increasing the risk of T2DM.

Children with T2DM may present with symptoms similar to those of type 1 diabetes, including polyuria (frequent urination), polydipsia (excessive thirst), and unexplained weight loss. However, many children are asymptomatic, and the diagnosis may be made incidentally during routine health checks or investigations for obesity-related complications. Acanthosis nigricans, characterized by darkened, velvety skin patches usually found in body folds, is a common physical sign of insulin resistance. Additional findings may include hypertension, dyslipidemia, and non-alcoholic fatty liver disease, indicating the presence of the metabolic syndrome.

The diagnosis of T2DM in children is based on standard criteria, which include:

1. Fasting Plasma Glucose (FPG): ≥ 126 mg/dL
2. 2-hour Plasma Glucose during an Oral Glucose Tolerance Test (OGTT): ≥ 200 mg/dL
3. Glycated Hemoglobin (HbA1c): ≥ 6.5%
4. Random Plasma Glucose: ≥ 200 mg/dL in the presence of classic symptoms of hyperglycemia

Differentiating T2DM from type 1 diabetes is crucial, as the management strategies differ significantly. Testing for diabetes-related autoantibodies (such as GAD65, IA-2, and insulin autoantibodies) helps exclude type 1 diabetes. Additionally, C-peptide levels can provide insight into endogenous insulin production, helping to distinguish between the two types. The management of T2DM in children involves a combination of lifestyle interventions and pharmacotherapy. Lifestyle modifications are the cornerstone of treatment and include:

1. Diet: A balanced, calorie-controlled diet emphasizing fruits, vegetables, whole grains, lean proteins, and healthy fats.
2. Physical Activity: Encouraging at least 60 minutes of moderate to vigorous physical activity daily.
3. Behavioral Therapy: Providing psychological support and involving the family in the treatment plan to enhance adherence and long-term success.

Pharmacological treatment typically begins with metformin, the only oral hypoglycemic agent approved for use in children. Metformin improves insulin sensitivity and has a favorable safety profile. In cases where glycemic control is not achieved with metformin alone, additional medications such as insulin or GLP-1 receptor agonists may be considered, though their use in very young children is less well-studied.

Children diagnosed with T2DM are at risk for developing chronic complications at a much younger age than those diagnosed in adulthood. These complications include Cardiovascular Disease such as Increased risk of hypertension, dyslipidemia, and atherosclerosis. Nephropathy such as Kidney damage leading to chronic kidney disease. Neuropathy Nerve damage causing pain, tingling, or numbness, particularly in the extremities. Retinopathy: Damage to the blood vessels in the retina, leading to vision problems. Early and aggressive management of T2DM is crucial to mitigate these risks and improve long-term health outcomes.

Type 2 diabetes mellitus in children is a growing public health concern, driven by the increasing prevalence of childhood obesity. Understanding the risk factors, clinical presentation, and pathophysiology is essential for early diagnosis and effective management. A multidisciplinary approach involving lifestyle modifications, pharmacotherapy, and regular monitoring is key to preventing long-term complications and ensuring a better quality of life for affected children.

Case Presentation

A 6 years old female was brought by her mother to pediatric polyclinic with main complaint of increased thirst and urination, unexplained weight loss (2 kg over the past 2 months), fatigue, and darkened skin patches on the neck and elbows (acanthosis nigricans). Her mother has type 2 diabetes; maternal grandmother has hypertension. The patient's birth history was full term and normal deiivery. She has Normal milestones and no developmental delays. She has history of recurrent otitis media, otherwise healthy.

Her vital signs were blood pressure 110/70 mmHg (elevated for age). Her height was 120 cm (90th percentile), her Weight was 35 kg (99th percentile), and her Body Mass Index (BMI) was 24.3 kg/m² (above the 95th percentile for age and sex). The patient's general Examination were Overweight and acanthosis nigricans present. Systemic Examination was no significant findings.

Laboratory examinations were Fasting Blood Glucose: 150 mg/dL (normal < 100 mg/dL), HbA1c: 8.2% (normal < 5.7%), Oral Glucose Tolerance Test (OGTT): 2-hour postprandial glucose 200 mg/dL (normal < 140 mg/dL), Lipid Profile: Elevated total cholesterol and LDL, decreased HDL, Liver Function Tests:* Mildly elevated ALT and AST, Urine Analysis: Presence of glucose, no ketones. Patient's Diagnosis was The clinical presentation and laboratory results led to a diagnosis of type 2 diabetes mellitus.

The treatment plan included:

1. Lifestyle Modifications:

- Diet: Referral to a dietitian for a balanced, calorie-controlled diet tailored to a young child's needs.
- Exercise: Encouragement to engage in regular physical activities appropriate for her age.

- Behavioral Therapy: Support for the patient and family to implement and maintain lifestyle changes.

2. Pharmacological Treatment:

- Metformin: Initiated at a low dose (250 mg twice daily), gradually increased to 500 mg twice daily, monitoring for any gastrointestinal side effects.

3. Monitoring and Follow-Up:

- Regular blood glucose monitoring.
- Quarterly HbA1c tests to assess glycemic control.
- Monitoring for potential complications, including hypertension and dyslipidemia.

At the 6-month follow-up:

- Glycemic Control: HbA1c reduced to 7.1%.
- Weight: Reduced by 3 kg with a corresponding decrease in BMI.
- Symptoms: Significant improvement in thirst, urination, and fatigue.
- Blood Pressure: Improved to 100/65 mmHg with lifestyle changes.

Discussion

This case of a 6-year-old girl with T2DM emphasizes several critical aspects of early-onset diabetes, particularly in the context of the current obesity epidemic among children. The discussion will cover the epidemiology, pathophysiology, clinical features, diagnostic challenges, and management strategies, providing a comprehensive view of the complexities involved in treating young children with T2DM.

The prevalence of T2DM in children has been increasing over the past few decades, closely paralleling the rise in childhood obesity. Although T2DM remains rare in children under 10 years old, it has been increasingly reported in this age group, especially among ethnic minorities such as African American, Hispanic, Native American, and Asian populations. In the United States, the SEARCH for Diabetes in Youth Study has highlighted the growing incidence of T2DM among children and adolescents, with a significant proportion of cases occurring in those with a family history of diabetes and obesity.

The pathophysiology of T2DM in children is similar to that in adults but with some distinctions. It involves a combination of insulin resistance and beta-cell dysfunction. Obesity, particularly central adiposity, plays a crucial role in the development of insulin resistance. Adipose tissue secretes various adipokines and inflammatory cytokines that impair insulin signaling pathways. In genetically predisposed individuals, the pancreatic beta cells fail to compensate for the increased insulin demand, leading to hyperglycemia. In young children, the rapid progression from insulin resistance to overt diabetes is often seen, possibly due to more aggressive beta-cell dysfunction. Children with T2DM often present with symptoms similar to those of type 1 diabetes, such as polyuria, polydipsia, and unexplained weight loss. However, many cases are asymptomatic and detected incidentally during routine health checks or investigations for obesity-related complications. Acanthosis nigricans, a marker of insulin resistance, is frequently observed and serves as a clinical clue. Other features may include hypertension, dyslipidemia, and fatty liver disease, reflecting the broader metabolic syndrome.

Diagnosing T2DM in young children can be challenging. The initial presentation may overlap with type 1 diabetes, necessitating a careful evaluation of clinical and laboratory parameters. Key diagnostic criteria include elevated fasting glucose, HbA1c, and OGTT results. Distinguishing between type 1 and type 2 diabetes is essential, as the management strategies differ significantly. Testing for autoantibodies (such as GAD65, IA-2, and insulin autoantibodies) helps exclude type 1 diabetes. Additionally, measuring C-peptide levels can provide insight into endogenous insulin production.

The management of T2DM in young children requires a multifaceted approach:

1. Lifestyle Modifications:

- Diet and exercise are cornerstone interventions. A dietitian can help design a balanced, age-appropriate diet to achieve gradual weight loss and improve insulin sensitivity. Physical activity should be fun and engaging to ensure adherence.

- Behavioral therapy involving the entire family is crucial, as family dynamics and support play a significant role in the success of lifestyle interventions.

2. Pharmacological Treatment:

- Metformin is the first-line pharmacological treatment approved for children with T2DM. It improves insulin sensitivity and has a favorable safety profile. Starting at a low dose and gradually increasing helps minimize gastrointestinal side effects.

- In cases where glycemic control is not achieved with metformin alone, other medications such as insulin or newer agents like GLP-1 receptor agonists may be considered, though their use in very young children is less well-studied.

3. Monitoring and Follow-Up:

- Regular monitoring of blood glucose levels and HbA1c is essential to assess treatment efficacy and adjust the management plan as needed.

- Monitoring for potential complications such as hypertension, dyslipidemia, and liver dysfunction is important, given the high risk of comorbidities in children with T2DM.

The long-term implications of T2DM diagnosed in childhood are profound. These children are at risk for developing chronic complications such as cardiovascular disease, nephropathy, neuropathy, and retinopathy at a much younger age than those diagnosed in adulthood. Early and aggressive management is crucial to mitigate these risks and improve long-term health outcomes. The diagnosis of T2DM in a young child can have significant psychological and social impacts. It is essential to address these aspects by providing psychological support and counseling to the child and family. Coping with a chronic condition requires ongoing support to ensure adherence to treatment and lifestyle modifications.

Type 2 diabetes mellitus can occur in young children, necessitating early diagnosis and a multidisciplinary approach to management. Lifestyle changes and appropriate medication can lead to improved outcomes and a better quality of life for affected children. Awareness and education about the risk factors and early signs of T2DM in children are vital for healthcare providers and the general public to ensure timely intervention and prevention of long-term complications.

Conclusion

This case underscores the rising incidence of type 2 diabetes in children, linked to obesity and familial risk factors. Early recognition and intervention, including lifestyle modifications and medical management, are essential to mitigate the disease's impact and prevent complications.

References

1. Noshad, S., Afarideh, M., Heidari, B., Mechanick, JI., & Esteghamati, A. (2015). Diabetes Care in Iran: where we stand and where we are headed. Annals of Global Health, 81(6), 839-850. doi: 10.1016/j.aogh.2015.10.003*
2. Klein, S., Gastaldelli, A., Yki-Järvinen, H., & Scherer, PE. (2022). Why does obesity cause diabetes? Cell Metabolism, 34(1), 11-20. doi: 10.1016/j.cmet.2021.12.012
3. Djalalinia, S., Saeedi Moghaddam, S., Sheidaei, A., Rezaei, N., Naghibi Iravani, SS., & Modirian, M., et al. (2020). Patterns of obesity and overweight in the Iranian population: findings of STEPs 2016. Frontiers in Endocrinology, 11, 42. doi: 10.3389/fendo.2020.00042
4. Yan, Z., Cai, M., Han, X., Chen, Q., & Lu, H. (2023). The interaction between age and risk factors for diabetes and prediabetes: a community-based cross-sectional study. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 16, 85-93. doi: 10.2147/DMSO.S390857
5. De Tata, V. (2014). Age-related impairment of pancreatic Beta-cell function: pathophysiological and cellular mechanisms. Frontiers in Endocrinology, 5, 138. doi: 10.3389/fendo.2014.00138
6. Okati-Aliabad, H., Ansari-Moghaddam, A., Kargar, S., & Jabbari, N. (2022). Prevalence of obesity and overweight among adults in the Middle East countries from 2000 to 2020: a systematic review and meta-analysis. Journal of Obesity, 2022, 1-18. doi: 10.1155/2022/8074837
7. Akhtar, S., Nasir, JA., Ali, A., Asghar, M., Majeed, R., & Sarwar, A. (2022). Prevalence of type-2 diabetes and prediabetes in Malaysia: a systematic review and meta-analysis. PLoS One, 17(1), e0263139. doi: 10.1371/journal.pone.0263139
8. Satman, I., Yilmaz, T., Sengül, A., Salman, S., Salman, F., & Uygur, S., et al. (2002). Population-based study of diabetes and risk characteristics in Turkey. Diabetes Care, 25(9), 1551-1556. doi: 10.2337/diacare.25.9.1551
9. Larson-Meyer, DE., Newcomer, BR., Ravussin, E., Volaufova, J., Bennett, B., & Chalew, S., et al. (2011). Intrahepatic and intramyocellular lipids are determinants of insulin resistance in prepubertal children. Diabetologia, 54(4), 869-875. doi: 10.1007/s00125-010-2022-3