e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:12/December-2024 Impact Factor- 8.187 www.irjmets.com

DIABETES IN CHILDREN

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ABSTRACT

Diabetes in children, both type 1 and type 2, has become a significant public health concern globally. While type 1 diabetes is primarily autoimmune in origin, type 2 diabetes in children has emerged as a consequence of the obesity epidemic. Both forms of diabetes demand a multidisciplinary approach for management, incorporating pharmacological treatments like insulin and oral hypoglycemics, along with lifestyle interventions. This review discusses the pathophysiology, clinical features, diagnostic criteria, management strategies, dosages, and emerging treatment options in detail. A strong emphasis is placed on individualized care to improve outcomes and quality of life for pediatric patients.

I. INTRODUCTION

Pediatric diabetes differs fundamentally from adult diabetes in terms of etiology, presentation, and management. The rapid rise in the incidence of type 1 diabetes in certain regions, coupled with the increasing prevalence of type 2 diabetes due to lifestyle changes, highlights the urgent need for awareness, early diagnosis, and effective treatment strategies.

Epidemiology

- **Type 1 Diabetes (T1DM):**
- Global incidence varies from 0.1 to 40.9 cases per 100,000 children per year.
- Most prevalent in Northern Europe and North America.
- **Type 2 Diabetes (T2DM):**
- Rising in developed and developing nations due to obesity.
- Strong association with ethnic backgrounds like Hispanic, African American, and Southeast Asian populations.

Pathophysiology

Type 1 Diabetes Mellitus

- Autoimmune destruction of pancreatic β-cells leads to absolute insulin deficiency.
- Mediators include autoantibodies (anti-GAD, ICA, and anti-insulin antibodies) and T-lymphocytes.
- Genetic predisposition with environmental triggers like infections (e.g., enteroviruses).

Type 2 Diabetes Mellitus

- Characterized by insulin resistance and progressive β-cell dysfunction.
- Obesity leads to increased free fatty acids and inflammatory cytokines, worsening insulin action.
- Strongly linked with dietary habits, sedentary lifestyles, and genetic predisposition.

Clinical Features

Type 1 Diabetes

- Sudden onset of polyuria, polydipsia, and unintentional weight loss.
- Fatigue and irritability are common.
- Often presents as diabetic ketoacidosis (DKA), with symptoms like abdominal pain, nausea, and deep breathing (Kussmaul respiration).

Type 2 Diabetes

- Gradual onset of symptoms such as mild polyuria, polydipsia, and fatigue.
- Often asymptomatic and diagnosed incidentally.
- Associated features: obesity, acanthosis nigricans (dark, velvety patches on skin), and PCOS in adolescent girls.

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Diagnosis

Diagnostic criteria for diabetes in children align with the American Diabetes Association (ADA) guidelines:

1. **Fasting Plasma Glucose (FPG):** ≥ 126 mg/dL.
2. **2-Hour Plasma Glucose (OGTT):** ≥ 200 mg/dL.
3. **HbA1c:** ≥ 6.5%.
4. **Random Plasma Glucose:** ≥ 200 mg/dL in the presence of classic symptoms.

Autoantibody testing distinguishes T1DM from T2DM or other forms like MODY (Maturity-Onset Diabetes of the Young).

Management Strategies

Type 1 Diabetes Management

- **Insulin Therapy:**
- Basal-bolus regimen is the standard of care.
- Basal insulin (e.g., glargine or detemir) provides steady control.
- Rapid-acting insulin (e.g., lispro, aspart) is used before meals.

Dosages:

- Initial dose: **0.5–1.0 units/kg/day.**
- Adjusted based on blood glucose levels and HbA1c trends.
- **DKA Management:**
- IV insulin infusion at **0.1 units/kg/hour**.
- Correct dehydration with isotonic saline and monitor for electrolyte imbalances.

Type 2 Diabetes Management

- **First-line:**
- Metformin (starting at **500 mg once daily**, titrated to **2000 mg/day**).
- **Second-line:**
- GLP-1 receptor agonists (e.g., liraglutide) for weight control.
- Basal insulin if metformin fails to control hyperglycemia.

II. MONITORING AND COMPLICATIONS

Monitoring

- **Glycemic Targets:**
- HbA1c < 7.5% for most children.
- **Self-Monitoring of Blood Glucose (SMBG):**
- Essential for insulin dose adjustments and avoiding hypoglycemia.

Complications

1. Acute:
- Hypoglycemia: Symptoms include sweating, palpitations, and confusion.
- DKA: Requires urgent intervention.
2. Chronic:
- Retinopathy, nephropathy, and neuropathy.
- Screen annually for microalbuminuria and retinopathy after 5 years of diagnosis.

Emerging Therapies

1. **Closed-Loop Insulin Delivery Systems:**
- Artificial pancreas systems integrating continuous glucose monitors (CGM) with insulin pumps.
2. **Immunomodulatory Therapy:**
- Trials are underway to halt β-cell destruction in early T1DM.

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3. β-Cell Regeneration:

- Stem cell and gene therapies offer promising future directions.

III. CONCLUSION

Diabetes in children requires early diagnosis and a tailored, multidisciplinary approach. Advances in treatment options and technology have improved management outcomes, but challenges like adherence, affordability, and accessibility persist. A focus on preventive care and patient education remains central to improving long-term quality of life for children with diabetes.

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