Pravara Med Rev; March 2023, 15 (01), 81-86
DOI: 10.36848/PMR/2022/99100.51080

Original article

Study of clinical and epidemiological pattern and metabolic profile of Type 1 Diabetes Mellitus in children

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Abstract:

Introduction: Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease that results from the destruction of pancreatic beta cells, leading to insulin deficiency. It is one of the most common chronic diseases in childhood, with an increasing incidence worldwide.

Material and methods: Present Observational study was conducted at Department of Paediatrics, Dr.D.Y.Patil Medical College, Pimpri, Pune. Data was collected through medical record review and questionnaires completed by patients and their caregivers. The data collected included demographic information, clinical features, laboratory results, and treatment history.

Results: In the present study, there were 6 (14.3%) diabetic children, 4 boys (16%) and 2 girls (11.8%) are products of third degree consanguineous marriage. The age of onset of Type 1 Diabetes mellitus in <6 year olds is 28.6%, in 6-10 year age group 54.8% and in children greater than 10 years, it is 7 percent. Polyuria, polydipsia and abdominal pain were the commonest symptoms observed in 38 (90.5%), 23 boys and 15 girls, 31 (73.8%), 18 boys and 13 girls and 30 (71.4%) , 20 boys and 10 girls respectively. Altered sensorium was serious symptom observed in 4 boys and 3 girls, total 7 (16.7%). Fever in 17 (40.5%), vomiting in 16 (38.1%) and polyphagia in 15 (35.7%) were other important symptoms.

Conclusion: Type 1 Diabetes Mellitus is one of the common chronic autoimmune disease in children, with rising prevalence in India, leading to major complications.

Keywords: Metabolic profile, chronic autoimmune disease, diabetes Mellitus

Introduction:

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease that results from the destruction of pancreatic beta cells, leading to insulin deficiency. It is one of the most common chronic diseases in childhood, with an increasing incidence worldwide.[1,2,3] The clinical and epidemiological pattern and metabolic profile of T1DM in children can provide important insights into the disease's natural history and help guide its management. Clinical features of T1DM in children typically include polyuria, polydipsia, weight loss, fatigue, and blurry vision. The onset of symptoms can be rapid or gradual, and the diagnosis is usually confirmed by the presence of hyperglycemia and glycosuria.[4] Management of T1DM in children typically involves insulin replacement therapy, carbohydrate counting, and regular monitoring of blood glucose levels. Epidemiologically, T1DM has a bimodal age distribution, with the highest incidence occurring in children aged 4-7 years and a second peak in adolescence. The incidence of T1DM varies between different ethnic and geographical populations, with the highest incidence reported in Northern European countries.[5,6]

Material and methods:

Present Observational study was conducted at Department of Paediatrics, Dr.D.Y.Patil Medical College, Pimpri, Pune. Data was collected through medical record review and questionnaires completed by patients and their caregivers. The data collected included demographic information, clinical features, laboratory results, and treatment history.

Patients underwent a complete clinical evaluation, including measurement of height, weight, blood pressure, and waist circumference. A thorough physical examination was performed to assess for complications of diabetes, such as diabetic retinopathy and neuropathy. Laboratory evaluation included measurement of blood glucose levels,

PMR P ISSN: 0975-0533, E ISSN: 0976-0164

HbA1c, C-peptide, autoantibodies to pancreatic islet cells, lipid profile, and renal function tests. Ketone levels were measured in patients with suspected DKA.

Inclusion criteria

Children between six months to twelve years of age group

Children diagnosed with type 1 Diabetes Mellitus.

Exclusion criteria

Children less than six months and more than twelve years of age group.

Children with Diabetes insipidus or Type 2 diabetes mellitus

Institutional Ethical Clearance was obtained before starting the study.

Results:

Out of total 42 cases, one case (2.4%) belonged to the age group 6 months to one year. There were 5 cases (11.9%) in the age group 1-4 years, 11 cases (26.2%) belonging to the age group 5-8 years and 25 cases (59.5%) in the age group 9-12 years.

In this study, there were 25 (59.5%) boys and 17 (40.5 %) girls. Boys and girls were equally affected (p= 0.37)

In this study, children from 9 years to 12 years of age group were the most affected, 25 (59.5%) cases. Out of this, 16 (28%) were male and 9 (23.5%) were female. in the age group 5 years to 8 years, there were 11 (26.2%) cases, of which 4 (40%) were male and 7 (58.8%) were females. Total 5 (11.9%) cases were from the age group of 1-4 years and only one case (2.4%) below the age of one year was affected (11 months old, male child).

Children from urban areas were more involved 39 (92.9%) than the rural areas, 3 (7.1%).

Children from upper middle class families were involved more than fifty percent, 22 (52.4%). Near about 18 (42.9%) cases were from lower middle class and only 2 (4.8%) cases were from the lower class.

Table 1: Consanguinity wise distribution of cases

Consanguinity	Gender		Total (n=42)
	Male (n=25)	Female (n=17)	
Absent	21(84%)	15(88.2%)	36(85.7%)
Present	4(16%)	2(11.8%)	6(14.3%)

In the present study, there were 6 (14.3%) diabetic children, 4 boys (16%) and 2 girls (11.8%) are products of third degree consanguineous marriage.

Table 2: Distribution of Cases according to Family History of Diabetes

Family history of Diabetes (Present/Absent)	Gender		Total (n=42)
	Male (n=25)	Female (n=17)	
Type 1 DM present	0(0%)	2(11.8%)	2(4.8%)
Type 2 DM Present	5 (20%)	4 (23.5%)	9 (21.4%)
Absent	20 (80%)	11(64.7%)	31(73.8%)
Total	25	17	42(100%)

PMR P ISSN: 0975-0533, E ISSN: 0976-0164

Either parent or grand parent of 5 boys (20%) and 4 girls (23.5%), total of 9 (21.4%) gave history of Type II Diabetes.

Table 3: Comparison of Hospital stay and Stay in PICU

	Gender		Total	P value
	Male	Female		
Stay in PICU	1.72±0.98	2.88±3.62	2.19±2.45	0.133
Hospital stay	6.60±2.45	7.76±3.13	7.07±2.77	0.184

Mean duration of PICU stay was longer for girls when compared to mean duration of PICU stay of boys 2.88±3.62 to 1.72±0.98.
Mean duration of hospital stay was longer for girls when compared to mean duration of hospital stay of boys 7.76±3.13 6.60±2.45.

Table 4: Onset of T1DM According to Age

Age of onset (y)	Gender		Total
	Male	Female	
<6	9(36%)	3(17.6%)	12(28.6%)
6-10	13(52%)	10(58.8%)	23(54.8%)
>10	3(12%)	4(23.5%)	7(16.7%)
Total	25(100%)	17(100%)	42(100%)

The age of onset of Type 1 Diabetes mellitus in <6 year olds is 28.6%, in 6-10 year age group 54.8% and in children greater than 10 years, it is 7 percent.

Table 5: Distribution of Cases as per Clinical presentation (DKA/Hyperglycemia) on Admission

Presentation	Gender		Total
	Male	Female	
Hyperglycemia	1(4%)	3(17.6%)	4(9.5%)
DKA	24(96%)	14(82.4%)	38(90.5%)
Total	25(100%)	17(100%)	42(100%)

In 4 children of the total 42, incidental hyperglycemia lead to the diagnosis of Diabetes and in 38 (90.5%), initial presentation was with typical signs of DKA. 24 boys and 14 girls presented with DKA .

Table 6: Distribution of cases according to Duration of Type 1 Diabetes Mellitus

Duration of type 1 DM	Gender		Total
	Male	Female	
Newly Diagnosed Cases	15(60%)	12(70.6%)	27(64.3%)
1Y	5(20%)	0(0%)	5(11.9%)
2Y	1(4%)	4(23.5%)	5(11.9%)
3Y	4(16%)	1(5.9%)	5(11.9%)
Total	25(100%)	17(100%)	42(100%)

Newly diagnosed in 15 boys and 12 girls, in total 27 (64.3%) diabetes was.
Longest duration of illness was for 3 years seen in 5 (11.9%), 2 years in 5 (11.9%) and 1 year duration in another 5 (11.9%) children .

Table 7: Distribution of Cases according to Chief Complaints

COMPLAINTS	Gender		Total (n=42)
	Male (n=25)	Female (n=17)	
Fever	9(36%)	8(47.1%)	17(40.5%)
Vomiting	10(40%)	6(35.3%)	16(38.1%)
Altered sensorium	4(16%)	3(17.6%)	7(16.7%)
Abdominal pain	20(80%)	10(58.8%)	30(71.4%)
Polyuria	23(92%)	15(88.2%)	38(90.5%)
Polydipsia	18(72%)	13(76.5%)	31(73.8%)
Polyphagia	8(32%)	7(41.2%)	15(35.7%)

Polyuria, polydipsia and abdominal pain were the commonest symptoms observed in 38 (90.5%), 23 boys and 15 girls, 31 (73.8%), 18 boys and 13 girls and 30 (71.4%) , 20 boys and 10 girls respectively. Altered sensorium was serious symptom observed in 4 boys and 3 girls, total 7 (16.7%). Fever in 17 (40.5%), vomiting in 16 (38.1%) and polyphagia in 15 (35.7%) were other important symptoms.

Discussion:

The metabolic profile of T1DM in children is characterized by elevated blood glucose levels, decreased insulin secretion, and increased ketone production. [8]Management of T1DM in children aims to maintain blood glucose levels within a target range to prevent acute and long-term complications, including diabetic ketoacidosis, microvascular and macrovascular complications, and impaired growth and development. In conclusion, the study of clinical and epidemiological pattern and metabolic profile of T1DM in children can provide important insights into the natural history of the disease and guide its management. It is essential to raise awareness of T1DM and promote early detection and appropriate management to prevent acute and long-term complications.

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease that primarily affects children and young adults. The disease results from the destruction of pancreatic beta cells, leading to insulin deficiency. The clinical and epidemiological pattern and metabolic profile of T1DM in children can provide important insights into the disease's natural history and help guide its management.[9,10]

One of the hallmark clinical features of T1DM in children is the triad of polyuria, polydipsia, and weight loss. These symptoms are caused by hyperglycemia, which leads to increased urine output, thirst, and catabolism of fat and protein. Other common symptoms of T1DM in children include fatigue, blurry vision, and recurrent infections. The onset of symptoms can be rapid or gradual, and children may present with diabetic ketoacidosis (DKA), a life-threatening condition characterized by hyperglycemia, acidosis, and ketonemia. [11,12] In the present study, most cases (59.5%) belonged to age group 9-12 years. Aria Setoodeh et al observed mean age of male children was 9.24+1,2, females mean age 9.83+3.35 years in their study. [13] In the present study, boys, 25, (59.5%) were more affected than girls, 17, (48.4%).

Sandeep Kumar, Ajay Bando et al observed that boys and girls were equally affected [14]. In study done by RR Jahagirdar, VV Khadilkar et al observed 8 boys and 4 girls. [15] In the present study, half off the cases (52.4%) belonged to upper middle class. Children, 26, (61.9%)were exclusively breastfed in this study. Kimpkimaki et al studied the duration of exclusive breastfeeding and concluded that Short term exclusive breastfeeding predisposes young children with increased genetic risk of Type 1 Diabetes to progressive beta cell autoimmunity, infants who have been breastfed exclusively for at least four months had lower risk of sero conversion of positivity for 1A-2A or all four auto antibodies, than those infants who had been breastfed exclusively for less than 2 months. [13]

In the present study, onset of Type 1 Diabetes Mellitus was more in the age group of 6-10 years (54.8%), less than 6 years old 28.6 % and 7 % in more than 10 year olds. A study done by Aria Setoodeh et al observed mean age of onset as 7.6+3 years.[12] Mean weight of boys was 25.44±15.13, girls 25.62±7.57, and of total study population was 25.51±12.51 kg. Mean height of boys was 124.63±27.20 cm, girls 127.35±20.04 and of total study population was 125.73±24.32 cm. Height and weight of boys and girls was similar, no statistical difference observed. In the study done by Sandeep Kanwal & Ajay Bando et al observed mean weight was 17.76+8.38 kg. RR Jahagirdar, VV Khadilkar et al noted the median height was 126.3 cm and the median BMI was 13.1 kg/m2. (51,54) In this study, polyuria, polydipsia, and stomach discomfort were the most prevalent features. In a research by RR Jahagirdar et al., polyuria (83.3%) was the most prevalent symptom, followed by vomiting (50%) and abdominal discomfort. [15]

The diagnosis of T1DM in children is usually confirmed by the presence of hyperglycemia and glycosuria. Blood glucose levels above 200 mg/dL in the presence of symptoms or fasting blood glucose levels above 126 mg/dL are diagnostic of diabetes. Glycosuria, or the presence of glucose in the urine, is a sensitive but not specific indicator of hyperglycemia. Additional tests, such as measurement of HbA1c, C-peptide, and autoantibodies to pancreatic islet cells, can help confirm the diagnosis and differentiate T1DM from other types of diabetes.[16]

Management of T1DM in children typically involves insulin replacement therapy, carbohydrate counting, and regular monitoring of blood glucose levels. Insulin is administered via injections or insulin pumps, and the dose is adjusted based on the child's age, weight, activity level, and carbohydrate intake. Carbohydrate counting involves estimating the amount of carbohydrates in food and matching it to the appropriate insulin dose. Regular monitoring of blood glucose levels is essential to prevent acute and long-term complications, including hypoglycemia, hyperglycemia, and diabetic ketoacidosis.[3,4,6]

Epidemiologically, T1DM has a bimodal age distribution, with the highest incidence occurring in children aged 4-7 years and a second peak in adolescence. The incidence of T1DM varies between different ethnic and geographical populations, with the highest incidence reported in Northern European countries. The exact causes of T1DM are not well understood, but it is believed to result from a combination of genetic and environmental factors. There is no known cure for T1DM, and current management strategies aim to maintain blood glucose levels within a target range to prevent acute and long-term complications.[8,9]

Conclusion:

Type 1 Diabetes Mellitus is one of the common chronic autoimmune disease in children, with rising prevalence in India, leading to major complications.

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