Original Article

Temporal Trends in Type 1 Diabetes from 2013–2023: Hospital-Based Study

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Abstract

Objective: Type 1 Diabetes Mellitus (T1DM) is one of the most common pediatric endocrine diseases having a significant burden on healthcare system, children and their families.

The objective of the study was to determine the temporal trends of T1DM in children 9 months to 18 years presenting to the department of pediatric endocrinology and diabetes over a period of 11 years.

Methodology: This study was a retrospective observational study carried out at the Department of Pediatric Endocrinology and Diabetes, The Children's Hospital, and University of Child Health Sciences Lahore Pakistan. Hospital record was used for Data collection from January 2013 to December 2023. All cases of T1DM patients aged 9 months to 18 years were included in the study after confirming the diagnosis of type 1 diabetes. Data was analyzed using SPSS 27.

Results: Among 2419 patients 1303 were male and 1116 were female making them 53.9% and 46.1% respectively. The age group with highest frequency was 5y-9.9y (41.6%) followed by 10y-18y (32%) and the lowest frequency age group was 9m-4.9y (26.4%). From 2013 to 2016 the most frequent age at presentation was more than 10 to 18 years but during 2019 to 2023 the most frequent age of diagnosis became 5y-9.9y.

Conclusion: A consistent rise in the number of patients being diagnosed as type 1 diabetes mellitus was observed. A shift is seen in the most frequent age group at presentation from 10–18 years to 5–10 years age group.

Keywords: Type 1 Diabetes Mellitus, temporal trend, hospital-based study.

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Introduction

Type 1 diabetes mellitus (T1DM) is a common chronic disease of childhood which has a great impact on healthcare system, children, and their families.[1,2] It is an autoimmune disease resulting from absolute insulin deficiency due to destruction of pancreatic beta cells. The most common antibodies detected are GAD autoantibodies followed by IA2, insulin and ZnT8 autoantibodies.[3]

Incidence and prevalence rates of T1DM are on a rise worldwide and has significantly influenced the child health. It is not only being highly reported in developed countries but also showing a steeper rise in low incidence countries like China, India, Iran and Pakistan. Trends and age of highest incidence which was previously seen in peri-pubertal years is now sliding towards younger age.[4]

A study conducted in Beijing, China has calculated the incidence of T1DM as 3.11–5.46/100,000 per year, with an annual increase of 5.10% which is more pronounced for 0–4 years age (7.07%). At the time of diagnosis of T1DM, 84.6% of patients had diabetic ketoacidosis.[4] In a study from India, estimation of the incidence was done in various states over a period of 13 years which ranged from 3.7–4.0 per 100,000. The prevalence was between a range of 4.27–31.9; lower prevalence found in rural and higher among the urban population.[5] A similar study conducted in Iran evaluated incidence and prevalence of T1DM over a period of 30 years and found two-fold rise in the incidence of T1DM in Iran. The factors attributing to this rise were mainly; change in incidence rate and the increase in population.[6] A previous study done in our institution showed that maximum number of newly diagnosed T1DM patients were from age group 0-5 years and there was twofold increase in the number of diabetes patients from 2008 to 2012 with similar trends in both genders.[7]

Currently Pakistan does not have any national diabetes registration system especially in children, so hospital registered data is a valuable source of information regarding epidemiological trends in T1DM.[8] Therefore, there is a great need of in-depth epidemiological studies in the country highlighting the precipitating environmental factors causing progressive increase in this lifelong disease with debilitating outcome in low incidence countries.

In given circumstances, hospital registration data can be reliably used to evaluate the trends in epidemiology of T1DM because most of the patient with newly diagnosed T1DM present with diabetic ketoacidosis and require hospitalization for treatment.[4,9] Those who do not present with ketoacidosis usually present to outpatient clinic for confirmation of diagnosis and appropriate management.[10,11]

The purpose of this study was to evaluate the time trends and the burden of T1DM in children of various age groups and gender presenting to the largest tertiary care hospital in the region.

Methodology

This retrospective observational study was conducted at Children's Hospital and The Institute of Child Health, Lahore in the Department of Endocrinology and Diabetes from January 2013 to December 2023. A formal proposal was submitted to the institutional review board (IRB) and study was approved (Ref. No: 765/CH-UCHS dated 17-01-2024).

All cases of newly diagnosed T1DM patients aged 9 months to 18 years presenting to the department of pediatric endocrinology were included in the study after confirming the diagnosis of T1DM. Patients were diagnosed using the ISPAD guidelines based on classic signs and symptoms, supportive blood glucose record and HbA1c. In cases where diagnosis was not clear, autoantibodies were also requested. Patients who had other types of diabetes such as Type 2 Diabetes, Monogenic Diabetes or drug-induced Diabetes were excluded from this study.

Data including age and gender were collected using the department records. In accordance with the WHO cut points used in the Diamond study, the cases were stratified into three age groups i.e., 9 months (m)-4.9 years (y), 5y-9.9y, 10y-18y. Temporal trends of age and gender were analyzed in relation to time using Chi-Square test and ANOVA was used to assess significance of number of patients in relation to time. Temporal trends were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 27.0. A p-value of < 0.05 was considered as statistically significant.

Results

Our study included 2419 patients, including 1303 male and 1116 female patients making them 53.9% and 46.1% respectively. The minimum age of the patients included in our study was 9 months and maximum 18 years. A consistent rise in the number of patients was observed except year 2020 where a significant fall in the number of patients was observed (p-value=0.001). (Table 1)

Table 1: *Number of T1 Diabetes Mellitus patients from 2013 to 2023.*

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
No. of cases	111	118	179	189	203	208	360	115	290	308	338	2419

Table 2: *Number of children presenting with diabetes according to age group..*

	9m-4.9yr	9m-4.9yr %	5yr-9.9yr	5yr-9.9yr %	10yr-18yr	10yr-18yr %	Total
2013	30	27%	35	31.50%	46	41.40%	**111**
2014	27	22.90%	47	39.80%	44	37.30%	**118**
2015	38	21.20%	63	35.20%	78	43.60%	**179**
2016	50	26.50%	58	30.70%	81	42.90%	**189**
2017	46	22.70%	91	44.80%	66	32.50%	**203**
2018	57	27.40%	62	29.80%	89	42.80%	**208**
2019	111	30.80%	164	45.60%	85	23.60%	**360**
2020	27	23.50%	54	47%	34	29.60%	**115**
2021	83	28.60%	121	41.70%	86	29.70%	**290**
2022	94	30.50%	124	40.30%	90	29.20%	**308**
2023	75	22.20%	187	55.30%	76	22.50%	**338**
Total	**638**	**26.40%**	**1006**	**41.60%**	**775**	**32.00%**	**2419**

Table 3: *Number of male and female patients presenting per year.*

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Male	63 (56.8%)	59 (50%)	103 (57.5%)	93 (49.2%)	113 (55.7%)	109 (52.4%)	202 (56.1%)	57 (49.6%)	173 (59.7%)	185 (60.1%)	146 (43.2%)
Female	48 (43.2%)	59 (50%)	76 (42.5%)	96 (50.8%)	90 (44.3%)	99 (47.6%)	158 (43.9%)	58 (50.4%)	117 (40.3%)	123 (39.9%)	192 (56.8%)

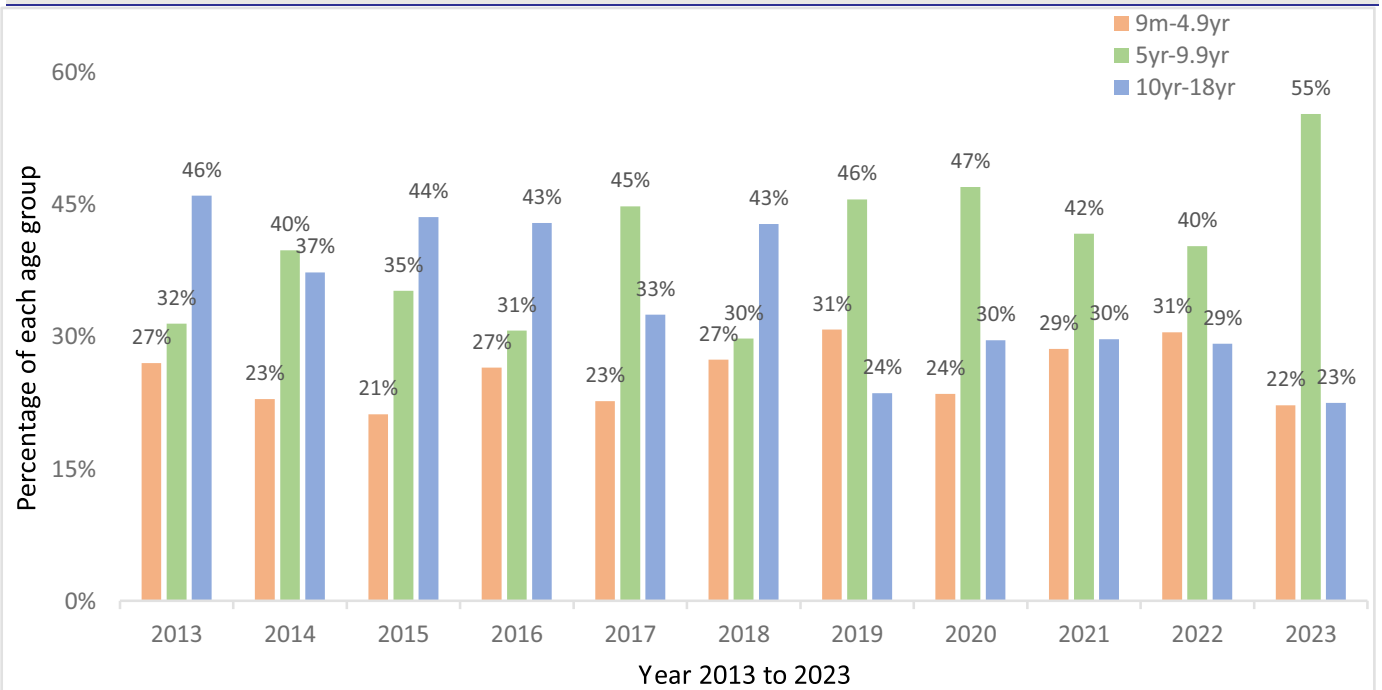


Figure 1: *Graphical presentation of children presenting with diabetes according to age group.*

Time trend according to various age groups is shown in Figure 1. Substantial difference in age groups distribution is observed over the years. During year 2013 to 2016 the most frequent age at presentation was more than 10 years which has become less frequent age group in later years. Contrary to the previous trend, during year 2019 to 2023 the most frequent age of diagnosis became 5y-9.9y (p-value=0.001).

Gender distribution of patients diagnosed with Type 1 Diabetes mellitus is shown in Table 3 and Figure 2. A total of 1303 male patients and 1116 female were found in the study, showing a statistically significant male predominance (p-value=0.001).

Discussion

We have observed a threefold rise in overall number of T1DM patients in last 10 years i.e., 111 patients in 2013 to 338 patients in 2023. There was a marked drop in number of new patients with T1DM in 2020 which can partially be attributed to closure of outpatient department and lack of public transport due to government policy of lockdown during COVID. The most prevalent age at diagnosis has shifted from 10-18 years (41%) in 2013 to 5-9 years (55.3%) in 2023. No difference of gender prevalence was seen in our study.

In the past couple of decades, a global rise in incidence of type 1 diabetes (T1DM) is seen even in low incidence countries like China,[4] India,[5] Iran[6] and Pakistan[7] whereas the studies from high incidence countries have shown slowing down of the previous rate of rise in incidence of T1DM.[12] Our data has documented as threefold rise in number of new cases being diagnosed at our hospital.

Another finding noted in present study is that the age at diagnosis is sliding towards younger age groups. A consistent rise in number of school age children (5-9 years) presenting with T1DM as seen in this study is also supported by studies from Europe and North America.[13,14,15] Other studies from Brazil and Montenegro supported the previous findings of highest incidence in pubertal age group (10-18 years).[8,12]

In this study we didn't find any gender predominance whereas Raicevic et al. found incidence of T1DM in male to be higher than in females.[12] An increase in the incidence of T1DM during COVID pandemic was found in some studies.[16,17] This pattern was reversed in our study possibly due to restrictions in traveling during COVID pandemic, the patients were unable to reach tertiary care centers.

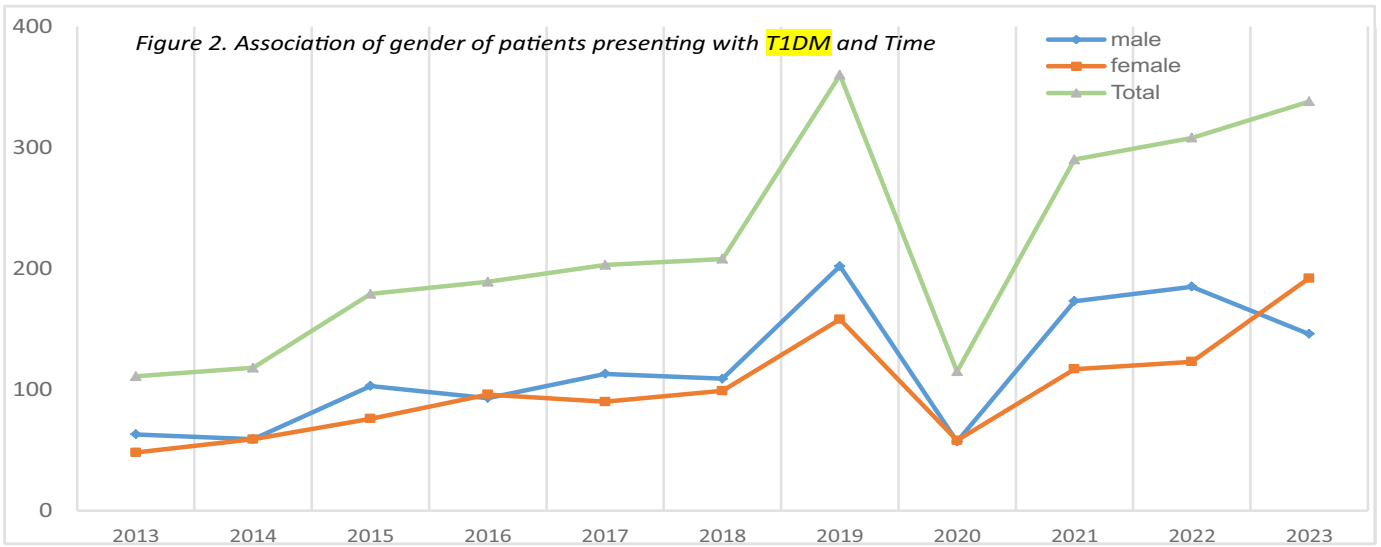


Figure 2: *Association of gender of patients presenting with T1DM and Time.*

The strength of this study is its duration of 10 years that is in continuation with a previous study of 5 years (2008-2012) which allows it to be compared with previous trends.[7] Limitation of this study was the inability to find the incidence of T1DM due to lack of calculation of the target population as our centre is a referral health facility where patients from all over Pakistan are referred and our centre is not the only referral centre receiving these patients.

We recommend further studies which are multi-center and include more diverse variables to find ongoing trends in the incidence, age and gender predominance. Social variables like urban or rural background, socioeconomic status, nutritional preferences, vaccination status should also be included as done in other epidemiological studies.[18,19]

Conclusion

This study finds a threefold rise in number of T1DM patients with no gender predominance. The most common age at diagnosis has decreased from pubertal age group (10-18 years) to pre-pubertal (5-9 years) age group.

Ethical Approval: This study was approved by the Ethical Review Committee

Conflict of Interest None

Funding Source None

Authors' Contribution

JM: Conception.

JM: Design of the work.

JM: Data acquisition, analysis, or interpretation.

JM: Draft the work.

JM: Review critically for important intellectual content.

All authors approve the version to be published.

All authors agree to be accountable for all aspects of the work

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