Original Research Article

TYPE 1 DIABETES (T1D) IN CHILDREN UNDER 5 YEARS OF AGE: MULTICENTRIC STUDY OF 22 CASES

ABSTRACT

Introduction : The incidence of T1D is increasing worldwide, particularly in young children under 6 years of age. The objective of this study was to describe the characteristics of type 1 diabetes in children under 5 years of age in our resource-limited country setting.

Materials and methods : This was a retrospective, descriptive study over a period from January 2018 to July 2022 in Dakar. All type 1 diabetic children under 5 years of age were included except those with an unusable file or less than 6 months of follow-up.

Results: We collected 22 records of children aged 0 to 5 years, with a prevalence of 7.8% of all children followed in the two centers. The socioeconomic level was considered average for 54% of patients. Ketoacidosis was the main mode of discovery in our patients (86%). The nutritional status was good for 77% of the children followed and 5% were overweight. The average HbA1c was 10.57 ± 0.5%. Analog insulins were the main insulins used by our patients, (64%). The average daily dose of insulin was 1.08 IU /kg. The diet was normal in the majority of patients (90%). No patient had a chronic complication during follow-up. Severe hypoglycemia was noted in 20% of cases. All our patients benefited from daily glycemic monitoring and had a notebook available. The monitoring rate was 3 checks, i.e. one check before each meal. No deaths were reported.

Conclusion : Diabetes in children under 5 years of age is not common. The majority of children are on insulin analogues with a glycemic control far from optimal. A prospective study could allow us to better identify the problems in order to provide appropriate solutions.

Keywords: Type 1 diabetes, children under 5, Senegal

1. INTRODUCTION

"In Africa, data on diabetes are scarce and fragmented. Indeed, more than half of African countries do not have recent data sources"**[1].** In Senegal, the hospital prevalence was estimated at 3.6 ‰ in 2015 at the Albert Royer hospital **[2].** The incidence of T1D is increasing worldwide, especially in young children under 6 years of age [3**, 4]**. "In this age group, unpredictable feeding, irregular physical activity, and parental-dependent eating habits complicate diabetes management and make it difficult to achieve good metabolic control"**[5].**In Senegal with the project «changing diabetes in children ", insulin is free as are several aspects of care. However, this free provision does not concern insulin analogues

which are more adapted to mimic physiological insulin secretion. The main objective of this work is to describe the characteristics of type 1 diabetes in children under 5 years of age in our context of a country with limited resources.

2. MATERIAL AND METHODS

This was a multicenter study that was carried out in two (2) reference university hospitals in Dakar that treat childhood diabetes: AbassNdao Hospital Center , Albert Royer National Children's Hospital Center

We conducted a retrospective, descriptive study over a period from January 2018 to July 2022.

Inclusion criteria: all type 1 diabetic children under 5 years of age receiving insulin therapy followed in pediatric departments

Non-inclusion criteria: diabetic children with unusable records or less than 6 months of follow-up.

The data were collected from the files and recorded on survey sheets pre-established for this purpose.

Glycated hemoglobin was divided into 3 groups: less than 7%, 7 to 9%, greater than 9%. Four groups of glycated hemoglobin were reported corresponding to four controls at three-month intervals.
Statistical analysis: Data were collected and analysed using Microsoft Excel 2010. The descriptive study involved calculating frequencies and proportions for the qualitative variables and averages, standard deviations and medians for the quantitative variables.

3. RESULTS

We collected 22 records of children aged 0 to 5 years, with a prevalence of 7.8% on all children followed in the two centers. The annual frequency was 5 cases per year .

The age groups between] 1-3 years] and [3-4 years] were predominant (36.36%) (figure1)

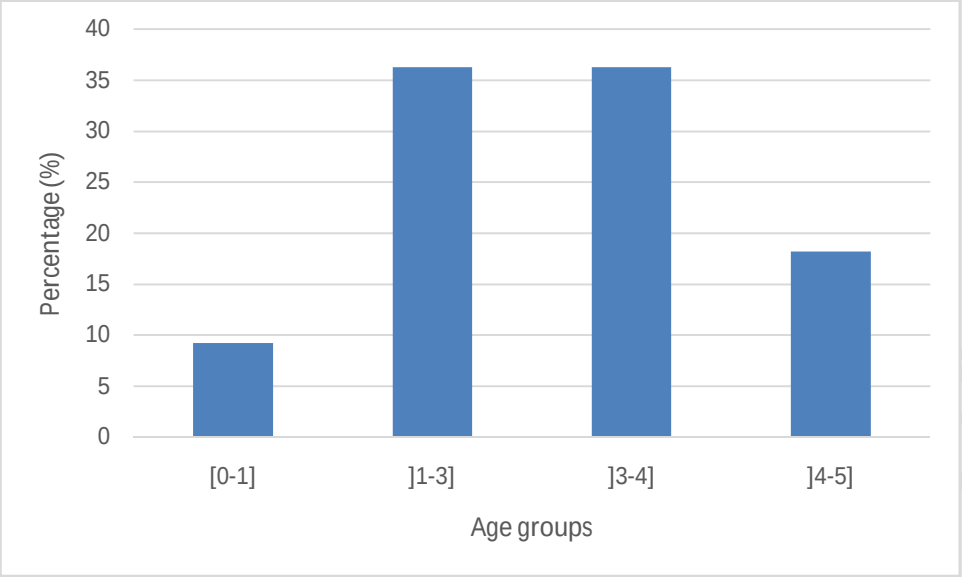

Figure 2: Distribution of patients by age

The sex ratio was 1. The socioeconomic level was considered average for 54% of patients.

The notion of familial diabetes was found in 68% of children. Ketoacidosis was the main mode of discovery in our patients (86%) (Table 1).

Table 1 :Patient characteristics

	Effectif (n)	Percentage(%)
Familial diabetes		
Yes	15	68
No	7	32
Discovery mode		
Carinal syndrome	3	14
Ketoacidosis	19	86
Insulin type		
Insulin analogue	14	64%
Insulin premix	5	22%
Insulin nph+rapid	3	14%

Snack		
Yes	13	59%
No	9	41%
Nibbles		
Yes	13	59%
No	9	41%

The nutritional status was good for 77% of the children followed and 5% were overweight (figure 2).

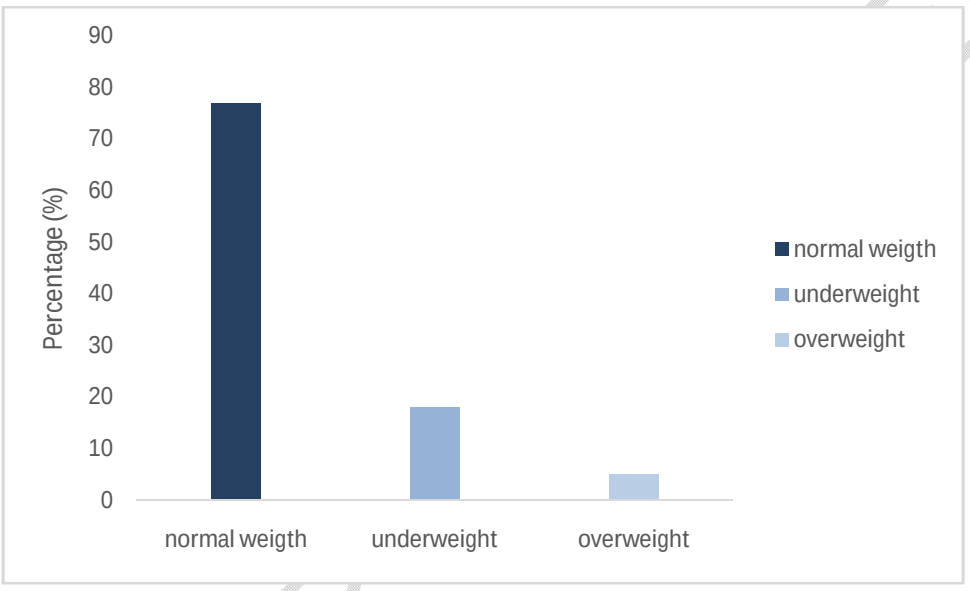

Figure 2: Distribution of patients according to nutritional status

Among the patients, 8% had lipodystrophy. It was located either in the arms or on the thigh. The average duration of diabetes was 19 months +/- 12 months.

The mean HbA1c was 10.57 ± 0.5%. During the 4 checks, HbA1c was higher than 9% in more than half of our patients with respectively 57.14% for the first check, 57.14% the 2nd , 85.71% the 3rd and 71.43% at the last check (figure 3).

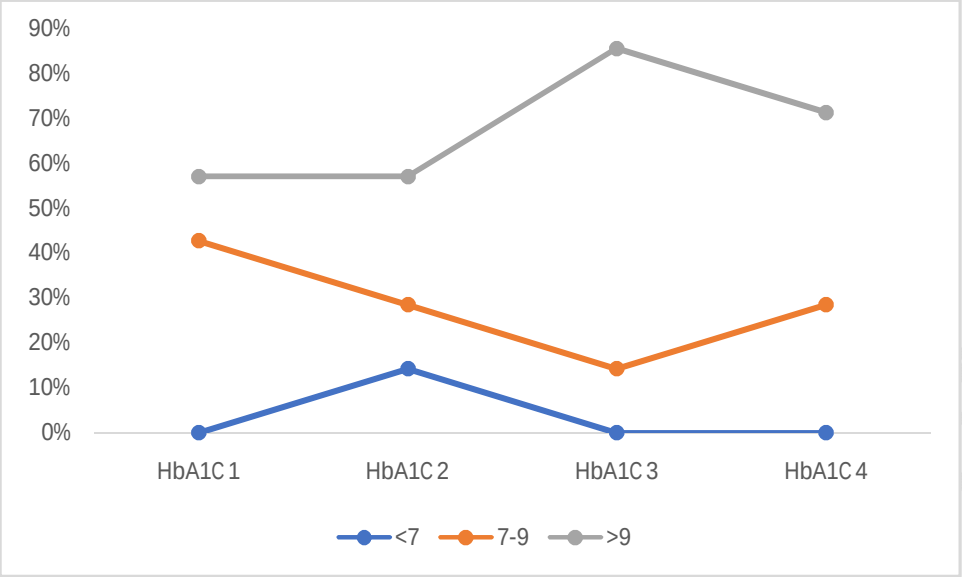

Figure 3 : Evolution of mean glycated hemoglobin during the 4 controls

Analog insulins were the main insulins used by our patients, i.e. 64% (Table 1). The average daily dose of insulin was 1.08 IU /kg, with extremes of **0.5** and **2 IU /kg.** The therapeutic regimen was either a 4-injection regimen in 73% of cases or a 3-injection regimen in 27% of cases. The most commonly used injection sites were the arms (95%) and thighs (91%). Among those who alternated, 95% did so with each injection and 5% every day. The diet was normal in the majority of patients (90%). It was not restrictive in any of the cases and there was a proportion of pre-established foods in only 9% of the children followed. All children ate 3 meals per day. More than half (59%) had a snack (Table 1). No patient presented a chronic complication during the follow-up. On the metabolic level, severe hypoglycemia was noted in 20% of cases. All our patients benefited from daily glycemic monitoring and had a notebook available. The monitoring rate was 3 checks, i.e. one check before each meal. No deaths were reported, 27% of patients were lost to follow-up.

3. DISCUSSION

“The prevalence of diabetes in children under 5 years of age was 7.8% of all children followed in the two centers. Diabetes occurs less often in children under 5 years of age in our context. Other African authors reported an even lower prevalence of 5.9 %”**[6]** . This problem will only become more important, as the incidence of type 1 diabetes is increasing worldwide, and the fastest increase is noted in children under 5 years of age **[7]** . One study estimated that the number of children aged 5 years diagnosed each year with type 1 diabetes would double by 2020 **[8]** .
Results of a systematic review showed that the overall cumulative incidence of T1D in children aged 0–4 years was 11.2 (95% CI = 10.0–12.3) per 100,000 child- years . However, heterogeneity was high between studies. Regional estimates showed that the region European had the highest cumulative incidence **[9]** .
“The mean age of diagnosis of diabetes was 24 months with a range of 3–48 months. Elsewhere, forty -five percent of children with diabetes were under 10 years of age at diagnosis of type 1 diabetes, but there were two peaks in age of diagnosis, the first between 4 and 6 years and the second between 10 and 14 years”**[10]** .

Ketoacidosis was the main mode of discovery in our patients. Symptoms of **diabetes** often develop acutely in children and adolescents, especially in younger patients. The clinical condition can deteriorate rapidly and diabetic ketoacidosis (DKA) is a common complication at the time of diagnosis **[11]** .DKA can be observed in up to 50% of young people at the time of diagnosis **[12,13].**

“Nutritional status was good for 77% of the children followed and 5% were overweight. For normal growth and development in children before the age of seven, it is essential to maintain blood glucose levels close to normal and to strive to maximize the time spent in the target range, as well as to provide adequate nutritional intake. Restrictive diets or undernutrition that do not provide essential nutrients for growth and development should be avoided. This requirement for adequate nutrition is partly based on the high metabolic demands of the brain during infancy and childhood”[14]. “The diet was normal in the majority of patients (90%). Management of type 1 diabetes in very young children is particularly challenging because of their unpredictable eating habits, erratic activity, and increased susceptibility to severe hypoglycemia”[15,16].

“The mean HbA1c was 10.57 ± 0.5%. During the 4 controls, HbA1c was higher than 9% in more than half of our patients. This is a real problem and endangers these still very young children. ISPAD suggests that optimizing glycemic control in children under seven years of age with T1D is crucial for their future, both in terms of acute and chronic complications and with regard to neurocognitive function, brain structure and health-related quality of life”[14]. “Multiple risk factors have been associated with potential suboptimal cognitive and fine motor development in children and adolescents with T1D. These factors include early onset of disease (typically defined as <5 years of age) disease duration, history of moderate to severe ketoacidosis, severe hypoglycemia, and cumulative exposure to hyperglycemia”[14].

“Analogues were the main insulins used by our patients, 64%. The mean daily insulin dose was 1.08 IU /kg , with extremes of 0.5 and 2 IU /kg.The therapeutic regimen was either a 4-injection regimen in 73% of cases or a 3-injection regimen in 27% of cases. Insulin therapy recommendations for children under seven years of age are essentially comparable to those targeting older children and adolescents, taking into account age-specific elements. Insulin therapy should always be adapted to each child, and planned with their caregivers. Children under seven years of age with optimal glycemic control generally require less insulin than older children, based on their body weight. A total insulin dose of 0.4 to 0.8 U/kg/day (median dose 0.6 U/kg/day) has been reported in children under seven years of age with well-controlled T1D after the remission phase”**[17].**

Severemetabolic hypoglycemia was noted in 20% of cases. Children diagnosed with type 1 diabetes at a younger age are at increased risk of long-term neurocognitive dysfunction, which may be related to episodes of severe hypoglycemia **[18,19]** .

The monitoring rate was 3 checks, i.e. one check before each meal. The use of CGMs in 7-year-old children revealed that hypoglycemic episodes occurred in 28% of nights **[20]** . Although considerable technological advances have been made with the advent of insulin pumps and CGM, a recent trial of CGM use in young children showed no benefit in terms of glycemic control or reduction in hypoglycemia rates **[21]** . No deaths have been reported despite difficulties encountered during management.

4. CONCLUSION

Diabetes in children under 5 is not common. It is often discovered in the form of ketoacidosis. The majority of children are on insulin analogues with regular monitoring. However, glycemic control is far from optimal. A prospective study could allow us to better identify the problems in order to provide appropriate solutions.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the authors.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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