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THERAPEUTIC AND PROGRESSIVE ASPECTS OF TYPE 1 DIABETES IN CHILDREN IN LIBREVILLE FROM 2019 TO 2023

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ABSTRACT

Introduction: Diabetes mellitus is a metabolic disorder characterized by the presence of chronic hyperglycemia resulting from a defect in insulin secretion or insulin action, or both.

Objective: describe the therapeutic and progressive modalities of type 1 diabetes in children in Libreville.

Methodology: cross-sectional, analytical study over a period of five years, in the pediatrics department of the Mother-Child University Hospital Center Fondation Jeanne Ebori (CHUME-FJE) and in the endocrinology department of the Libreville University Hospital Center (CHUL), including all children diabetics aged 0 to 17 received during the study period.

Results: 107 children had type 1 diabetes, a prevalence of 1.21%, 25% had no health insurance and 69% of the children's parents had an economically weak Gabonese status. The basal-bolus regimen was the treatment regimen of choice in 73 patients, or 83%. The average length of hospitalization was 8.1 ±3.01 days. Children with low socioeconomic status had a shorter length of hospitalization than those without (P<0.02). During the study period, 50% were re-hospitalized for diabetic imbalance and the main factors of decompensation were therapeutic non-compliance (45%) and infection (41%).

Conclusion: Diabetes is not rare in Gabon and its evolution has been alarming over the last five years, particularly in children. The lack of comprehensive and total care contributes to the poor prognosis observed.

Keywords: Type 1 diabetes, Care, Child, Libreville

1 INTRODUCTION

The WHO defines the term \diabetes\ as a metabolic disorder of multiple etiology, characterized by chronic hyperglycemia accompanied by disturbances in the metabolism of carbohydrates, lipids and proteins due to disorders in the secretion and\/or action of

insulin (insulin resistance)[1]. Diabetes mellitus constitutes a public health problem worldwide. There are several types, type[1] diabetes (T1D), type 2 diabetes (T2D), secondary and gestational diabetes[2].T1D (insulin dependent) is the most common chronic disease in children and a source of serious complications leading to significant morbidity and mortality [1].

In most Western countries, T1D corresponds to more than 90% of diabetes in children and adolescents[3]. The incidence of childhood diabetes has been increasing over the past fifteen years. The EURODIAB study reports a geographical disparity in the incidence rates of T1D in children[4]. In France, in the vast majority of cases, childhood diabetes remains T1D, resulting from the autoimmune destruction of insulin-secreting pancreatic cells [5]. In Morocco, the incidence tripled between 1990 and 2005[6]

In Sudan the incidence of type 1 diabetes in children under 15 years of age is 10.1\/100,000[7]. The WHO forecasts a global increase in the prevalence of diabetes which is expected to reach 300 million patients in 2025. This development is clearer in developing countries, and particularly in sub-Saharan Africa[8]. In 2015, a study by Ntyonga-pono showed that Gabon is the 3rd country in the African region most affected by diabetes mellitus, with a national prevalence estimated at 9.08%. The causes of this explosion are urbanization (86.5% of the population lives in cities), a sedentary lifestyle, with cheap taxis reducing walking, rich diets, and the increase in screening[9]. The increase in incidence, especially among toddlers, poses the problem of their very specific care which is highly time-consuming for caregivers[4]. The objective of treating T1D in children is twofold. On the one hand, obtaining optimal glycemic control, guaranteeing a minimum of long-term vascular complications, the main reflection of which is the level of glycated hemoglobin (HbA1c), but also glycemic variability. On the other hand, to limit hypoglycemia and hyperglycemic excursions for harmonious development, good social integration, and better quality of life for the child and his parents. Few children with diabetes strictly adhere to the diet. This is often due to cultural beliefs which poorly integrate the notion of long-term illness; to the poverty of most families who have difficulty obtaining insulin even though it is available. Developing a diet based on local products can be made difficult by the lack of exact knowledge of their carbohydrate content.

As a result, the diet is more often a Western-style diet, not easily accessible to families with limited financial resources[10]. In Gabon, there is no recent study carried out specifically on childhood diabetes, highlighting the epidemiological, clinical, therapeutic and evolutionary aspects. The aim of this work is to describe the epidemiological, clinical, therapeutic and progressive aspects of diabetes in children and adolescents in Libreville.

2 METHODOLOGY

This was a cross-sectional, descriptive and analytical study covering a period of 5 years, from January 2019 to December 2023, carried out at the CHUME-FJE pediatric department and at the CHUL. This study focused on the medical records of diabetic patients aged 0 to 17 years old, regardless of gender, hospitalized in the pediatric center of the CHUME-FJE and in the endocrinology department of the CHUL. We included all diabetic children aged 0 to 17 years old whose diagnosis was made between January 2019 and December 2023. Data collection was done from the files of hospitalized patients and this phase lasted 3 months. The files were selected after consulting the relative register of hospitalized patients. The following information was collected and recorded on a pre-established and standardized form as parameters of epidemiological, clinical and biological interest, other parameters such as triggering/decompensation factors, treatment, diet alone, basal insulin therapy, bolus, other medications favorable outcome death complications. Data analysis and data entry was done using Microsoft Excel 2023 software. Statistical analysis and graphics were done using CDC Epi info version 7.2.2 software. The chi-square test was used to compare variables. The significance threshold was set at $p<0.05$.

3 RESULTS

3.1 Socioeconomic characteristics

107 children were diabetic, representing a hospital prevalence of 1.2%. The average age of discovery of childhood diabetes in our population was 11 years (± 3.6 years). The median age was 12 years.

The minimum age of discovery of diabetes in our population was 2 years, the maximum age was 17 years.

During our study, 25.0% of children did not have health insurance at the time of hospitalization, and the main causes were related to a birth certificate problem or parental neglect.

According to the data collected from our study, 69.0% of the children's parents had an economically weak Gabonese (GEF) status. The remaining 31.0% were either from public servant parents or from the private sector.

Treatment: all children were on insulin therapy, rehydration protocol and hypocarbohydrate diet.

The basal-bolus multi-injection regimen, made up of 3 rapid insulin injections distributed over three meals of the day and one slow insulin injection in the evening, was the therapeutic regimen found in 73 patients (83.0%).

Length of Hospitalization: Length of hospitalization for children ranged from 3 to 18 days, with a mean length of hospitalization of 8.1 days (±3.0).

Mortality rate: the evolution was marked at the end of hospitalization by 7 deaths (8.0%), 5 deaths at home (6.0%), for an overall mortality rate of 14.0%.

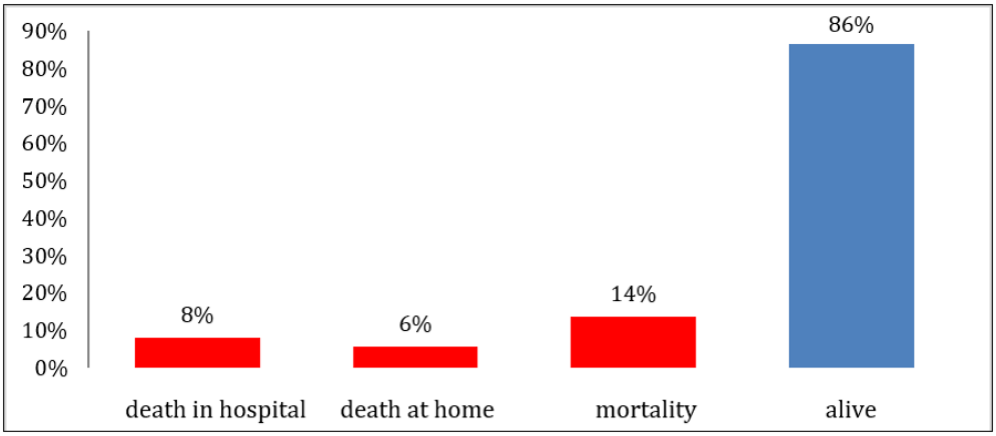

Figure 1: Distribution of patients according to consultation time-During the study period, 44 children (50.0%) were re-hospitalized.

Recurrent decompensation factors: the main decompensation factors were therapeutic non-compliance (45.0%) and infection (41.0%).

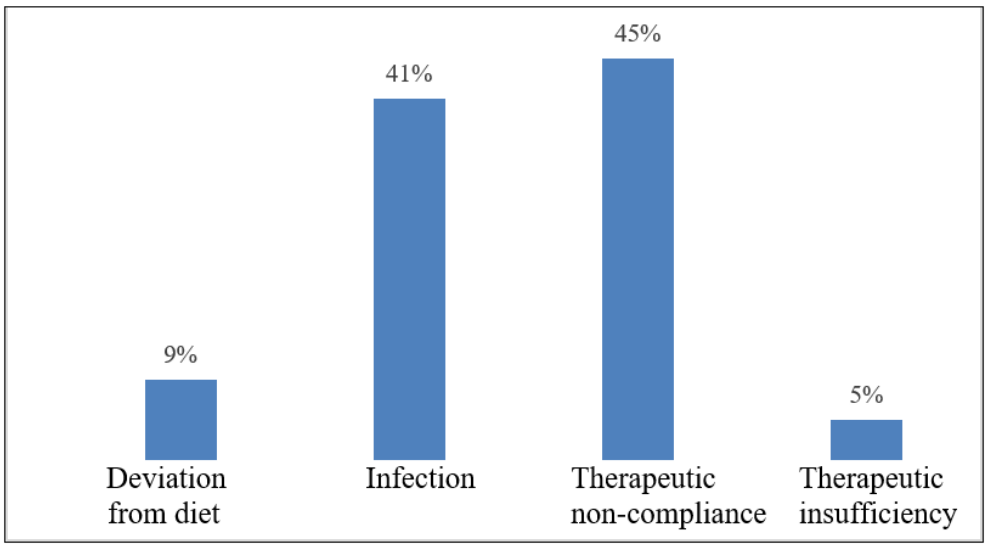

Figure 2: Distribution of patients according to recurrent decompensations

Reasons for therapeutic non-compliance: for 50.0% of re-hospitalized patients, the reason for therapeutic non-compliance was linked to a lack of medication due to financial difficulty. In addition, the other 50.0% were related to skipped processing due to forgetting.

We looked for a relationship between therapeutic compliance and family history, re-hospitalizations, deaths and family history, re-hospitalization, duration of hospitalization and low socioeconomic status, Relationship between duration of hospitalization and low socioeconomic status, Relationship between low economic status, ketoacidotic coma and mortality, Relationship between ketoacidotic coma and mortality:

- There was no significant difference between medication compliance and family history (p=0.20).

- There was no significant difference between re-hospitalization, mortality and family history (p=0.20).
- There was no significant difference between mortality and low economic status (p=0.123).
- Children with low socioeconomic status were statistically significantly less re-hospitalized.
- The factors that influenced therapeutic compliance were represented in Tables 1, 2, 3 and 4 (p=0.02).

Table 1: Distribution of children according to re-hospitalization and socioeconomic status.

	Low socio- conomic Condition		**Total**	***P***
re-hospitalization	**Yes**	**No**		
Yes	30 (34%)	14 (16%)	44 (50%)	0,02
No	31 (35%)	13 (15%)	44 (50%)	
Total	61 (69%)	27 (31%)	88 (100%)	

Children with low socioeconomic status had a shorter length of hospitalization than those without (P\u003C0.02)

Table 2: Distribution of children according to length of hospitalization and socioeconomic status

	Low socio-economic Conditions		**Total**	***P***
length of hospitalization (in day)	**Yes**	**No**		
< 7	29 (33%)	11 (13%)	40 (45%)	0,02
≥ 7	32 (36%)	27 (31%)	48 (55%)	
Total	61 (69%)	27 (31%)	88 (100%)	

Children arriving in a ketoacidotic coma had a statistically significant higher risk of death.

Table 3: Distribution according to ketoacidotic coma and mortality

Coma	**Mortality**		**Total**	***P***
	Yes	**No**		
Yes	6 (15%)	35 (85%)	41 (100%)	0,02
No	6 (13%)	41 (87%)	47 (100%)	
Total	12 (14%)	76 (86%)	88 (100%)	

Children arriving in a ketoacidotic coma had a statistically significant higher risk of death.

Table 4: Distribution according to ketoacidotic coma and mortality

Coma	**Mortality**		**Total**	***P***
	Yes	**No**		
Yes	6 (15%)	35 (85%)	41 (100%)	0,02
No	6 (13%)	41 (87%)	47 (100%)	
Total	12 (14%)	76 (86%)	88 (100%)	

4 DISCUSSION

The study reveals that all the children were under a rehydration and insulin therapy protocol (100.0%) and a hypocarbohydrate diet (100.0%).

This series is similar to that of Boutabia et al in Algeria[11] in which all type 1 diabetic children were on insulin therapy and rehydration (100.0%) and a hypocarbohydrate diet in all cases. The series by Touré et al in Mali[12] specified that insulin therapy was the treatment in 97.6% of cases. The basal-bolus regimen was the treatment regimen of choice in 73 patients (83.0%) in our series.

This result is similar to that of Hassaim in Algeria[13] in which all patients were subjected to a basal-bolus regimen while in Trellu et al in France[14] the treatment included a conventional two-injection regimen in 76.5% of cases and a basal-bolus multi-injection regimen.

was found in 16.0% of cases. These differences could be due to the fact that the French favor fewer injections by setting meal times.

Conventional insulin therapy requires “adjusting life to treatment” which can be restrictive for some patients; whereas the basal-bolus multi-injection regimen involves “adjusting treatment to life.”

4.1 Length of hospitalization

The duration of hospitalization of children varied from 3 to 18 days, with an average duration of hospitalization of 8.1 days (±3.01), similar to that of Oko et al in Congo[15] which was 8.7 ± 4 days. The duration of hospitalization often varies depending on the clinical condition of the patient upon admission, the speed of assessments and the purchase of medications by the parents, as well as complications during hospitalization.

4.2 Mortality rate

The evolution was marked by a mortality rate of 14.0%, higher than that of Niang et al in Senegal[16] which was 6.7%, but superimposable to that of Oko et al in Congo[15] with a mortality of 12.7%, to that of Sanogo et al in Mali[17] with a mortality of 17.0%.

This difference with Niang's result may be due to the consultation time: 15.6 days in our series compared to 8 days in their series. Indeed, generally speaking, in African countries, this is explained by the late consultation time and\/or the delay in diagnosis, the still high prevalence of inaugural coma, as well as a lack of qualified personnel.

In addition, lack of awareness among healthcare workers of the occurrence of diabetes in toddlers, particularly those under 2 years of age[18], is often responsible for incorrect diagnoses, a source of complications or even death.

4.3 Children rehospitalized

During our study period, 44 children (50.0%) were rehospitalized for diabetic imbalance.

This result is superimposable to that of Anjjar and al in Morocco 3 and that of Ben Becher and al in Tunisia[19] who respectively found rehospitalization of 50.0% and 38.0% of children for diabetic imbalance. Ignorance, non-compliance or forgetting of the instructions dictated by the nursing staff during therapeutic education, sometimes due to external consultations that are too far apart, are often responsible for the frequent rehospitalizations of diabetic children.

4.4 Recurring decompensation factors

The main factors of decompensation were therapeutic non-compliance (45.0%) and infection (41.0%), similar to the results of Oko et al in Congo[15] where infection was 52.7%.

In the literature, the problem of non-compliance still remains a challenge to hope for better quality of care. Infections, particularly malaria, pulmonary infection and urinary infection, are recurrent factors in the decompensation of childhood diabetes.

The absence of long-acting impregnated mosquito nets and the presence of breeding sites around patients' homes increases the prevalence of malaria and the frequent risk of decompensation of diabetes in these children.

4.5 Reasons for therapeutic non-compliance

For 50.0% of re-hospitalized patients, the reason for therapeutic non-compliance was linked to a lack of medication due to financial difficulty. In addition, the other 50.0% were linked to skipping treatment due to forgetfulness, abandonment or a deviation in diet or even indiscipline.

The literature from the sub-region, notably that of Nzame et al[20], as well as in other African series 3, 10, 20, show that few children strictly respected the diet or their treatment in general, and that this was linked to the financial difficulties

of the children families. The financial problem therefore remains a key element in improving the care of diabetic children.

Relationship between re-hospitalization and low socioeconomic status children with low socioeconomic status were statistically significantly less re-hospitalized (P<0,02).

Economic status can directly influence access to health care and the ability to pay for medication or treatment requirements, which in turn affect successful disease management.

Ankotche et al in Ivory Coast [21] estimated that the cost of treatment represents 70.0 to 96.0% of the family budget for the most vulnerable patients and that this is a barrier to access to care.

covers 80.0% of the treatment for common pathologies, 90.0% for long-term conditions and 100.0% for certain procedures (delivery carried out under medical supervision, medical evacuations abroad); and the patient pays the remainder called co-payment, 20.0% or 10.0% of agreed rates. [22] Despite the contribution of the CNAMGS, paying co-payments remains difficult in the long term for certain categories of precarious patients.

4.6 Relationship between ketoacidotic coma and mortality

In our study, children arriving in a ketoacidotic coma had a higher risk of death (P = 0.02). This result is also found in the series by Oko et al in Congo[15] in which ketoacidotic coma was a poor prognostic factor responsible for a risk high rate of death in children, with P = 0.007. This significant risk of death in the event of a coma can be explained by the vulnerability of children, the insufficiency of technical support and qualified personnel, as well as the financial difficulties of the majority of families concerned.

In addition, for children residing within the country, the distance from specialized hospitals is a barrier to access to care. Faced with this harsh reality in our context, parents consult when their child is already at the stage of complications.

In addition, depending on beliefs, some parents leave the hospital to turn either to religion or to traditional practices.

Considered lost to follow-up, this phenomenon reduces the frequency of outpatient consultations and possible hospitalizations of these children in the event of diabetic imbalance.

4.7 Relationship between length of hospitalization and low socioeconomic status

Children with low socioeconomic status had a shorter length of hospitalization than those without. This result corroborates those of Ankotche et al in Ivory Coast [21] on the serious impacts of the financial cost of diabetes on its management, apart from complications.

This short duration of hospitalization is explained by the discharge of patients without medical advice, but also by consensus between doctors and parents when the carrying out of analyzes is too delayed. Indeed, in our daily practice, faced with the inability to assume the cost of hospitalization and the constraints of care, some parents interrupt the hospitalization and sign a discharge for the patient. In addition, signing this release is also encouraged by the different emotions generated in parents: anger and guilt when announcing a chronic illness, such as diabetes. 3 Patients with average or good economic status often opt for a full investigation of the disease during hospitalization, which results in a length of hospitalization that can exceed two weeks.

However, in patients with low economic status, after glycemic control, doctors can recommend their discharge and the investigation assessment is carried out externally. Only complications of the disease during hospitalization can prolong its duration.

5 CONCLUSION

Diabetes is not a rare pathology in Gabon and its evolution has been alarming over the last five years, particularly in children. Late diagnosis and late treatment based on financial vulnerability increase the mortality rate in our context.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of Informed consent

Informed consent was obtained from all individual participants included in the study.

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