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Growth and Puberty in a Group a Cameroonian Children with Type I Diabetes: a Cross Sectional Study

Évaluation de la croissance et de la puberté chez des enfants camerounais vivant avec un diabète de type 1

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ABSTRACT

Aim. To describe growth and puberty of Cameroonian children living with diabetes **Patients and methods**: we carried out a cross sectional study based on data provided by the national registry of children living with diabetes. We analysed Height, weight, body mass index derived in standard deviation for age and sex, tanner stage to evaluate puberty and haemoglobin A1c to evaluate metabolic control. Linear regression was used to analyzed correlation between variables. **Results**. We included 151 patients. Median height was -0.5 SDS (IQR – 5.5 to + 3 SDS), -0.3 and -1 for girls and boys respectively (p=0.24) in the studied population. We found growth retardation in 11.25% of them. This was similar for boys and girls. A positive correlation was found between haemoglobin A1c and growth retardation (r^2 0.57). Overweight and obesity were found in 13% of patients, mostly girls. Median age of menarche was 13.23 years. **Conclusion.** Our study shows that 11.25% of Cameroonian children with type I diabetes are affected by growth retardation. This situation is correlated with metabolic control. In some cases that can be explained by pubertal delay; however, other aetiologies have to be ruled out.

RÉSUMÉ

Objectif. Décrire la croissance et la puberté des enfants camerounais vivant avec le diabète de type I. **Patients et méthodes.** Nous avons mené une étude transversale basée sur des données fournies par le registre national des enfants atteints de diabète. Nous avons analysé la taille, le poids index de l'indice de masse corporelle dérivé en déviation standard pour l'âge et le sexe, le stade Tanner pour évaluer la puberté et l'hémoglobine A1c pour évaluer le contrôle métabolique. La régression linéaire a été utilisée pour analyser la corrélation entre les variables. **Résultats**. Nous avons colligé 151 patients répondant aux critères d'inclusion. La taille médiane était de -0,5 SDS (IQR - 5,5 à + 3 SDS), -0,3 et -1 respectivement pour les filles et les garçons (p = 0,24) dans la population étudiée. Nous avons trouvé un retard de croissance chez 11,25% d'entre eux, filles et garçons. Une corrélation positive a été trouvée entre l'hémoglobine A1c et le retard de croissance (r^2 0,57). La surcharge pondérale et l'obésité ont été retrouvées chez 13% des patients, principalement chez les filles. L'âge médian des premières règles était de 13,23 ans. **Conclusion**. Le retard de croissance affecte 11.25% des enfants camerounais atteints de diabète de type I. Il est corrélé au contrôle métabolique. Si certains retards sont probablement en rapport avec un retard pubertaire, d'autres étiologies doivent être exclues.

INTRODUCTION

Growth disorders are frequent in chronic diseases in children, but are not expected in children with type I diabetes, with adequate metabolic control [1-3]. In Sub-Saharan countries, the double burden of children living with diabetes includes insulin availability and food availability or adequacy [3-5]. Our research question was to know the prevalence of growth retardation and pubertal delay among patients with diabetes comparing to general population in the Cameroonian context.

PATIENTS AND METHODS

This retrospective study, in 9 pediatric diabetes clinics around the country, included all children aged 2 to 19 years diagnosed for at least 3 months. Data were collected from the national diabetes registry of children provided by the Changing Diabetes in Children (CDIC) project. We recorded, for each patient, age, sex, duration of DM since diagnosis and anthropometric variables. The latter parameters included body weight (to the nearest 0.1 kilogram), and height (to the nearest centimeter). The

height was considered normal between -2 to + 2 SDS for age and sex, short stature for height less than – 2 SDS for age and sex. Body mass index (BMI) was derived as weight (kg)/height*height (m), and patients subsequently grouped into 4 classes according to NCHS/WHO pre-established standards [6]: undernourished (BMI < -2 Zscore), normal (-2 ≤ BMI ≤ +2 Zscore), overweight (+2 ≤ BMI ≤ +3 Zscore), and obese (BMI > +3 Zscore). Puberty was described using the Tanner clinical staging [7]

Patients' glycemic control was investigated by measuring their Glycated Hemoglobin (HbA1c) level with 2 µL of capillary blood using an In2it kit (Bio-Rad Laboratories, Deeside, UK). We considered as HbA1c at diagnosis the one at inclusion in the national registry. The patient was considered as well controlled when HbA1c was less than 7.5% in keeping with ISPAD recommendations [9].

Data analysis used Epi Info version 7.0 (Center for Disease Control, Atlanta, USA). Results are presented as count (proportion) for qualitative variables, and median (Inter-quartile range IQR) for quantitative ones. The Mann Whitney Wilcoxon test (or equivalents) served for groups' comparisons. The Spearman correlation served to investigate the relation between patients' stature and their glycemic control. Results were considered statistically significant when p value < 0.05. The CDIC project received approval from the National Ethics Committee of Cameroon (Authorization No 271/CNE/SE/2011) to carry out research from data obtained in the project.

RESULTS

One hundred and fifteen children out of the 266 who were reported in the children diabetes registry were not included in the present study, among which 67 patients have been diagnosed and followed up for less than 3 months, and 48 because of incomplete data. On the whole, we enrolled 151 children and adolescents, including 83 boys (55%). The median age was 17 years (IQR 14-18), 16.4 and 17.1 years for girls and boys respectively (p = 0.52).

The median height was -0.5 SD (IQR – 1.45 to + 0.5), -0.3 and -1 for girls and boys respectively (p = 0.24). Seventeen patients (11.2%) presented with growth retardation, of whom 9 boys (52.9%) with no difference between boys and girls (p = 0.52). Patients with growth retardation were all adolescents (median age: 17.3 years IQR 15.4-18.01) with DM being diagnosed for a median duration of 6 months (IQR 3-43.5 months) see table I.

Tanner stage was described for 84 patients of our study population. Pubertal delay was present in 9.5 % (n=8) of adolescents. (figure 1). Median age of menarche for girls was 13.2 years.

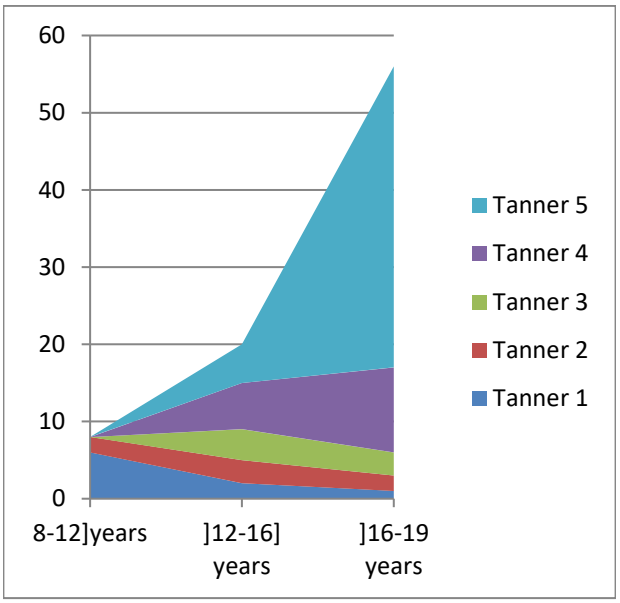

Figure 1: Tanner stage of 84 patients with diabetes

As depicted in table 1, there was a significant improvement of HbA1C after the first trimester of follow up (from a median of 11.5 to 8.61% (102.2 to 71mmol/mol), p < 0.001). HbA1c at diagnosis was significantly lower among boys with normal height when compared to girls (p = 0.041), and HbA1c after the 1st trimester was significantly lower in girls with growth retardation than in boys (p = 0.0032; Table 1). There was no significant difference of glycaemic control between children with or without growth retardation (p= 0.26). The short stature was not related to duration of diabetes (r^2 = 0.10) and correlation with Hb A1C was weak: at diagnosis (r^2 0.57) and at 3 months (r^2 0.65)

Table I: Characteristics of patients with growth retardation compared with patients with normal height

	Patients presenting with short stature (n = 17; 11.25%)			Patients with height within -2 and +2 SDS (n=134; 88.75%)		
	Girls (n=8)	Boys (n=9)		Girls (n=60)	Boys (n=74)	
Age [IQR]	16.06 [7.57-18.97]	16.53 [9-18.35]	P 0.6304	16.08 [9.4-19.2]	15.51 [2-19.4]	0.97
Duration of diabetes mellitus [IQR]	30.2 [0.2-168]	25.2 [0.2-72]	P 0.2352	25.6 [0.2-133]	31.4 [0.2-168]	0.797
HbA1C at inclusion%(mmol/mol) [IQR]	10 (86) [7.7(61)-14 (130)]	12.1(109) [8.2(66)-14 (130)]	P 0.0697	11.9 (107) [6.9 (52)-14(130)]	11.1(98) [6.2 (44)-14(130)]	0.041
HbA1C at 1st trimester %(mmol/mol) [IQR]	6.6 (49) [5.7-8.2]	10.1(87) [6.9(52)-13.8(127)]	P 0.0032	9 (75) [6.5 (48)-14(130)]	8.6 (71) [6.5(48)-14(130)]	0.628

We found obesity in 3 patients, all of the female sex, and overweight in 17 patients among whom 11 girls (64.7%). These latter were significantly younger than affected boys (p = 0.026), with a shorter duration of DM since diagnosis (p = 0.016; Table 2). We recorded only one patient of the male sex who was underweight. No correlation was found between BMI and glycaemic, neither with duration of diabetes (r^2 0.08).

Table II: Characteristics of patients with overweight or obesity compared with patients with normal BMI: girls are more affected and are younger than boys

	Overweight and obese diabetic patients (n=20, 13.2%)		p	Patients with normal BMI (n=130, 86%)		P
	Girls (n=14)	Boys (n= 6)		Girls (54)	Boys (76)	
Median Age [IQR]	15.7	18.1	0.026	16.7	17	0.98
Duration of diabetes mellitus (months) [IQR]	4.5 [0.2-168]	46.5 [12-116]	0,016	14 [0.2 -133]	13.5 [0.2 – 168]	0.90
HbA1C at inclusion %(mmol/mol) [IQR]	13.5(124) [6.7(50)-14(130)]	9.6 (81) [7.5(58)-14(130)]	0.38	12.8 (116) [6.9(52)-14(130)]	11.9 (107) [6.2(44)-14(130)]	0.36
HbA1C at 1st trimester %(mmol/mol)[IQR]	7.8 (62) [5.7(39)-14(130)]	8.7 (72) [6.5(48)-12.7(115)]	0.62	9.3 (78) [6.5(48)-14(130)]	8.1(65) [6.5(48)-14(130)]	0.49

DISCUSSION

The aim of the present study was to identify prevalence of growth retardation and pubertal delay among children and adolescents affected by diabetes, in comparison with general population. The study has some flaws. In fact, the retrospective design of this study justified all incomplete data (48 cases), precluding us from including these patients hence limiting our sample size with consequential potential selection bias. Besides, nutritional status was not completely assessed (caloric intake unknown).

Nonetheless, the study was multicentric with data recorded from 9 diabetes centers disseminated in the country. Consequently, our results may be representative of the children and adolescents diabetes patients disseminated throughout the country. Additionally, we used WHO standards to accurately and reliably report our patients' weight, height and BMI, 3 months after inclusion to exclude possible dehydration found at diagnosis of diabetes.

Our work shows that in Cameroonian children with type I diabetes, roughly one child on ten is affected by short stature, without any sex difference. In the general Cameroonian population, short stature is less prevalent (5%) than what we witnessed [9-10]. Balde et al. in 2012, found a higher prevalence among children and adolescent in Guinea (28%) [11]. This could be explained by a higher prevalence of under nutrition in his study population (median BMI 18 kg/m²). Mao and al had smaller prevalence [12]. The inclusion was done soon after diagnosis, suggesting that growth retardation was present prior diagnosis of diabetes as growth anomalies appears after many years of follow up [13]. This may be then related to chronic nutrition insufficiency [1-2]. Nonetheless the prevalence 2 fold higher than in our general population questioned aetiology of this chronic food inadequacy: food insufficiency or coexisting medical conditions?

In parallel, pubertal delay was found in 9% of our patients. In Guinea, the proportion was higher: 40%. [11] As age of diagnosis was late and duration of disease short in our study, the pubertal delay similarly to growth retardation may not be linked to diabetes. Onset of menarche was comparable to general population in Cameroon. [unpublished data] Overweight and obesity in girls was also similar to the urban Cameroonian population [14].

CONCLUSION

Growth retardation and pubertal delay affects approximately 10% of adolescents affected by diabetes prior their diagnosis. This is not related to their metabolic status but opens reflexion on challenges with regard to the nutritional management of affected children, and more so on pubertal growth evaluation.

Declaration heading

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Authors' contribution

Design and setting: Suzanne Ngo Um Sap, Mesmin Dehayem, Ritha Mbono, Paul Olivier Koki

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Statistical analysis: Suzanne Ngo Um Sap, Jobert Richie Nansseu, Louis De Djob,

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