

# Growth Delay in Children: Experience of the Department of Metabolic and Endocrine Diseases at the Children's Hospital of Rabat

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**Abstract:** Objective: The aim of our study is to describe the epidemiological, clinical and biological aspects of staturo-ponderal delay and to deduce the main etiologies. Material and Methods: the study was carried out on 141 patients (78 boys and 63 girls). Patients ranged in age from 9 months to 17 years (mean: 9 years 1 month) with a statural delay that varied from -2DS to -5DS (mean: -2.5DS). Results: Analysis of the data showed a frequency of 13.5% of patients with severe growth retardation, 35% of whom had a growth hormone deficiency. The hormonal assessment showed a GH deficiency in 43% of patients with a greater difference in chronological age and bone age (2.5 years) than in non-deficient patients (2 years). Among them, 51% of patients have an elevated TSH. Magnetic resonance imaging performed in 37 cases was in favor of a pituitary anomaly in 12% of cases, including interruption of the pituitary stem (4% of cases), hypoplasia (3% of cases), an adenoma (1% of cases) and an empty sella turcica in 4% of cases. Conclusion: Severe central growth retardation is common. Systematic monitoring and follow-up of growth is essential in children, as is vaccination, in order to identify and manage early any causal pathology that may disrupt the child's growth.

**Keywords:** Growth, Delay, Etiologies, Stature-Weight, Children

## 1. Introduction

Growth is a complex biological phenomenon through which living beings, as they increase their mass, mature morphologically and progressively acquire their full functional capacity. Stunting in children results from undernutrition and is correlated with disturbances in neurocognitive development. The World Health Assembly's goal is to reduce the number of stunted children under five years of age by 40% by 2025 [1].

Growth retardation is a very frequent reason for consultation in pediatrics. It is defined by a height below or equal to -2 standard deviations (SD) of the average height for an age and a sex. In Morocco the standard is

that of the French population as determined by Sempé and Pedron [2].

It can be the first sign of a pathological process directly endangering the vital or functional prognosis of the child.

Children with A short stature have a height less than 2 standard deviations below the mean [3]. Stature delay is said to be "severe" when height is less than or equal to -3 SD [4]. Statural growth retardation can be of pathological origin [5]. It can be secondary to a chronic disease, a nutritional defect, a bone disease or a hormonal or endocrine anomaly. Intrauterine growth

retardation (IUGR) and growth problems in children result in 26% of children under 5 years of age worldwide being stunted, and 8% being too thin for their height (WHO). The burden of stunting has halved in Asia and Latin America/Caribbean, but has increased by 24% in Africa during the same period [5].

In Morocco, stunting in children has an incidence of 16.5% compared to a world average of 27%, and 29% in developing countries according to the WHO. Monitoring of growth and development is essential. It must be part of the systematic follow-up of every child, of the same importance as vaccination, in order to detect and take early care of any causal pathology that could disturb the good progress of the child's life. However, not recognizing a growth delay means not identifying a situation that is accessible to a treatment that would allow improving or even normalizing the height.

Our work aims to identify patients with stunted growth who are followed in the pediatric department at the Chu of Rabat. This on the one hand and on the other hand to deduce the different etiologies identified.

## 2. Materials and Methods

### 2.1. Study Type

This is a retrospective study of 140 cases of patients with short stature out of 720 records of children followed in pediatric endocrinology consultation at the children's hospital of Rabat for a period between 2011-2014. The study took place between March 19, 2015 until April 30, 2015.

#### 2.1.1. Patients

The children included were boys and girls followed up in a pediatric consultation for short stature and with staturo-ponderal growth delay. Files with insufficient clinical, paraclinical or biological data were excluded from the study.

#### 2.1.2. Clinical Parameters for Growth Assessment

1. *Height*: is measured in the supine position (length) until the age of 2-3 years and then standing (height). Expressed in absolute value and in standard deviation (SD) following the growth curve.
2. *Weight*: measured with the child undressed. Expressed in cm and standard deviation (SD).

### 2.2. Calculated Parameters

1. The growth rate (cm/year): it represents the number of cm acquired in one year.
2. Body mass index BMI (kg/cm<sup>2</sup>): this is the ratio of weight to height squared. It reflects the nutritional status and the fat mass.
3. target height: this describes the genetic potential for

height that an individual is programmed to achieve due to the high heredity of height:

$$TC \text{ (cm)} = \frac{\text{Father's height (cm)} + \text{Mother's height (cm)} \pm 13 \text{ cm by sex}}{2}$$

### Establishment of a Growth Curve

It is an essential step in the approach of a growth delay in a child. This growth curve (height, weight and possibly BMI curves) allows:

1. To appreciate the importance of the growth delay by calculating the height delay in SD/age.
2. To establish the growth rate and thus to differentiate between growth retardation with normal growth rate (old retardation and not getting worse), and growth retardation with slow growth rate (recent retardation and getting worse).
3. To determine the statural age which is the age that corresponds to the height of the child.
4. To compare the evolution of weight and the evolution of height.

### 2.3. Biological Markers for Growth Assessment

TSH Us (Thyroid Stimulating Hormone)

TSH is the most sensitive indicator to assess thyroid dysfunction very often in the case of growth retardation hypothyroidism when the TSH level exceeds 7μUI/ml.

Lt4 (Free Thyroxin)

A decrease in blood T4 level (below 0.7 ng/dl) is indicative of hypothyroidism.

IGF-1

A decreased plasma level in relation to the child's age may indicate a growth hormone deficiency.

## 3. Results

Out of 720 patients who are seen in consultation in the endocrinology-pediatrics department. 140 patients are followed up for a delay in weight and height, which is a prevalence of 19.5%. This makes it the first reason for consultation in pediatric endocrinology. In our study, 55% of the children who consulted for staturo-ponderal retardation were male (n=78), while girls represented.

45% (n=63). The sex ratio is thus 1.2. The average age was 9 years and 01 months with a minimum of 09 months and a maximum of 17 years, with a peak in frequency between the ages of 4 and 12 years.

*Weight*: The mean weight of the patients studied at the first visit was -2DS with extremes ranging from -4SD to -1SD. A weight ≤ -4DS was present in 3 patients or 2.12%.

*Height*: They ranged from -5 SD to -1 DS for age with a mean of -2.5 SD. 13.5% of the children was in the dwarfism stage (≤ -4 SD).

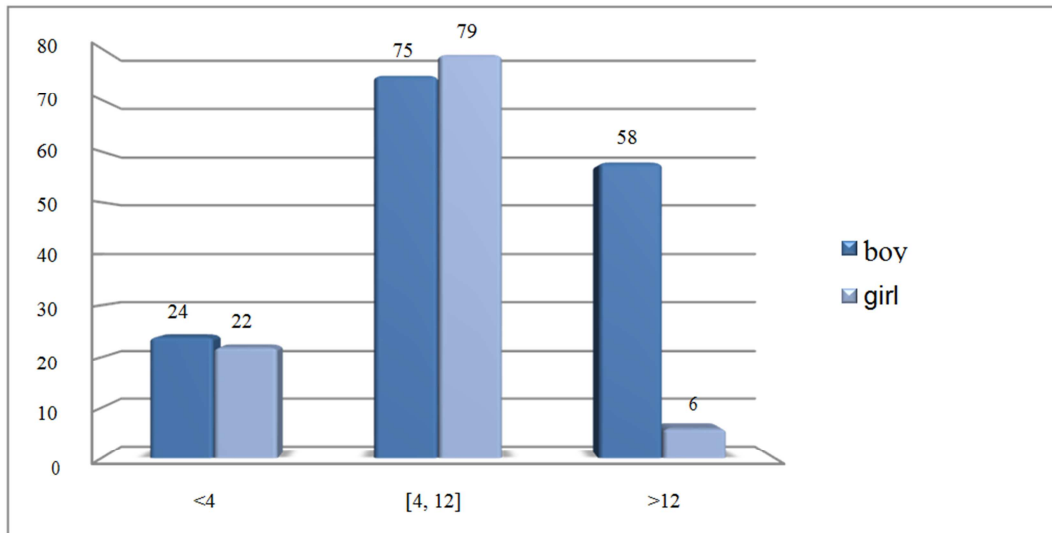


Figure 1. Distribution of patients by age.

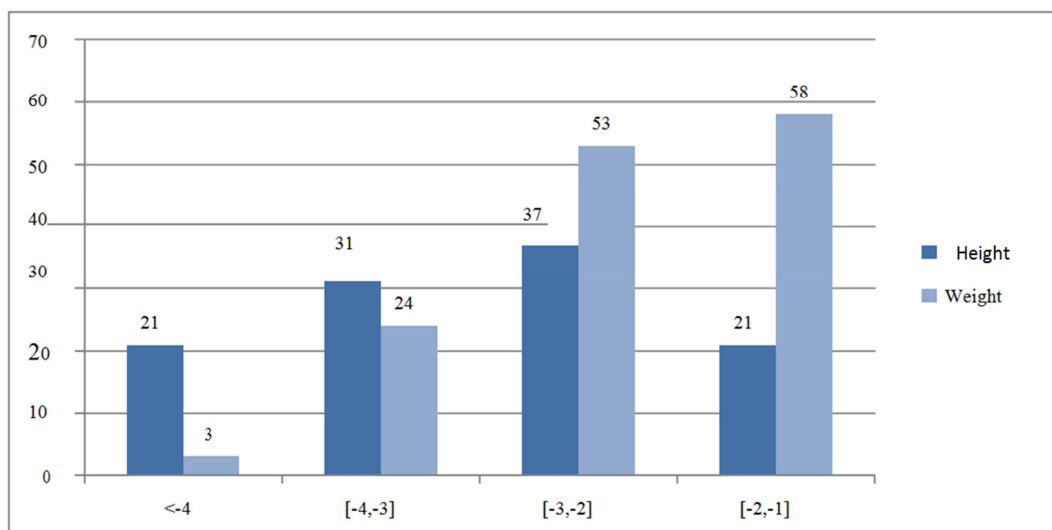


Figure 2. Distribution of patients by height and weight in standard deviations.

Bone Age X-rays of the left hand and wrist were taken in 103 patients and interpreted according to the reading method of GREULICH and PYLE.

The average bone age was 6 years 03 months with extremes between 3 months and 17 years.

The chronological age (CA) - Bone age difference varies from 01 month to 7 years and 06 months, with an average of 2 years and 4 months. 29 cases have a difference CA-BA  $\leq$  1 years, 17 cases have a difference between [1 year, 2years], 40 cases have a difference CA-BA between [2 years, 4 years ] and 18 cases have a difference CA-BA >4 years.

#### Growth hormone stimulation test:

The test was performed in 79 cases and came back positive in 61 of them, which represents 77%.

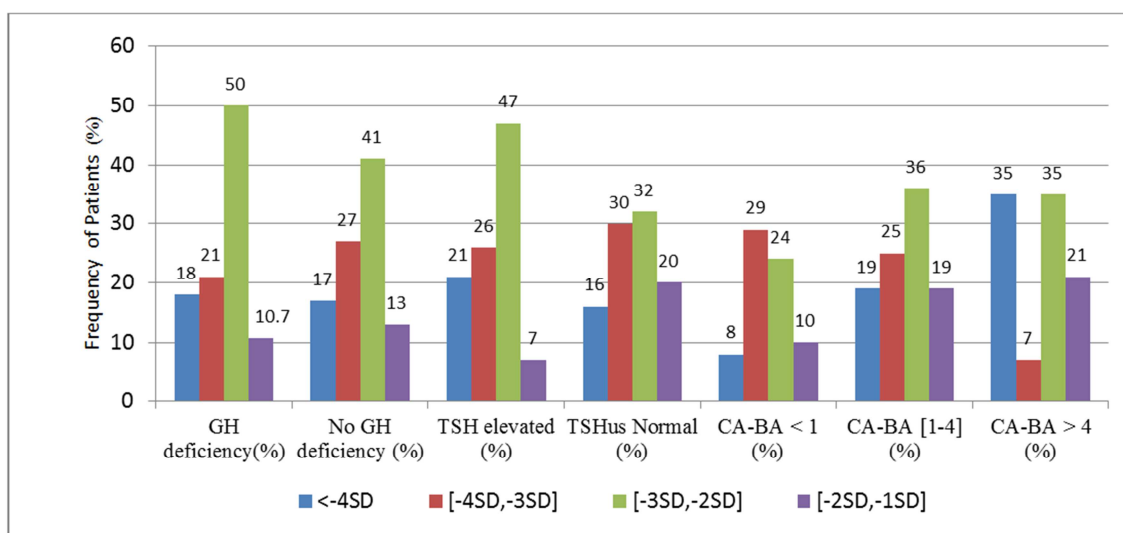
The stimulation test was performed in 79 patients. GH deficiency was found in 61 patients, which represents 77%. GH deficiency (<20 ng/mL) was observed after injection of the stimulating agent. No GH deficiency was found in the

group with a stimulation GH > 20 ng/ mL.

Among 140 patients studied, 64% (90/140) had IGF-1 assays. We found that 69% (62/90) had normal IGF-1 levels for their ages, while 12% (11/90) had a low limit for age and 19% had a collapsed IGF-1 level for age.

Pituitary MRI was performed in only 37 patients. We retained 12% of the patients who present pituitary anomalies: 4% have an interruption of the pituitary stem, 3% have a hypoplasia, 1% has a pituitary adenoma and 4% have an empty sella turcica. The pituitary MRI was not done in 74% of the patients.

Among 140 subjects, 100 were tested for thyroid stimulating hormone (TSHus). The results showed that 51% (52/100) of the patients had an elevated TSHus (>2 UI/L which 55% were boys and 45% were girls). Among 74 cases who had LT4 measurement, 5% had a decreased level (<0.7 ng/dl).



**Figure 3.** Relationship between the result of the stimulation test, the TSHus level, the difference between chronological age-bone age and stature delay in patients.

The result of the GH stimulation test and the severity of stunting show a high peak frequency in the group of patients with -3SD and -2SD height with GH deficiency (50%) and without deficiency (41%). In this same group, the frequency is high (45%) in patients with an elevated TSHus and 32% have a normal TSH.

Our study shows the relationship between the difference between chronological age and bone age and the severity of the statural delay. For this purpose, we calculated the percentage of patients according to the CA-BA difference in each height group. Our results show a high percentage 35% of patients with a difference of more than 4 years in the group with severe stunting (<-4SD and in the group with stunting between [-3SD,-2SD]).

## 4. Discussion

Among subjects, 19.5% had pathologic short stature and 80.5% had normal variants growth. This prevalence is low compared to that found by other authors which are 37% [6]. In our study population, we noted a predominance of males in children with growth retardation (55% of subjects) with a sex ratio of 1.2. This is in agreement with what has been reported by other authors [7-9]. Our results show that the average age at the first consultation is 9 years, which is identical to that found by other reporters [7, 8]. Another study show the average age at first consultation is 15 years [10]; this shows an initial management of stunting in our study that allowed a start of growth hormone treatment in our patients, with a satisfactory statural gain depending on the cause. In current practice, plasma IGF-1 remains a marker sensitive to the effect of growth hormone, we found a low IGF-1 level in 31% of patients. In Algeria, reporters have found a low level in 95% and 100% of patients respectively [11]. Growth retardation is also thought to be due to malnutrition or an unbalanced diet. Several international institutions have reported the importance of nutrition in child growth,

including the World Bank [12, 13], the World Health Organization [14], the Food and Agriculture Organization of the United Nations [15] and UNICEF [16].

The thyroid workup shows discordant results; in our work we observed an increase in TSH in 51% and a decrease in T4 in only 4% of patients. While in another study, the increase of TSHus is found in only 13% and the decrease of T4 in 15% of the cases. On the other hand, other studies agree on the severity of statural retardation in GH deficiency, this diagnosis is evoked when the growth rate is slowed down and it becomes insufficient to maintain the child's height in the normal range with stable SD over time. This progressive or abrupt loss of height often results in a height less than 2SD below the average for the age. In our series, we found a mean height of -2.6 SD which corresponds to a GH deficiency. This value is comparable to that found in other studies - 2.6DS [10] and -3DS in Greece [17]. In addition, other authors have reported a severe delay in patients with growth retardation: either the study done in Iran in 2004 (-6.7DS) [5] or by others (-4.9 DS) [5].

Bone age is also affected in GH deficiency, we found a difference chronological age-bone age of 1.7 years, this difference is close to the study of Papadimitriou et al and which is 1.5 years and the study of Hamidoun MH which is 1.8 years. On the other hand, the difference BA-AO is more important in the studies made by other authors (4.5 years and 5.7 years) [5, 19] respectively. The impact of the covid 19 pandemic on children's mental health, development and growth is documented [20]. This has caused stress, psychological disorders and sometimes depression in children.

## 5. Conclusion

Stunting is a public health problem, as growth is a reflection of a child's health and life course. The reasons for stunting are many and varied. The orientation of the

diagnosis towards one of the great known etiological frameworks requires the analysis of the data of the biological and clinical examination, as well as the bone maturation to determine the definitive statural prognosis, and especially not to leave a cause susceptible to be raised by a specific treatment. The important delay of the consultation age as well as the heaviness of the paraclinical assessment and the stimulation tests constitute the main difficulties encountered in the management of growth retardation. But, the major obstacle is the cost of hormonal treatment which is still at the stage of challenge in our country.

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