

Original Research Article

An aetiological evaluation of short stature

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ABSTRACT

Background: Short stature can be a normal variant or secondary to an underlying disorder. It is necessary to evaluate short stature to differentiate a normal from pathological short stature and thus decide the further treatment needed. This study was conducted at a tertiary care hospital to find out the various etiologies of short stature

Methods: An observational study was conducted on 49 children in age of 2-12 years with short stature. They were grouped as normal variants and pathological short stature depending on upper-lower segment ratio the study group was later divided into proportionate and disproportion short stature. They were further investigated to find out the etiology of the short stature. The bone age of all groups was compared with the chronological age to calculate the bone age retardation.

Results: Out of 49 children 26.5% were normal variants and 73.4% as pathological type. 77.7% of pathological short stature were proportionate type. The male:female ratio was 1:1.4. Chronic systemic disorders were detected in 24.48% while malnutrition and endocrine disorders constituted 12% each. The bone age retardation in endocrine disorders was 0.47.

Conclusions: Chronic systemic disorders were commonest cause of pathological short stature in this study. Females were predominantly affected in all groups and bone age retardation was maximum in endocrine disorders, thus indicating that early diagnosis and management of these disorders is necessary to decrease the growth retardation in these children. An understanding of short stature not only permits to differentiate a normal variant from an underlying disorder but also helps in modifying the course by means of early intervention.

Keywords: Constitutional growth delay, Short stature

INTRODUCTION

Growth results from interaction of genetics, health and nutrition. It is an interplay of many bio-physiological and psycho-social factors which can adversely affect the growth. Hence, growth assessment is an essential tool in child care. Any deviation in normal growth pattern leads to various growth disorders and can be the first sign of underlying problem. Linear growth retardation is one of them which can be detected as short stature. Short stature may be the only or the main presenting symptom in many

cases. Various studies have been conducted to know the growth pattern and evaluate the causes of short stature.

Short stature is defined as height below 3rd percentile or less than 2 standard deviations (SDs) below the median height for that age and sex according to the population standard. Around 2.5-3% of the children worldwide are short. Short stature can be readily recognized with the help of growth charts.¹⁻³ Growth chart analysis can be improved by calculating the growth velocity and mid parental height. The evaluation of short stature starts by identifying normal variants from abnormal or

pathological.⁴ Further evaluation of pathological short stature is done as per various etiologies.^{5,6}

Familial short stature and Constitutional Growth delay are considered as normal variants.⁷ While the pathological short stature includes a wide variety of underlying disorders. Children with constitutional growth delay have a delayed puberty due to decrease in the growth velocity.⁸ Bone age in these patients corresponds with the height age and they achieve a normal adult height later.⁹

In Familial short stature growth proceeds along a curve below but parallel to fiftieth percentile and is characterized by low mid parental height but normal bone age and growth velocity. Clinical features of pathological short stature depend on the underlying disorder. Depending on the upper-lower segment ratio pathological short stature can be further divided into proportionate and dis-proportionate short stature.¹⁰⁻¹³ Chronic systemic disorders, malnutrition, chromosomal or endocrinal disorders lead to a proportionate short stature.¹⁴⁻¹⁷ While most of the dis-proportionate short stature are secondary to skeletal dysplasias or resistant rickets.^{18,19} In developing countries malnutrition and chronic systemic disorders are still the leading causes of short stature. Due to increasing awareness and accessibility to different investigations like hormonal assays, Karyotyping the incidence of short stature secondary to genetic and endocrine disorders is increasing.²⁰⁻²²

Short stature is a common paediatric problem that requires the pediatrician to decide whether it represents only a normal variation or indicates an underlying disease. An understanding of short stature not only permits early detection months to years before other clinical symptoms appear but may also help in modifying the course of the underlying cause by means of early intervention.

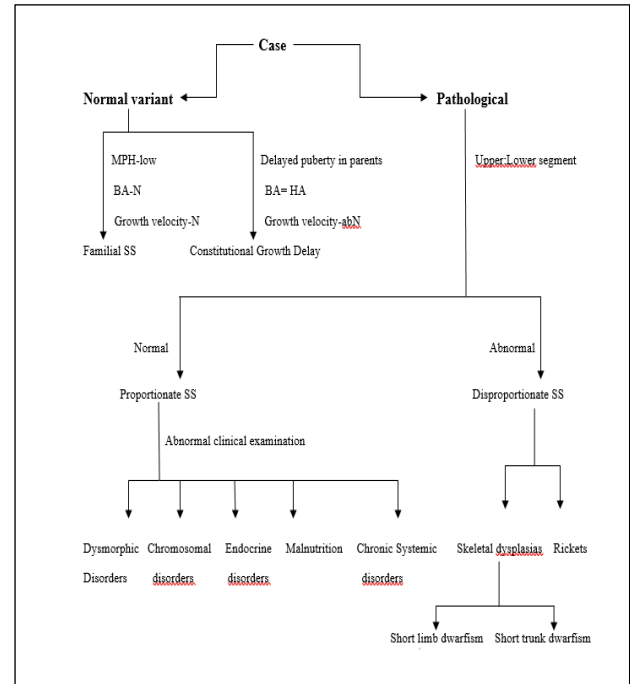
METHODS

Children in the age group 2-12 years with a height of less than 3rd centile or 2 standard deviations below the median height for that age and sex were enrolled in this observational study. Relevant history regarding the birth size, any intra-uterine insult, age of parents at the time of child's birth, maternal medication, history of short stature or delayed puberty in parents was taken. Details of diet and past medical history were also taken.

The height, weight was measured by wall mounted stadiometer and weighing scale. Upper-lower segment ratio was measured in all children. We examined the children for any features of dysmorphism or endocrine disorder, any signs of malnutrition or any chronic systemic disorder. As per the history, anthropometric parameters and examination, appropriate investigations were done.

The height was plotted on the IAP growth charts to determine whether child had short stature (1-3) and the height age was also calculated.

Mid parental height was calculated by (Father's height + Mother's height±13) / 2. Bone age was calculated in all children using the Lt. X-ray wrist AP view. Investigations like skeletal survey, Karyotyping, hormonal assay, renal and liver function tests were done as required. These cases were further grouped according to the aetiology as per the study protocol. Bone age retardation was calculated in all groups.



MPH: mid-parental height, BA: bone age, HA: height age, N: normal, ABN: abnormal, SS: short stature

Figure 1: Study protocol.

RESULTS

A total of 49 children were enrolled in this study. We analysed these cases for the aetiology. The commonest cause of short stature was chronic systemic disorders followed by Constitutional growth delay. The normal variant short stature constituted 26.5%, in which majority of cases had a Constitutional growth delay.

Amongst the pathological variety, the proportionate short stature was predominant. One fourth of these cases were secondary to chronic systemic disorders. Malnutrition and endocrine disorders were detected in around 12% of cases. Females were predominantly affected in all types (M:F=1:1.45) except in skeletal dysplasias (M:F=1.5:1). As per the bone age:chronological age ratio we studied the bone age retardation in all the cases. We found that the maximum bone age retardation was found in endocrine disorders followed by skeletal dysplasias.

There was almost no bone age retardation in cases of Familial short stature.

Table 1: Distribution of study cases according to the aetiology, N=49.

Cause	(n=49), No (%)	Male (n=20)	Female (n=2)
Constitutional growth delay	10 (20.4)	3	7
Familial short stature	3 (6.12)	1	2
Chronic systemic disorders	12 (24.48)	5	7
Endocrine disorders	6 (12.24)	2	4
Malnutrition	6 (12.24)	3	3
Chromosomal disorders	2 (4.08)	1	1
Dysmorphic disorders	2 (4.08)	1	1
Skeletal dysplasias	5 (10.20)	3	2
Rickets	3 (6.12)	1	2

Table 2: Distribution of study group according to the type of short stature.

Type of short stature	N (%)	Male	Female
Normal variant	13 (26.5%)	4	9
Pathological short stature	36 (73.4%)	16	20
Proportionate short stature	28 (77.77%)	12	16
Disproportionate short stature	8 (22.22%)	4	4

Table 3: Bone age retardation in the study group according to the cause.

Cause	Avg. BA/CA	Male BA/CA	Female BA/CA
Constitutional growth delay	0.6	0.59	0.61
Familial short stature	0.96	0.99	0.94
Chronic systemic disorders	0.69	0.61	0.64
Endocrine disorders	0.47	0.5	0.47
Malnutrition	0.62	0.54	0.61
Chromosomal disorders	0.58	0.56	0.59
Dysmorphic disorders	0.78	0.88	0.68
Skeletal dysplasias	0.54	0.6	0.46
Rickets	0.61	0.55	0.64

DISCUSSION

In this study, approximately a quarter of cases (26.5%) were grouped as normal variants. This percentage was high as compared to Choudhary et al, 18.29% and Zargar et al, 18.7%.²²⁻²³ Sultan M et al, has reported normal variant as high as 37.4%.

Amongst the pathological variety, majority of cases were proportionate type. The commonest cause in this study group was chronic systemic disorder. This was in

agreement with the study of Garg et al.²⁴ The higher percentage of short stature due to chronic disorders was probably because this study was conducted in a tertiary level community hospital where children with chronic illness are referred for further treatment.

Malnutrition and endocrine disorders were found in around 12% of cases each. Other studies like Choudhary et al, have reported higher incidence (26%). The lower incidence of endocrine disorders in the present study was because hormonal assays were not available at the same hospital and financial constraints. Females were predominantly affected in all groups (1:1.4), similar to Choudhary et al, (1:1.2), while Sultan et al, reported a ratio of (9:1).

Thus, in the present study chronic disorders was the most common cause for short stature. An early diagnosis of these disorders with appropriate treatment would likely reduce the burden of short stature. Maximum bone age retardation was seen in endocrine disorders followed by skeletal dysplasias.

In Constitutional growth delay the bone age corresponded with the height age than the chronological age cases with familial short stature had almost no bone age retardation. Bone age retardation helps to predict the severity of growth retardation and also helps to predict the growth potential of a child.

CONCLUSION

Endocrine disorders like congenital hypothyroidism if detected by neonatal screening and treated appropriately can definitely aid to increase the growth potential in these children. Thus, this study helps in evaluating the magnitude of short stature and in designing an approach towards short stature in children. Some of the patients could not be investigated due to financial constraints while some patients were lost to follow up.

Recommendation

Regular growth monitoring by plotting the growth charts in the daily paediatric OPD will definitely help to pick up the children with short stature early. Nutritional counselling and early detection of systemic disorders with proper management will reduce the incidence of short stature.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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