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ETIOLOGY OF SHORT STATURE IN CHILDREN

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ABSTRACT **Objective:** To determine the causes of short stature in children with special emphasis on growth hormone deficiency.

Material And Methods: Hundred children (50 boys and 50 girls), ranging from 02 to 15 years presenting with short stature were studied. Height and weight were plotted on appropriate growth charts and centiles determined. Relevant hematological and biochemical investigations including thyroid profile were done. Bone age was determined in all cases.Growth hormone axis was investigated after excluding other causes. Karyotyping was done in selected cases. Data was analyzed by SPSS 10.0 by descriptive statistics. Mean values were compared using t-test.

Results: In this study, the five most common etiological factors in order of frequency were Constitutional Growth Delay(CGD), Familial Short Stature (FSS), malnutrition, coeliac disease and Growth Hormone Deficiency (GHD). In 37.4% of patients, the study revealed normal variants of growth – CGD, FSS or combination of both, 46.7% cases had non-endocrinological and 15.9% had endocrinological etiology. CGD (22.1%) in males and FSS (27%) in females were the most common etiology. GHD was found in 6.1% children and it comprised 38.2% of all endocrinological causes. Children with height falling below 0.4th centile were more likely to have a pathological short stature (79.2%) compared to 39.3% whose height was below 3rd centile but above 0.4thcentile ($p<0.05$).

Conclusion: CGD and FSS are most common causes of short stature in boys and girls respectively, whereas, GHD is a relatively uncommon etiology.

KEYWORDS : Constitutional growth delay. Familial short stature. Growth hormone deficiency. Short stature.

INTRODUCTION

Short stature is a common problem in children globally, especially in developing countries[1]. When compared with well-nourished and genetically relevant population, short stature is defined as height or length below 3rd percentile for that age and gender[2]. Statistically, this refers to children who are shorter than 97% of their age and gender matched peers. Causes of short stature are diverse but fortunately the most common causes, beyond the first two years of life are Familial Short Stature (FSS) and Constitutional Growth Delay(CGD)[3,4].These are variants of normal growth and need no medical treatment, however, emotional stress associated with it should be alleviated [5]. Almost any chronic disease can cause short stature such as renal disease, malignancy, pulmonary disease, Cystic Fibrosis (CF), cardiac disease etc [6].Coeliac disease is a prime example of a remediable cause of short stature, especially in younger children[7].Nutritional deprivation and therapies like glucocorticoids, chemotherapeutic drugs, radiotherapy can result in short stature[8].Common endocrinological causes of short stature include hypothyroidism, hypopituitarism (isolated GHD or multiple anterior pituitary hormone deficiencies), hypercortisolism and classical Laronsyndrome[9,10]. All these are characterized by being overweight-for-height. Short stature may also be seen with severe Intrauterine Growth Retardation (IUGR) orchildren born Small for Gestational Age (SGA) and inlarge number of dysmorphic syndromes[11].Idiopathic Short Stature (ISS) is considered when no causative disorder can be identified[12].

MATERIALS AND METHODS

This observational study was carried out over a period of 12 months from September 2018 to august 2019 at Paediatric Department of saraswathi institute of medical sciences ,hapur,U.P. Children residing in INDIA with short stature were enrolled.

Inclusion criteria were age below 18 years, height more than 2 SD below the mean (< 3rdpercentile), low growth velocity (< 4 cm/yr)or small for mid parental height and adequate follow-up(at least for 6 months).

Exclusion criteria were diagnosed cases of thalassemia major or other chronicvdiseases, as well as patients or their parents not willing to be included in the study.

Thorough history and physical examination were recorded on a predesigned proforma. Standing height without head or foot gear (measured with astadiometer), upper to lower segment ratio, weight and head circumference were measured. For height measurement, head was positioned in Frankfurt plane,the head projection was placed at the crown of the head and the measurement was recorded to the nearest 0.1cm[13]. All efforts were made to record heights on subsequent visits on the same apparatus. Growth parameters were first plotted on 2000 CDC growth charts (developed by the American National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion)[14] and all those children with height below 3rd centile were included in the study after satisfying inclusion criteria.

RESULTS

A total of 100 cases [50 males (50%), 50 females(50 %)] were identified as having short stature, with mean chronological age of 6.1 +3.1 years, mean bone age of 5.0 +2.8 years, mean height of age 4.3 +2.6years and mean growth velocity of 4.9 +3.5 cm/years. Among the study population, mean height was 99.6 centimeters (+15.4) and mean mid-parents height was163.3 centimeters (+10.4). All children fell below 3rdcentile for their height on 2000 CDC growth charts, whereas, 58 patients(58%) had height below 0.4th centile on 1990 UK growth charts.

Three main etiological groups were identified. Non-endocrinological diseases as a group were the most common cause (46.7%) in comparison with normal variants of growth (37.4%) and endocrinological causes (15.9%). In males, 50% had non-endocrinological diseases, 33.6% were normal variants of growth while 16.4% had endocrinological diseases whereas, in females these values were 40.5%,44.6% and 14.9% respectively.

In this study, the five most common single etiological factors were CGD(17.3%), FSS (15%), malnutrition (9.8%), celiac disease(6.5%) and GHD (6.1%).

In males, CGD (22.1%) and in females FSS (27%) were the most common single etiological factor. A total of 5 cases(2 males and 3 females) had both FSS and CGD.Malnutrition and celiac disease were the leading non-endocrinological causes of short stature. A total of 43.5% cases were below 05 years of age.Normal variants of growth were more common in children with age above 05 years; 27 out of 56 (49%),compared to 5 out of 23 (22.6%) children under 05years of age ($p<0.05$). Non-endocrinological causes were more common in

children with age under 05 years, (64.5%), in comparison to (33.1%) in children over 05 years of age ($p<0.05$).

In cases with height falling below 3rdcentile, 60.7% were variants of normal growth and only 4.5% were of endocrinological disturbance. The same values reduced to 20.8% and 24% respectively, in cases where height was falling below 0.4thcentile. Among uncommon causes of short stature in this study were Turnersyndrome , Down syndrome, Seckel syndrome ,Hallermann Strieff syndrome , Russel Silversyndrome, Leri Weill dyschondrosteosis , Bartter syndrome, chronic renal failure, cystic fibrosis, poorlycontrolled asthma, insulin dependent diabetes mellitus,diabetes insipidus, glycogen storage disease type I,achondroplasia, metaphyseal dysplasia, mucopolysaccharidosis and Duchenne muscular dystrophy .

There were a total (6.1%) cases of GHD in this study, mean height was 104.4+11.3 cms, mean age at the time of diagnosis was 7.8+2.9 years, mean bone age was 4.5 +2.0 years andmean growth velocity was 2.9 +0.4 cm/year. All cases of GHD were diagnosed after suboptimal response to two consecutive GH stimulation tests. 84.6% of GHD cases had age more than 05 years and 92.3% werefalling below 0.4th centile on nine percentile UK growthcharts[15].

DISCUSSION

Short stature has been studied extensively worldwide[18] but similar studies are quite few in India. As per definition of short stature, 3% of normal population falls in this category. Any child with an abnormally slow growth rate, height below 3rd percentile, or height considerably below the genetic potential deserves further evaluation. An assessment of growth requires reliable growth measurements with data plotted on suitable growth charts.Fortunately, majority of children with height falling below 3rd centile are part of normal population, with only a small number having endocrine abnormalities.

Nevertheless, the most common cause of short stature was normal variants of growth as a group. CGD ranked as the commonest in males and FSS in female subjects;the same was concluded by Bhadada et al. in their study of 352 children with short stature in India.Below 05years of age, pathological short stature was 77.4% while above 05 years, it was 50.5% ($p<0.05$). Another important observation made in this study was that 79.2% of cases with pathological short stature werehaving height falling below 0.4th percentile on nine centile UK growth charts compared to normal variants,where only 20.8% cases were falling below 0.4thpercentile ($p<0.05$). Most children whose height fallsbelow the 3rd centile but not below 0.4th centile, were normal (60.7%), with only few having endocrine abnormalities.

CONCLUSION

CGD and FSS are the leading causes of short stature in children where as, GHD is relatively less common with a predilection for males. Thus the GH axis should only be investigated in selective cases and after adequate monitoring of growth and exclusion of other causes of short stature. Children with height falling below 0.4th centile are more likely to have a pathological cause for their short stature ($p < 0.05$). Thus the use of UK growth charts with 9 percentile lines designed by Child Growth Foundation, UK, appears to be appropriate for use in our country. Short stature children under 05 years of age were more likely to have a pathological cause.

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