

Etiological Study of Short Stature among Children Attending Outpatient Department of Pediatrics in a Tertiary Care Medical College Hospital

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Abstract

Background: Short stature is a term applied to a child whose height is two standard deviations or more below the mean height for children of that gender and chronologic age. Familial short stature and Constitutional Growth delay are considered as normal variants, the pathological short stature includes a wide variety of underlying disorders. Chronic systemic disorders, malnutrition, chromosomal or endocrinal disorders lead to a proportionate short stature. While most of the disproportionate short stature are secondary to skeletal dysplasias or resistant rickets. Etiological evaluation plays an important role in identification of physiological as well as pathological causes of short stature. **Subjects and Methods:** All children of age between 2 and 18 years with height below 2 standard deviation of mean for age and gender were included in the study. **Result:** A total of 100 children were studied who fulfilled the criteria of short stature, out of which 61 children were male and 39 were female children. Present study showed that females had more pathological variants (72%) than males (46%) whereas males had more physiological variants (54%) than females (28%) with P-value: 0.011 Hypothyroidism was more common in females than males with 28% and 8% respectively. Genetic syndrome was more common in females than males with 10% and 3% respectively. **Conclusion:** Etiological evaluation is of pivotal role in identification of physiological as well as pathological causes of short stature and also helps in modifying the course of stature by means of early intervention.

Keywords: Short stature, Physiological short stature, Pathological short stature.

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Received: January 2020

Accepted: January 2020

Introduction

Growth is a continuous complex biologic process subject to genetic, environmental, nutritional and hormonal influences. Disturbance of any of these factors results in altered growth potential.^[1] 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.^[2] Short stature is a term applied to a child whose height is two standard deviations or more below the mean height for children of that gender and chronologic age (and ideally of the same racial-ethnic group). This translates into being below the third percentile for height, which is plotted against country specific growth charts.^[3] It is one of the most common problems in paediatric age group globally, especially in developing countries.^[4] Around 2.5-3% of the children worldwide are short. The evaluation of short stature starts by identifying normal variants from abnormal or pathological. While Familial short stature and Constitutional Growth delay are considered as normal variants, the pathological

short stature includes a wide variety of underlying disorders.^[5]

Depending on the upper-lower segment ratio pathological short stature can be further divided into proportionate and disproportionate short stature.^[6,7,8,9] Chronic systemic disorders, malnutrition, chromosomal or endocrinal disorders lead to a proportionate short stature.^[6,10,11,12] While most of the disproportionate short stature are secondary to skeletal dysplasias or resistant rickets.^[13] In developing countries malnutrition and chronic systemic disorders are still the leading causes of short stature.^[6]

The value of height or stature has been linked to academics, occupational placement, leadership and performance, sports participation or passage to glamour world.^[4] Psychosocial stress associated with shortness is more distressing, depending upon height deficit and child's coping skills.^[1,4]

There are numerous literatures evaluating the etiological factors, effect of various community and personal level interventions to deal with weight disorders. However, there are few studies documenting the etiological profile of short stature from India.⁵ Etiological evaluation plays an important role in identification of physiological as well as pathological

causes of short stature. While physiological short stature requires only parental reassurance and follows up, pathological short stature requires timely detection, evaluation and management.^[4] Hence the purpose of the study is to determine the factors causing short stature in children of age group of 2-18 years.

Subjects and Methods

This cross-sectional study was conducted in department of paediatrics in Sri Siddhartha medical college and research centre. All children of age between 2 and 18 years with height below 2 standard deviation of mean for age and gender were included in the study. Children with age less than 2 years, age more than 18 years and parents of children who are not willing to participate in the study were excluded from the study. Detailed clinical history regarding child's as well as family members was taken. Head to toe examination was done. Detailed anthropometric evaluation was done which includes: height, weight, head circumference, body mass index, mid arm circumference. Assessment of Height age, Mid parental height, Target height, Target height range was estimated. Bone age assessment is done by comparison with BA radiographs (left hand wrist joint x ray) of standard ages available as Greulich Pyle Atlas. The above obtained data was statistically analysed using software Epi Info software version 3.5.3.

Results

A total of 100 children were studied who fulfilled the criteria of short stature, out of which 61 children were male and 39 were female children. In the present study most of children were in the age group of 1 – 5yrs, followed by 6 – 10 yrs and a smaller number of children in the age group of 16 – 18 yrs. Number of male and female children in the age group 1 – 5 yrs were 51% and 46% respectively and less number in the age group of 16 – 18 yrs with 8.2% and 5.1% respectively. [Table-1]

Table 1: Age and sex distribution among children with short stature

Age Group	Sex		Total
	Male	Female	
1 – 5	31 (50.8%)	18 (46.2%)	49 (49.0%)
6 – 10	19 (31.1%)	13 (33.3%)	32 (32.0%)
11 – 15	6 (9.8%)	6 (15.4%)	12 (12.0%)
16 – 18	5 (8.2%)	2 (5.1%)	7 (7.0%)
Total	61 (100.0%)	39 (100.0%)	100 (100.0%)

Short stature in children were divided into pathological and physiological variants. Present study showed that females had more pathological variants (72%) than males (46%) whereas males had more physiological variants (54%) than females (28%) with P-value: 0.011 [Table-2].

Table 2: Distribution of short stature children according to pathological and physiological variants

Variants	Sex		Total
	Male	Female	
Pathological Variants	28 (45.90%)	28 (71.80%)	56 (56.0%)
Physiological Variants	33 (54.10%)	11 (28.20%)	44 (44.0%)
Total	61 (100%)	39 (100%)	100 (100.0%)

Chi-Square: 6.473, P-value: 0.011

Familial short stature was the most common cause of short stature. In our study familial short stature was more common in males than females with 44% and 26% respectively followed by chronic systemic disease with 20% in males and 18% in females. Hypothyroidism was more common in females than males with 28% and 8% respectively. Genetic syndrome was more common in females than males with 10% and 3% respectively. [Table-3]

Table 3: Etiology of short stature among children

Etiology	Sex		Total
	Male	Female	
Familial Short Stature	27 (44.3%)	10 (25.6%)	37 (37%)
Chronic Systemic Disease	12 (19.7%)	8 (20.5%)	20 (19%)
Hypothyroidism	5 (8.2%)	11 (28.2%)	16 (16%)
Malnutrition	6 (9.8%)	3 (7.7%)	9 (9%)
Constitutional Growth Delay	6 (9.8%)	1 (2.6%)	7 (7%)
Genetic Syndromes	2 (3.3%)	3 (7.6%)	5 (5%)
Global Developmental Delay	2 (3.3%)	1 (2.6%)	3 (3%)
Growth Hormone Deficiency	1 (1.6%)	1 (2.6%)	2 (2%)
Others	0 (0%)	1 (2.6%)	1 (1%)
Total	61 (100%)	39 (100%)	100 (100%)

In our study, chronic systemic disease was found in 19 children out of which 12 were males and 7 were females. Chronic bronchial asthma (26.3%) was the most the most common cause followed by CHD-ASD (15.7%), B thalassemia major (10.5%), tetralogy of Fallot (10.5%) and seizures (10.5%). [Table 4]

Table 4: Distribution of Chronic Systemic Disease among children with short stature

Chronic Systemic Disease	Sex		Total
	Male	Female	
Chronic Bronchial Asthma	3 (25%)	2(28.6%)	5 (26.3%)
CHD-ASD	3(25%)	0	3(15.7%)
B Thalassemia Major	1(8.3%)	1(14.3%)	2(10.5%)
CHD-Tetralogy of Fallot	2(16.6)	0	2(10.5%)
Seizures	0	2(28.6%)	2(10.5%)
CHD-VSD	1(8.3%)	0	1(5.2%)
CHD- MR TR	1(8.3%)	0	1(5.2%)
Chronic Kidney Disease	0	1(14.3%)	1(5.2%)
Chronic liver diseases	1(8.3%)	1(14.3%)	2(10.5%)
Total	12 (100%)	7 (100%)	19(100%)

Discussion

The current study exhibited male to female ratio as 1.5:1 which is similar to studies by Rabbani et al. (1.2:1), Hussain A etal (1.25:1), Manish gutch et al. (1.2:1), Moayeri etal

(1.8:1), Bhadada et al (1.6:1).^[2,15-18] The studies done by Lashari et al (.9:1), Ganavi et al (.9:1), had a female predominance in short stature which is contrary to our study.^[19,20] Epidemiologic data indicate that all variants of short stature are twice as common in boys as in girls.^[20,21] It is possible that this gender difference merely reflects greater parental concern about male height which leads to a self-referral ascertainment bias.^[17] Majority of children with height falling below 3rd centile is part of normal population, with only a small number having other abnormalities. This dominance of normal variants of growth in the present study is in accordance with other worldwide studies like Moayeri et al. which was 47%.^[22,23] Utah growth study done by Lindsey et al, shows the greatest incidence of normal variant (80%) where as other Indian studies like Bhadada et al (36.10%), Phirke et al (26.50%), Garg et al (24%), Colaco et al (29.9%) had shown similar results compared to our study.^[23,18,15,24,25]

Table 5: Comparison of present study with other studies with respect to various factors of Short Stature

	Male: Female	Normal Variants	Familial Short Stature	Constitutional Growth Delay	Pathological causes
Rabbani et al ¹	1.2:1	37.4%	21.3%	6.6%	62.6%
Lashari S K et al ²⁰	0.9:1	55%	-	-	45%
Lindsey et al ²³	2.7:1	80%	37.3%	26.8%	20%
Moayaeri H et al ¹⁷	1.8:1	47%	14%	33%	53%
Bhadda S et al ¹⁸	1.6:1	36.1%	15.09%	-	63.9%
Hussain A et al ¹⁵	1.25:1	61%	37.5%	15.8%	39%
Phirke S et al ¹⁴	0.7:1	26.5%	6.1%	20.4%	73.5%
Manish gutch et al. ¹⁶	1.2:1	57%	15.9%	41.2%	43%
Colaco et al ²⁵	-	29.9%	20.9%	8.4%	70%
In our study	1.5:1	44%	37%	7%	56%

Familial short stature is the single most common cause of short stature in our study which is classified under normal variant. This is in accordance with almost all worldwide studies including Lindsey et al. (37%), Hussain A et al (37%) and Shiva et al. (33%).^[23,15,26] Even though familial short stature showed a greater frequency in the present study, constitutional growth delay was very less compared to other studies like Lindsey et al. (26.8%) and Shiva et al. (20.4%).^[23,26] Since this study was conducted in tertiary care hospital, pathological causes accounted for 56% of total short stature. This is in accordance to study done by Rabbani et al. (62%) and Moayeri et al. (53%) and Bhadada et al. (64%).^[1,17,18] In Utah study done by Lindsey et al. pathologic variants were found to be very low, ie, only 20% since it was conducted on very large population of normal

school going children.^[7]

The most common cause of pathological short stature was found to be chronic systemic diseases followed by hypothyroidism in our study. Chronic systemic diseases constitute 20% of the whole short stature cases, ie 36% of pathological short stature. Almost all children evaluated were having acute or chronic illness because this study was conducted in a tertiary care hospital. This may be the reason for high frequency of chronic systemic diseases. Few studies like study done by Rabbani et al. (21%), Phirke S et al. (24%) findings are consonant with our study, most other studies showed very less children with chronic systemic illness like Lashari S K et al. 9 (4%), Lindsey et al. 10 (10%), Moayeri H et al (4%), Bhadada et al. 5 (12.40%), Ganavi et al. (10%), Deep Dutta et al. (1.00%) and Colaco et al. (8.40%).^[1,14,20,23,17,18,19,27,25] Most of these studies are being done in endocrine clinic of tertiary hospitals where more of endocrinologic causes will be encountered. Endocrine disease was one of the causes of pathological short stature in child and it was found to be high in females than males with 31% and 10% respectively (P<0.01). In our study the endocrine causes for short stature was 18% whose findings are consonant with other research like Rabbani et al (15.9%) and Phirke (12.24%).^[1,14] Endocrine causes were low in Shiva et al. (3%), Garg et al. (4.7%) and high in Lashari et al. (28%), Hussein et al. (26%), Ganavi et al. (24%), Colaco et al. (33.3%) which are conflicting to our study.^[15,19,20, 24-26] This may be due to the difference of study settings where each study is being done. Hypothyroidism (16%) was the most common endocrine cause of short stature in our study. It is accordant to studies done by Bhadada et al. (14.2%), Lashari et al. (15%), Rabbani et al. (17.2%).^[1,18,20] Cases of hypothyroidism was very less in Utah study done by Lindsey et al. (1%), where mass screening of 79,495 school going children was done.^[23] Growth hormone deficiency accounted for only 2% of short stature in our study.

Table 6: Comparison of present study with other studies with respect to Endocrinological causes

	Chronic systemic disease	Endocrine causes
Rabbani et al ¹	21%	15.9%
Lashari S K et al ²	4%	28%
Lindsey et al ²³	10%	-
Moayaeri H et al ¹⁷	4%	-
Bhadda S et al ¹⁸	12.4%	-
Hussain A et al ¹⁵	-	26%
Ganavi ramgopal	10%	24%
Phirke S et al ¹⁴	24.48%	12.24%
Deep Dutta ²⁷	1%	
Garg et al ²⁴	40%	4.7%
Colaco et al ²⁵	8.4%	33.3%
In our study	19%	18%

In our study, among pathological short stature, malnutrition (9%) was found to be the most common non endocrinological cause. These results were consistent with

the worldwide studies like Utah growth study done by Lindsey et al (10%), and various studies in India like Phirke S et al. (12.24%), Deep Dutta et al. (6.00%), Garg et al. (13.00%), Colaco et al. (8.40%), and Zarger et al. (10.4%)^[14,23-25,27,28]

Other causes like genetic syndrome constitute 5 % of short stature which is in consonant with many Indian studies done by Bhadada et al. (7.4%), Phirke et al. (4%) and Deep Dutta et al.(8%).^[14,18,27]

The shortcomings of this study include failure to calculate and plot growth velocity which requires a regular follow-up at six months to twelve months interval, which was not possible in this cross-sectional study. Secondly, it was a hospital-based study where patients of specific diseases are referred.

Conclusion

Short stature is one of the most common problems in paediatric age group globally, especially in developing countries. This study helps us to know about the causes of their short stature. Physiological short stature like familial short stature requires only parental reassurance. But chronic systemic disease and hypothyroidism are preventable causes which requires timely detection, evaluation and management. Etiological evaluation is of pivotal role in identification of physiological as well as pathological causes of short stature and also helps in modifying the course of stature by means of early intervention.

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How to cite this article: Khan IVH, Harshini BP, Ashoka C, Kumar GV. Etiological Study of Short Stature among Children Attending Outpatient Department of Pediatrics in a Tertiary Care Medical College Hospital. Asian J. Clin. Pediatr. Neonatol.2020;8(1):32-36.
DOI: [dx.doi.org/10.47009/ajcpn.2020.8.1.8](https://doi.org/10.47009/ajcpn.2020.8.1.8)

Source of Support: Nil, **Conflict of Interest:** None declared.

