Clinical, Hormonal and Radiological Profile of Short Stature In Government Rajaji Hospital, Madurai

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I. Introduction

Short stature is defined as height below 3rd percentile or less than two Standard Deviations (SDs) below the median height for that age and sex according to the population standard; or even if the height is in normal percentiles but growth velocity is consistently below 25th percentile over 6–12 months of observation.Approximately 3% children in any population are short, amongst which 50% is due to physiological (familial or constitutional) and 50% is pathological.

Normal growth requires proper nutrition along with the various hormonal stimuli. The important hormones are:
1. Growth hormone (GH)
2. Insulin-like growth factor (IGF)-1
3. Thyroid hormones
4. Sex steroids and other growth factors.

Linear growth is maximal during infancy, 25 cm during 1st year and 10 cm/year in next 2 years. Subsequently, it gradually declines to 6–7 cm/year till puberty. After puberty growth accelerates in sigmoid manner and it is around 10 cm/year.

Age of onset of puberty varies in different population and it correlates more with bone age (BA) than the chronological age (CA). Short stature may be due to constitutive intrinsic growth defect or due to of any of the extrinsic factors.

II. Aims and objectives

- To study the age distribution of short stature among the patients attending Endocrinology outpatient department in our hospital.
- To study the sex distribution presenting with short stature among the study population
- To study the etiological distribution with the aid of bone age with Left hand and wrist X-ray, Tanners pubertal staging, hormonal profile GH , TSH, LH & FSH in the study population.
- To categorise the causes of short stature among different age groups and gender in the study population.

III. Materials and methods

IV. Study population

The study will be conducted in patients attending in Endocrinology Outpatient department for hormonal evaluation from , Government Rajaji Hospital, Madurai.
Sample size: 50

Inclusion criteria:
1. Age: 13 to 18 years Height more than 2.5 SD below the mean for chronological age.
2. Growt rate below the fifth percentile for chronological age for local
population (Agrawal's Growth Chart)
3. Height more than 2 SD below the mean for chronological age when corrected
for mid parental height

Exclusion criteria:
1. Short Stature due to chronic illness like underlying cardiac diseases, respiratory diseases, gastrointestinal diseases and cystic fibrosis.
2. Short stature due to skeletal dysplasias like achondroplasia SYNDROMES like Down syndrome, Noonans syndrome, Trisomy 13 and Trisomy 18

Data collections:
Patients presenting with short stature in endocrinology Out- Patient department in Govt Rajaji Hospital, Madurai.

Methods of Study:
The height of all children is measured keeping their head in Frankfurt plane while occiput, shoulder, buttocks and heel touching vertical board. The children were drawn upto their full height by upward pressure on mastoids.
-Detailed history (antenatal, perinatal and postnatal)
-Clinical Examination

Investigations:
1. Complete Hemogram
2. Blood Glucose
3. Renal Function Test
4. Liver function test
5. Xray left wrist
6. Hormonal evaluation
- T3, T4, TSH, LH and FSH, Prolactin, Testosterone in males
- Growth hormone will be estimated by clonidine stimulation test-4µg /kg and growth hormone levels are measured at 60, 90 and 120 min.

Design Of Study: Analytical Study
Period Of Study:6 Months
Collaborating Departments:
Department Of Endocrinology
Department Of Radiology
Department Of Biochemistry
Ethical Clearance: Obtained
Consent: Individual Written And Informed Consent
Analysis: Statistical Analysis
Conflict Of Interest: Nil
Financial Support: NIL

Participants:
* Patients attending Endocrinology outpatient department for evaluation of short stature from February 2015 to August 2015 in Government Rajaji hospital , Madurai are included in my study.

V. Observation And Results

1. Gender distribution in the observed population:

SEX	No.of cases
MALE	30
FEMALE	20

In our study male constituited about 60% (n=30) and female 40%(n=20

The male to female ratio is 1.5 : 1 .

2. Age distribution in observed population ofshort stature

AGE	MALE	FEMALE	TOTAL
13 - 15	23	15	38
16 - 18	7	5	12
Total	30	20	50

In our study among 50 patients, 76% (n=38) of patients were in the range of 13-15 years, 24 % (n=12) of patients are between 15 - 18 years .. It shows that incidence of of patients presenting with short stature is more during 13 to 15 years.

3. Height Distribution In Boys Among The Study Population

HEIGHT (Cm)	TOTAL
<145	7
145 - 155	16
155 - 165	6
>165	1

In our study population of 30 the observed height of the boys ranges from l35cm to 170 cms

-23.3% (n = 7) had height less than 145 cms
- 53.3% (n=16) had height ranging from 145 to 155 cms
-. 20% (n=6) had height ranging from 155 -165 cms.
-3.33% (n= 1) had height more than 165 cms
Majority of patient presented with height ranging from 145 cm to 155 cm .

4. Height Distribution Of Girls In The Study

HEIGHT	TOTAL	PERCENTAGE
<145	1	5
145 - 150	12	60
150 - 160	7	35

In our study population of 20 the observed height among girls ranges from 140 cms to 168 cms.

-5% (n= 1) the height was less than 145cm
-60% (n= 12) patients had height ranging from 145-150cm
-35% (n= 7) patients the observed height ranges from 150-160 cm
Majority of the study population in girls had height ranging from 145- 150 cm

5. Pubertal Staging –Tanner For Boys Observed In Ourstudy Population

Tanner staging	TOTAL	Percentage
STAGE I	15	50
STAGE II	10	34
STAGE III	4	13
STAGE IV	1	3
STAGE V	0	0
TOTAL	30	100

-50% (n=50) were observed to have Stage – I of Tanners staging which is pre pubertal.
-34% (n=10) were observed to have Stage –II ,
13% (n=4%) were observed in Stage III   3% (n=1) was observed in Stage –IV of anner staging. Majority of patients belong to pre pubertal.

6. Tanner's Pubertal Staging Observed In Female Patient Of Study Population

Tanner stage	TOTAL	PERCENTAGE
STAGE I	3	15
STAGE II	8	40
STAGE III	6	30
STAGE IV	3	15
STAGE V	0	0
TOTAL	20	100

Among the girls in study population 15% (n= 3) belongs to STAGE-I -40% (N =8) were observed in STAGE-II
-30% (N=6) were observed in STAGE-III
-15% (n =3) in STAGE-IV of Tanners pubertal staging.

7. Distribution Of Bone Age In The Study Population

BONE AGE	MALE	FEMALE	TOTAL	PERCENTAGE
NORMAL	3	9	12	24
DELAYED	27	11	38	76

In our study population , majority of patients 76% (n=38) had delayed bone age for chronological age in 27 out of 30 boys and 11 out of 20

- 24% (n = 12) were found to have normal bone age for chronological age.

8. Growth Hormone Level An Its Correlation In Thestudy Population

Gh Levels	Male	Female	Total	Percentage
Normal	15	15	30	60
Elevated	4	1	5	10
Decreased	11	4	15	30
			50	100

In our study population 60% (n=30) had normal levels of GH , 10%   (N=5) had elevated levels of GH and 30% (n=15) were found to have decreased

levels of GH. Majority of patients had normal levels of growth hormone.

9. Distribution Of Tsh Levels In Study Population

Tsh	Male	Female	Total	Percentage
Normal	26	16	42	84
Elevated	4	3	7	14
Decreased	0	1	1	2
			50	100

In our study population 84% (n=42) had normal levels of TSH, 14% (N=14) had elevated levels of TSH (hypothyroidism) and 2% (n=1) had decreased levels of TSH due to pan hypopituitarism. Majority of patients had normal levels of TSH.

10. Etiological Distribution Among The Study Population

ETIOLOGY	MALE	FEMALE	TOTAL	PERCENTAGE
Constitutional growth delay	11	5	16	32
Familial short structure	4	8	12	24
Growth hormone	6	2	8	16
Hypothyroidism	4	2	6	12
Mal nutrition	4	2	6	12
Diabetes mellitus	1	0	1	2
Genetic syndrome- turner	0	1	1	2

Majority of patients about 56% (n=28) belongs to normal variants of short stature like constitutional growth delay and familial short stature.Endocrine disorders like GH Deficiency was seen in 16% (n=8). and hypothyroidism in 12% (n=6). 12% (n= 6) patients presented with malnutrition. 2% of patients presented with diabetes mellitus.

11. Comparison Of Pathological Causes With Age

Pathological causes	Const + Familial	Other patho	p value
13 - 15 (38)	18	20	0.947 NS
16 - 18 (12)	11	1	0.025 SIG

In our study population of 13- 15 yrs   18 out of 38 had   normal variants of growth   and 20 had pathological cause for shortstature and the p value is 0.947 which is not significant.The patients belonging to 16-18yrs of age 11 out of 12 had normal variants of growth and only 1 patient had pathological cause and the p value is 0.025 which is significant.

12. Comparison Of Pathological Causes And Normal Variants Of Growth :

Constitutional growth delay + Familial short structure	28
Other pathological causes	22
28 / 50, 22/50	p value 0.603 NS

The normal variants of growth like constitutional growth delay and familial short stature constituited of about 28 among 50 patients. The pathological causes were seen in 22 among 50 patients.The p value is 0.603 which is insignificant

13. Comparison Of Age Vs Etiology

Age group	Const + Familial	Other patho	p value
13 - 15 (38)	18	20	0.947 NS
16 - 18 (12)	11	1	0.025 SIG

In age group of 13-15 yrs of age group the p value is 0.047 between normal variants of growth and pathological causes which is non significant .Between the age group of 16-18 yrs the p value is 0.025 between pathological and normal variants of growth which is significant.

14. Comparison Of Sex Vs Etiology In Our Study Population

Pathological causes	Const + Familial	Other patho	p value
MALE (30)	15	15	0.823 NS
FEMALE (20)	13	7	0.409 NS

The p value between normal variants and pathological causes in males in our study population is 0.823 and among females is 0.409 which is not significant.

VI. Discussion

Gender Distribution In The Observed Population:
In our study male constituted about 60% (n=30) and female 40% (n=20).
The male to female ratio is 1.5:1 .This shows that the short stature is more common in male population than female population .This finding is consistent with study done in Medical College of Wisconsin, "The Evaluation and Follow-up of Children Referred to Paediatric Endocrinologists for Short Stature" done by David Wyatt et al

Age distribution in observed population of short stature
In our study among 50 patients, 76% (n=38) of patients were in the range of 13-15 years, 24 % (n=12) of patients are between 15 - 18 years. It shows that incidence of of patients presenting with short stature is more during 13 to 15 years.

Height distribution in boys among the study population
In our study population of 30 the observed height of the boys ranges from l35cm to 170 cm 23.3% (n = 7) had height less than 145 cm, 53.3% (n=16) had height ranging from 145 to 155 cm, 20% (n=6) had height ranging from 155 -165 cm. 3.33% (n= 1) had height more than 165 cm. Majority of patient presented with height ranging from 145 cm to 155 cm.

Height distribution of girls in the study
In our study population of 20 the observed height among girls ranges from 140 cm to 168 cm.
-5% (n= 1) the height was less than 145cm
-60% (n= 12) patients had height ranging from 145-150cm
-35% (n= 7) patients the observed height ranges from 150-160 cm
Majority of the study population in girls had height ranging from 145- 150 cm

Pubertal staging –Tanner for boys observed in our study population
50% (n=50) were observed to have Stage – I of Tanners staging which is prepubertal.34% (n=10) were observed to have Stage –II , 13% (n=4%) were observed in Stage III and 3% (n=1) was observed in Stage – IV of Tanner staging
This finding is consistent with study done in Medical College of Wisconsin " The Evaluation and Follow-up of Children Referred to Paediatric Endocrinologists for Short Stature" done by Katrina et al where 73% were in prepubertal staging among the study population.

Tanner's Pubertal staging observed in female patient of study population
Among the girls in study population 15% (n= 3) belongs to STAGE-I 40% (N =8) were observed in STAGE-II 30% (N=6) were observed in STAGE-III 15% (n =3) in STAGE-IV of Tanners pubertal staging.

Distribution of bone age in the study population

In our study population, majority of patients 76% (n=38) had delayed bone age for chronological age in 27 out of 30 boys and 11 out of 20 and 24% (n =

12) were found to have normal bone age for chronological age.

Growth hormone level an its correlation in thestudy population
In our study population 60% (n=30) had normal levels of GH , 10% (N=5) had elevated levels of GH and 30% (n=15) were found to have decreased levels of GH.
Majority of patients had normal levels of growth hormone. This finding is consistent with study conducted in 2,500 children in Bai Jerbai Wadia Hospital , Bombay, India where GH deficiency is the most common cause of short stature of about in This finding is also consistent with study conducted in Department of Endocrinology, Sher-i-Kashmir Institute of Medical Sciences, GH deficiency was the commonest cause of short stature of about 22.8% of cases.

Distribution of TSH levels in study population
In our study population 84% (n=42) had normal levels of TSH, 14% (N=14) had elevated levels of TSH (hypothyroidism) and 2% (n=1) had decreased levels of TSH due to panhypopituitarism. Majority of patients had normal levels of TSH. This finding is consistent with study conducted in Department of Endocrinology, Sher-i-Kashmir Institute of Medical Sciences, Primary hypothyroidism -7.8%

Etiological distribution among the study population
Majority of patients about 56% (n=28) belongs to normal variants of short stature-like constitutional growth delay and familial short stature. Endocrine disorders like GH Deficiency was seen in 16% (n=8) and hypothyroidism in 12% (n=6). 12% (n= 6) patients presented with malnutrition. 2% of patients presented with diabetes mellitus. This finding is consistent with study conducted by Mehboob Sultan et al in Department of Paediatrics, Military Hospital, Rawalpindi and Combined Military Hospital, Multan during September 2004 to January 2007. Two hundred and fourteen children (140 boys and 74 girls), with age 02 to 15 years presenting withs hort stature were studied and majority of patients had CGD, FSS or combination of both, 46.7% and non-endocrinological causes constituted of about15.9% .

Comparison Of Pathological Causes With Age
In our study population of 13- 15 yrs   18 out of 38 had normal variants of growth and 20 had pathological cause for short stature and the p value is 0.947 which is not significant.The patients belonging to 16-18yrs of age 11 out of 12 had normal variants of growth and only 1 patient had pathological cause and the p value is 0.025 which is significant.

Comparison Of Pathological Causes And Normal Variants Of Growth:
The normal variants of growth like constitutional growth delay and familial short stature constituted of about 28 among 50 patients. The pathological causes were seen in 22 among 50 patients. The p value is 0.603 which is insignificant. This finding is consistent with study conducted by Mehboob Sultan et al in Department of Paediatrics, Military Hospital, Rawalpindi and Combined Military Hospital, Multan during September 2004 to January 2007. Two hundred and fourteen children (140 boys and 74 girls), with age 02 to 15 years presenting with short stature were studied and majority of patients had CGD, FSS or combination of both, 46.7% and non endocrinological causes constituited of about 15.9% .

Comparison Of Age Vs Etiology
In age group of 13-15 yrs of age group the p value is 0.047 between normal variants of growth and pathological causes which is non-significant . Between the age group of 16-18 yrs the p value is 0.025 between pathological and normal variants of growth which is significant.

Comparison Of Sex Vs Etiology In Our Study Population
The p value between normal variants and pathological causes in males in our study population is 0.823 and among females is 0.409   which is not significant. This study is consistent with study conducted by ShaukatMahmood Qureshi Department of Paediatrics, Military Hospital, Rawalpindi and Combined Military Hospital,Multan

Conclusion
- Short stature is more common in boys rather than girls.
- In our study short stature was more common in age group of 13-15 yrs.

- Majority of boys presented with height less than 5th percentile. Most of the girls in this study had height in the range of 145- 150 cm between 5th to 10th percentile
- In this study most of the boys with short stature were found to be in Prepubertal stage of Tanners Pubertal Staging. The girls in this study were found to be in prepubertal and pubertal stage of Tanners
- Bone age was found to be delayed in majority of patients in our study.
- In our study the most common cause for short stature was found to be the normal variants comprising of constituitional growth delay and familial short stature rather than endocrinological causes.
- The constitutional growth delay and familial short stature was more common in older children whereas both endocrinological and non-endocrinological causes were almost found equal in younger patients.

Limitations

1. Only a small number of population was taken into study.
2. In this study Growth hormone axis studies, karyotyping and genetic studies were not done.
3. IGF-1 levels, GHBP levels were not done to diagnose or follow up these patients.

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