Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

STUDY OF SHORT STATURE IN CHILDREN

[1]Dr. Kapil Shrimali, [2]Dr. Purvi Patel, [3]Dr. Chirag Shah, [4]Dr.Subhas Das

[1,4]Resident Doctor, [2]Assistant Professor, [3]Associate Professor
Department of Pediatrics, B. J. Medical College, Civil Hospital, Ahmedabad, India

Abstract: **Back ground & Objective: Study of short stature (SS) in children with special reference to etiology & management.**
Methods: Prospective analytic study done in indoor patients at a tertiary care center from Oct 2013 to Sept 2015. Anthropometry was used for screening of short stature.
Results: In present study, Total Incidence of short stature was 9.3% while proportionate SS was in 94.15% and disproportionate SS was in 5.85%. Etiology wise, Pathological (69%) is more common than Physiological (31%).In Physiological variety; Constitutional SS was seen in 68.2% while familial SS was in 31.8%.In Pathological variety- Haematological causes were maximum it accounts for 21.33%, majority were thalassemia patients (14.64%) followed by Respiratory involvement (10.87%), commonly in asthma patients(6.6%); Cardiovascular causes (10%), majority patients have VSD(5.0%); CNS involvement (9.6%); Genetic syndromes (8.7%),maximum in Downs syndrome(5.8%); Renal system(8.3%),maximum in nephrotic syndrome(6.2%); Endocrinological (6.2%),maximum in hypothyroidism(3.2%); GI &Metabolic disorders accounts for 2.9% each ,maximum among Diabetes Mellitus (1.6%); Orthopedic problems were seen in 2.5% patients. Bone age was normal (equal to chronological age) in 29.28% of patients, while it was abnormal (<chronological age) in 70.72% patients.
Interpretation & Conclusion
Patients of physiological SS, have low growth velocity but in their target range. Patients of pathological SS, early recognition of growth abnormality and early intervention in form of treatment & control of chronic disease, hormone therapy, adequate nutrition, replacement of deficient vitamins & minerals maintains adequate growth velocity.

Keywords: **Disproportionate, growth velocity, pathological, physiological, proportionate, Short stature.**

1. INTRODUCTION

Short stature is a common problem in children globally, especially in developing countries. 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. Statistically, this refers to children who are shorter than 97% of their age and gender matched peers. Although a small body size can simply be within the normal ranges, it may also indicate various possible medical conditions.

Causes of short stature are diverse. It may be genetic, metabolic, chronic systemic illness or simple environmental issues such as reduced food availability. Almost any chronic disease can cause short stature such as renal disease, malignancy, pulmonary disease, Cystic Fibrosis (CF), cardiac disease etc. Celiac disease is a prime example of a remediable cause of short stature, especially in younger children. Nutritional deprivation and therapies like glucocorticoids, chemotherapeutic drugs, radiotherapy can result in short stature. Common endocrinological causes of short stature include hypothyroidism, hypopituitarism (isolated GHD or multiple anterior pituitary hormone deficiencies), hypercortisolism and classical Laron syndrome. All these are characterized by being overweight-for-height. Short stature may also be seen with severe

Intrauterine Growth Retardation (IUGR) or children born Small for Gestational Age (SGA) and in large number of dysmorphic syndromes. Idiopathic Short Stature (ISS) is considered when no causative disorder can be identified. The aim of this study is to find out the etiological profile of short stature, its management and the effect of intervention on stature. Many causes are treatable and child can achieve normal height after treatment that's why we have done this study so that we can identify and treat the patients of short stature.

Materials & methods:

A pre-structured and pre -tested performa was used to evaluate various etiology, management and effect of intervention on short stature at our tertiary care center. patients admitted in pediatric ward were included in our study. Informed consent was obtained. The data was recorded and analyzed using appropriate statistical analysis.

2. SELECTION CRITERIA FOR SHORT STATURE IN CHILDREN

All children with age < 12 years if they presented with height < 3rd percentile for age on:

a. National Centre for Health Statistics-Centre for Disease Control (2 yr. to 12 yr.) growth curve

b. World Health Organisation (2 months to 12 yr.) curves is chosen as reference.

Study Design: Prospective analytic study

Study Period - October 2013 to September 2015

Setting – Patients having Short Stature admitted in pediatric wards in tertiary care center.

1. INCLUSION CRITERIA:

- All indoor patients with age 2months to 12 years.

2. EXCLUSION CRITERIA:

- OPD patients
- Patients with inadequate follow up.
- Neonates and infants < 2 months.

3. ANTHROPOMETRY

1. Height measurement is performed with child standing erect without shoes with heels together, arms resting at the side of the body , heels buttocks occiput touching the wall and head positioned in the Frankfurt plane(>2 Years) by Staediometer.

Figure: Height measurement by Staediometer.

Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

2. Length measurement is performed with the child lying supine (2 months – 2 years) by Infantometer.

Figure: Length measurement by Infantometer (mat type)[12]

3. Upper segment (sitting height) / lower segment is taken for all patients.
4. Weight performed on electronic machine.
5. Nutritional evaluation of patients < 5 years, weight / height < -2SD were considered as malnourished according to World Health Organization criteria.
6. For patients >5 years, BMI is calculated and those with BMI <5 pc were considered as malnourished according to Center for Disease Control criteria & graph.
7. Target height was calculated

Boys: Mother's height + Father's height /2 + 6.5

Girls: Mother's height + Father's height /2 - 6.5

4. INVESTIGATIONS

- Routine investigations(complete blood count,renal function test,liver function test,urine ,stool ,chest x-ray etc.) as required is done
- Special investigations (calcium,hormone level,vitamin D ,imaging,echo,metabolic screening etc.)as per etiology performed.

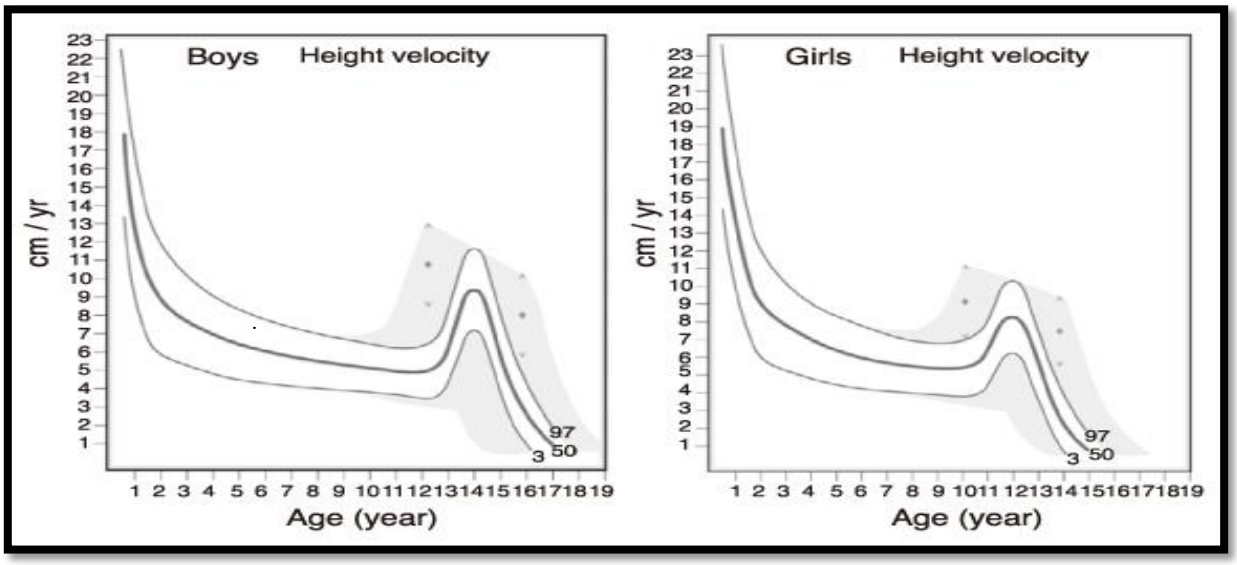


Figure: Height velocity chart for follow up

- X-Ray for Bone age according to Gruelich and Pyle bone age atlas.

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

- Hormonal study based on Growth hr.,thyroid hr.,FSH,LH,Testosterone using Immune-Radiomimetric assay ("sandwich-ELISA")
- Karyotype study was done at Genetic center as required.
- Follow up height every 6 months was plotted on the respective growth curves & growth velocity determined.
- Growth velocity <25th percentile was considered inadequate.
- Further treatment planned according to growth rate pattern and follow up done.

5. RESULTS

Table.1: Incidence of short stature in admitted patients

	Number
Total no. of admissions (oct.2013- sept.2015)	2570
Total no. of pts. of short stature	239
Incidence (%)	9.3%

Table .2: Age& Sex- Wise Distribution

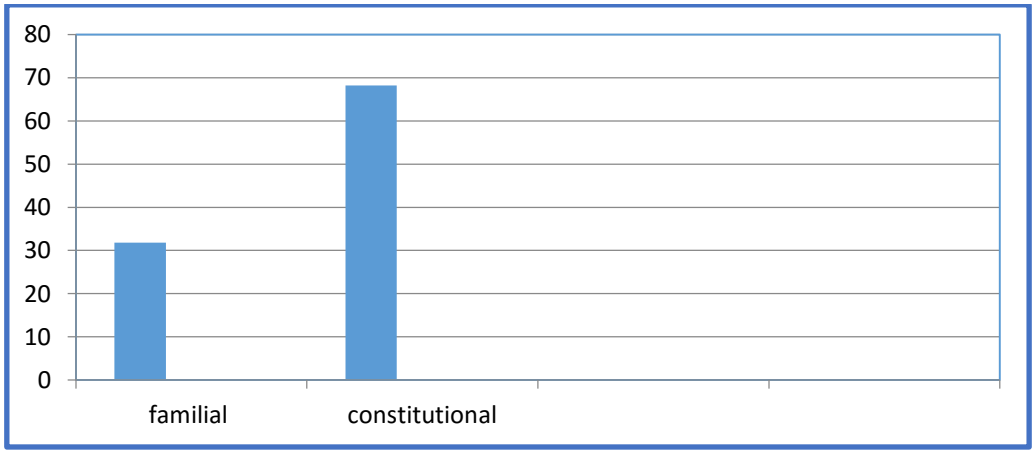
The male: female ratio is 1.15:1. Maximum incidence of short stature is seen in the age group of 1y-5y (54.39%).

Age	**Male**	**Female**	**No.**	**Percentage**
2M –1Y	9	6	15	6.28%
1Y – 5Y	68	62	130	54.39%
5Y-9Y	31	26	57	23.85%
9Y-12Y	20	20	37	15.48%
Total	128	111	239	-
Percentage	53.56%	46.44%	-	100%

Table 3: Etiological Profile

Etiology	**Number**	**Percentage**
Physiological	74	31%
Pathological	165	69%

Table 4: Physiological Short Stature



As per this study, the incidence of constitutional short stature (68.2%) is greater than familial (31.8%) among physiological short stature patients.

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

Table 5: Pathological Short Stature

Table 5 Systemic involvement-

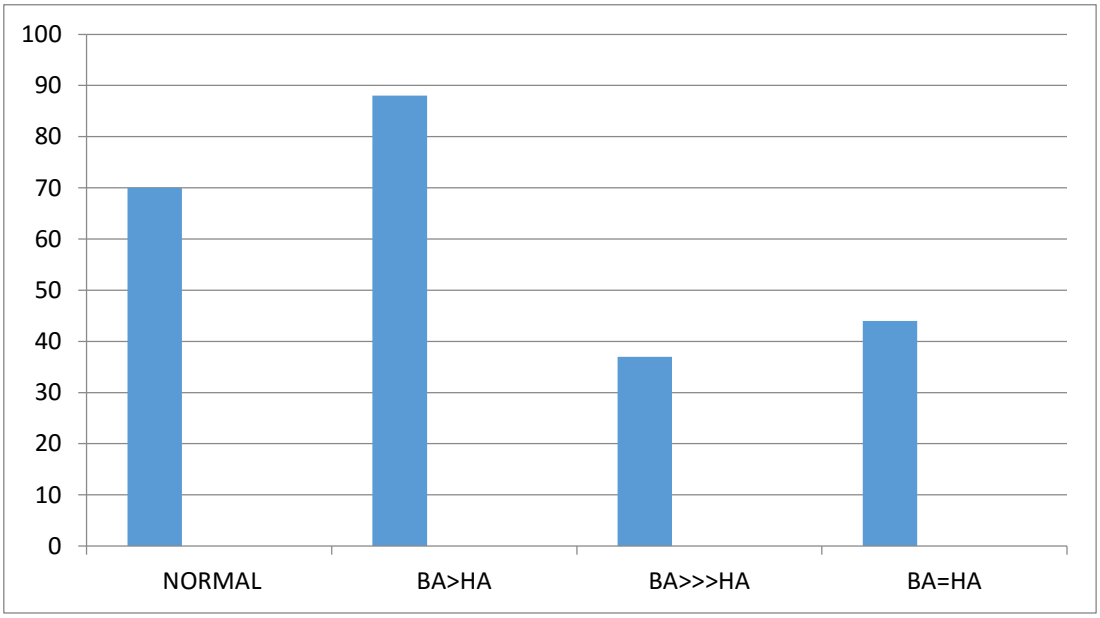
Body system		Number(N=239)	Percentage
a)respiratory	Asthma-16(6.6%) Tuberculosis-8(3.3%) Cystic fibrosis-2(0.8%)	26	10.8%
b)cvs	CHD- VSD-12(5.0%) ASD-3(1.2%) PDA-2(0.8%) TOF-3(1.2%) TAPVC-1(0.4%) TGA-2(0.8%) Complex CHD-1(0.4%)	24	10%
c)renal	Congenital anomaly-2(0.8%) Nephrotic syndrome-15(6.2%) Chronic kidney disease-3(1.2%)	20	8.3%
d)hematological	Leukemia-2(0.8%) Thalassemia35(14.64%) Fanconi's anemia-1(0.4%) Sickle cell anemia-2(0.8%) Hemolytic anemia-1(0.4%) Nutritional anemia-9(3.6%)	51	21.33%
e)genetic	Downs-14(5.8%) Turner-1(0.4%) Crouzons(0.4%) Others(unidentified)-5(2.0%)	21	8.7%
f)endocrine	GH deficiency-3(1.2%) Hypothyroidism-8(3.2%) Hypopituitarism-1(0.4%) Cushings syndrome-1(0.4%) CAH-2(0.8%)	15	6.2%
g)GI	Chronic diarrhea-3(1.2%) Celiac ds-4(1.6%)	7	2.9%
h)orthopedics	Kypho-scoliosis-3(1.2%) Kochs spine-2(0.8%) Osteopetrosis-1(0.4%)	6	2.5%
i)metabolic	DM-4(1.6%) Rickets-2(0.8%) MPS-1(0.4%)	7	2.9%
k)CNS	Cerebral palsy-9(3.4%) TbME-14(5.2%)	23	9.6%

Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

Graph 2.Bone age analysis



1. In this study bone age was found to be normal according to age among 70(29.28%) of patients.

2. In the abnormal bone age category,

A. Bone age is slightly greater than height age has highest reported incidence of 88(36.82%) that includes patients of chronic systemic illness & malnutrition.

B. In the bone age is markedly greater than height age category the incidence is 37(15.48%) that includes patients of endocrinology, genetic syndromes & hematological disorders.

C. The incidence of bone age is equal to height age in 44(18.42%) with patients of constitutional short stature & some chronic systemic illness.

Table 6. Family History

Significant:	**87(36.4%)**
Late Puberty of parents	15
Short stature of siblings	25
Short stature of parents	47
Insignificant:	**152(63.6%)**

As per this study, family history was significant among 87(36.4%) of patients which included pts. of Familial and Constitutional short stature.

Family history among other patients was not significant.

Table7. Antenatal And Birth History

Pre-Term	**05(23.80%)**
IUGR	**02(9.521%)**
Birth Events	**02(9.521%)**
Maternal Nutrition	**11(52.38%)**
Maternal Infection	**00**
Maternal Drug use	**01(4.76%)**
Total	**21**

As per this study, significance of ante natal history is about 21(8.78%).

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

Table 8.Development History

Normal	**195(81.6%)**
Delayed	44 (18.4%)
Total	239

As per this study delayed development is found among 44(18.4%) of patients that includes patients of hypothyroidism, genetic syndrome and some chronic systemic illness eg. cerebral palsy.

Table 9.Mid Parental Height (MPH)

Within target range	**61 (25.52%)**
Below target range	**178(74.48%)**

Mid parental height was found to be within the target range in 61(25.52%) patients of familial SS & malnutrition.
It is found below target range in 178(74.48%) pts. That includes pts. of constitutional , endocrinological, chronic systemic illness etc..

Table 10.Short Stature Type

Proportionate	**225(94.15%)**
Disproportionate	**14(5.85%)**

As per this study, incidence of disproportionate short stature is 14(5.85%) that includes patients of ortho., hypothyroidism, Mucopolysaccharidosis.

Table 11.Follow - Up Study

Pt . Came for f'up	**217(90.79%)**
Lost to f'up	**22(9.21%)**

Table 12.Growth Rate Patterns

System	**No.(%)**	$<25^{th}$ pc	$>25^{th}$ pc
a)respiratory	26	7	19
b)CVS	24	9	15
c)Renal	20	6	14
d)Hematological	51	19	32
e)Genetic	21	17	4
f)Endocrine	15	8	7
g)GI	7	2	5
h)orthopaedics	6	2	4
i)metabolic	7	4	3
j)CNS	23	10	13

As per this study, inadequate growth velocity was maximally affected in genetic diseases, 17 among 21 patients growth velocity found to be below 25 th percentile. Respiratory illness found to be minimally affecting growth velocity 7 among 26 patients.

Physiological Short Stature Growth Velocity Pattern

Among patients of familial and constitutional short stature 8 (10.8%) patients were lost to follow up out of 74.

All the patients had GV below the 25^{th} percentile.

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (115-124), Month: May - August 2016, Available at: www.noveltyjournals.com

6. DISCUSSION

In the present study the incidence of short stature among total hospital admissions was 9.3%. In the study by Colaco et al[1], the incidence of short stature among total hospital admissions was 5.6%. In the present study, male:female ratio was 1.15:1 while in the study by Haldar D[2,3], male:female ratio was 0.80. In the present study, incidence of short stature was maximum in 1-5 years which is 54.39%, in the study by mohammad[4], incidence of short stature was maximum in 1-5 years which is 43.5%.

In the present study, the percentage of pathological short stature (69%) was greater than physiological(31%)while in the study by Garg[5], the percentage of pathological short stature(75%) was greater than physiological.

In the present study, the incidence of short stature due to endocrinological cause was 6.2%, GH (1.2), Hypothyroidism (3.2), CAH (0.8), DM (1.6). In the study by Muhammad[4], the incidence of short stature due to endocrinological cause was 14%, GH (6.1), Hypothyroidism (5.6), CAH (1.4), DM (0.9).

The incidence of short stature in the present study with patients of malnutrition was 16.5% and in the study done by Muhammad[4] was 9.8%.The difference can be attributed to higher rate of admission of patients of low socio economic level with greater occurrence of malnutrition among them in our tertiary care centre.

The incidence of chronic anemia in the present study was 14.64% as this tertiary care centre holds thalassemia clinics which explains the difference with the study by Muhammad where incidence was 1.9%.

1. In this study, inadequate growth velocity was found among asthma patients with poor control which is similar to study done by Mc Cowan 1998 which showed decreased growth velocity in patients with high dose steroids and requiring frequent hospital visits.

Among cystic fibrosis patients both had inadequate GV owing to recurrent infections which is consistent with the study done by Assam BM 2009.

2. Among patients. of acyanotic CHDs control of heart failure & proper nutrition have adequate GV while pts. of cyanotic CHDs have invariably poor GV except after TGA surgical correction. In the study done by Soliman AT[6] size of L-R shunt, hemodynamics, hypermetabolic state are all factors determining growth velocity with normal growth velocity by control of heart failure.

3. Among patients of nephrotic syndrome, adequate growth velocity could be seen in patients of steroid responsive nephrotic syndrome. Inadequate GV was seen in 2 patients of steroid resistant & steroid dependent nephrotic syndrome & frequent relapsers. Patients of chronic kidney disease show poor growth or have inadequate GV. This is consistent with the study by Tsau et al.

4. Among thalassemia patients, well transfused & well chelated patients have adequate GV. No endocrine abnormality had been found in any thal.pt. Study by Hamida A emphasises the importance of adequate blood transfusion and chelation therapy.

5. 2 patients of downs syndrome were found to attain adequate GV after thyroxine supplementation and correction of heart defects. This is consistent with the study by C.E.Cronk[7].

6. Adequate GV was attained in pts. after GH therapy. The study by Thorner MO showed similar results. Early institution of thyroxine therapy showed adequate GV in congenital hypothyroidism, which is consistent with the study by D B Grant[8]. Adequate GV was found in 3 patients of DM with proper glycemic control. This is similar to study by Pitukcheewant P.

7. CONCLUSION

Total cases of short stature- 239

- The incidence of short stature in the present study is 9.3%.
- Maximum incidence of short stature is found to be among the age group of 1-5 years which is 54.39%.

- Male: Female ratio is 1.15:1.
- In etiological profile of short stature Pathological (69%) is more common than Physiological (31%).
- In Physiological short stature category, among admitted patients-
- Constitutional (68.2%) is more common than familial (31.8%).
- In Pathological short stature category, incidences among admitted patients are as follows-
- Malnutrition is confounding variable occurring in patients of other causes of short stature too.
- Respiratory system (10.87%), with maximum incidence among asthma patients (6.6%).
- Cardiovascular system (10.0%), maximum in VSD (5.0%).
- Renal system (8.3%), maximum in nephrotic syndrome (6.2%).
- Endocrinological (6.2%), maximum in hypothyroidism (3.2%).
- Haematological (21.33%), maximum among thalassemia patients (14.64%).
- Metabolic disorders (2.9%), maximum among Diabetes mellitus type-1(1.6%)
- Genetic syndromes (8.7%), maximum in downs syndrome (5.8%).
- Bone age was normal (equal to chronological age) in 29.28% of patients, while it was abnormal (<chronological age) in 70.72% patients.
- Incidence of proportionate short stature in this study is 94.15% and disproportionate is 5.85%.
- Patients of physiological short stature, have low growth velocity but in their target range.
- Patients of pathological short stature category, Early recognition of growth abnormality and early intervention maintains adequate growth velocity.
- Maintenance of adequate nutrition.
- Replacement of deficient vitamins & minerals.
- Treatment & control of chronic disease.
- Early recognition & institution of hormone therapy.
- Early surgical intervention for CHDs & control of heart failure.

8. ABBREVIATIONS

- ASD – Atrial Septal Defect.
- BMI – Body Mass Index.
- BA-Bone Age
- CA – Chronological Age.
- CAH – Congenital Adrenal Hyperplasia.
- CDC – Centre for Disease Control and Prevention.
- CHD – Congenital Heart Disease.
- GH – Growth Hormone.
- GV – Growth Velocity.

- H/A – Height for Age.
- ICP – Infancy-Childhood-Puberty.
- IGF – Insulin like Growth Factor.
- IGF-BP – Insulin like Growth Factor-Binding Protein.
- IUGR – Intra Uterine Growth Retardation.
- MELAS – Mitochondrial Encephalopathies, Lactic Acidosis & Stroke like syndromes.
- NCHS – National Centre for Health Statistics.
- PDA – Patent Ductus Arteriosus.
- SD – Standard Deviation.
- TAPVC – Total Anomalous Pulmonary Venous Connection.
- TGA – Transposition of Great Arteries.
- TOF – Tetralogy of Fallot.
- US/LS – Upper segment/Lower segment ratio.
- UTI – Urinary Tract Infection.
- VSD – Ventricular Septal Defect.
- W/A – Weight for Age.
- W/H – Weight for Height.
- WHO – World Health Organisation.

REFERENCES

[1] Colaco P, Desai M, Choksi CS. Short stature in Indian children: the extent of the problem. Indian J Pediatr. 1991;58 Suppl 1:57-8.

[2] Kamboj M. Short stature and growth hormone. Indian J Pediatr. 2005; 72:149-57.

[3] Ulph F, Betts P, Mulligan J, Stratford RJ. Personality functioning: the influence of stature. Arch Dis Child. 2004;89:17-21.

[4] Original article, Etiology of Short Stature in Children,Mehboob Sultan, Muhammad Afzal, Shaukat Mahmood Qureshi, Shahid Aziz, Muhammad Lutfullah,2008

[5] Garg P. Short stature in Indian children: experience from a community level hospital. Sri Lanka J Child Health. 2004;34:84-8.

[6] Growth parameters and endocrine function in relation to echocardiographic parameters in children with ventricular septal defect without heart failure.Soliman AT, Madkour A, Galil MA, El Zalabany M, Aziz SM, Ansari BM.Department of Child Health, University of Alexandria, Egypt. atsoliman@yahoo.com

[7] Growth of Children With Down's Syndrome: Birth to Age 3 Years,C. E. Cronk Pediatrics Vol. 61 No. 4 April 1, 1978
pp. 564 -568 .Pediatrics,pediatrics.aappublications.org

[8] Arch Dis Child. 1994 June; 70(6): 464–468.D B Grant.