Clinical & Physiological Pattern among children with Obstructive Sleep Apnea Syndrome in Parami General Hospital

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Aim and Objectives of the Study

- To explore clinical symptoms and signs in children with OSAS of Myanmar
- To find out physiological parameters during the diagnostic method.
- To raise awareness of parents and clinicians for common symptoms and signs of OSAS in children for timely referral.
- To encourage new study on Pediatric OSAS in Myanmar.

Introduction

Introduction

Definition of OSA in children (American Association of Pediatrics 2014)

"Disorder of breathing during sleep characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction that disrupts normal ventilation during sleep and normal sleep pattern accompanied by symptoms and signs".

+ **Prevalence**	1.2%-5.7% (in western country) unknown in Myanmar
+ **Morbidity**	behavioral problems, learning difficulties, growth retardation, Pulmonary Hypertension and Congestive Cardiac Failure
+ **Coexisting Risk**	Feeding difficulties, recurrent otitis media, nasal or laryngeal obstruction, syndromes, Neuromascular disorders

ICSD3 diagnostic criteria of OSA in children

- **Criteria A and B must be met.**

ICSD3 diagnostic criteria of OSA in children

- Criteria A-The presence of 1 or > of the followings -

  1-Snoring

  2-Laboured, paradoxical, or

  obstructed breathing during sleep

  3- sleepiness, hyperactivity, behavioral problems, or learning problems.

ICSD3 diagnostic criteria of OSA in children

- Criteria B-PSG findings (1 or both)

1. One or more obstructive apneas, mixed apnea or hypopneas per hour of sleep.

OR

2- A pattern of obstructive hypoventilation ,

defined as at least 25% of total sleep time

with $PaCO_2 > 50$ mmHg.

In association with 1 or > of the followings

- a-Snoring
- b- flattening of inspiratory nasal wave form
- c- Paradoxical thoracoabdominal motion.

ICSD3 diagnostic criteria of primary snoring in children

- *Snoring but AHI<1 → Primary snoring

(ICSD diagnostic manual 3rd edition 2014)

Introduction

Polysomnogram(PSG)

+ Sleep test device - AASM compliance type 2 device
(Embla X- 100, UK made)

+ Softwere -Ramlogic auto scoring softwere

+ Protocol -Sleep PLM protocol with 92.8% sensitivity and 42.8% specificity

Introduction

Polysomnogram (PSG)

+ Sensor for

EEG,EOG,EMG, inductive movement of chest and

abdomen , SPO2, tidal volume , NREM and REM sleep stages and position.

+ Reproduce following data

AHI, O2 desaturation index, sleep stages , sleep

efficiency %, EEG arousal pattern, Epileptic discharges (epilepsy) limb movement pattern , Heart Rate and respiratory effort ect---

Introduction

Diagnosis and Severity Accessment of OSAS

*Diagnosis is done by AHI = Apnea-Hypopnea Index (diagnosis= AHI = or > 1) by Polysomnogram

* Severity criteria 0-5= Normal,
5-15= Mild,
15-30= Moderate,
>30=Severe

* Diagnosis method Polysonography (PSG)

Management according to European Respiratory Society Statement for 1month to 23 months and 2 to 18 years (2017 Dec)

TABLE 2 Similarities and differences in the diagnosis and management of obstructive sleep disordered breathing (SDB) in younger and older children (1–23 months *versus* 2–18 years)

	Younger children (1– 23 months)	Older children (2–18 years)
Diagnosis		
Symptoms reflecting upper airway obstruction are frequently present both during wakefulness and sleep	Yes	No
Adenotonsillar hypertrophy and obesity predominantly cause SDB	No	Yes
Various congenital, syndromic and/or genetic entities predominantly cause SDB	Yes	No
Feeding difficulties and growth failure may coexist with OSAS	Yes	No
Pulmonary hypertension may complicate OSAS, especially in patients with complex conditions	Yes	Yes
Polysomnography is the gold standard for diagnosis of OSAS	Yes	Yes
Endoscopy is especially useful to determine the level of upper airway collapse	Yes	No
Management		
Adenotonsillectomy is the most commonly used treatment	No	Yes
NPPV is frequently used as first-line treatment due to a high incidence of multilevel, dynamic airway collapse	Yes	No
Orthodontic appliances are effective in cases of OSAS with retrognathia or malocclusion	No	Yes
Patients with complex conditions are prioritised for treatment	Yes	Yes
Follow-up after each treatment intervention may identify persistent OSAS	Yes	Yes
Patients on NPPV undergo nocturnal cardiorespiratory monitoring annually	Yes	Yes

OSAS: obstructive sleep apnoea syndrome; NPPV: non-invasive positive pressure ventilation.

Material and Method

- Subsequent PSG testing (overnight sleep test) to each patient.

- OSAS diagnosis by using criteria from American Academy of Sleep Medicine (AASM) 3rd edt diagnostic manual 2014. (Mentioned in Introduction)

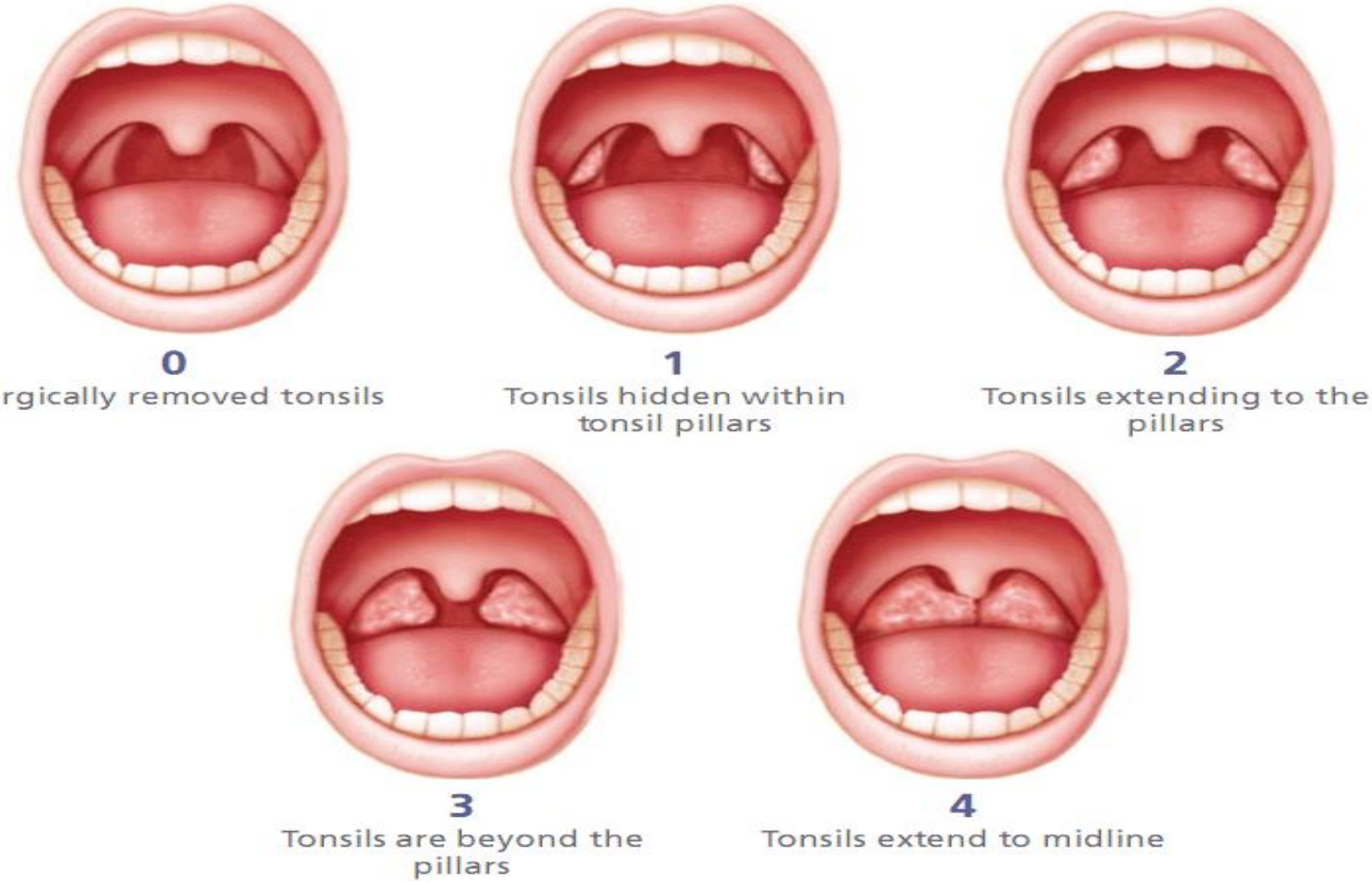
- Data analysis by SPSS (ver.13)

Material and Method

- Number of patients - 86 children (< 18yr) with suspected OSAS.
- Type of study -Cross sectional hospital based descriptive study
- Inclusion Criteria - All referred Patients
- Study period - 2013 Jan to 2017 Sept.

Material and Method

- Recording of clinical and demographic data including graphical tonsil size grading (G0 to G4)



How we Do Sleep Study (Polysomnography)

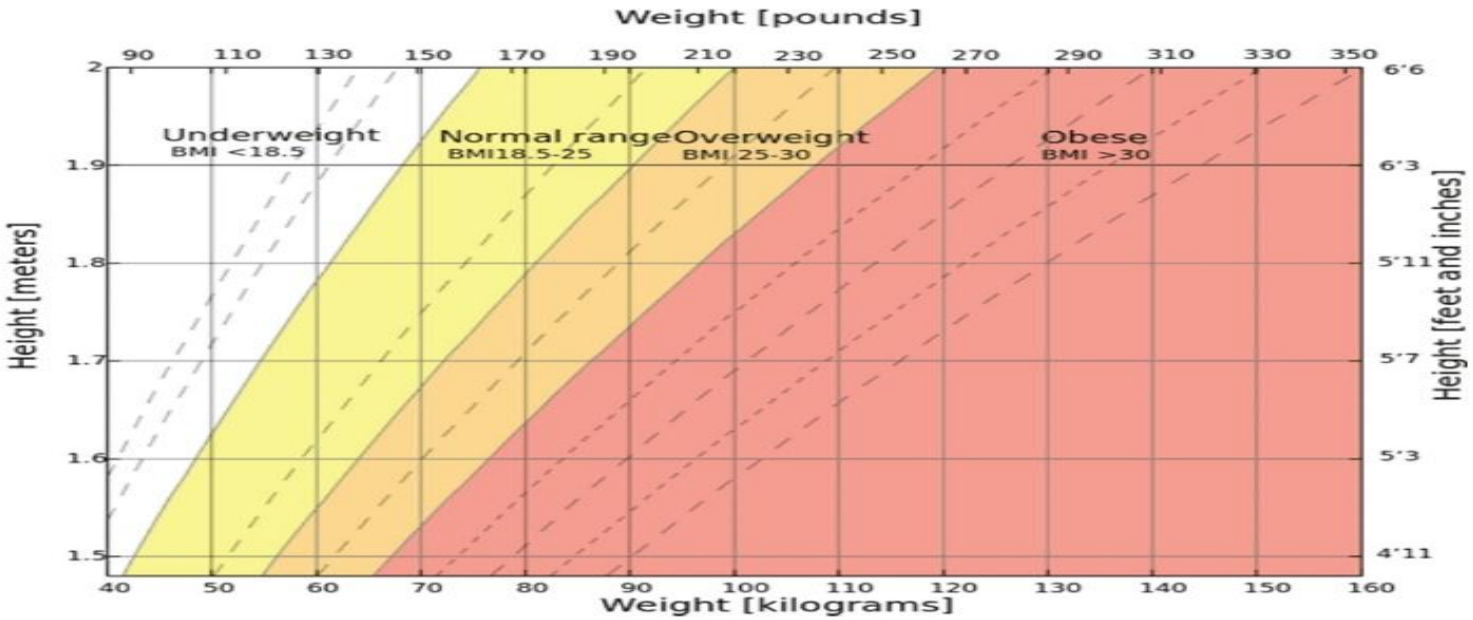
BMI measurement

- BMI = weight/height square (kilogram/metre square) kg/m2
- BMI over 91st centile =overweight
- BMI over 98th centile =obese
- BMI over 99th centile =severely obese

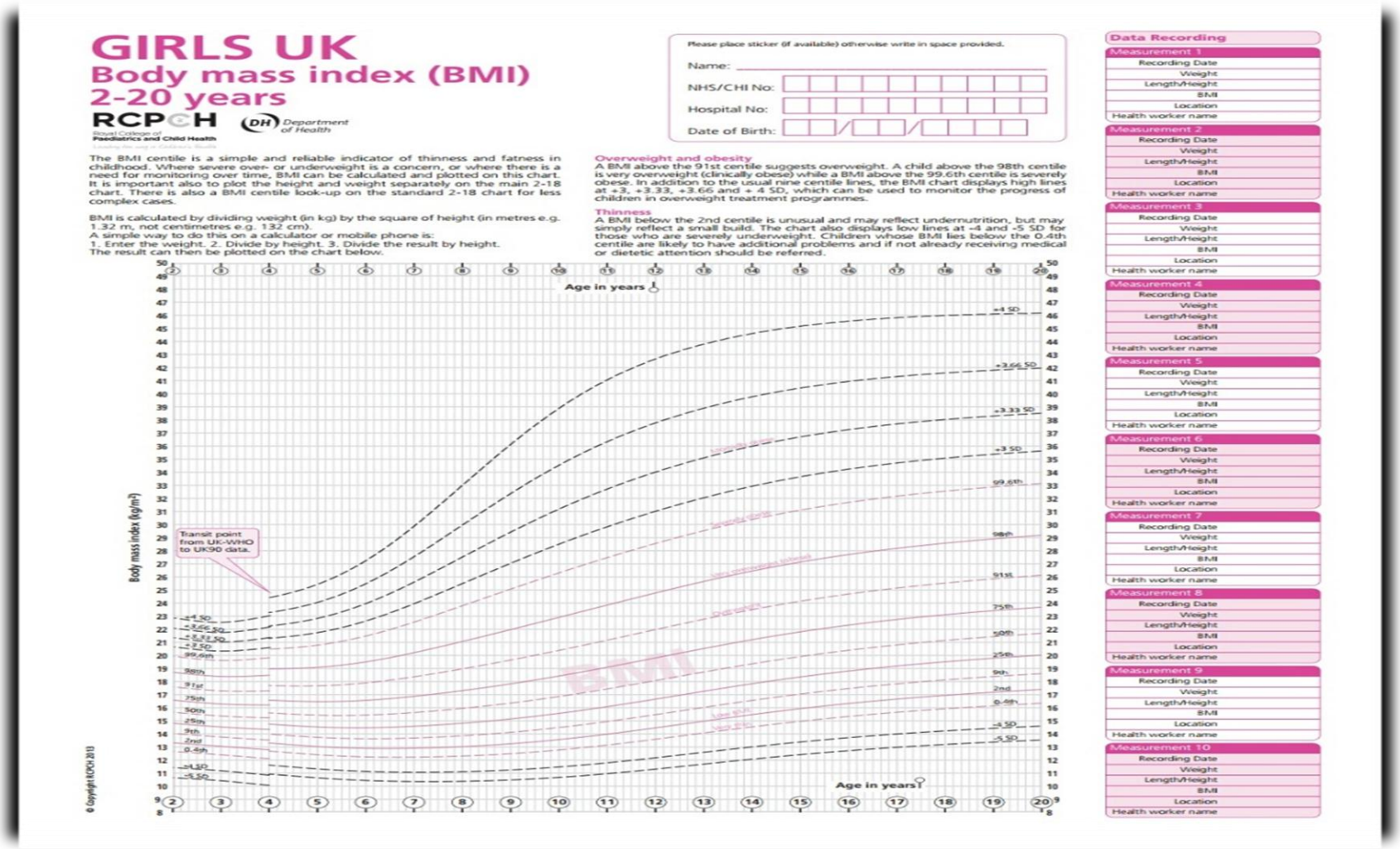
BMI Weight Ranges

BMI weight ranges

Less than 18.5 = Underweight
Between 18.5 - 24.9 = Healthy Weight
Between 25 - 29.9 = Overweight
Over 30 = Obese



BMI Centile(GIRL,RCPCH 2-20years)



GIRLS UK
Body mass index (BMI) 2-20 years

RCPCH Royal College of Paediatrics and Child Health

DH Department of Health

Please place sticker (if available) otherwise write in space provided.

Name: _____

NHS/CHI No:

Hospital No:

Date of Birth: / /

The BMI centile is a simple and reliable indicator of thinness and fatness in childhood. Where severe over- or underweight is a concern, or where there is a need for monitoring over time, BMI can be calculated and plotted on this chart. It is important also to plot the height and weight separately on the main 2-18 chart. There is also a BMI centile look-up on the standard 2-18 chart for less complex cases.

BMI is calculated by dividing weight (in kg) by the square of height (in metres e.g. 1.32 m, not centimetres e.g. 132 cm).
A simple way to do this on a calculator or mobile phone is:
1. Enter the weight. 2. Divide by height. 3. Divide the result by height.
The result can then be plotted on the chart below.

Overweight and obesity
A BMI above the 91st centile suggests overweight. A child above the 98th centile is very overweight (clinically obese) while a BMI above the 99.6th centile is severely obese. In addition to the usual nine centile lines, the BMI chart displays high lines at +3, +3.33, +3.66 and + 4 SD, which can be used to monitor the progress of children in overweight treatment programmes.

Thinness
A BMI below the 2nd centile is unusual and may reflect undernutrition, but may simply reflect a small build. The chart also displays low lines at -4 and -5 SD for those who are severely underweight. Children whose BMI lies below the 0.4th centile are likely to have additional problems and if not already receiving medical or dietetic attention should be referred.

Age in years

Body mass index (kg/m²)

Transit point from UK-WHO to UK90 data.

+4 SD
+3.66 SD
+3.33 SD
+3 SD
99.6th
98th
91st
75th
50th
25th
9th
2nd
0.4th
-4 SD
-5 SD

BMI

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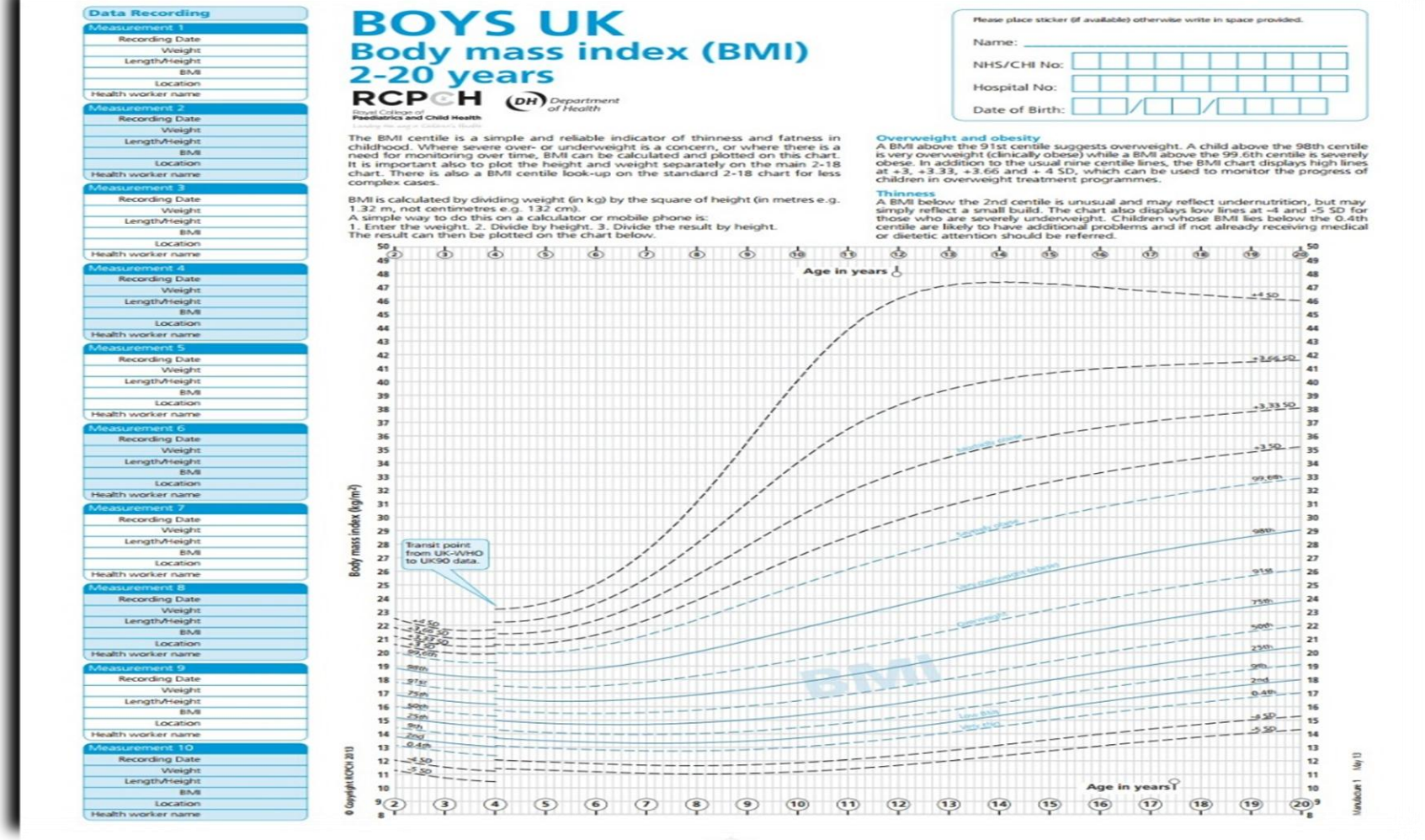
Data Recording

Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5	Measurement 6	Measurement 7	Measurement 8	Measurement 9	Measurement 10
Recording Date	Recording Date	Recording Date	Recording Date	Recording Date	Recording Date	Recording Date	Recording Date	Recording Date	Recording Date
Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight
Length/Height	Length/Height	Length/Height	Length/Height	Length/Height	Length/Height	Length/Height	Length/Height	Length/Height	Length/Height
BMI	BMI	BMI	BMI	BMI	BMI	BMI	BMI	BMI	BMI
Location	Location	Location	Location	Location	Location	Location	Location	Location	Location
Health worker name	Health worker name	Health worker name	Health worker name	Health worker name	Health worker name	Health worker name	Health worker name	Health worker name	Health worker name

BMI Centile (BOY,RCPCH, 2-20years)



Data Recording

Measurement 1
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 2
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 3
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 4
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 5
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 6
Recording Date
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Measurement 7
Recording Date
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Location
Health worker name

Measurement 8
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 9
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

Measurement 10
Recording Date
Weight
Length/Height
BMI
Location
Health worker name

BOYS UK
Body mass index (BMI)
2-20 years

RCPCH
Royal College of Paediatrics and Child Health

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Name:

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Age in years

Body mass index (kg/m²)

Transit point from UK-WHO to UK90 data.

+4 SD
+3.66 SD
+3.33 SD
+3 SD
99.6th
98th
91st
75th
50th
25th
9th
2nd
0.4th
-4 SD
-5 SD

Healthy weight
Overweight
Very overweight or obese

BMI

Age in years

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Version 1 May 13

Results

Baseline Characteristics of Suspected Obstructive Sleep Apnoea Children

No.	DATA	Figure	SD
1	Total No	86 (52M,60.5%)+ (34F,39.5%)	
2	Mean Age	7.17	+ - 3.657
3	Mean BMI	20.92	+ - 8.35
4	Snoring	81(96.4%)	
5	Tonsil Enlargement (G1to G4)*	58 (67.4%)	
6	OSAS children (AHI1 or >)*	62(73.8%)	
7	Apnea	58(68.2%)	
8	Bed Wetting	28(32.6%)	
9	Restless Breathing	26(30.2%)	

Baseline Characteristics of Suspected Obstructive Sleep Apnoea Children

No.	DATA	Figure	SD
10	Insomnia	9 (10.5%)	
11	Morning Headache	8 (9.4%)	
12	Abnormal Day Time Sleepiness	16 (18.8%)	
13	Learning difficulties	9 (11.0%)	

Results of all Referred Suspected OSA children

- Among 86 children, Mean age is 7.17+ or- 3.65 and Mean BMI was 20.92.

- **Snoring** **(n=81) 96.4% of all cases, highest.**

- Tonsilar enlargement (n=57) 67.4%,
- Apnoic attack (n=58) 68.2%
- Children with AHI >/ 1 (n=62) 73.8% respectively.

Results of all Referred Suspected OSA children

Least Commonest presentations

- **Insominia** **9 (10.5%)**
- **Morning Headache** **8 (9.4%)**
- **Abnormal Day Time Sleepiness** **16 (18.8%)**
- **Learning difficulty** **9 (11.0%)**

- Bed Wetting (n=28)32.6%
- Restless Breathing (n= 26)30.2% , both are **the second lowest group.**

Children with Snoring (Proportion of OSA vs. PSG normal)

Table 6 Proportion of OSA and normal among children who have snoring

AHI classification	Number of patients (n, %)
OSA (AHI≥1)	61 (75.3%)
Normal (AHI <1)	18 (22.2%)
Unknown	2 (2.5%)
Total	81

*In majority of children with snoring, OSA was common. (In Jalilolghadr S el,al 2015)

*Snoring but AHI<1 → Primary snoring (ICSD diagnostic manual 3rd edition 2014)

Children with Snoring (Proportion of OSA vs. PSG normal)

- Out of all children presenting with Snoring 81 (96.4%),
- N=61 (75.3%) was found out that AHI = or > 1, diagnosed as OSAS.
- N=18 (22.2%) was noted as AHI< 1 in PSG. (normal finding in Polysomnogram). { Primary snoring, ICSD 3rd Ed, 2014)

Children diagnosed as OSAS

Prevalence of clinical features and Physiological findings by PSG

Table 5 Prevalence of clinical features and characteristics of polysomnographic findings among OSA patients

Variables	Results
Clinical features	
Snoring (N = 62)	61 (98.4%)
Apnea (N = 61)	46 (75.4%)
Bed wetting (N = 62)	24 (38.7%)
Restless breathing (N = 62)	19 (30.6%)
Abnormal day time sleepiness (N = 61)	13 (21.3%)
Morning headache (N = 62)	6 (9.7%)
Learning difficulty (N = 59)	5 (8.5%)
Insomnia (N = 62)	5 (8.1%)
PSG parameters	
O_2 desaturation (%) (N = 62)	13.18 ± 16.612
Snore time (minutes) (N = 62)	5.2 ± 9.310
Sleep efficiency (%) (N = 61)	84.89 ± 16.713
Mean O_2 saturation (%) (N = 62)	95.81 ± 4.062
Lowest O_2 saturation (%) (N = 62)	79.94 ± 11.443
Limb movement index (N = 61)	9.51 ± 7.636

Above Signs and Symptoms are common.

In Marcus CL et.al, 2002.Diagnosis and Management of Childhood OSAS,2002.

Results of Children diagnosed as OSAS (Table5)

Prevalence of Clinical features and Physiological findings by PSG

- **Clinical presentation of OSA Group patients**

- The **most common** presentation was **SNORING n= 61(98.4%)**.

- **Apnoea n= 46 (75.4%)** was responsible for the **second commonest** finding.

Results of Children diagnosed as OSAS (Table5)
Prevalence of Clinical features and Physiological findings by PSG

- **Clinical presentation of OSA Group patients**

- **Bedwetting n=24 (38.7%)** which is nearly Double of **Abnormal Daytime Sleepiness n=13(21.3%)** and **Restless Breathing n= 19 (30.6%).**

- **Morning Headache, Learning Difficulties and Insomnia** are co-mobidities found in Childhood OSAS , **6(9.7%), 5 (8.5%), 5 (8.1%)** respectively.

Results of Children diagnosed as OSAS (Table5)

Prevalence of Clinical features and Physiological findings by PSG

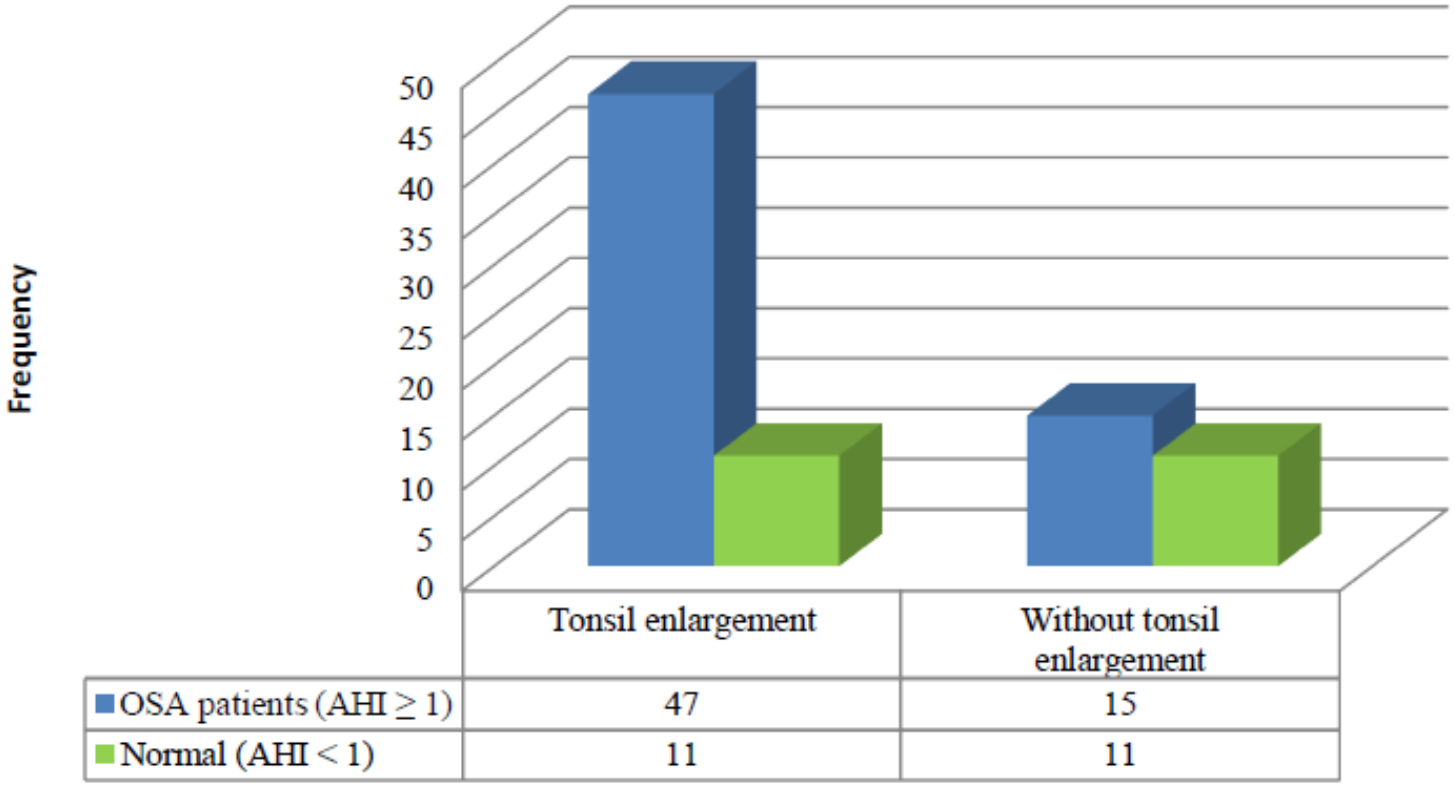
- **PSG parameters of children diagnosed as OSAS**

Parameter	Finding (Mean Value)	Normal value
O2 Desaturation attack	13.18+ /- 16.612	3 or less
Snore time in minutes	5.2 +/- 9.310	
Sleep Efficiency	84.89 +/- 16.713	99.9%
Mean O2 saturation	95.81 +/- 4.062	More than 95%
Lowest O2 Saturation	79.94 +/- 11.443	More than 92%
Limb Movement Index	9.51+/- 7.636	Less than 1

**Sleep efficiency % =total duration of sleep / total recording period

Results- Tonsil Enlargement and AHI

Frequency of AHI abnormalities in patients with Tonsilar Enlargement. Fig 1.



	Tonsil enlargement	Without tonsil enlargement
OSA patients (AHI ≥ 1)	47	15
Normal (AHI < 1)	11	11

Figure 1 Frequency of tonsil enlargement in OSA patients and normal

Frequency of Tonsilar Enlargement in patients with OSA and No (AHI<1)
Fig1 result

	Tonsilar Enlargement (n=58)	No Tonsilar Enlargement (n=26)
OSAS (AHI >/1 }	47 (81%)	15 (57%) D/to other causes
Normal / Primary Snoring {AHI<1}	11(9%)	11 (43%) D/to other causes

- **Prevelence of OSA is higher in Children with Enlarged Tonsils.
- Significant difference between two groups (Chi square=5.060,df=1, p=0.024)

Distribution of patients according to tonsil grades among children with tonsil enlargement (n=58) . Fig2

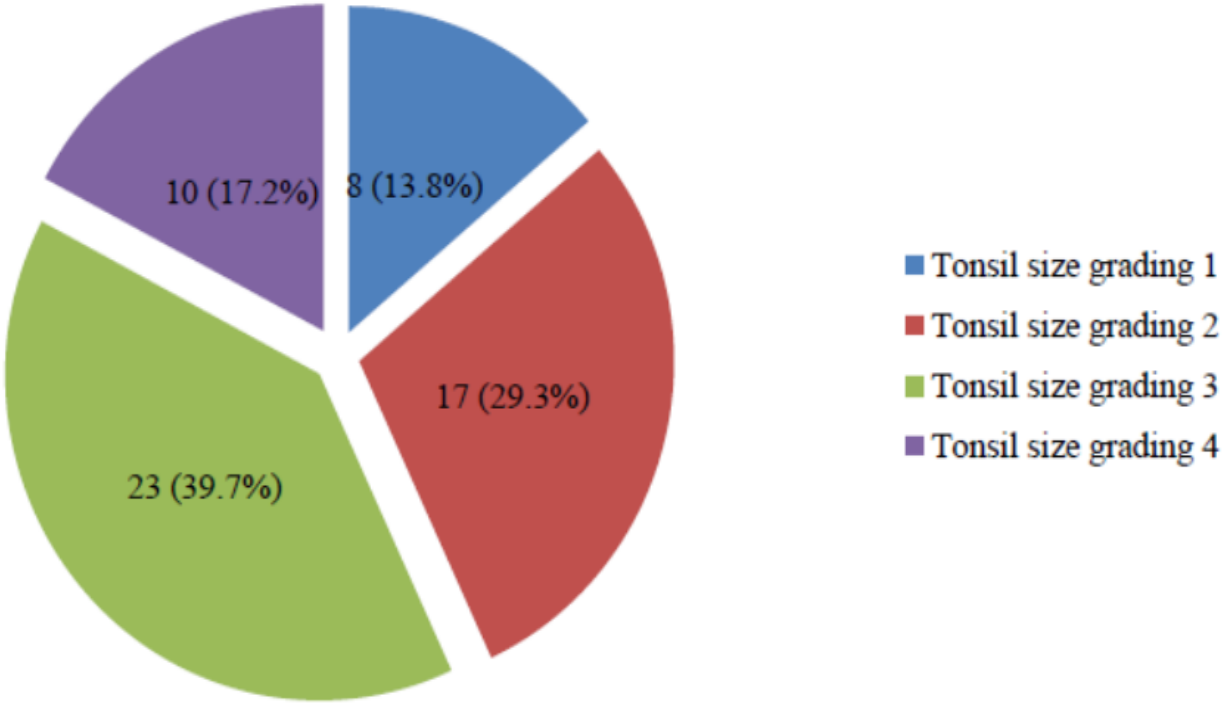


Figure 2 Distribution of patients according to tonsil grades among children with tonsil enlargement

Results

Table2- Characteristics of PSG parameters in tonsil enlarged patients (n=58)

N0	PSG parameters	range	Mean+/-SD
1	AHI (N=58)	0-50	8.53+/-11.55
2	Sleep efficiency(%) (N=57)	8.80-99.90	83.96+/-18.80
3	Mean O2 saturation% (N=58)	77.50-99.10	96.47+/- 3.413
4	Lowest o2 saturation % (N=58)	50.00-95.00	83.02+/-10.40
5	O2 desaturation% (N=58)	0-53.40	9.61+/- 14.09
6	Limb Movement Index (N=58)	0-45.60	8.93+/-7.273

Result: Tonsilar Size Grading and Mean AHI of Different Tonsil Groups. Table 3

Table 3 Percentage of OSA and mean AHI in different tonsil size groups

Tonsil size	OSA patients (AHI ≥ 1)/Total number of patients (%)	Mean AHI (± SD)
Grade 1	6/8 (75%)	2.89 ± 4.09
Grade 2	15/17 (88.2%)	10.11 ± 14.39
Grade 3	17/23 (73.9%)	7.44 ± 9.86
Grade 4	9/10 (90%)	12.86 ± 13.04

Result: Tonsilar Size Grading and Mean AHI of Different Tonsil Groups. Table 3

Finding1. Table 3

No significant trend in prevalence of OSA with different tonsil grades. (p=0.586)

- One way analysis of variance.
- F=1.297, df=3, p=0.0285
- Finding2. Table3
- No significant difference in mean AHI in relationship with Tonsil Size Grading.

-Results
PSG Parameters in Different Tonsilar Size Grading

Table 4 PSG parameters in various tonsil grades groups

PSG parameters	Tonsil size				p Value
	Grade 1 Mean ± SD	Grade 2 Mean ± SD	Grade 3 Mean ± SD	Grade 4 Mean ± SD	
O_2 Desaturation (%)	3.09± 5.07	11.34 ± 17.60	9.61 ± 13.97	11.89 ± 12.71	0.537
Snore time (minutes)	2.18 ± 6.152	5.59 ± 6.52	3.71 ± 8.85	3.88 ± 5.55	0.727
Sleep efficiency (%)*	84.91 ± 11.17	83.0 ± 22.44	81.65 ± 21.57	89.91 ± 8.21	0.717
Mean O_2 saturation (%)	97.58 ± 0.84	95.27 ± 5.83	96.83 ± 1.51	96.77 ± 1.74	0.359
Lowest O_2 saturation (%)	88.88 ± 6.81	80.29 ± 14.20	83.57 ± 8.17	81.70 ± 8.97	0.274
Limb movement index	7.73 ± 3.91	8.95 ± 10.31	9.75 ± 6.57	7.96 ± 4.94	0.881

*N = 57

Finding=No significant difference between the mean value of all parameters and different grades of tonsils

Results-BMI and AHI

Results- BMI and AHI index correlation in all Suspected OSA(n=84)

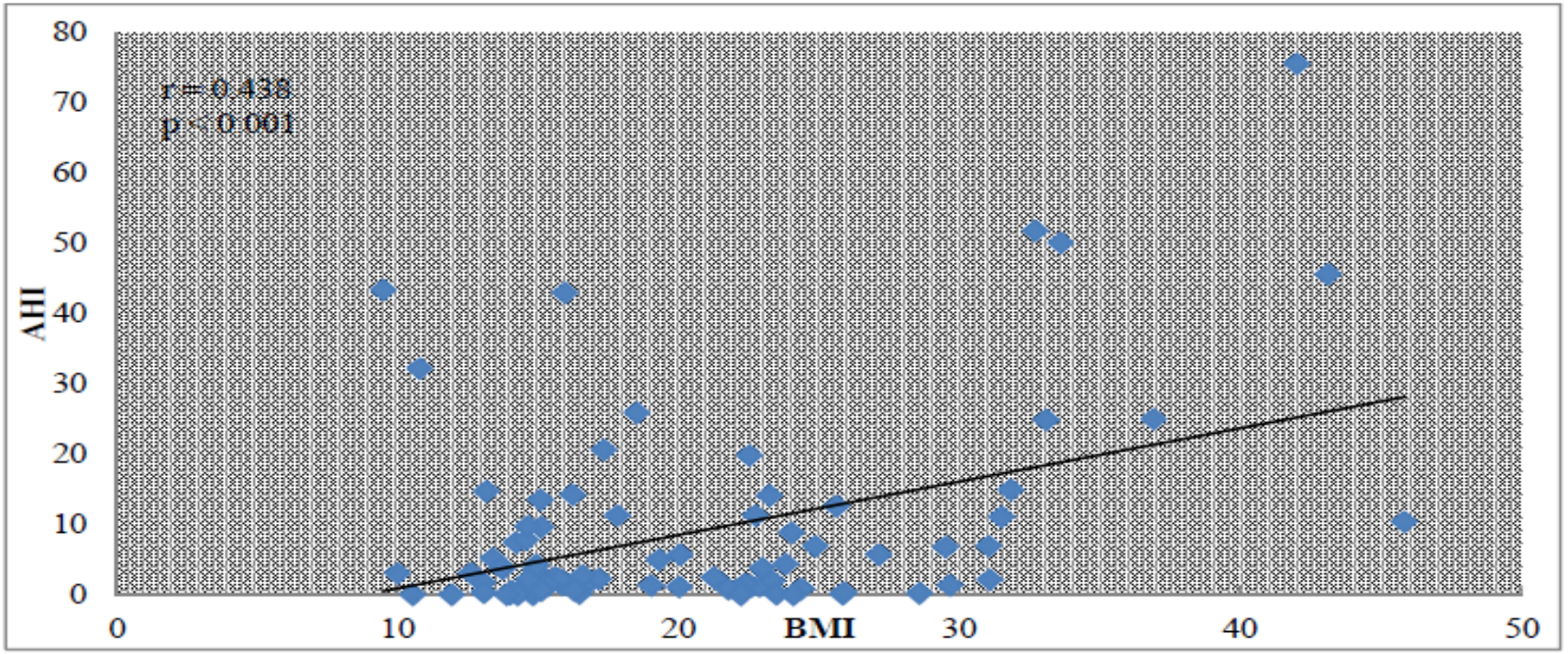


Figure 3 Correlation between BMI and AHI (N=84)

There was positive correlation between BMI and AHI

(r=0.438 p= < 0.001)

Discussion

In this study, we have studied 86 referred cases with clinically suspected OSA.

It is observed that

***common symptoms for referral to do sleep study**

- Snoring , enlarged tonsils apnea, bed wetting ,

restless sleep. (Jaliolghadr S et.al, ICSD 3)

*** In this study, Children with snoring but no hypoxia or OSA---- regarded as**

Primary Snoring (ICSD 3 criteria)

Discussion

*67.4% children got enlarged Tonsils in all suspected cases.

* Tonsil sizes did not correlate with severity of AHI.(Nolan et.al, ICSD3).

* daytime sleepiness, morning headache, insomnia, learning difficulties are also found in referred Pediatric patients. (in Marcuc Clet.al)

Discussion

In this study children with OSAS had-

- Marked hypoxia (O2 desaturation) was found during sleep in OSA Patients.(ICSD3)
- EEG arousals, Limb movements and Apneic EEG noted
- If Left Untreated___ Learning Difficulties, Pulmonary Hypertension, Cardiac Failure would arise.(1. Sateia MJ. Int..et.al)
- BMI = significant positive relation with AHI in this study.

  (Rann Areans et.al, Kan Kt et.al)

Limitation

- Tonsil size are graded visual score rather than expensive imaging.
- Patients are collected from referred hospitals (hospital based study)
- Not from community.

Conclusion

- In children with OSA, snoring and enlarged tonsils were the commonest associated findings.
- Tonsil sizes did not correlate with severity of AHI.
- BMI has significant positive relation with AHI.

Recommandation

- Every children who have any signs and symptoms of frequent snoring, enlarged tonsils, apnea, bed wetting, over weight, restless sleep, insomnia, daytime sleepiness , morning headache
- should be **screened for OSA and referred to pediatrician** for clinical management.

References

- 1. Sateia MJ. international classification of sleep disorders , third edition; highlights and notification.
- 2.American Academy of Pediatrics, Clinical practice guidelines; diagnosis and management of childhood obstructive sleep apnea syndrome.Pediatrics.2002;109:704-712
- 3-Canapari C. Obstructive Sleep Apnea in Children. J Clinical Outcome Management.2009 Aug;16(8):383-391.
- 4-Sleep Medicine Board Review. Tonsil size scoring.[mage on internet] .2011[updated 2011 Oct 25;cited 2017 Nov 21] Available from https://sleepmedicineboardreview.wordpress.com/2011/10/25/tonsil-size-scoring.
- 5.Capdevila OS,Kheirandish-Gozal L, Dayyat E, Gozel D.Pediatric Obstructive Sleep apnea; Complications, Management and Long-term outcomes. Proceedings of the American Thoracic Society.2008;5(2):274-282.
- 6.Kryger M, Roth T, Dement WC. Principle and practice of sleep medicine.6th edition.Philidia:Elsevier;2017.170p.
- 7.Sateia M,Berry R,Cramer BM, Doghramiji K,Edinger J,Feber R,Rosen G,Silber M,walters A,Zee P.International Classification of Sleep Disorder.3rd edition, Darian IL,AASM;2014.38p.
- 8.Arens R,Muzumdar H.Children obesity and obstructive sleep apnea syndrome. Journals of applied physiology 108:436-444:2010.
- 9.Kang K-Tchou C-H,Weng W-C, Lee P-L,Hsu W-C(2013) Association between Adnnoltonsilar Hypertrophy,Age and Obesity in Children with Obstructive Sleep Apnea.PLOS ONE8*10)2010.14p
- 10. Nolan J,Brietzke SE(2011) Systemic review of pediatric tonsil size and polysomnogram – measured obstructive sleep apnea severity. Otolaryngo1 Head Neck Surg.2011;144:844-850.

Thank You…

THANK YOU very much both Audience and Our Research Team for the great effort.

Questions are warmly welcome.