British Journal of Medicine & Medical Research
9(10): 1-9, 2015, Article no.BJMMR.19026
ISSN: 2231-0614

SCIENCEDOMAIN *international*
www.sciencedomain.org

Frequency of Parent-reported Indicators of Sleep Disordered Breathing in Children with Clinical Diagnosis of Adenotonsillar Hypertrophy in Benin City, Nigeria

N. C. Onyeagwara[1], A. L. Okhakhu[1] and L. O. Onotai[2*]

[1]Department of Otorhinolaryngology, University of Benin Teaching Hospital, Ugbowo, Benin City, Nigeria.
[2]Department of Otorhinolaryngology, University of Port Teaching Hospital Port Harcourt, Choba, Port Harcourt, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author NCO designed the study, wrote the protocol, authors ALO and LOO managed the literature searches and analyzed the results. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/19026
Editor(s):
(1) Xin-an Liu, Neuroscience Department, the Scripps Research Institute, Scripps, Florida, USA.
Reviewers:
(1) Anonymous, University of Rio de Janeiro, Brazil.
(2) Anonymous, Stanford University Sleep Medicine Division, USA.
(3) Silke Anna Theresa Weber, São Paulo State University, Brazil.
(4) Filiz Keyf, Department of Prosthodontics, Hacettepe University, Turkey.
Complete Peer review History: http://sciencedomain.org/review-history/10201

Original Research Article

Received 21st May 2015
Accepted 4th July 2015
Published 16th July 2015

ABSTRACT

Background: Sleep disordered breathing (SDB) comprises a wide spectrum of sleep-associated breathing abnormalities; those related to increase upper airway resistance include snoring, upper airway resistance syndrome (UARS) and obstructive sleep apnea syndrome (OSAS). This concept suggests that a person who snores may be exhibiting the first manifestation of SDB and that snoring should not be viewed as normal. Obstructive sleep disordered breathing is common in children. Snoring, mouth breathing, and obstructive sleep apnea (OSA) often prompt parents to seek medical attention.
Aim: This study aims to determine the frequency of parent-reported indicators of SDB among

**Corresponding author: Email: onotailuckinx@yahoo.co.uk;*

children clinically diagnosed with adenotonsilar hypertrophy (ATH) in the Otorhinolaryngology department of the University of Benin Teaching Hospital (UBTH), Benin City.

Methods: This was a cross-sectional study of children aged 12 years and below who were sent to the Ear Nose and Throat clinics of UBTH, Benin-city with symptoms of obstructive adenotonsilar hypertrophy (ATH) between May 2012 and April 2014. All consecutive parent/caregiver who presented their child/ward to the ENT clinic with symptoms of obstructive adenotonsilar hypertrophy (ATH) were interviewed using structured questionnaire/proforma after verbal consent was obtained.

Results: A total of 104 children were studied. The children were 73 males and 31 females with a male/ female ratio of 2.4:1. The children were aged 1-12yrs with average age of 4.98 ± 2.68 years. The parents/caregivers were 92 females and 12 males giving a ratio of 7.6:1.The frequency of sleep apnea was reported by 50 children/care givers (48.1%). There was a high prevalence of reporting for patients between the ages of 1 and 4years 62 (59.6%) which was followed by those between 5 and 9 years 34 (32.7%). Symptoms lasted more than 3 years in 43(41.3%), 1-2 years in 31(29.9%) and less than 1 year in 30 (28.8%) of the patients. Symptoms reported were snoring 104 (100%), nasal obstruction 97(93%), nasal discharge 96 (92%), mouth breathing 92 (88%), sleep apnea 50 (48.1%), restless night sleep 72 (69.2%), sore throat 69(66.3%), failure to thrive 2(1.9%). Cervical (jugulo-digastric) lymph node was enlarged in 70 (67.3%). Tonsillar grades were as follows; grade 3 was 59 (56.7%), 4 was 27 (26%) while 1 and 2 accounted for 17 (16.3%).

Conclusion: Snoring was the commonest symptom reported in children with SDB. Parents and caregivers should monitor their children closely during sleep as this may reveal early symptoms of adenotonsilar hypertrophy causing SDB.

Keywords: Sleep disordered breathing; snoring; adenotonsilar hypertrophy; obstructive sleep apnea; Benin-city; Nigeria.

1. INTRODUCTION

Adenotonsilar hypertrophy (ATH) is a common cause of Sleep-disordered breathing (SDB) in children if airway occlusion is severe. SDB is a broad term for sleep breathing difficulties that can range from recurrent loud snoring to Obstructive Sleep Apnea (OSA). OSA appears to be an end result of a changeable arrangement of anatomic and pathophysiologic factors, several of them may be under genetic control. In addition, the underlying anatomic substrate for OSA differs for whites and African-Americans in increasing susceptibility to OSA [1]. Other risk factors are neuromuscular disease, craniofacial abnormalities [2]. Several other factors; like racial, genetics, anatomy and the environment have been implicated as reasons for higher prevalence of SDB in Afro-Americans compared to other races [3,4]. The prevalence of OSA is characteristically superior, more severe and presented at a younger age among certain ethnic groups, such as African-Americans [5].

Symptoms of ATH include snoring, sleep apnea, mouth-breathing, restless sleep with frequent arousals, recurrent nasal discharge, poor feeding, failure to thrive and at times sore throat [6]. Although parents complain of noisy breathing in their children which may occur in habitual snorers, their worry is more of the cessation of breath as the implication and sequale are not understood by them. Lack of adequate and refreshing sleep may affect cognitive development and neuronal function in affected children.

Sleep apnea and hypopnea syndrome (SAHS) is a major health problem due to its prevalence rate of 2-12% [2,6,7], but several studies using varying monitoring techniques to examine the prevalence and severity of obstructive or apneic events among normally developing infants using larger samples of younger children documented that the frequency of obstructive or mixed apneas is high, ranging from 46.7% having either obstructive or mixed apneas) to 44.0% having obstructive apneas, to 10.3% having more than 1.2 obstructive apneas per hour) [8,9].

Many centers in developed countries apart from using post nasal space plain radiographs for the diagnosis of hypertrophy of the adenoids they also use a more highly efficient noninvasive exorbitant polysomnography which is beyond countries with limited resources to classify the severity of obstruction. Also, nocturnal pulse oximetry has been found useful in the analysis of oxygen saturation of patients with obstructive sleep apnea (OSA). Our management in our

environment is dependent on parent-report and assessment of patients using Brodsky's tonsillar grading and Fujioka's adenoidal/nasopharyngeal measurement by lateral cephalometry [10,11].

There is relatively little local data available and since there may be geographic, genetic and racial differences, the application of overseas data to our population seems not to fit. To better understand the problem locally, we carried out this preliminary study to determine the frequency of parent- reported SDB among children who presented with features of obstructive adenotonsilar hypertrophy in the Department of Otorhinolaryngology outpatient clinic of the University of Benin Teaching Hospital (UBTH), Benin City. The findings will serve as baseline data for both future quantitative and qualitative research.

2. PATIENTS AND METHODS

This was a preliminary cross-sectional study of children aged 12 years and below who were sent to the Ear Nose and Throat clinics of UBTH, Benin-city with symptoms of obstructive adenotonsilar hypertrophy (ATH) between May 2012 and April 2014.

2.1 Inclusion Criteria

The parent/caregiver of all patients who were aged 12 years and below who had obstructive ATH were included in the study.

2.2 Exclusion Criteria

Children with craniofacial and neuromuscular diseases and all whose parent/caregivers declined consent were excluded.

The scope of this study will not include facial cephalometric and anthropometric measurements such as BMI. Besides, we do not have facilities for sleep studies and blood gases.

2.3 Methods

All children with symptoms of obstructive ATH were used for this study. Their parents/caregivers were interviewed consecutively using structured proforma after verbal consent.

The proforma elicited information on age, sex and duration of symptoms.

Other direct questions were; Does your child snore?, does your child's breath cease during sleep at night?, if yes for how long and how many times does it happen during 8 hours sleep?. Does he/she wake up frequently at night or is the child restless? Does your child fall asleep easily in class or in a quiet place during the day? Is your child restless during the day? Does your child breathe with his mouth open most of the time? Does your child have running nose often? Is your child growing well? Does your child have features of sore throat? Does his/her nose block?

Subsequently, patients were categorized into those with ATH alone without obstructive symptoms and those with ATH+ SDB

General examination was thereafter done and standardized tonsillar hypertrophy grading scale according to Brodsky [10] grading scale was used as follows; (0) Tonsils are entirely within the tonsillar fossa. (1+) Tonsils occupy less than 25 percent of the lateral dimension of the oropharynx as measured between the anterior tonsillar pillars. (2+) Tonsils occupy less than 50 percent of the lateral dimension of the oropharynx. (3+) Tonsils occupy less than 75 percent of the lateral dimension of the oropharynx. (4+) Tonsils occupy 75 percent or more of the lateral dimension of the oropharynx as depicted in Fig. 1. Examination of the neck was also done to check for cervical lymphadenopathy.

Moreover, plain radiographs of the post nasal space was done for each patient to evaluate the degree of obstruction using adenoid nasopharyngeal ratio (ANR) as proposed by Fujioka [11] as depicted in Fig. 2. Those with A: N ratio > 0.6 and or grade 2-4 tonsils with OSA, had adenotonsillectomy while those < 0.6 with no apnea and mild tonsils were managed conservatively with anti-allergic medications and antibiotics.

2.4 Data Analysis

The data obtained were analyzed using SPSS version 16.0. Descriptive data were illustrated with simple tables and pie chart. Continuous data were expressed as mean/standard deviation.

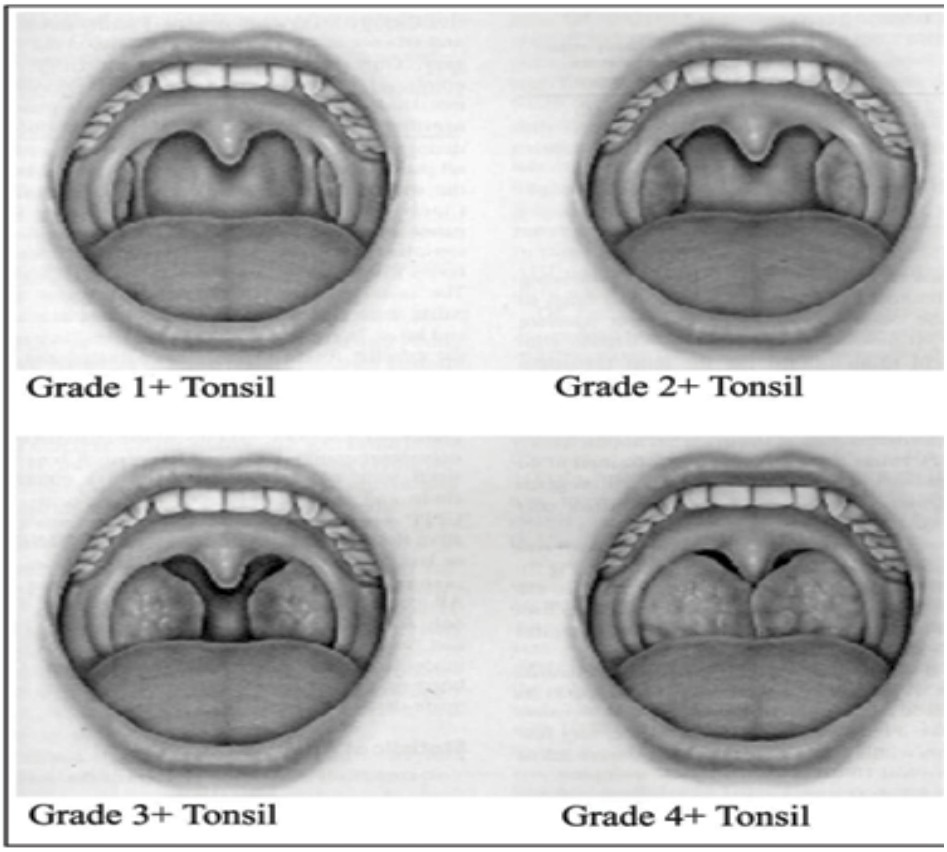

Fig. 1. Grading of palatine tonsils hypertrophy proposed by L. Brodsky [10]

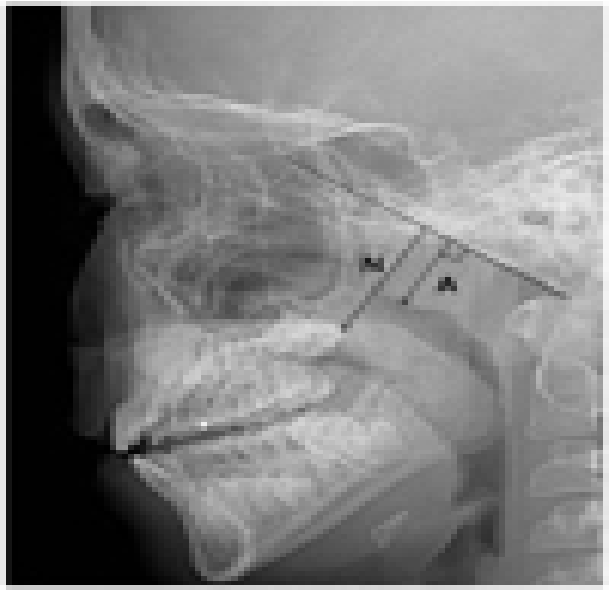

Fig. 2. Estimation of the adenoid-nasopharynx (A/N) ratio (Fujioka Method). The distance between the outermost point of convexity of adenoid shadow and spheno-basiocciput (A) is divided by the distance between spheno-basiocciput and posterior end of the hard palate (N) [11]

3. RESULTS

A total of 104 children whose parents/caregivers interviewed were studied. The parents/caregivers were 92 females and 12 males with a female: male ratio of 7.6:1. The children comprised 73 males and 31 females with male: female ratio of 2.4:1. The children were aged 1-12 yrs with average age of 4.98 ± 2.68 years. The frequency of sleep apnea was reported by 50 children/care givers (48.1%). There was a high prevalence of reporting for patients between the ages of 1 and 4years 62 (59.6%) which was followed by those between 5 and 9 years 34 (32.7%).

Symptoms lasted more than 3 years in 43 (41.3%) children, 1-2yrs in 31 (29.9%) and less than 1 year in 30 (28.8%) of the patients. Symptoms reported were snoring 104 (100%), nasal obstruction 97(93%), nasal discharge 96 (92%), mouth breathing 92 (88%), restless night sleep/frequent arousal 72 (69.2%) sore throat 69 (66.3%), failure to thrive 2 (1.9), there was no record of any child falling asleep easily during the day (hypersomnolence).

Cervical (jugulo-digastric) lymph node was enlarged in 70 (67.3%) children as shown in Table. 1. Tonsillar grades were as depicted in Table. 2. Most of the children 50 (48.1%), had adenotonsillectomy, 12 (11.5%) had adenoidectomy and 10 (9.6%) had tonsillectomy as shown in Fig. 3.

Table. 1 Clinical symptoms elicited from parents/caregivers

Symptom	Number	Percentage
Snoring	104	100
Nasal obstruction	97	93
Nasal discharge	96	92
Mouth breathing	92	88
Frequent arousals	72	69.2
Sore throat	69	66.3
Sleep apnea	50	48.1
Failure to thrive	2	1.9
Hypersomnolence	0	0
Cervical lymphadenooathy	70	67.3

Table 2. Tonsillar Grades of patients

Tonsillar grade	No. of patients	Percentage
1-2	17	16.3
3	60	57.7
4	27	26
Total	104	100

4. DISSCUSSION

The frequencies of parental reported SDB in children with ATH is high in our environment, snoring was 104 (100%), sleep apnea was 48.1%, frequent arousals at night was 72 (69.2%). This high figure is similar with some earlier reports [8,9].

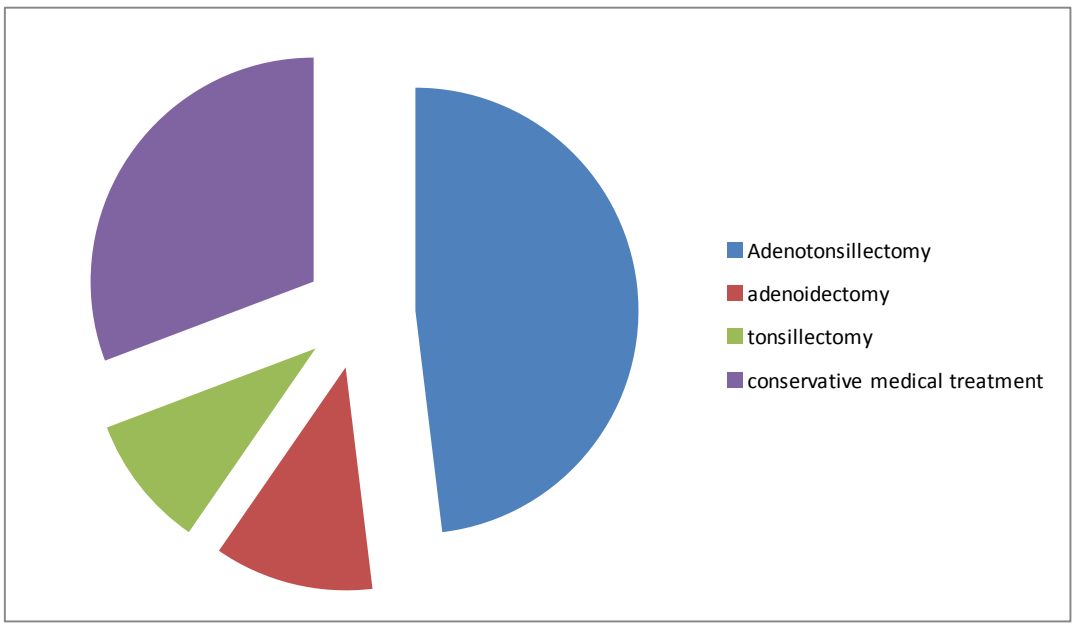

Fig. 3. Showing modalities of treatment of patient with ATH having SDB

This may be attributed to the skewed nature of the specialist's clinic receiving patients who may have failed conservative management. Racial, genetics and cranio-facial anatomy and the environment have been implicated as reasons for higher prevalence of SDB in Afro-Americans and according to Marcus CL et al. [12], African American children have been shown to have 4 to 6-fold higher risks than white children, independent of other factors such as obesity, premature birth, and maternal smoking [3,4,]. These necessitated more studies among Africans and this study may have contributed in creating awareness for adequate management of affected children.

However, this differs from other studies which reported a lower prevalence of 3-12% [2,7]. Lumeng JC and Chervin RD [2] have stated that the frequency of parent-reported sleep apnea is exceedingly low, and would likely result in many missed cases of OSA if used as a sole diagnostic or screening criterion. These lower figures of OSA have been attributed to under diagnosis, parents sleeping in separate rooms from their children as well as parental sleep-offs. Our setting still has many children sleeping with their parents in same room which makes for better observation of their children while asleep.

Several studies indicated that parents' observation of their child's breathing is an inaccurate basis for the diagnosis of OSA [2]. Also Clinical evaluation that included witnessed apneas, mouth breathing, tonsil size, and snoring was found to have poor predictive accuracy [13]. In a limited income setting like ours, these have given us high index of suspicion and have helped in our management of patients so far while waiting for a time when accurate but more expensive tools will be available to the common man through improved health policy.

The average age of 4.98 ± 2.68 years with a peak of age 1-4 was because both tonsils and adenoid are part of the Waldeyer ring, which is a ring of lymphoid tissue found in the pharynx which provides defense against pathogens and are involved in the production of immunoglobulins and the development of both B cells and T cells [14]. The hypertrophy and hyperplasia in this age group can be ascribed to the period of child's immunological independence from maternal immunity.

In this study, more female parents/caregivers brought their children to the hospital for treatment than their male counterparts. This finding was not surprising to us because in our society it is usually the mothers/female caregivers that bring children to the hospital. It is only in few cases when the mothers or female caregivers are indisposed the fathers/ male caregivers take the responsibility of bringing the sick child to the hospital.

Furthermore, this study showed a male preponderance of over 70%. The reason for this difference in gender was not clear but other studies have reported the male gender as risk factor for OSA [15]. Kitamura et al. [16] concluded that the prevalence of childhood SDB probably does differ by sex, with boys being affected at rates that are 50 to 100% higher than those for girls.

The major symptoms elicited in this study were snoring, nasal obstruction and nasal discharge followed by mouth breathing, sore throat, sleep apnea and frequent arousals [8]. This is attributable to the interplay of airway narrowing due to adenotonsilar hypertrophy, abnormal airway muscle tone, and genetics predisposing children to obstructed breathing, turbulent airflow, mouth breathing and recurrent nasal discharge. Consequences of untreated obstructive sleep apnea include failure to thrive, attention-deficit disorder among others. A very low failure to thrive was recorded in this study. Various factors have been proposed to explain the poor weight gain in patients with OSA. They include disturbed growth hormone release, low calorie intake, and increased energy expenditure during sleep and since no particular factor alone can be implicated, it is most likely to be interplay among them. There was no recorded hyper somnolence though it is more common in adults.

A higher percentage of our patients reported their symptoms for more than 3 years. This indicates that patient with SDB experienced prolonged morbidity and delays in treatment, which may be attributed to primary physician, parent, and third-party, who tell them symptoms, will resolve with time without treatment. This agrees with a report where parental and physician delay was responsible for the late detection and treatment of OSA in children [17].

Presently, we are aware that polysomnography is the "gold standard" for the assessment of OSA and other aspects of SDB or at least nocturnal pulse oximetry which has the positive predictive value of 97% in detecting OSA [9,18] is also very

useful. However, we used subjective clinical measures and classification of the tonsils by Brodsky [10] and Fujioka [11] which are affordable and have been evaluated and found to have good statistical correlations [19,20].

In this study most patients have grade 3 and 4 tonsils which relate to their degree of obstruction. Hypertrophy of tonsil and adenoid is considered important risk factors for OSA [2-7]. In the 2 to 6 years-olds, enlargement of the adenoid and tonsil frequently narrows the nasopharynx and oropharynx leading to a partial or total obstruction of the upper airway. This corresponds to development of OSA in children. It is possible that in subjects with snoring, mechanisms related to cysteinyl leukotrienes prevent the age-dependent reduction in the size of pharyngeal lymphoid tissue which normally occurs in children without SDB.

Tonsillar tissue excised from children with OSA has increased content of cysteinyl leukotrienes and increased expression of their receptors. Elevated concentrations of cysteinyl leukotrienes have also been found in samples of urine and exhaled breath condensate collected from children with SDB [21]. Regulation of nerve growth factor (NGF) and neurokinin (NK1) receptor-dependent pathways associated with respiratory syncytial virus infection may participate in the pathogenesis of tonsillar enlargement in early childhood especially in children with OSA [22]. These infections can account for the 66.3% and 67.3% clinical symptoms of sore throat and cervical lymphadenopathy and corroborate bacteriological study of tonsillar surface and core which showed a high prevalence of *Staphylococcus aureus* [23]. However, in our series we did not determine the levels of cysteinyl leukotrienes and other studies to implicate infective agents.

Some patients with intermittent infections such as adenoiditis and tonsillitis were managed with antibiotics and decongestants which according to James Chan et al. [24] leads to reduction in the bacterial antigen load, secondary reduction in the population of B lymphocytes in the germinal centers of tonsils and adenoids, and the physics of airflow (Poiseuille's law) are such that small changes in airway diameter dramatically affect airway resistance. Few patients have improved by watchful waiting which was attributed to growth of the developing airway leading to a proportional reduction in airway obstruction because of adenotonsilar hypertrophy [25]. This depiction may have also occurred among our patients as some of them responded to conservative treatment as seen in our series.

Otolaryngologists commonly performed adenotonsillectomy in children with features suggestive of obstructive sleep apnea syndrome which improved the quality of life of the children in the post-operative period. However, this mode of treatment may not stand the test of time if other causative factors and co-morbidities are not tackled. This agrees with the research done by Marcus et al. [26]; which supported surgery as the first line of treatment for OSA. We are aware that neither single nor combined symptoms and signs of OSA have satisfactory performance in predicting pediatric OSA when compared with the use of modern diagnostic equipment such as polysomnography and nocturnal pulse oximetry. Because of lack of appropriate diagnostic facilities in our setting, we could not evaluate our patients post-operatively to find out if they still suffer from obstructive sleep apnea and other forms of SDB using objective techniques. In the near future, we hope to have better diagnostic facilities that will enable us carry out studies to correlate variables like BMI, facial abnormalities and ATH with obstructive SAHS.

5. CONCLUSION

This study highlighted the frequency of parent reported symptoms of children with sleep disordered breathing (SDB) with clinical diagnosis of ATH in our environment in an Otorhinolaryngological point of view. In the meantime, pediatricians and other practitioners can use these findings to promote awareness of SDB by asking parents/caregivers about snoring and sleep apnea during their children's regular healthcare maintenance visits. Increasing the recognition of SDB by all stakeholders will decrease diagnostic delay and avoid serious sequelae of SDB among children in our environment with ATH.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Cakirer B, Hans MG, Graham G, Aylor J, Tishler PV, Redline S. The relationship between craniofacial morphology and obstructive sleep apnea in whites and in African-Americans. Am J Respir Crit Care Med. 2001;163(4):947-50.
2. Lumeng JC, Chervin RD. Epidemiology of Pediatric Obstructive Sleep apnea. Proc Am Thorac Soc. 2008;5(2):242-52.
3. Spilsbury JC, Storfer-Isser A, Kirchner HL, Nelson L, Rosen CL, Drotar D, Redline S. Neighborhood disadvantage as a risk factor for pediatric obstructive sleep apnea. J Pediatr. 2006;149(3):342-7.
4. Montgomery-Downs HE, Gozal D. Sleep habits and risk factors for sleep-disordered breathing in infants and young toddlers in Louisville, Kentucky. Sleep Med. 2006; 7(3):211-9.
5. Casale M, Pappacena M, Rinaldi V, Bressi F, Baptista P, Salvinelli F. Obstructive sleep apnea syndrome: from phenotype to genetic basis. Curr Genomics. 2009; 10(2):119-26.
6. Ferreira AM, Clemente V, Gozal D, Gomes A, Pissarra C, César H, Coelho I, Silva CF, Azevedo MH.Snoring in Portuguese primary school children. Pediatrics. 2000;106(5):E64.
7. Ali NJ, Piston PJ, Stradling JR. Snoring, Sleep disturbance and behavior in 4-5year old. Arch Dis Chld. 1993;68(3):360-366.
8. Kahn A, Groswasser J, Sottiaux M, Rebuffat E, Sunseri M, Franco P, Dramaix M, Bochner A, Belhadi B, Foerster M. Clinical symptoms associated with brief obstructive sleep apnea in normal infants. Sleep. 1993;16(5):409–13.
9. Brouillette RT, Morielli A, Leimanis A, Waters KA, Luciano R, Ducharme FM. Nocturnal pulse oximetry as an abbreviated testing modality for pediatric obstructive sleep apnea. Pediatrics. 2000;105(2):405-12.
10. Brodsky L. Modern assessment of tonsils and adenoids. Pediatr Clin North Am 1989; 36(6):1551-69.
11. Fujioka M, Young LW, Girdany BR. Radiographic evaluation of adenoidal size in children: Adenoidal-nasopharyngeal ratio. AJR Am J Roentgenol. 1979; 133(3):401-04.
12. Marcus CL, Brooks LJ, Draper KA, Gozal D, Halbower AC, Jones J, Schechter MS, Sheldon SH, Spruyt K, Ward SD, Lehmann C, Shiffman RN. Diagnosis and management of childhood obstructive sleep apnea syndrome. Pediatrics. 2012; 130(3):576-84.
13. Carroll JL, McColley SA, Marcus CL, Curtis S, Loughlin GM. Inability of clinical history to distinguish primary snoring from obstructive sleep apnea syndrome in children. Chest. 1995;108(3):610–8.
14. Kenna MA, Amin A. Anatomy and physiology of the oral cavity. In: Snow JB, Wackym PA. Ballenger's Otorhinolaryngology Head and Neck Surgery. 17th ed. Shelton: BC Decker Inc; 2009;769-74.
15. Fadzil Abdullah AA, Jamalludin AR, Norrashidah AW, Norzila MZ, AsiahKassim K, RusAnida A, Hasniah AL, Ramli Z, Samsinah H. Prevalence of sleep disordered breathing among malay school children in primary school in Malaysia; Med J Malaysia. 2012;67(2):181-5.
16. Kitamura T, Miyazaki S, Kadotani H, Suzuki H, Kanemura T, Komada I, Nishikawa M, Kobayashi R, Okawa M. Prevalence of obstructive sleep apnea syndrome in Japanese elementary school children aged 6-8 years. Sleep Breath. 2014;18(2):359-66.
17. Richards W, Ferdman RM. Prolonged morbidity due to delays in the diagnosis and treatment of obstructive sleep apnea in children. ClinPediatr (Phila). 2000; 39(2):103-8.
18. Nixon GM, Kermack AS, Davis GM, Manoukian JJ, Brown KA, Brouillette RT. Planning adenotonsillectomy in children with obstructive sleep apnea: the role of overnight oximetry. Pediatrics. 2004;113(1 part 1):e19-25.
19. Yasan H, Aynal G, Erdogan O, Yarinitas M. Does subjective tonsillar grading reflect the real volume of palatine tonsils? Int J pediatrotorhinolaryngol. 2011;75 (5):618-9.
20. Major MP, Flores-Mir C, Major PW. Assessment of lateral cephalometric diagnosis of adenoid hypertrophy and posterior upper airway obstruction: a systematic review. Am J Orthod Dentofacial Orthop. 2006;130(6):700-8.
21. Kaditis AG, Lianou L, Hatzinikolaou S, Kalampouka E, Gartagani-Panayiotopoulou P, Zintzaras E, Chrousos G. Tonsillar size in 2- to 14-Year-Old Children with and without Snoring. Pediatr Pulmonol. 2009;44(12):1216-22.

22. Goldbart AD, Mager E, Veling MC, Goldman JL, Kheirandish-Gozal L, Serpero LD, Piedimonte G, Gozal D. Neurotrophins and tonsillar hypertrophy in children with obstructive sleep apnea. Pediatr Res. 2007;62(4):489-94.
23. Babaiwa UF, Onyeagwara NC, Akerele JO. Bacterial tonsillar microbiota and antibiogram in recurrent tonsillitis. Biomedical Research. 2013;24(3):298-302.
24. James Chan, Jennifer CE, Peter JK. Obstructive sleep apnea in children. Am Fam Physician 2004;69(5):1147-55.
25. Patino M, Sadhasivam S, Mahmoud M. Obstructive sleep apnoea in children: Perioperative considerations Br. J. Anaesth. 2013;111(suppl 1):i83-95.
26. Marcus CL, Moore RH, Rosen CL, Giordani B, Garetz SL, Taylor HG, Mitchell RB, Amin R, Katz ES, Arens R, Paruthi S, Muzumdar H, Gozal D, Thomas NH, Ware J, Beebe D, Snyder K, Elden L, Sprecher RC, Willging P, Jones D, Bent JP, Hoban T, Chervin RD, Ellenberg SS, Redline S. Childhood adenotonsillectomy trial (CHAT). A randomized trial of adenotonsillectomy for childhood sleep apnea. N Engl J Med. 2013;368(25):2366-76.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/10201