

Usage of Epworth Sleepiness Scale, Modified Mallampati Scoring and Brodsky Grading in Adults with Hypertrophic Palatine Tonsils and Sleep Disordered Breathing

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ABSTRACT

Objective: We aimed to determine the correlation of Modified Mallampati scoring and Brodsky tonsillar grading as indicative factor for sleep disordered breathing by using an Epworth sleepiness scale in patients with hypertrophic tonsils.

Methodology: Data for this prospective cross-sectional analytical study was collected at an ENT Department of PNS Shifa Hospital, Karachi between January to July 2021. Non-probability consecutive sampling technique was used. After taking informed consent, a subject evaluation proforma was filled which involved detailed personal history of the selected subjects with hypertrophic tonsils and sleep disordered breathing. Epworth sleepiness scale was assessed, Physical examination of subjects involved grading of tonsils and examination of the tongue was done. Data was entered and analyzed on SPSS 23.0 software.

Results: The present study enrolled (n=54) adult subjects with mean age calculated to be 25.72 ± 7.9 SD. Pre-operative Epworth scores were significantly lower in subjects with Brodsky grade I and II as compared to higher grades which is in accordance with increasing severity of obstruction as tonsil grading advanced. Furthermore, statistically significant association was seen between Epworth scoring and Mallampati grading.

Conclusion: The results of the current study generated significant recommendations for the evaluation of the anatomy of pharynx, use of Epworth questionnaire, Mallampati and Brodsky classification might be a rapid, non-invasive screening tool for advance identification and timely intervention for subjects at risk of sleep disordered breathing.

KEYWORDS: Sleep Apnea, Obstructive, Palatine Tonsil, Hypertrophy, Tongue

INTRODUCTION

Obstructive sleep apnea (OSA) is a serious disorder and has been associated with various anatomical structures of pharynx. Due to lack of awareness in

our setup this condition is either being unidentified or misdiagnosed.¹ Pharynx and structures along airway are the main anatomical sites for OSA such as hypertrophy of uvula, higher tongue grading, narrow pharyngeal cavity and mandibular retrognathia.² Consequently, it is important for physicians to inspect all the related structures leading to development of the disease.³ The clinical presentation of patient with acute or chronic inflammation of tonsils differs in etiology, most commonly presenting with fever, difficult or painful swallowing, enlarge and erythematous tonsil. The presence of enlarged tonsils accompanied by obstructive symptomatology significantly raises the likelihood of OSA, therefore a primary care physician needs to know the risk factors such as obesity, increased neck circumference, age above 40-years, nasal obstruction and hypertrophic tongue with thorough upper respiratory examination when patients came with enlarged tonsils.⁴

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The prevalence of OSA is increasing with time and according to epidemiological studies males 49.7% were found to be affected with the disease as compared to females 23.4%.⁵ Young, adults and senior members of the society are suffering from various types of sleep conditions and its being reported that 50% individuals aged ≥ 60 years could not enjoy a peaceful sleep. There are various physiological, psychosocial and anatomical reasons that disturb sleep patterns greatly with different manifestations in all age groups.⁶

It's being observed that most of the patients with OSA have higher tongue grading. During 1980s Grading of tongue was assessed through Mallampati scoring (MS) which independently identifies difficult intubation before surgery and the presence of OSA. This scoring system consist of four grades and involved the close relation of anatomical structures of oropharynx and allows visual characterization of the upper respiratory tract anatomical structures.⁷

The commonest subjective questionnaire used for valuation of sleep apnea risk in general population is the Epworth Sleepiness Scale (ESS) which is a self-administered questionnaire composed of eight questions and inquires about the different circumstances that individuals often experienced daily.⁸ Scoring of Epworth scale influenced by various factors involving gender, ethnic variations and individuals' morphometrics.⁹

Other diagnostic test for OSA is Polysomnography which is the "gold standard" nowadays and involves detailed account of various physiological activities of human body with a hospital stay and are costly which is not easy in our hospital setup.¹⁰ Evaluation of tonsillar hypertrophy is significant in clinical routine, which is a foremost feature related to an OSA patient as removal of enlarging tonsils expands the narrowed oropharyngeal isthmus. A modified and comprehensive evaluation tool is needed for pre-surgical assessment of patient with hypertrophic tonsils and obstructive airway disease such as Brodsky grading which is convenient and cost effective way of assessment of tonsils and considered as a predictive factor for the successful surgical result.¹¹

Before surgery it is important to know the level of airway occlusion. Previous studies had identified palatine tonsils as a common cause of airway occlusion.¹² It is therefore examination of tonsils and tongue is a convenient way for initial

assessment of OSA. The purpose of this study was to analyze the anatomy of oropharynx with the use of modified Mallampati scoring for tongue grading, Epworth sleepiness scale and Brodsky tonsillar grading in assessing patients with hypertrophic tonsils and sleep disordered breathing. The present study aimed to elucidate relationship of the aforementioned parameters that affects oropharyngeal anatomy.

METHODOLOGY

This cross-sectional study was performed at otorhinolaryngology department of PNS Shifa hospital, Karachi from January to July 2021. The study protocol was approved by the ethical and review committee board of the institution with reference No: ERC 09/2020 issued by Bahria University Health Sciences Campus Karachi. Sample size estimation of the current study was obtained by an open source calculator "Open Epi verion 3" which was 45 for tonsillar hypertrophy with or without sleep disordered breathing at confidence interval 95% and with margin of error 5%. A total of 54 individuals with enlarged tonsils with or without sleep disordered breathing and age ranged from 18-60 years were included in the study. Children and individuals above 60 years and those participants who had history of trauma, excised tonsils, thyroid or Cushing's disease, expecting or lactating woman were excluded from the study. Children were excluded from the study because they have different growth parameters for evaluation. An increase in size of tonsils is not the only indication as they are normally larger in pediatric population due to greater immunologic activity as compared to adults and involute physiologically during adolescence.¹³ Written informed and understood consent was obtained from all the study participants after explaining the purpose of the research. A subject evaluation proforma was filled which contains demographic information and medical history of the study participants. Epworth sleepiness scale was used to assess obstructive sleep apnea which consisted of eight item questions on Likert scale to evaluate rate of dozing during various activities by the participant starting from 0 (never) to 3 (high chance of dozing). It consists of a total score of 24 and a score greater than 10 specifies excessive day time sleepiness.¹³ Clinical examination involved grading of tonsils to assess the percentage of its

enlargement according to Brodsky tonsillar grading (Grade 0: Tonsils within the tonsillar fossa or removed, Grade I: Less than 25% of the oropharynx occupied, Grade II: 25% to 50% occlusion of the oropharynx, Grade III: 50% to 75% occlusion of the oropharynx whereas Grade IV: Greater than 75% of the oropharynx occupied, completely obstructing the airway). The anatomical features were examined while keeping the participants calmly sitting and breathing in relaxed way. In order to reduce subjectivity grading of tonsils was done first by the otorhinolaryngologist and then by researcher according to percentage occlusion of oropharynx by tonsils.¹⁴

Mallampati score is a simple, quick test that can be a good predictor of obstructive sleep apnea. It is an assessment to check the position of tongue in relation to the structures present in the oral cavity, which falls in four grades (Grade I indicate clear visibility of tonsils, fauces and soft palate, grade II involves visualization of uvula, tonsillar pillars and upper pole of tonsils, grade III comprises of partial visualization of soft palate whereas tonsils, pillars and uvular base are all not clearly visible and grade IV is denoted by visibility of hard palate only).¹⁵

Apart from the history and examination, polysomnography which is the most accurate test for diagnosis of OSA is not patient friendly and cost effective. Therefore, in order to screen a large population, Epworth and Berlin's questionnaire was developed. Unlike tonsillar size high Mallampati grade is also associated with OSA and can be used as an influencing factor or screening tool as reported by Pakistani research done in 2018.¹⁶ Otorhinolaryngologist on the basis of history and physical examination diagnosed the subjects with OSA. Examining the correlation of Modified Mallampati scoring and Brodsky tonsillar grading as indicative factor for obstructive sleep apnea by using the Epworth sleepiness scale was studied.

Photograph of the subjects were taken after their consent and ensuring confidentiality using mobile phone camera and head light was used for illumination. All proformas were coded and data was entered on SPSS version 23 for statistical analysis. Data was analyzed for normality, descriptive data was expressed as mean, standard deviation, percentages, and statistical test were applied. In order to establish a relationship between Epworth sleepiness scale and modified Mallampati

scoring Chi-square test was applied whereas Fischer exact test was applied to see the association of Epworth sleepiness scale and Brodsky tonsillar grading. Level of significance was set at P value \leq 0.05.

RESULTS

This prospective study enrolled adult subjects (n=54) with age range from 18-60 years. The mean age was calculated to be 25.72 ± 7.9 SD. The overall study found male predominance 29 (54%) as compared to females 25 (46%). Regarding Epworth sleepiness scale questionnaire 38(70%) subjects had ESS score <10 whereas 16 (30%) subjects had score >10 which reflects excessive daytime sleepiness.

Table 1: Association of Brodsky Grading with Epworth Sleepiness Scale(n=54)

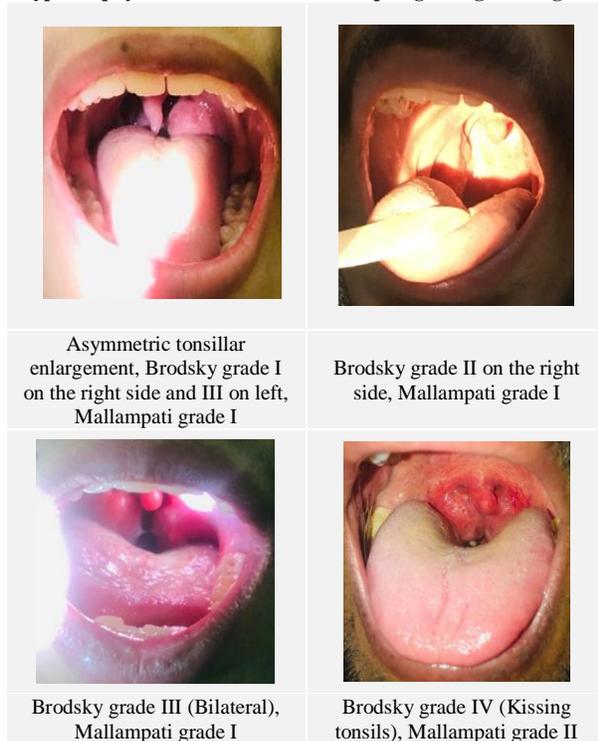
Brodsky Grading (Right Tonsil)	Epworth Score (n=54)		P-value	
	≤ 10	Above 10		
Grade I	3 7.9 %	0 0 %	0.0001*	
Grade II	30 78.9 %	2 12.5 %		
Grade III	5 13.2 %	11 68.8 %		
Grade IV	0 0 %	3 18.8 %		
Total	38 100 %	16 100 %		
Brodsky Grading (Left Tonsil)	Epworth Score (n=54)			P-value
	≤ 10	Above 10		
Grade I	2 5.3 %	0 0.0 %		0.144
Grade II	22 57.9 %	6 37.5 %		
Grade III	12 31.6 %	6 37.5 %		
Grade IV	2 5.3 %	4 25.0 %		
Total	38 100 %	16 100 %		

P-value of ≤ 0.05 is significant and shown with asterisk*

Thirty-one (57 %) out of 54 patients have had asymmetric tonsils whereas 23 (43%) tonsils were symmetric. In the present study for tonsillar grading there were 5 (5%) tissue graded as I, 60 (56%) as II, 34 (31%) as III and 9 (8%) as grade IV tonsillar enlargement (figure 1). Regarding tongue grading 27(50%) had grade I, 20 (37%) had grade II, 7(13%) had grade III whereas no grade IV tongue hypertrophy was noted. Majority of the study participants 26 (48.1 %) were diagnosed with acute tonsillitis followed by 22 (40.7 %) with recurrent tonsillitis and 6(11.1%) diagnosed with OSA.

Epworth Sleepiness Scoring by Brodsky Grading: Epworth scores were significantly lower in subjects with Brodsky grade I and II as compared to higher grades which is in agreement with increasing severity of OSA in relation with higher tonsil grading. For the right side significant results were obtained as compared to left side grading (Fischer Exact test, P value =0.00, P value = 0.14) as seen in table 1.

Figure 1: Grading done according to Brodsky tonsillar hypertrophy classification and Mallampati grading for tongue



Epworth Sleepiness Scoring by Mallampati Scoring: Regarding association of Epworth scoring with tongue grading, out of 16 (30%) subjects who had scores above 10 maximum number of participants had grade II and III tongue grading which is in agreement with the fact that tongue hypertrophy leads to structural obstruction of aero digestive tract. There were no subject graded IV Mallampati scoring. Statistically significant association was seen between Epworth scoring and tongue grading (Chi-square test, P value =0.01) as seen in table 2. Fischer Exact test was applied to see the significance, ESS Score: ≤ 10 indicates normal, above 10, and up to 24 indicates excessive day time sleepiness or sleep disorder, n=Total number of study participants test was applied to see the significance, ESS Score: ≤ 10 indicates normal,

above 10, and up to 24 indicates excessive day time sleepiness or sleep disorder, n=Total number of study participants.

Table 2: Association of Mallampati scoring with Epworth Sleepiness Scale(n=54)

Mallampati scoring for tongue grading	Epworth Score (n=54)		P-value
	≤ 10	Above 10	
Grade I	23 60.5 %	4 25.0 %	0.013*
Grade II	13 34.2 %	7 43.8 %	
Grade III	2 5.3 %	5 31.3 %	
Grade IV	0 0 %	0 0 %	
Total	38 100 %	16 100 %	

P-value of ≤ 0.05 is significant and shown with asterisk*, Chi-square

DISCUSSION

A good sleep has a great impact on healthy life. Many individuals suffer from difficult sleep due to many structural reasons of pharynx but it becomes alarming when it occurs frequently leading to a disorder like OSA.¹⁷ According to an international literature, OSA may restrict the airway, causing serious health concerns and requires immediate medical intervention. Morphological factors involved hypertrophy of tongue, uvula, tonsils, soft palate along with disordered breathing.¹⁸ These factors are studied in the present study. Epworth sleepiness score has been commonly utilized as a predictor of obstructive airway disease. The current study compared subjective measurement of tonsils with Epworth scoring and found highly significant correlation with right side as compared to left side grading. This can be due to presence of a greater number of grade II and III hypertrophic tonsils present on right side. Hence, the present study suggests that subjective assessment of tonsils and Epworth scoring have more predictive strength to identify severity of disordered breathing. The current study results are in agreement with a cross sectional study conducted in Washington, involved patients who underwent pharyngeal surgery for OSA and authors further reported that tonsil size and apnea hypopnea index predict severity of the condition.¹⁹ A prospective cohort of Chinese adult patients suggests that tonsil size may be more extrapolative of OSA.²⁰ On another hand Predictive strength of Brodsky

scoring system can be limited due to discrepancy with objective measurements of tonsillar tissue.²¹ An Asian study assessed 3,432 adults' subjects with suspected OSA and developed a clinical formula for its evaluation and screening. They involved variables that could have been valuable. They observed that variables like age, gender, anthropometric measurements, tonsillar anatomy, MS and ESS were of great importance and directly linked with OSA. They concluded that these formulas give an effective way to screen the disease.²²

On the other hand, Brazilian research by Duarte et al did not found association between Epworth and tonsil classification in a retrospective study, however it pointed out that the modified Mallampati scoring had a limited role as a predictor factor for the severity of the disease.²³

Tonsil size is not the only factor, there are other parameters that needed to be considered when diagnosing or assessing patients with obstructive symptoms. These include age, gender, BMI, neck circumference, the American Society of Anesthesiologists (ASA) score, Mallampati score and comorbidities including hypertension and diabetes.²⁴

Along with hypertrophic tonsils majority (50%) of the enrolled subjects in current study had grade I tongue hypertrophy as compared to higher grades and no patient was graded as grade IV. As the Mallampati grade advances to II and III there is rise in number of subjects with sleep apnea as 7(43.8%) and 5(31.3%) respectively depicting direct association of the two-grading systems. Similarly, a recent Pakistani study was conducted to investigate an economical and effective approach for the diagnosis of obstructive airway disease. Hassan, Altaf & Haider established significant association of higher Mallampati grade with higher Epworth scores, consequently greater risk of OSA in patients with higher tongue grading. Therefore, vigilant evaluation of patients with obstructive airways, identification of obstructive anatomical sites and their surgical treatment are important. Moreover, high tongue grading is considered to be an independent risk factor whereas nasal obstruction is an added risk associated for aggravation of apnea.²⁵

Many studies in the literature were found to contradict with the results of the present study. In a Pakistani research Naqvi et al reported Berlin and

Epworth questionnaire had non-significant association with higher tongue grading. However, Mallampati scoring system have predictive strength to identify OSA in low risk individuals of Epworth and Berlin scoring system.²⁶

Assessment of upper airway during physical examination is extremely important with suspension of OSA. Increase in apnea during sleep is due to raised negative pressure with in airway during inspiratory cycle. Similarly, assessment of tongue grading is also important and has influence on sleep disordered breathing. Individuals with higher scores of Mallampati have an increased tendency of obstruction due to macroglossia impeding airway from nasal and oral cavity to lower respiratory tract.³

The findings of the present study highlighted the role of a physician to identify the structural findings of oral cavity in subjects with sleep disordered breathing. They serve their patients with valuable service by utilizing screening tools for provision of better treatment to their practice.

Elastography is as an additional diagnostics method for the recurrent tonsillitis.²⁷ Other parameters like perfusion of tissue, dynamic account of obstructive sites at oropharyngeal and tonsil levels, duration of occlusion caused by these structures, arousal and sleep states are also important which should be studied thoroughly.

Limitations: There are certain limitations to the current research which involved small sample size and single centered study, we need large sample data by conducting multi-centric study to validate and generalize the results.

CONCLUSION

Based on the present study's findings, we conclude that Epworth questionnaire, Mallampati and Brodsky grading are associated with adult sleep disordered breathing.

Recommendations: Future studies are needed to clarify the associations between studied parameters, further use of imaging modalities such as ultrasound and shear wave elastography for tonsil tissue in order to refine diagnosis and management of the disease.

Disclaimer: The article has been extracted from thesis of corresponding author as part of her MPhil

project. The co-authors were working as faculty members and MPhil scholars (co-researchers) at Bahria University Health Sciences Campus Karachi, Pak during the same tenure.

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Dr. Ambreen Usmani	Study design, concept, supervisor throughout research, critically reviewed for the intellectual content and approved it.
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Dr. Mariya Azam Khattak	Study design, acquisition of data and manuscript writing, revised and approved the article.
Dr. Saneed Khaliq	Data acquisition, manuscript writing, Reviewed and approved the manuscript.
All authors are responsible for the integrity of the data and the accuracy of the data analysis.	
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