ORIGINAL ARTICLE

Relationship of Brodsky Tonsillar Grading in Adults with Age, Gender, and Anthropometric Measurements

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ABSTRACT

Objective: To determine the association of Brodsky Tonsillar Grading with age, gender, body mass index, and neck circumference in adults

Methodology: A cross-sectional study was conducted at PNS Shifa Hospital, Karachi from January to July 2020. A total of 54 adults with tonsillar hypertrophy were included. History and demographic details of each subject were noted. Both right and left tonsil sizes were graded using Brodsky Grading. Height, weight, and neck circumference was measured. Analysis was done using Statistical Package for Social Sciences 23.0.

Results: Age was associated significantly (p-value 0.0009) with Brodsky Tonsillar Grading for the right tonsil whereas it was insignificant for the left tonsil (p-value 0.25). Insignificant association between clinical grading of tonsils with gender (male n = 29, p-value 0.079 and female n =25, p-value 0.343) was found. Thirty one study participants were found to have normal BMI, 14 were overweight whereas 9 individuals were obese. Significant association was found between Brodsky Grading for right tonsil (p-value 0.014) and BMI. Statistically non-significant association was found between Brodsky Grading for left tonsil (p-value 0.216) and BMI. Regarding neck circumference and clinical grading, significant relationship was found with p-value 0.002 and 0.014 respectively.

Conclusion: Brodsky Tonsillar Grading was associated positively with age and BMI for the right side and with neck circumference for both the sides. Therefore clinical assessment of tonsils by grading and anthropometric measurements are helpful in recognition of patient's condition and treatment.

Key Words: Brodsky grading, body mass index, neck circumference, tonsil

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INTRODUCTION

Acute tonsillitis is the inflammation of one or both tonsillar tissues with fever, malaise, odynophagia, swelling, and hyperemia of these structures. It may be associated with exudate or cervical lymphadenopathy[1]. It is usually viral in origin and may occur in epidemic form superimposed by bacterial infection, most commonly beta hemolytic streptococcus. Staphylococci, pneumococci, hemophilus influenza and moraxella catarrhalis are also involved in the pathogenesis of the condition[2]. Whereas, chronic infection comprises recurrence of acute attacks, usually five or more attacks of true tonsillitis in a year and persistence of symptoms for about twelve months which include chronic throat discomfort, pain, enlarged tonsils, palpable tender jugulodiagastric lymph nodes, and foetororis[3].

An ultrasonographic study reported that the size of palatine tonsils differs in different age groups[4]. The study reports that the variation in size of palatine tonsils depended upon age, distinctiveness of an individual, and disease status. It also found a prompt increase in the size of tonsils at about fifth or sixth year of age attaining maximum size at adolescence. It further described that tonsil size was associated with anthropometric indices like age, weight, and height, with strongest correlation with height.

Another study depicting the magnitude of otorhinolaryngological illnesses in Pakistani population shows that the greatest frequency of patients who came to the

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hospital and were admitted, included pharyngeal issues with (31.04 %) prevalence, out of whom majority were with tonsillitis (54.54 %); Others reported with nasal disease (29.01 %), ear disease (16.71 %), oral and laryngeal disease[5].

The clinical presentation of patients with acute or chronic inflammation of tonsils differs in etiology, most commonly presenting with fever, difficult or painful swallowing, enlarged and erythematous tonsil. The highest manifestation of hypertrophic tonsil with obstructive symptomatology includes obstructive sleep apnoea (OSA). Therefore clinical examination should include identification of risk factors of OSA such as overweight or obese subjects, increased neck circumference, age above 40 years, nasal obstruction, and hypertrophic tongue. Tonsillar hypertrophy is classified using Brodsky Grading Scale which is a standard method used worldwide. Preoperative assessment of tonsil size via clinical grading was found to be associated with actual tonsil volume measured by physical methods. Furthermore, age and BMI are the independent influencing factors affecting tonsil size[6].

Clinical assessment of tonsils was done in the present study using Brodsky Tonsillar Grading Scale, which is easily performed and clinically practical. A Chinese prospective study evaluated three tonsil grading scales including Brodsky Grading Scale, 3-Grade Scale, and 5-Grade Scale and demonstrated that the Brodsky Tonsillar Grading Scale produced better intra observer and inter-observer reproducibility[7]. A modified 3-Grade Scale had extensive grade interval and therefore can have greater chances of error because of repeated measurements. Providing an actual elucidation is difficult, as we feel that our eyes detect halves and quarters more easily than thirds, the study stressed[7]. Many researches have linked obesity with cardiovascular, renal diseases, diabetes mellitus, and otorhinolaryngological conditions, with raised mortality rates. Mean Body Mass Index (BMI) and obesity has been related with leading inflammatory conditions in otorhinolaryngology involving tonsillitis, rhinosinusitis, and otitis media in adults[8].

Regarding anthropometric measurements, neck circumference has gained importance as it is simpler, easy to measure, and more practical, not influenced by the last meal or clothing. A Pakistani cross sectional study validates the significance of it as a measure of general and central adiposity as a screening tool for determination of obesity[9]. This research found a cut off value of neck circumference for overweight subjects to be greater than 35.5 cm in men and 32 cm in women; Further, collar size correlates well with other anthropometric measurements such as weight, waist circumference, age, hip circumference, waist to hip ratio, and BMI for men and women, the study found[9].

Another cross sectional study revealed neck circumference as a significant risk indicator for metabolic states and may be vital in identification of visceral and central adiposity in healthcare settings primarily, in primary health care units, and in research projects[10]. The study recommended that anthropometric measurements should be assessed when expensive instruments and various equipment are not available. This technique is helpful in measuring in pregnant ladies on whom, traditional measures might become challenging or not possible, it pointed out[10].

Physical examination of upper airway anatomy by an ENT specialist can give a clue to the severity of OSA. Other undervalued variables like age, gender, BMI, collar size, narrowness of anterior pillars, tongue, and tonsillar grading should be considered as they are related with the seriousness of OSA[11].

This research was conducted to study the influencing factors for the association of Brodsky Tonsillar Grading with age, gender, and anthropometric measurements.

METHODOLOGY

This cross sectional study was conducted at the ENT (Ear, Nose, and Throat) and Radiology Departments of PNS Shifa hospital, Karachi from January to July 2020. Ethical approval letter with reference No: ERC 09/2020 was issued by the Ethical Review Committee of Bahria University Medical and Dental College before commencement of data collection.

OpenEpi version 3, which is an Internet source, was used for sample size estimation. At 95% confidence interval, and 5% margin of error, sample size was calculated to be 45 for tonsillar hypertrophy. However, 54 subjects were included with hypertrophic tonsils and age ranges from 18 to 60 years. Exclusion criteria of the study comprised children and subjects above 60 years. Those who gave history of tonsillectomy, trauma, malignancy, Cushing's disease, thyroid disorders, and pregnant and lactating women were excluded from the study.

Informed consent was signed by each participant before enrollment and pro forma was filled by the principal investigator which included a brief history obtained from each subject, demographic data, and physical examination with tonsillar grading by otorhinolaryngologist first and then by the principal investigator to decrease subjectivity.

Brodsky Tonsillar Grading was used in the present study. The morphological features were evaluated while the patients were sitting calmly with spontaneous breathing. Tonsils were graded as follows:

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 oropharynx
Grade III: 50% to 75% occlusion of the oropharynx occupied
Grade IV: Greater than 75% of the oropharynx occupied, completely obstructing the airway

Height in meters and weight in kilograms were noted for calculation of BMI. Neck circumference was measured by using non flexible plastic tape, in the midline below the laryngeal prominence and perpendicular to the long axis of the neck. The minimal circumference was recorded to the nearest 0.1 cm, while the subject was asked to look straight with shoulders down but not bent. Care was taken not to include neck/shoulder muscle such as trapezius in the recording of measurement. Cut off values for neck circumference was taken to be 42cm in males and 37.5cm in females.

Data were coded and SPSS version 23 was used for statistical analysis. Results were expressed as mean ± standard deviation for quantitative variables and number (percentages) for qualitative variables. The data was analyzed for normality. Chi-Square test was applied to see the association of tonsil grading with gender and BMI. One Way ANOVA was used to see the association of clinical grading with age and neck circumference. The results were considered as significant when p-value was = 0.05.

RESULTS

In the present study, the maximum number of study participants were males 29 (54%) whereas 25 (46%) were females with mean age of 24.72 years ± 7.9 SD. Tonsillar hypertrophy was graded according to Brodsky Tonsillar Grading. There were 54 reported patients with 108 tonsils out of which 5 (5%) tonsillar tissues were graded as grade I, 60 (56%) grade II, 34 (31%) grade III whereas 9 (8%) as grade IV. Thirty one (57.40%) out of 54 patients had asymmetric tonsils. Maximum number of patients were diagnosed with acute tonsillitis 26 (48.1%), recurrent tonsillitis 22 (40.7%), and with obstructive sleep apnoea 6 (11.1%).

Among males, 1(3%) had neck circumference = 42 cm whereas 28 (97%) had collar size = 42 cm, regarding females, 8 (32%) individuals had neck circumference = 37.5 cm whereas 17 (68%) had = 37.5 cm. It was found in the present study that age associates significantly (p-value 0.0009) with Brodsky Tonsillar Grading for right tonsil whereas statistical non significance was found for left tonsil (p-value 0.25) as shown in Table 1. There was no statistically significant association between clinical grading of tonsils with gender (male n = 29 and female n =25) (p-value 0.079 and 0.343, respectively), as demonstrated in Table 2. Thirty one study participants were found to have normal BMI, 14 were overweight whereas 9 individuals were obese (Table 3). Significant association was found

Table 1: Association of Brodsky Tonsillar Grading with Mean Age n=54

Brodsky Tonsillar Grading (Right)	Number Sample (n)	Mean age ± SD	p-value
Grade I	3	29.67 ± 10.0	0.009*†
Grade II	32	22.84 ± 5.3	
Grade III	16	29.38 ± 9.7	
Grade IV	3	33.0 ± 7.9	
Brodsky Tonsillar Grading (Left)	Number Sample (n)	Mean age ± SD	
Grade I	2	21.0 ± 1.4	0.25 †
Grade II	28	25.21 ± 7.6	
Grade III	18	26.67 ± 9.2	
Grade IV	6	28.5 ± 1.6	

p-value = 0.05 is considered significant and shown with asterisk*
†-One way ANOVA was applied to see the significance
Unit used-Age in years
n=Total number of study participants

Table 2: Association of Brodsky Tonsillar Grading With Gender n=54

Brodsky Tonsillar Grading (Right)	Number Sample (n)	Female (n=25)	Male (n=29)	p-value
Grade I	3	0	3	0.079 ‡
		0 %	10.3 %	
Grade II	32	13	19	
		52 %	65.5 %	
Grade III	16	11	5	
		44 %	17.2 %	
Grade IV	3	1	2	
		4 %	6.9 %	
Brodsky Tonsillar Grading (Left)	Number Sample (n)	Female (n=25)	Male (n=29)	
Grade I	2	2	0	0.343 ‡
		8 %	0 %	
Grade II	28	12	16	
		48 %	55.2 %	
Grade III	18	7	11	
		28 %	37.9%	
Grade IV	6	4	2	
		16 %	6.9%	

p-value = 0.05 is considered significant
‡- Chi-Square test was applied to see the significance
n=Total number of study participants

Table 3: Association of Brodsky Tonsillar Grading Scale with BMI n=54

Brodsky Tonsillar Grading Right	BMI Normal	BMI Overweight	BMI Obesity	p-value
Grade I	2	1	0	
	6.5 %	7.1 %	0 %	
Grade II	23	7	2	
	74.2 %	50 %	22.2 %	
Grade III	6	4	6	
	19.4 %	28.6 %	66.7 %	0.014*‡
Grade IV	0	2	1	
	0 %	14.3 %	11.1%	
Total	31	14	9	
	100 %	100 %	100 %	
Brodsky Tonsillar Grading Left	BMI Normal	BMI Overweight	BMI Obesity	
Grade I	2	0	0	
	6.5 %	0 %	0 %	
Grade II	18	6	4	
	58.1 %	42.9 %	44.4 %	
Grade III	10	6	2	
	32.3 %	42.9 %	22.2 %	0.216‡
Grade IV	1	2	3	
	3.2 %	14.3 %	33. 3%	
Total	31	14	9	
	100 %	100 %	100 %	

p-value of = 0.05 is significant and shown with asterisk*
‡-Chi-Square test was applied to see the significance
Units used: BMI = body weight in kilograms/height in meters square. Normal BMI, 18.5-24.9; overweight, 25-29.9; and obesity, 30-34.9
n=Total number of study participants

between Brodsky Grading for right tonsil (p-value 0.014) and BMI. Statistically non-significant association was found between Brodsky Grading for left tonsil (p-value 0.216) and BMI. Regarding neck circumference and tonsillar grading, significant relationship was found between them for right and left tonsil with p-value 0.002 and 0.014 respectively as shown in Table 4.

Table 4: Association of Brodsky Tonsillar Grading With Mean Neck Circumference (n=54)

Brodsky tonsillar grading(Right)	Number Sample (n)	Mean Neck circumference ± SD	p-value
Grade I	3	34.00 ± 2.79	
Grade II	32	33.53 ± 2.69	
Grade III	16	35.71 ± 3.83	0.002*†
Grade IV	3	40.57 ± 2.06	
Total	54	34.59 ± 3.45	
Brodsky tonsillar grading (Left)	Number Sample (n)	Mean Neck circumference ± SD	
Grade I	2	32.30 ± 0.00	
Grade II	28	33.83 ± 3.39	
Grade III	18	34.72 ± 2.92	0.014*†
Grade IV	6	38.53 ± 3.36	
Total	54	34.59 ± 3.45	

p-value of =0.05 is significant and shown with asterisk*
†: One Way ANOVA was applied to see the significance
Units used: centimeter (cm) for measurement of neck circumference
n=Total number of study participants

DISCUSSION

Preoperative assessment of tonsil size is important in clinical practice as narrow pharyngeal cavity has critical impact on pathophysiology of pharyngeal diseases such as OSA. Tonsillectomy is regarded as an effective treatment to enlarge pharyngeal cavity. Thus size of tonsillar tissue is an essential parameter for tonsillectomy[12].

There are many methods for evaluation of tonsil size. Brodsky Scale is used widely and is a classical method. The advantage of this scale involves easy implementation and less cost whereas certain factors that affect the accuracy of this scale include entrenched tonsils, subjective assessment of the physician, and nearby anatomical structures. Pre-surgical evaluation of tonsillar tissue can be done by imaging modalities like computed tomography (CT), magnetic resonance imaging (MRI) and ultrasound for multidimensional evaluation of pharyngeal anatomy[13].

Authors of a cross sectional study conducted on adults revealed the coherent correspondence between clinical and objective tonsillar dimensions and added that Brodsky Grading was more effectively linked with OSA severity than actual palatine tonsillar volume. The current study also revealed that patients who were diagnosed with OSA had higher tonsillar grading like grade III and IV[14].

Authors of a recent ultrasonographic study showed that subjective grading and USG volumes had no effect in adults but tonsillar size increases in children with age. The current study involved adult participants and showed insignificant relationship of tonsillar grading with age, as tonsillar size increases in childhood and stabilizes thereafter. Effect of BMI which was considered in their study showed no impact on tonsil volume in children and adults which concurs with the present study findings[15].

In the present study, data was analyzed separately for right and left sided tonsils. Statistically non-significant association with age was found in the present study for the left side whereas significant association was found for the right side. A study conducted in 2019 estimated association of clinical grading in subjects with hypertrophic tonsils, with or without sleep disordered breathing. Non-significant difference was found between subjective tonsil sizes, age, and obesity[16].

Authors of a research showed that tonsil volume augments with age but not with height or weight. Whereas the current study reported significant association of clinical grading with age and BMI for the right side and non-significant for the left side. Therefore, more exploration is required to study the effect of obesity on the size of tonsil[17].

Hypertrophic tonsils and recurrent tonsillitis can cause difficulty in swallowing, OSA, and body growth disturbance. Still, the relationship between BMI and hypertrophic tonsil is controversial. In terms of clinical grading, right tonsil showed significant results in the current study and the left showed non-significant relationship with BMI. Many studies in literature compare tonsillar hypertrophy with BMI in paediatric age group but very few studies have been conducted in adults. Lai et al, have reported that BMI, pharyngeal anatomy, and anthropometric measurements do not reflect the size of tonsils in adults[18].

A study conducted by Venkatesha, Yogeesha, and Asha, reported non-significant correlation of clinical grading with BMI[19]. Therefore more studies are required to resolve this question.

The current study found insignificant association of clinical tonsillar grading with gender. We did not find any study in the literature that determines this association.

Narang et al. have reported that hypertrophic tonsils and anthropometric measurements like neck circumference and height measurements may have predictive ability for OSA and these parameters can be utilized in ambulatory settings in order to screen high risk obese young population[20]. The present study's results remain steady in procuring statistically significant results for relationship between clinical grading of tonsil and neck circumference. Similarly in the current study, subjects diagnosed with OSA had tonsillar hypertrophy of grade III and IV.

Likewise, Ho, Moul, Krishna showed in their retrospective study that neck circumference was significantly linked with OSA patients reporting with tonsillar hypertrophy[21].

Findings of the present study contradict the results of Venkatesha, Yogeesha, and Asha in which they reported non-significant correlation between clinical grading and neck circumference in adults, and propose that these predictive factors might be of significance in OSA subjects in contrast with patients with recurrent tonsillitis[19].

The current research had certain limitations, such as small effective sample size involving 54 reported subjects with 108 tonsils. Therefore, future studies with larger sample sizes are needed to generalize the results. It was a single institution study and enrolled adult participants, whereas more studies are required which involve all age groups for development of better association of studied parameters. Predictive accuracy of clinical grading influenced by various subjective factors therefore, more comprehensive techniques such as multidimensional imaging like MRI, CT, or ultrasound, are needed when assessing patients for better decision-making and treatment of patients.

CONCLUSION

Clinical assessment of tonsils by Brodsky Grading is an essential aspect of evaluation of patients receiving surgical care. Clinical grading was found to be linked with age and BMI for the right side and with neck circumference for both the sides. Therefore, subjective grading along with assessment of anthropometric parameters are helpful for better recognition of patient's condition and treatment.

Conflict of Interest: The authors declare that they have no conflict of interest.

Author's contribution: AM: Conceive the idea, design, data collection, analysis and interpretation, manuscript writing; YM: Data collection, literature search, and manuscript writing; SK: Review and manuscript editing; RR: Statistical analysis, writing of results and critical review of article; MA: Data collection, critical review of manuscript, literature search; SS: Data collection, literature review, editing of manuscript.

REFERENCES

1. Watkinson JC, Clarke RW. Scott-Brown's Otorhinolaryngology and Head and Neck Surgery.8th ed. CRC Press; 2018.
2. Udaipurwala I. Principles and Practice of Oto-rhino-laryngology. 6th ed. Karachi.Paramount.2017.
3. Anderson J, Paterek E. Tonsillitis. StatPearls. 2021. 4. Ozturk M. Ultrasonographic measurement of palatine tonsil size and its correlation with body-mass index and hepatosteatosis in adolescents. J .Turgut Ozal Med. Cent. 2017; 24 (3):1.
5. Rafi MT, Mehboob S, Aftab K, Saify Z said, Rehman U. Prevalence and Possible Surgical Intervention of Ear, Nose and Throat Diseases in Local Population of Pakistan. J Pharm Pharm Sci. 2017; 3(8):137.
6. Lu X, Zhang J, Xiao S. Correlation between Brodsky tonsil scale and tonsil volume in adult patients. Biomed Res Int. 2018; 24; 2018:6434872.

7. Ng SK, Lee DLY, Li AM, Wing YK, Tong MCF. Reproducibility of clinical grading of tonsillar size. Arch Otolaryngol Head Neck Surg. 2010;136 (2):159-162,
8. Kim TH, Kang HM, Oh IH, Yeo SG. Relationship between otorhinolaryngologic diseases and obesity. Clin Exp Otorhinolaryngol. 2015; 8 (3):194-197.
9. Hingorjo MR, Qureshi MA, Mehdi A. Neck circumference as a useful marker of obesity: a comparison with body mass index and waist circumference. J Pak Med Assoc. 2012; 62 (1):36–40.
10. Joshipura K, Muñoz-Torres F, Vergara J, Palacios C, Pérez CM. Neck circumference may be a better alternative to standard anthropometric measures. J Diabetes Res. 2016; 2016:1–8.
11. Yagi H, Nakata S, Tsuge H, Yasuma F, Noda A, Morinaga M, et al. Morphological examination of upper airway in obstructive sleep apnea. Auris Nasus Larynx. 2009; 36(4):444–9.
12. Davoodreza S. Correlation of tonsillectomy with palatine tonsil size. Acta Med Iran. 2011; 49 (5):305–6.
13. Ozturk M, Kilinc T. Sonographic measurement of palatine tonsil volume in children and comparison with actual volume. Med Science. 2017;6(4):685-8
14. Jara SM, Weaver EM. Association of palatine tonsil size and obstructive sleep apnea in adults: Tonsil Size and Sleep Apnea in Adults. The Laryngoscope. 2018; 128 (4):1002–6.
15. Saðtaþ E, Mengi E, Kara CO, Þenol H. A Novel assessment method with ultrasound for obstructive tonsillar hypertrophy in children. J Ultrasound Med. 2021;40(9):1795–801
16. Kaditis AG, Lianou L, Hatzinikolaou S, Kalampouka E, Gartagani-Panayiotopoulou P, Zintzaras E, et al. Tonsillar size in 2- to 14-year-old children with and without snoring: Tonsillar Size in 2- to 14-Year-Old Children. Pediatr Pulmonol. 2009; 44(12):1216–22.
17. Hong HS, Lee JY, Jeong SH. Normative Values for Tonsils in Pediatric Populations Based on Ultrasonography. J Ultrasound Med. 2018;37(7): 1657–63.
18. Lai C-C, Friedman M, Lin H-C, Wang P-C, Hsu C-M, Yalamanchali S, et al. Objective versus subjective measurements of palatine tonsil size in adult patients with obstructive sleep apnea/hypopnea syndrome. Eur Arch Otorhinolaryngol. 2014; 271(8):2305–10.
19. Venkatesha BK, Yogeesha BS, Asha M. Clinical grading of tonsils: does it truly represent total tonsil volume in patients with recurrent tonsillitis. Int J Otorhinolaryngol Head and Neck Surg. 2017; 3(2):354-8.
20. Narang I, Al-Saleh S, Amin R, Propst EJ, Bin-Hasan S, Campisi P, et al. Utility of Neck, Height, and Tonsillar Size to Screen for Obstructive Sleep Apnea among Obese Youth. Otolaryngol Head Neck Surg. 2018; 158(4):745–51.
21. Ho AW, Moul DE, Krishna J. Neck circumference-height ratio as a predictor of sleep related breathing disorder in children and adults. J Clin Sleep Med. 2016; 12(03):311–7