Abstract

Objective: Compare subjective (0-4+ tonsil scale) and objective (tonsil weight, tonsil volume, intertonsillar distance) tonsil size measurements in the prediction of pediatric Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) severity by polysomnogram (PSG).

Study Design: Prospective cohort.

Subjects and Methods: Pediatric patients who meet indications for adenotonsillectomy underwent subjective oropharyngeal exam in which tonsil palate position were subjectively measured. At the time of adenotonsillectomy, tonsil volume (measured by volumetric displacement), weight (grams), and size (length, width, and height) were objectively measured along with simple pharyngeal dimensions such as intertonsillar distance, anterior and posterior pillar width, and hard palate length. Stepwise multivariable linear regression modeling was used to assess explanatory variables and the prediction of preoperative OSAHS severity as determined by overnight PSG. Analysis of residuals (Cook’s Distance) was used to assess the influence of possible outliers.

Results: Thirty-four pediatric patients (median age=4, range=2-9) were included. Objective tonsil weight (spearman’s rho=0.4960, p=0.0002, Figure 1), tonsil volume (spearman’s rho=0.7559, p<0.001, Figure 2), and intertonsillar distance (spearman’s rho=-0.7559, p<0.001, Figure 3) were strongly correlated with subjective (0-4+) tonsil size but not with age (spearman’s rho=0.0483, p=0.7928) or BMI (spearman’s rho=-0.0242, p=0.8217).

Stepwise multivariable linear regression modeling was used to assess the effect of various covariates on the dependent variable of preoperative apnea-hypopnea index (AHI). Stepwise modeling demonstrated that only age (β=-3.21, p=0.001), measured tonsil weight (β=1.43, p=0.003), and hard palate length (β=979, p=0.003) were significant predictors of preoperative apnea-hypopnea index (AHI) (β=0.5358). Subjective tonsil size, Mallampati score, Friedman palate position, BMI, and intertonsillar distance were not significant covariates.

Analysis of residuals for possible outliers was performed using residual plots and Cook’s Distance. This resulted in one possible outlier observation being removed. This resulted in only measured tonsil weight (p=0.046) persisting as a significant predictor (Figure 4). The final regression model is shown in Figure 5.

Conclusions: Subjective tonsil size measurements correlate well with objective tonsil volume measurements. However, only objective tonsil measurements were significantly predictive of objective PSG measured OSAHS severity.

Methods and Materials

Prospective Cohort. Children who met clinical indications of obstruction and received parental consent were recruited. Following informed consent and enrollment in the study: age, height, weight, BMI, vital signs, sleep history questionnaires and a quality of life instrument as well as physician assessment of tonsil size was recorded at the pre-operative visit. A pre-operative sleep study was obtained in all patients. Immediate pre-operative assessment of tonsil size and modified Mallampati score was obtained in the preoperative holding area by two surgical physicians. Intra-operative caliper measurements, tonsil and adenoid weight and volume after removal was recorded. Pre-operative sleep study data and questionnaires were obtained and evaluated.

Intra-Operative Measurements

- Soft palate length and uvula length/width
- Hard palate width
- Maxillary palatal length
- Anterior pillar length
- Tonsil Weight and dimensions
- Tonsil Volume

Other Measurements

- Tonsil Size (1-4+)
- Palate Position (Friedman)
- Adenoid Size (% obstructive)
- Pre-Op RDI/TIAI
- Post-Op RDI/TIAI
- OSA-18 QOL Survey

Bibliography


Introduction

Sleep disordered breathing (SDB) is a continuum of sleep related breathing disturbances and has become the leading indication for adenotonsillectomy in pediatric patients. Clinical assessment of SDB requires a thorough history, physical exam and detailed discussion about symptoms of SDB. These symptoms include snoring, chronic mouth breathing, hypernasal voice, dental abnormalities, restless sleep, daytime somnolence or hyperactivity, and enuresis nocturna.

Pediatricians often use physical exam findings of large tonsils to screen patients prior to referral for an oropharyngeal evaluation for SDB. Sleep history questionnaires/report of symptoms by parents is thought to be more predictive of dysfunction than physical exam findings alone, but has a high false positive rate when compared to polysomnography (PSG).

In a study by Brodsky, 33 patients with large tonsils scheduled for tonsillectomy for obstruction were compared with 18 patients with small tonsils and a history of chronic infection. Despite the obvious selection bias, these patients had interesting differences in the oropharyngeal measurements obtained. However, correlation of true size to the preoperative assessment of the tonsil and its relationship to severity of symptoms was not examined. To date there has been no study to correlate the visual inspection of the tonsils to their true size or relation to SDB symptoms or quality of life (QOL).

Results

Thirty-four non-obese (mean BMI=16.9, range = 12.5-20.9) pediatric patients (median age=4, range=2-9) with a chief complaint of sleep disordered breathing were included. Mean pre-operative AHI was 9.5 events/hour (range = 1-39 events/hour). Objective tonsil weight (spearman’s rho=0.6143, p=0.0002, Figure 1), tonsil volume (spearman’s rho=0.4960, p=0.0039, Figure 2), and intertonsillar distance (spearman’s rho=-0.7559, p<0.001, Figure 3) were strongly correlated with subjective (0-4+) tonsil size but not with age (spearman’s rho=0.0483, p=0.7928) or BMI (spearman’s rho=-0.0242, p=0.8217).

Stepwise multivariable linear regression modeling was used to assess the effect of various covariates on the dependent variable of preoperative apnea-hypopnea index (AHI). Stepwise modeling demonstrated that only age (β=-3.21, p=0.001), measured tonsil weight (β=1.43, p=0.003), and hard palate length (β=979, p=0.003) were significant predictors of preoperative apnea-hypopnea index (AHI) (β=0.5358). Subjective tonsil size, Mallampati score, Friedman palate position, BMI, and intertonsillar distance were not significant covariates.

Analysis of residuals for possible outliers was performed using residual plots and Cook’s Distance. This resulted in one possible outlier observation being removed. This resulted in only measured tonsil weight (p=0.046) persisting as a significant predictor (Figure 4). The final regression model is shown in Figure 5.

Conclusions

Objective tonsil measurements (weight, volume, and measured inter-tonsillar distance) correlate well with subjective (0-4+) tonsil size. However, only one objective tonsil measurements (weight) correlated with pre-operative obstructive sleep apnea severity. This suggests that true tonsil size, not necessarily the intra-oral subjective size assessment, is the best predictor of sleep disordered breathing severity.

Pediatric Tonsil Size: Objective vs. Subjective Measurements

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