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Adenotonsillectomy Effects on Obstructive Sleep Apnea and Quality of Life in Children Under 5

Dr. Faraqid Jabbar Sharhan[1], Dr. Ali Fleih Joada[2] and Dr. Wasen Nasur Hussian[3]

[1]M.B.Ch.B., C.A.B.P. \ (Pediatrics), Iraqi Ministry of Health, Thi-Qar Health Directorate, Department of Pediatrics, Al-Shatra General Hospital, Thi-Qar, Iraq.

[2]M.B.Ch.B., F.I.C.M.S., C.A.B.M.S. (Otorhinolaryngology and Head & Neck Surgery) Iraqi Ministry of Health, Thi-Qar Health Directorate, Department of Otorhinolaryngology and Head & Neck Surgery, Al-Shatra General Hospital, Thi-Qar, Iraq.

[3]M.B.Ch.B., C.A.B.P. \ (Pediatrics), Iraqi Ministry of Health, Al-Russafa Health Directorate, Fatimah Al-Zaharaa Hospital for Gynaecology and Pediatrics, Baghdad, Iraq.

Abstract: This paper examines the effects of adenotonsillectomy on children aged below 5 years with obstructive sleep apnea (OSA), in terms of clinical outcomes and quality of life. The study was a cross-sectional study on 103 patients who had a mean age of 41.2 months. The polysomnographic results in the postoperative period revealed a notable decrease in apnea-hypopnea index (AHI) of 18.6 occurrences per hour before surgery to 4.1 occurrences per hour after surgery, and other measures of oxygen saturation and the quality of sleep were also increased. The quality of life was evaluated with the help of the OSA-18 questionnaire, which revealed the dramatic postoperative improvement of the quality of life as the mean score dropped to 38.2. There were high reports of symptom resolutions, such as snoring, with 92.2% of the parents reporting the resolution of loud snoring and general improvement in the symptoms, but some of the patients still reported residual OSA symptoms. Multivariate analysis had found preoperative AHI, obesity, and the existence of asthma to be primary foretellers of continuant postoperative OSA. To sum up, adenotonsillectomy in children who are below the age of five with OSA is related to a significant decrease in the severity of the disease and significant changes in quality of life, though there is still a group of patients who continue to experience the symptoms.

Keywords: Adenotonsillectomy, Obstructive Sleep Apnea, Children, and Quality Of Life Questionnaire.

INTRODUCTION

Adenotonsillectomy is also a surgery which is undertaken in case of children having obstructive sleep apnea (OSA), especially when hypertrophy of the adenotonsillar plays a significant role in airway obstruction [Bamaniya, H. *et al*., 2020; Demirhan, H. *et al*., 2010]. This procedure can be significant in respiratory health, behavior, and quality of life of children below the age of five. Recurrent episodes of partial or total obstruction of the upper airways during sleep are features that characterize OSA in early childhood that can result in intermittent hypoxia, sleep fragmentation, and consequently daytime effects like hyperactivity, attention deficit, and mood swings [Greenfeld, M. *et al*., 2003; Escarrá, F., & Vidaurreta, S. M. 2015; Caixeta, J. A. S. *et al*., 2021]. The most common cause identified in pre-school-aged children is adenotonsillar hypertrophy, and surgical excision can be a reasonable therapeutic option in most cases [Kurnatowski, P. *et al*., 2008]. Adenotonsillectomy is aimed at eliminating airway obstruction and increasing objective measures of sleep, but the end product is to improve the functioning of the day and the well-being of the family [Kurnatowski, P. *et al*., 2006]. The concept of QoL in this group includes physical health, social interaction, emotional well-being, and school readiness that could be also improved with the help of better sleep quality [Kim, D. K., & Han, D. 2015]. Adenotonsillectomy in children younger than five years with OSA results in significant, objective improvements in nighttime breathing as well as in daytime QoL indicators, in addition to identifying the risk, recovery patterns, and likelihood of postoperative persistent or recurrent symptoms in some patients [Kang, K. T. *et al*., 2014; KAVANAGH, K. T., & BECKFORD, N. S. 1988]. The interaction of objective changes in sleep-disordered breathing with the subjective references to well-being is the key to comprehending the complete effect of the surgery [Imanguli, M., & Ulualp, S. O. 2016]. The severity and QoL of OSA and comorbidity affect both the severity and the quality of life regardless of surgery [Franco Jr, R. A. *et al*., 2000].

METHOD

The paper used the cross-sectional cohort design to identify the effect of adenotonsillectomy on obstructive sleep apnea (OSA) among children under the age of five years. Patients with clinically diagnosed OSA who had adenotonsillectomy were identified in consecutive order. The study used a dataset of 103 patients of different hospitals in Iraq

*Corresponding Author: Dr. Faraqid Jabbar Sharhan

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whose average age was 41.2 months (3.4 years) and a 12-month follow-up period between March 2025 and March 2026 based on the medical records. Clinical records and polysomnography (PSG) reports were used to extract pre- and post-operative data. The change in the apnea-hypopnea index (AHI), which is a standard PSG-based measure of the severity of sleep-disordered breathing, was the main result. The secondary outcomes were nocturnal oxygen saturation measures, sleep quality measures, and health-related quality of life (HRQoL) measured with the OSA-18 survey, which is a reliable pediatric tool. Osa-18 includes domains focused on sleep disturbance, physical symptoms, emotional well-being, limitations in daytime activities, and concerns of the caregiver. Data on pre-operative measures was gathered one month before surgery; post-operative measures done at least three months after surgery, so that stabilization of the sleep parameters and adaption to the postoperative changes could occur. SPSS, version 26.0, described the samples of the patients with descriptive statistics. Primary analysis involved pre- and post-operative comparison of AHI by using a paired statistical test that suited continuous data that was not normally distributed; the type of test used (e.g., Wilcoxon signed-rank) depended on the tests of normality. Analysis of secondary outcomes was done in the same manner to the PSG-derived oxygenation indices and HRQoL scores. The level of statistical significance was set at 0.05 at two-sided. The regression models used in multivariate analyses to determine predictors of persistent OSA were used after surgery by taking pre-operative AHI, obesity status, and comorbid asthma to be candidate predictors.

RESULTS

Table 1. Enroll the basics data of 103 patients who participated in this study.

Characteristic	Value
Age, months (Mean ± SD)	41.2 ± 10.8
Sex, n (%)	
Male	62 (60.2%)
Female	41 (39.8%)
BMI z-score (Mean ± SD)	1.2 ± 1.5
Comorbidities, n (%)	
Asthma/Reactive Airway Disease	28 (27.2%)
Allergic Rhinitis	22 (21.4%)
Preoperative AHI, events/hr (Mean ± SD)	18.6 ± 12.4
Preoperative OSA-18 Total Score (Mean ± SD)	82.5 ± 14.3

Table 2. Primary Polysomnographic Outcomes Pre- and Post-Operative during 12 months.

Parameter	Pre-Op (Mean ± SD)	Post-Op (Mean ± SD)	p-value
Apnea-Hypopnea Index (AHI) (events/hr)	18.6 ± 12.4	4.1 ± 5.8	<0.001
Oxygen Nadir (%)	82.1 ± 6.5	90.5 ± 3.2	<0.001
Total Sleep Time with SpO_2 <90% (%)	8.4 ± 11.2	1.1 ± 2.5	<0.001
Peak End-Tidal CO_2 (mmHg)	53.8 ± 4.9	48.1 ± 3.1	<0.001

Table 3: Surgical Outcome Based on AHI Criteria (N=103).

Variables	Categories in after the operative AHI	Patients	Percentage
Cure	AHI <1	31	30.1%
Resolution	AHI <5	68	66.0%
Residual OSA	AHI ≥5	35	34.0%
Residual Severe OSA	AHI ≥10	12	11.7%

Table 4: Change in OSA-18 Quality of Life Survey Scores (N=103).

OSA-18 Domain	Pre-Op Score (Mean ± SD)	Post-Op Score (Mean ± SD)	Change (Mean ± SD)
Sleep Disturbance	4.5 ± 0.6	2.1 ± 0.9	-2.4 ± 0.8
Physical Symptoms	4.2 ± 0.7	1.8 ± 0.7	-2.4 ± 0.7
Emotional Distress	3.8 ± 0.9	1.7 ± 0.8	-2.1 ± 0.9
Daytime Function	3.6 ± 1.0	1.6 ± 0.7	-2.0 ± 0.9
Caregiver Concerns	4.1 ± 0.8	1.5 ± 0.6	-2.6 ± 0.7

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Total Score	82.5 ± 14.3	38.2 ± 11.5	-44.3 ± 12.1

Table 5: Clinically Significant Improvement in Quality of Life (OSA-18).

Change in Total Score	n	%
≥ 30 points	92	89.3%
14 - 29 points	9	8.7%
< 14 points	2	1.9%

Table 6: Assessment of clinical outcomes of symptoms reported by parents during 12 months of follow-up.

Symptom	Pre-Op Prevalence	Completely Resolved	Improved but Persistent	Unchanged/Worse
Loud Snoring	103 (100%)	95 (92.2%)	7 (6.8%)	1 (1.0%)
Witnessed Apneas	87 (84.5%)	80 (92.0%)	6 (6.9%)	1 (1.1%)
Mouth Breathing	98 (95.1%)	75 (76.5%)	20 (20.4%)	3 (3.1%)
Nighttime Choking/Gasping	71 (68.9%)	65 (91.5%)	5 (7.0%)	1 (1.4%)

Table 7: Post-Operative Complications.

Complications	n	%
Primary Hemorrhage (<24h)	1	1.0%
Secondary Hemorrhage (>24h)	4	3.9%
Dehydration	11	10.7%
Respiratory Distress	2	1.9%

Table 8: Evaluation of the AHI severity of pre-operative AHI severity in comparison with post-operative.

Pre-Op Severity	n	Mean Pre-Op AHI (SD)	Mean Post-Op AHI (SD)	Resolution Rate (AHI<5)
Mild (AHI 1-5)	15	3.2 (1.1)	1.5 (1.0)	100% (15)
Moderate (AHI 5-10)	33	7.5 (1.4)	2.8 (2.1)	87.9% (29)
Severe (AHI >10)	55	29.8 (10.1)	6.2 (7.5)	43.6% (24)

Table 9: Multivariate analysis to assess factors predicting the persistence of obstructive sleep apnea.

Predictor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Pre-Op AHI (per 5-unit increase)	1.45	1.18 - 1.79	<0.001
Obesity (BMI z-score >2)	3.82	1.52 - 9.60	0.004
Presence of Asthma	2.31	0.92 - 5.80	0.074
Age <36 months	1.90	0.78 - 4.62	0.158

DISCUSSION

The purpose of the current cross-sectional study was to measure the impact of adenotonsillectomy on the severity of obstructive sleep apnea (OSA) and health-related quality of life (QoL) of children under the age of 5 years. Surgery led to significant improvements in objective polysomnographic outcomes as well as parent-reported QoL outcomes of a cohort of 103 (mean age 41.2 months). The Apnea-hypopnea index (AHI) decreased to 18.6-4.1 pre- and post-operative events/hr, respectively ($p < 0.001$). In line with a general decrease in sleep-disordered breathing [Al-Iede, M. *et al*., 2024], oxygenation was enhanced significantly: the oxygen nadir rose to 90.5% as compared to 82.1% ($p < 0.001$), and the percentage of total sleep time when oxygen saturation was below 90 percent decreased to 1.1% as compared to 8.4%. Moreover, it seemed that ventilatory monitoring was also enhanced, which was facilitated by the decrease in peak end-tidal CO 2 (53.8 to 48.1 mmHg, $p<0.001$). The results correspond with a study of the effect of the adenotonsillectomy in pediatric OSA, which indicates that the procedure is extremely effective in OSA that is mostly driven by adenotonsillar hypertrophy [Garetz, S. L. *et al*., 2008]. QoL had improved significantly in our study. The OSA-18 total score dropped to 38.2 at the end of the operation after having been 82.5 at the start of the operation ($p < 0.001$). Domain level also showed improvement, and these included sleep disturbance, physical symptoms, emotional distress, daytime functioning, and caregiver concerns [Goldstein, N. A. *et al*., 2002; Section on Pediatric Pulmonology, & Subcommittee on Obstructive Sleep Apnea Syndrome. 2002]. A substantial percentage of children recorded a 30-

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point or more point change of clinical importance [Sarmah, U. *et al*., 2019]. The age of the cohort (younger than 5 years) was relatively young, in which the residual OSA following adenotonsillectomy has been reported more commonly than in older children because of the effect of developmental airway factors and co-morbidities. In the paper, there is a positive residual disease trend; OSA hounding children who were followed-up with 34 percent of children described as AHI 5 events/hr and 11.7 percent of those with more severe residual disease (AHI 10). This percentage of residual OSA falls within the ranges that are usually found in some studies, particularly when the baseline AHI is excessive, or there are risk factors which concur with the validity of the results externally [Ishman, S. L. *et al*., 2015; Ishman, S. L. *et al*., 2015]. Asthma did not pass the conventional methods of statistical significance (adjusted OR 2.31, p = 0.074), but the effect size implies the existence of a clinically relevant risk, as observed previously that the presence of lower airway inflammation and reactive airway disease could result in continued upper airway collapsibility and sleep fragmentation [Lima Júnior, J. M. D. *et al*., 2008; Schneuer, F. J. *et al*., 2022]. Airway obstruction and collapsibility due to adiposity effects are promoted by obesity, whereas nocturnal breathing instability may be worsened by asthma and its associated inflammation. Parent-reported symptom resolution was good, but not perfect: loud snoring had been resolved in 92.2 percent of the children, and the majority of respiratory symptoms improved, although a small subgroup had the same findings or had no improvement.

CONCLUSION

In children younger than 5 years of age with obstructive sleep apnea, adenotonsillectomy resulted in significant results in disease severity and daily functioning, and polysomnographic apnea-hypopnea index (AHI) dropped to 4.1 events/hour ($p < 0.001$), and the quality of life was significantly better, as measured by the OSA-18 scale (82.5 to 38.2; $p < 0.001$). Such findings support the use of adenotonsillectomy as an effective first-line intervention of this age group and report physiologic utility to a level of the achievement of significant symptom and functional reduction. However, there was no uniform finding that sleep-disordered breathing was normalized in the post-operative period: a subgroup of children with residual/persistent OSA-related features and multivariate analysis found increased preoperative AHI, obesity, and asthma, as the best predictors of persistence.

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