International Journal of Pediatric Otorhinolaryngology 79 (2015) 210–215

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Quality of life after adenotonsillectomy in children with obstructive sleep apnea: Short-term and long-term results

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ARTICLE INFO

Article history:
Received 26 September 2014
Received in revised form 4 December 2014
Accepted 9 December 2014
Available online 16 December 2014

Keywords:
Adenoidectomy
Child
Polysomnography
Quality of Life
Sleep apnea syndromes
Tonsillectomy

ABSTRACT

Objective: To assess short-term and long-term changes in quality of life after adenotonsillectomy (T&A) in children with obstructive sleep apnea (OSA).
Materials and methods: Children aged 2–18 years old were enrolled. All subjects had clinical symptoms, overnight polysomnography diagnosis of OSA, and received T&A as treatment. Caregivers were asked to complete the OSA-18 survey before surgery, within 6 months after surgery (short-term), and more than 6 months after surgery (long-term).
Results: A total of 114 children were included (mean age, 7.0 ± 3.5 years; 75% boys). The mean OSA-18 total score was 71.5 ± 16.0 before surgery. After surgery, the mean OSA-18 total score was significantly decreased in both the short-term (40.3 ± 12.2, $p < 0.001$) and the long-term (42.0 ± 13.7, $p < 0.001$). All five OSA-18 domains were also significantly decreased during short-term and long-term postoperative follow up ($p < 0.001$). Short-term and long-term outcomes were compared. Mean OSA-18 total scores, sleep disturbance score, emotional distress score, daytime function score, and caregiver concerns score did not differ significantly between the short-term and long-term periods, while the physical symptom score was slightly higher in the long-term than the short-term period (9.7 ± 3.3 vs. 8.7 ± 3.0, $p = 0.02$). Additionally, the physical symptoms score was higher in the long-term period in the female ($p = 0.01$), older age (>6 years) ($p = 0.03$), and non-obese ($p = 0.04$) subgroups.
Conclusion: T&A improves short-term and long-term quality of life in children with OSA. Nevertheless, caregivers observed children with aggravation of physical symptoms of quality of life during long-term follow up, especially in the female, older, and non-obese subgroups.
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1. Introduction

Obstructive sleep apnea (OSA) in children is a respiratory disorder characterized by upper airway collapse during sleep [1,2], and had a prevalence of 1–3% [3]. Diagnosis is based on clinical symptoms, physical examinations and sleep studies [1,2]. Polysomnography (PSG) is the gold standard for establishing the presence and severity of OSA [1,2,4]. Hypertrophy of the adenoid and tonsils are the main causes of OSA in children [2,5]. Adenotonsillectomy (T&A) thus is widely recognized as an effective first-line therapy for childhood sleep apnea [6–10].

The impacts of childhood OSA on quality of life have recently begun to attract growing research attention [11–14]. Measuring quality of life in children requires using self- or caregiver-administered instruments to quantify impact on emotional state, physical symptoms, and family interaction. Among quality of life measures, the obstructive sleep apnea 18-items Quality of Life Questionnaire (OSA-18) is a disease-specific tool widely applied to

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http://dx.doi.org/10.1016/j.ijporl.2014.12.011
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pediatric obstructive sleep disorders [10,12–14]. Pertinent studies found that pediatric OSA had significantly impacted quality of life [14–16]. Furthermore, children with OSA achieved significant short-term and long-term quality of life improvements after T&A, as documented by changes in OSA-18 scores [14,17,18]. However, demographic factors affecting short-term and long-term changes in quality of life after surgery have not been well studied and thoroughly understood.

This study elucidates short-term and long-term quality of life outcomes after T&A in children with OSA. It then investigates the trajectories of quality of life changes after surgery and elaborates whether postoperative quality of life changes be maintained over the long-term among different subgroups (that is, age, gender, adiposity, and disease severity).

2. Materials and methods

2.1. Study population

The study protocol and informed consent to undergo questionnaires were approved by the Ethics Committee of the National Taiwan University Hospital. From January 2011 to May 2013, children aged 2–18 years were recruited from clinics. Initially, our participants were recruited from the respiratory, pediatric, and otolaryngologic clinics. Children with symptoms suggestive of sleep-disordered breathing (including snoring, mouth breathing, daytime sleepiness, hyperactivity, or witness breath pause) were then sent to otolaryngologic clinic for historical (symptoms) and anatomical (adenotonsillar size) assessments [19]. Basic data, clinical history, physical examination were taken. The tonsils were graded using the scheme by Brodsky et al. [20] as follows: (grade I) small tonsils confined to the tonsillar pillars; (grade II) tonsils extending just outside the pillars; (grade III) tonsils extending outside the pillars, but not meeting in the midline; grade IV) large tonsils that meet in the midline. Adenoid size was determined based on the measure of adenoidal–nasopharyngeal (AN) ratio identified in lateral cephalometric radiograph. The AN ratio was measured as the ratio of adenoidal depth to nasopharyngeal diameter using the method of Fujioka et al. [21] Children with AN ratio ≥ 0.5 or tonsil grade ≥ 2 underwent T&A for the treatment of OSA. The weight and height of each child were measured, and used to calculate body mass index (BMI). Age and gender corrected BMI was applied for each child using established guidelines [22]. Obesity was defined as a BMI exceeding the 95th percentile for subject age and gender [22,23]. Historical and anatomical assessments for all subjects were evaluated by the same examiner (Hsu WC).

All children underwent preoperative PSG studies to confirm the diagnosis of OSA, which was defined as the apnea/hypopnea index (AHI) ≥ 1 event/h in the PSG studies [4–10]. The quality of life assessment was based on the OSA-18 survey, which comprised an 18-item caregiver completed questionnaire [12]. The exclusion criteria were (1) AHI < 1 event/h in preoperative PSG studies, (2) previous tonsil, adenoid, or pharyngeal surgery, (3) cranio-facial anomalies, genetic disorders, neuro-muscular diseases, cognitive deficits, or mental retardation.

2.2. Polysomnography (PSG)

All subjects completed overnight PSG studies before surgery. Over-night PSG (Embla N7000, Medcare Flaga, Reykjavik, Iceland) was performed in the sleep lab following a protocol described elsewhere [5,9,23–25]. The sleep stage and respiratory event were scored based on the 2007 American Academy of Sleep Medicine standard [26]. Obstructive apnea was defined as the presence of continued inspiratory effort associated with a >90% decrease in airflow lasting ≥2 breaths. Hypopnea was defined as a ≥50% decrease in airflow lasting ≥2 breaths associated with arousal, awakening, or reduced arterial oxygen saturation of ≥3%. The diagnosis of pediatric OSA was defined as the occurrence of an apnea/hypopnea index (AHI) ≥1 event/h in the PSG studies [4–10].

2.3. OSA-18 quality of life questionnaire (OSA-18)

All subjects completed the validated OSA-18 questionnaires before surgery, within 6 months of surgery, and more than 6 months after surgery. Franco et al. [12] first described OSA-18, and Kang et al. [25] cross-culture translated and validated the traditional Chinese version of the OSA-18 questionnaire. The OSA-18 survey, a caregiver-administered quality of life questionnaire, contains 18 items divided into five subscales: sleep disturbance, physical symptoms, emotional distress, daytime function, and caregiver concerns. Each item is scored with a 7-point ordinal scale. OSA-18 is graded to produce each item score, as well as additional scores for the five sub-scales, and total score. The OSA-18 total score is the sum of the 18 items and, thus ranged from 18 (no impact on quality of life) to 126 (major negative impact) [12,25]. According to Franco et al. [12], children with OSA-18 total scores below 60 imply a small impact on quality of life; scores between 60 and 80 imply a moderate impact; and scores exceeding 80 imply a large life quality impact.

2.4. Adenotonsillectomy (T&A)

Tonsillectomy was performed using the coblation method, while adenoidectomy was performed using the microdebrider-assisted method. All surgical procedures were performed in a single stage under general anesthesia with two days of hospitalization [9,27].

2.5. Statistical analysis

Data were analyzed using SPSS Statistics 21.0 (IBM Corporation, New York, United States). Continuous data were expressed in terms of mean and standard deviation, and categorical data in terms of number and percentage. Before and after surgery continuous data were compared using a paired-sample *t*-test. Meanwhile, short-term and long-term continuous data in all participants and subgroups were compared using the paired-sample *t*-test. Factors affecting short-term and long-term persistence of the quality of life after surgery were assessed by multivariable logistic regression. The level of statistical significance was set at a p value below 0.05.

3. Results

3.1. Study population

The final analysis included a total of 114 children. The mean age was 7.0 ± 3.6 (range 2–18) years. Boys comprised 75.4% (86/114) of the sample. Fourteen subjects were toddlers (1–3 years), 48 were preschool age (3–5 years), 40 were school age (6–12 years), and 12 were adolescents (13–18 years). According to age and gender corrected BMI, 25 subjects were obese, while 89 were non-obese. Mean AHI in all subjects was 15.7 ± 21.4 (range 1–131) events/h before surgery. In terms of OSA severity, 43 children had mild OSA (AHI, 1–5/h), and 71 children had moderate-to-severe OSA (AHI, >5/h).

Initially, 114 children had preoperative and postoperative short-term OSA-18 survey. The long-term OSA-18 survey was complete in 89 of the 114 (78%) subjects of the initial cohort. The mean interval between preoperative OSA-18 survey and surgery was 47.0 ± 22.1 (median 41, range 13–98) days. Meanwhile, the mean interval between surgery and short-term OSA-18 survey was 49.2 ± 39.8 (median 32, range 6–169) days, while that between surgery

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