Changes in Quality of Life and Respiratory Disturbance After Extended Uvulopalatal Flap Surgery in Patients With Obstructive Sleep Apnea

Hsueh-Yu Li, MD; Ning-Hung Chen, MD; Yu-Hsiang Shu, MSc; Pa-Chun Wang, MD, MSc

Objective: To evaluate the subjective and objective outcomes of extended uvulopalatal flap (EUPF) surgery in patients with obstructive sleep apnea.

Design: Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), Snore Outcomes Survey (SOS), Epworth Sleepiness Scale (ESS), and polysomnography were performed preoperatively and then 6 months postoperatively.

Setting: Tertiary care, sleep disorders referral center.

Patients: Fifty-five consecutive patients (52 men and 3 women; mean age, 45 years) with obstructive sleep apnea.

Intervention: EUPF surgery.

Main Outcome Measures: Overnight polysomnography variables included respiratory distress index (RDI), snore index, minimum oxygen saturation, sleep stages 1 and 2, sleep stages 3 and 4, rapid eye movement, and sleep efficiency. Questionnaire variables included SF-36, SOS, and ESS scores. Success of the operation was defined as a more than 50% reduction of the RDI from the initial value and a postoperative RDI of less than 20.

Results: The overall success rate of the EUPF surgery was 82%; the RDI, snore index, and minimum oxygen saturation improved significantly after surgery (P < .001). Sleep architecture in overnight polysomnography remained unchanged (P = .48 and P = .74). Patients demonstrated significant improvement in both their SOS and ESS scores (P < .001) and significant increases in 7 of 8 SF-36 subscales (P < .05 for all). However, there was poor correlation between the improvement in quality of life and the reduction in sleep-related respiratory events.

Conclusions: Extended uvulopalatal flap surgery can greatly reduce sleep-related adverse events and proves to be an effective therapy to enhance the quality of life of patients with obstructive sleep apnea. This study also suggests that subjective and objective outcomes are equally important when reporting the results of EUPF surgery.


From the Departments of Otolaryngology (Dr Li) and Pulmonary and Critical Care Medicine (Dr Chen), Sleep Center, Chang Gung Memorial Hospital, Taipei, Graduate Institute of Epidemiology, College of Public Health, National Taiwan University, Taipei (Mr Shu), and Department of Otolaryngology, Cathay General Hospital, Taipei, and Department of Public Health, China Medical University, Taichung (Dr Wang), Taiwan. The authors have no relevant financial interest in this article.

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STUDY POPULATION

A total of 55 patients (52 men and 3 women; mean age, 45 years; age range, 23-70 years) underwent EUPF surgery for OSA between January 1, 2001, and June 30, 2001, at the Department of Otolaryngology and Sleep Center, Chang Gung Memorial Hospital, Taipei, Taiwan. All patients underwent an upper airway examination by an otolaryngologist (nasofibroscopy with the Muller maneuver and 3-dimensional computed tomography) and were judged to have a narrowed retropalatal space. All patients had been referred from different clinics in Taiwan because of habitual snoring, excessive daytime sleepiness, and other symptoms of OSA.

SURGICAL TECHNIQUE

The EUPF operation was performed with the patient under general anesthesia. Bilateral tonsillectomy was performed initially. Bilaterally, a triangular incision (1 cm) from the upper pole of tonsillar fossa toward the third maxillary molar was made to remove the mucosa and submucosal adipose tissue. A larger tonsillar fossa was then created with increased superior and lateral dimensions (Figure, A). Following this procedure, the mucoosal web between the uvula and the posterior tonsillar pillar was divided (0.5 cm) in an oblique direction along the uvula. The uvula and soft palate were retracted toward the junction of the soft and hard palate to determine a point in the midline approximately 5 to 10 mm below the posterior end of the hard palate. A V-shaped incision was made from this landmark to the upper poles of the bilateral tonsillar fossae. Left-angled scissors were then used to dissect the plane between submucosal adipose tissue and muscle layer along the incision line toward the tip of the uvula (fat stripping technique) (Figure, B). The uvular mucosa was divided along the uvular edge, and the tip was excised with the specimen. The denuded uvula and soft palate now comprised the EUPF. This flap was imbricated and sutured to the residual mucosa of the soft palate using 2-0 Vicryl (Ethicon Inc, Somerville, NJ). The new tonsillar fossa was closed to decrease the dead space (Figure, C). The approximation of anterior and posterior tonsillar pillars was performed using mattress sutures with maximal lateralization (Figure, D). Nasal surgery was performed simultaneously to correct septal deviation in 12 patients.

SLEEP STUDY

Overnight PSG (UltraSom System; Nicolet, Madison, Wis) was performed in the usual manner to document the sleep variables and architecture in each patient. These measures included respiratory disturbance index (RDI), snore index (SI), and minimum oxygen saturation (MSAT). The RDI was defined as the number of total apnea and hypopnea episodes per hour of sleep. An apnea episode was defined as cessation of airflow that lasted longer than 10 seconds, whereas a hypopnea episode was defined as a 50% or greater reduction in combined oral and nasal flow that lasted longer than 10 seconds. The SI was defined as the number of spikes in sound intensity per hour of sleep. The MSAT was defined as the minimal oxygen saturation detected during the sleep test period. The sleep architecture was analyzed using the sleep stages (stages 1 and 2, stages 3 and 4, and rapid eye movement [REM] stage), which were scored according to the international criteria of Rechtschaffen and Kales.

Sleep efficiency referred to the ratio of total sleep time to time in bed.

SURVEY FORMS

All patients completed questionnaires, including the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), the Snore Outcomes Survey (SOS), and the Epworth Sleepiness Scale (ESS) at baseline and then 6 months after surgery. Data were retrospectively reviewed.

The SF-36 is a widely used, generic quality-of-life measurement that divides general health into 8 domains, including physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). These SF-36 subscales and their definitions are as follows: PF, limitation on physical activities, such as walking, bathing, and strenuous sports; RP, problems with work or other daily activities as a result of physical health; BP, intensity of bodily pain or limitation due to pain; GH, perception of current health and health outlook; VT, level of energy; SF, extent health interferes with normal social activities; RE, problems with daily activities as a result of emotional issues; and MH, mental health screening. Each subscore is based on a scale of 0 to 100, with 100 as the optimal health score. A Chinese (Taiwan) version of the SF-36 was used with permission in this study.

The SOS contained 8 Likert-type items that evaluated the duration, severity, frequency, and consequences of problems associated with sleep-disordered breathing (SDB), in particular snoring. Because of the impact of SDB on others, a separate Spouse/Bed Partner Survey (SBPS) containing 3 Likert-type items was also developed as an adjunct to the SOS. Scores on the SOS and SBPS are normalized on a scale ranging from 0 (worst) to 100 (best). A Mandarin Chinese version of the SOS was used with permission in this study.

The 8-item ESS evaluated daytime somnolence in 8 specific situations and generated a total score ranging from 0 (best) to 24 (worst). A Mandarin Chinese version of the ESS was used with permission in this study.

STATISTICAL ANALYSIS

Results are expressed as mean±SD. A paired t test was used to compare preoperative and postoperative scores in the PSG sleep variables, sleep architecture, SF-36 subscales, SOS, and ESS. P<.05 was considered statistically significant. The t test was
RESULTS

STUDY POPULATION

The participants were 52 men and 3 women (mean age, 45.1±9.7 years). The mean RDI was 43.6±29.7. The mean SI was 208.7±129.3, and the MSAT during sleep was 78.9±9.8. The distribution of the severity of SDB was as follows: mild, 11 (20%); moderate, 15 (27%); moderate-severe, 11 (20%); and severe, 18 (33%). The mean body mass index (BMI), a measure of weight in kilograms divided by the square of height in meters, was 26.4±4.1 before surgery and 25.8±3.1 after surgery. The change in BMI was insignificant (P=.47).

PSG SLEEP VARIABLES

Before surgery, the mean RDI was 43.6±29.7, the mean SI was 208.7±129.3, and the MSAT during sleep was 78.9±9.8. The postoperative PSG sleep variables and their changes are given in Table 1. The degrees of improvement were 72.2% for RDI (P<.001), 48.6% for SI (P<.001), and 7.5% for MSAT (P<.001). All reached statistically significant levels.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>Change</th>
<th>P Value†</th>
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</thead>
<tbody>
<tr>
<td>Polysomnogram measures</td>
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<tr>
<td>Respiratory distress index</td>
<td>43.6±29.7</td>
<td>12.1±19.1</td>
<td>−31.5±29.0</td>
<td>&lt;.001</td>
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<td>Snore index</td>
<td>208.7±129.3</td>
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<tr>
<td>Minimum oxygen saturation,%</td>
<td>78.9±9.8</td>
<td>84.8±10.2</td>
<td>5.9±10.7</td>
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<td>Sleep structure, %</td>
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<tr>
<td>Stages 1 and 2</td>
<td>65.1±11.1</td>
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<td>1.5±15.4</td>
<td>.48</td>
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<tr>
<td>Stages 3 and 4</td>
<td>3.4±5.4</td>
<td>2.9±5.3</td>
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<td>.74</td>
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<tr>
<td>Rapid eye movement</td>
<td>10.7±5.7</td>
<td>10.9±6.7</td>
<td>0.2±7.7</td>
<td>.84</td>
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<tr>
<td>Sleep efficiency</td>
<td>73.4±17.3</td>
<td>77.6±15.9</td>
<td>4.9±22.6</td>
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*Data are given as mean ± SD unless otherwise noted.
†P Test.

A total of 44 of 55 patients met the predefined success criteria. The success rate for this cohort was 80% in general. The success rates for mild, moderate, moderate-severe, and severe SDB groups were 73% (8/11), 80% (12/15), 91% (10/11), and 78% (14/18), respectively.

SLEEP ARCHITECTURE

The sleep architecture remained unchanged following surgery (Table 1). The variations of stages 1 and 2 (P=.48), stages 3 and 4 (P=.74), REM stage (P=.84), and sleep efficiency (P=.13) were all statistically insignificant.

GENERAL HEALTH STATUS

Except for BP, 7 of 8 of the SF-36 subscale scores from the OSA patients were significantly worse than the subjects representing the Taiwanese population norm (P<.01 for all). After EUPF surgery, the study patients performed equivalently (P=.05) with the normative data in the RP, BP, VT, RE, SF, and GH domains (Table 2).

Table 1. Preoperative and Postoperative Polysomnographic Sleep Variables and Sleep Structure in 55 Patients

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*Data are given as mean ± SD.
†P<.01, t test, significantly different compared with the Taiwanese population norm.
‡P<.001, t test, significantly different compared with the Taiwanese population norm.
§P<.0001, t test, significant differences between preoperative and postoperative SF-36 subscale scores.
¶P<.05, t test, significantly different compared with the Taiwanese population norm.
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SOS, Snore Outcomes Survey.  

Both the SOS and SBPS scores improved significantly (P<.001) following EUPF surgery (Table 3). Compared with the preoperative snore-related health status, the degrees of quality-of-life improvement were 107.8% for SOS and 131.7% for SBPS. The ESS also showed a significant improvement (P<.001) following surgery (Table 3). Compared with the preoperative level of daytime somnolence, the degree of reduction in sleepiness was 33.9%.

**Correlations, Trends, and Outcome Predictors**

There were poor associations (Spearman correlation, P=.05) between the changes of the SOS and SBPS with the changes of SF-36 subscale scores. The change of ESS correlated well with the changes of the SF-36 subscales PF (Spearman correlation ρ=−0.35, P=.01), RE (Spearman correlation ρ=−0.4, P=.004), and GH (Spearman correlation ρ=−0.44, P=.002) (Table 4).

**Effect of Disease Severity on Subjective Outcomes**

There was no trend noted in the changes of SOS, SBPS, or ESS scores (1-way ANOVA, P>.05). A trend was noted in the changes of SF-36 subscales PF (P=.005), MH (P=.02), and VT (P=.01) scores using the 1-way ANOVA test; patients with more severe sleep apnea tended to have greater changes in these subscale scores.

**Predictor Analysis**

Stepwise multiple regression models, using change of outcomes as dependent variables, revealed that preoperative BMI was a predictor of the changes of MSAT (R²=0.23, P=.05) and sleep efficiency (R²=0.28, P=.04). BMI changes were predictive of the change in sleep stages 1 and 2 (R²=0.58, P=.03), whereas age was found to be predictive of the change in sleep stages 3 and 4 (R²=0.12, P=.02). The analysis of the predictability of subjective outcomes showed that the severity of OSA was predic-
tive of the changes of MH ($R^2=0.26$, $P<.001$) and VT ($R^2=0.13$, $P=.03$).

**COMMENT**

This study showed that the modified UPPP procedure, the EUPF, has a significant effect on the objective measures of sleep-related adverse breathing events and results in a significant subjective improvement in the patient’s quality of life. Extended uvulopalatal flap is different from traditional UPPP in 3 aspects: fat stripping with preservation of muscle, expansion of retrolatal space in both the anteroposterior and lateral dimensions, and imbrication instead of excision. The fat stripping technique is based on the hypothesis that the deposits of fat around the upper airway could narrow this space and predispose the airway to collapse when the muscle tone in this area is reduced during sleep. In a previous study, it was shown that the narrowing of the lateral dimension of the retrolatal space in overweight patients with OSA was significantly correlated to their sleep respiratory disturbances. The expansion of the supratonsillar fossa significantly correlated to their sleep respiratory disturbance.18 The reason why the patients scored worse in the PF subscale postoperatively is unknown. Although a few patients complained of the sensation of having a lump in the throat (7%, 4/55) and mild nasal regurgitation (6%, 3/55), none of them complained about any physical limitation in their daily activities. Furthermore, none of them had any cardiopulmonary problems after EUPF surgery. Longer follow-up and more objective data need to be gathered to explain this phenomenon.

The ESS, developed by Johns, has been recognized as a valid measure of sleep propensity. The Chinese version of the ESS was found to have satisfactory reliability and validity. In this series, ESS scores of patients returned to normal levels following surgery (from 11.8 to 7.5). The symptom of excessive daytime sleepiness often has a restraining influence on many social and work-related situations and probably diminishes the quality of life of the patient.20 The correlations between the changes of ESS and some SF-36 subscale scores and the insignificant correlation between SOS and SF-36 ($r=-0.03$, $P=.98$) attest the published hypothesis that shows that sleepiness, rather than snoring, is a more important general health determinant.

Our data demonstrate that EUPF surgery can significantly improve the general health status of patients in multiple dimensions on the SF-36 questionnaire, especially for those variables involving activities of daily living. The degrees of improvement for both RP and RE exceeded 80%. The elevation of the energy level (14.4 points or a 26.5% increase in VT score) was a presumed consequence of the reduction in daytime somnolence (ESS score decreased from 11.8 to 7.5) even though their degrees of improvement varied. The scores of RP, RE, SF, VT, and GH returned to normal levels following surgery. This not only reflected the effectiveness of EUPF surgery but also substantiated the observation that SDB indeed incurs some general health burdens.

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Corresponding author and reprints: Pa-Chun Wang, MD, MSc, Department of Otolaryngology, Cathay General Hospital, 280 Jen-Ai Rd, Section 4, 106 Taipei, Taiwan (e-mail: drtony@pts4.seed.net.tw).

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