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Tongue Base Suspension Combined With UPPP in Severe OSA Patients

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OBJECTIVE: Tongue base surgery in the severe OSA patients may improve the success of uvulopalatopharyngoplasty (UPPP) as the collapse is multilevel. The aim of this study was to evaluate the long-term objective and subjective effectiveness of the minimally invasive tongue base suspension combined with UPPP in severe OSA patients.

STUDY DESIGN AND SETTING: We conducted a retrospective analysis of 22 OSA patients undergoing UPPP and the tongue base suspension for the treatment of severe OSA.

RESULTS: Twenty-two men who had their preoperative and postoperative polysomnography had a 54% reduction in the preoperative Respiratory Disturbance Index (RDI), from 47.50 ± 15.74 to a level of 17.31 ± 14.17. The standard surgical cure rate which is a >50% reduction in the RDI and a postoperative RDI of <20 events/hour was 81.81%. All patients had some degree of subjective improvement in their snoring, daytime sleepiness, and the Epworth sleepiness scale.

CONCLUSIONS: The tongue base suspension combined with UPPP has been shown to reduce RDI better than UPPP alone. This minimally invasive technique is highly successful at 81.81% when combined with UPPP in the severe OSA patients with multilevel airway collapse.

SIGNIFICANCE: This study shows the benefits of minimally invasive tongue base suspension combined with UPPP in severe obstructive sleep apnea syndrome.

Obstructive sleep apnea (OSA) is a relatively common and potentially fatal disorder affecting 2% to 4% of middle-aged adults.[1] Narrowed upper airway and abnormal collapsibility during sleep are the main causes of OSA.[2,3] The consequences of the collapse of the upper airway are airway resistance, hypopnea, and apnea. Increased ventilatory effort causes EEG microarousals, alterations in sleep architecture, sleep fragmentation, hypersomnolence, and neurological symptoms of OSA.[4] Reduced airflow results in hypoxemia that can lead to hypertension, cerebral vascular accident, and myocardial infarction. Nasal continuous positive airway pressure (CPAP) is considered the gold standard and the primary treatment for OSA. However, the therapeutic use of CPAP is seriously limited by low long-term compliance.[5,6] The oral prosthesis that are useful for mild and moderate OSA seem to be unsuccessful in severe OSA.[7] Considerable effort has been expended to establish the usefulness of different techniques for surgical treatment. The success of the surgical management has relied on the recognition of the sleep-related collapse of multiple segments of the upper airway; initially these segments were retropalatal and retrolingual areas; lateral pharyngeal wall has been included recently.[8]

Although a variety of surgical techniques have been described to manage OSA, a multilevel pharyngeal surgery is required to overcome this collapse at multiple levels of pharyngeal airway especially in severe OSA patients.[9] Fujita[10] and Riley et al[11] described soft tissue modification and skeletal techniques to enlarge posterior airway space at the level of retrolingual area. Riley et al[12] were also the first to advocate the simultaneous performance of a multilevel surgery for patients in whom multiple sites of obstruction has been found. Fujita et al[13] designed the UPPP to enlarge the potential airspace in the oropharynx. The success rates for all of these surgical techniques are limited and have some morbidity.

A new technique has recently been introduced to enlarge

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the retrolingual airway.[14] The tongue suspension procedure is a minimally invasive and reversible technique that may be successful in the surgical treatment of severe OSA. The objectives of the mandibular osteotomy and genioglossal advancement are to pull the tongue mass anteriorly. However, this muscular tongue mass has some elasticity limiting the advancement of tongue base anteriorly. This new technique stabilizes and supports the posterior tongue base. This is a technique with direct goal to tongue base in opposition with other techniques like genioglossus advancement and hyoidopexy. The aim of this article is to define the alternative role of a relatively simple and inexpensive method of a tongue base suspension when CPAP and heavy surgical procedures as genioglossus advancement (GA) or maxillomandibular advancement (MMA) are not accepted by the patients.

STUDY DESIGN AND SETTING

This is a retrospective analysis of data prospectively gathered on 22 severe OSA patients treated with tongue suspension and UPPP between March 1998 and January 2004 at the ME-DI ENT Clinic in Istanbul. Twenty-two patients were involved in the study. The exclusion criteria were simple snoring and mild and moderate OSA (RDI $<$30/h). Relevant symptoms associated with sleep disorders, such as daytime sleepiness, were assessed with the Epworth Sleepiness Scale (ESS) and questionnaires. All patients underwent a complete head and neck evaluation, fiberoptic nasoendoscopy, Muller maneuver, and overnight standard polysomnography (PSG), including electroencephalography (EEG), electrooculography (EOG), measurement of oral and nasal airflow with thermistors, electrocardiography (ECG), O_2 saturation (SpO_2), EMG (chin, intercostal) anterior tibialis and thoracic and abdominal respiratory efforts, snore sound via microphone, and monitoring of body position. PSGs were evaluated and scored by a board-certified sleep physician at the American Hospital of Istanbul, Turkey, who used universally accepted criteria for respiratory disturbance index (RDI), apnea index (AI), hypopnea index (HI), and oxygen desaturation. Hypopnea was defined as a decrease of 50% in the amplitude of breathing lasting $>$10 seconds and apnea was defined as more than 90% reduction in breathing amplitude of breathing lasting $>$10 seconds. RDI was defined as the number of obstructive apneas and hypopneas and respiratory effort-related arousals (RERA)/h. AI was defined as the number of apneic episodes that occur during sleep divided by the number of hours of sleep. All patients were offered the option of nasal CPAP as a first choice instead of pharyngo-hypopharyngeal surgery. Patients were selected for surgery based on the clinical examination findings, Muller maneuver, and PSG results (RDI $>$30/h). None of the 22 severe OSAS patients had any prior surgery for obstructive sleep apnea. All patients underwent preoperative counseling and informed consent was obtained. According to the Riley Classification system,[12] all patients were classified as having type II obstruction (oropharynx/tongue base/hypopharynx). All patients underwent multilevel pharyngeal surgery including UPPP and tongue base suspension. UPPP was performed with the standard technique of Fujita et al.[13] The tongue base suspension was modified from the DeRowe's soft tissue-to-bone anchor (The Repose System).[14] Our modification is described below in the following operative procedure.

Patients were evaluated clinically 1, 3, and 6 months after surgery and the PSGs were obtained at least after 6 months postoperatively for the results. For all patients RDI, AI, O2 saturation, body mass index (BMI), and snoring score were calculated.

A paired *t* test was done to assess statistically significant differences between preoperative and postoperative parameters. Statistical analysis was performed using nonparametric Wilcoxon test. Results were accepted to be significant for a P value of <0.05. A surgical cure was defined as a $>$50% reduction in the RDI and a postoperative RDI of $<$20 events/h.[15]

OPERATIVE PROCEDURE

Tongue Base Suspension

The tongue base suspension procedure was performed through a small submental incision. A small hole on the mandible to attach the number 2 polypropylene suture was created with a drill (Fig 1A). First a temporary black silk suture loop was passed with a suture passer through the same incision to the right side of the tongue base from the floor of the mouth (Fig 1B). Similarly, the polypropylene suture was passed to the tongue base on the opposite side (Fig 1C). To keep the vascular bundle safe, we passed the suture passer in the middle one third of the tongue base, by palpating the base of the tongue. The polypropylene suture was then passed across the tongue base with a free cutting needle to the temporary suture loop (Fig 1D). The black silk suture loop pulled the polypropylene suture back to the submental incision area in the floor of the mouth muscles. The polypropylene suture was tied with maximal force on the mandible hole (Fig 1E and F). The submental skin incision was closed with a subcutaneous absorbable suture.

At the end of the procedure a deep dimple on the base of the tongue was created and could be seen with fiberscopic endoscopy (Fig 2). This procedure takes approximately 20 minutes to perform. Patients were kept hospitalized at least 1 night for possible edema of the tongue. A prophylactic antibiotic and systemic corticosteroid are given.

RESULTS

The demographics, preoperative and postoperative BMI, ESS scores, PSG, snoring scores (VAS), and postopera-