Lateral-Expansion Pharyngoplasty: Combined Technique for the Treatment of Obstructive Sleep Apnea Syndrome

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Abstract

Introduction Obstructive sleep apnea syndrome (OSAS) is a multifactorial disease characterized by episodes of partial or complete collapse during sleep of different regions of the upper airway. Surgery for OSAS evolved with the introduction of different techniques, considering new surgical concept of reconstruction of the upper airway.

Objective To retrospectively evaluate the effectiveness of a new approach aimed at reducing pharyngeal collapse by combining two surgical techniques: lateral and expansion pharyngoplasty.

Methods We reviewed the medical records of 38 patients with OSAS undergoing lateral/expansion pharyngoplasty from January 2012 to December 2016. The following data were collected: patient age, gender, and pre- and postoperative body mass index (BMI), Epworth sleepiness scale (ESS) scores, snoring visual analogue scale (VAS) scores, and polysomnography (PSG) results.

Results The PSG results showed a significant reduction in the apneahypopnea index (AHI) from 22.4 ± 27.3 events/h preoperatively to 13.6 ± 17.9 events/h postoperatively (p = 0.009), with postoperative AHI reduction greater than 50% in 63.2% of the patients. There was also a significant reduction in the microarousal index (19.5 ± 22.6 vs 11.0 ± 13.4 events/h; p = 0.001) and in the minimum oxygen saturation (82.6 ± 10.3 vs 86.9 ± 11.1; p = 0.007).

Conclusions Lateral-expansion pharyngoplasty represents a new surgical strategy for the treatment of OSAS in patients with palatal collapse by combining two different techniques: lateral and expansion pharyngoplasty. The two techniques, performed as a one-stage procedure, led to improvements in excessive daytime sleepiness, snoring, and PSG respiratory parameters by acting on lateral and retropalatal collapse, producing favorable results with good applicability in otolaryngology clinical practice.

Keywords
► obstructive sleep apnea
► polysomnography
► upper airway surgery
► surgical technique
► pharyngeal muscles
► pharynx/surgery

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Introduction

Obstructive sleep apnea syndrome (OSAS) is a complex and multifactorial disease characterized by episodes of partial or complete collapse during sleep of different regions of the upper airway, such as nasal cavities, palate, uvula, tonsils, base of the tongue, lateral pharyngeal walls, and epiglottis. Continuous positive airway pressure (CPAP) has been long considered the first-line therapy for OSAS, being effective when used properly and in accordance with the standards of the American Academy of Sleep Medicine (AASM). However, due to difficult adherence of some patients to this treatment modality, the actual effectiveness of CPAP is low, with a large number of users abandoning it within 1 year of prescription. Conversely, surgery for OSAS does not depend on patient adherence, and when topodiagnosis is combined with the right pharyngeal procedure, effective long-term results have been observed.

Surgical OSAS treatment has evolved over the years with the introduction of different techniques. In 1964, Ikematsu developed a surgical procedure to reduce snoring by shortening the palate and uvula. In 1977, Quesada et al introduced the concept of partial palate resection, a technique that was considered the first uvulopalatopharyngoplasty (UPPP). In 1981, Fujita et al published the UPPP technique by modifying the original procedure described by Ikematsu and generating great enthusiasm in the otolaryngology community. Several variations of the UPPP technique have been described since then, leading to a conceptual shift from aggressive palate resection to reconstructive surgery and improving pharyngeal function by changing its shape.

In 2003, Cahali described lateral pharyngoplasty, a surgical technique designed to splint the lateral pharyngeal walls via a microdissection of the superior pharyngeal constrictor muscle, thus giving support to these walls and reducing lateral collapse in patients with OSAS. In 2007, Pang and Woodson described expansion sphincter pharyngoplasty, which consists of a tonsillectomy followed by rotation of the palatopharyngeus muscle, partial uvulectomy, and closure of the anterior and posterior tonsillar pillars. The purpose of this procedure is to create lateral wall tension and remove the bulk of the lateral pharyngeal walls. In 2012, Sorrenti and Piccin improved the technique by stabilizing the palatopharyngeus muscle with a less aggressive and more physiologic surgery.

Considering this new surgical concept of reconstruction of the upper airway, we combined two techniques, lateral and expansion pharyngoplasty, in a single procedure to both increase the pharyngeal space and address retropalatal and lateral collapse.

Objective

To retrospectively evaluate the effectiveness of a new approach aimed at reducing pharyngeal collapse by combining two surgical techniques: lateral-expansion pharyngoplasty.

Methods

This was a retrospective longitudinal study. The study was approved by the research ethics committee of the institution, CAAE: 72825617.7.0000.0062–Comissão Nacional de Ética em Pesquisa (CONEP, in the Portuguese acronym). We retrospectively reviewed the medical records of all patients with OSAS undergoing lateral-expansion pharyngoplasty at the department of otolaryngology of our institution from January 2012 to December 2016.

The following data were collected from the medical records: patient age, gender, and pre- and postoperative body mass index (BMI), Epworth sleepiness scale (ESS) scores, snoring visual analogue scale (VAS) scores, and polysomnography (PSG) results.

The eligible participants were all patients aged 18 to 60 years old with a diagnosis of OSAS according to the International Classification of Sleep Disorders who were classified as Friedman stage I or II on physical examination and had retropalatal obstruction of the oropharynx and/or hypopharynx (Fujita type I and II) as seen with awake flexible endoscopy. Exclusion criteria were the presence of upper airway tumors and/or polyps, craniofacial anomalies, and hypertrophy of the base of the tongue as measured by cephalometry and fiberoptic nasopharyngoscopy with the Muller maneuver that grades hypopharyngeal and retropalatal collapse on a 4-point scale, excluding retroglottal collapse.

Obesity was defined as BMI $> 30$ kg/m$^2$. The severity of OSAS was classified according to the apnea/hypopnea index (AHI) as mild ($\geq 5$ to $< 15$ events/hour), moderate ($\geq 15$ to $< 30$ events/hour), and severe ($\geq 30$ events/hour)$^2$. Postoperative evaluation was performed, on average, after 7 months of follow-up.

Surgical Technique

The procedure was performed under general anesthesia with orotracheal intubation. After performing a bilateral tonsillectomy, the superior pharyngeal constrictor muscle was dissected and sectioned (Fig. 1). After the identification and elevation of the palatopharyngeus muscle, its inferior end was transected (Fig. 2). The palatopharyngeus muscle was then fixed with 3.0 Vicryl suture, close to the ipsilateral hamulus of the pterygoid process, through a palatal tunnel (Fig. 3). The palatal mucosa was then closed with suture (Fig. 4).

Data Analysis

Statistical analysis was performed using SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). A $p$-value $< 0.05$ was considered significant for all analyses. Categorical variables were expressed as absolute and relative frequencies, and continuous variables were expressed as mean $\pm$ standard deviation. Data were analyzed using the general linear model (GLM). For the longitudinal analysis, a generalized estimating equations (GEE) model was used to evaluate the treatment effect. The normality of data distribution was
assessed by exploratory analysis of histograms or a comparison of Akaike and Bayesian information criteria. All ESS, snoring VAS and PSG variables were analyzed using gamma distribution. Age, gender, and delta BMI (baseline BMI – postoperative BMI) were used as covariates. Bonferroni correction was applied to adjust for multiple comparisons.

Results

The sample consisted of 38 patients, 31 (81.6%) men and 7 (18.4%) women. The ages of the patients ranged from 30 to 58 years, with a mean age of 40.8 ± 4.8 years. The mean preoperative BMI was 27.4 ± 2.8 kg/m², and the mean postoperative BMI was 26.6 ± 5.8 kg/m² (p = 0.4).

The mean ESS score significantly improved from 12.0 ± 9.1 preoperatively to 3.4 ± 3.6 postoperatively (p < 0.001). The mean snoring VAS score also significantly improved from 8.5 ± 4.6 preoperatively to 3.4 ± 1.9 postoperatively (p < 0.001).

The results of pre- and postoperative PSG are shown in Table 1. Significant reductions were observed in postoperative AHI (p = 0.009), microarousal index (p = 0.001), and minimum oxygen saturation (p = 0.007) (Table 1).

There was a postoperative AHI reduction greater than 50% in 24 (63.2%) patients and of less than 50% in 8 (21.0%) patients (Table 2).

Discussion

Obstructive sleep apnea syndrome has received increased attention recently from the medical community due to its significant association with cardiovascular disease, hypertension, obesity, depression, dyslipidemia, gastroesophageal reflux disease, and diabetes mellitus, which can potentially increase health care expenditures. Sleep fragmentation and chronic hypoxia also affect patients’ cognitive function and quality of life, leading to deficits in performance that may, in

![Fig. 1](image1.png) Identification and dissection of the superior pharyngeal constrictor muscle.

![Fig. 2](image2.png) The palatopharyngeus muscle is transected to obtain a tunnel through the palatal musculature that reaches the hamulus of the pterygoid process.

![Fig. 3](image3.png) The palatopharyngeus muscle flap is elevated through the palatal tunnel and fixed to the palatal musculature with 3.0 Vicryl suture, close to the ipsilateral hamulus of the pterygoid process.

![Fig. 4](image4.png) Closure of the palatal mucosa with suture.
Lateral-expansion pharyngoplasty represents a new surgical strategy for the treatment of OSAS in patients with palatal collapse by combining two different techniques: lateral and expansion pharyngoplasty. The two techniques, performed as a one-stage procedure, led to improvements in excessive daytime sleepiness, snoring, and PSG respiratory parameters in patients with OSAS by acting on lateral and retropalatal collapse, producing favorable results with good applicability in otolaryngologic clinical practice.

Conflict of Interest
The authors have no conflicts of interest to declare.
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