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A tertiary center experience with velopharyngeal surgical techniques for treatment of snoring and obstructive sleep apnea

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ABSTRACT

Objectives: The aim of this study was to assess the outcomes of patients who treated with the relatively new surgical procedures; anterior palatoplasty (AP), Cahali lateral pharyngoplasty (CLP), and expansion sphincter pharyngoplasty (ESP) for habitual snoring or obstructive sleep apnea (OSA).

Methods: Prospective series of 93 patients were evaluated. The performed surgical techniques, polysomnographic outcomes, pre- and postoperative clinical parameters, and complication rates were assessed.

Results: There were 14 snorers and 79 OSA patients. The mean age was 40.7 years, mean BMI was 27.67 kg/m^2, and the mean follow-up time was 5.90 months. There were 30 subjects in AP, 30 subjects in CLP, and 33 subjects in ESP groups. Apnea hypopnea index (AHI) improved from 16.90 to 14.27 ($p = 0.135$) in AP, from 17.69 to 12.05 in CLP ($p = 0.004$), and from 26.83 to 9.08 in ESP groups ($p < 0.001$). When surgical success criteria is defined as more than 50% reduction in AHI to final AHI <15 events/h, success rates were 45%, 64%, and 74% in AP, CLP, and ESP groups, respectively. Epworth Sleepiness Scale and visual analog scale for snoring significantly decreased after all procedures ($p < 0.05$). The minimum oxygen saturation significantly increased after all procedures, however, only ESP caused statistically significant improvements in oxygen desaturation index, mean SaO_2 and the percentage of sleep time with SaO_2 below 90%. During the follow-up period, 61 of 93 patients (65.6%) indicated one or more complaints, but none of them was persistent.

Conclusion: We suggest that these relatively new velopharyngeal surgical techniques are effective in the management of snoring and OSA without causing persistent side-effects, and ESP is one step ahead of the other two techniques.

1. Introduction

Obstructive sleep apnea (OSA), arisen from collapsibility of the upper airway, is a common problem worldwide, which is associated with increased risk of cardiovascular disorders,

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metabolic syndrome, sudden death, stroke, etc. Due to its life-threatening comorbidities, OSA should be diagnosed and treated properly to prevent systemic complications. Positive airway pressure (PAP) remains the first-line treatment choice for OSA. However, surgical treatment has been always an alternative treatment option especially in patients who have compliance and/or adherence problems due to various side effects of PAP therapy such as blocked up nose, mask pressure, dry mouth, mask leaks, etc.

The main purposes of the surgical treatments for habitual snoring and OSA are to increase the upper airway cross-sectional area and to prevent the collapsibility of the upper airway by reconstructing the pharyngeal structures [1]. After uvulopalatopharyngoplasty (UPPP) was first introduced by Fujita et al. in 1981 [2], UPPP and its modifications have been widely used in the treatment of snoring and OSA. However, desired surgical success could not be obtained. Moreover, relatively high prevalence of complications such as nasal regurgitation, velopharyngeal insufficiency, taste disturbances, voice changes, and persistent retropalatal obstruction, UPPP has gradually lost its popularity. Surgeons prefer newer surgical techniques which are less aggressive and more tolerable. Anterior palatoplasty (AP), Cahali lateral pharyngoplasty (CLP), and expansion sphincter pharyngoplasty (ESP) have been popularized in recent years that are used instead of UPPP [3–5]. The most important feature of these newer techniques is to make a reconstruction in the upper airway and to change the velopharyngeal–oropharyngeal dynamics by protecting mucosa, uvula and muscles.

In the last decade, we have used AP, CLP and ESP techniques for patients with snoring and/or OSA who do not want to use PAP treatment and seek for surgical alternatives. We believe that these techniques are more tolerable and can be easily performed without causing undesired complications. The aim of this study is to assess the outcomes of patients who treated with the surgical procedures of AP, CLP, and ESP due to habitual snoring or OSA.

2. Materials and methods

2.1. Study protocol

The patients with habitual snoring or OSA, who were planned to undergo one of the procedures of AP, CLP or ESP, were prospectively enrolled between June 2011 and August 2015. The study protocol is approved by the Ethical Committee of Gulhane Medical School. All subjects had preoperative polysomnography (PSG). Polysomnographies were scored according to the 2007 American Academy of Sleep Medicine Manual for the Scoring of Sleep and Related Events [6]. PAP treatment had been offered as the primary choice of treatment to all patients with OSA, and surgery was considered when patients did not tolerate or refused PAP therapy. However, only the patients with OSA (preoperative apnea hypopnea index (AHI) > 5 events/h) were planned to undergo postoperative PSG.

2.2. Inclusion criteria

The patients who underwent AP, CLP, or ESP as a single surgical procedure for treatment of snoring and/or OSA were included.

2.3. Exclusion criteria

The patients were excluded if they (1) had no description of preoperative levels of AHI (for all patients), (2) had no description of postoperative levels of AHI (for the patients with diagnosis of OSA), (3) had hypopharyngeal obstruction, (4) underwent OSA surgeries other than AP/LP/ESP, (5) underwent adjunctive OSA surgery at the same time with AP/LP/ESP, (6) underwent multilevel OSA surgery, (7) had nasal surgery after preoperative PSG and (8) had a craniofacial abnormality. The patients with previous history of nasal surgery such as septoplasty, rhinoplasty before PSG were not excluded.

2.4. Surgical procedures

The type of the surgery was decided according to patients' anthropometric and anatomic characteristics, clinical findings and endoscopic examinations. Tonsil grade, Modified Mallampati score, modified Muller's maneuver, palate phenotype (oblique, vertical, intermediate type) [7], and retropalatal collapse patterns (anteroposterior, lateral, circular collapse) were evaluated.

The AP was performed as described by Pang et al. [3]. This procedure was suggested to the patients if they had (1) redundant soft palate, (2) smaller tonsils (grade 0–2) and (3) primarily antero-posterior velopharyngeal collapse in endoscopic evaluation and modified Muller's maneuver. (4) Modified Mallampati score 1–2. A 4×1 cm horizontal rectangular strip of mucosa was excised from the soft palate and then the stripped area was sutured with 10–15 vicryl sutures. The muscle layer was completely protected in this procedure (Fig. 1). None of these patients had tonsillectomy or any other procedures concomitantly.

The CLP was performed as described by Cahali [4]. This procedure was suggested to the patients if they had (1) significant lateral pharyngeal wall, (2) Modified Mallampati score 1–2, (3) grade 0–4 tonsils, and (4) primarily lateral pharyngeal wall collapse in endoscopic evaluation and modified Muller's maneuver. First, tonsillectomy was performed. Then, the superior pharyngeal constrictor and palatopharyngeus muscles were identified and divided from each other. Superior pharyngeal constrictor muscle was dissected from lateral pharyngeal space and laterally based flap was sutured anteriorly to the same-side palatoglossus muscle. After that, a 1 cm incision nearby the uvula, which extends 45° from medial to lateral direction, was made. The palatopharyngeus muscle was dissected and divided superior and inferior flaps. Finally, a palatopharyngeal Z-plasty was performed, flaps and mucosa were closed (Fig. 2).

The ESP was performed as Pang and Woodson have described and then modified with "tunnel method" [5,8]. This procedure was suggested to the patients if they had (1) lateral

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