

## Trends in Otolaryngology Residency Training in the Surgical Treatment of Obstructive Sleep Apnea

Michael W. Sim, MD; Jeffrey J. Stanley, MD

**Objectives/Hypothesis:** Most patients with obstructive sleep apnea (OSA) have multilevel obstruction. Improved outcomes with multilevel surgery compared to isolated palatal surgery have been well documented. Despite this, surgical practice patterns in the United States have been slow to change. The purpose of this study was to evaluate whether current practice patterns are a reflection of limited surgical residency training in hypopharyngeal procedures.

**Study Design:** Cross-sectional Internet survey.

**Methods:** Program directors from 103 accredited U.S. otolaryngology residency programs were surveyed regarding past (2000, 2005) and more recent (2010) resident surgical competency in operative techniques for treatment of OSA.

**Results:** Of the 48 survey respondents, 85%, 90%, and 100% reported resident surgical competency for oropharyngeal procedures in 2000, 2005, and 2010, respectively. Uvulopalatopharyngoplasty and tonsillectomy were the most common procedures reported in all 3 years. In contrast, 63%, 71%, and 83% reported resident surgical competency for hypopharyngeal procedures in 2000, 2005, and 2010. Lingual tonsillectomy was the most common procedure in all 3 years.

**Conclusion:** Surgical practice patterns in the United States do not reflect current practice recommendations for treatment of OSA, which emphasize multilevel surgery. Limited surgical residency training in hypopharyngeal procedures may be a contributing factor, although there appears to be an increasing trend in resident competency. Improvement in the scope of resident surgical training for treatment of OSA may lead to improved surgical outcomes.

**Key Words:** Obstructive sleep apnea, multilevel surgery, residency training, resident education, practice patterns.

**Level of Evidence:** 3b.

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### INTRODUCTION

Continuous positive airway pressure (CPAP) is the gold standard for the treatment of obstructive sleep apnea (OSA). However, less than 50% of patients with OSA are CPAP compliant,<sup>1</sup> with the majority being either intolerant or unwilling to use CPAP therapy. Surgery may be a viable treatment option for these patients.

Historically, surgical treatment for OSA has focused on single-site surgery of the oropharynx. Uvulopalatopharyngoplasty (UPPP) with or without tonsillectomy has been the mainstay of surgical therapy following its introduction in the early 1980s.<sup>2</sup> This surgical technique was designed to alleviate retropalatal collapse in patients with OSA. Modification of the UPPP technique, including the uvulopalatal flap, Z-palatopharyngoplasty,

and expansion sphincter pharyngoplasty were subsequently developed in an attempt to improve the success rate of palatal surgery and prevent postoperative complications. The overall success rate of UPPP in unselected patients with OSA is approximately 40%.<sup>3</sup>

Limited improvement following oropharyngeal surgery alone, coupled with identification of additional anatomic sites of obstruction, specifically the hypopharynx, prompted the development of multiple additional procedures during the past 2 decades. Improved surgical outcomes with multilevel surgery have been well documented.<sup>4,5</sup> Despite the development of additional surgical procedures to address hypopharyngeal obstruction, surgical practice patterns in the United States have been slow to change. Data from the 2006 Nationwide Inpatient Sample, State Ambulatory Surgery Database, and State Inpatient Database revealed that of the 35,263 outpatient and inpatient surgeries performed for the treatment of OSA, greater than 75% were isolated palatal procedures and only 19% involved hypopharyngeal procedures.<sup>6</sup>

Given these findings, the objective of this study was to evaluate whether limited surgical residency training in hypopharyngeal procedures may be contributing to current practice patterns.

### MATERIALS AND METHODS

A complete list of 103 accredited otolaryngology residency program directors in the United States was obtained from the Accreditation Council for Graduate Medical Education. Each

From the Department of Otolaryngology–Head and Neck Surgery, (M.W.S.); and the Sleep Disorders Center, Department of Otolaryngology–Head and Neck Surgery (J.J.S.), University of Michigan Health System, Ann Arbor, Michigan, U.S.A.

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Send correspondence to Michael Sim, MD, 1500 E. Medical Center Dr., 1904 Taubman Center Ann Arbor, MI 48109-5312.  
E-mail: michaelism@gmail.com

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TABLE I.  
Proportion of Resident Surgical Competency in Oropharyngeal Procedures (n = 48).

Procedures	Trends (by year)			P Value
	2000	2005	2010	
Uvulopalatopharyngoplasty	81.2% (39)	87.5% (42)	95.8% (46)	0.027
Tonsillectomy	81.2% (39)	87.5% (42)	97.9% (47)	0.009
Uvulo flap	12.5% (6)	14.6% (7)	16.7% (8)	0.563
Uvulopalatal flap	16.7% (8)	20.8% (10)	22.9% (11)	0.445
Laser-Assisted uvuloplasty	25.0% (12)	12.5% (6)	6.3% (3)	0.009
Pillar implant technique	2.1% (1)	14.6% (7)	25.0% (12)	0.001
Transpalatal advancement pharyngoplasty	4.2% (2)	8.4% (4)	18.8% (9)	0.019
Radiofrequency palatal reduction	25.0% (12)	31.2% (15)	29.2% (14)	0.651
Oropharyngeal procedure, any type	85.4% (41)	89.6% (43)	100.0% (48)	0.010

UPPP = uvulopalatopharyngoplasty.

director was contacted by e-mail and requested to complete an online survey created by the senior author (J.J.S.). The survey inquired about sleep apnea surgical training opportunities available to residents in the years 2000, 2005, and 2010 within their respective programs. The specific techniques listed for oropharyngeal procedures were UPPP, tonsillectomy, uvulo flap, uvulopalatal flap, laser-assisted uvuloplasty, pillar implant technique, radiofrequency palatal reduction, and transpalatal advancement pharyngoplasty. Hypopharyngeal techniques surveyed included mandibulotomy with genioglossus muscle advancement, hyoid suspension, tongue base suspension, radiofrequency tongue reduction, midline glossectomy, lingual tonsillectomy, and partial epiglottectomy.

Survey data was tabulated according to procedure and year. Statistical analyses were then performed. Cochran-Armitage and chi-squared tests were used to determine whether trends were statistically significant within each group (oropharyngeal and hypopharyngeal) and to determine if there was a statistically significant difference between the oropharyngeal and hypopharyngeal groups within each year. In addition, a trend test *P* value was calculated for each individual procedure to determine if the change in proportion through the years was significant.

## RESULTS

Survey response rate by program directors was 47% (n = 48). The difference between resident surgical competency for oropharyngeal procedures and hypopharyngeal procedures of any type were found to be statistically significant for each of the years studied, with *P* values of 0.02, 0.04, and 0.006 for the years 2000, 2005, and 2010, respectively.

The proportions of respondents reporting resident surgical competency in at least one oropharyngeal procedure of any type were 85%, 90%, and 100% in the years 2000, 2005, and 2010, respectively. This was found to be a statistically significant increasing trend (*P* = 0.01). UPPP and tonsillectomy were the most common procedures reported in all 3 years, with reported competency rates of 96% and 98% in 2010. The only procedure that saw a declining trend was laser-assisted uvuloplasty (*P* = 0.009), with a competency rate of 6% in 2010. This finding is in keeping with the recent American Academy

of Sleep Medicine practice parameters, which no longer recommend this treatment for OSA.<sup>7</sup> The uvulo flap, uvulopalatal flap, and radiofrequency palatal reduction techniques have had relatively steady competency rates, whereas competency rates for transpalatal advancement pharyngoplasty and pillar implant techniques have increased through the years (*P* = 0.019 and *P* = 0.001, respectively). The results for oropharyngeal procedures are summarized in Table I.

In contrast, 63%, 71%, and 83% of program directors reported resident surgical competency for at least one hypopharyngeal procedure of any type in the years 2000, 2005, and 2010, respectively (*P* = 0.023). Lingual tonsillectomy was the most common procedure in all 3 years, with a competency rate of 69% in 2010. Hyoid suspension had the second highest reported competency rate of 48% in 2010, a 21% increase from 2000 (*P* = 0.035). Surgical competency in the tongue base suspension technique also showed a significant increase from 13% in 2000 to 33% in 2010 (*P* = 0.014). The competency rate for mandibulotomy with genioglossus muscle advancement showed a decline from 23% in 2000 to 15% in 2010, but this was not statistically significant (*P* = 0.302). The results for hypopharyngeal procedures are summarized in Table II.

## DISCUSSION

In the past 2 decades, there has been increased interest in multilevel surgery for treatment of obstructive sleep apnea, with a special focus on hypopharyngeal procedures. In previous studies, nonresponders to single level surgery were found to have additional sites of obstruction, usually at the level of the hypopharynx. Fujita was the first to describe anatomic levels of obstruction in OSA and subsequently created a classification system.<sup>8</sup> Type I patients were observed to have obstruction at the level of the oropharynx only and accounted for 25% of the study population. Type III patients had obstruction at the level hypopharynx only and accounted for 10% of the study population. The majority of patients were classified as type II, with

TABLE II.  
Proportion of Resident Surgical Competency in Hypopharyngeal Procedures (n = 48).

Procedures	Trends (by year)			P Value
	2000	2005	2010	
Mandibulotomy genioglossus advancement	22.9% (11)	20.8% (10)	14.6% (7)	0.302
Hyoid suspension	27.1% (13)	37.5% (18)	47.9% (23)	0.035
Tongue base suspension	12.5% (6)	20.8% (10)	33.3% (16)	0.014
Radiofrequency tongue reduction	27.1% (13)	39.6% (19)	35.4% (17)	0.389
Midline glossectomy (with or without laser)	18.8% (9)	22.9% (11)	29.2% (14)	0.230
Lingual tonsillectomy	50.0% (24)	60.4% (29)	68.8% (33)	0.061
Partial epiglottectomy	14.6% (7)	14.6% (7)	16.7% (8)	0.777
Hypopharyngeal procedure, any type	62.5% (30)	70.8% (34)	83.3% (40)	0.023

evidence of both oropharyngeal and hypopharyngeal sites of collapse.<sup>9</sup>

Greater than 30 case series have reported the outcome of multilevel surgery. In one of the largest case series published to date, Riley et al.<sup>4</sup> reported an overall success rate of 61% for 306 patients undergoing phase I surgery inclusive of multilevel surgery. Success rates were higher for those with mild and moderate OSA, at 71% and 78%, respectively. In this patient population, 93% were found to have obstruction at both the oropharyngeal and hypopharyngeal level. A recent meta-analysis of 1,978 patients who underwent multilevel surgery reported an overall success rate of 66.4%, with significant improvement in both AHI and oxygen saturation levels.<sup>5</sup>

These and other studies suggest that the majority of patients with OSA have multilevel obstruction and that multilevel surgery yields better outcomes than single-level oropharyngeal procedures. Yet, as previously described, the majority of procedures performed today for the treatment of OSA are isolated palatal procedures addressing collapse at the retropalatal level only. In the previously cited 2006 nationwide inpatient sample study, radiofrequency tongue reduction and midline glossectomy were the most commonly performed hypopharyngeal procedures.<sup>6</sup> This is not surprising given that midline glossectomy was one of the earliest hypopharyngeal procedures developed, and that radiofrequency tongue reduction is less technically challenging than other hypopharyngeal surgeries.

The current study found that lingual tonsillectomy had the highest rate of resident surgical competency among all hypopharyngeal procedures during each of the years surveyed. Hyoid suspension, despite involving osseous manipulation, had the second highest competency rate. This can be explained by the fact that the key portions of the procedure, namely exposure of the hyoid bone and superior aspect of the thyroid cartilage, are familiar to most otolaryngology residents as part of other more commonly performed neck procedures. Mandibulotomy with genioglossus muscle advancement had the lowest competency rate among residency training programs in 2010 and showed a declining trend from

2000, although not statistically significant. This may be due to the fact that the latter is a more technically challenging procedure compared to the other hypopharyngeal procedures. This low competency rate and downward trend should perhaps be observed with concern since previous studies have shown this to be an effective procedure with success rates of 57% to 100%,<sup>10</sup> depending on the severity of OSA.

A clear difference in surgical resident competency rates between oropharyngeal and hypopharyngeal procedures was identified, with 100% of programs reporting competency in the former versus 83% in the latter for 2010 ( $P = 0.006$ ). However, an increasing trend in surgical competency for hypopharyngeal procedures was noted from an initial rate of 63% in 2000. In a similar survey study, Shen et al. found that only a minority of otolaryngology programs (35%) allocated greater than 1 month for training in sleep medicine.<sup>11</sup> Most programs reported that residents spent less than 0.6 months on sleep medicine education. Nearly all programs reported training residents to perform oropharyngeal procedures, with far fewer training residents to perform hypopharyngeal procedures. That study, however, did not seek to evaluate trends in surgical training patterns as established in the current study.

In another recent study of hypopharyngeal surgery practice patterns among nonresident surgeons who were self-identified as having a special interest in sleep medicine or general otolaryngology within the American Academy of Otolaryngology–Head and Neck Surgery, Kezirian et al. found that only 39% of survey respondents described their OSA surgical training as of high quality during residency.<sup>12</sup> Over 40% of respondents reported limited training in hypopharyngeal procedures, with the exception of radiofrequency tongue reduction. These findings correlate with the results of the current study documenting lower competency rates in hypopharyngeal procedures, especially for the earlier years surveyed.

The obvious limitation of the current study is the 47% survey response rate. This raises susceptibility to sampling error, making it a less accurate representation of the entire target population (all 103 accredited

otolaryngology residency training programs in the United States). This is, however, in line with typical response rates obtained in other published survey studies. Response bias is also a consideration, as program directors could potentially have answered the questions in a manner that was self-promoting. A program director's inherent bias may be magnified in studies that attempt to assess the quality and strength of residency programs. Nonresponse bias is another source of error, since programs that provide less training in sleep surgery would have had less motivation to participate in the survey. And finally, measurement error is a limitation in this study as the accuracy of program director responses is dependent on the extent to which objective versus subjective measures were used to assess surgical competency. However, of all academic faculty members, program directors are still the best-qualified respondents for this type of survey given their unique responsibilities and duties as supervisors of the training curriculum.

This study sought to evaluate trends in otolaryngology residency training in the surgical treatment of OSA in light of the trend in the literature advocating multilevel surgery. It appears that hypopharyngeal surgical competency is increasing, although it still lags behind competency in oropharyngeal procedures. Through this and future studies it is hoped that there will be an increased awareness of the importance of building a strong foundation for surgical treatment of sleep apnea during residency training.

## CONCLUSION

Surgical practice patterns in the United States do not reflect current practice recommendations for treatment of obstructive sleep apnea, which emphasize multilevel surgery for patients with multilevel obstruction. Inadequate surgical training during residency in more technically challenging hypopharyngeal procedures

appears to be a contributing factor. The results of this study demonstrate an increasing trend in the number of programs training residents to perform hypopharyngeal procedures, which should be reflected in future national surveys. Continued improvement in the scope of surgical training for the treatment of OSA is expected to lead to better postoperative outcomes.

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