Journal of Advances in Medicine and Medical Research

33(1): 98-104, 2021; Article no.JAMMR.65617
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Endoscopic Harmonic Midline Partial Glossectomy in Obstructive Sleep Apnea

A. I. Elkawa[1*], Y. I. Aglan[1] and M. A. Hagras[1]

[1]Department of Otolaryngology Head and Neck Surgery, Tanta University, P. O. Box 31527 Tanta, Egypt.

Authors' contributions

This work was carried out in collaboration among all authors. Author AIE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors YIA and MAH managed the analyses of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2021/v33i130800
Editor(s):
(1) Dr. Sandra Aparecida Marinho, Paraíba State University (Universidade Estadual da Paraíba), Brazil.
(2) Dr. Rameshwari Thakur, Muzaffarnagar Medical College, India.
Reviewers:
(1) Marrakchi Jihene, University Tunis El Manar, Tunisia.
(2) Neslihan Sari, Kızıltepe Government Hospital, Turkey.
(3) Mahalakshmi. K, Tagore Dental College & Hospital, The Tamil Nadu Dr. M. G. R. Medical University, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/65617

Mini-review Article

Received 02 December 2020
Accepted 07 February 2021
Published 15 February 2021

ABSTRACT

Aim: Our study was done to evaluate the role of Endoscopic posterior midline partial glossectomy as a surgical modality for the hypopharyngeal collapse in obstructive sleep apnea patients.
Study design: Prospective case series study.
Place and Duration of Study: Tanta university hospital, otolaryngology department, from October 2017 till March 2019.
Methodology: This was a prospective case series study, conducted on 10 patients from 2017 - 2019 with tongue base collapse and normal craniofacial angles, the patients were evaluated preoperative and 6 months postoperative subjectively by Epworth sleepiness scale (ESS) and objectively by polysomnography and lateral cephalometry.
Results: Our study included 10 patients with age (mean ± SD48.70±4.08), BMI(mean ±SD24.45±1.56), 5 patients showed a significant reduction in AHI with a success rate of 50% with a significant change in ESS and the non-significant changes in cephalometric parameters.
Conclusion: Transoral endoscopic posterior midline partial glossectomy can improve the surgical outcomes of obstructive sleep apnea patients.

**Corresponding author: E-mail: amr.elkowah@med.tanta.edu.eg;*

Keywords: Obstructive sleep apnea surgeries; transoral endoscopic; tongue base reduction.

ABBREVIATIONS

OSA: Obstructive sleep apnea,
PSG: Polysomnography,
AHI: Apnea-hypopnea index

1. INTRODUCTION

Obstructive sleep apnea (OSA) is a common disorder resulting from the collapse of the pharyngeal airway during sleep. It is affecting approximately 2% of women and 4% of men 30 to 60 years old [1]. Although CPAP (continuous positive airway pressure) is the gold standard treatment for OSA, Many patients express dissatisfaction with CPAP and become noncompliant with treatment [2].

Hypopharyngeal airway obstruction can be caused by the prominence or relaxation of the base of the tongue, lateral pharyngeal wall, and occasionally, the aryepiglottic folds or epiglottis. Compromised maxillofacial anatomy in the form of a narrowed maxillomandibular arch or maxillomandibular deficiency can also be a significant factor leading to hypopharyngeal obstruction [3].

Various techniques of volumetric reduction of the tongue have been supported by the literature for their positive impact in the reduction of the apnea-hypopnea index and relatively less operative morbidity and long-term complications [4].

This study aimed to evaluate our results in endoscopic harmonic tongue base reduction.

2. MATERIALS AND METHODS

This was a prospective case series study done in Otolaryngology Department Tanta university hospital, conducted on 10 patients from 2017 - 2019 with moderate to severe OSA with tongue base collapse and normal craniofacial angles, the patients were evaluated preoperative and 6 months postoperative subjectively and objectively, exclusion criteria were CPAP acceptance, body mass index (BMI) more than 40, central sleep apnea and any contraindications for general anesthesia.

All patients had the following;

1. Complete history and otolaryngologic examination by 0oendoscope for nose and oropharynx, 70◦ endoscopic examinations for hypopharynx and larynx, and flexible nasendoscopy for evaluation of palate and posterior pharyngeal wall relation and 3D evaluation of hypopharyngeal level.
2. Subjective evaluation by ESS (Epworth sleepiness scale)

- Validated Arabic version ESS: This version was done in 2014 in Saudi Arabia by Anwar E. Ahmed et al.

3. **Objective evaluation:** This evaluation includes polysomnography (PSG) and radiological evaluation. Standard PSG with a minimum of seven parameters measured, including electroencephalogram (EEG), electrooculogram (EOG), chin electromyogram (EMG), an ECG, as well as monitors for airflow, respiratory effort, and oxygen saturation. A technician is in constant attendance. Apnea was defined as a drop in peak oronasal thermal sensor excursion ≥ 90%of baseline with at least 10 seconds and at least 90% of the event's duration meets the amplitude reduction criteria for apnea.

Hypopnea was defined as a drop in nasal pressure signal excursions ≥ 30 %of baseline with at least 10 seconds, there is a ≥ 4desaturation from pre-event baseline and at least 90% of event's duration meets the amplitude reduction criteria for hypopnea or as a drop-in nasal pressure signal excursions ≥ 30 %of baseline with at least 10 seconds, there is a ≥ 3desaturation from pre-event baseline or associated for arousal and at least 90% of event's duration meets the amplitude reduction criteria for hypopnea. The following parameter was measured (AHI). Oxygen desaturation index (ODI) was also evaluated.

2.1 Radiological Evaluations

I- lateral cephalometry: Lateral cephalography was done, in the position that the orbital-auricular plane parallel to the floor and the subject was t in the upright position with a 165-cm focal film distance and a 15-cm film distance from the sagittal plane. All patients were instructed to maintain their tongues in a completely relaxed position and the teeth in centric occlusion after swallowing and to breathe from the nose at the end of the expiratory phase.

We used the following cephalometric measures for all patients.

SNA (Sella–nasion A point): (81.4±2.9) SNB(Sella-nasion B point: N(78.4±3).

Facial axis angle: N (86±3.) MP-H (mandibular plane –hyoid length):N(14±5.4mm).

PAS(posterior airway space: N(16.1±2.3)mm. see Fig. 1.

2- MRI was used to identify neurovascular bundle course before surgery.

The success criteria definition was AHI less than half preoperative values and less than 20.

All preoperative data and 6 months after operation were collected and compared. The parameter included in our study (ESS, AHI, ODI, and cephalometric analysis.

2.2 Surgical Steps

I- tongue base surgery: (10 patients)

Tongue base surgery included (lingual tonsil, posterior midline glossectomy, and epiglottoplasty)

Surgical steps:

1- General anesthesia and transoral endotracheal intubation, perioperative antibiotic
2- Mouth gag opening. two lateral stitches were taken on each side
3- In all patients, we used a harmonic scalpel with a curved needle and bleeding control with bipolar radiofrequency.
4- We started with posterior medline glossectomy or lingual tonsillectomy depending on which was easily accessible. See Fig. 2.
5- We used a syringe needle as a guide to staying superficial to the neurovascular bundle
6- We left a cuff of mucosa intact on each side to prevent hypopharyngeal stenosis and avoid damage neurovascular bundle laterally
7- We preferred to do unilateral removal of epiglottis for fear of aspiration and airway edema.
8- Intraoperative and 2 days post-operative steroid
9- Bedside flexible examination of the airway was done in operative day night
10- All patients were on nasal airway on high flow or BIPAP
11- Criteria for discharge (no edema, no pain, and the patient can swallow).

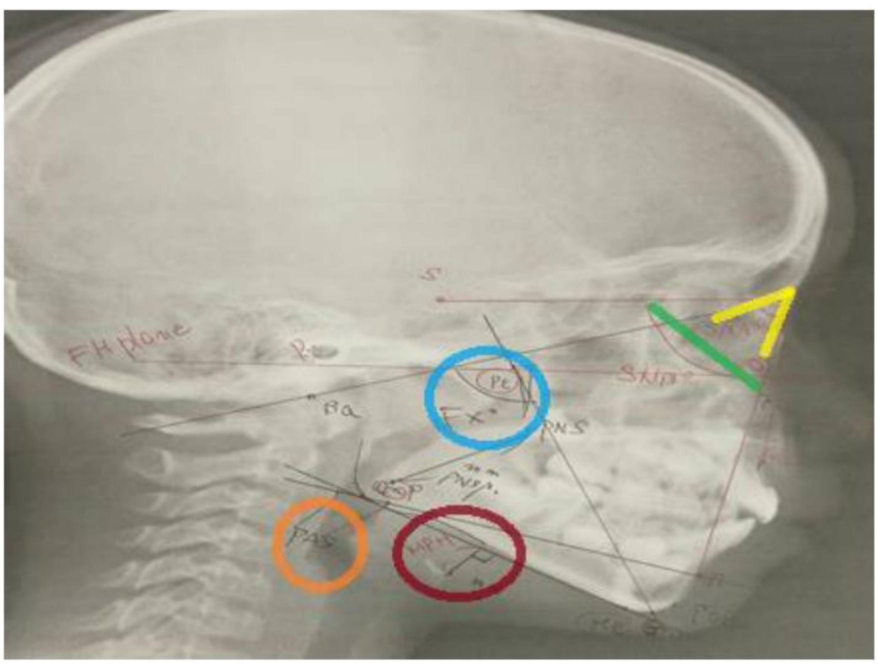

Fig. 1. Showed cephalometric parameters used

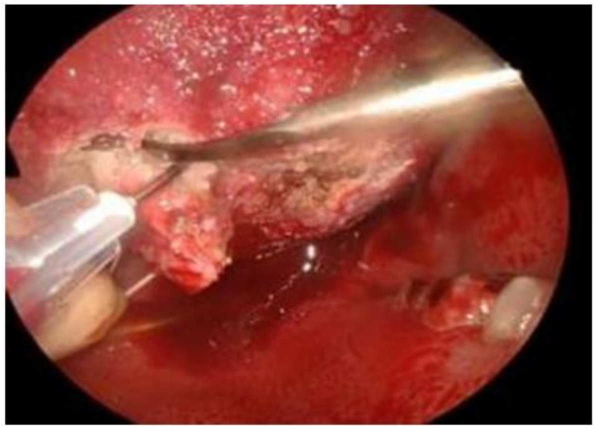

Fig. 2. Showed harmonic scalpel tongue base reduction

3. RESULTS

Our study included 10 patients, all were males with age (mean ± SD48.70±4.08), BMI(mean ±SD24.45±1.56).

3.1 Subjective Evaluation

In subjective and objective evaluations AHI, ODI showed non-significant changes with p-value (0.098 &0.418) but ESS showed significant changes (mean ±SD14.5±3.17) preoperative to (mean ±SD10.2±3.33) with p-value 0.001. Patients fulfilled success criteria were 5 patients with a success rate of 50%.

3.2 Cephalometric Evaluation

All cephalometric analysis showed non-significant changes in all parameters SNA, SNB, facial axis angle, PAS, and MP-H; p values were 0.111,0.231,0.229,0.278,0.215 respectively. See Table 1 and Figs. 3 and 4.

3.3 Complication of Producer

Complications of our intervention were; One case of primary hemorrhage managed by anesthesia and bipolar cauterization and 1 case of secondary hemorrhage on the 7th day managed by conservative treatment.

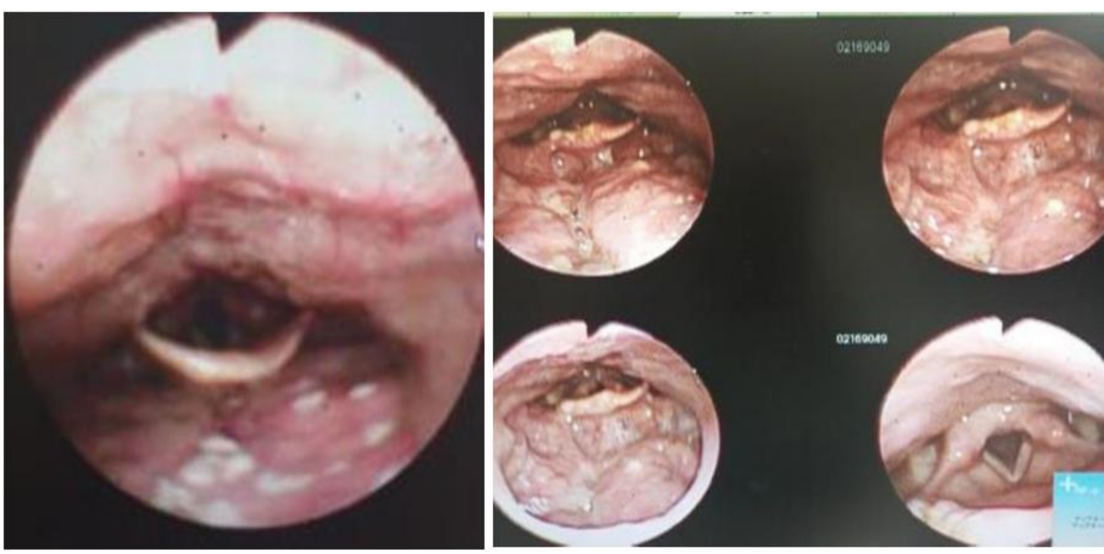

Fig. 3. Showed pre tongue base collapse and 6 months post transoral posterior midline partial glossectomy

Table 1. Showd cephalometric parameters

		Pre	Post	P-value
SNA	Mean ± SD	81.85 ± 2.99	81.22 ± 2.63	0.111
(degree)	Range	76.85 86.1	78.34-85.98	
SNB	Mean ± SD	77.5 ± 1.74	76.73 ± 1.56	**0.231**
(degree)	Range	75.11-79.56	74.22-79.13	
Facial axis	Mean ± SD	84.49 ± 3.02	83.63 ± 2.73	0.229
	Range	78.38 ± 88.74	78.97-87.13	
PAS	Mean ± SD	11.82 ± 2.11	10.82 ± 2.01	0.278
(mm)	Range	9.5-15.89	6.58-13.67	
MP-H	Mean ± SD	20.95 ± 3.11	20.4 ± 2.56	0.215
(mm)	Range	15.43-26.21	15.78-23.6	

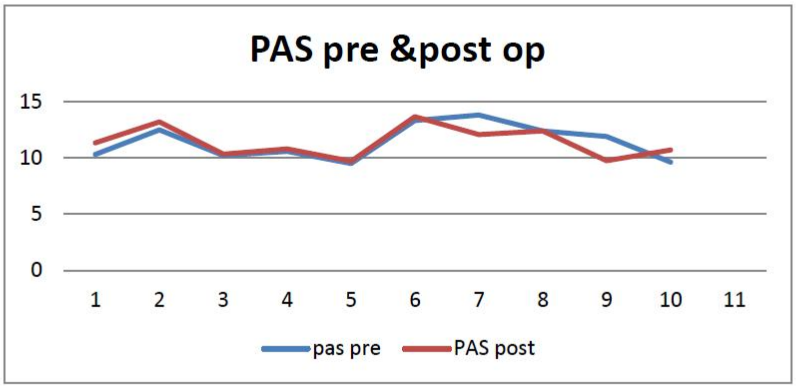

Fig. 4. Showed non-significant changes in PAS (posterior airway space)

4. DISCUSSION

The OSA management challenges are major, while medical treatment (CPAP and oral equipment) are effective in reducing the extent of OSA in a less intrusive way, patient compliance remains a problem. As an alternative method, so many patients seek surgery [5].

Multilevel reconstruction surgery was first introduced by Riley et al. according to Stanford protocol, sites of obstruction were classified as oropharynx (type 1) oropharynx and hypopharynx (type2) Hypopharynx (type3). Phase 1 includes UPPP for type 1 or UPPP and genioglossus advancement with hyoid myotomy or GAHM for type 3. phase2 maxillary mandibular advancement after phase 1 failure. Although this protocol was revised in 2019 but the mainframe of the two-phase protocol still the same [6].

According to Stanford's new protocol 2019 phase, I include nasal, palatal, and base of tongue surgeries, and stage II includes maxillomandibular advancement but if the patient has a dentofacial deformity or severe apnea or DISE findings suspect lateral pharyngeal collapse or concentric velum collapse, MMA is a surgical option from start [6].

The tongue base collapse in OSA patients can be managed by transoral volume reduction or genioglossal advancement or tongue base suspension.

The transoral volumetric tongue base reduction became more popular as surgeons started to be familiar with the anatomical location of neurovascular bundles. The reduction can be done by CO2 laser, radiofrequency, coblation, or Robotics.

The contraindications for transoral volumetric tongue base reduction are small mouth opening or trismus or craniofacial anomaly.

The transoral approach to tongue base collapse is less invasive than genioglossal advancement or tongue base suspension but good anatomical orientation with nearby neurovascular bundles.

As regarding robotic tongue base reduction, Vicini et al. applied robotic surgery for tongue base reduction sleep apnea although robotic gives three-dimensional view and precise cut, Miller et al. [7] did a systematic review on six studies reveiwing353 patients, the study showed a significant decrease in AHI 44.3 ± 22.4 to 17.8 ± 16.5, P <.01, ESS (12.9 ± 5.4 to 5.8 ± 3.7, P <.01), lowest oxygen saturation (79.0 ± 9.5 to 84.1 ± 6.5, P <.01), surgical success rate, defined as a more than 50% reduction of AHI with a postoperative AHI less than 20, was 68.4% but all of these revised articles lacking definitive selection criteria and further studies were needed to optimize indication criteria to increase the success rate, another obstacle is the cost of this maneuver as robotics system costs about $2 million-plus $1866 instrumental accessories for each procedure and needed long term training still limitations for this techniques [8].

Hwang c. et. al did a retrospective study on 45 patients with tongue base reduction using robotic or coblator with lateral pharyngoplasty showed success rate was 75% in the robotic group and 62%in coblation with no significant difference between both groups [9].

Our study is a prospective study but all the above mentioned were retrospectives, we used AASM 2017 but all the above old versions for scoring.

4.1 Facial Axis Angle

We used ordinary cephalometric parameters but we added facial axis angle. facial axis angle is the angle between Ba-N and Pt-Gnc (facial axis); for the determination of the growth type or skeletal type in adults. This angle is not age-dependent and can only be changed by treatment. The normal value for 9-year olds: 90° ± 3°, 90° = neutral growth, less than 90° = vertical growth type (face longer and more OSA risk as Mandible grows downwards behind, more than 90° = horizontal growth less OSA risk as Mandible grows forward above.so This angle is a good indicator for facial growth hence the OSA predictor and doesn’t change with a head position as other parameters SNA, SNB.

4.2 Oxygen Desaturation Index (ODI)

We also added oxygen desaturation index (ODI) as parameters as AHI alone is not satisfactory and doesn’t give an idea about the depth and duration of desaturations and when the depth and duration of the apnea attacks increase, AHI may paradoxically fall. ODI is the mean number of desaturation attack per hour can be measured using PSG. The cut-off value of ODI as 10 is sensitive(93%) for moderate to severe apnea [10].

We used the harmonic scalpel to did volumetric tongue base reduction, It is a surgical device used to cut and cauterize tissue at the same time. Here ultrasonic energy is converted to mechanical energy at the active blade. Advantages include precise dissection, excellent hemostasis, and less lateral thermal damage. But Coblation is a type of radiofrequency ablation. Here radiofrequency energy is passed through isotonic sodium chloride and it produces a plasma field. By coblation the medium is dissociated into free sodium ions, which causes destruction of intercellular bonds and thus tissue dissociation. This reaction is achieved at temperatures between 60 and 70 C (compared with 400 to 600 C in electrocautery). The presence of cool, irrigating isotonic saline limits heat delivered to tissues. So harmonic is superior to coblation in precise cut and less lateral heat; in Indian study compared coblation versus harmonic in tonsillectomy showed that harmonic is less painful and less risk for secondary bleeding (5 cases in coblation to 1 in harmonic) [11].

5. STUDY LIMITATIONS

The limitations of our study are; the number of the patients was small 10 patients but it is a prospective study, we also evaluated the sleep-related outcomes only missing post-operative pain, taste disorder, dysphagia, and short term follow up 6 months.

6. CONCLUSION

a- Transoral endoscopic posterior midline glossectomy has a role in the reduction of OSA symptoms in selected patients.
b- Facial axis angle is a cephalometric parameter to evaluate facial growth.
c- Oxygen desaturation index is important for scoring with AHI.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The study gained ethical committee approval from the School of Medicine, Tanta University, Egypt. The number is 3243297.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sistla SK, Paramasivan VK, Agrawal V. Anatomic and pathophysiologic considerations in surgical treatment of obstructive sleep apnea. Sleep Med Clin. 2019;14(1):21-31.
DOI: 10.1016/j.jsmc.2018.11.003
2. Mansukhani MP, Somers VK, Shafazand S. PAP and cardiovascular events in adults with sleep apnea: Is PAP useful? J Clin Sleep Med. 2017;13(12):1487-1489.
3. Li KK. Hypopharyngeal airway surgery. Otolaryngol Clin North Am. 2007;40(4): 845-853.
4. D'Agostino MA. Transoral robotic partial glossectomy and supraglottoplasty for obstructive sleep apnea. Otolaryngol Clin North Am. 2016;49(6):1415-1423.
5. Eckert DJ, White DP, Jordan AS, Malhotra A, Wellman A. Defining phenotypic causes of obstructive sleep apnea. Identification of novel therapeutic targets. Am J Respir Crit Care Med. 2013;188(8):996-1004.
6. Liu SY-C, Awad M, Riley R, Capasso R. The role of the revised Stanford protocol in today's precision medicine. Sleep Med Clin. 2019;14(1):99-107.
7. Miller SC, Nguyen SA, Ong AA, Gillespie MB. Transoral robotic base of tongue reduction for obstructive sleep apnea: A systematic review and meta-analysis. Laryngoscope. 2017;127(1):258-265.
8. Childers CP, Maggard-Gibbons M. Estimation of the acquisition and operating costs for robotic surgery. Jama. 2018; 320(8):835-836.
9. Hwang CS, Kim JW, Kim JW, et al. Comparison of robotic and coblation tongue base resection for obstructive sleep apnoea. Clin Otolaryngol. 2018;43(1):249-255.
10. Temirbekov D, Güneş S, Yazıcı ZM, Sayın İ. The ignored parameter in the diagnosis of obstructive sleep apnea syndrome: The oxygen desaturation index. Turkish Arch Otorhinolaryngol. 2018;56(1):1.
11. Basu S, Sengupta A, Dubey AB, Sengupta A. Harmonic Scalpel Versus Coblation Tonsillectomy A comparative study. Indian J Otolaryngol Head Neck Surg. 2019; 71(4):498-503.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/65617