

Uvulopalatopharyngoplasty and Barbed Reposition Pharyngoplasty with and without Hyoid Suspension for treatment of Obstructive Sleep Apnea: A Comparative Study of Functional Results

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Abstract

Background: Obstructive sleep apnea hypopnea syndrome (OSAHS) is a prevalent disorder impacting 23.4 percent of females and 49.7 percent of males aged forty years.

Aim: To compare the functional results in cases of OSAHS having UPPP, regarding Fairbanks, and barbed reposition pharyngoplasty, regarding Mantovani, without or with hyoid suspension (HS).

Patients and methods: This prospective research included 40 cases that were chosen from cases attended the otolaryngology outpatient clinic in AL-Azhar University Hospitals (Al-Hussein and Sayed Galal University Hospitals), throughout the duration from May 2023 to May 2025. Regarding surgical manipulation of each group: Group (A): cases undergoing UPPP and HS (thyrohyoidopexy), Group (B): cases undergoing UPPP only, Group (C): cases undergoing BRP and HS, Group (D): cases undergoing BRP only.

Results: The analysis of the percentage changes in Oxygen Desaturation Index (ODI), Apnea-Hypopnea Index (AHI), Epworth Sleepiness Scale (ESS), and BMI across four study groups demonstrates statistically significant differences, as evidenced by a p-value below 0.001.

Conclusion: The barbed reposition pharyngoplasty method regarding Mantovani was more efficient than the traditional uvulopalatopharyngoplasty method of Fairbanks for cases of OSAHS. The combined use of hyoid suspension demonstrated higher advantages in Uvulopalatopharyngoplasty than barbed reposition pharyngoplasty. Multilevel surgical procedures (oro and hypopharyngeal) in the operative management of obstructive sleep apnea cases, such as UPPP, BRP, and hyoid bone suspension, are more efficient than a unilevel procedure (UPPP or BRP), as this disorder has multiple levels of obstruction in most cases.

Keywords: OSAHS, AHI, ODI

1. Introduction

Obstructive sleep apnea hypopnea syndrome is a prevalent disorder impacting 49.7% of males and 23.4% of females aged forty years.¹ The risk factors involve male sex, age, obesity, cigarette smoking, and anomalous anatomy of the face.² The clinical symptoms include excessive daytime sleepiness, reduction of cognitive performance, morning headache, sexual dysfunction, reduced life quality, and elevated cardiovascular risk.³ The primary pathological event of OSAHS syndrome is the

upper airways collapse, which may simultaneously happen at various levels, like nasal, retropalatal, and/or laryngeal and/ or retrobasilingual.⁴ Despite the common location of collapse being the soft palate, the walls of the pharynx, palatine tonsils, and the tongue base are also involved. The larynx, and particularly the epi-glottis, is less included.⁵

The main treatment of OSAHS is conservative methods involving enhanced sleep hygiene, weight loss, the use of dental splints, and continuous positive airway pressure (CPAP) therapy.⁶

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Continuous positive airway pressure was first utilized to preserve the upper airway patency throughout sleep. Via Sullivan et al. in 1981, outcomes have been verified through numerous monitoring studies, and CPAP today represents the gold standard for management of obstructive sleep apnea hypopnea syndrome. Despite this, approximately forty percent of cases demonstrate intolerance to continuous positive airway pressure machines and need alternative management, involving operation.⁷

Operative methods for obstructive sleep apnea hypopnea syndrome aim at decreasing the air-way blockage influence because of the excessive bulk of soft tissues lining the rhinoro-hypopharynx, and they can be conducted as combined or single processes and classic or robot-as-sisted, based on case disorders.⁸ The most prevalent operative method for OSAHS is UPPP, initially defined via Fujita in 1984 and then standardized via Fairbanks in 1999. Uvulopalatopharyngoplasty is utilized to manage the area of the retropalate; however, it only manages blockage in the soft palate, whereas it doesn't address the col-lapse at various degrees. Simple Uvulopalatopharyngoplasty as a management of OSAHS has a rate of success which varies from sixteen percent to eighty-three percent. Additionally, the recurrence rate of obstructive sleep apnea hypopnea syndrome at ten years is as high as forty percent, particularly in obese cases.⁹

The goal of this prospective research is comparing the functional results in cases of OSAHS having UPPP regarding fairbanks and BRP regarding mantovani, without or with HS.

2. Patients and methods

This prospective research included 40 cases that were chosen from cases attended at the otolaryngology outpatient clinic in Al-Azhar University Hospitals (Al-Hussein and Sayed Galal University Hospitals), throughout the duration from May 2023 to May 2025. Regarding surgical manipulation of each group: Group (A): cases undergoing UPPP and HS (thyroidectomy), Group (B): cases undergoing UPPP only, Group (C): cases undergoing BRP and HS, Group (D): cases undergoing BRP only. All patients were suffering from snoring and OSAHS, as evidenced by polysomnography and by endoscopic investigation (Muller maneuver) to detect the collapse site.

Inclusion criteria: Age between twenty-five and seventy-five years, Body mass index (BMI) above fifteen and below thirty-five, Any level of volume of tonsil, apnea-hypopnea index above fifteen, and failure of CPAP therapy before surgery.

Exclusion criteria:

Cases with severe medical disorders, cases with craniofacial abnormalities impacting airways, cases with restricted mouth opening, and prior airway surgery

Methodology:

All cases were subjected to the following protocol: Complete history taking, general examination, complete oto-rhino-laryngological examination and investigations (flexible nasopharyngoscopy, polysomnography).

Treatment:

Uvulopalatopharyngoplasty:

Fairbank's Technique:

Tonsillectomy was done first if present. Start by severing the webs of the uvulopalate. That produces the contracture, mobilizes the posterior pillars, and avoids tethering of the palate. A mucosal incision in the shape of a box starts at the base of the tongue, ascends in the sulcus between the mandible and the anterior pillar, and subsequently turns medially to cross the soft palate about midway between the trailing margins of the hard and soft palates. Mucosa, fat, glands, and fibrous tissue were removed down to but not by the muscular layers. The uvula is amputated at the trailing margins of the muscle fibers of the soft palate. The posterior pillar progresses in the cephalad-lateral direction to elevate the lateral dimension of the airway of the oropharynx. The redundancies of the pharynx are decreased. To enhance the lateralization of the posterior pillar, to avoid the creation of a hematoma, and to give coverage of the mucosa of the operative defect, sutures are inserted between the mucosal margins and the superficial muscle layers. The surface of the nasopharynx of the soft palate is moved forward to meet the incision on the oral surface and to cover the defect of the operation on the oral surface. Forward-facing suture line reduces the possibility of stenosis. It additionally expands the posterior and anterior dimensions of the airway of the nasopharynx. Note that the rectangular appearance was designed to reduce regurgitation of the nasopharynx.

Barbed reposition pharyngoplasty: is a lateral pharyngoplasty method for the management of OSAHS that includes the utilize of barbed sutures for the replacement of the pharyngeal palate muscle with stabilization and enlargement of the posterior and lateral space of the velopharynx.

The main features of BRP: It was just partially cut in its inferior aspect, allowing an adequate mobilization of the posterior pillar. The entire palatopharyngeal muscle has been relocated toward the pterygomandibular raphe, thereby reshaping the novel inlet of the oropharynx. A midline crossing suture for snoring was introduced through the pillar method. The supratonsillar fat dissection was performed as recommended.

Hyoid bone suspension:

Hyoid bone suspension involves attaching the hyoid bone to the superior border of the thyroid cartilage to facilitate the stabilization of the hyoid bone in the inferior region.

The underlying principle for changing the hyoid is that, anatomically, the hyoid complex is a crucial portion of the hypopharynx. Anterior mobility of the hyoid complex enhances the posterior airway space as well as neutralizes blockage at the base of the tongue.

That concept was verified through numerous reports.¹⁰ HS started by scrapping the neck, starting from the chin down to the level of the nipple, pen mark for marking the level of the thyroid cartilage and hyoid bone. A horizontal incision of about five centimeters was made in a relaxed skin line at the level between the hyoid and thyroid cartilage, with the head positioned slightly extended. Excessive fat tissue was removed to enhance visualization. Second, the strap muscles were cut by diathermy midway between the thyroid cartilage and the hyoid bone. Exploration of both the hyoid bone and the upper border of the thyroid lamina was done. Then, the elevation of the perichondrium from the thyroid lamina is performed by dissection. Vicryl 0 or 1 on a round needle was used to fix the hyoid bone with thyroid cartilage, and the direction was as follows: from inner to outer in the thyroid lamina, then it would encircle the hyoid bone from below to above. Two stitches might be taken on each side, then the shoulder back should be removed for further approximation by neck flexion, then tightening of the stitches, cutting the strap muscle can be repaired and approximated again using Vicryl 3-0. An operative drain is positioned and frequently removed after twenty-four to seventy-two hours following surgery if drainage is below ten milliliters per twenty-four hours. The wound was then closed in two layers; the subcutaneous layer was closed by Vicryl at 3-0, and the skin was closed subcutaneously by using proline 3-0 or 4-0.

3. Results

According to demographic data, age across four study groups reveals statistically significant differences in mean ages, indicated by a p-value below 0.001. Analysis of gender distribution across four study groups indicates no statistically significant differences, as evidenced by a p-value of 0.926.

Table 1. Comparative analysis among examine groups regarding age and sex

		A	B	C	D	TEST RESULT	PAIRWISE COMPARISONS
AGE		n=12	n=14	n=7	n=7		
	Mean	38.67 ±	43.93 ±	39.43 ±	46.57 ±	F=16.048,	p2 = 0.018*
	± SD	3.68	4.41	1.81	2.57	p1	p3 = 0.607
	Median	38.00	43.50	40.00	46.00	<0.001*	p4 <0.001*
GENDER	(Min-Max)	(35.00-44.00)	(39.00-50.00)	(37.00-41.00)	(44.00-51.00)		p5 = 0.054
	Female	5(41.7%)	6(42.9%)	2(28.6%)	3(42.9%)	X2=	p6 = 0.188
	Male	7(58.3%)	8(57.1%)	5(71.4%)	4(57.1%)	0.466,	p7 <0.001*
						p1=0.926	p2: 1.000
							p3: 0.938
							p4: 1.000
							p5: 0.874
							p6: 1.000
							p7: 1.000

F: One-way ANOVA test, p1: Comparative analysis between all groups, p2: Comparative analysis among group A and group B, p3: Comparative analysis among group A and group C, p4: Comparative analysis among group A and group D, p5: Comparative analysis among group B and group C, p6: Comparative analysis among group B and group D, p7: Comparative analysis among group C and group D

The analysis of the percentage change in BMI across four study groups demonstrates statistically significant differences, indicated by a p-value below 0.001.

Table 2. Comparative analysis among examine groups regarding percentage change in BMI.

		A	B	C	D	TEST RESULT	PAIRWISE COMPARISONS
DELTA BMI		n=12	n=14	n=7	n=7		
	Mean	-5.08	-8.14	-8.86	-17.86	H=	p2 <0.001*
	± SD	± 2.27	± 2.60	± 4.14	± 5.18	19.462,	p3 = 0.056
	Median	-4.50	-9.00	-8.00	-21.00	p<0.001*	p4 <0.001*
	(Min-Max)	(-3.00-10.00)	(-4.00-12.00)	(-4.00-13.00)	(-9.00-22.00)		p5 = 0.687
							p6 <0.001*
							p7 = 0.020*

BMI: Body mass index, H: Kruskal Wallis test.

The analysis of the percentage alteration in the Epworth Sleepiness Scale (ESS) scores across four study groups reveals statistically significant differences, evidenced by a p-value below 0.001.

Table 3. Comparative analysis among examine groups regarding percentage change in ESS.

		A	B	C	D	TEST RESULT	PAIRWISE COMPARISONS
DELTA ESS		n=12	n=14	n=7	n=7		
	Mean	-4.25	-12.50	-18.86	-15.86	H=50.294,	p2 <0.001*
	± SD	± 2.49	± 2.07	± 2.12	± 4.56	p<0.001*	p3 <0.001*
	Median	-4.50	-12.50	-19.00	-17.00		p4 <0.001*
	(Min-Max)	(8.00-0.00)	(15.00-8.00)	(22.00-16.00)	(22.00-8.00)		p5 <0.001*
							p6 = 0.105
							p7 = 0.151

ESS: Epworth Sleepiness Scale.

The analysis of the percentage alteration in Oxygen Desaturation Index (ODI) across four study groups demonstrates statistically significant differences, as evidenced by a p-value below 0.001.

Table 4. Comparative analysis among examine groups regarding percentage change in ODI.

		A	B	C	D	TEST RESULT	PAIRWISE COMPARISONS
DELTA ODI		n=12	n=14	n=7	n=7		
	Mean	-25.83	-23.29	-30.14	-40.43	H=	p2 = 0.142
	± SD	± 2.55	± 5.58	± 2.54	± 3.21	30.742,	p3 <0.001*
	Median	-25.00	-22.50	-31.00	-41.00	p<0.001*	p4 <0.001*

(Min- Max)	(- 29.00- 22.00)	(- 31.00- 13.00)	(- 34.00- 26.00)	(- 46.00- 36.00)
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p5 <0.001*
p6 <0.001*
p7 <0.001*

ODI: Oxygen Desaturation Index.

The analysis of the percentage alteration in Apnea-Hypopnea Index (AHI) across four study groups demonstrates statistically significant differences, as evidenced by a p-value below 0.001.

Table 5. Comparative analysis among examine groups regarding percentage change in AHI.

		A	B	C	D	TEST RESULT	PAIRWISE COMPARISONS
DELTA AHI	Mean	n=12 -43.50	n=14 -60.07	n=7 -64.57	n=7 -64.57	H=45.545,	p2 <0.001*
	± SD	± 6.49	± 4.55	± 2.44	± 2.99	p<0.001*	p3 <0.001*
	Median	-44.50	-61.00	-64.00	-65.00		p4 <0.001*
	(Min- Max)	(- 50.00- 28.00)	(- 66.00- 52.00)	(- 69.00- 62.00)	(- 68.00- 59.00)		p5 <0.001*
							p6 = 0.015* p7 = 1.000

AHI: Apnea-Hypopnea Index.

4. Discussion

The recent research demonstrated an insignificant variance has been observed among the examined groups concerning sex, but some statistically significant variances have been observed among the examined groups concerning age and BMI, but these differences were clinically non-significant. Van Tassel et al.,¹¹ showed that age and BMI showed no significant impact on the outcome of HS with UPPP for the management of obstructive sleep apnea.

Regarding the percentage change in BMI, the recent research demonstrated some statistically significant variances have been observed among the examined groups. The results showed the patients underwent BRP only showed the highest percentage change in BMI followed by BRP and HS group then UPPP only and UPPP and HS groups. highlighting that BRP only experienced the most significant reduction in BMI compared to all other groups.

In agreement with the current study, Minni et al.,¹² in a similar study compared four groups that underwent UPPP or BRP with or without HS. The research demonstrated that the preoperative BMI was significantly greater in BRP patients compared to UPPP patients; however, post-operative BMI showed no significant difference. In the BRP group, a significant decrease has been detected for the median delta body mass index (p-value equal to 0.004) compared to the UPPP group.

The analysis of the percentage alteration in the Epworth Sleepiness Scale scores across four study groups reveals statistically significant differences, evidenced by a p-value below 0.001. Significant differences are found among Group A and the other groups: Group B (p-value below 0.001), Group C (p-value below 0.001), and

Group D (p-value below 0.001). The comparisons between Group B and Group C (p-value below 0.001) also show significant variances. Group C, followed by group D, experienced the most significant reduction in ESS compared to other groups. No significant differences are noted between Group B and Group D (p-value equal to 0.105), and between Group C and Group D (p-value equal to 0.151). The above results showed that the highest reduction in ESS score was found in the BRP and HS group, followed by the BRP only group, then the UPPP only group, and the UPPP with HS group.

Kamel et al.,¹³ in another clinical trial, confirmed that barbed reposition pharyngoplasty is superior to classic Uvulopalatopharyngoplasty regarding ESS score outcomes.

As well, Rashwan et al.,¹⁴ demonstrated that the mean of variances of Epworth Sleepiness Scale values was greater in barbed reposition pharyngoplasty group than uvulopalatopharyngoplasty groups: 5.52 ± 4.1 vs 1.36 ± 1.9 ; P-value below 0.005.

Analysis of the percentage alteration in Oxygen Desaturation Index across four study groups demonstrates statistically significant differences, as evidenced by a p-value below 0.001. An insignificant difference is noted between Group B and Group A (p-value equal to 0.142). Significant variances are detected between Group A and both Groups C (p-value below 0.001) and D (p-value below 0.001), indicating that Groups C and D achieved a significantly higher decrease in ODI in comparison with Group A. There are also significant differences among Group B and Groups C (p-value below 0.001) and D (p-value below 0.001). A significant variance is found between Group C and Group D (p-value below 0.001), indicating that Group D experienced the most substantial reduction in ODI, suggesting the highest efficacy among all groups.

The above results suggested the superiority of BRP only over other procedures in terms of the reduction of ODI. The highest reduction in ODI was found in BRP only group followed by BRP with HS group then UPPP with HS group and UPPP only group.

The superiority of BRP over UPPP was confirmed by Rashwan et al.,¹⁴ who showed that the mean of variances of ODI values was greater in barbed reposition pharyngoplasty group compared to uvulopalatopharyngoplasty group (15.09 ± 17.6 vs 7.13 ± 6.8 ; P-value below 0.0005).

The meta-analysis conducted by Saenwandee et al.,¹⁵ indicated that barbed reposition pharyngoplasty resulted in a significant decrease of the Oxygen Desaturation Index of -11.7 (MD 95% CI -16, -7.4).

Also, Vicini et al.,¹⁶ in a controlled clinical trial

showed significant postoperative reduction at 6 months of ODI from 24.38 ± 17.72 to 9.30 ± 10.24 ($P = 0.00$) in barbed reposition pharyngoplasty group, whereas insignificant alterations have been observed in observation group (control group).

The analysis of the percentage alteration in Apnea-Hypopnea Index across four study groups demonstrates statistically significant differences, as evidenced by a p-value below 0.001. Significant variances are detected among Group A and the other groups: Group B (p-value below 0.001), Group C (p-value below 0.001), and Group D (p-value below 0.001), suggesting that the interventions for Groups B, C, and D were more effective. A significant variance is also noted between Group B and other groups: Group C (p-value below 0.001) and Group D (p-value equal to 0.015). Insignificant variance in AHI percentage change between Group C and Group D.

The above results suggested the superiority of BRP either with or without HS over UPPP procedures in terms of the reduction of AHI. A probable explanation is that barbed reposition pharyngoplasty group ensures, in comparison with Uvulopalatopharyngoplasty, a higher and more stable retraction of soft tissue of the pharynx because of the latero-lateral traction and anchorage to the pterygomandibular raphe, an increase of the anterior and posterior space, and superior maintenance of the muscle tissue and mucosa.¹²

Lombo et al.,¹⁷ involved cases conducted traditional Uvulopalatopharyngoplasty, radiofrequency aided Uvulopalatopharyngoplasty (RF-UPPP) or BRP and showed that mean relative Apnea-Hypopnea Index decrease following operation wasn't statistically various between 3 methods (p-value equal to 0.098), while there was a tendency for higher decrease with barbed reposition pharyngoplasty.

4. Conclusion

The barbed reposition pharyngoplasty method regarding Mantovani was more efficient than Fairbanks' traditional uvulopalatopharyngoplasty method for cases of OSAHS. The combined use of hyoid suspension demonstrated higher advantages in Uvulopalatopharyngoplasty than barbed reposition pharyngoplasty. Randomized pro-spective experiments of longer monitoring are critical to verifying our outcomes and formulating a more precise indication of the optimum protocol for treatment. From the result of this study, multilevel surgical procedures (oro and hypopharyngeal) in the operative treatment of obstructive sleep apnea cases (UPPP, BRP & hyoid bone suspension) are more efficient than unilevel procedures (UPPP or BRP), as this

disorder has multiple levels of obstruction in most cases.

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