

Post-Operative Sleep Endoscopy in Different positions

After Palatopharyngoplasty for Obstructive Sleep Apnea

阻塞型睡眠呼吸中止症經顎咽成型術後之多體位睡眠內鏡檢查



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Objective

To patients with obstructive sleep apnea (OSA) who are not compliant to conservative therapy, upper airway surgery is an alternative. However, because of the complex nature of upper airway, it is hard for surgeons to do surgical decision making. Drug induced sleep endoscopy (DISE) is an accessible tool for surgeons to see which part of upper airway collapse when OSA patients are asleep, however, the surgical decision making according to those findings did not always achieve better surgical outcome. In literature review, for OSA patients with multiple obstruction sites or only one obstruction site in DISE, single surgery to one of the obstruction sites contributed to similar postoperative sleep apnea improvements. One reason for the surprising result was that doing DISE with manual injection of propofol may cause unsteady sleep and excessive collapse in upper airway, especially tongue base.

To clarify whether multiple surgeries are necessary to multiple obstructions in DISE, we did a study of DISE with target-controlled infusion (TCI-DISE) before and after single surgery. TCI-DISE is a better way to control the sleep depth by using drug injection machine. The findings of drug-induced sleep endoscopy (DISE) in supine position are not always correlated with the outcome of upper airway surgery. Since staging pattern of upper airway collapse may vary with sleep position. Anatomical changes in DISE of different positions should be considered holistically. We attempted to analyze the staging pattern of upper airway collapse as position changes, and compare the findings before and after palatopharyngoplasty. These analyses may help elucidate the value of DISE in different positions for the treatment of obstructive sleep apnea.

Methods

Study Participants

This prospective study assessed 42 patients with moderate to severe OSA who underwent palatopharyngoplasty from 2016 to 2018 at Shin Kong Wu Ho-Su Memorial Hospital; we performed DISE before and at least 3 months after surgery. Inclusion criteria were as follows: (1) having a baseline AHI or respiratory event index of >15 events/h, as revealed by a polysomnogram or home sleep apnea test; (2) having received a follow-up sleep study and sleep endoscopy at least 3 months after upper airway surgery; (3) having no prior upper airway surgery other than nasal surgery; (4) being unwilling to accept CPAP therapy or nonadherent to CPAP therapy under the care of a board-certified sleep medicine specialist; (5) having no habitual use of sedatives, antipsychotics, melatonin and alcohol abuse.

DISE with Target-Controlled Infusion System (TCI-DISE)

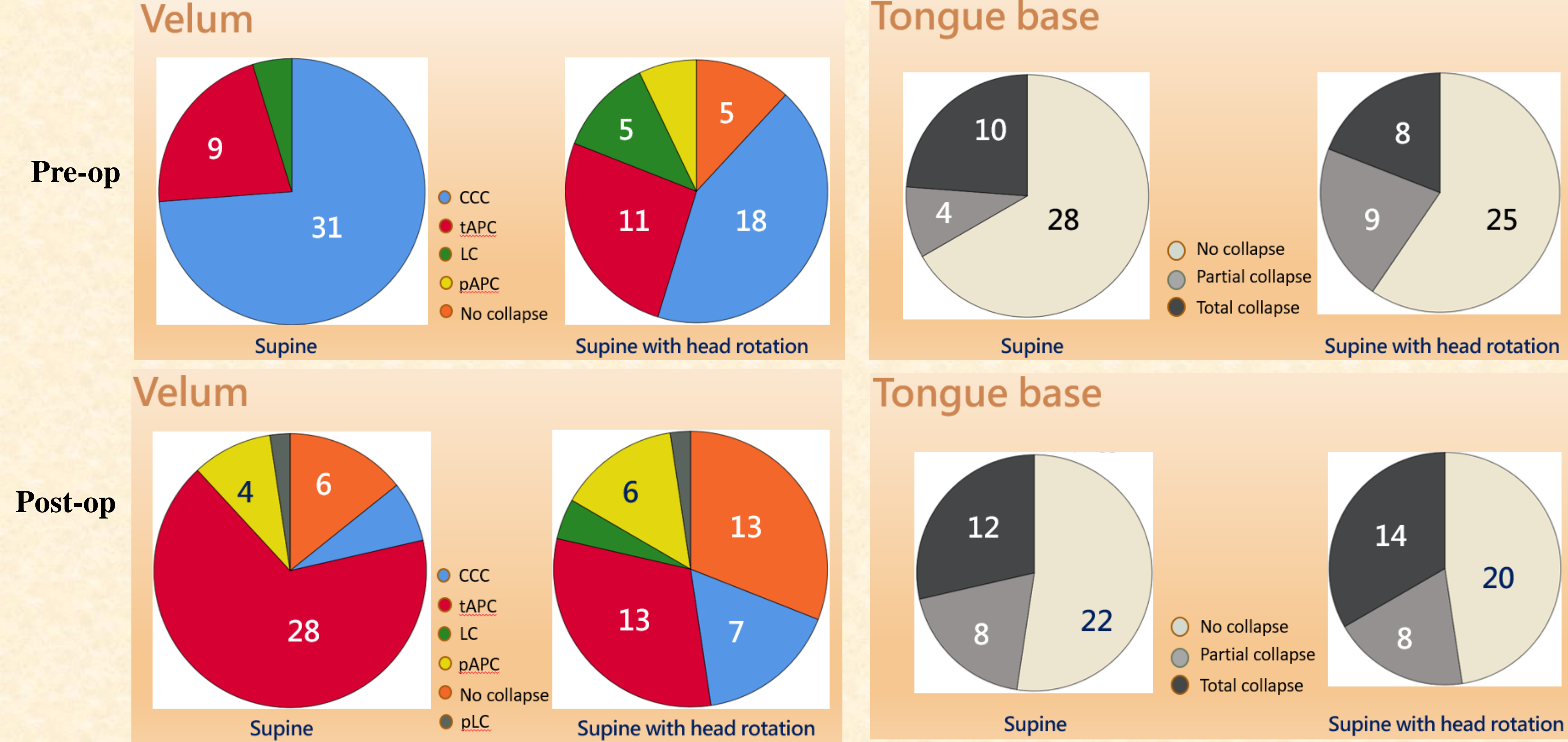
DISE was conducted first in the supine position (SP), and then repeated in the supine position with head rotation (SPHR) in an operation room immediately before surgery. A target-controlled infusion system was employed to reach anesthesia of absent arousal to loud verbal stimulation and maintain the bispectral index (BIS) level at approximately 60–70. When the required BIS level was achieved, a flexible endoscope was used to assess potential obstructions in the upper airway. All DISE findings were recorded and scored on the velum, oropharyngeal lateral walls, tongue base, and epiglottis (VOTE) classification system.

Surgical Procedure

The palatopharyngoplasty procedure for the participants was originated from the conventional SP with the incorporation of some LP elements. Briefly, after tonsillectomy, we removed the submucosal fat tissue in the semilunar-shaped supratonsillar area, with careful preservation of the palatopharyngeus muscle and pillar mucosa. The supratonsillar mucosa was elevated laterally to expose the pterygomandibular raphe, where the upper palatopharyngeus muscle was secured with 2-0 Vicryl sutures. We partially lysed the palatopharyngeus inferiorly before suspending it to the pterygomandibular raphe. We also shortened the uvula to 1 cm in length if required.

Results

Changes of Collapse Pattern in Different Positions



Surgical Outcome

Baseline characteristics and changes after surgery (<i>N</i> = 42)		
Variable		<i>P</i>
Age, year	46.9 ± 11.2	
Male sex	34 (80.9%)	
BMI (kg/m ²)		0.783
Pre-op	28.2 ± 4.1	
Post-op	28.0 ± 3.5	
AHI (events/ hours)		<0.001
Pre-op	42.0 ± 23.3	
Post-op	24.9 ± 20.6	
Minimum SaO ₂ (%)		0.005
Pre-op	76.0 ± 9.5	
Post-op	80.1 ± 8.0	
Surgical outcome		
AHI reduction ratio (%)	39.9 ± 30.0	
Increase of minimal SaO ₂	3.3 ± 6.8	
Success rate	16 (38.1%)	

Abbreviations: OP, operation; BMI, body mass index; AHI, apnea-hypopnea index; SaO₂, arterial oxyhemoglobin saturation] Data are presented as frequency (percentage) or mean ± standard deviation

Correlation between Sleep Endoscopy (SP) and Surgical Outcome

Outcomes according to preoperative and postoperative status at the velum (SP)				
	# of patients	Post-OP AHI	AHI reduction ratio	Success
Pre-OP velum				
Non-CCC	11	24.7 ± 14.9	27.2 ± 30.7	5 (45.5)
CCC	31	25.9 ± 22.3	43.8 ± 29.3	11 (35.5)
<i>P</i> value		0.888	0.174	0.662
Pre-OP velum				
0	0	NA	NA	0 (0.0)
1	0	NA	NA	0 (0.0)
2	9	29.2 ± 14.4	19.9 ± 25.2	4 (44.4)
3	2	11.1 ± 4.2	49.2 ± 46.1	1 (50.0)
CCC	31	25.9 ± 22.3	43.8 ± 29.3	11 (35.5)
<i>P</i> value		0.569	0.194	0.576
Post-OP velum				
Non-CCC	39	25.8 ± 20.1	38.8 ± 29.0	15 (38.5)
CCC	3	23.7 ± 30.4	51.4 ± 45.3	1 (33.3)
<i>P</i> value		0.867	0.497	1.000
Post-OP velum				
0	6	15.2 ± 7.7	47.4 ± 22.8	2 (33.3)
1	5	32.7 ± 18.7	22.2 ± 7.8	2 (40.0)
2	28	27.8 ± 22.1	38.7 ± 31.8	11 (39.3)
3	0	NA	NA	0 (0.0)
CCC	3	23.7 ± 30.4	51.4 ± 45.3	1 (33.3)
<i>P</i> value		0.563	0.616	0.942

Abbreviations: OP, operation; AHI, apnea-hypopnea index; NA, not applicable; CCC, complete concentric collapse; SP, supine position
0, no collapse
1, partial anteroposterior collapse
2, total anteroposterior collapse
3, total lateral collapse;

Outcomes according to preoperative and postoperative status at the tongue base (SP)				
	# of patients	Post-OP AHI	AHI reduction ratio	Success
Pre-OP status (dichotomous)				
No collapse/partial	32	21.0 ± 18.6	45.8 ± 30.0	13 (40.6)
Complete	10	40.6 ± 21.0	20.8 ± 21.8	3 (30.0)
<i>P</i> value		0.017	0.038	0.586
Pre-OP status				
No collapse	28	21.7 ± 19.8	43.9 ± 32.1	11 (39.3)
Partial	4	17.1 ± 10.7	56.0 ± 11.5	2 (50.0)
Complete	10	40.6 ± 21.0	20.8 ± 21.8	3 (30.0)
<i>P</i> value		0.042	0.089	0.752
Post-OP status (dichotomous)				
No collapse/partial	30	18.5 ± 15.4	45.3 ± 30.9	13 (43.3)
Complete	12	42.7 ± 22.1	26.9 ± 24.5	3 (30.0)
<i>P</i> value		0.001	0.104	0.383
Post-OP status				
No collapse	22	18.5 ± 15.9	43.1 ± 30.5	10 (45.5)
Partial	8	18.6 ± 15.3	52.1 ± 33.9	3 (37.5)
Complete	12	42.7 ± 22.1	26.9 ± 24.5	3 (25.0)
<i>P</i> value		0.003	0.221	0.392

Abbreviations: OP, operation; AHI, apnea-hypopnea index; SP, supine position

Correlation between Sleep Endoscopy (SPHR) and Surgical Outcome

Outcomes according to preoperative and postoperative status at the velum (SPHR)				
	# of patients	Post-OP AHI	AHI reduction ratio	Success
Pre-OP velum				
Non-CCC	24	18.7 ± 13.1	30.2 ± 30.1	12 (50.0)
CCC	18	27.2 ± 23.3	42.8 ± 29.3	4 (22.2)
<i>P</i> value		0.004	0.365	0.064
Pre-OP velum				
0	5	9.2 ± 3.5	50.2 ± 36.1	3 (60.0)
1	3	11.1 ± 4.2	58.6 ± 25.1	2 (66.7)
2	11	24.2 ± 25.1	19.9 ± 25.2	4 (36.7)
3	5	15.2 ± 5.6	49.2 ± 32.1	3 (60.0)
CCC	18	27.2 ± 23.3	42.8 ± 29.3	4 (22.2)
<i>P</i> value		0.002	0.318	0.259
Post-OP velum				
Non-CCC	35	22.8 ± 20.9	48.0 ± 29.6	15 (42.9)
CCC	7	28.6 ± 31.2	46.2 ± 45.8	1 (14.3)
<i>P</i> value		0.867	0.497	0.161
Post-OP velum				
0	13	11.2 ± 9.3	46.9 ± 36.1	6 (46.2)
1	7	12.7 ± 11.7	46.3 ± 37.8	4 (57.1)
2	13	27.8 ± 22.1	38.7 ± 31.8	5 (38.5)
3	2	19.2 ± 18.1	49.6 ± 47.5	1 (50.0)
CCC	7	28.6 ± 31.2	46.2 ± 45.8	1 (14.3)
<i>P</i> value		0.422	0.616	0.841

Abbreviations: OP, operation; AHI, apnea-hypopnea index; NA, not applicable; CCC, complete concentric collapse; SPHR, supine position with head rotation
0, no collapse
1, partial anteroposterior collapse
2, total anteroposterior collapse
3, total lateral collapse;

Outcomes according to preoperative and postoperative status at the tongue base (SPHR)				
	# of patients	Post-OP AHI	AHI reduction ratio	Success
Pre-OP status (dichotomous)				
No collapse/partial	34	20.4 ± 17.9	45.8 ± 30.0	14 (41.2)
Complete	8	41.2 ± 24.9	20.8 ± 21.8	2 (25.0)
<i>P</i> value		0.01	0.038	0.102
Pre-OP status				
No collapse	25	21.7 ± 19.8	42.6 ± 30.6	11 (39.3)
Partial	9	18.2 ± 11.3	54.2 ± 12.1	2 (50.0)
Complete	8	41.2 ± 24.9	20.8 ± 21.8	3 (30.0)
<i>P</i> value		0.038	0.089	0.233
Post-OP status (dichotomous)				
No collapse/partial	28	18.5 ± 15.4	45.3 ± 30.9	13 (46.4)
Complete	14	43.2 ± 24.1	26.5 ± 24.9	3 (21.4)
<i>P</i> value		0.001	0.104	0.025
Post-OP status				
No collapse	20	17.5 ± 15.4	44.1 ± 32.6	10 (45.5)
Partial	8	19.1 ± 16.0	50.1 ± 34.3	3 (37.5)
Complete	14	43.2 ± 24.1	26.5 ± 24.9	3 (25.0)
<i>P</i> value		0.001	0.221	0.107

Abbreviations: OP, operation; AHI, apnea-hypopnea index; SPHR, supine position with head rotation

Conclusion

Our study demonstrated that the collapse pattern at the velum and tongue base might change as different body positions. Preoperative CCC in the supine position with head rotation might be more indicative of poorer surgical outcomes than in the supine position alone. Preoperative and postoperative complete tongue base collapse identified in TCI-DISE, whether in supine alone or supine with head rotation position, were associated with relatively poor outcomes.