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DIFFICULT AIRWAY ANTHROPOMETRIC MEASUREMENTS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA ACCORDING TO SLEEP ENDOSCOPY SCORES

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Abstract

Aim: The aim of the study was to determine the measures to evaluate difficult intubation and predictors of intubation difficulties in the preoperative period in patients undergoing obstructive sleep apnea syndrome (OSAS) surgery. With these measurements, both the modified Cormack Lehane score and obstructions during sleep endoscopy were evaluated.
Methods: The study included 40 patients who presented at the outpatient clinic with the complaint of snoring, underwent polysomnography, and were diagnosed with OSAS between August 2018 and December 2019. Measurements were taken of the modified Mallampati Index, mouth opening, thyromental distance, and sternomental distance. The modified Cormack Lehane scoring system was applied after anesthesia induction.
Results: A statistically significant correlation was observed between thyromental distance and the Modified Cormack Lehane Scoring-system (MCLS) (p= 0.017) and between intubation time and MCLS (p= 0.012). As MCLS increased, the average intubation time increased. A statistically significant correlation was observed between external compression and MCLS (p= 0.001) and between the number of intubation trials and MCLS (p= 0.035). A positive correlation was found between MCLS and the desaturation index (p= 0.035, r= 0.343) and between the MCLS and the hypopnea index (p= 0.031, r= 0.342)
Conclusions: There was found to be interdependence with the measurements related to difficult intubation according to both the sleep position and the apnea hypopnea index and hypopnea index.

Keywords: *Sleep apnea, difficult intubation, sleep endoscopy, thyromental distance, modified Cormack Lehane scoring system, airway management*

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Introduction

Obstructive sleep apnea syndrome (OSAS) is a common disease that affects all age groups. Patients with OSAS are prone to obstruction of the upper airway during sleep, which causes them to wake because of the extra breathing effort required to restore the airway which has collapsed due to apnea. These events repeat at a recurring frequency throughout the sleep time. The same events occur when sedative and anesthetic agents suppress consciousness. Both functional and anatomic abnormalities may play a role in the pathogenesis of disorders in patients with OSAS syndrome[1-3].

Anesthesia management is difficult in patients with OSAS syndrome due to cardiac arrhythmia, myocardial ischemia, cerebrovascular insufficiency and intracranial hypertension, and difficult intubation is an important problem in the induction period of general anesthesia. Studies on the theoretical explanation of the relationship between OSAS and difficult intubation are not common, and those which have been published on this subject in literature have generally been retrospective[1-3]. The Modified Mallampati score (MMS) is an important measurement for the evaluation of anatomic variations of the upper airway. The MMS is an effective method in evaluating tongue root and narrow mouth opening, i.e. the oropharynx [4]. The relationship between a high MMS and difficult intubation in patients with OSAS has been proven in studies[5]. The Stop-Bang score in patients with OSAS, the Modified Cormack and Lehane scoring system (MCLS), and thyromental and sternomental distances have also been associated with difficult intubation[3].

Identification and diagnosis of difficult intubation in the preoperative period reduces complications in OSAS patients. The aim of this study was to evaluate predictive factors for difficult airway in OSAS patients (Han's scoring, modified Mallampati Index, MCLS, neck circumference, thyromental distance, sternomental distance, upper lip bite test) together with sleep endoscopy findings and polysomnography data.

Materials and Methods

Approval for the study was granted by the Local Ethics Committee (protocol no: 298; dated: 25/07/2018). All the study subjects provided informed consent for voluntary participation in accordance with the Helsinki Declaration. This prospective study was conducted with OSAS patients who were planned to undergo surgery between August 2018 and December 2019.

Study Population

Patients aged >18 years, who were referred to the Sleep Disorders Clinic of the Otolaryngology Department and underwent diagnostic polysomnography (PSG) for any reason between August 2018 and December 2019, were reviewed for participation in the study. A total of 40 patients who were scheduled to undergo surgery were included in the study for analysis. Neck circumference (cm) was measured with a flexible tape-measure, horizontally at the upper margin of the laryngeal prominence with the patient positioned with head erect and eyes facing forward. Height and weight were measured with the subject without shoes or heavy outer garments. Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared.

In all the patients, the MMS was determined as the measurement of mouth opening. The distance between the thyroid notch and mentum was recorded as the thyromental distance, and the distance between the sternal notch and the mentum as the sternomental distance. Patients were asked to complete the STOP-BANG questionnaire. STOP-BANG stands for S – history of snoring, T – history of tiredness, O – observed apneas during sleep, P – blood pressure (hypertension), B – body mass index (BMI) >35 kg/m2, A – age >50 years, N – neck circumference >40 cm, G – gender is male.

Each positive response is given one point and the total points provide the total score. Patients were evaluated with drug-induced sleep endoscopy (DISE) before the operation. MCLS was applied after anesthesia induction[6].

Modified Cormack and Lehane scoring system (MCLS)[6]

Grade 1: Most of the glottic opening can be seen
Grade 2a: Partial view of the vocal cords
Grade 2b: Only the arytenoids and epiglottis seen.
Grade 3: Only the epiglottis is visible
Grade 4: Neither the glottis nor the epiglottis can be seen

Han's mask ventilation grading scale made[7]

Grade1: Ventilated by mask
Grade 2: Ventilated by mask plus oral airway adjuvant ± muscle relaxant
Grade 3: Difficult to mask ventilate despite above, inadequate or unstable, requiring two providers
Grade 4: Unable to mask ventilate with or without the use of muscle relaxants

Modified Mallampati scoring

The airway is classified according to the structures seen, as follows: class I, soft palate, fauces, uvula, pillars; class II, soft palate, fauces, uvula; class III, soft palate, base of uvula; class IV, soft palate not visible at all (Modified Mallampati)[8].

Measurement of mouth opening

Mouth opening was measured by asking the subject to open their mouth as wide as possible, while the examiner measured the maximum distance from the incisal edge of the maxillary central incisors to the incisal edge of the mandibular central incisors at the midline[9].

Measurement of sternomental thyromental distance

During the airway assessment, sternomental distance was measured as the straight distance between the upper border of the manubrium sterni and the bony point of the mentum with the head in full extension and the mouth closed[10].
The height was measured between the anterior border of the thyroid cartilage and the anterior border of the mentum, with the head in a neutral position and the mouth closed[11].

Upper lip bite test

Classification of the jaw protrusion was made with the upper lip bite test. Patients are asked to bite their upper lip with the lower incisors and the classification is applied as Grade I: lower incisors can bite the upper lip above the vermilion line; Grade II: lower incisors can bite the upper lip below the vermilion line; Grade III: lower incisors cannot bite the upper lip. Grades I and II predict easy intubation, while Grade III predicts difficult intubation[12].

Jaw protrusion

Temporomandibular joint mobility is assessed by asking the patient to open the mouth fully and then place their lower incisors as far forward as possible (subluxation).

A: Lower teeth can be placed in front of the upper teeth
B: Lower teeth can be placed in line with the upper teeth
C: Lower teeth cannot be placed in line with the upper teeth

The laryngoscope used during intubation was recorded and whether or not videolaryngoscope, Gem elastic bougie, and external compression were used.

Sleep Endoscopy Protocol

After the patients were taken to the operating room, an intravenous (i.v.) 0.9% NaCl infusion was started at the rate of 3 ml/kg/h. During the procedure, patients were given nasal O2 (2 L / min), and electrocardiography (ECG), pulse oximetry, and non-invasive blood pressure monitoring were performed. The bispectral index (BIS), electroencephalography (EEG) electrodes (BIS QUATRO; Covidienlc, 15 Hampshire Street, Mansfield, MA, USA) were placed on the patient's forehead for monitorization. The BIS recording time was set to 15 seconds. For sedation, an iv propofol infusion was started at a dose of 100 µg / kg / min. The propofol infusion was continued until the patient became unconscious and snoring started, then the velopharyngeal region obstruction was evaluated. The BIS value was evaluated between 50-60 (deep sedation) with flexible nasopharyngo-laryngoscope and obstruction areas of the patients were evaluated by the otolaryngologist (Bilal N.). The vellum, oropharynx, tongue, epiglottic regions were evaluated according to the VOTE classification as 0: no obstruction, 1: partial obstruction, 2: full obstruction[13,14].
Patients were excluded from the study if they had American Society of Anesthesiologists (ASA) physical classification of ≥3, food allergies such as xylocaine, propofol, eggs, beans, milk, moderate or severe chronic obstructive pulmonary disease, epilepsy or cerebrovascular disease, or were aged <18 years.

Sleep Studies and Polysomnography Scoring

The sleep of the patients overnight was evaluated with an Embla® S4500 PSG amplifier (Flaga, Reykjavik, Iceland). A total of 21 signals were recorded with the PSG device, respiratory signals, electroencephalography (EEG), electrocardiography (ECG), electro-oculography (EOG), electromyography (EMG), snoring and patient position. Obstructive hypopnea is defined as a decrease in air flow of at least 30% lasting at least 10 seconds and a 3% decrease in accompanying arousal in SaO_2. Apnea is defined as a minimum 90% reduction in airflow amplitude and respiratory events lasting at least 10 seconds[15].
According to the International Classification of Sleep Diseases (ICSD-3), the diagnosis of OSAS was made from the determination of one or more of the diagnostic criteria of apnea hypopnea index (AHI) > 5 from the result of PSG report and snoring, witnessed apnea or daytime sleepiness [10]. According to AHI, the severity of OSAS was evaluated as AHI of 5-14.9 points: mild, AHI of 15-29.9 points: medium, and AHI of ≥30 points: severe. Those with AHI <5 were considered as the control group.

Statistical Evaluation

Data obtained in the study were analyzed statistically using IBM SPSS ver. 22 and R 3.3.2. software. Conformity of the data to normal distribution was examined with the Shapiro-Wilk test. Comparisons of 3 or more groups of variables with normal distribution were made with One Way Anova, and post hoc tests of Tukey HSD and Tamhane T2. In the comparisons of 3 or more groups of non-normally distributed variables, the Kruskal Wallis H test was applied. The Exact test was applied to determine relationships between categorical variables. Correlations between quantitative variables were investigated using the Pearson correlation test. Statistical significance was accepted as $p < 0.05$.

Results

Evaluation was made of a total of 40 patients comprising 31 males and 9 females with a mean age of 41.2± 9.9 years. The demographic data of the patients are given in Table 1.

Table 1. Demographic data of patients

Gender	Male Female	*n(%)*	31(77,5) 9(22,5)
Age BMI		*Mean±SD*	41,2±9,9 29,6±3,7
STOP BANG	Low High	*n(%)*	7(17,5) 33(82,5)
Stop bang scala AHI		*Mean±SD*	4,35±0,7 20,0±4,8
HI		*Median±SD*	6,07±5,43
AI Total sleep time Sleep eficiency		*Mean±SD*	13,7±9,8 384,4±80,7 89,3±6,6
Desaturation index		*Median±SD*	10,9±10,3
Minimum oxygen saturation Mean O_2 saturation Mean heart rate		*Mean±SD*	85,6±5,9 95,5±2,1 68,0±9,2
Arousal index		*Median±SD*	21,5±19,2
Propofol Remifentanyl Intubation time		*Mean±SD*	182,0±43,28 107,0±38,02 57,9±54,8

The surgeries performed for patients undergoing sleep endoscopy were anterior palatoplasty in 5 (12.5%) cases, anterior palatoplasty + lateral palatoplasty in 3 (7.5%), anterior palatoplasty + lower concha radiofrequency in 1 (2.5%), open approach septorhinoplasty in 5 (12.5%), expansion sphincter pharyngoplasty in 10 (25%), lower turbinate radiofrequency in 1 (2.5%), and septoplasty in 14 (35%).

The average STOP-BANG score was calculated as 4.35 ± 0.5, with distribution as 2 points in 4 patients, 3 points in 3 patients, 4 points in 12, 5 points in 17, and 6 points in 4.

Postoperative complications were determined as desaturation in 5 patients, of which 1 was applied nasal airway due to the development of apneas during awakening. CPAP was performed in one patient due to desaturation, and then followed up in the intensive care unit (ICU). Tachycardia developed in 5 patients. One patient had elevated blood pressure and increased lactate level, so was followed up in the ICU. Blood pressure recovered with artery therapy. One patient developed suspected myocardial infarction (MI) and was followed up, but there was no increase in cardiac enzymes. Bleeding developed in 1 patient.

The intubation of 29 (72.5%) patients was completed at the first attempt, in 8 (20%) at the second attempt and in 3 (7.5%) at the third attempt.

There was no statistically significant difference between MCLS and BMI ($p = 0.373$). As the MCLS increased, the BMI average increased. There was no statistically significant difference between MCLS scoring and neck circumference ($p = 0.174$). As the MCLS increased, the average neck circumference increased. A statistically significant difference was observed in the relationship between thyromental distance and MCLS ($p = 0.047$). A statistically significant difference was observed between those intubated with gum elastic bougie and MCLS ($p = 0.001$). A statistically significant difference was observed in the relationship between intubation time and MCLS ($p = 0.007$). As MCLS increased, the average intubation time increased. A statistically significant difference was observed between external compression and MCLS ($p < 0.001$). As MCLS increased, the number of external compressions increased.

Table 2. Evaluation of patients' measurements according to modified Cormack and Lehane scoring system

		1	2A	2B	3	4	p
BMI, Median (Q1-Q3)		25,90 (24,10-28,70)	28,40 (27,30-31,60)	29,80 (28,50-31,00)	30,30 (28,70-34,50)	30,15 (27,80-32,70)	0.373
ASA	2,0	3,00(60,00)	5,00(83,33)		5,00(83,33)	15,00(83,33)	0.674
	3,0	2,00(40,00)	1,00(16,67)		1,00(16,67)	3,00(16,67)	
Modified mallampati score	1,0	1,00(20,00)	1,00(16,67)		0,00(0,00)	0,00(0,00)	0.519
	2,0	1,00(20,00)	2,00(33,33)		2,00(33,33)	5,00(27,78)	
	3,0	3,00(60,00)	2,00(33,33)		3,00(50,00)	12,00(66,67)	
	4,0	0,00(0,00)	1,00(16,67)		1,00(16,67)	1,00(5,56)	
Neck Circumference Median (Q1-Q3)		39,00 (36,00-41,00)	41,00 (37,00-41,00)	38,75 (37,50-41,00)	40,50 (38,00-43,00)	42,50 (40,00-43,00)	0.174
Thyromental Distance Median (Q1-Q3)		10,00 (10,00-10,00)[d]	9,00 (8,00-10,00)	9,00 (8,00-9,00)	7,50 (6,00-9,00)[a]	9,00 (8,00-10,00)	0.047
Sternomental Distance Median (Q1-Q3)		18,00 (16,00-18,50)	17,00 (15,00-17,00)	16,50 (16,00-17,00)	16,00 (16,00-16,00)	16,00 (15,00-19,00)	0.865
Mouth Opening Median (Q1-Q3)		7,00 (6,00-7,00)	7,00 (6,50-7,00)	6,75 (6,00-7,00)	6,50 (6,00-7,00)	7,00 (6,00-7,00)	0.969
Upper Lip Bite Test	0,0	0,00(0,00)	0,00(0,00)		0,00(0,00)	1,00(5,56)	1.00
	1,0	5,00(100,00)	6,00(100,00)		6,00(100,00)	17,00(94,44)	
Jaw protrusion	A	5,00(100,00)	6,00(100,00)		6,00(100,00)	17,00(94,44)	1.00
	B	0,00(0,00)	0,00(0,00)		0,00(0,00)	1,00(5,56)	
STOP BANG score, Median (Q1-Q3)		4,00 (4,00-5,00)	4,00 (4,00-5,00)	5,00 (4,00-5,00)	4,50 (3,00-5,00)	5,00 (4,00-5,00)	0.922
Laryngoscope Type	Mac.	2,00(40,00)	2,00(33,33)		0,00(0,00)	8,00(44,44)	1.00
	Mil.	3,00(60,00)	4,00(66,67)		6,00(100,00)	10,00(55,56)	
Video-Laryngoscope	,0	3,00(60,00)	2,00(33,33)		3,00(50,00)	9,00(50,00)	0.327
	1,0	2,00(40,00)	4,00(66,67)		3,00(50,00)	9,00(50,00)	
Gum elastic bougie	,0	1,00(20,00)	4,00(66,67)		0,00(0,00)	1,00(5,56)	p<0.001*
	1,0	4,00(80,00)	2,00(33,33)		6,00(100,00)	17,00(94,44)	
Intubation time (sec) Median (Q1-Q3)		15,00 (14,00-30,00)[e]	35,00 (15,00-35,00)[e]	26,00 (17,00-125,00)[e]	20,00 (15,00-25,00)[e]	65,00 (35,00-140,0)[a,b,c,d]	0.007*
External compression	,0	1,00(20,00)	5,00(83,33)		0,00(0,00)	1,00(5,56)	p<0.001*
	1,0	4,00(80,00)	1,00(16,67)		6,00(100,00)	17,00(94,44)	
Number of attempts	1,0	5,00(100,00)	5,00(83,33)		6,00(100,00)	8,00(44,44)	0.080
	2,0	0,00(0,00)	1,00(16,67)		0,00(0,00)	7,00(38,89)	
	3,0	0,00(0,00)	0,00(0,00)		0,00(0,00)	3,00(16,67)	

A statistically significant difference was observed between the number of attempts and MCLS (p = 0.080).As MCLS increased, the number of attempts increased (Table 2). When Han's mask was evaluated according to the ventilation grading scale, a statistically significant difference was observed between BMI, intubation time and number of attempts, respectively (p = 0.056, p = 0.011, p = 0.035). As the Han mask ventilation grading scale increased, the number of attempts, intubation time, and BMI increased (Table 3). When the findings of sleep endoscopy were examined, superior thyroid notch (Adam's apple) was observed to be statistically significant in patients with complete collapse in the vellum. Neck circumference was 41cm (39.0-43.0) in patients with complete collapse. In those with partial collapse, the average neck circumference was calculated to be 39.3 cm (34.5-41.8). Neck circumference in patients without collapse was calculated as mean 33.5 cm (33.5-33.5). Thyromental distance was measured as 9 cm (8.0-10.0) in patients with complete collapse, and 8.5 cm (7.5-10.5) in those with partial collapse, and 6 cm (6.0-6.0) in those without collapse.

Table 3. Evaluation of patients' measurements according to Han's mask ventilation grading scale scoring

			Han's mask ventilation scale scoring						
			1.0		2.0		3.0		p
BMI[a]		Median (Q1-Q3)	28,8 (25,4-30,5)		28,6 (27,5-32,0)		32,0 (29,5-33,9)		0.056
ASA	2.0	n(%)	10	83.3	14	87.5	9	75.0	0.869
	3.0		2	16.7	2	12.5	3	25.0	
Modified mallampati score	1.0	n(%)	2	16.7	1	6.3	1	8.3	0.830
	2.0		3	25.0	5	31.3	3	25.0	
	3.0		7	58.3	9	56.3	6	50.0	
	4.0		0	0.0	1	6.3	2	16.7	
Neck Circumference[a]		Median (Q1-Q3)	39,0 (36,8-42,0)		41,0 (37,5-42,0)		43,0 (40,5-44,0)		0.051
Thyromental Distance[a]		Median (Q1-Q3)	9,0 (7,0-10,0)		9,0 (8,3-10,0)		9,0 (8,0-10,0)		0.946
Sternomental Distance[a]		Median (Q1-Q3)	16,0 (15,0-18,3)		16,0 (16,0-17,5)		16,5 (15,5-18,0)		0.871
Mouth Opening[a]		Median (Q1-Q3)	7,0 (6,0-7,0)		7,0 (6,3-7,0)		6,8 (6,0-7,0)		0.955
Upper Lip Bite Test	.0	n(%)	0	0.0	1	6.3	0	0.0	1.00
	1.0		12	100.0	15	93.8	12	100.0	
Jaw protrusion	A	n(%)	12	100.0	15	93.8	12	100.0	1.00
	B		0	0.0	1	6.3	0	0.0	
STOP-BANG Score	2.0	n(%)	2	16.7	2	12.5	0	0.0	0.144
	3.0		2	16.7	0	0.0	1	8.3	
	4.0		3	25.0	6	37.5	3	25.0	
	5.0		2	16.7	8	50.0	7	58.3	
	6.0		3	25.0	0	0.0	1	8.3	
Laryngoscope Type	Miller	n(%)	5		8		2		0.218
	Macintosh		7		8		10		
Video-Laryngoscope	.0	n(%)	7	58.3	11	68.8	3	25.0	0.085
	1.0		5	41.7	5	31.3	9	75.0	
Gum elestic bougie	.0	n(%)	4	33.3	3	18.8	4	33.3	0.737
	1.0		8	66.7	13	81.3	8	66.7	
Intubation time(sec)		Median (Q1-Q3)	22,5 (15,0-35,0)		33,0 (22,5-50,0)		117,5 (63,0-145,0)		0.011
External pressure	.0	n(%)	6	50.0	4	25.0	2	16.7	0.213
	1.0		6	50.0	12	75.0	10	83.3	
Number of attempts	1.0	n(%)	11	91.7	12	75.0	6	50.0	0.035
	2.0		1	8.3	4	25.0	3	25.0	
	3.0		0	0.0	0	0.0	3	25.0	

Sternomental distance was measured as 7 cm (7.0-7.0) in those with full collapse, 6.8 (6.0-7.0) cm in those with partial collapse, and 6.0 cm (6.0-6.0) in those without collapse evaluated as (Table 4).

When evaluated with sleep endoscopy at the level of epiglottis, tongue root, and oropharynx, no statistically significant difference was determined in the difficult airway predictive values (modified Mallampati, HAN score, CMLS, neck circumference, thyromental distance, sternomental distance, upper lip bite test).

A positive correlation was found between MCLS and the desaturation index ($p = 0.035$, $r = 0.343$) (Figure 1).

A positive correlation was found between MCLS and the hypopnea index ($p = 0.031$, $r = 0.342$) (Figure 2).

Table 4. Evaluation of difficult intubation measurements according to sleep endoscopy findings

			Vellum						P
			No Collapse		Partial Collapse		Fully Collapse		
Modified Mallampati	1,0	n(%)	0	0,0	2	25,0	2	6,5	0,228
	2,0		1	100,0	0	0,0	10	32,3	
	3,0		0	0,0	6	75,0	16	51,6	
	4,0		0	0,0	0	0,0	3	9,7	
Han's scoring	1,0	n(%)	1	100,0	4	50,0	7	22,6	0,207
	2,0		0	0,0	3	37,5	13	41,9	
	3,0		0	0,0	1	12,5	11	35,5	
Adam's apple protrusion	No	n(%)	1	100,0	2	25,0	21	67,7	0,042
	Yes		0	0,0	6	75,0	10	32,3	
Modified Cormack Lehane Scoring-system	1,0	n(%)	0	0,0	1	12,5	4	12,9	0.154
	2A		0	0,0	3	37,5	2	6,5	
	2B		0	0,0	1	12,5	5	16,1	
	3,0		1	100,0	1	12,5	4	12,9	
	4,0		0	0,0	2	25,0	16	51,6	
Neck Circumference		Median (Q1-Q3)	33,50 (33,50-33,50)		39,3 (34,5-41,8)		41,0 (39,0-43,0)		0,173
Thyromental Distance		Median (Q1-Q3)	6,00 (6,00-6,00)		8,5 (7,5-10,5)		9,0 (8,0-10,0)		0,790
Sternomental Distance		Median (Q1-Q3)	14,00 (14,00-14,00)		16,5 (15,0-17,5)		16,0 (16,0-18,0)		0,620
Mouth Opening		Median (Q1-Q3)	6,00 (6,00-6,00)		6,8 (6,0-7,0)		7,0 (6,0-7,0)		0,588

Figure 1. Positive correlation between Cormack Lehane score and desaturation index

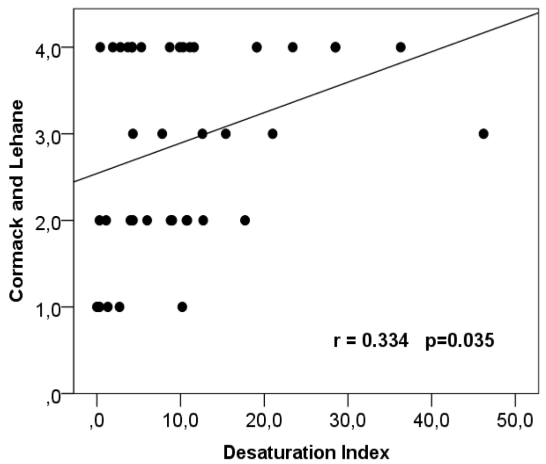
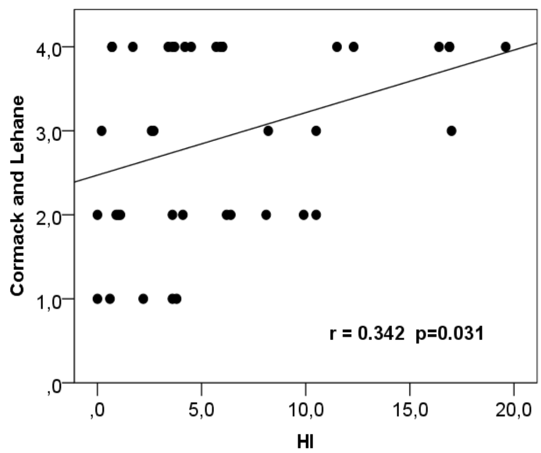


Figure 2. Cormack Lehane score correlation curve of hypopnea index



Discussion

The results of this study demonstrated that the statistical significance of the MCLS used for difficult intubation with thyromental distance, intubation time, number of attempts and external compression is an important criterion in the management of OSAS anesthesia.

The Cormack-Lehane and the Modified Cormack -Lehane scoring systems were developed for the evaluation of the hypopharynx using direct laryngoscopy[16-18]. The grading of these scoring systems is based on the extent to which hypopharyngeal obstruction affects the visualization of fixed laryngeal structures. The aim of this study was to determine whether a similar grading system could be used during DISE for the assessment of hypopharyngeal obstruction in patients with OSAS.

OSAS concerns most branches as well as anesthetists. In the preoperative examination, the upper airway should be evaluated anatomically in order to detect pathologies that may cause difficulty in the upper airway opening under endotracheal intubation and anesthesia[19]. A high STOP-BANG score obtained in the anamnesis shows that the patient may have difficult airway management. In this study, no statistically significant difference was observed when the STOP-BANG score was evaluated with MCLS and the HAN score. No statistically significant correlation was determined.

Difficult intubation is an important problem during general anesthesia. While difficult intubation has been reported at a rate of 2.2% in low-weight patients, this rate is 15.5% in obese patients[16]. Obesity and OSAS are interdependent. The average BMI of the current study patients was 29.6±3.7, neck circumference was measured as 40.12±12.1 cm, and 47.5% of the patients were evaluated as morbidly obese.

In a study conducted by Siyam et al.[17], the ratio between OSAS and difficult intubation was reported to be 21.9%. In the current study, according to MCLS, when difficult intubation was accepted as level 3 and 4[7], it was found to be 60%.

There is evidence that OSAS causes peroperative morbidity and mortality. In particular, upper airway surgery, which may be accompanied by intraluminal obstruction such as surgeries that may cause hematoma, tubes such as nasogastric catheters and nasal tampons, and narrowing of the upper airway, such as postoperative edema, are of great importance in terms of OSAS[18-20]. Sleep endoscopy performed before upper airway surgery contributes greatly to evaluations made by both the surgeon and the anesthetist in terms of areas with collapse[21,22].

In the current study, when obstruction levels (vellum, oropharynx, tongue root, epiglottis) in sleep endoscopy were compared with MCLS, the Han score and the modified Mallampati score, no statistically significant difference was found with these scores.

Eggerstedt et al.[23] observed a statistically significant difference of 6.5cm in the thyromental distance of patients with full obstruction in the epiglottis region. In the current study, the average thyromental distance was determined to be 9 cm in patients with complete obstruction in the vellum region in patients undergoing sleep endoscopy. The sleep endoscopy findings and difficult intubation findings were evaluated together, but the only significant result determined was in respect of evident Adam's apple. The difficulty of evaluating obstructions at all levels with difficult intubation findings has been previously stated in literature[23].

Sleep-related breathing difficulties can affect all age groups and can be seen with some diseases and syndromes. Studies on how the pathologies of these affect the duration of anesthesia and surgery are still in the initial stages[2].

The most important point for anesthesiologists is to be aware of patients with OSAS symptoms and diagnosis and to take due care in the perioperative management of these patients.

Conclusion

In patients with obstructive sleep apnea, difficult intubation was re-evaluated with BMI, the modified Mallampati score, STOP-BANG, and the Cormack Lehane scoring system. There was found to be interdependence with the measurements related to difficult intubation according to both the sleep position and the apnea hypopnea index and hypopnea index.

Author contributions
All authors contributed to the study conception and design. All authors read and approved the final manuscript.

Conflict of interest
The authors declare that they have no conflict of interest.

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Ethical approval

The study's ethical approval was given by the Kahramanmaraş Sütçü İmam University Local Ethics Committee (protocol no: 298; dated: 25/07/2018)

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