ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

Med J SDU / SDÜ Tıp Fak Derg ▶ 2019:26(1):35-45 doi: 10.17343/sdutfd.395467

PREDICTORS OF POSTEXTUBATIONAL OUTCOMES FOLLOWING OBSTRUCTIVE SLEEP APNEA SURGERY: A RETROSPECTIVE COHORT STUDY

OBSTRÜKTİF UYKU APNESI CERRAHİSİNİ TAKİBEN EKSTÜBASYON SONRASI SONUÇLARIN BELİRLEYİCİLERİ: RETROSPEKTİF KOHORT ÇALIŞMA

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Cite this article as: Okşar M, Okuyucu Ş, Akoğlu E, Çolak S, Turhanoğlu S. Predictors of postextubational outcomes following obstructive sleep apnea surgery: A retrospective cohort study. Med J SDU 2019; 26(1): 35-45.

Öz

Amaç
Obstrüktif uyku apnesi (OSA) hastaları ekstübasyon sırasında sık sık çeşitli komplikasyonlarla karşılaşırlar. Bu retrospektif çalışmada, OSA cerrahi olgularında ekstübasyonda görülen çeşitli komplikasyonların sıklıkları ve postoperatif ekstübasyon sonrası komplikasyonlar ile ilişkisi araştırıldı.

Yöntem
Bu çalışma, Mustafa Kemal Üniversitesi Hastanesi Kulak Burun Boğaz Kliniğine başvuran ve tek başına veya diğer OSA ile ilgili prosedürlere ek olarak uvulofaringoplasti yapılması planlanan ve Ekim 2011 ile Aralık 2013 arasında 22 OSA hastasını kapsamaktadır. Veri toplamak için OSA cerrahisi vakalarının, OSA ve OSA'lı hastaların özellikleri, ve ayrıca OSA ile ilişkili komplikasyonların tipi ve sıklığı konularında literatüre dayanan bir araştırma protokolü kullanıldı. Veriler hasta ve hasta yakınları ile temas kurularak doğrulandı. OSA cerrahisi olgularında ekstübasyonda ve post operatif ekstübasyon sonrası dönemde görülen başlıca komplikasyonlar ve bu komplikasyonlar arasındaki ilişki araştırıldı.

Bulgular
En sık görülen ekstübasyon komplikasyonu hipertansiyondu (% 31.8), en sık görülen postoperatif komplikasyonlar ise hemoglobin oksijen desatürasyonu (% 18.2) idi ve bunu yutma zorluğu (% 13.6) izledi. Aşağıdaki komplikasyonlar arasında anlamlı ilişkiler vardı ($p < 0.05$): ekstübasyonda üst hava yolu obstrüksiyonu ile hem postoperatif deliryum hem de yutma güçlüğü arasında, ekstübasyonda öksürük ile hem postoperatif deliryum hem de desatürasyon, ekstübasyonda larengomalazi-pulmoner aspirasyon ile postoperatif tekrar entübasyon, ekstübasyonda hipertansiyon ile postoperatif desatürasyon, ekstübasyonda taşikardi ile postoperatif desatürasyon ve ekstübasyonda ritim bozukluğu ile postoperatif deliryum, yoğun bakım ünitesine beklenmedik kabul ve desatürasyon.

Sonuç
Ekstübasyon komplikasyonları postoperatif komplikasyonları tahmin etmek için kullanılabilir. Ek olarak, ekstübasyonda disritmi gösteren hastalar yakından izlenmelidir.

Anahtar Kelimeler: Ekstübasyon, postoperatif komplikasyon, obstrüktif uyku apnesi, kardiyak ritim bozukluğu.

Abstract

Objective
Obstructive sleep apnea (OSA) patients often present with various complications during extubation.

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Müracaat tarihi/Application Date: 15.02.2018 • Kabul tarihi/Accepted Date: 07.04.2018

This retrospective study investigated the frequencies of various complications during extubation and their associations with postextubation/postoperative complications in OSA surgery cases.

Material and Methods
This study comprised 22 OSA patients admitted to the otolaryngology clinic of Mustafa Kemal University Hospital, Turkey. The patients underwent uvulopharyngoplasty alone or with other OSA-related procedures between October 2011 and December 2013. We reviewed the literature on the management of OSA surgery cases, the related characteristics of OSA and patients with OSA, and the type and frequency of the complications associated with OSA surgery. The collected data were verified by contacting the patients and their relatives. The chief complications seen during and after extubation in the OSA surgery cases, as well as the relationship between these complications, were investigated.

Results
Hypertension was the most frequent extubation complication (31.8%). The most frequent postoperative complications were hemoglobin oxygen desaturation (18.2%) and difficulty swallowing (13.6%). Significant associations ($P < 0.05$) were noted between the following complications during extubation and postoperatively: upper airway obstruction and delirium/difficulty swallowing, respectively; cough and delirium/desaturation, respectively; laryngomalacia–pulmonary aspiration and reintubation, respectively; hypertension and desaturation, respectively; tachycardia and desaturation, respectively; and dysrhythmia and delirium/unexpected need for intensive care unit admission/desaturation, respectively.

Conclusion
Extubation complications can be used to predict postoperative complications. Furthermore, patients exhibiting dysrhythmia at extubation should be monitored closely.

Keywords: extubation; postoperative complication; obstructive sleep apnea; cardiac dysrhythmia

Introductıon

Risk factors obtained from patient history, physical examination, and polysomnography are currently considered in various perioperative protocols, screening tools, and guidelines for the management of obstructive sleep apnea (OSA) patients during surgery (1). Polysomnography and clinical examinations are the best methods to diagnosis high-risk OSA (2). However, sleep tests are expensive and time consuming because they require the identification of alternative preoperative or perioperative signs to predict postoperative complications in OSA. A majority of existing protocols and guidelines are based on expert opinions accrued from clinical experience, but few predictors of surgical complications due to OSA have been validated in clinical trials. Moreover, the currently used protocols are not entirely successful in predicting postoperative complications. We assessed various extubation complications after an otherwise uneventful surgical procedure as predictors of postoperative complications when guiding postoperative management decisions. We focused on extubation complications that could not be predicted pre- or intraoperatively.

Material and Metod

Study Design
This study comprised 22 patients admitted to the otolaryngology clinic of Mustafa Kemal University Hospital, Turkey, with complaints of snoring and sleep apnea. Patients were diagnosed with OSA and underwent uvulopharyngoplasty alone or with other OSA-related procedures at our hospital between October 2011 and December 2013. Data were obtained from patient records and the hospital information system. All patients were contacted by phone to retrieve any missing data. The main data categories used were demographics and postoperative complications. The complications recorded at extubation were as follows: (1) hypoventilation leading to hypercapnia as measured by arterial blood gas analysis ($PaCO_2$) and clinically significant hypoxemia; (2) upper airway obstruction (obstruction of the larynx and airway structures above it) determined by difficulty breathing and voice followed by increased heart rate and blood pressure with rapidly developing cyanosis; (3) laryngo-bronchospasm (obstruction of the larynx and lower airway and shortness of breath and voice with no chest movement or intercostal and supraclavicular retractions); (4) uninterrupted coughing for several minutes immediately after extubation; (5) laryngeal failure and pulmonary aspiration due to OSA and/or OSA surgery; (6) hypertension (HT) at extubation (systolic ≥180 and/or diastolic ≥110 mmHg); (7) tachycardia (≥100 beats per min); and (8) dysrhythmia. The complications assessed postoperatively or those that appeared secondary to the extubation complications were as follows: (1) delirium (assessed using the Delirium Rating Scale); (2) unexpected intensive

care unit (ICU) admission needed before extubation; (3) hemoglobin (Hb) oxygen desaturation (≤90%); (4) need for reintubation; (5) difficulty swallowing due to OSA surgery, particularly tongue base and/or hyoid suspension interventions; and (6) sore throat, which is not considered a severe complication but is a common complaint among patients and could last for weeks postoperatively.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS; Released 2012, IBM SPSS statistics for Windows, Version 21.0; IBM Corp. Armonk, NY). $\chi 2$ tests were used to assess the relationship between two categorical variables. However, during analysis, Fisher's exact test was used because of the insufficient number of patients.

Results

The majority of patients were males (77.3%) and were overweight or obese (mean body mass index (BMI) 28.77 ± 3.54 kg; range, 21.99−33.91 kg), with most (16; 81.8%) gaining substantial weight (>10 kg) over the past decade (Table 1). All 22 patients complained of snoring and sleep apnea. The most frequent preoperative comorbidity was anxiety disorder (18.2%), followed by ischemic cardiac disease (13.6%), HT (9.1%), attention deficit disorder (9.1%), and lung disease (9.1%). Tables 2 and 3 list the extubation and postoperative complications, respectively. All statistical tests for the association are presented in Tables 4 to 9. Significant associations were noted during extubation and postoperatively with respect to the following: upper airway obstructions and delirium (P = 0.014)/difficulty swallowing (P = 0.041), respectively; cough and postoperative delirium (P = 0.043)/Hb oxygen desaturation (P = 0.024), respectively; laryngomalacia–pulmonary aspiration and reintubation (P = 0.045), respectively; HT and desaturation (P = 0.005), respectively; tachycardia and desaturation (P = 0.002), respectively; and dysrhythmia and delirium (P = 0.043)/unexpected ICU admission (P = 0.043)/Hb oxygen desaturation (P = 0.001), respectively. No correlations in hypoventilation or laryngospasm were observed between the extubation and postoperative complications.

Discussion

We identified several extubation complications that were significantly associated with serious postoperative complications. Although many institutions use preoperative screening tools, we used the extubation complications seen in our study population to predict the postoperative complications. We demonstrated that extubation complications could be reliable predictors for postoperative complications in OSA surgery cases. For instance, dysrhythmia at extubation was associated with delirium, unexpected ICU admission, and Hb oxygen desaturation. Persistent sore throat was a common postoperative complaint; therefore, it has no prognostic value. Furthermore, consistent with previous reports (3), Hb oxygen desaturation was a frequent postoperative complication and was associated significantly with cough, HT, and tachycardia at extubation. However, the most serious extubation complication requiring ICU transfer was dysrhythmia. Dysrhythmias can be caused by patient- and/or surgery-related perioperative factors. Patient-related causes of postoperative dysrhythmias in OSA include common comorbidities, such as structural heart disease, HT, and previous history of postoperative dysrhythmias (4). Obesity and chronic obstructive pulmonary disease are possible extracardiac reasons for postoperative dysrhythmias in OSA patients (5, 6). Although the surgery-related causes of complications were unclear because of the variety of surgical procedures used in this patient group, hyoid suspension and tongue base interventions, as well as the presence of airway edema, can cause difficulty swallowing. Therefore, these procedures may be indirectly responsible for subsequent complications, such as cough, Hb desaturation, hypercapnia, dysrhythmia, and HT. Only one of our patients was transferred to the ICU because of tachycardia unresponsive to treatment.

Keziran et al. (7) reported a serious nonfatal complication rate of 1.5% and a 30-day mortality rate of 0.2% after uvulopalatopharyngoplasty. In our study, unexpected ICU admission and monitoring rates were 9.1% with no mortality. Kim et al. (8) found Hb oxygen desaturation in 8 (8.9%) of their 90 patients. The Hb oxygen desaturation rate of 18.2% in our study was higher than that reported by Kim et al. (8) and may be attributed to differences in the apnea–hypopnea index between the two study populations.

Postoperative complications in OSA cases treated with different types of non-OSA surgery were investigated by Liao et al. (9) in a retrospective matched cohort study. The most frequent complication in their study was Hb oxygen desaturation (≤90%), which was similar to our findings of a 17% Hb oxygen desaturation rate. However, the most frequent complications in our study were HT (31.8%), tachycardia (27.3%), and cough and dysrhythmia (both 22.7%). Furthermore, sore throat, although not considered a severe complication of OSA surgery, was the most frequent complaint in the study group. Liao et al. (9) reported rates of bronchospasm (2%), laryngospasm (8%), need

for reintubation (4%), dysrhythmia (8%), tachycardia (3%), and HT (7%) lower than those observed in our study. Despite the relatively uneventful intraoperative period in our study, the extubation and postextubation periods were problematic depending on the specific surgical procedure used and the presence of edema in the airway. As mentioned earlier, hyoid suspension and tongue base interventions, which require the patient to be placed in head upright and lateral decubitus positions, appear to be the major causes for extubation complications in our study.

Considering the preoperative risk factors, the most predisposing factors for OSA-associated airway narrowing were male gender and elevated BMI in our study population. Advanced age, male gender (particularly with central obesity), menopause, general obesity, large neck circumference, macroglossia, micrognathia, and maxillary constriction were reported by different investigators for the same reason (10, 11). In our study, the majority of patients (14/22) were smokers, and most of them experienced regular nasal congestion, which can be considered a potentially modifiable risk factor for the disease.

Table 1 Demographic and baseline clinical characteristics of the OSA cases (N = 22)

	N	**%**
Sex (F/M)	5/17	22.7/77.3
ASA I/II/III	12/7/1	63.6/31.8/4.5
	Min−Max	**Mean ± SD**
Age (years)	17–61	40.82 ± 11.198
Height (m)	1.57–1.92	1.72 ± 0.075
Weight (kg)	57−123	85.57 ± 14.750
BMI (kg/m2)	21.99−33.91	28.77 ± 3.544
Medical history	**N**	**%**
Alcohol	8	36.4
Smoking	14	63.6
Family history	4	19.0
Dyspnea	13	61.9
Snoring	22	100.0
Sleep apnoea	22	100.0
Difficulty swallowing	1	4.5
Underlying medical disease(s)		
Hypertension	2	9.1
Ischemic cardiac disease	3	13.6
Cardiac failure	0	0.0
Cerebral ischemia	0	0.0
Depression	2	9.1
Anxiety disorder	4	18.2
Attention deficit	2	9.1
No weight gain in the last decade	4	18.2
Weight gain in the last decade*	18	81.8
Lung disease	2	9.1
Stuffiness	18	81.8
Allergic rhinitis	1	4.5
Previous Ear, Nose, Throat operations	4	18.2

SD, standard deviation; BMI, body mass index;* weight gain between 10 and 20 kg

In our study, it was not possible to document the relationships between the apnea–hypopnea index and extubation, as well as postoperative outcomes, because polysomnography was performed preoperatively in selected patients only. Moreover, associations between extubation, postoperative complications, underlying medical conditions, and specific surgeries were also not evaluated because of the limited number of cases. Thus, large-scale studies are needed for this purpose.

The complications that are specifically related to anesthesia in OSA patients are difficult intubation and extubation due to facial structural differences between patients and/or ventilatory control. In general, the intraoperative period can be uneventful when airway patency is maintained. Therefore, early complications related to anesthesia are generally encountered at extubation and may extend to the postoperative period. However, complications related to OSA surgery can vary from one patient to another because of patient characteristics and the various symptoms presented by OSA patients, which may require different types of surgeries. Thus, we believe that extubation complications can predict postoperative complications and may help in planning the postoperative care required for OSA patients.

Conflıcts Of Interest
The authors declare no conflicts of interest.

Funding
This research did not receive any grants from funding agencies in the public, commercial, or not-for-profit sectors.

Congresses
TARK 2014, Ankara, Turkey

Table 2 Frequencies of tracheal extubation complications

Complication	N	%
Hypoventilation	3	13.6
Upper airway obstruction	3	13.6
Laryngo-bronchospasm	2	9.1
Cough	5	22.7
Laryngeal failure and pulmonary aspiration	1	4.5
Hypertension	7	31.8
Tachycardia	6	27.3
Dysrhythmia	5	22.7
Myocardial infarct/ischemia	0	0.0

N, number

Table 3 Frequencies of postoperative complications

Complication	N	%
Delirium	2	9.1
Unexpected ICU admission	2	9.1
Hemoglobin desaturation	4	18.2
Reintubation	1	4.5
Difficulty swallowing	3	13.6
Sore throat	22	100.0

ICU, intensive care unit; N, number

Table 4 Associations between upper airway obstruction during tracheal extubation and postoperative complications

			Upper Airway Obstruction 0*	Upper Airway Obstruction 1**	Total	χ^2	P
Delirium	0*	N	18	1	19	13.263	**0.014*** **
		%	94.7	5.3	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Unexpected ICU admission	0*	N	17	2	19	2.303	0.271
		%	89.5	10.5	100.0		
	1**	N	1	1	2		
		%	50.0	50.0	100.0		
Desaturation	0*	N	16	1	17	5.147	0.080
		%	94.1	5.9	100.0		
	1**	N	2	2	4		
		%	50.0	50.0	100.0		
Reintubation	0*	N	18	2	20	6.300	0.143
		%	90.0	10.0	100.0		
	1**	N	0	1	1		
		%	0.0	100.0	100.0		
Difficulty swallowing	0*	N	17	1	18	7.843	**0.041*** **
		%	94.4	5.6	100.0		
	1**	N	1	2	3		
		%	33.3	66.7	100.0		
Total		N	18	3	21		
		%	85.7	14.3	21 21		

* No symptom; ** Yes; *** P < 0.05 (χ^2 test).

Table 5 Associations between cough during tracheal extubation and postoperative complications

			Cough 0*	Cough 1**	Total	χ^2	P
Delirium	0*	N	17	3	20	7.480	**0.043*** **
		%	85.0	15.0	100.0%		
	1**	N	0	2	2		
		%	0.0	100.0	100.0%		
Unexpected ICU admission	0*	N	16	4	20	0.932	0.411
		%	80.0	20.0	100.0%		
	1**	N	1	1	2		
		%	50.0	50.0	100.0%		
Desaturation	0*	N	16	2	18	7.607	**0.024*** **
		%	88.9	11.1	100.0%		
	1**	N	1	3	4		
		%	25.0	75.0	100.0%		
Reintubation	0*	N	17	4	21	3.562	0.227
		%	81.0	19.0	100.0%		
	1**	N	0	1	1		
		%	0.0	100.0	100.0%		
Difficulty swallowing	0*	N	16	3	19	3.819	0.117
		%	84.2	15.8	100.0%		
	1**	N	1	2	3		
		%	33.3	66.7	100.0%		
Total		N	17	5	22		
		%	77.3	22.7	100.0		

* No symptom; ** Yes; *** $P < 0.05$ (χ^2 test).

Table 6 Associations between laryngeal dysfunction / failure and pulmonary aspiration during tracheal extubation and postoperative complications

			Laryngeal dysfunction/failure 0*	1**	Total	χ^2	P
Delirium	0*	N	20	0	20	10.476	0.091
		%	100.0	0.0	100.0		
	1**	N	1	1	2		
		%	50.0	50.0	100.0		
Unexpected ICU admission	0*	N	20	0	20	10.476	0.091
		%	100.0	0.0	100.0		
	1**	N	1	1	2		
		%	50.0	50.0	100.0		
Desaturation	0*	N	18	0	18	4.714	0.182
		%	100.0	0.0	100.0		
	1**	N	3	1	4		
		%	75.0	25.0	100.0		
Reintubation	0*	N	21	0	21	22.000	**0.045*** **
		%	100.0	0.0	100.0		
	1**	N	0	1	1		
		%	0.0	100.0	100.0		
Difficulty swallowing	0*	N	19	0	19	6.635	0.136
		%	100.0	0.0	100.0		
	1**	N	2	1	3		
		%	66.7	33.3	100.0		
Total		N	21	1	22		
		%	95.5	4.5	100.0		

* No symptom; ** Yes; *** $P < 0.05$ (χ^2 test).

Table 7 Associations between hypertension during tracheal extubation and postoperative complications

			HT at the extubation 0*	1**	Total	χ^2	P
Delirium	0*	N	15	5	20	4.714	0.091
		%	75.0	25.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Unexpected ICU need	0*	N	15	5	20	4.714	0.091
		%	75.0	25.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Desaturation	0*	N	15	3	18	10.476	**0.005*** **
		%	83.3	16.7	100.0		
	1**	N	0	4	4		
		%	0.0	100.0	100.0		
Reintubation	0*	N	15	6	21	2.245	0.318
		%	71.4	28.6	100.0		
	1**	N	0	1	1		
		%	0.0	100.0	100.0		
Difficulty Swallowing	0*	N	14	5	19	1.945	0.227
		%	73.7	26.3	100.0		
	1**	N	1	2	3		
		%	33.3	66.7	100.0		
Total		N	15	7	22		
		%	68.2	31.8	100.0		

* No symptom; ** Yes; *** $P < 0.05$ (χ^2 test).

Table 8 Associations between tachycardia during tracheal extubation and postoperative complications

			Tachycardia 0*	Tachycardia 1**	Total	χ^2	P
Delirium	0*	N	16	4	20	5.867	0.065
		%	80.0	20.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Unexpected ICU admission	0*	N	16	4	20	5.867	0.065
		%	80.0	20.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Desaturation	0*	N	16	2	18	13.037	**0.002*** **
		%	88.9	11.1	100.0		
	1**	N	0	4	4		
		%	0.0	100.0	100.0		
Reintubation	0*	N	16	5	21	2.794	0.273
		%	76.2	23.8	100.0		
	1**	N	0	1	1		
		%	0.0	100.0	100.0		
Difficulty swallowing	0*	N	15	4	19	2.718	0.169
		%	78.9	21.1	100.0		
	1**	N	1	2	3		
		%	33.3	66.7	100.0		
Total		N	16	6	22		
		%	72.7	27.3	100.0		

* No symptom; ** Yes; *** P < 0.01 (χ^2 test)

Table 9 Associations between dysrhythmia during tracheal extubation and postoperative complications

			Dysrhythmia 0*	Dysrhythmia 1**	Total	χ^2	P
Delirium	0*	N	17	3	20	7.480	**0.043*** **
		%	85.0	15.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Unexpected ICU admission	0*	N	17	3	20	7.480	**0.043*** **
		%	85.0	15.0	100.0		
	1**	N	0	2	2		
		%	0.0	100.0	100.0		
Desaturation	0*	N	17	1	18	16.622	**0.001**** **
		%	94.4	5.6	100.0		
	1**	N	0	4	4		
		%	0.0	100.0	100.0		
Reintubation	0*	N	17	4	21	3.562	0.227
		%	81.0	19.0	100.0		
	1**	N	0	1	1		
		%	0.0	100.0	100.0		
Difficulty swallowing	0*	N	16	3	19	3.819	0.117
		%	84.2	15.8	100.0		
	1**	N	1	2	3		
		%	33.3	66.7	100.0		
Total		N	17	5	22		
		%	77.3	22.7	100.0		

* No symptom; ** Yes; *** $P < 0.05$, **** $P < 0.01$ ($\chi 2$ test).

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