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Özgün Araştırma / *Original Article*

Airway Management Experiences In Bariatric Surgery

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ABSTRACT

Objective: *Obese patients are hazardous due to airway morbidity as against to the non-obese. However, there are contradictory data about predicting factors of tracheal intubation and mask ventilation in morbidly obese people.*
Methods: *We studied 196 patients undergone laparoscopic sleeve gastrectomy surgery. Neuromuscular blockade (NMB) was achieved with rocuronium. At the end of the surgery, complete reversal of NMB was obtained with sugammadex. Mallampati scores, Cormack-Lehane scores, number of intubation attempts, ventilation and OSAS descriptives were recorded.*
Results: *Mallampati 4 scores were related to higher difficult ventilation situation and OSAS. Also, none of Cormack-Lehane 4 scores were intubated at first attempt. Higher Cormack-Lehane scores (3 and 4) were related to higher difficult ventilation situation and OSAS. During standard induction and transtracheal intubation, the sense of concern in anesthesiologists was recorded as none, moderate and high. During 98.5% of standard induction and transtracheal intubation, anesthesiologists declared they had no concerns. Difficult ventilation situation was not related to age. OSAS was related to higher ages.*
Conclusion: *BMI is not a predictable factor for difficult intubation,however difficult mask ventilation can predict difficult intubation in obese patients because of anatomical reasons. Also presence of obstructive sleep apnea syndrome (OSAS) and high Mallampati class situations may cause difficult intubation. Presence of sugammadex in the operating room may encourage anesthesiologists.*

Keywords: *Difficult intubation, difficult ventilation, obesity, sugammadex*

ÖZ

Amaç: *Obez hastalar, obez olmayan hastalara göre hava yolu morbiditesi açısından daha risklidirler. Ancak literatürde, obezlerde zor trakeal entübasyon ve zor maske ventilasyonunu ön gösterecek faktörler ile ilgili çelişkili veriler bulunmaktadır.*
Yöntem: *Laparoskopik sleeve gastrektomi ameliyatı geçiren 196 hasta çalışmaya dahil edildi. Rokuronyum ile nöromüsküler blokaj (NMB) sağlandı. Ameliyat sonunda, sugammadeks ile NMB'nin tamamen geri dönüşü sağlandı. Mallampati skorları, Cormack-Lehane skorları, entübasyon deneme sayısı, ventilasyon ve Obstrüktif uyku apne sendromu (OSAS) verileri kaydedildi.*
Bulgular: *Mallampati skoru 4, zor ventilasyon durumu ve OSAS ile ilişkili bulundu. Ayrıca, Cormack-Lehane skoru 4 olan hastaların hiçbiri ilk denemede entübe edilemedi. Daha yüksek Cormack-Lehane skorları (3 ve 4), daha zor ventilasyon durumu ve OSAS ile ilişkili bulundu. Standart indüksiyon ve transtrakeal entübasyon sırasında, anestezi uzmanlarında endişe duyusu hiç, orta ve yüksek olarak sorgulandı. Standart indüksiyon ve transtrakeal entübasyonun %98.5'i sırasında anestezi uzmanları endişe durumlarını "hiç" olarak belirttiler. OSAS ileri yaş ile ilişkili bulundu.*
Sonuç: *BMI tek başına zor entübasyonu öngörmezken, obez hastalarda anatomik nedenlerden dolayı maske ventilasyonu tahmin edilebileceği gibi zordu. OSAS hastaları ve yüksek Mallampati skoru (3 ve 4) olan morbid obez hastaların entübasyonu zor olabilir. Ameliyathanede sugammadeks varlığı anestezistleri cesaretlendirmektedir.*

Anahtar kelimeler: *zor entübasyon, zor ventilasyon, obezite, Sugammadex*

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INTRODUCTION

During bariatric surgery, morbidity or mortality risks increase synchronously with the increased body mass index (BMI) and common fat spreading [1]. Airway management is harder because of desaturation of oxygen expeditiously, difficult mask ventilation and difficult intubation [2]. Therefore, obese patients are likely to have airway morbidity more than the non-obese. However, there are contradictory data about predicting factors of tracheal intubation in morbidly obese people. In this study, we evaluated the link between Mallampati score, Cormack Lehane score, BMI and difficult tracheal intubation (DTI) and difficult face mask ventilation in morbid obese patients undergoing laparoscopic sleeve gastrectomy (LSG) surgery by studying the airway management experiences in our hospital.

MATERIALS and METHOD

This retrospective study was conducted at Sanko University Medical Faculty Hospital between March 2015 and December 2017. Approval for the study was granted by the local Institutional Ethics Committee (No: 2017/01-5 date: 25.01.2017). Written informed consent was obtained from all patients.

The study included patients undergoing LSG operations.

The LSG operation was performed on all patients with standard anesthesia management using propofol 200 mg, rocuronium (Esmeron, Organon, USA) 0.5 mg kg^{-1} and fentanyl 0.2 µg kg^{-1} with sevoflurane and remifentanil infusion 0.25-0.5 µg kg^{-1} min IV for maintenance. Sugammadex 2 mg kg^{-1} was used for reversal of rocuronium after surgery. After extubation, the patients were transferred to the post-anesthetic care unit (PACU) for observation for 30 minutes, or longer if appropriate. Patients were then transferred to the intensive care unit (ICU) for 24 hours or more if necessary.

Mallampati scores, Cormack-Lehane scores, number of intubation attemps, ventilation and obstructive sleep apnea syndrome (OSAS) descriptive, difficult intubation situation were recorded. The American Society of Anesthesiology (ASA) defines difficult intubation as occurring when "tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology" [3].

Statistical analysis

SPSS 23.0 (IBM Corporation. Armonk. New York. USA) program was used for the analysis of data. Kolmogorov-Smirnov test was used to evaluate normality of data. The Levene's test was used for evaluating homogeneity of variance. Quantitative data were expressed as mean ± standard deviation (SD); categorical data were expressed as frequencies (n) and percentages (%). Chi-square and Fisher's Exact test were used for categorical data comparisons. One-way ANOVA was used for continuous data in group comparisons; Tukey post hoc test was used for multiple comparisons. The data were examined at confidence level of 95% and the value of $p<0.05$ was accepted as statistically significant.

When the Spearman correlation coefficient is calculated for the relationship between the Mallampati score with age and BMI and Cormack-lehane score with age and BMI, although $p<0.05$ the "r" is very close to 0 and looks very moderate in very small surroundings.

RESULTS

This study included 196 patients. Mean age was 35.8±9.8 years and mean BMI was 47.0±4.9. Gender distribution was assessed as 64 (32.7%) males and 132 (67.3%) females.

Mallampati scores, Cormack-Lehane scores, intubation, ventilation and OSAS descriptive data were analyzed. Mallampati scores in 24 patients were class I, in 74 patients were class II, in 78 patients were class III and in only 20 patients were class IV. Cormack-Lehanes scores in 121 patients were I, in 55 patients were II, in 14 patients were III and in only 6 patients were IV. One hundred eighty-one patients were intubated on the first attempt (92.3%), 12 patients were intubated in the second attempt (6.1%) and only 3 patients were not able to intubate with standard laryngoscopy. Two of these 3 patients were intubated with video laryngoscopy and 1 of these patients was intubated with ventilation tube exchanger inserted with video laryngoscopy and then

Table I. Relationship between Cormack-Lehane and Mallampati scores and intubation, ventilation descriptives and OSAS

	n	Intubation at first attemp (%)	Intubation at second attemp (%)	Intubation with video laryngoscopy (%)	Difficult ventilation (%)	OSAS (%)
Mallampati Score						
1	24	95.8%	4.2%	0%	8.3%	8.3%
2	74	98.6%	1.4%	0%	10.8%	10.8%
3	78	91%	7.7%	1.3%	15.4%	16.7%
4	20	70%*	20%*	10%*	60.0%*	75%*
Cormack-Lehane Score						
1	121	100%	0%	0%	7.4%	8.3%
2	55	100%	0%	0%	12.7%	16.4%
3	14	35.7%	64.3%**	0%	86.7%	92.9%**
4	6	0%	50%**	50%**	100%**	100%**

**Mallampati score 4 and **Cormack-Lehane scores 3 and 4 were related to difficult airway management.*

endotracheal tube was inserted over this exchanger. Thirty-four patients were considered to have difficult ventilation (17.3%). Thirty-eight of our patients were diagnosed with OSAS before surgery (Table I).

We analyzed the relationship between age and Cormack-Lehane scores, Mallampati scores, intubation and ventilation descriptive data and OSAS. Higher Cormack-Lehane scores were related to higher age; however, the number of patients with Cormack-Lehane scores of 3 or 4 was not enough to complete statistical analyses. Also Mallampati score of class 4 was related to higher age but similarly the number of patients was not enough to make statistical analysis. Intubation descriptive data were not related to age, mean age was 35.5±9.5 in patients who were intubated on the first attempt and 37.5±12.5 years in patients who were intubated in the second attempt. Ages of patients whom were intubated with video laryngoscopy were 39, 58 and 41 years. Difficult ventilation situation was not related to age. However OSAS was related to older ages (41.3±11.4/34.5±8.9) ($p<0.005$).

When the relationship between BMI and Cormack-Lehane scores, Mallampati scores, intubation and ventilation descriptive data and OSAS are analyzed, higher Mallampati scores were related to higher BMI values. Similarly, Cormack-Lehane scores were related to higher BMI values too. However, intubation descriptive data were not related to BMI values. BMI values of patients who were intubated with video laryngoscopy were 64.6, 65.2 and 57.8 and these were higher than the mean BMI value of all patients. Difficult ventilation situation was related to higher BMI values (49.2/46.6). Also OSAS was related to higher BMI values too (50.2/46.3) ($p<0.005$).

Relationship between gender and other descriptive data was analyzed. Cormack-Lehane scores, Mallampati scores, intubation and ventilation descriptive data and OSAS were not related to gender. The genders of 3 patients who were intubated with video laryngoscopy were 2 males and 1 female.

Relationship between Cormack-Lehane scores, Mallampati scores and intubation and ventilation descriptive data and OSAS were analyzed (Table I). Mallampati 4 scores were related to fewer patients intubated on the first attempt and more patients intubated in the second attempt. Mallampati 4 scores were related to higher difficult ventilation situation and OSAS. Also, none of Cormack-Lehane 4 scores were intubated at first attempt. Higher Cormack-Lehane scores (3 and 4) were related to higher difficult ventilation situation and OSAS.

During standard anesthesia induction and transtracheal intubation, the sense of concern in anesthesiologists was recorded as none, moderate or high.

Table II. Sense of concern during intubation in anesthesiologists

Sense of Concern	n (%)
None	193 (98.5%)*
Moderate	2 (1%)
Highly	1 (0.5%)

During 98.5% of standard induction and transtracheal intubation, anesthesiologists declared that they had no concerns, for 1% declared moderate concern and for 0.5% (1 patient) declared as highly concern (Table II).

In the postoperative period, after extubation 1 patient was re-intubated because he could not maintain spontaneous ventilation due to OSAS without any obstruction evident. Two hours later he was extubated smoothly. One patient was re-intubated because of desaturation due to lung edema and metabolic acidosis and hemodialysis was performed on this patient urgently. Six hours after hemodialysis, he was extubated without any problem.

DISCUSSION

Because of adipose tissue accumulation roundabout the chest and abdomen, the respiratory system decays in obese patients. Also due to adipose tissue accumulation in pharyngeal tissues, these patients often have decreased pharyngeal area too. All these anatomical problems and together with the increased intra-abdominal pressure and decreased chest wall compliance, they lead to restrictive lung diseases [4]. The prevalence of OSAS in obese patients is estimated about 40% [5], similar to these studies the proportion of OSAS in our patients was 38%. BMI is associated with the presence and severity of OSAS [6], similarly the average of BMI in patients with OSAS was higher among our patients (50.2/46.3). In this present study, OSAS was related to higher BMI. This correlates with previous studies [7].

Liao et al. [8] reported that if patients with OSAS are treated preoperatively, they have fewer perioperative complications, according to this, we prescribed continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) and bronchodilator treatment preoperatively. We consider that, owing to preoperative treatments of our study patients, only 1 patient needed CPAP and 1 patient needed reintubation in ICU.

The study by Lee et al. [7] evaluated OSAS and age relationship in obese patients. They reported that middle-aged patients with OSAS were more likely to be obese, as measured by anthropometric measurements, than younger or older OSAS patients. In our study OSAS was related to higher age (41.3/34.5 years).

The key element in airway control during anesthesia induction in obese patients is optimizing oxygenation [9]. We can achieve this with the 45 degree sitting position, pre-oxygenation, non-invasive ventilation and anticipating difficult face mask ventilation as defined in previous studies [10]. Neuromuscular blockers can improve airway management. Moreover, rapid sequence induction is indicated because bariatric patients have many criteria for difficult airway [2]. But the choice of neuromuscular blocker is still controversial. A recent survey showed that doctors rely on both suxamethonium and rocuronium [11]. Because the combination of rocuronium-sugammadex allows faster recovery [12] and rocuronium has the advantage of being usable through the whole surgery [13]. The use of sugammadex to quickly reverse rocuronium-induced neuromuscular blockade may allow respiratory activity to recover before notable arterial desaturation has occurred. On the other hand, authors of some other studies reported that sugammadex is not a reliable drug for rescuing patients in a CICV situation [14]. But we do not know the effect of sugammadex because we did not have to wake up any of the patients in our hospital. But the presence of sugammadex encouraged us, during 98.5% of standard induction and transtracheal intubation anesthesiologists declared they had no concerns.

There are contradictory data about predicting factors of tracheal intubation in morbidly obese people. In study of Lundstron et al. they reported that, BMI ≥35 kg m^2 is predictable for difficult tracheal intubation [15]. On the other hand, some of other studies report that increased BMI alone may not be associated with difficult intubation in morbidly obese patients [16,17]. Brodsky et al. [17] found that difficult intubation was associated with a Mallampati score of 3 and more important it was associated with increased neck circumference at thyroid cartilage region. In a recent study investigating bariatric patients, they reported only a Mallampati score of 4, 3 and male gender predicted difficult intubation, but not BMI, OSAS, or neck circumference [18]. Similarly, in our study Mallampati score 4 and Cormack-Lehane score 3 and 4 were related to difficult intubation/ventilati-

on but not with BMI. Additionally as reported in previous studies, BMI alone did not predict difficult intubation [16,17], but mask ventilation is predictably difficult in obese patients for anatomic reasons, including increased upper airway resistance, excessive supraglottic tissues [19]. After induction of general anesthesia, Posterior displacement of the soft palate, the tongue base, and the epiglottis impairs upper airway patency [20]. In our study, difficult ventilation situation was seen 17.3% of all patients. This percentage is high when compared to the general adult population [21].

Literature reports have suggested the use of bougie introducer, flexible fiberoptic bronchoscope, video laryngoscope and LMA as rescue techniques for the management of challenging airway situations [22]. In our study, the main tools to manage difficult airway management were video laryngoscopy and the utilization of video laryngoscopy and bougie together in one patient. We did not need to use LMA, because video laryngoscopy was stayed ready in the operating room.

CONCLUSIONS

In this study we consider that, BMI alone does not predict difficult intubation, while mask ventilation can predict difficult intubation in obese patients for anatomical problems. Morbidly obese patients with obstructive sleep apnea syndrome and high Mallampati may be difficult to intubate. Presence of sugammadex in the operating room may encourage anesthesiologists.

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