Changes in pulse oximetry levels and factors affecting oxygen saturation during routine upper gastrointestinal endoscopy with or without sedation

Sedasyonlu ve sedasyonsuz rutin üst gastrointestinal sistem endoskopisi sırasında pulse oksimetri düzeyindeki değişiklikler ve oksijen saturasyonunu etkileyen faktörler

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Background/aims: *We aimed to investigate whether endoscopy or midazolam as premedication causes oxygen desaturation and to determine factors which may affect the occurrence of oxygen desaturation.* ***Methods:*** *Totally 200 patients with various indications (103 men and 97 women), who presented to the Endoscopy Unit of Dicle University Hospital for upper gastrointestinal endoscopy examination, were included in the study. Anamnesis and anthropometric values of the patients were taken. Preoperative oxygen saturation, hemoglobin levels and heart rate per minute were recorded. Patients with initial oxygen saturation levels <90% were excluded. Patients were divided into two groups. The first group included 100 patients who underwent endoscopic examination without sedation and the second group included 100 patients who underwent endoscopic examination with sedation [midazolam (2-5 mg)]. At the end of endoscopy, intravenous flumazenil (0.2 mg) was administered to the premedication patients. Patients were monitored for oxygen saturation and heart rate starting before the sedation and oropharynx anesthesia and lasting until 1 min after the end of the procedure. During the endoscopic examination, minimum oxygen saturation and maximum heart rate values were recorded. The duration of the oxygen saturation <90% was recorded throughout the procedure and the relation of this time with the total time of the endoscopic examination was evaluated.* ***Results:*** *The mean age of the 200 patients included in the study was 45 and 44 years for Group 1 and Group 2, respectively. No differences were found between the two groups in terms of body mass index, smoking, hemoglobin and basal maximum pulse rate, duration of endoscopy, minimum basal oxygen saturation, duration of hypoxia and time to hypoxia. No relation was determined between oxygen desaturation and gender, duration of the endoscopy, basal pulse rate or hemoglobin level. It was found that smoking made significant contributions to the oxygen desaturation.* ***Conclusion:*** *Midazolam premedication for upper gastrointestinal system endoscopy is a reliable procedure and does not contribute an additional risk in individuals without serious comorbidities. Smoking habits should be taken into account in endoscopy patients.*

Key words: Premedication, midazolam, endoscopy, deoxygenation

Amaç: *Endoskopinin ve premedikasyonda kullanılan midazolamın oksijen desaturasyonuna yol açıp açmadığını, bunun yanında ortaya çıkacak oksijen desaturasyonuna etkili olabilecek faktörleri araştırmayı hedefledik.* ***Yöntem:*** *Çalışmaya, Dicle Üniversitesi Hastanesi Endoskopi Ünitesi'ne çeşitli endikasyonlarla üst gastrointestinal endoskopi için başvuran 103'ü erkek, 97'si kadın toplam 200 hasta dâhil edildi. Hastaların anamnezleri ve antropometrik değerleri alındı. İşlem öncesi oksijen saturasyonu, hemoglobin düzeyi ve dakikalık kalp hızı kaydedildi. Başlangıçta oksijen saturasyonu %90'ın altında olan hastalar çalışmaya dâhil edilmedi. Hastalar 2 gruba ayrıldı. 100 kişilik hasta grubuna sedasyonsuz (1.grup), 100 kişilik diğer hasta grubuna ise sedasyonlu (2.grup) olarak endoskopi işlemi uygulandı. Sedasyon amacı ile midazolam (2-5mg) kullanıldı. Premedikasyon uygulanan olgulara endoskopi bitiminde intravenöz flumazenil (0.2 mg) uygulandı. Hastalar sedasyon ve orofarinks anestezisi öncesinden başlanarak, işlem bitiminden bir dakika sonrasına kadar devamlı şekilde oksijen saturasyonu ve kalp hızı bakımından monitörize edildiler. Endoskopi işlemi süresince en düşük oksijen saturasyonu ve en yüksek kalp hızı değerleri kaydedildi. İşlem boyunca oksijen saturasyonunun ne kadar süre ile % 90'ın altında kaldığı kaydedildi ve bu sürenin endoskopi işleminin toplam süresi ile ilişkisi değerlendirildi.* ***Bulgular:*** *Çalışmaya alınan 200 hastanın yaş ortalaması 1.grupta 45, 2.grupta ise 44 idi. Her iki gurup arasında vücut kitle indeksi, sigara içimi, hemoglobin ve bazal en yüksek nabız düzeyi, endoskopi süresi, bazal en düşük oksijen saturasyonu, hipoksi süresi ve hipoksiye girme zamanı bakımından fark yoktu. Cinsiyet, endoskopi süresi, bazal nabız, hemoglobin düzeyi ile oksijen saturasyonu arasında herhangi bir ilişki saptanmadı. Sigara içiminin oksijen desaturasyonuna anlamlı katkıda bulunduğu saptandı.* ***Sonuç:*** *Üst gastrointestinal sistem endoskopisi için midazolam premedikasyonu güvenilir bir uygulamadır ve bu işlem, ciddi komorbiditesi olmayan bireylerde ek risk oluşturmamaktadır. Sigara alışkanlığı, endoskopi hastalarında dikkate alınmalıdır.*

Anahtar kelimeler: Premedikasyon, midazolam, endoskopi, deoksijenasyon

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INTRODUCTION

Currently, upper gastrointestinal system endoscopy is a procedure which is often used for therapeutic or diagnostic purposes. Premedication administration before endoscopy has gained importance in the last years. While it was accepted that premedication improves patient tolerance to the procedure and provides a comfortable work environment for the physician, there are studies which show the potential side effects of the methods used. At the same time, it was also reported that endoscopy was tolerated well without any premedication administration and could be made safely (1, 2). For the premedication procedure, diazepam, flunitrazepam, midazolam, meperidine, butorphanol, fentanyl or some combinations thereof can be used (3). The endoscopic procedure alone or many of the medications used for premedication may cause disorders in blood oxygenation. In the conducted studies, it was displayed that the oxygenation disorder occurs during the first minutes of the endoscopy procedure and at the time of the penetration of the endoscope into the esophagus (3). Also, opiates used for premedication may cause termination of respiration and decreases in tidal volume by depressing the response to carbon dioxide. Furthermore, it was reported that benzodiazepines such as midazolam, flunitrazepam and diazepam may lead to oxygen desaturation (3).

The objectives of our study were i) to examine whether or not endoscopy and/or premedication procedure leads to oxygen desaturation, ii) to investigate any other factors which may potentially cause oxygen desaturation during the endoscopy, and iii) to show the clinical importance of the factors leading to oxygen desaturation during the endoscopy procedure.

MATERIALS AND METHODS

A consecutive 200 patients admitted to the Endoscopy Unit of Dicle University Medical Faculty between September 2004 and December 2004 were included in the study. All participants provided written informed consent before the endoscopic examination. The first 100 patients were included in Group 1 and the second 100 patients in Group 2. Endoscopy procedure without and with sedation was applied to the first (55 men, 45 women) and second (48 men, 52 women) patient groups, respectively. Midazolam was administered with the aim of sedation as 2 mg by slow infusion into the antecubital vein for a minimum of 2 min. Eye movements, verbal fluency and lethargy were monitored and dose was increased to 5 mg as needed. In summary, a dose in the range of 0.30 µg/kg and 0.50 µg/kg was administered. Endoscopic procedure was started within a minimum of 5 min and maximum of 10 min in the group under sedation. At the end of endoscopy, intravenous flumazenil 0.2 mg was administered to the premedication patients. Xylocaine pump spray 10% was used as oropharynx anesthesia before the endoscopy. Patients were monitored for oxygen saturation and heart rate follow-up starting before the sedation and oropharynx anesthesia and lasting until 1 min after the end of the procedure. For this purpose, a pulse oximetry device (KT-MED Reusable Pulse Oximetry Sensor, Model KTP5-01) was used. Patients with basal oxygen saturation levels <90% were excluded from the study.

Patients were questioned for atherosclerotic heart disease, heart failure, chronic obstructive pulmonary disease and bronchial asthma before endoscopy. Smoking habits were also queried and for smokers amount and duration were recorded as package/year. Furthermore, blood hemoglobin and hematocrit levels were recorded as g/dl and %, respectively. Other physical examination findings were evaluated. The body height and weight of the patients were recorded as centimeter and kilogram, respectively. Following the weight and height measurements, body mass indices (BMI) (kg/m^2) were calculated. Endoscopic procedure was performed by two qualified gastroenterologists. Gastrointestinal Videoscope (Olympus, GIF-TYPE V-70) with outer diameter of 9.2 mm was used for the endoscopy procedure. Total time of the procedure was recorded as seconds.

According to monitorization, preprocedure basal oxygen saturation and heart rate were recorded. During the endoscopy procedure, minimum oxygen saturation and maximum heart rate values were recorded. The time with oxygen saturation <90% during the endoscopic procedure and the relation of this time with the total time of the endoscopy were recorded. The relation of the anatomic area to be examined (from esophagus to the second part of the duodenum) with the periods of oxygen saturation <90% was recorded.

In the statistical analysis, quantitative variables were assessed using independent t-test. If necessary, chi-square or Mann-Whitney U test was used. The effect of the factors on oxygen saturation was evaluated by logistic regression analysis.

SPSS 12.0 software was used for this purpose. P values <0.05 were accepted as indicating statistical significance.

RESULTS

The percentage of men and women in the first group (without sedation) was 55% and 45% and in the second group (with sedation) 48% and 52%, respectively. There was no difference between the two groups with regard to gender (p=0.423). Both groups were similar with regard to age (p=0.667), body height (p=0.903), mean weights (p=0.781) and BMI (p=0.138). Smoking ratios, hemoglobin levels, basal pulse and oxygen saturations, and mean duration of the endoscopic procedure were similar in both groups. No differences were found between the two groups with respect to either maximum pulse value or minimum oxygen saturation (Table 1).

Table 1. Main characteristics of Group 1 and Group 2 (mean values)

Characteristics	Groups*	Mean (±SD)
Age	Group-1	45.07±18.35
	Group-2	43.51±16.70
Weight (kg)	Group-1	61.28±12.82
	Group-2	64.85±14.03
Height (cm)	Group-1	166.05±8.54
	Group-2	164.79±8.91
BMI (kg/m²)	Group-1	22.52±4.31
	Group-2	24.32±4.57
Basal pulse rate	Group-1	92.93±16.90
	Group-2	95.41±17.49
Duration of endoscopy	Group-1	231.40±166.31
(second)	Group-2	240.80± 181.19
Maximal pulse rate	Group-1	115.07±25.02
(per minute)	Group-2	119.06±23.88
Basal oxygen saturation	Group-1	96.76±2.19
(%)	Group-2	97.10±1.88
Minimum oxygen saturation	Group-1	94.77±3.09
(%)	Group-2	95.49± 2.36
Hemoglobin (g/dl)	Group-1	12.27±2.59
	Group-2	12.01±2.89

*Group: 1. 100 controls without any sedation, 2. 100 patients given midazolam

The average hypoxia time was 31 seconds for the patients in the first group versus 90 seconds for the second group, but the difference was not statistically significant. Oxygen saturation of 7 patients in the first group was decreased below 90% (minimum value: 85%), while this decrease was observed in 3 patients (minimum value: 88%) in the second group (p=0.082). Mean value for time to hypoxia in Group 1 was 106 seconds and in Group

2 140 seconds. No significant difference was found between groups regarding this mean (p=0.091). Oxygen saturation was decreased below 90% in 2, 3, 3 and 2 patients during the examinations of esophagus, antrum, bulbus duodeni and corpus, respectively. An assessment by logistic regression analysis including all the patients demonstrated that the effect of sex, BMI, duration of endoscopy, basal pulse value and hemoglobin level on oxygen saturation was insignificant. In this analysis, it was noted that only smoking had a negative effect on oxygen saturation. The difference in oxygen saturation levels measured in Groups 1 and 2 was not statistically significant (p=0.397). Details are summarized in Table 2.

Table 2. Main characteristics of Group 1 and Group 2 (mean values)

Parameters	P value	OR* (95% CI)
Gender	0.423	2.2 (0.3-14.5)
BMI	0.138	0.8 (0.7-1.1)
Duration	0.431	0.9 (0.9-1.0)
Basal heart rate	0.702	1.0 (0.9-1.0)
Hemoglobin	0.229	1.2 (0.9-1.6)
Groups	0.397	0.5 (0.1-2.3)
Smoking	0.037	1.0 (1.0-1.0)

*OR: Odds ratios and 95% Confidence Interval (CI) for each significant variable

DISCUSSION

Premedication in endoscopic procedures creates a more comfortable environment for patient and physician. Currently, midazolam and diazepam are the most commonly administered medications in upper gastrointestinal endoscopy. However, narcotic agents, tranquilizers, antihistaminics, barbiturates and agents for general anesthesia are also used for the same purpose. The side effects of the agents used for premedication are generally on the cardiovascular and respiratory systems, and may be more pronounced in older patients and in those with a respiratory disease. Studies have shown that the cardiopulmonary complications account for 50% of the morbidity in upper gastrointestinal endoscopy and that systemic sedation further contributes to this fact (4). Furthermore, in a study including 2015 cases, it was reported that in 94% of these cases, the upper gastrointestinal system endoscopy was well tolerated without pre-endoscopic sedation and topical anesthesia, and that the endoscopic procedure was performed more easily (2). Patient compliance provided by premedication enables a more detailed exa-

mination. Therefore, it is not easy to decide not to premedicate the patients. In fact, contributions of the premedication to cardiopulmonary complications are not of great clinical importance. Also, in one study, 120 patients were divided into three groups to receive diazepam, midazolam or normal saline. Decreases in oxygen saturation were observed in all of the groups but no significant differences between groups were reported (5). The results of another study where patients were divided to premedication with fentanyl and diazepam and no-premedication groups revealed that the hypoxemia seen just after the endoscopy was not associated with sedation but with the procedure itself (6). In other studies, where the effects of the medications used in premedication were assessed, it was reported that sedation, duration of the procedure and smoking cause a decrease in oxygen saturation, but no significant differences between groups developed, and the main cause of the hypoxemia was ventilation-perfusion disorder resulting secondary to vasospasm and bronchospasm (7). There are also studies which point out that hypoventilation and oxygen desaturation developing during the endoscopy procedure are the results of the mechanical effect of the endoscope or reflex stimulation (8).

According to the results of our study, no statistically significant differences between the sedation and no-sedation groups were found regarding mean basal and maximum pulse values, mean basal and minimum oxygen saturation, mean duration of oxygen saturation <90% and mean blood hemoglobin levels. These results are parallel with the findings of the above-mentioned studies. In the other studies, it was concluded that sedation patients are exposed to more oxygen desaturation than the no-sedation patients; therefore, during the upper gastrointestinal system endoscopy, the follow-up of oxygen saturation by pulse oximetry is required in patients with serious systemic disease, especially those with abnormalities in respiratory function tests (9, 10). In our study, it was noted that duration of hypoxia was longer in sedation patients than no-sedation patients, but this difference was found statistically insignificant. Because cardiac and/or pulmonary disease histories and physical examination findings in our study groups were not of special importance to sufficiently affect the endoscopy, the conditions of the comorbid patients were not evaluated. Furthermore, it was concluded that smoking has a negative impact on oxygen saturation in both sedation and no-sedation groups. In one study where patients had undergone endoscopy procedure with midazolam sedation, it was reported that oxygen desaturation (<90%) was associated with age ≥65, hemoglobin level <10 g/dl and BMI >28 kg/m^2. Additionally, it was noted that oxygen monitorization by continuous pulse oximetry and oxygen inhalation is required in patients with such risk factors (11). Our study also showed that hemoglobin level and BMI have no effect on oxygen desaturation.

In conclusion, midazolam sedation during endoscopic procedure is a reliable procedure and does not contribute an additional risk in individuals without serious comorbidities. It is important that smoking habit in particular be taken into account in endoscopy patients.

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