THE EFFECTS OF SEDATION WITH INTRAVENOUS MIDAZOLAM IN 100 PATIENTS UNDERGOING UPPER GASTROINTESTINAL ENDOSCOPY

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ABSTRACT

Objective: The use of sedation in upper gastrointestinal endoscopy is widespread because of better patient tolerance. As this sedation is usually performed by non-anesthesiologists in and outside of hospital settings, possible adverse effects arising during the procedure must be dealt with carefully. In this study, the safety and efficacy of midazolam for conscious sedation in 100 patients undergoing upper gastrointestinal endoscopy were evaluated prospectively.

Patients and Methods: Hundred consecutive patients undergoing upper gastrointestinal endoscopy were sedated with intravenous midazolam. The dose of midazolam was titrated according to the patient's need and the duration of the procedure. Heart rate and oxygen saturation of all the patients were continuously monitored during the procedure and any complications were recorded. The amnesic effect of midazolam and patient comfort were also evaluated.

Results: During the procedure, absence of oxygen desaturation ($SaO_2 \geq 95\%$) was found in 80%, mild oxygen desaturation (95% > SaO2 ≥ 92%, at least 15 seconds duration) in 16%, and severe oxygen desaturation (SaO2 < 92%, at least 15 seconds duration) in 4%. Twenty-six patients had tachycardia only during the insertion of the endoscope, 17 patients had it throughout the procedure. Ventricular premature beats were recorded in two patients. Different degrees of amnesia were seen in 60% of the patients and the comfort level was excellent in 41%, good in 43%, and fair in 16%.

Conclusion: Sedation of patients undergoing upper gastrointestinal endoscopy with intravenous midazolam results in better tolerance of the procedure. Routine monitoring must be provided because of the risks of desaturation and arrhythmia.

Key Words: Midazolam, Conscious sedation, Upper gastrointestinal endoscopy.

INTRODUCTION

Despite the fact that the vast majority of diagnostic endoscopic procedures can be performed under topical throat anesthesia alone, it has been shown that the use of sedation results in better patient tolerance and less hemodynamic stress in response to insertion and manipulation of the endoscope (1). Midazolam is the most

(Accepted 16 March, 2001) *Marmara Medical Journal 2001;14(2):96-100*

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widely used agent for this purpose, due to its short acting time and amnesic property (1). The aim of this study was to evaluate the effects of sedation in 100 patients undergoing upper gastrointestinal endoscopy at the Marmara University Institute of Gastroenterology between November 2000 and March 2001.

MATERIALS AND METHODS

After giving information about the procedure, the age, gender, body weight, and prior experiences (a history of previous upper gastrointestinal endoscopy) of 100 consecutive patients undergoing upper gastrointestinal endoscopy were recorded. Associated medical illnesses were graded according to the American Society of Anesthesiologists' Physical Status Classification (ASA grade) (ASA I: A healthy patient without any systemic medical problems other than surgical; ASA II: A patient with mild systemic disease that results in no functional limitation; ASA III: A patient with severe systemic disease that results in functional impairment; ASA IV: A patient with a severe systemic disease that is a constant threat to life; ASA V: A moribund condition in a patient who is not expected to survive with or without operation; ASA VI: Declared brain death whose organs are being harvested for transplantation; E: Emergency operation is required) (2). Oxygen saturation and heart rate were continuously monitored from 10 min. before sedation until the end of the endoscopy. Topical pharyngeal anesthesia was administered with lidocaine 10% (Xylocain®, Eczacıbaşı). A 22-gauge cannula was placed intravenously for application of the sedation drugs. Level of sedation was assessed using the following sedation scale: 1: Awake, alert, agitated; 2: Slightly drowsy, easily aroused; 3: Frequently drowsy, arousable, drifts off to sleep during conversation; 4: Somnolent, minimal or no response to physical stimulation. A bolus dose of 0.04 mg/kg midazolam (Dormicum®, Roche) was given intravenously 2 min. before the esophageal intubation by the same anesthesiologist. For patients aged over 60 years 1 mg. midazolam was used. Sedation level was assessed between 2 and 3 by giving 50% of the initial dose as required. The procedures were performed by three different endoscopists. The duration of the procedure and complications such as a fall in oxygen saturation and arrhythmia were recorded. Oxygen desaturation was assessed as absence of oxygen desaturation ($SaO2 \geq 95\%$), mild oxygen desaturation ($95\% > SaO2 \geq 92\%$, at least 15 seconds duration), and severe oxygen desaturation ($SaO2 < 92\%$, at least 15 seconds duration). Before discharge, procedural amnesia was reported by the patient according to a four-point scale (1: Do not remember the procedure, 2: Remember only the esophageal intubation, 3: Remember only the withdrawal of endoscope, 4: No amnesia) and the patient's comfort level was assessed according to a "comfort score" (1: Excellent, 2: Good, 3: Fair, 4: Poor).

All values were expressed as mean ± standard deviation. Spearman's rank test was used to analyze the correlations of oxygen desaturation with age, body weight or duration of procedure and chi-square test for gender. A P value less than 0.05 was considered statistically significant.

RESULTS

A total of 100 patients received midazolam (58 women and 42 men). The demographic characterization and a prior experience of the patient, duration of the procedure, and the dose of midazolam used are shown in Table I. The baseline SaO_2 was 98.3 ± 1.0 %. During the procedure, there was no desaturation in 80%, mild oxygen desaturation in 16%, and severe oxygen desaturation in 4% (Fig 1). Supplementary oxygen at 5 L/min via nasal cannula was given to patients in the severe oxygen desaturation group. Age (correlation coefficient=0.19, p =0.058), gender (p=0.06), body weight (correlation coefficient=0.19, p =0.054), or total endoscopy time (correlation coefficient=0.16, p =0.11) was not related to the degree of oxygen desaturation. In ASA III patients, severe desaturation was found in 14.3% while it was 3.2% in ASA I-II patients (Fig 2). Twenty-six patients had tachycardia only during the insertion of the endoscope, 17 patients had it throughout the procedure. Ventricular premature beats were recorded in two patients but there was no need to use an anti-arrhythmic agent (Fig 3). There were no deaths, episodes of cardio-respiratory arrest, or pulmonary aspirations amoung our patients.

Table I.: Demographic characterization and prior experience of patient, duration of procedure and dose of midazolam usage.

	Female (n=58)	Male (n=42)
Age (year) (mean±SD)	49 ± 14	45 ± 15
Body weight (kg) (mean ± SD)	64 ± 12	76 ± 12
ASA grade (number of patients)		
I	33	27
II	23	10
III	2	5
Prior experience (number of patients)	18	16
Duration of procedure (minute) (mean ± SD)	9.4 ± 4.2	11.3 ± 6.3
Midazolam dose (mg) (mean ± SD)	3.8 ± 1.2	3.9 ± 1.1

ASA grade: American Society of Anesthesiologists Physical Status Classification.

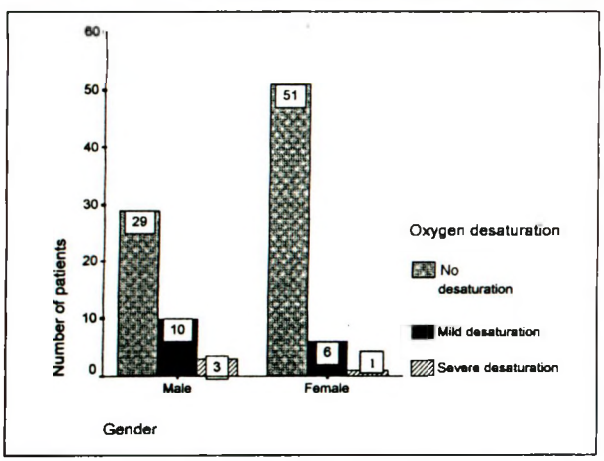
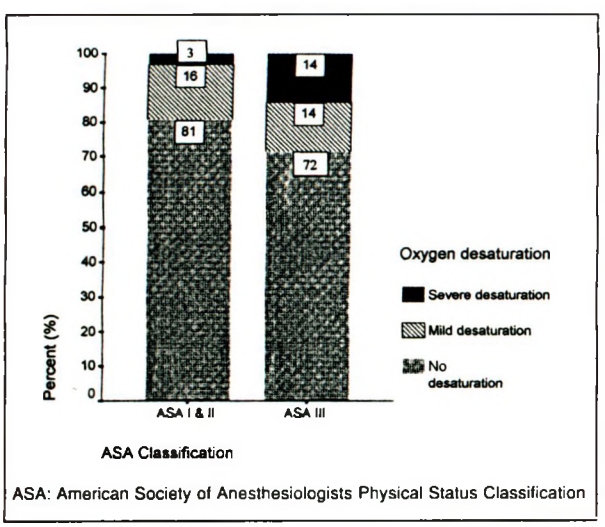


Fig.1: Oxygen desaturation of patients.



ASA: American Society of Anesthesiologists Physical Status Classification

Fig.2: Oxygen desaturation of patients according to the ASA Classification.

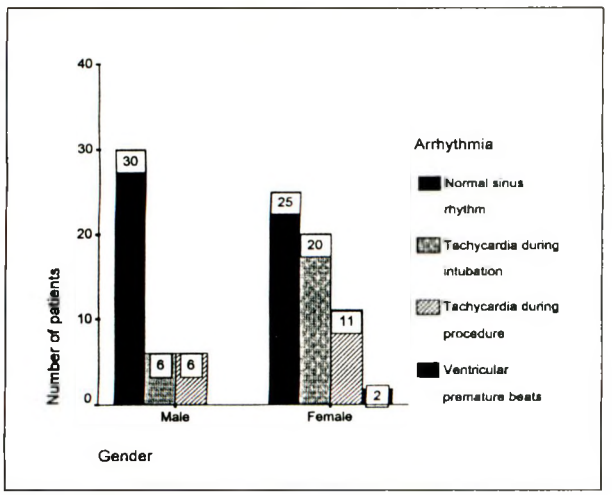


Fig.3: Arrhythmia in patients.

Thirty percent of patients did not remember the procedure, 26% remembered only the esophageal intubation, 4% remembered only the withdrawal of the endoscope, and 40% did not have any amnesia. The comfort level was excellent in 41%, good in 43%, and fair in 16%.

DISCUSSION

Conscious sedation is the use of medication to minimally depress the level of consciousness in a patient while allowing the patient to continually and independently maintain a patent airway and respond appropriately to verbal commands and/or gentle stimulation (3). The task force of the American Society of Anesthesiologists decided that the term "sedation and analgesia" more accurately defines this therapeutic goal than does the commonly used term "conscious sedation" (4). This type of sedation can be used in procedures such as all types of endoscopy, lumbar puncture, cardioversion, wound care, burn debridement, bone marrow aspiration and placement or removal of implanted devices and tubes. It can also be used in procedures during which the patient suffers anxiety but must remain as motionless as possible, such as magnetic resonance imaging and computed tomography scan. Another type of sedation, deep sedation or Monitored Anesthesia Care (MAC), uses medication to induce a controlled state of depressed consciousness or unconsciousness in which the patient may experience partial or complete loss of protective reflexes including the

ability to independently and continuously maintain a patent airway (3). However, only anesthesiologists must administer this type of sedation. On the other hand, the patient may progress from one degree of sedation to another depending on his underlying medical status, the medications administered, dosage and route of administration. Excessive sedation may result in cardiac or respiratory depression that must be rapidly recognized and appropriately managed to avoid the risk of hypoxic brain damage, cardiac arrest, or death. So, observation and monitoring of the patient by a person skilled in advanced life support is very important in this type of procedure (5). In this study, an anesthesiologist maintained the same level of sedation. This is the main reason for the low complication rate. However, sedation during upper gastrointestinal endoscopy is usually performed by non-anesthesiologists in and outside of hospital settings. Because of safety reasons, there are studies offering only topical throat anesthesia. Tan and Freeman (6) studied 244 cases and found that only 32% of patients who had throat spray tolerated the endoscopy well, compared to 70% of those who chose sedation. They claimed that male patients, those with lower anxiety levels, and those over 50 years old, tolerated endoscopy with throat spray better. Campo et al (7) studied 509 patients undergoing diagnostic gastroscopy after the administration of topical pharyngeal anesthesia, without sedation. Patient tolerance was poor in 84 of 273 (31%) patients undergoing gastroscopy for the first time, and in 61 of 236 (26%) patients with prior experience. In our study, there was no poor patient tolerance even in the "no amnesia" group.

Hypoxia is one of the most important complications of upper gastrointestinal endoscopy (1). In this study, we found absence of oxygen desaturation in 80%, mild oxygen desaturation in 16%, and severe oxygen desaturation in 4%. Wang et al (8) studied oxygen saturation using pulse oximetry in 100 sedated and 100 non-sedated patients breathing room air during diagnostic upper gastrointestinal endoscopy. Hypoxia ($SaO_2 \leq 92\%$, at least 15 seconds duration) occurred in 17% and 6% of sedated patients and non-sedated patients, respectively ($p<0.03$). Mild desaturation ($SaO_2 \leq 94\%$, less than 15 seconds duration) occurred in 47% of sedated patients compared with 12% of non-sedated patients ($p<0.001$). Sedation significantly increases the incidence of desaturation and hypoxia but they can occur without sedation also. Iwao et al (9) studied 120 patients undergoing non-sedated diagnostic upper gastrointestinal endoscopy and observed no oxygen desaturation ($Sa02 \geq 95\%$) 56%, mild oxygen desaturation ($95\% > SaO_2 \geq 90\%$) 35%, and severe oxygen desaturation ($SaO_2 < 90\%$) 9%. They claimed that age, gender, smoking, hemoglobin level, body mass index, or total endoscopy time were not related to the degree of oxygen desaturation and recommended continuous monitoring of arterial oxygenation in all patients during the procedure. Basal $SaO_2 < 95\%$, respiratory disease, more than one attempt needed for intubation, emergency procedure and ASA score of III or IV are found as predictive factors of oxygen desaturation during upper gastrointestinal endoscopy in non-sedated patients (10,11). Such patients require very close monitoring and endoscopists should be especially alert to the possibility of respiratory depression in these cases. The effect of supplementary nasal oxygen is also studied in sedated patients and it is found that supplementary oxygen abolishes desaturation and hypoxia (8). The routine use of supplemental oxygen would greatly reduce this unnecessary risk to patients.

Upper gastrointestinal endoscopy is often accompanied by tachycardia because of the stress response (12). This can be dangerous for patients with coronary heart disease (CHD). Electrocardiograph recording using a Holter monitor was performed in 71 patients with stable CHD, to check for silent ischemia, and during gastroscopy, 30 patients (42%) had silent ischemia, but only 1 patient (1%) became symptomatic (13). Wilcox et al (14) studied 25 hospitalized patients with well-defined CHD during endoscopic procedures requiring intravenous sedation. Twenty four percent of patients had one or more episodes of electrocardiographic ischemia during the recording periods. Sedation may provide some protection against hemodynamic stress in response to insertion and manipulation of the endoscope (15). But tachycardia was seen in 43% of the patients in our study, although they had an acceptable level of sedation.

In conclusion, sedation applied by a skilled person during upper gastrointestinal endoscopy provides better patient tolerance with a lower complication rate. As there are risks of desaturation and arrhythmia during this procedure, even without sedation, adverse risk factors should be carefully identified and routine monitoring, at least with a pulse oximeter, should be carried out.

REFERENCES

1. *Bell GD. Review article: premedication and intravenous sedation for upper gastrointestinal endoscopy. Aliment Pharmacol Ther 1990;4:103-122.*
2. *Morgan GE, Mikhail MS. Clinical Anesthesiology. Connecticut: Appleton & Lange, 1992:1-12.*
3. *Whitwam JG. Anxiolysis, sedation and anaesthesia. In: Whitman JG, McCloy RF, eds. Principles and practice of sedation. London: Blackwell Science, 1998:3-7.*
4. *Practice guidelines for sedation and analgesia by non-anaesthesiologists: A report by the American Society of Anesthesiologists Task Force on Sedation. Anesthesiology 1996;84:459-471.*
5. *Bell GD, McCloy RF, Charlton JE, et al. Recommendations for standards of sedation and patient monitoring during gastrointestinal endoscopy. Gut 1991;32:823-827.*
6. *Tan CC, Freeman JG. Throat spray for upper gastrointestinal endoscopy is quite acceptable to patients. Endoscopy 1996;28:277-282.*
7. *Campo R, Brullet E, Montserrat A, et al. Identification of factors that influence tolerance of upper gastrointestinal endoscopy. Eur J Gastroenterol Hepatol 1999;11:201-204.*
8. *Wang CY, Ling LC, Cardosa MS, Wong AK, Wong NW. Hypoxia during upper gastrointestinal endoscopy with and without sedation and the effect of pre-oxygenation on oxygen saturation. Anaesthesia 2000;55:654-658.*
9. *Iwao T, Toyonaga A, Harada H, et al. Arterial oxygen desaturation during non-sedated diagnostic upper gastrointestinal endoscopy. Gastrointest Endosc 1994;40:277-280.*
10. *Alcain G, Guillen P, Escolar A, Moreno M, Martin L. Predictive factors of oxygen desaturation during upper gastrointestinal endoscopy in non-sedated patients. Gastrointest Endosc 1998;48:143-147.*
11. *Yen D, Hu SC, Chen LS, et al. Arterial oxygen desaturation during emergent non-sedated upper gastrointestinal endoscopy in the emergency department. Am J Emerg Med 1997;15:644-647.*
12. *Tinnesen H, Puggaard L, Braagaard J, Ovesen H, Rasmussen V, Rosenberg J. Stress response to endoscopy. Scand J Gastroenterol 1999;34:629-631.*
13. *Schenck J, Müller CH, Lübbers H, Mahlke R, Lehnick D, Lankisch PG. Does gastroscopy induce myocardial ischemia in patients with coronary heart disease? Endoscopy 2000;32:373-376.*
14. *Wilcox CM, Faibicher M, Wenger NK, Shalek KA. Prevalence of silent myocardial ischemia and arrhythmias in patients with coronary heart disease undergoing gastrointestinal tract endoscopic procedures. Arch Intern Med 1993;153:2325-2330.*
15. *Oei Lim VL, Kalkman CJ, Bartelsman JF, Res JC, Van Wezel HB. Cardiovascular responses, arterial oxygen saturation and plasma catecholamine concentration during upper gastrointestinal endoscopy using conscious sedation with midazolam or propofol. Eur J Anaesthesiol 1998;15:535-543.*