The Relationship Between Demographics and Reactions During Endoscopy Under Moderate Sedation

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Abstract

Aim: Upper gastrointestinal (UGI) endoscopic procedures are performed under varying levels of anesthesia, with moderate sedation commonly utilized. However, some patients may exhibit reactions such as coughing, retching, and struggling, potentially affecting procedure quality. This study aims to investigate the relationship between patient characteristics and demographic variables and the occurrence of these reactions during UGI endoscopy under moderate sedation.

Methods: This prospective observational cohort study included patients scheduled for UGI endoscopy under moderate sedation. Patient reactions, including coughing, retching, and struggling, were documented during the procedure. Patients were categorized into two groups based on the presence or absence of reactions, and demographic characteristics were compared between groups. Institutional review board approval was obtained.

Results: Between December 2021 and May 2022, 79 patients (44 female, 35 male) were enrolled, with 51.9% experiencing reactions during UGI endoscopy. Coughing was the most common reaction (65%), followed by struggling with the scope (52.5%) and retching (47.5%). Procedure cancellation due to intolerance occurred in 12.2% of cases. No significant differences were observed between groups in terms of demographic variables or medical history. Additionally, no cardiac or pulmonary complications were reported.

Conclusions: Moderate sedation appears to be safe and effective for UGI endoscopy, facilitating adequate visualization of the UGI system while ensuring patient comfort. The occurrence of patient reactions during the procedure does not appear to be significantly influenced by demographic or clinical characteristics. Ensuring appropriate sedation levels remains essential for optimizing procedural quality and patient experience.

Keywords: *Endoscopy, sedation, moderate sedation, complication*

1. Introduction

Upper gastrointestinal (UGI) endoscopic procedures are routinely conducted under varying levels of anesthesia[1-3]. Sedation is employed to induce a controlled state of depression in consciousness, primarily aiming to alleviate patient anxiety and discomfort, enhance examination effectiveness, and minimize procedural recall. A range of sedative and analgesic agents are available to achieve the desired level of sedation for gastrointestinal endoscopy, contributing to decreased patient discomfort and improved procedural quality[4,5]. Nevertheless, some patients may exhibit adverse reactions during the procedure, such as coughing, retching, or resistance to the endoscope, occasionally necessitating procedure cancellation, particularly under moderate sedation.

Two hypotheses are postulated to explain such reactions. The first suggests that low socioeconomic and educational status may contribute to these occurrences, while the second posits that patients' comorbidities or medication usage could be influential factors. Although existing literature extensively discusses preprocedural assessments, anesthesia levels, drug options, and procedural complications, scant attention has been paid to these specific intra-procedural scenarios[1,2,6].

Therefore, this study aims to investigate potential associations between patient characteristics, demographic variables, and intra-procedural reactions during endoscopy conducted under moderate anesthesia in our endoscopy unit. By elucidating any correlations between patient factors and procedural responses, this research seeks to enhance our understanding of the underlying determinants of adverse reactions during UGI endoscopic procedures, thus facilitating the optimization of patient care and procedural outcomes.

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2. Materials and methods

This study adopts a prospective observational design, with institutional review board approval obtained from the local ethical committee under protocol number KAEK/2021.11.264. Prior to participation in the research, informed consent was obtained from all patients.

The study enrolled patients aged 18 and above who were referred to our endoscopy unit for screening or diagnostic upper gastrointestinal (UGI) endoscopy between December 2021 and May 2022. Eligible patients were required to present negative results from a COVID-19 polymerase chain reaction (PCR) test conducted prior to the procedure, and were admitted to the unit following an overnight fasting period.

Exclusion criteria encompassed patients with a known history of cancer or prior gastrointestinal surgery, individuals under the age of eighteen, pregnant women, patients diagnosed with chronic inflammatory (e.g., tuberculosis, sarcoidosis) or autoimmune diseases, hematological disorders, steroid users, and those with inaccessible medical records.

Demographic characteristics and medical histories were elicited from patients by the attending specialist physician and documented using a pre-designed form. Variables such as age, gender, educational background, occupation, weight, height, body mass index (BMI), personal medical history, known comorbidities, regular medication use, prior endoscopy history, and Mallampati score were recorded.

The endoscopy unit is officially acknowledged as a training unit by our national surgical association and all UGI endoscopies were done by educator level endoscopists. UGI endoscopy procedures were conducted using a Fujinon Eluxeo VP-7000 processor and EG-760R standard gastroscope. Prior to commencement of the procedure, vital signs including heart rate (beats/minute), systolic and diastolic blood pressure (mmHg), and pulse oxygen saturation (%) were recorded. Throat analgesia was administered using 10% lidocaine spray (Vem İlaç San. Tic. A.Ş., Istanbul, Turkey), followed by intravenous administration of midazolam (20 mcg) (Deva Holding A.Ş., Istanbul, Turkey) and pethidine hydrochloride (10 mcg) (G.L.Pharma GmbH, Lannach, Austria) by a registered nurse under the endoscopist supervision, with additional doses administered as necessary to achieve moderate sedation. Once sedation was achieved, the endoscopic examination was conducted. Vital signs were monitored throughout the procedure, with nasal oxygen support provided if pulse oxygen saturation levels decreased. Procedure duration and patient reactions were documented, while endoscopic findings were promptly recorded by the performing surgeon and stored in the database.

Patients were stratified into two groups based on their intra-procedural reactions. Group 1 comprised patients who exhibited coughing, retching, hiccups, significant decreases in oxygen saturation, or procedural intolerance, while Group 2 included patients who did not manifest any such reactions during the examination.

2.1. Statistical Analysis

The sample size was calculated with the G*Power Version 3.1.9.2 program. SPSS 23.0 for Windows program was used for statistical analysis. Descriptive statistics of evaluation results; numbers and percentages for categorical variables, mean, standard deviation, median, minimum and maximum for numerical variables. Independent student t-test, Oneway ANOVA and paired sample t-test were used for normally distributed parameters, Mann Whitney-U, Kruskall Wallis test and Wilcoxon signed-rank tests were used for non-normally distributed parameters. Differences between the ratios of categorical variables in independent groups were analyzed with Chi-Square and Fisher's exact tests. In all tests, the statistical significance level is considered as $p<0.05$.

3. Results

During the period between December 2021 to May 2022, a cohort of 79 patients (44 females, 35 males) was enrolled in this prospective study. Detailed patient characteristics and demographic data are outlined in Table 1.

Among the participants, 41 patients (51.9%) exhibited reactions during upper gastrointestinal (UGI) endoscopy, as delineated in Group 1. The most prevalent reaction within this group was coughing (65%), followed by struggling with the scope (52.5%) and retching (47.5%). Notably, 12.2% (5 out of 41) of patients in Group 1 required cancellation of the procedure due to intolerance, necessitating referral for administration under general anesthesia. Analysis revealed no significant differences between Group 1 and Group 2 with respect to age, gender, body mass index (BMI), educational level, comorbidities, medication usage, Mallampati score, history of surgery, or prior endoscopic procedures (Table 2).

Moreover, subgroup analysis indicated that obesity (BMI > 30 kg/m2) did not independently influence the occurrence of these reactions.

Two patients from Group 1 received additional sedative dosages, enabling the procedures to proceed without complication. Furthermore, oxygen support was provided to five patients in Group 1 due to significant decreases in oxygen saturation, with all patients spontaneously recovering. Mean blood pressure and oxygen saturation

Table 1

Distribution of the demographics and patient characteristics

	Group 1 (n=41) n(%)	Group 2 (n=38) n(%)	*p*
Gender			
Female	24 (58.5)	20 (52.6)	0.598
Male	17 (41.5)	18 (47.4)	
Age (Mean±SD)	45.6±14.4	45.1±15.8	0.877
BMI (kg/m2) (Mean±SD)	27.3±5.8	28.4±6.9	0.420
Educational level			
Primary or lower level	22 (53.7)	17 (44.7)	0.428
College or higher level	19 (46.3)	21 (55.3)	
Working status	22 (53.7)	24 (63.2)	0.392
Co-morbidities	13 (31.7)	12 (31.6)	0.990
Obesity	10 (24.4)	10 (26.3)	0.884
Operation history	19 (46.3)	17 (44.7)	0.886
Endoscopy history	12 (29.3)	14 (36.8)	0.474
Allergic history	5 (12.2)	2 (5.3)	0.279
Pill intake	17 (41.5)	14 (36.8)	0.674
Procedure			
UGI endoscopy	25 (61.0)	29 (76.3)	0.143
UGI endoscopy and colonoscopy	16 (39.0)	9 (23.7)	
Mallamopati score			
1	13 (31.7)	13 (34.2)	0.657
2	10 (24.4)	10 (26.3)	
3	7 (17.1)	9 (23.7)	
4	11 (26.8)	6 (15.8)	

UGI: Upper gastrointestinal, BMI: body mass index.

Table 2
Distribution of the procedural outcomes between two groups

	Group 1 (n=41) n(%)	Group 2 (n=38) n(%)	*p*
Retching	19 (47.5)	-	<0.001**
Desaturation	5 (12.5)	-	<0.001**
Struggling	21 (52.5)	-	<0.001**
Intolerance	5 (12.2)	-	<0.001**
Hiccups	1 (2.5)	-	<0.001**
Coughing	26 (65.0)	-	<0.001**
Biopsy	27 (67.5)	32 (84.2)	0.086
Chronic gastritis	25 (96.2)	29 (100)	0.286
Intestinal metaplasia	2 (7.7)	3 (10.3)	0.733
Helicobacter pylori status	16 (61.5)	19 (65.5)	0.759
	Group 1 (n=41) Mean±SD	Group 2 (n=38) Mean±SD	*p*
Heartrate (beat/min) Initial	85.2±13.4	83.6±12.3	0.586[b]
Middle of the procedure	105.8±18.2	99.1±15.3	0.092[b]
End of the procedure	95.2±16.2	88.8±11.5	0.053[b]
Maximum	111.8±18.2	103.5±14.9	0.057[c]
Blood pressure (mmHg)			
Initial systolic	122.4±12.3	129.6±18.8	0.068[b]
Initial diastolic	76.9±9.9	82.2±15.2	0.095[b]
Systolic (middle of the procedure)	128.1±16.1	134.8±24.3	0.271[b]
Diastolic (middle of the procedure)	86.6±15.4	84.9±15.2	0.665[c]
Systolic (end of the procedure)	122.3±13.6	125.0±18.0	0.542[b]
Diastolic (end of the procedure)	77.1±12.9	77.7±15.0	0.879[b]
Oxygen saturation (%) Initial (%)	98.9±1.3	98.8±1.2	0.687[c]
Middle of the procedure (%)	97.2±3.3	97.1±2.8	0.494[c]
End of the procedure (%)	97.8±2.2	97.9±1.8	0.938[c]
ΔHeartbeat	9.76±14.8	4.38±11.4	0.086[b]
ΔDiastolic	0.13±11.2	-1.82±14.8	0.589[b]
ΔSystolic	-0.55±12.2	-2.52±18.1	0.642[b]
ΔSaturation	-1.05±1.9	-0.77±1.6	0.600[c]

** p<0.05, **p<0.001, a:Chi-square and Fisher exact test, b: Independent T-test, c: Mann Whitney U test, Δ: Difference between the last and the initial value, UGI: Upper gastrointestinal, BMI: body mass index.*

levels, as well as changes observed at the conclusion of the procedure, are summarized in Table 2, indicating no discernible disparities between the two groups.

Of the study cohort, 25 patients underwent both UGI endoscopy and colonoscopy, with standard bowel cleansing performed prior to the procedures. All gastroscopies were done prior to the colonoscopy. Analysis revealed no significant variance in bowel cleansing status between the two groups ($p > 0.05$).

Endoscopy reports indicated that gastritis and mucosal erosion were the most frequently detected abnormalities, with no notable difference observed between the two groups. Biopsy samples were obtained from 59 patients (74.7%) in the cohort, with no significant differences noted between groups. Moreover, there were no disparities in the incidence of chronic gastritis or Helicobacter pylori positivity in the pathology samples (Table 2).

Notably, no cardiac or respiratory complications were observed during the early post-procedural period.

4. Discussion

Upper gastrointestinal (UGI) endoscopy, while considered an invasive procedure, is generally safe for patients when conducted under appropriate conditions. The primary goal of sedation during UGI endoscopy is to ensure procedural quality, minimize patient discomfort, and optimize examination outcomes[4,5,7]. A plethora of literature exists outlining recommendations for sedation levels and optimal drug combinations to achieve these objectives[1,8,9]. Sedation protocols may vary depending on the preferences of the endoscopist, the capabilities of the healthcare facility, and local legal considerations.

In settings where anesthesiologists are readily available, deep sedation is often the preferred choice for endoscopic procedures. Deep sedation offers maximal patient comfort and procedural efficacy. However, the availability of anesthesiologists may be limited, particularly in certain healthcare settings or during periods of high demand, such as the COVID-19 pandemic. In such cases, non-anesthesiologist-administered sedation protocols have been shown to be safe and feasible alternatives, providing effective sedation while minimizing procedural risks[1,2,9].

Guidelines suggest that endoscopists can safely administer propofol for deep sedation in the absence of an anesthesiologist[1,2,9]. Additionally, conscious sedation has been demonstrated to be both safe and cost-effective for outpatient procedures, offering a balance between patient comfort and procedural efficiency[10]. However, the decision to opt for superficial or moderate sedation in hospital settings may be influenced by local legal considerations and potential complications associated with deep sedation.

Our hospital, established during the COVID-19 pandemic, initially faced challenges due to a shortage of anesthesiologists, necessitating a preference for minimal or moderate sedation during endoscopic procedures. However, as the hospital has since adapted and acquired an anesthesiology team, there is now a shift towards performing endoscopic procedures under deep sedation, ensuring optimal patient comfort and procedural efficacy.

Common sedation-related issues during endoscopy often stem from inadequate measures to address patient discomfort or pain. Studies comparing the use of benzodiazepines alone versus in combination with analgesics like pethidine hydrochloride have demonstrated the efficacy of analgesic use in improving patient comfort[11,12]. However, the risk of sedative and analgesic overdose underscores the importance of continuous monitoring of respiratory conditions before and after drug administration to prevent complications such as upper airway obstruction and respiratory suppression[1,8].

While deep sedation offers optimal patient comfort, it may result in the loss of the gag reflex and compromised respiratory function, posing potential risks during the procedure[1,8]. Moderate sedation, on the other hand, allows for adequate airway maintenance but may lead to patient reactions such as coughing, retching, or struggling with the scope, impacting examination quality. Pre-procedural evaluation, including consideration of patient history, medications, and comorbidities, is crucial for assessing the risk of complications and tailoring sedation protocols accordingly. All patients were questioned about risk factors and underwent endoscopy but there was no relationship between these symptoms with patients' demographics and personal history. And also the patient's mallampati

score is not associated with these situations which was thought to be a possible major cause during the study design.

Despite existing literature on endoscopic complications, few studies have focused specifically on patient reactions and associated factors during procedures conducted under appropriate sedation. Our study aimed to fill this gap by observing patient reactions during UGI endoscopy performed under moderate sedation. Only hypoxemia and hypotension were mentioned in the literature with a rate of 6-9.9% and 3-7% respectively[9]. In our study hypoxemia rate was similar with 6.3%. The most common complication associated with the endoscopic procedures are cardiac and respiratory system problems. In contrast to belief, the cardiopulmonary complication rates were found to be similar when comparing propofol induced anesthesia and traditional anesthesia for endoscopic procedures in a systematic review[13]. No major cardiopulmonary complications were encountered in this study. Further research is warranted to explore optimal sedation practices and their impact on patient outcomes during UGI endoscopy.

Deep sedation is safe and more comfortable but potential legal issues and sedation-related malpractice claims, endoscopists are prone to apply moderate sedation during the endoscopy[14,15]. Hence, pre-evaluation of the characteristics of the patients can help to predict potential problems that may arise during the procedure, and in these cases, the depth of sedation can be increased by this way.

People subject to varying degrees of discrimination and prejudice in real world or healthcare services. Race, socioeconomic status and especially ageism has been revealed at different levels in the literature[16-20]. In parallel with this situation, it was thought that the reactions exhibited by the patients and the findings obtained during endoscopy under moderate sedation may be related to age groups, education level and socioeconomic status. When the obtained data were evaluated, it was observed that the reactions such as cough, retching, hiccups, and struggling with the scope during endoscopy were not associated with the demographic data, patient history, mallampati score of the patients, and variables such as age, gender, education level, and comorbidity were homogeneously distributed in both groups.

The study has some limitations. Firstly, this is a cohort study and need to be supported by a randomised trial. Second, groups are small but adequate for stastistical analysis. Finally, under moderate sedation, there may be additional factors yet to known to trigger these reactions.

5. Conclusion

In conclusion, the choice of sedation level during UGI endoscopy should be guided by considerations of patient comfort, procedural efficacy, local legal considerations, and available resources. Pre-procedural patient evaluation and continuous monitoring during the procedure are essential for ensuring patient safety and optimizing procedural outcomes.

Statement of ethics

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by Başakşehir Çam and Sakura City Hospital, Scientific Research and Publication protocol number KAEK/2021.11.264

Conflict of interest statement

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Author Contributions

All authors read and approved the final version of the manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Originality Assertion

The authors have not submitted this article to another journal previously.

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