RESEARCH

COMPARISON OF THE EFFECTS OF GENERAL ANESTHESIA AND DEEP SEDATION ON ANESTHESIA COMPLICATIONS AND MORTALITY IN ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY PROCEDURES

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Abstract

Introduction: Endoscopic retrograde cholangiopancreatography is extremely painful and uncomfortable when performed without anesthesia. However, the type of anesthesia to be applied remains a matter of debate. In this study, general anesthesia and sedation procedures were compared in endoscopic retrograde cholangiopancreatography performed by the same anesthesia and surgical team over a 5-year period.

Materials and Method: Patients aged over 65 years were divided into two groups, general anesthesia and sedation, and their data were analyzed retrospectively. Anesthesia complications, surgical complications, duration of the procedure, need for intensive care, and length of hospital stay and intensive care needs were compared between groups in 2812 patients.

Results: Data from 1885 patients were analyzed. The procedure time and hospital stay were shorter, and anesthesia-related complication rate was lower in the general anesthesia group. Although not statistically significant, mortality was higher, and the need for intensive care was similar to the sedation group. The complication rate significantly increased in patients aged over 75 years

Conclusion: Endoscopic retrograde cholangiopancreatography can be performed under deep sedation or general anesthesia. The experience of the anesthetist is an important factor for this choice. The use of sedation in geriatric patients is associated with more complications that require airway interventions. In addition, anesthesia complications due to prolonged procedures were more common in the sedation group. Conclusion: In our study, it was observed that general anesthesia was safer for endoscopic retrograde cholangiopancreatography procedures performed in geriatric patients by an experienced anesthesia and surgical team.

Keywords: Geriatrics; Cholangiopancreatography; Anesthesia, General; Deep Sedation.

INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) refers to the direct cannulation of the ampulla of vater in the second part of the duodenum with or without the use of a guide wire by dilating or creating a sphincterotomy through an upper gastrointestinal system endoscope with an oblique view; visualization of the biliary system and/or pancreatic duct under the scope by providing an opaque material through this cannula; and obtaining images at the desired stages. ERCP is widely used in the diagnosis and treatment of bile duct pathologies and has wide clinical benefits (1). ERCP is performed in > 500,000 cases per year in the United States alone. The complexity of ERCP is also increasing. Anesthesia plays an important role during ERCP procedures. In recent years, there has been an increase in both the number and diversity of patients in non-operating room anesthesia and day case surgeries, including ERCP procedures. Increasingly, older patients are receiving non-operating room anesthetic procedures. This has led to the search for safer anesthesia methods. However, despite the increasing numbers of cases and centers, anesthesia applications and sedation protocols in ERCP procedures cannot be standardized (2). The fact that the team that performs sedation in endoscopic procedures in different countries differs from anesthesiologists makes it difficult to reach a consensus. An important point with no consensus is the type of anesthesia used. Different studies have advocated general and deep sedation (3,4). Geriatric patients are related groups that require attention in terms of anesthesia, are prone to complications, and may have increased mortality, morbidity, and cost (5,6).

ERCP is painful and usually requires sedation and analgesia. However, the patient population in which this procedure is applied is mostly the elderly, rendering this procedure difficult in terms of both anesthesia and surgery. There are limited studies that consider each parameter in small patient groups; however, there are few studies with large patient groups (7). The effects of general anesthesia and deep sedation on mortality in ERCP are unclear in the literature. For this reason, in our study, a large group of patients who underwent ERCP procedures by a single experienced anesthesia and surgical team were examined, and ERCP procedures in geriatric patients in which general anesthesia and deep sedation were applied were compared in terms of procedure time, complications, and patient characteristics.

MATERIAL AND METHODS

After obtaining permission from the local ethics committee (Ethics Committee Decision No: 2021/175) and permission to use the hospital archives, the computer records of patients over 65 years of age, out of a total of 2812 patients who underwent ERCP under anesthesia in the ERCP unit of our hospital between December 31, 2015 and December 31, 2020, were analyzed retrospectively. Repetitive ERCP procedures during the same hospitalization were determined asthe exclusion criteria (Figure 1). Age, sex, American Society of Anesthesiologists (ASA) Classification score, additional disease, airway evaluations and Mallampati scores, laboratory results, patient information and anesthesia type (general-deep sedation), duration of the procedure, and complications of surgery or anesthesia from our records, early period (first 7 days) mortality, and anesthetic drugs used were recorded as procedural information. Anesthesia duration was defined as the time from the onset of anesthesia to awakening and recovery of the patient. ERCP time was defined as the time between insertion and removal of the ERCP probe. All procedures were performed by a single anesthesia team and a surgical team. The surgical and anesthesia team had at least 10 years of ERCP and non-operating room anesthesia experience, and worked regularly in the same unit. Nausea and vomiting, anaphylaxis or allergic reaction,

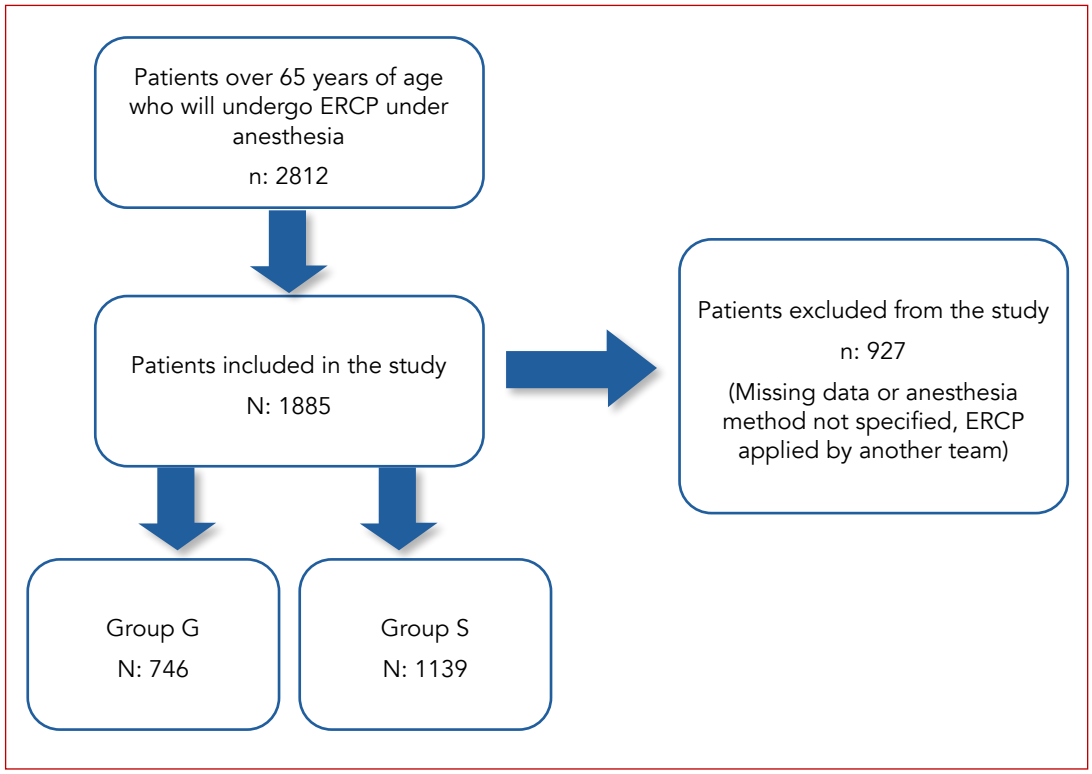

Figure 1. Study Flow Chart

cardiovascular collapse, cardiac arrest, prolonged hypotension for 1 min, bronchospasm, desaturation under anesthesia, postoperative desaturation, tooth damage, and anesthesia complications were recorded. Pancreatitis, bleeding, perforation, and other surgical complications were also recorded. Failure of the procedure due to anesthesia (such as anesthesia complication in the patient before the procedure and interruption of the procedure due to anesthesia-related problems) was recorded as present or absent. Procedures requiring removal of the endoscope and airway intervention were recorded as anesthesia-induced interruptions.

In all patients, according to national guidelines, 3-channel electrocardiography, automated non-invasive blood pressure, pulse oximetry, and temperature monitoring were performed before the procedure until the 30th minute after recovery (8). The depth of anesthesia was monitored using electroencephalography-based monitoring (bispectral index [BIS]). The anesthetics administered to the patients were adjusted according to the BIS values or the patient's response to the procedure, within the framework of our protocols. EtCo2 monitoring was applied to patients in the general anesthesia group but not in the sedation group. All patients received supplemental oxygen via nasal cannula (3 L/min) during the periprocedural period. The patients were divided into those who received deep sedation (Group S) and those who received general anesthesia (Group G). Deep sedation was defined as a patient who could respond to repetitive painful stimuli and whose cardiovascular and respiratory functions were preserved. Patients in Group S who needed general anesthesia after the start of the procedure were

recorded as needing airway intervention. During anesthesia, analgesia was provided with fentanyl or remifentanil in all patients. Propofol was used as an intravenous induction agent and ketamine was used together with propofol in the sedation group. A neuromuscular block was applied with rocuronium before endotracheal intubation in patients in Group G, and sugammadex was used in the reverse procedure.

Demographic data, such as age, sex, ASA score, complication development rate, length of hospital stay, early period (first 7 days) mortality, and need for intensive care, were compared between the groups.

Statistical analysis

IBM SPSS Statistics version 22 was used for all statistical analyses. First, the normality of the data distribution was evaluated (IBM Corp. IBM SPSS Statistics for Windows, version 22.0; Armonk, NY: IBM Corp.). Data are expressed as the mean and standard deviation. The Mann–Whitney U test and Student's t-test were used to compare quantitative data. The chi-square test was used to compare categorical variables. It was also expressed as a percentage when comparing the groups. Statistical significance was set at $P < 0.05$.

RESULTS

In our study, the computer records of 1885 patients aged 65 years and over, out of a total of 2812 patients who underwent ERCP under anesthesia in the ERCP unit of our hospital between 31.12.2015 and 31.12.2020, were retrospectively analyzed. ERCP procedures were divided into two groups: those performed under general anesthesia (Group G, n=746) and those performed under deep sedation (Group S, n=1139). The sex, age, and ASA classification of the patients are shown in Table 1. Group G included 418 female patients and 328 male patients, while Group S included 626 female and 513 male patients. There were no significant sex differences between the two groups (p=0.647, Table 1). The majority of the patients were in the ASA II group, and the mean age was as follows: Group G= 75.92±7.07 and Group S= 76.75±7.23

Table 1. Patients' gender and ASA status

	Group G (n = 746)	**Group S (n = 1139)**	**Total (n = 1885)**	**p**
Gender (female / male, n)	418 / 328	626 / 513	1044 / 841	0.647
Age, year, n	75.92±7.07	76.75±7.23	76.42±7.18	0.023
ASA I, n	100	100	200	**0.000**
ASA II, n	342	834	1176	
ASA III, n	272	201	473	
ASA IV, n	32	4	36	

Group G; patients underwent general anesthesia, Group S; patients underwent sedation
ASA ; American Society of Anesthesiologists.

Table 2. Comparison of patients according to the mortality, postoperative exit, hospital stay and ERCP duration

	Group G (n = 746)	Group S (n = 1139)	Total (n=1885)	p
Mortality, (n (%)				
Exitus, n	38	47	85	
% within mortality	44.7	55.3		
% within anesthesia	5.1	4.1		
% of total	2	2.5	4.5	
				0.322
Alive, n (%)	708	1092	1800	
% within mortality	39.3	60.7		
% within anesthesia	94.9	95.9		
% of total	37.6	57.9	95.5	
Anesthesia complications	38%5	89%7.8	127	**0.021**
Surgical complications	22	41	63	0.113
Postoperative exit				
Service room, n (%)	663	1009	1672)	0.847
% within mortality	39.7	60.3		
% within anesthesia	88.9	88.6		
% of total	35.2	53.5	88.7	
ICU, n (%)	83	130	213	0.882
% within mortality	39	61		
% within anesthesia	11.1	11.4		
% of total	4.4	6.9	11.3	
Hospital stay, day,				
median (min-max)	3 (1-30)	21 (1-52)	2 (1-52) 3.94 ± 4.35	**0.000**
mean ± SD	3.98 ± 3.95	3.92 ± 4.59		
ERCP duration, minute				
median (min-max)	30 (15-75)	50 (10-90)	45 (10-90) 41.80±11.3	**0.000**
mean ± SD	35.99 ± 8.70	45.60 ± 11.3		

Group G; patients underwent general anesthesia, Group S; patients underwent sedation, ICU; intensive care unit, SD; standart deviation, ERCP; Endoscopic retrograde cholangiopancreatography

(Table 1). It was observed that the sedated patients were older (p=0.023).

The mortality rate was 4.5% among all patients, and 44.7% of the patients who died were in the general anesthesia group and 55.3% were in the sedation group. While the mortality rate in Group G was 5.1%, it was 4.1% in Group S. There were no statistically significant differences between the two groups in terms of mortality. No significant differences were observed (p=0.322, Table 2). After the procedure, 11.3% of all patients were admitted to the intensive care unit and 88.7% were discharged to the hospital. While 39.7% of those admitted to the ward were in the general anesthesia group, 60.3% were in the sedation group, 39% of those admitted to the intensive care unit were in the general anesthesia group, and 61% were in the sedation group (p=0.847). While the need for intensive care in Group G patients was 11.1%, the need for intensive care was 11.4% in Group S patients and 11.3% on average. There was no significant difference between the two groups in terms of discharge or intensive care need (p=0.847, Table 2).

Desaturation was observed during postoperative recovery in 16 (2.1%) patients in Group G. Intraoperative desaturation was not observed in the general anesthesia group. Hypotension was observed during the induction of anesthesia in 22 patients (2.9%). No other complications of anesthesia were observed. The total number of complications was 38. In Group S, 55 (4.8%) patients had intraoperative desaturation, 19 (1.6%) patients had postoperative desaturation, and 15 (1.3%) patients experienced hypotension during anesthesia induction. A total of 89 complications were observed in the sedation group. Complication rates were significantly different between Group G and S patients. (p=0.021). Surgical complications were observed in 22 Group G and 41 Group S patients. There was no difference between the two groups in terms of surgical complications (p=0.113). The length of hospital stay and ERCP duration were significantly lower in the general anesthesia group than in the sedation group (p<0.001 and p<0.001, respectively; Table 2). While anesthesia-related interruption was not observed during ERCP in Group G patients, the procedure was interrupted for anesthesia intervention in 35 patients in Group S (<0.001). While there was no significant correlation between the development of complications in patients according to ERCP duration (p=0.336) and sex (p=0.537), a significant correlation was observed between age and complications (p<0.001). The mean age of the patients who developed complications was 83.94±6.5 years, while the mean age of the patients who did not develop complications was 75.88±6.9 years. While the complication rate was 1.7% in patients aged < 75 years, this rate increased to 10.6% in those aged > 75 years. A significant relationship was observed between age and complications (p<0.001).

According to the results obtained here, fewer anesthesia complications, shorter hospital stay, and shorter ERCP duration were observed in patients who underwent general anesthesia during the ERCP procedure. The need for intensive care, mortality, and surgical complications were similar to those of deep sedation.

DISCUSSION

The main findings of the current study include the following: 1) mortality and need for postoperative intensive care in ERCP procedures did not differ among the groups (p=322 and p=0.847, respectively); 2) length of hospital stay and ERCP duration were found to be significantly lower in the general anesthesia group than in the sedation group (p<0.001); and 3) fewer anesthesia complications were observed under general anesthesia (p=0.021). These findings show that general anesthesia is safer in terms of ERCP procedures.

In our study, the procedures in Group S were performed using propofol, midazolam, and ketamine. In a study evaluating the analgesic needs of ERCP patients, two-thirds of sedated patients experienced pain. Therefore, short-acting sedative agents may be beneficial for patients (9,10). Dexmedetomidine is a good option because it protects the airway better; however, it has a cost disadvantage (10). Propofol is another widely used and proven safe agent. Studies show that propofol is a safe option in non-operating room sedation procedures (11). In our study, propofol was preferred in both groups. Ketamine, on the other hand, requires a more complicated approach because it increases secretion; therefore, glycoprolate or atropine is needed, or midazolam is needed to reduce its hallucinogenic effects. In addition, hypertension in our study patients, similar in other geriatric patients, is an important limitation for the use of ketamine. Remifentanil, on the other hand, can be a good analgesic for daily procedures with its short duration of action. We think that remifentanil will be used more widely in the target of comfortable and safe anesthesia.

Mild sedation or conscious sedation has been abandoned in painful procedures such as ERCP. Propofol-based monitoring of anesthetic care can be used. However, patients often require deep sedation. In addition, there is a risk of inability to maintain spontaneous respiration under propofol, the need for respiratory support, and desaturation during deep sedation. In this respect, general anesthesia seems to be safer in ERCP, as the risks of desaturation and loss of the airway are lower. In our study group, airway intervention, hypotension, or desaturation developed during sedation in 7.8% of patients in Group S. The ERCP procedure was interrupted in 35 patients. Complications requiring intraoperative airway intervention were not observed in patients in Group G. With neuromuscular blocks used in general anesthesia, residual neuromuscular block is an important risk factor and may cause respiratory complications in the postoperative period. In a study conducted by Amornyotin et al.(12) with 158 patients, airway intervention was required in 26.6% of ASA I–II group patients and 28.8% of ASA III–IV group patients. Desaturation, upper airway obstruction, hypotension, and bradycardia were determined as the causes. In addition, pulse oximetry may delay the recognition of desaturation during apneic periods in patients under sedation.

Since our study patients were most frequently in the ASA II and III groups and included the geriatric patient group, the rate of airway problems as high as one-third in the Amornyotin's study is not an acceptable rate (12). Turning intubated patients in the prone position is also risky. Extubation and airway complications associated with the procedure were also observed. However, in inexperienced teams, the risk of airway loss is as important a possibility as a complication related to patient position. At this point, endotracheal intubation may be safe. Although there are some studies in the literature about the use of the laryngeal mask airway in the prone position and loss and management of the airway, the use of a laryngeal mask in the prone position does not seem practical in procedures such as ERCP, where the airway is shared with the surgical team (13). When we compared our study groups, we observed that airway complications were more common in patients under sedation.

Procedure duration and success

A significant proportion of ERCP procedures are abandoned early owing to insufficient anesthesia, and the success of the procedure increases twofold under general anesthesia (14). The experience of the surgical team is as important as that of the anesthesiologist for the success of the procedure. Poor cooperation among sedated patients may affect their level of success. Unsuccessful attempts increase surgical complications as well as prolonged anesthesia and anesthetic complications. However, no significant correlation was found between the

development of complications and the duration of ERCP in our groups. However, the duration of anesthesia is an independent risk factor for cardiovascular and respiratory complications in procedures performed under sedation under perioperative conditions (15). In our study, the duration of the procedure in the sedation group was nearly doubled and was significantly higher. Since prolonged procedures are associated with increased anesthetic drug doses, it is expected to increase post-anesthesia complications. It has been shown that the procedure is shorter in Group G patients. These results bring general anesthesia to the forefront in order to perform it successfully and in a short time.

Although the initiation of general anesthesia was slower than that of sedation, the procedures under general anesthesia in our study were significantly shorter than those in the deep sedation group. The effect of these two groups on ERCP unit turnover time could not be investigated because of the retrospective nature of the study owing to low evidence. However, it can be thought that general anesthesia will not be a waste of time for the ERCP unit, because of the shorter procedure time, less interruption of the procedure, and lower complication rates (15). For this reason, it is thought that the general anesthesia method may be superior for patient turnover in ERCP units. In addition, the use of sugammadex in the conversion of neuromuscular blocks has contributed to a short review (16). Turnover time may also need to be considered as a factor in the choice.

Effect of ASA score

In a study involving 1023 patients, the total mortality rate was 0.88% in patients with ASA III and higher, who expected difficult intubation, and who excluded depths of anesthesia other than "light propofol-based general anesthesia." (17). In an eight-year study, the relationship between ASA and mortality was examined in approximately 1.5 million endoscopy and ERCP procedures, and no correlation was observed between ASA and mortality for ERCP procedures (18). In another study involving geriatric patients, it was shown that elderly (>80) patients had higher ASA scores (3-4), but no correlation was found between ASA, Age, Gender and mortality. According to other findings, it was shown that these elderly patients had lower Charlson Comorbidity Indexes compared to younger patients, which was interpreted as older patients were more selectively treated and patients with high comorbidities were avoided (19).

Although it is known that the duration of the procedure under anesthesia is an independent risk factor for respiratory and cardiovascular complications, Goudra et al. stated that the procedures were shorter in patients with high ASA scores and longer procedures were performed in low-risk patients. This suggests that there is a selectivity in the duration of the procedure according to the ASA score or patient risk. However, the results of the high ASA score and the combination of anesthesia type were not analyzed clearly in these studies (20). In our study, while the mean mortality was 4.1% in Group S patients, it was 5.1% in Group G patients. There was no difference between the groups in terms of mortality and need for postoperative intensive care. However, while there were 32 ASA IV patients in Group G, only four patients in Group S were in the ASA IV class and ASA scores were significantly different between the groups. There were no restrictions in terms of ASA scores and additional diseases in the study patients. General anesthesia was preferred in patients with high ASA scores. Although this finding was not significant, it may be the reason for the slightly higher mortality in the general anesthesia group. When evaluated together with the literature, this suggests that the two techniques may be similar in terms of mortality in geriatric patients, and general anesthesia may be preferred in patients with high ASA scores (21).

Factors that can affect complication rates

In a study conducted with 458 patients, 89.7% of the patients underwent deep sedation and 10% of them underwent ERCP under general anesthesia; 3.7% of the sedation group was converted to general anesthesia, and the procedure had to be terminated early in one patient. The BMI and ASA scores of the general anesthesia group were higher, and the postoperative complications were similar (22). Cote et al. conducted a similar study with 799 patients and showed that male sex, high BMI, and ASA score were risk factors for airway problems (23). Based on these results, the authors suggest that both methods can be used in non-obese and uncomplicated patients. In our study, 1885 patients were examined, and it was found that the length of hospital stay was significantly higher in the sedation group, and the rates of anesthesia-related complications were still higher. In our study, the ASA scores of the general anesthesia group were higher, but we could not find any difference in terms of sex. When the three studies were evaluated together, general anesthesia was safer in those with high ASA scores. Another point to be considered here is which factors, other than the type of anesthesia, affect the high complication rates of anesthesia. Therefore, in our regression analysis, age and the development of surgical complications were also associated with anesthesia complications. Although all our study patients were over 65 years of age, the complication rate in patients over 75 years of age increased significantly to 10.6%. In terms of surgical complications, factors such as the effect on the duration of the procedure and the effect on the patient's hemodynamics can be considered the cause or result of anesthesia complications.

After ERCP, the rates of bacteremia, pancreatitis, sepsis, hemorrhage, and duodenal perforation can be as high as 8%. Anesthesia complications include hemodynamic complications, airway problems, aspiration, drug reactions, and death (15). To analyze this situation, it may be necessary to analyze surgical indications and complications. When evaluated together in both groups, intraoperative desaturation complications were most common in 4.8% of sedation patients, followed by 2.9% intraoperative hypotension under general anesthesia, postoperative desaturation under general anesthesia (2.1%), and sedation. Postoperative desaturation (1.6%) and hypotension (1.3%) were observed following sedation. Other undesirable conditions, defined as complications, were not observed in the medical records. Surgical complications were similar in both groups. In one study, the most common anesthesia-related complication was hemodynamic instability (37.01%), followed by desaturation (11.65%) (24). The complication rates in this study were considerably higher than those in the present study.

Who should apply sedation?

In both anesthesia methods, it is a prerequisite to have an experienced anesthesiologist, appropriate equipment, and personnel for non-operating-room anesthesia. The complication rate was higher than the operating room for anesthesia procedures outside the operating room. Since the cases in our study were performed by a single surgical and anesthesia team, both teams are highly experienced. In this case, it increased the reliability of our results and explained the low complication rates. In some centers, sedation is provided by physicians who are not anesthesiologists during ERCP or other endoscopic procedures (25). While American and British anesthesia societies advocate that sedation procedures should only be performed by an experienced anesthesia team, surgery and gastroenterology societies do not agree with this situation, and the practice still remains controversial. The common point is that when a patient needs general anesthesia, he also needs an anesthesiologist (26). In some centers, anesthesiologists working inrotation provide non-

operating room anesthesia. However, the effect of this situation on the results remains unclear. However, in some studies, it has been reported that both the duration of work and the cost of a hospital caused an increase of 760 thousand dollars in sedation administered by non-anesthesiologists who do not have experience in non-operating room anesthesia (27). Deep sedation is associated with risks of airway interventions, oxygenation problems, and loss of spontaneous breathing by ASA (28). For this reason, the same monitoring and anesthesia care as general anesthesia are recommended in national and international guidelines at this level of sedation (8,26).

Hospitalization and intensive care

Prolonged postoperative hospital stay may be due to more than one reason. In our study, patients in the sedation group had significantly longer hospital stays. A striking finding of our study was that 83 (11.1%) of the 746 patients in the general anesthesia group and 130 (11.4%) of the 1139 patients in the sedation group were admitted to the intensive care unit. The type of anesthesia did not significantly change the need for intensive care. Surgical clinics and post-procedure treatment plans for these patients may have also been effective in determining their intensive care needs.

Due to the retrospective nature of our study, there are some limitations. First, no randomization was conducted for patient selection. General and deep sedation preferences changed periodically, depending on the conditions of the ERCP unit. The comfort and preferences of patients were not analyzed in this study. Patients with missing data were excluded from the study to increase the reliability of the data. For this reason, although 2812 patient files were examined, data from 1885 patientswere used for analysis (Figure 1). However, the number of patients examined here is high, which has not been found in many studies in the literature.

In our study, end-tidal carbon dioxide monitoring was not used as a standard in the sedation group or this application has not been recorded. Based on retrospective data, this process is not clear, this gap should also be considered as a shortcoming for evaluating patient outcomes. Our study patients were sedated under non-objective and objective monitoring such as BIS, hemodynamic and respiratory responses, and response to surgery. Accordingly, the effect of the end-tidal carbon dioxide values on the results is not clear. Therefore, an important limitation of our study is the non-standard use of this monitor. However, although the use of capnography is undisputed, how to use it is a matter of debate, Many open-ended points show that end-tidal carbon dioxide monitoring is still open to many researches, such as the fact that non-anesthesiologist physicians who are not familiar with this monitoring also give sedation depending on the conditions, Which value should be taken as the threshold for end-tidal carbon dioxide values in patients who will receive sedation, is the threshold value or the trend safer? (29,30). From this point of view, we think that our findings will contribute to an ongoing gap in the literature. Our large patient group followed by BIS in sedated procedures can be compared in many studies with patients sedated by end-tidal carbon dioxide. Another limitation of our study was that the complexity of ERCP procedures was not classified. Some procedures are inherently more challenging for surgeons than others. The Quality Committee of the American Society of Gastrointestinal Endoscopy divided the procedures into four classes according to their difficulties (23), which may have affected the duration of the procedure. However, such a large number of patients and a significant difference in the level of statistical significance appeared to reduce this effect. The doses of anesthetic drugs used were naturally different between the sedation and general anesthesia groups. However, this point would be the subject of a different study. In the current

study, complications and mortality were compared between general anesthesia and sedation procedures in a large patient group as the primary goal. However, more than one subparameter that may affect the high complication rate can be identified through further tests. Therefore, we believe that a prospective study will contribute to this area. The strengths of our study are that we included all geriatric patients without restriction in terms of ASA score and comorbidities; all patients in both groups were recruited in a single center, without rotation, with a team experienced in both anesthesia and surgery; and inclusion of a large patient group compared to that in studies in the literature.

CONCLUSION

Team experience is at the forefront of ERCP procedures in geriatric patients, both in increasing the success of the treatment and in reducing the complication rates. Deep sedation and general anesthesia did not affect mortality or the need for intensive care. However, general anesthesia seems to be safer in patients with high ASA scores. General anesthesia significantly reduced the length of hospital stay and ERCP procedure time. Complications related to general anesthesia are reduced, while the duration of the procedure is shortened. In this respect, general anesthesia appears superior to deep sedation. Nevertheless, the choice of anesthesia should be considered on a patient basis in line with the priorities, and it would be beneficial to make a choice in line with the experience of the team and conduct more randomized controlled clinical studies to strengthen the results.

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