ORIGINAL ARTICLE

Comparison of sedation effectiveness of remifentanil-dexmedetomidine and remifentanil-midazolam combinations and their effects on postoperative cognitive functions in cystoscopies: A randomized clinical trial

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Background: The aim of the study is to compare the effects of remifentanil/dexmedetomidine and remifentanil/midazolam combinations in monitored anesthesia care (MAC) during cystoscopies. **Materials and Methods:** Forty patients who received remifentanil infusion of 0.05 μg kg^{-1} min^{-1} for cytoscopy procedure were randomized into two groups: Either dexmedetomidine 1 mg kg^{-1} (Group D) or midazolam 0.2 mg kg^{-1} h^{-1} (Group M) was administered intravenously for the first 10 min. Subsequently, anesthesia was maintained by using the bispectral index as a continuous infusion of dexmedetomidine (0.2-0.7 μg kg^{-1} h^{-1}) or midazolam (0.05-0.15 μg kg^{-1} h^{-1}). Heart rate, mean arterial pressure, mini-mental state examination findings, levels of sedation andanalgesia, and the patient's and surgeon's satisfaction were recorded. **Results:** Successful sedation and analgesia were achieved in all the patients. We were able to reach the target sedation level faster in Group D (P<0.0001). In Group D, the cognitive functions were less affected than in Group M (P<0.0001). Patient's and surgeon's satisfaction were significantly higher in Group D. **Conclusion:** The targeted sedation levels were achieved in a shorter period with dexmedetomidine-remifentanil compared to midazolam-remifentanil. The dexmedetomidine-remifentanil combination was observed to affect the cognitive functions less than midazolam-remifentanil did with shorter recovery times. Besides, patient's and surgeon's satisfaction rates were superior with dexmedetomidine-remifentanil. It was concluded that dexmedetomidine-remifentanil may be a combination of choice for monitored anesthesia care applications in outpatient surgical procedures of short duration.

Key words: Dexmedetomidine, midazolam,remifentanil, monitored anesthesia care, mini mental state examination, cystoscopy

INTRODUCTION

Cystoscopy is a small surgical intervention used in lithotomy position in day-case anesthesia and can be performed under local, regional, or general anesthesia, sedoanalgesia or monitored anesthesia care (MAC). However, it may cause anxiety in patients due to the position and operation site.[1,2] With sedoanalgesia, the patient is cooperative and physiological reflexes are protected, thus providing rapid awakening and increased operative efficiency, patient's comfort, satisfaction, and reliability.[3-5] Sedoanalgesia is a preferred technique of day-case anesthesia over general anesthesia.[3]

Minimally invasive techniques have become more popular in urology, and sedoanalgesia is being used more commonly in these procedures. Cystoscopy is a day-case surgery that can be performed with sedoanalgesia.[3] Opioids, midazolam and dexmedetomidine are generally preferred agents for sedoanalgesia under monitored anesthesia care (MAC).[6,7] A 2006 review of closed malpractice claims in the American Society of Anesthesiologists' Closed Claim Database revealed oversedation leading to respiratory depression, which played a pivotal role in patients during MAC.[8] Midazolam is a benzodiazepine. Its reported adverse effects are variability of patient response and respiratory complications.[7] Dexmedetomidine is an α_2-adrenergic receptor agonist that has anxiolytic, analgesic and sedative properties. At therapeutic doses, dexmetomidine is not associated with respiratory depression but profound levels of sedation. This pharmacological profile with a very impressive safety margin has made it an attractive choice for anesthesiologist and intensivists.[9-11] Remifentanil is a selective μ opioid receptor agonist providing intense analgesia of rapid onset and very short duration, and it was reported to provide faster recovery and hemodynamic stability in anesthesia.[12]

Although anesthetics affect all the organs and systems, the main effects are on the nervous system. This leads

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cognitive functions to be affected in varying degrees of post-anesthesia complications. In general anesthesia, rapid recovery of mental status is an important goal for anesthesiologists. Mental status changes caused by anesthesia and surgery or the level of recovery can be assessed by determining post-operative cognitive functions.[13-15] Postoperative deterioration of cognitive functions and psychomotor abilities are often short-term and temporary, can occur even in very short surgical interventions. Although rarely seen, prolonged post-operative cognitive and psychomotor impairment is a serious problem.[15-20]

The use of different sedative agents for MAC may affect postoperative cognitive functions differently. Literature reveals no studies evaluating the components of cognitive functions such as orientation, attention, memory, generalinformation, and/or neurological higher cortical functions after MAC. Therefore, this randomized prospective clinical study was undertaken to compare the heart rate (HR), mean arterial pressure (MAP), sedation, analgesia, and postoperative cognitive functions in MAC with remifentanil/dexmedetomidine and remifentanil/midazolam using the bispectral index (BIS) in the patients undergoing cystoscopy, which requires short-term anesthesia due to the operation site and position.

To eliminate the individual differences in evaluation of sedation level, BIS, a statistical derivation of amplitude and frequency measurements of EEG which facilitates the titration of anesthetic, sedative, and analgesic agents and measures the hypnotic component of anesthesia without increasing the risk of awaking or sensation, and offers high sensitivity (97.3%) and specificity (94.4%), was used. The level of BIS was adjusted to be 70-90 to achieve optimal sedation.[21,22]

MATERIALS AND METHODS

Following the approval by the institutional Ethics Committee, written informed consent was obtained from all the participants for this randomized prospective clinical trial conducted at Gazi University Medical School, on patients with urinary tract disorders.

Forty adult ASA I-II patients between 20 and 70 years of age undergoing cystoscopy were enrolled in the study. Those who fasted for 6 h before the study were included in the study, while the exclusion criteria were presence of liver or kidney dysfunctions, cardiac and endocrine diseases, history of chronic use of sedatives, narcotics, alcohol, and allergy to any of the study medications. The participants, whose operations exceeded 30 min, were also excluded.

Throughout the study period, 40 patients were scheduled for cystoscopy procedure by the urology department. Non-premedicated patients (n=40) were randomly divided into two equal grou ps to receive either remifentanil/ dexmedetomidine (Group D, n=20) or remifentanil/midazolam (Group M, n=20). For randomization, the names of the patients were written on individual pieces of paper and enclosed in envelopes prepared for Group M (n=20) and Group D (n=20). The main researcher randomly withdrew names from these envelopes before the patient was rolled into the operation room and prepared the doses of the agents used in the study. In Group M, 10 ml (1 mg/ml) of midazolam was diluted with 40 ml NaCl 0.9% as 0.2 mg/ml of a total of 50 ml. In Group D, 2 ml (200 μg) dexmedetomidine was diluted with 48 ml NaCl 0.9% as 0.4 μg/ml of a total of 50 ml. In both groups, 5 mg remifentanil was diluted with 50 ml NaCl 0.9% as 100 μg/ml. The standard infusion set (REF VMC9626 Baxter, Colleague) and infusion pump (Eczacıbaşı, Colleague 3 volumetric infusion pump-ABD) were used.

When the patients arrived in the operating room, the Mini Mental State Examination (MMSE) was applied, and electrocardiogram (ECG) (Nihon Kohden Bedside monitor model BSM-4113K-Japan), heart rate (HR), non-invasive mean arterial pressure (MAP), oxygen saturation (SpO_2), end-tidal CO_2($ETCO_2$) and respiratory rate (RR) were monitored. The patients were informed about the Verbal Numeric Scale (VNS) and the Observer Assessment of the Alertness/Sedation Scale (OAA/S). The Bispectral Index (BIS) (Aspect Medical Systems A-2000 Bispectral index, USA) was used to measure the sedation level. The measurements were recorded in the pre, intra, and post-procedure (60 min) periods.

The heartrate, noninvasive-OAB, SpO_2, VNS, BIS, $ETCO_2$, OAA/S, and RR were recorded before the patient was moved into the operating room, before anesthesia induction (when the patient was taken into the operating room), at the time of anesthesia induction (initiation of drug infusion was considered min 0), during anesthesia maintenance (at minutes 2.5, 5, 7.5, 10, 15, 20, 25, 30), and at the end of the operation.

The time of initiation and ending of cystoscopy were also recorded. After the patients were removed to the awakening room, their HR, OAB, SpO_2, VNS, OAA/S values were recorded at the postoperative minutes (the ending time of drug infusions considered postoperative min. 0) 5, 10., 15, 20, 30, 45, and 60.

The side effects and treatment applied were recorded starting from the initiation of anesthesia induction (at min 0, 2.5, 5, 7.5, 10, 15, 20, 25, 30) until postoperative min 60 (at postoperative min.5, 10, 15, 20, 30, 45, 60).

O_2 was administered at 4 l min^{-1} via an oxygen mask. Hemodynamic and respiratory depression and total drug doses were also recorded. Respiratory depression was planned to be treated with tactile or verbal stimulation; bradycardia was treated with atropine.

During the induction, patients received remifentanil added to intraoperative sedative and hypnotic agents (dexmedetomidine or midazolam) with an infusion dose of 0.05 μg kg dk^{-1}, which has been proved not to change the sedation level and to have sufficient analgesic effect. The agents were infused at the doses recommended in the literature for sedoanalgesia.

Subsequently, for maintenance of anesthesia, infusion of either dexmedetomidine 0.2-0.7 μg kg^{-1} h^{-1} (Group D) or midazolam 0.05-0.15 μg kg^{-1} h^{-1} (Group M) were added to the infusion of remifentanil 0.05 μg kg^{-1} min^{-1} by maintaining the BIS levels between 70 and 90 during the first 10 min of induction. When the BIS levels were between 70 and 90, the patients were placed in lithotomy position. The procedure began following administration of 10 ml of local anesthetic gel into the urethra. The sedation levels were controlled with BIS and OAA/S. During the procedure, when BIS>90 or BIS<70 level was longer than 5 min, HR was changed by 25 % compared to the control values or reduced below 50 beat/min, OAB values changed by 25% compared to the control values, VNS was≥5, $ETCO_2$ values chnaged by 10% compared to the control values or suddenly decreased, or findings of respiratory depression or apnea were detected in $ETCO_2$ wave patterns, respiration rate was 8 res/min and SpO_2 value was below 90%, sedation depth was maintained by titration of midazolam and dexemedetomidine doses. When bradicardia did not improve despite titration of the drug doses, 0.5-1 mg atropin, and when hypotension did not improve, primarily iv crystaloid fluid infusion and if no improvement was observed, iv 5 mg efedrin administrations were planned. The patients who developed respiratory depression were stimulated by tactile and verbal stimulation, and among those who did not respond despite stimulations, controlled masked respiration was started.

At the end of the procedure, infusions were stopped and the patients were placed in supine position and satisfaction of the surgeon was evaluated by the surgeon performing the cystoscopy procedure on a 5-point scale (**1**=perfect, **2**=very good**, 3**=good, **4**=moderate, **5**=poor).

When the BIS levels were≥90, the patients were sent to the recovery room. In the recovery room, O_2 was applied at 2 l min^{-1} via a mask, and the HR, MAP, SpO_2, VNS, sedation level (OAA/S), side effects and drug therapies were recorded for a duration of 60 min and MMSE was applied at the 10^{th} and 45^{th} postoperative minute, and thereafter, the patients were transferred to the surgical ward. The satisfaction of the patients who did not have any side effects at postoperative min 60 and no anomalies in MMDT levels and whose OAA/S scores were 4-5 was evaluated using a 5-point scale (**1**=perfect, **2**=very good**,3**=good, **4**=moderate, **5**=poor).

Statistical analysis

Statistical assessments were performed with SPSS 12.0 program. The data were presented as mean ± standard deviation (mean ± SD), *n* (%). Age, height, duration of operation, and the time of sedation were recorded, and BMIs (body mass index) were compared using Student *t*-test. ASA, gender, patient's and surgeon's satisfaction, and perioperative adverse effects were evaluated using Chi-square or Fisher's exact tests.The data on HR, MAP, SpO_2, $ETCO_2$, RR, VNS, BIS, and OAAS data were analyzed using the repetitive measurements variance analysis. When there was a difference, comparisons were made using the inter-group Post hoc Scheffe test. The MMSE test results were compared with inter-group paired *t* test. The BIS level and OAAS correlation were compared using the Spearman correlation test. $P<0.05$ was considered statistically significant.

RESULTS

No significant differences were found between the age, BMI, gender, ASA and operation time [Table 1] of the groups. The patients in Group D had lower HR at the 5^{th} and also at the 7.5^{th} min compared to the control values and when compared to Group M ($P<0.05$). The MA*P* values of Group D were higher at the 10^{th} min compared to the values of Group M ($P<0.05$), and also at the 10^{th} min, the MAP values of Group M were lower than the control values ($P<0.05$) [Table 2].

When hemodynamic and respiratory changes were compared in the perioperative period, there was respiratory depression in two patients in Group M (2/20)and bradycardia in four patients in Group D (4/20), but the difference was not statistically significant. There were no statistically significant differences between the groups with regard to the SpO_2, $ETCO_2$ and RR/min values.

Table 1: Demographic data of the patients (mean±SD, *n*)

	Group M (*n*=20)	Group D (*n*=20)
Age	47.1±12.3	50.4±11.9
BMI (kg/m2)	26.0±3.0	26.1±2.6
Gender (M/F)	7/13	6/14
ASA(I/II)	15/5	16/4
Operation time	15.5±5.4	15.4±4.3
The time for targeted sedation (min)	7.12±0.9	4.9±0.5*

*$P<0.05$ compared to Group M

The BIS values were significantly lower at the 5th min in Group D compared to the values of Group M (P<0.0001), and the BIS values in both groups from the 5th min until the end of the procedure were significantly lower compared to the control values (P<0.0001) [Figure 1].

When the groups were compared for the time for targeted sedation (BIS≤90 min), it was found to be significantly shorter in Group D (4.9±0.5 min) than in Group M (7.12±0.9 min) (P<0.0001) [Table 1].

When the mean OAA/S values were compared, no significant differences were found between the groups. The OAA/S scores were significantly lower than the baseline (control) values (P<0.05) for both groups [Figure 2]. The postoperative mean OAA/S values of Group D were significantly lower than those of Group M at the 5 th, 45 th, and 60th min (P<0.0001).

In Group M, OAA/S was significantly higher compared to the controls at the 45thand 60th min (P<0.0001), and for Group D, except for the 10th min, the OAA/S values were significantly higher than the controls for all the measurements (P<0.05) [Figure 2].

There were no significant differences with regard to VNS values between the groups. In the study groups, for both Group D and Group M, positive correlation was detected between OAAS scores and BIS values (Group M (r=0.906, P<0.001); Group D (r=0.867, P<0.001)).

When the postoperative data were analyzed, the HR was similar until the 60th min, but the MAP measurements were found to be significantly lower in Group D compared to the values in Group M at the 5th and the 45th min (P<0.05) [Table 2]. SpO_2 values at all the measurement times were similar in both groups.

The postoperative total mean MMSE values were not significantly different between the groups, but in Group M, the total mean MMSE values were significantly lower than the control values at the 10th and 45th min (P<0.0001). The values of Group D were significantly lower than the preoperative total mean MMSE at the 10th min (P<0.0001) [Figure 3].

In Group M, the patients' satisfaction was determined as 'perfect' for 3 (3/20)and 'very good' for 17 (17/20) patients, and in Group D, it was 'perfect' in 18 (18/20) patients and good' in 2 (2/20) patients. When the groups were compared, the patient's satisfaction level was significantly higher in Group D than in Group M (P<0.0001). Surgeons' satisfaction was determined as 'perfect' for 10 patients (10/20) and 'very good' for 10 patients (10/20) in Group M, and in Group D, it was 'perfect' for all of the 20 patients (20/20), which was significantly higher than the values of in Group M (P<0.0001) [Table 3].

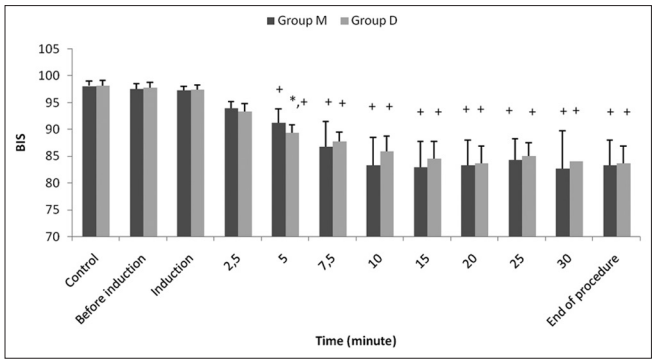

Figure 1: Comparison of bispectral index (BIS) values (mean±SD).*P<0.05 compared to Group M. +P<0.05 compared to control values

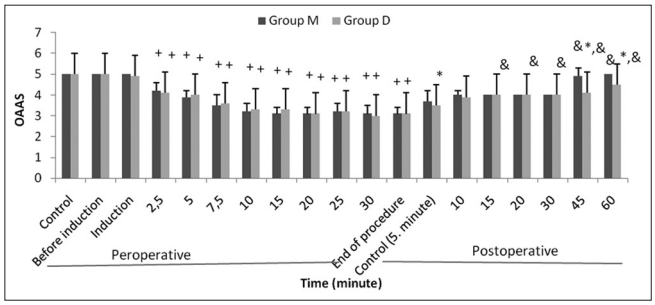

Figure 2: Comparison of preoperative and postoperative observer assessment of the alertness/sedation scale (OAA/S) values (mean±SD). *P<0.05 compared to Group M. +P<0.05 compared to control values. &P<0.05 compared to control (5 min) values

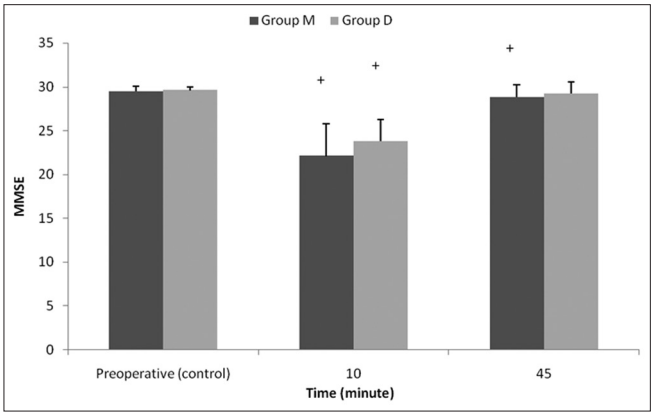

Figure 3: Comparison of mini mental state examination (MMSE) values (mean±SD). +P<0.05 compared to control values

DISCUSSION

Monitored anesthesia care with either midazolam-remifentanil or dexmedetomidine-remifentanil provided satisfactory conscious sedation and analgesia in all patients scheduled for cystoscopy when compared in terms of hemodynamia, sedation, analgesia, postoperative cognitive functions, recovery, patient's and surgeon's satisfaction. However, the targeted level of sedation was achieved sooner in the dexmedetomidine-remifentanil group with earlier recovery times or less postoperative cognitive function disruption. Patient's and surgeon's satisfaction were also

Table 2: Preoperative and postoperative comparison of heart rate (HR, beat/min) and mean arterial pressure (MAP, mmHg) (mean± SD)

	Group M (*n*=20) HR	Group D (*n*=20) HR	Group M (*n*=20) MAP	Group D (*n*=20) MAP
Control	78.5±12.4	73.9±12.8	104±14.7	99.9±19.4
Preoperative				
Before induction	76.8±12.2	72.4±11.5	105.6±16.7	100.1±16.4
Induction(0.dk)	76.7±12.5	71.8±9.9	103.2±15.2	98.7±16.8
2.5 min	76.5±12.2	69.5±12.1	103.6±11.6	97.7±15.3
5 min	75.9±10.2	66.9±10.7*,+	98.0±12.8	97.8±13.8
7.5 min	73.2±10.9	65.0±11.7*,+	94.9±12.5	100.6±13.1
10 min	71.9±8.7	65.2±9.5	89.7±13.9+	99.9±13.1*
15 min	73.2±11.8	66.5±12.5	96.6±15.3	104.7±12.7
20 min	73.7±11.0	68.0±10.5	97.3±11.5	104.3±16.9
25 min	75.5±11.3	74.5±10.1	107.2±11.8	97.5±15.0
30 min	75.0±12.3	77.0±6.0	106.0±7.3	97.0±8.0
End of procedure	73.7±11.0	74.0±8.5	99.3±10.3	104.3±12.5
Postoperative				
5 min	76.7±10.0	70.9± 9.0	101.4±13.6	85.6±12.8*
10 min	74.3±11.0	67.3±7.3	99.0±13.4	92.4±14.5+
15 min	71.5±9.5	66.5±7.4	98.5±14.0	91.2±14.4
20 min	69.8±11.0	67.3±7.0	98.4±13.0	93.0±13.0
30 min	68.9±9.4	66.9±6.8	96.2±14.7	91.0±13.6
45 min	69.7±12.2	67.1±6.5	101.0±16.0	89.8±12.7*
60 min	69.6±9.3	68.2±7.6	100.3±14.1	93.0±16.2

+*P*<0.05 compared to control value. **P*<0.05 compared to Group M

Table 3: Comparison of patient's and surgeon's satisfaction (*n* (%))

	Perfect (%)	Very good (%)	Good (%)	Moderate (%)	Poor (%)
Patient's satisfaction					
Group M	3 (15)	17 (85)	0 (0)	0 (0)	0 (0)
Group D	18 (90)*	2 (10)*	0 (0)	0 (0)	0 (0)
Surgeon's satisfaction					
Group M	10 (50)	10 (50)	0 (0)	0 (0)	0 (0)
Group D	20 (100)*	0 (0)*	0 (0)	0 (0)	0 (0)

**P*<0.05 compared to group M

superior in the dexmedetomidine-remifentanil group compared with those for the midazolam-remifentanil group.

We did not observe the biphasic effect seen in α_2 agonist use and treatment requiring hypotension[10] as we administered the bolus dose of the drugs at infusions in 10 min by titrating with BIS following volume replacement. Midazolam leads to an insignificant decrease in arterial blood pressure related to the decrease in systemic vascular resistance and a mild increase in HR. In previous studies, this effect of midazolam was reported to be evident when combined with opioids.[23] In our study, we detected a decrease in MAP at the 10th min measurement compared to control values following the bolus dose of remifentanil/midazolam in Group M.

Ulger *et al.*[24] administered dexmedetomidine to provide controlled hypotension in middle ear operations, and in 3 patients, they observed bradycardia which responded to atropine. Levanen *et al.*[25] compared 2.5 μg kg^{-1} intramuscular (im) dexmedetomidine and 0.07 mg kg^{-1}i.m. midazolam for premedication and observed bradycardia in 11 patients out of 20 in dexmedetomidine group and 1 patient out of 20 in midazolam group. Similarly, Aantaa *et al.*,[26] compared i.m.dexmedetomidine and midazolam for premedication and administered atropine in 2 patients in dexmedetomidine group for a heart rate under 45. In the present study, correlating with the literature, 4 patients in Group D developed bradycardia requiring atropine, whereas in Group M, none of the patients presented with bradycardia. This might have been associated with sympatholytic, vagomimetic and baroreflex sensitivity reducing effect of dexmedetomidine.[10,27,28]

The most prominent adverse effect of benzodiazepines is respiratory depression via a dose-dependent central effect, especially when combined with opioids.[7,29] We also observed respiratory depression in two cases in Group M as an alteration in the wave pattern of the capnograph without oxygen desaturation. The patients were treated uneventfully with tactile and verbal stimulations and oxygenation with a mask.

Remifentanil added to intraoperative sedative and hypnotic agents with an infusion dose of 0.05 μg kg dk^{-1}proved not to change the sedation level and to have sufficient analgesic effect.[30] Thus, we also administered remifentanil additionally in a constant infusion dose to the agents with no or insufficient analgesic effects.

During monitored anesthesia care, depending on the dose of anesthetic agents used, sedation level may extend beyond the intended level, even result in general anesthesia, and cardiorespiratory depression may occur. In order to prevent such complications, close monitoring is needed.[5] In a study which examined the adverse effects of 95 sedation events that occurred in and outside the hospital settings, adverse events that occurred in 78% of the patients resulted in death or neurological damage, whereas in monitored patients, this ratio was reported to be 28%.[31] Therefore, we monitored the study patients before and after the drug infusions preoperatively with ECG, noninvasive MAP, SpO_2, $ETCO_2$, respiratory rate, OAA/S, VNS, BIS, and in the recovery room with ECG, MAP, OAA/S and SpO_2.

It is known that increases in sedation levels may result in unresponsiveness to verbal stimuli, cooperation failure, sudden unexpected movements that may cause limitations in surgical exposure and even tissue injury or perforation during cystoscopy.[5] Different sedation scales applied at

different times have been used for evaluation of the sedation level in MAC.[32] In the present study, the sedation level was evaluated with the commonly used BIS and with OAA/S. The BIS value was set between 70 and 90 in order to provide optimal sedation. The time when the BIS was<90 was considered as the time for targeted sedation. The sedation level of the cases with BIS>90 was measured following the end of the operation in the recovery room using OAA/S since it was shown to be correlated with BIS.[33] The OAA/S values of our study groups were lower than the control values, and no differences were determined between the groups in terms of sedation levels.

Antaa *et al*.[34] did not find a difference between the two agents in their study comparing dexmedetomidine and midazolam in terms of sedation initiation values. Haengi *et al*.[35] reported that the BIS values of remifentanil/dexmedetomidine group decreased rapidly and continued to be low compared to the remifentanil/midazolam group and that the BIS values were lower in this group, and they observed deep sedation. In our study, the time for targeted sedation was 7.1 min in the midazolam group and 4.9 min in the dexmedetomidine group. We reached our target sedation level without requiring additional medication in all the subjects. In the light of these data, we concluded that BIS and OAA/S were correlated. Thus, it can be said that dexmedetomidine should be preferred over midazolam in such minor surgical interventions as it requires shorter time to reach the target sedation level.

In the present study, cognitive functions were also assessed in order to determine potential cognitive impairment due to surgery and/or anesthesia. Regional and general anesthesia was shown to affect postoperative cognitive functions, but the effect of sedoanalgesia is unknown. Literature presents few studies comparing sedoanalgesics for recovery and potential cognitive impairment. Thus, we aimed to compare commonly used sedatives such midazolam and dexmedetomidine.

Literature review indicated a variety of methods, recording times and the neuropsychological scales in studies for cognitive function assessment. Arain and Ebert[36] compared the effects of dexmedetomidine and propofol on psychomotor functions with Digital Symbol Substitution Test (DSST) at postoperative 10th and 45th min and found no differences between the two agents. Cheung *et al*.[37] studied dexmedetomidine and midazolam with MMSE preoperatively and at the 2nd h, did not report any differences. Mortero *et al*.[38] compared the effects of propofol with propofol+low dose ketamine combination on postoperative cognitive functions applying MMSE test preoperatively and at the postoperative 15th min.Silbert *et al*.[39] investigated attention, memory and psychomotor functions following cardiopulmonary bypass preoperatively, postoperatively at 18th h and 5th day using Rey Auditory Verbal Learning Test-RAVLT, Trail Making A and B, and Grooved Pegboard tests. Isler *et al*.[40] observed the effects of salbutamine on cognitive functions with MMSE test preoperatively, postoperatively at the 1st, 2nd,4th h and1stday. Sezer *et al*.[41] determined a significant decrease in the postoperative MMSE test scores compared to the preoperative scores in patients who developed post operative delirium following coronary by-pass surgery.

In the assessment of cognitive functions, Folstein[42] used the MMSE test because it is effective, and easy to apply.[42-44] Song *et al*.[45] compared recovery with MMSE test in patients who underwent cystoscopy with or without midazolam and showed a clinical but not a statistical difference.

The Mini-Mental State Examination (MMSE) is a widely used tool for assessment of cognitive mental status. It can be administered in less than 10 min by following simple instructions. Many of the other neuropsychological scales and tests for predicting the cognitive impairment are of limited use because of the time and complex training required to administer them.

In this study, we applied the mini mental state examination (MMSE)[42] preoperatively and at the 10th min and 45th min postoperatively for evaluation of postoperative cognitive dysfunction (POCD). Bitsch *et al*.[46] reported that patients undergoing hip fracture surgery often experience POCD but pathogenesis of POCD may be multifactorial. We did not encounter precipitation of POCD related to anesthesia and/or surgery in our study, probably because of very short anesthesia and surgery time of cystoscopies. In the present study, midazolam affected the cognitive functions and recovery independently of sedation. Dexmedetomidine affected the postoperative cognitive functions to a lower extent. Owing to its stable sedating effect, the patients could be awakened more easily.

In conclusion, this study suggests that remifentanil/dexmedetomidine combination is superior to remifentanil/midazolam combination in monitored anesthesia care for minor surgical interventions requiring day-case anesthesia such as cystoscopies.

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