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Research Article

Can Postoperative or Preemptive Epidural Analgesia Affect the Incidence of Postoperative Delirium After Major Abdominal Surgery?

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Abstract

Objectives: The study aimed to investigate the effects of postoperative and preemptive epidural analgesia combined with total intravenous anesthesia (TIVA) on the incidence of postoperative delirium (POD) in patients undergoing major abdominal surgery for ≥4 h.

Methods: In this prospective randomized study, after evaluating 158 patients, 110 patients who were more than 50 years old were divided as follows: Group A, which received postoperative epidural analgesia (n=57), and Group B, which received preemptive epidural analgesia (n=54) combined with TIVA. Before and after surgery, delirium was diagnosed using the Mini-Mental State Examination, Confusion Assessment Method, and writing test. Risk factors for delirium were determined.

Results: The overall incidence of delirium was 8.1% (9/110). POD was seen in five patients in Group A and four patients in Group B. The mean age of patients diagnosed with POD was 67.3±4.1 years, and this was greater than that of the remaining study patients (p=0.001). The average time until the onset of delirium was 2.2±0.8 days, and the mean duration of delirium was 6.3±4.2 days; however, there were no significant differences when comparing Group A patients with Group B patients in terms of these parameters (p>0.05). Significant risk factors for the development of delirium were old age, previous history of chronic obstructive pulmonary disease, male sex, being single, and excess smoking (p<0.001).

Conclusion: Older patients showed POD within the first 3 days after undergoing major abdominal surgery. The incidence of delirium was not different between the patients who received postoperative epidural analgesia and those who received preemptive epidural analgesia combined with TIVA.

Keywords: Delirium, epidural analgesia, major abdominal surgery, total intravenous anesthesia

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In the early phase of recovery after general anesthesia, cognitive functions such as consciousness, attention, orientation, perception, memory, judgment, and insight take time to reach their preoperative levels.[1] Postoperative delirium (POD) is a frequent form of cognitive dysfunction, and it is an acute confusional state that includes orientation loss and variable intensity of attention and memory dysfunction that fluctuate during the day. POD is usually temporary and is associated with reversible brain dysfunction. Its distinctive features include 1) disordered cognition, 2) fluctuating cognitive level, 3) altered psychomotor activity, 4) disordered sleep–wake cycle, 5) decrease in awareness

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of environment and focus of attention, 6) hypoactivity or hyperactivity, 7) aggression, 8) agitation or lethargy, and 9) hallucination.[2, 3]

The incidence of delirium across studies ranges from 5.1% to 52.2%, with higher incidences during hip fracture and aortic surgeries.[3] The following risk factors were assessed: age; sex; cognitive impairment; depression; presence of psychological symptoms; preoperative psychotropic drug use; alcohol use; history of prior delirium; laboratory electrolyte, glucose or albumin abnormalities; medical conditions (e.g., cerebrovascular disease or chronic pulmonary disease), American Society of Anesthesiologists (ASA) status; smoking history; body mass index; functional impairment; and hearing or visual impairment. Risk factors for POD include male gender, previously known history of cognitive dysfunction, alcohol consumption, abnormalities in electrolyte and glucose levels, unstable systemic diseases, major surgeries, long surgical duration, intraoperative hypotension, hypoxia, hemoglobin level of <10 g/dL, metabolic acidosis, postoperative pain, malnutrition, dehydration, infection, uneasiness after urination, use of analgesic drugs such as meperidine or transdermal fentanyl, and use of anticholinergic drugs.[4, 5]

Table 1. Confusion Assessment Method (CAM)* Diagnostic Algorithm

Feature 1: Acute Onset or Fluctuating Course

This feature is usually obtained from a family member or nurse and is shown by positive responses to the following questions:

- Is there evidence of an acute change in mental status from the patient's baseline?
- Did the (abnormal) behavior fluctuate during the day, i.e., tend to come and go or increase and decrease in severity?

Feature 2: Inattention

This feature is shown by a positive response to the following question:

- Did the patient have difficulty focusing attention, e.g., being easily distractible, or have difficulty keeping track of what was said?

Feature 3: Disorganized thinking

This feature is shown by a positive response to the following question:

- Was the patient's thinking disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject?

Feature 4: Altered Level of consciousness

This feature is shown by any answer other than "alert" to the following question:

- Overall, how would you rate this patient's level of consciousness? [alert (normal)], vigilant (hyperalert), lethargic (drowsy, easily aroused), stupor (difficult to arouse), or coma (unarousable)]

** The diagnosis of delirium by the CAM requires the presence of features 1 and 2 and either 3 or 4.*

Speaking, consciousness, orientation of perception, integrity, memory, and motor activities can be measured by means of the Mini-Mental State Examination (MMSE), Confusion Assessment Method (CAM) (Table 1), and writing test (Table 2).[6-8] The CAM is a standard instrument derived from DSM-III-R criterion and has been provided to be useful for diagnosing patients with delirium.[7] The MMSE is easy to conduct and generates reliable results, and it can be used to test serially under fluctuating conditions.

The objective of this study was to compare the impact of postoperative epidural analgesia combined with total intravenous anesthesia (TIVA) and preemptive epidural analgesia combined with TIVA on the postoperative incidence of delirium in elderly patients undergoing major abdominal surgery.

Materials and Methods

After approval from the Institutional Review Board, the study was conducted on 158 patients; 110 patients completed the study; these patients underwent major abdominal surgery from June 2012 to March 2014 .

The present study included adult patients who were aged ≥50 years and those who planned to stay in the hospital for at least 5 days after surgery. Additional inclusion criteria were as follows: surgery under general anesthesia, fluent speaking, ability to read, and absence of serious loss of hearing or vision, which would impair neuropsychological test results. Exclusion criteria were age <50 years; ASA status >III; history of drug abuse or psychological disorders that could affect the cognitive functions of patients; urgent or immediate operation; known coagulative diseases or recent thrombolytic treatment; general contraindications for epidural anesthesia, including treatment being rejected by patients; known hypersensitivity to the drugs used in the study; preoperative use of analgesics and hypnotics; use of beta blockers; history of drug allergy; and left ventricular ejection fraction <50%; and intraoperative documentation

Table 2. Writing test

The test may be used in the preoperative period (for baseline values) or whenever the patient seems mentally disturbed in the postoperative period.

1. Reluctance to write

- Is the patient able to write at all (at least his or her name)?

2. Motor impairment

- Is the writing legible or is it impaired because of tremor, clumsiness, or micrographia?

3. Spatial disorders

- Is the patient starting on a place on the paper leaving sufficient space for the intended sentence and is he or she aligning correctly?

of hypertension, hypotension, or hypoxemia.

The primary end point was the relationship between the anesthetic technique and cognitive functions evaluated using the MMSE, CAM, and writing test.[6-8] A preoperative assessment was made within one day before surgery. Neuropsychological tests were repeated within 7 days after surgery. The patients were visited for the first 5 days after surgery or until they left the hospital.

According to the randomization list, the patients were divided into two groups: Group A (n=55), postoperative epidural analgesia combined with TIVA, and Group B (n=55), preemptive epidural analgesia combined with TIVA. Prehydration was performed by administering 8 mL/kg of balanced electrolyte solution to all patients in the two groups. After baseline parameters were recorded, all patients received intravenous 1 mg of midazolam. The patients were brought to the operating room after fasting for 8 h. All patients were monitored using a bispectral index scale (BIS) monitor in addition to a standard monitor, including electrocardiogram, invasive blood pressure, and arterial oxygen saturation. Using the median approach and loss-of-resistance technique, an epidural catheter was inserted through a 17-G Tuohy needle at the T12-L1 space; it was then pushed forward for 3 to 4 cm. The patients were kept in the supine position. Ten minutes later after the test dose, motor and sensory blocks were assessed using the Bromage scale (0–4) and pinprick test. In the patients in the two groups, motor and sensorial blocks were not observed. In Group A, the patients received 8–10 mL of normal saline (NS) through the epidural catheter. In Group B, the patients received 0.166% bupivacaine +10 µg/mL fentanyl (bolus 8–10 mL) through the epidural catheter. The anesthetist who applied epidural blocks and the adjusted epidural infusion was unaware of the classification of the patients. Another independent anesthetist prepared all epidural injections. Anesthesia was performed according to the institutional standards. All patients were administered with an initial bolus of 0.5–1 µg/kg of remifentanil and 1 mg/kg of propofol with 2% lidocaine at 20 mg. Later, the propofol dose was reduced to 0.25 mg/kg to cause the eyelid reflex

Table 3. Comparison of the demographic characteristics of the patients in both groups

	Group A		Group B		*P*
	Mean	SD	Mean	SD	
Age	59.8	7.2	61.7	6.8	0.601
Lenght of intensive care (day)	2.0	2.1	1.7	1.3	0.690
	N	%	N	%	
Sex					–
Female	13	23.6	17	30.9	
Male	42	76.3	38	69.1	
Married or single					
Single	10	18.1	8	14.5	0.771
Married	45	81.8	47	85.4	
Co-morbid condition					
No	30	54.5	31	56.3	0.808
Yes	25	45.5	24	43.6	
Current smoker					
No	50	90.9	52	94.5	0.452
Yes	5	9.1	3	5.5	
Heavy alcohol intake					
No	54	98.2	55	100	0.876
Yes	1	1.8	0	0	
Diagnosis					
Rectum Ca	22	40	20	36.3	0.765
Colon Ca	20	36.3	20	36.3	–
Stomach Ca	6	10.9	7	12.7	0.812
Osephagus Ca	1	1.8	1	1.8	–
Pancreas Ca	4	7.3	5	9.09	0.804
Other Cancer Liver met.	1	1.8	2	3.6	0.746
Surrenal Ca	1	2.8	0	0	0.654

P<0.05 statistically significant. SD: standard deviation; N: number
No differences were observed between groups in terms of demographic characteristics (p>0.05).

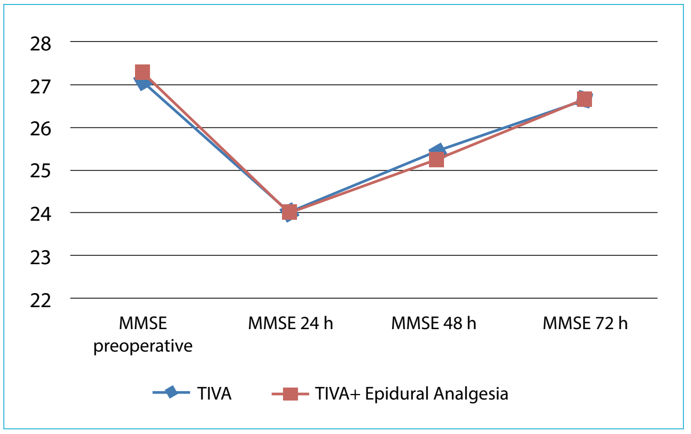

Figure 1. Comparison of Mini-Mental State Examiation (MMSE) scores between patients in Group A and those in Group B

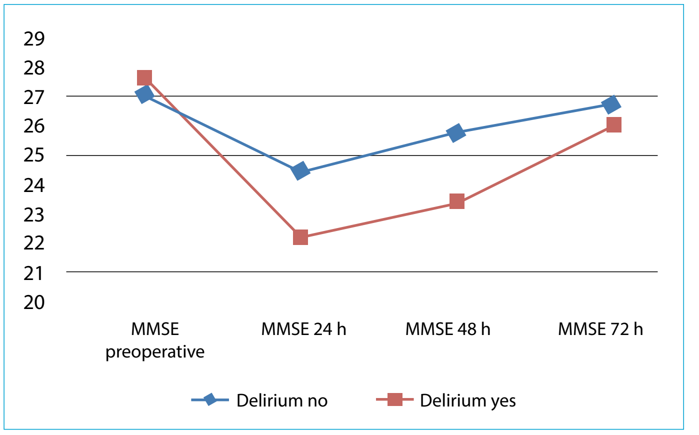

Figure 2. Comparison of Mini-Mental State Examination (MMSE) scores between patients with delirium and those without delirium

to disappear. After the BIS value reached 40–50, endotracheal intubation was facilitated with 0.6 mg/kg of intravenous rocuronium.

After endotracheal intubation, the epidural catheter was connected to an infusion pump delivering 0.1% bupivacaine +2 µg/mL fentanyl at 0.1 mL/kg/h in group B and the same NS infusion rate was used in Group A. General anesthesia was administered using oxygen/air (50%/50%). A propofol infusion of 40–150 µg/kg/min was titrated to keep the BIS value between 40 and 50, and the patients were administered intravenous remifentanil at a maintenance dose of 0.15–1.0 µg/kg/min.

All patients were mechanically ventilated to an ETCO2 of 32–35 mm Hg. To measure the mean arterial pressure (MAP) and perform blood gas analysis, a subclavian central venous pressure catheter and arterial line were placed. During induction, MAP values were obtained from the non-invasive blood pressure.

Insufficient analgesia was defined as an increase in systolic blood pressure and/or heart rate by >20% of the baseline values in response to surgical stimulus for >5 min. In case of insufficient analgesia, the patients received intravenous remifentanil at 1 µg/kg. IV colloids were administered at 10 mL/kg/h, and packed red bloods cells were given only when the hematocrit was <26%, in accordance with our department's protocol. Bradycardia was defined as a heart rate of <40 beats/min, and hypotension was defined as a decrease in systolic blood pressure to less than 20% of the baseline value. Bradycardia was treated with intravenous dose of 0.01 mg/kg atropine, and hypotension was treated by infusing Ringer's solution and 5 mg intravenous ephedrine if necessary. The rate of hypotension, hypertension, or bradycardia was recorded. Invasive blood pressure, heart rate, peripheral oxygen saturation, central venous pressure, and BIS value were recorded.

Thirty minutes before the end of surgery, the patients in Group A were first administered epidural analgesia with 0.166% bupivacaine +10 µg/mL fentanyl (bolus dose of 8–10 mL), and after 10 min, similar to the patients in Group B, postoperative analgesia was applied in accordance with the institutional standard protocols. To determine possible intra- and postoperative differences between the groups, the intraoperative requirement of packed red blood cells, fresh frozen plasma, and inotropic drugs was recorded.

On days 1, 2, 3, 4, and 5 after surgery, the MMSE, CAM, and writing test were applied by a trained researcher who was blinded to the study groups. The CAM includes four features: "acute onset or fluctuating course," "inattention," "disorganized thinking," and "altered consciousness level." A positive "delirium" diagnosis gives a positive result in the first two features and either of the third and fourth features. A positive CAM and writing test result in at least one of the first five postoperative days was defined as "delirium." Pain levels were measured using the Numerical Pain Scale. After surgery, the patients were informed about pain in the Numerical Rating Scale as follows: 0=no pain and 10=most serious pain.[9]

All adverse events or experiences related to intra and post anesthesia were evaluated and recorded. Adverse events and patient and doctor satisfaction were evaluated. Complications and morbidity and mortality rates were recorded in 30 days and after then.

Statistical Analysis

SPSS software 10.0 (SPSS Inc, Chicago, Illinois, U.S.A.) was used for statistical analysis. The Kolmogorov–Smirnov distribution test was used for the examination of normal distribution in addition to identifying statistical methods. Continuous variables were analyzed using descriptive statistics (mean, standard deviation). All p-values were twotailed. Continuous variables were compared between patients with and those without delirium using the t-test or Mann–Whitney test. The t-test was used if the data were normally distributed in both groups; the Mann-Whitney test was used if normality was violated. The Wilcoxon signed-rank test was used for the intragroup comparison of parameters. The sample size of each group was calculated as 35 patients in each group for the incidence of postoperative cognitive impairment one day after anesthesia to have 70% reduction (e.g., from 50% to 15%) to be clinically significant (alpha error of 0.05) or power calculations revealed that a total of 60 patients, 30 per arm, was needed to detect a difference in proportions of 30% for determining incidence of delirium (power of 80%; a two-sided alpha level of 0.05) at a 95% confidence interval at p<0.05.

Results

The mean age of the patients (n=110) was 60.9 years (SD=7.1), and more than half of the patients were male (72.7%) (Table 1). Most patients (83%) were married, and slightly more than half had comorbidities. Few patients were current smokers (7.3%) and were heavy alcohol users (1.8%) (Table 3).

Using the CAM criteria and the writing test, POD was seen 7.2% patients in group A and 9.09% patients in group B. The average time of delirium onset was 2.2 days in the patients in Group A and 2 days in those in Group B had at least one episode of delirium in the first 3 days after surgery. According to the groups was not statistically significant different in the incidence of delirium (p>0.05) (Table 4, 5). All patients with delirium were severely reluctant to write and had motor disabilities and spatial disturbances. No patient without delirium developed these disturbances.

In the patients in Groups A and B, the preoperative MMSE score and the score at 24 h and 48 h showed statistically significant decline in the MMSE score (p=0.000 and p<0.001, respectively). Compared to the preoperative MMSE score, this was not a statistically significant decrease in the MMSE score at 72 h (Group A p=0.115>0.001; Group B p=0.138>0.001) (Table 6, Fig. 1).

The number of current smokers was significantly higher in patients with delirium. Age (p=0.000<0.001) and long length of intensive care (days) were statistically significant factors affecting delirium (p=0.000<0.001). The number of current smokers was significantly higher in patients with delirium (p<0.05) was significantly higher mortality rate in delirium (p<0.005) (Table 7).

The patients in Group A and Group B, according to the preoperative MMSE score observed in patients with delirium, statistically significant decrease in 24 h and 48 h MMSE score was observed, but there was not statistically significant decrease in the 72 h MMSE score (p=0.042<0.05) (Table 8, Fig. 2).

Table 4. Delirium incidence according to groups

Delirium	Group A		Group B		*P*
	n	%	n	%	
No	50	90.9	51	92.7	
Yes	5	9.09	4	7.2	

Table 5. The onset time of delirium at the end of surgery

		Group A		Group B	
		n	%	n	%
Onset time of delirium at the end of surgery (day)	1st day	1	20	1	25
	2nd day	3	60	2	50
	3rd day	1	20	1	25
	4th day	0	0	0	0
	5th day	0	0	0	0

Table 6. Mini-Mental State Examination Scores according to the groups

	Group A	Group B	*P*
	Mean±SD	Mean±SD	
MMSE preoperative	27.1±1.1	27.3±1.2	0.283
MMSE 24.h	24.1±2.1	24.0±2.3	0.924
MMSE 48.h	25.5±2.2	25.3±2.2	0.580
MMSE 72.h	26.6±1.6	26.7±1.7	0.803
Between groups P	>0.05	>0.05	

P<0.05; statistically significant; SD: standard deviation; N: number; MMSE: mini mental status exam.
Differences in the scores preoperatively and at 24 h, 48 h, and 72 h between the groups were not statistically significant (p>0.05).

Discussion

The word "delirium" is derived from the Latin word delirare. It means "to be out of one's furrow." Delirium is an acute cerebral state characterized by disordered consciousness and cognitive dysfunction. The impacts of the applied anesthesia technique on the development of delirium should be discussed. However, important risk factors can be changed with a multidisciplinary care model to postoperative pain management, attentive drug selection, and complicated events under the control of anesthetist.

As a result of the interaction of central muscarinic cholinergic system with many anesthetic drugs, the inhibition observed in muscarinic cholinergic receptors may lead to POD and cognitive dysfunction.[10] In the present study, postoperative or preemptive analgesia combined with TIVA was ap-

Table 7. Effect of demographic characteristics of patients with and those without delirium

	Delirium No		Delirium Yes		*P*
	Mean	**SD**	**Mean**	**SD**	
Age	56.9	5.3	67.3	4.1	0.000***
Lenght of intensive care (day)	1.4	0.7	4.4	3.2	0.000***
	N	%	N	%	
Sex					
Female	27	26.7	3	33.3	0.177
Male	74	73.2	6	66.7	
Married or single					
Single	14	18.8	4	44.4	0.189
Married	87	81.2	5	55.6	
Co-morbid condition					
No	56	55.4	6	66.7	0.299
Yes	45	44.6	3	33.3	
Current smoker					
No	91	91	6	66.7	0.012*
Yes	10	9	3	33.3	
Heavy alcohol intake					
No	100	99	0	0	0.952
Yes	1	1	0	0	
Mortality					
Live	99	98	6	66.7	0.005**
Ex	2	2	3	33.3	

P<0.05 statistically significant. SD: standard deviation; N: number
**p<0.01; ***p<0.001

plied in patients who underwent major abdominal surgery for ≥4 h to determine the incidence of delirium in patients aged ≥50 years.

Among risk factors for the development of delirium, advanced age was considered. Generally, old patients (>65 years) practice polypharmacy. The metabolizing ability of drugs decreases. Furthermore, visual and hearing disorders lead to disorientation in old people. POD is observed more frequently in old people due to the high rates of postoperative hypoxia, and cardiovascular, respiratory, and cerebrovascular diseases.[11] In the study, 44.5% of the patients had a history of one or more diseases and practiced polypharmacy. No difference was detected between the groups in terms of age. However, the impact of age on delirium was statistically significant (p=0.000 <0.001). The number of patients with delirium was more in the group of advanced age when compared to the patients without delirium in Group A and Group B. The incidence of delirium was significantly high in advanced age patients. Predisposing risk factors for delirium include but are not limited to visual disorders, serious diseases, preoperative cognitive disorders, urea nitrogen:creatinine ratio of ≥18:1, iatrogenic events including malnutrition, multiple drug use due to concomitant problems such as the existence of a urinary catheter, infections, liquid and electrolyte abnormalities, physical restrictions to protect the patient are among the factors triggering POD. In a prospective study among patients in last-stage cancer with many general medical states, delirium developed at a rate of 32%.[12] It was shown that the risk of delirium increased if the patients in the hospital showed dysphoric mood and despair. All patients in the present study underwent major abdominal surgery due to malignancy, and this was an important risk factor in the development of delirium.

In patients who have undergone abdominal surgery, the incidence of POD ranges from 17%[2] to 51%.[13] The incidence is approximately 87% in old patients requiring intensive care. Linda et al.[14] found that in 35% postoperative colorectal operative patients aged ≥50 years, at least one episode of delirium was observed within the first 3 days after surgery; it was observed within the first 24 h in 21% patients and on the second (9%) and third (7%) day in some patients. In the present study, the incidence of POD was 9.09% in the Group A patients and 7.2% in the Group B patients, which is contrary to findings in the literature.

To determine POD in the patients, the MMSE,[6] CAM,[7] and writing test[8] were used. The CAM is a very important rating scale that helps makes a diagnosis quickly and accurately and was developed to help non-psychiatrically trained clinicians. It has become a standard delirium tool used most commonly used in clinics and research for 16 years.

The MMSE is a test composed of 24 questions on orientation, attention, calculation, recording or close memory, and linguistic and visual perception; the total score that can be obtained is 30, and the questions can be answered within 5–10 min.[15] This test is not specific to POD, but it could give significant results when applied on the third day after surgery.[1-16] In young patients, cognitive deficits were observed in tests applied on the second day after surgery.[17] It was argued that postoperative mental state tests should be applied 1 week after major surgery at the earliest to eliminate anesthetic substances and metabolites.[18]

The objective of TIVA with propofol and remifentanil is to develop cognitive results with quick recovery and early return to normal activities.[19] In the present study, we preferred propofol and remifentanil in TIVA for the quick recovery and early return of psychomotor functions.

In previous clinical studies and animal trials, it was argued that the long duration of the neurotoxicity of general anesthetics might lead to postoperative cognitive dysfunction.[20]

It was proven that the BIS value established a good relationship with hypnotic state of patients at the time of respiration and IV anesthesia. The objective of the BIS monitor is to reduce the risk of intraoperative consciousness and to guide anesthetists to prevent unnecessary deep anesthesia and resulting prolonged recovery periods. Chan et al.[21] emphasized that BIS-guided anesthesia implementation significantly decreases the incidence of POD and delirium in old patients who have undergone major non-cardiac surgery.

In this study, the incidence of delirium was low in both groups, contrary to literature, and titration of doses according to patients needs in anesthesia regimen based on BIS-guided propofol/remifentanil (TIVA) in patients undergoing prolonged surgical procedures led to a quick and early recovery.

Due to the residual effects of relaxants, pharygolaryngeal muscle activity and hypoxemia depression may contribute to delirium/agitation. Due to residual paralysis, neuromuscular functions of patients should be thoroughly monitored in PACUs because insufficient antagonization of neuromuscular blockers increases postoperative complications, particularly during hypoxic periods. In the present study, rocuronium, which is a neuromuscular blocker with a quick start and medium period of action, was used. In a study in which Toffguard was used, there was no necessity of neuromuscular blocker use in all patients within the last 25 min; therefore, no residual effects of postoperative neuromuscular blockers were observed. In the present study, delirium was not associated with the use of neuromuscular blockers.

The most important classes of drugs related to delirium are sedative hypnotics, opioids, and anticholinergic agents. It was shown that pain control was effective for preventing complications related to the central nervous system When pain was less in studies, pain sensitivity decreased in old patients; however, pain tolerance decreased in high pain alerts. Lynch et al showed that the risk of delirium was high in patients with high score of pain within three days postoperatively.[22] Analgesia and postoperative pain were found to be correlated with the development of POD.

For pain management, normeperidine, which is a metabolite of meperidine, is not suggested to be used in operative patients as it is associated with delirium risk. No significant difference was observed in the incidence of POD or cognitive regression among agents such as morphine, fentanyl, or other more commonly used postoperative opioid agents such as hydromorphone.[23]

As epidural analgesia has a less systemic effect than IV analgesics, epidural analgesia should theoretically be associated with a decrease in the incidence of POCD.[24]

In the present study, bupivacaine and fentanyl were continuously applied to all patients for 48 h as epidural analgesia. VAS ≥4 was detected in no patient. No respiration depression or hemodynamic instability was seen in the patients. This resulted from the provision of effective analgesia in low doses and concentrations. In the present study, we decreased the incidence of delirium with early recovery and convenient postoperative analgesia.

In POD, it is important to evaluate the intensity of postoperative cognitive disorders. It was shown that the incidence of confusion after anesthesia increased in old patients[13]; this was 19.6% even 7 days after surgery. The MMSE is a global cognitive function test and it can be applied at bedside.[6] It allows the measurement of the progress of a disease after surgery. The MMSE score has total 30 points. If the score is <23, it is not diagnostic of a diagnosis of dementia, but it offers supportive evidence. While low MMSE scores (for example, 26–29) are not indicative of dementia, they can be effective for postoperative management. Moreover, in the absence of dementia, the risk of POD is more than 2-fold higher in those with MMSE scores of ≤28 or less than in those with scores of 29 or 30.[25]

In this study, at the 24th, 48th, and 72nd h after surgery, the difference between the groups was not significant in terms of the MMSE scores ($p>0.05$). However, it was seen that the 24 h ($p<0.006$) and 48 h ($p<0.001$) scores in patients with delirium were significantly lower ($p<0.01$).

POD, with the ensuing functional decrease and high mortality risk, increases the duration of intensive care and cost of patient care.

In the present study, the period of intensive care ($p=0.000$,

<0.001) and rate of mortality ($p<0.05$) in the patients with delirium were statistically longer and higher in the patients with delirium than in those without delirium.

Conclusion

POD is frequently seen, not generally recognized, and is life threatening. Delirium is potentially predictable and preventable. It is an important condition associated with increased treatment costs and high morbidity and mortality rates, particularly in old patients. Preoperative anesthetic management is important as many drugs used within the preoperative period may contribute to the onset of delirium, particularly in old patients. Pain may worsen POD and agitation. In this study, no difference was observed in terms of POD in patients who underwent preemptive epidural analgesia combined with TIVA and those who underwent postoperative epidural analgesia combined with TIVA. Training doctors and nurses on delirium and risk factors and increasing awareness is the most important factor for protection.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee (Number/Date: 204/June 19, 2012)

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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