Journal of Clinical Anesthesia 36 (2017) 118–122

Contents lists available at ScienceDirect

Journal of Clinical Anesthesia

Original contribution

Effects of dexmedetomidine administered for postoperative analgesia on sleep quality in patients undergoing abdominal hysterectomy☆,☆☆,★

Zuolei Chen, MD, (Associate Professor) [a,*], Rundong Tang, MD, (Resident) [a], Rui Zhang, MD, (Associate Professor) [b], Yan Jiang, MD, (Associate Professor) [c], Yingzhi Liu, MD, (Professor) [a]

[a] Department of Anesthesiology, Affiliated Hospital of Qingdao University, Qingdao 266003, China
[b] Department of Anesthesiology, Weifang Medical University, Weifang 261053, China
[c] Department of Otorhinolaryngology, Affiliated Hospital of Qingdao University, Qingdao 266003, China

ARTICLE INFO

Article history:
Received 25 May 2016
Received in revised form 27 September 2016
Accepted 28 October 2016
Available online xxxx

Keywords:
Dexmedetomidine
Postoperative analgesia
Sleep disturbance
Polysomnography

ABSTRACT

Study objective: To evaluate the effects of postoperative dexmedetomidine infusion on sleep quality in patients undergoing abdominal hysterectomy.
Design: Randomized, double-blind study.
Setting: Postoperative recovery area and ward.
Patients: Sixty patients of American Society of Anesthesiologists physical status I or II scheduled for elective hysterectomy were enrolled.
Interventions: Patients in group C received sufentanil infusion (a continuous dosage of 0.02 μg kg^{-1} h^{-1}, a bolus dose of 0.02 μg/kg, a 10-minute lockout interval), and patients in group D received combined infusion of sufentanil with dexmedetomidine (a continuous dosage of sufentanil 0.02 μg kg^{-1} h^{-1} with dexmedetomidine 0.05 μg kg^{-1} h^{-1}, a bolus doses of sufentanil 0.02 μg/kg with dexmedetomidine 0.05 μg/kg, a 10-minute lockout interval).
Measurements: Polysomnography (PSG) was performed on the following 3 nights: the night before surgery (PSG1), the first night after surgery (PSG2), and the second night after surgery (PSG3). Postoperative pain scores using visual analog scoring scale, levels of sedation, and cumulative sufentanil consumptions were also recorded.
Results: After surgery, patients suffered from significant sleep disturbance with a lower sleep efficiency index and subjective sleep quality and a higher arousal index at PSG2 and PSG3. Compared with group C, postoperative administration of dexmedetomidine significantly improved the sleep efficiency index and subjective sleep quality. Although the rapid eye movement and N3 stage sleep did not differ between the 2 groups, the N1 stage and arousal index were lower and the N2 stage in group D at PSG2 and PSG3 was higher. Compared with group C, patients in group D have better pain relief with a lower visual analog scoring scale and cumulative sufentanil consumptions at 6, 24, and 48 hours after surgery.
Conclusions: Dexmedetomidine infusion not only offers effective analgesia but also improves postoperative sleep quality in patients undergoing hysterectomy.

1. Introduction

Studies showed that after major surgery, most patients experience significant disturbance in their sleep architecture, which is characterized by markedly reduced rapid eye movement (REM) sleep and slow wave sleep [1-3]. Postoperative sleep disturbance may contribute to cardiovascular, neurological, immunological, and metabolic complications, leading to increased morbidity [4-8]. Thus, improving the postoperative sleep quality probably has a positive effect on the recovery of surgical patients.

Dexmedetomidine, a selective α_2-adrenergic receptor agonist, which is characterized by sedative, sympatholytic, and analgesic effects, has been effectively used for postoperative analgesia in patients undergoing cesarean delivery and hysterectomy [9,10]; however, whether or not it also has a positive effect on postoperative sleep quality in these patients is to be investigated. Alexopoulou et al [11] noted that in critically ill patients, dexmedetomidine infusion during the night resulted in

☆ Disclosures: None.
☆☆ Conflicts of interest: None.
★ Presentation: None.
* Correspondence to: Zuolei Chen, MD, Department of Anesthesiology, Affiliated Hospital of Qingdao University, No. 59 Haier Road, Qingdao 266003, China. Tel.: +86 18561967939 (Mobile); fax: +86 532 82913090.
E-mail address: qyfymzk@163.com (Z. Chen).

http://dx.doi.org/10.1016/j.jclinane.2016.10.022
0952-8180/

light sedation, thereby improving sleep quality by increasing sleep efficiency and stage 2; however, Oto et al [12] concluded that nighttime infusion of dexmedetomidine induced severely disturbed sleep architecture in mechanically ventilated patients because there was no evidence of slow wave sleep and REM sleep.

This randomized, placebo-controlled study was designed to investigate the effects of dexmedetomidine used as an adjuvant analgesic through patient-controlled analgesia (PCA) on postoperative sleep quality in patients undergoing abdominal hysterectomy.

2. Materials and methods

This study was performed between January 2015 and December 2015, and the study protocol was approved by the Ethics Committee of University Hospital of Qingdao (No.2014MZ04) on December 25, 2014. Informed written consent was obtained from all patients before study enrollment.

2.1. Patients

Patients who underwent total abdominal hysterectomy at our hospital were enrolled in this study if they met the following inclusion criteria: age between 30 and 55 years and American Society of Anesthesiologists grade I or II. Exclusion criteria included preoperative heart rate (HR) less than 50 beats/min, second- or third-degree atrioventricular block, sleep apnea, severe psychiatric or mental disorder, use of sedatives or hypnotics, inability to comply with poly-somnographic measurements, a history or current diagnosis of other sleep disorders as assessed by clinical manifestation, and a diagnostic polysomnography (PSG) record.

2.2. General anesthesia

All the patients were scheduled for the first operation at approximately 9:00 AM. General anesthesia was induced intravenously with sufentanil (0.3 μg/kg), propofol (2 mg/kg), and vecuronium (0.1 mg/kg), and tracheal intubation was performed 3 minutes later. Maintenance of anesthesia was accomplished with continuous remifentanil infusion (0.15-0.20 μg kg^{-1} min^{-1}) and propofol infusion (4-8 mg kg^{-1} h^{-1}). The infusion rates were adjusted to keep the BIS (BIS monitor; Aspect Medical System, Newton, MA) range between 40 and 60 and to stabilize the hemodynamics (both mean blood pressure [MBP] and HR maintained between 20% less and 20% more than preoperative levels). In addition, vecuronium (0.05 mg/kg) was intermittently added to maintain muscle relaxation. Both the propofol and remifentanil infusions were discontinued at the end of the surgery, and morphine sulfate 0.1 mg/kg was administered intravenously 20 minutes before the completion of the surgery. After surgery, the patient was transferred to the postanesthesia care unit (PACU) for postoperative monitoring until the patient was fully awake.

2.3. Study protocol and measurements

A computer-generated randomization table was used to divide patients into 2 groups (n = 30 per group). Then, the PCA system was attached, and the patients were instructed in its use. The PCA system (sufentanil 100 μg with or without dexmedetomidine 250 μg diluted into 100 mL) was programmed to deliver a continuous dosage of sufentanil 0.02 μg kg^{-1} h^{-1} and a bolus dose of 0.02 μg/kg, with a 10-minute lockout interval in group C, whereas patients in group D received the continuous dosage of sufentanil 0.02 μg kg^{-1} h^{-1} with dexmedetomidine 0.05 μg kg^{-1} h^{-1}, and a bolus doses of sufentanil 0.02 μg/kg with dexmedetomidine 0.05 μg/kg, with a 10-minute lockout interval. Finally, the patients were discharged from PACU to the reasonably sound-insulated surgical ward in rooms where the noninvasive blood pressure, pulse oxygenation (Spo_2), and HR were monitored.

Postoperative pain scores and levels of sedation were evaluated as previously described [10]. In brief, a 10-cm visual analog scoring scale (VAS; with 0, no pain, to 10, the worst imaginable pain) was used to measure the pain intensity. The level of sedation was evaluated by a 5-point scale (0, fully awake; 1, drowsy/closed eyes; 2, asleep/easily aroused with a simple verbal command or light tactile stimulation; 3, asleep/arousable by strong physical stimulation; 4, unarousable). Patients were encouraged to push the analgesic-demand button when they experienced significant pain (VAS>4 at rest). For patients with a poor response to the PCA system, an additional rescue bolus of 50 mg flurbiprofen axetil was administered intravenously. Variables such as sufentanil consumption, VAS, level of sedation, MBP, HR, and Spo_2 were measured at 1, 6, 24, and 48 hours, postoperatively. Adverse effects during the postoperative analgesia such as hypotension, bradycardia, and hypoxemia were treated with ephedrine, atropine, and oxygen with or without naloxone, respectively.

PSG was performed on the following 3 nights from 9 PM to 6 AM: the night before surgery (PSG1), the first night after surgery (PSG2), and the second night after surgery (PSG3). All patients were investigated in the same quiet ward and the nocturnal interventions were minimized during the nights of the study. The PSG and its subsequent analysis were performed according to the American Academy of Sleep Medicine Manual for the Scoring of Sleep and Associated Events [13]. PSG channels (Alice 5; Healthdyne, Atlanta, GA) were electroencephalography (C3-A2, C4-A1), 2-channel submental electromyography, and 2-channel electrooculography. Sleep variables, such as the sleep efficiency index (the ratio of total sleep time/total recording time), arousal index (the number of arousals per hour of sleep) and percentage of REM, and stage 1 (alpha rhythm is replaced by low-amplitude, mixed-frequency activity for >50% of the epoch), 2 (≥1 K-complexes or trains of sleep spindles occur in the first half of the current epoch or the last half of the previous epoch), and 3 (≥20% of an epoch consists of slow wave activity) sleep were recorded and analyzed by the sleep laboratory staff who was blinded to the patient's treatments. Transition from stage 1 to stage 3 refers to a progressive increase in slow waves on electroencephalography, an increase in sleep depth, and a progressive increase in the arousal threshold.

In addition, subjective sleep quality was evaluated on a scale of 0 to 10 (0, bad sleep; 10, excellent sleep) at 7:00 AM on the next morning.

2.4. Statistical analysis

Statistical analysis was performed using SPSS 19.0 software (SPSS Inc, Chicago, IL). The Kolmogorov-Smirnov test was used to assess the distribution of variables. Quantitative data were expressed as mean ± SD or median and interquartile range. To compare patient characteristics and operative data between the groups, independent *t* tests for continuous variables, and Fisher exact tests or χ^2 tests for categorical variables were performed. For statistical analysis of sleep measures, the Student *t* test was used, and the Wilcoxon rank sum test was used to compare the subjective data on sleep and sedation. One-way analysis

Table 1
Clinical characteristic of patients in group C and group D

	Group C (n = 29)	Group D (n = 30)	*t* or χ^2	*P*
Age (y)	44.7 ± 8.3	42.5 ± 7.0	1.102	.276
Body weight (kg)	60.3 ± 5.3	58.5 ± 4.6	1.395	.169
BMI (kg/m^2)	23.1 ± 1.2	22.5 ± 1.8	1.501	.139
ASA I-II (n)	18/11	16/14	0.461	.497
Intraoperative data				
Duration of surgery (min)	115.6 ± 25.3	108.6 ± 18.9	1.207	.233
Duration of anesthesia (min)	128.6 ± 16.7	130.1 ± 13.5	0.380	.705
Estimated blood loss (mL)	105.8 ± 25.5	98.5 ± 22.6	1.165	.249
Fluid infusion (mL)	1210.0 ± 60.7	1210.0 ± 60.7	0.611	.544
Recovery time at PACU (min)	37.7 ± 6.7	40.5 ± 8.0	1.455	.151

Variables were presented as mean ± SD or number of patients (n). Group C, sufentanil; group D, sufentanil plus dexmedetomidine; ASA, American Society of Anesthesiology; BMI, body mass index; PACU, postanesthesia care unit.