Effect of Dexmedetomidine Combined with Epidural Anesthesia on Stress Responses and Postoperative Complications in Patients Undergoing Thoracoscopic Radical Resection of Lung Cancer

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Purpose: To investigate the effect of dexmedetomidine combined with epidural anesthesia on stress responses and postoperative complications in patients undergoing thoracoscopic radical resection of lung cancer. **Methods:** A total of 100 patients who underwent radical resection of pulmonary carcinoma in our hospital between February 2019 and July 2020 were selected and randomly divided into control group (n=50) and experimental group (n=50), and their clinical data were retrospectively analyzed. Among them, the control group patients received epidural anesthesia, while the patients in the experimental group were treated with dexmedetomidine combined with epidural anesthesia. After that, the anesthesia onset time, duration of analgesia, postoperative waking time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate, postoperative expression levels of inflammatory factors, as well as blood pressure before surgery (T0), 1 h during surgery (T1), 1 h after surgery (T2), and 2 h after surgery (T3) were compared between the two groups. **Results:** The anesthesia onset time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate and postoperative expression levels of inflammatory factors in the experimental group were all significantly lower than those in the control group, with statistical significance ($P < 0.05$); the duration of analgesia and postoperative waking time in the experimental group were significantly longer than those in the control group, with statistical significance ($P < 0.05$); there was no statistical significance in the comparison of the blood pressure at T0, T1, T2 and T3 between the two groups ($P > 0.05$).
Conclusion: The application of dexmedetomidine combined with epidural anesthesia for the patients undergoing thoracoscopic radical resection of lung cancer can significantly reduce complication rate after surgery, improve analgesic effect and relieve stress responses in patients.

Keywords: dexmedetomidine; thoracoscopic radical resection of lung cancer; epidural anesthesia; stress response; complication

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Lung cancer, characterized by high fatality and recurrence rates, refers to malignant tumors in people's respiratory system, and due to the differences in lung cancer stages and tumor size among different patients, clinical outcomes may differentiate from individuals after surgical treatment [1-3]. Thoracoscopic radical resection of lung cancer is a novel minimally invasive surgery, with the advantages of small surgical trauma, simple operation, less blood loss and rapid recovery after surgery, and this surgery has less effect on patients' pulmonary function, which is helpful for improving prognosis. Thoracoscopic radical resection of lung cancer should be conducted with the aid of anesthesia, and the common anesthesia method is epidural anesthesia, in which local anesthetics are injected into epidural space, so as to effectively block spinal nerve roots and make the nerves at the anesthesia sites numbness to achieve the anesthetic effect [4-6]. Dexmedetomidine, a common drug mainly for the general anesthesia with endotracheal intubation, has been widely applied in various types of surgery. Epidural anesthesia combined with dexmedetomidine has been reported to significantly prolong patients' duration of analgesia and relieve their stress responses after anesthesia [7-9]. In order to explore the anaesthetic efficacy of dexmedetomidine combined with epidural anesthesia and its effect on postoperative complications in patients undergoing thoracoscopic radical resection of lung cancer, the patients underwent thoracoscopic radical resection of lung cancer in our hospital were selected as the study subjects and they received different anaesthetic modalities; after that, the anesthesia onset time, duration of analgesia, postoperative waking time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate, postoperative expression levels of inflammatory factors, as well as blood pressure at T0, T1, T2 and T3 were compared between the two groups. Specific study results are reported as follows.

MATERIALS AND METHODS

General Information

A total of 100 patients who underwent radical resection of pulmonary carcinoma in our hospital between February 2019 and July 2020 were selected and randomly divided into control group (n=50) and experimental group (n=50). The experimental group patients aged from 36 to 67 years old, while the patients in the experimental group aged from 35 to 67 years old. There was no statistical significance in the comparison of general information such as gender, age, disease course, etc. between the two groups (P > 0.05), as shown in Table 1.

Table 1.
Comparison of general information between the two groups ($\bar{x}\pm s$)

Group	Experimental group	Control group	t/X^2	P
Gender (Male/Female)	22/28	24/26	0.16	0.69
Age (years old)	50.34±7.22	50.08±7.36	0.19	0.86
Height (cm)	167.38±10.55	165.80±10.31	0.76	0.45
Weight (kg)	66.52±11.05	65.43±11.67	0.48	0.63
Disease course (months)	1.36±0.13	1.39±0.11	1.25	0.22
Smoking history (years)	7.75±1.39	7.50±1.34	0.92	0.36
Drinking history (years)	11.37±2.37	11.07±2.55	0.61	0.54
Hypertension (cases)	12	10	0.23	0.63
Diabetes (cases)	9	10	0.07	0.80
Hyperlipidemia (cases)	4	7	0.92	0.34

Inclusion / Exclusion Criteria

Inclusion criteria:

① Patients underwent radical resection of pulmonary carcinoma in our hospital.

② Patient aged 18 years old and elder.

③ Patients had no other organic diseases or blood coagulation disorders, and they did not take any coagulation drugs recently.

④ Patients had no history of drug allergy, no drug abuse and no bad addiction.

⑤ This study was approved by the Hospital Ethics Committee, and the patients all voluntarily participated in the study and signed the informed consent.

Exclusion criteria:

① Patients received other surgeries recently.

② Patients had disturbance of consciousness and could not cooperate with this study.

③ Patients or their family members did not agree to participate in this study.

Methods

Patients in both groups were fasted and inhibited to drink for 8 h before surgery, and they underwent routine examinations preoperatively. After entering the operating room, they received the examinations of blood pressure, oxygen saturation, electrocardiogram, etc., and then their cubital vein pathway was opened to monitor invasive blood pressure.

In the control group, the patients received epidural anesthesia in lateral positions, and the anesthesia site was determined by the position of surgical incision, but the general anesthesia site was in the central interspinous space within the surgical range. After the determination of anesthesia site finished, 0.5 % ropivacaine (Manufacturer: Guangdong Huarun Shunfeng Pharmaceutical Co., Ltd.; State Food and Drug Administration approval number: H20050325) was injected into the selected anesthesia site. During surgery, the intravenous infusion of 0.25 ml/kg of normal saline was performed continuously, which was then followed by anesthesia induction in the way that the plasma concentration of 4 ng/(min·kg) of remifentanil (Manufacturer: Jiangsu Nhwa Pharmaceutical Co., Ltd.; State Food and Drug Administration approval number: H20143314; Specification: 1 mg) was injected.

In the experimental group, the patients in lateral positions were treated with dexmedetomidine combined with epidural anesthesia. After the anesthesia site was determined, 0.5 % ropivacaine was injected, and the continuous intravenous infusion of 1 μg/kg of dexmedetomidine (Manufacturer: Sichuan Guorui Pharmaceutical Co., Ltd.; State Food and Drug Administration approval number: H20143195; Specification: 1ml: 0.1mg) was carried out at the speed of 0.2 μg/(kg·h); subsequently, anesthesia induction of 4ng/(min·kg) of remifentanil was conducted [10-12].

Observation Indexes

The anesthesia onset time, duration of analgesia, postoperative waking time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate, postoperative expression levels of inflammatory factors, as well as blood pressure at T0, T1, T2 and T3 were compared between the two groups.

The scores of the SDSS cognitive function scale ranged from 0 to 20 points, and higher scores indicated lower cognitive function.

The postoperative pain of the patients was evaluated by the VAS pain score scale, in which 0 represented no pain, 1-3 points represented mild and tolerable pain, 4-6 points represented the pain that affected normal sleep but was tolerable, and 7-10 points represented intense and intolerable pain. 2-3 points was classified as good analgesia, while 3 points or above was classified as incomplete analgesia.

Statistical Treatment

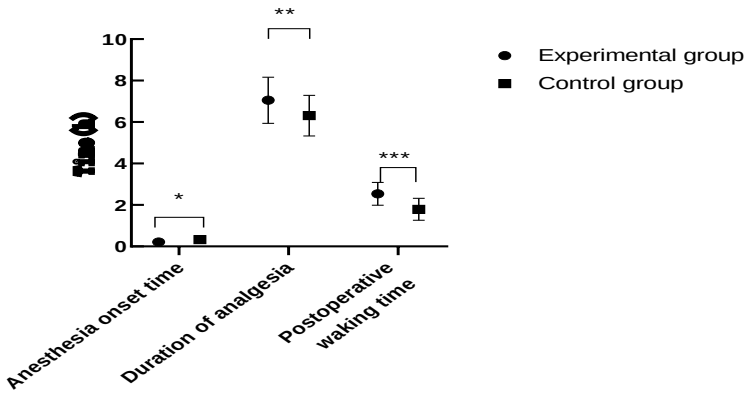
The selected data processing software for this study was SPSS20.0, and GraphPad Prism 7 (GraphPad Software, San Diego, USA) was used to draw the pictures of the data in this study. Measurement data were expressed by ($\bar{x}\pm s$) and tested by t-test. Enumeration data were expressed as [n (%)] and tested by X^2 test. The differences had statistical significance when $P < 0.05$.

RESULTS

Comparison of Anesthesia Onset Time, Duration of Analgesia and Postoperative Waking Time between the Two Groups

The anesthesia onset time in the experimental group was significantly less than that in the control group, while the duration of analgesia and postoperative waking time were significantly more than those in the control group, with statistical significance ($P < 0.05$), as shown in Figure 1.

Figure 1.
Comparison of anesthesia onset time, duration of analgesia and postoperative waking time between the two groups.



Note: The abscissa indicated anesthesia onset time, duration of analgesia and postoperative waking time, while the ordinate indicated time, h.

* indicated the comparison in the anesthesia onset time between (0.21 ± 0.06) h in the experimental group and (0.33 ± 0.07) h in the control group, with statistical significance, t = 9.20, P < 0.001.

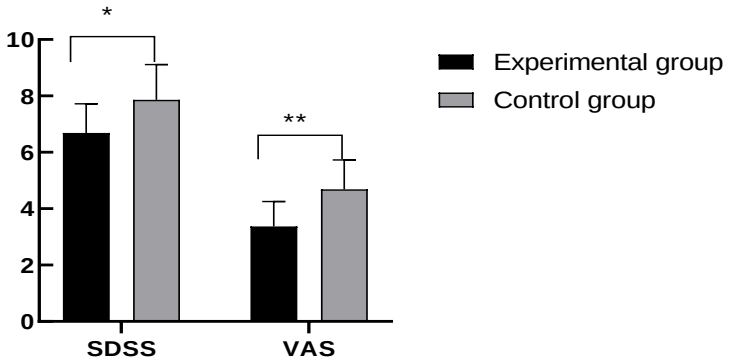
** indicated the comparison in the duration of analgesia between (7.05 ± 1.11) h in the experimental group and (6.31 ± 0.98) h in the control group, with statistical significance, t = 3.53, P < 0.001.

*** indicated the comparison in the postoperative waking time between (2.54 ± 0.55) h in the experimental group and (1.79 ± 0.53) h in the control group, with statistical significance, t = 6.94, P < 0.001.

Comparison of SDSS Cognitive Function and VAS Pain Scores between the Two Groups

The SDSS cognitive function and VAS pain scores in the experimental group were significantly lower than those in the control group, with statistical significance (P < 0.05), as shown in Figure 2.

Figure 2.
Comparison of SDSS cognitive function and VAS pain scores between the two groups



Note: The abscissa indicated SDSS cognitive function and VAS pain scores, while the ordinate indicated score.

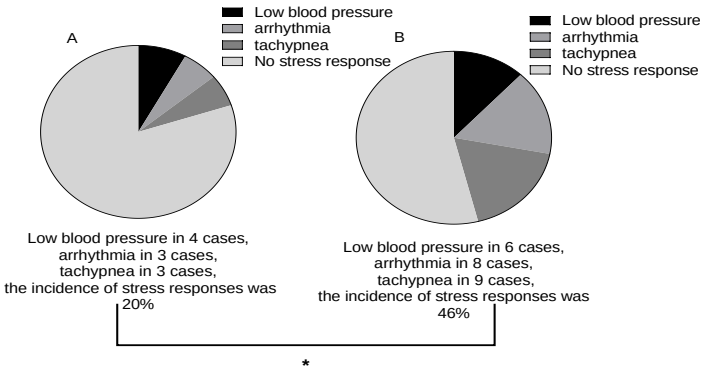
* indicated the comparison in the SDSS scores between (6.69 ± 1.03) points in the experimental group and (7.86 ± 1.25) points in the control group, with statistical significance, t = 5.11, P < 0.001.

** indicated the comparison in the VAS score between (3.37 ± 0.88) points in the experimental group and (4.69 ± 1.04) points in the control group, with statistical significance, t = 6.85, P < 0.001.

Comparison of Incidence of Stress Responses between the Two Groups

There were several stress responses such as low blood pressure, arrhythmia, tachypnea, etc. occurring in the patients in both groups, and the incidence of stress responses in the experimental group was significantly less than that in the control group, with statistical significance (P < 0.05), as shown in Figure 3.

Figure 3.
Comparison of incidence of stress responses between the two groups.



Note: Figure A represented the incidence of stress responses in the experimental group, and there were 4 patients with low blood pressure, 3 patients with arrhythmia and 3 patients with tachypnea, with the incidence of stress responses of 20 %.

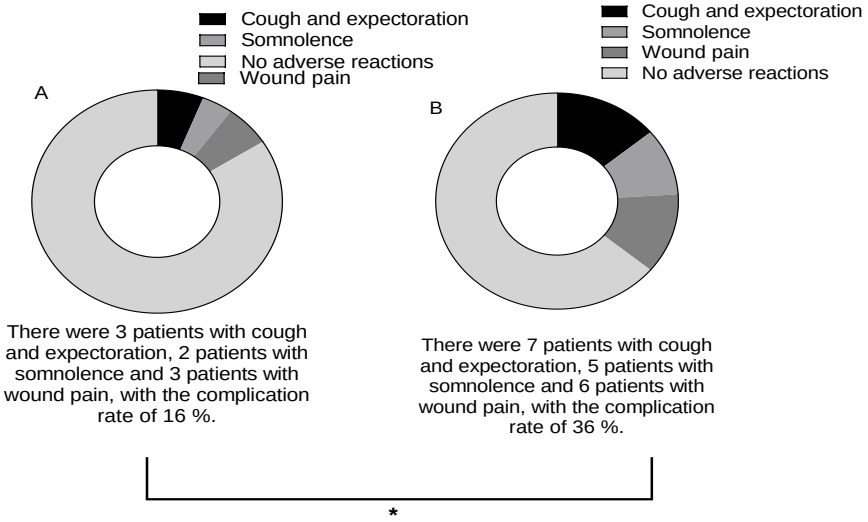
Figure B represented the incidence of stress responses in the control group, and there were 6 patients with low blood pressure, 8 patients with arrhythmia and 9 patients with tachypnea, with the incidence of stress responses of 46 %.

* indicated the comparison of the incidence of stress responses between the two groups, with statistical significance (X^2 = 7.64, P = 0.006).

Comparison of Postoperative Complication Rate between the Two Groups

The complication rate in the experimental group was significantly lower than that in the control group, with statistical significance (P < 0.05), as shown in Figure 4.

Figure 4.
Comparison of postoperative complication rate between the two groups.



Note: Figure A represented the complication rate in the experimental group, and there were 3 patients with cough and expectoration, 2 patients with somnolence and 3 patients with wound pain, with the complication rate of 16 %.

Figure B represented the complication rate in the control group, and there were 7 patients with cough and expectoration, 5 patients with somnolence and 6 patients with wound pain, with the complication rate of 36 %.

* indicated the comparison in the complication rates between the two groups, with statistical significance, X^2 = 5.20, P = 0.02.

Comparison of Expression Levels of Inflammatory Factors between the Two Groups after Surgery

The expression levels of inflammatory factors such as hs-CRP, IL-1β, IL-6, etc. in the experimental group were significantly lower than those in the control group, with statistical significance ($P < 0.05$), as shown in Table 2.

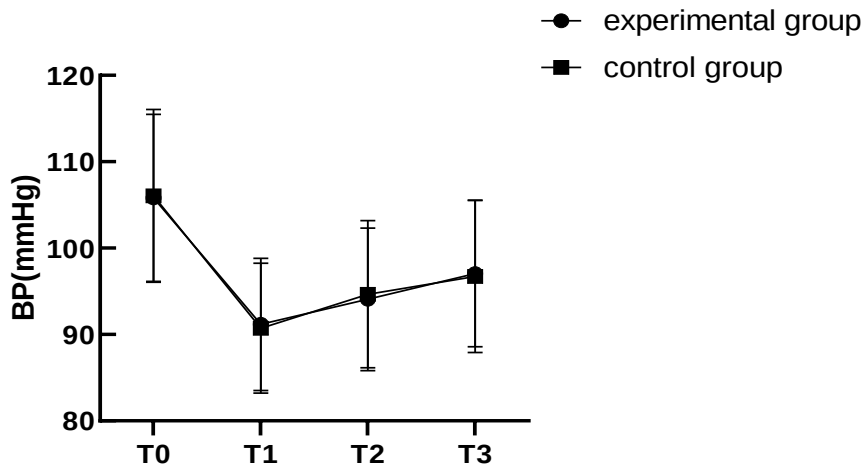
Table 2.
Comparison of expression levels of inflammatory factors between the two groups after surgery

Group	hs-CRP (μg/L)	IL-1β (ng/L)	IL-6 (ng/L)
Experimental group	1.39±0.56	4.51±1.66	2.99±0.81
Control group	3.38±1.25	7.24±1.90	5.57±1.23
t	10.27	7.65	12.39
P	<0.001	<0.001	<0.001

Comparison of Blood Pressure at T0, T1, T2 and T3 between the Two Groups

There were no significant changes of blood pressure at T0, T1, T2 and T3 between the two groups, with no statistical significance ($P > 0.05$). There was a decreasing trend of blood pressure at T1 in both groups, but it was still within the safe range, as shown in Figure 5.

Figure 5.
Comparison of blood pressure at T0, T1, T2 and T3 between the two groups.



Note: The abscissa represented T0, T1, T2 and T3, while the ordinate represented blood pressure (BP), mmHg.

There was a comparison in the blood pressure between (105.81 ± 9.67) mmHg in the experimental group and (106.04 ± 10.00) mmHg in the control group at T0, with statistical significance, $t = 0.12$, $P = 0.91$.

There was a comparison in the blood pressure between (91.17 ± 7.66) mmHg in the experimental group and (90.73 ± 7.52) mmHg in the control group at T1, with statistical significance, $t = 0.29$, $P = 0.77$.

There was a comparison in the blood pressure between (94.08 ± 8.25) mmHg in the experimental group and (94.66 ± 8.51) mmHg in the control group at T2, with statistical significance, $t = 0.35$, $P = 0.73$.

There was a comparison in the blood pressure between (97.04 ± 8.47) mmHg in the experimental group and (96.73 ± 8.82) mmHg in the control group at T3, with statistical significance, $t = 0.18$, $P = 0.86$.

DISCUSSION

Thoracoscopic radical resection of lung cancer is a minimally invasive surgical treatment often adopted in the stages I and II of lung cancer, which can promote rapid recovery after treatment and has less effect on lung function [13-15]; therefore, it has been widely used in clinical treatment. Generally, thoracoscopic radical resection of lung cancer requires anesthesia, and the most common anesthesia method is epidural anesthesia [16-18]. However, anaesthesia can easily stimulate human body and make patients suffer from some stress responses such as excessive secretion of lactate and epinephrine, reduced blood pressure, arrhythmia, etc., and meanwhile patients' nervous system, immune system, endocrine system as well as coagulation system and other mechanisms are all involved in the processes of stress responses, so the patients are prone to embolism, myocardial infarction, myocardial ischemia, coronary artery thrombosis and other complications, posing a great threat patients' physical health [19-21]. In this study, with the purpose of investigating the anesthesia modalities with less effect on stress responses and related complications in patients undergoing thoracoscopic radical resection of lung cancer, the patients who underwent thoracoscopic radical resection of lung cancer in our hospital were selected and given different anesthesia modalities, and then their anesthesia onset time, duration of analgesia, postoperative waking time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate, postoperative expression levels of inflammatory factors, as well as blood pressure at T0, T1, T2 and T3 were all compared between the two groups.

Our results showed that the anesthesia onset time, SDSS cognitive function score, VAS pain score, incidence of stress response, postoperative complication rate and postoperative expression levels of inflammatory factors in the experimental group were all significantly lower than those in the control group, with statistical significance ($P < 0.05$), indicating that dexmedetomidine combined with epidural anesthesia can significantly reduce anesthesia onset time, improve cognitive levels, relieve preoperative pain and provide good recovery environment for patients, and has less effect on nervous system. The patients in the experimental group were less likely to have stress responses, indicating that dexmedetomidine combined with epidural anaesthesia can weaken the effect of anaesthetic drugs on patients' nervous, immune, endocrine, as well as coagulation systems, thereby reducing the incidence of adverse reactions such as embolism, myocardial ischaemia and hypoxia and greatly improving the safety of surgery. Based on the fact that the levels of inflammatory factors in patients' bodies tend to rise in a short period of time after surgical treatment, the patients will be in micro-inflammatory states, which increases the risks of traumatic infection, lung infection and other diseases [22-24]. The results mentioned above showed that the experimental group patients had lower expression levels of inflammatory factors, suggesting that the patients have low incidence of developing infection, with good effect on promoting prognosis and rehabilitation.

Moreover, analgesia and postoperative waking time are important indexes for judging the efficacy of anesthesia; if analgesia time is short, patients may experience severe pain that is detrimental to recovery and negatively affects their emotions, quality of life, and so on. Our study results pointed out that the duration of analgesia and postoperative waking time in the experimental group were significantly longer than those in the control group, with statistical significance ($P < 0.05$) and there was no statistical significance in the comparison of the blood pressure at T0, T1, T2 and T3 between the two groups ($P > 0.05$), presuming that the stress responses stimulated by anesthetic drugs to the patients result in lower blood pressure, but the blood pressure is still in the safe range and has no effect on the surgical outcomes and safety. Qiu Yuwei et al [25] scholars have stated in their studies that dexmedetomidine combined with epidural blockade can effectively reduce the expression levels of inflammatory factors in the perioperative period in patients undergoing thoracoscopic radical resection of lung cancer, and has obvious therapeutic effect on relieving pain, intraoperative hypotension and postoperative nausea and vomiting, which is in line with the results concluded in our study and successfully demonstrates scientificity of this study.

In conclusion, dexmedetomidine combined with epidural anesthesia in patients undergoing thoracoscopic radical resection of lung cancer can significantly reduce postoperative complication rate, improve analgesic efficacy and relieve stress reactions in patients, with high application value, which is worthy of application and promotion in clinical treatment.

FUNDING

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REFERENCES

1. Zha Y, Gong X, Yang C, et al. Epidural analgesia during labor and its optimal initiation time-points: A real-world study on 400 Chinese nulliparas. Medicine (Baltimore) 2021; 100:e24923.
2. Benfield R, Song H, Salstrom J, Edge M, Brigham D, Newton ER. Intrauterine contraction parameters at baseline and following epidural and combined

spinal-epidural analgesia: A repeated measures comparison. Midwifery 2021; 95:102943.
3. Yan R, Jin S, Liu H, et al. Dexmedetomidine inhibits cell malignancy in osteosarcoma cells via miR-520a-3p-YOD1 interactome. Biochem Biophys Res Commun 2021; 543:56-64.
4. McFadzean WJM, Macfarlane P, Granger N, Murrell JC. Influence of peri-incisional epaxial muscle infiltration with bupivacaine pre- or post-surgery on opioid administration in dogs undergoing thoraco-lumbar hemilaminectomy. Vet J 2021; 270:105622.
5. Abowali HA, Paganini M, Enten G, Elbadawi A, Camporesi EM. Critical Review and Meta-Analysis of Postoperative Sedation after Adult Cardiac Surgery: Dexmedetomidine Versus Propofol. J Cardiothorac Vasc Anesth 2021; 35:1134-1142.
6. Deng Y, Cai L, Wang F, et al. Upregulated microRNA-381-5p strengthens the effect of dexmedetomidine preconditioning to protect against myocardial ischemia-reperfusion injury in mouse models by inhibiting CHI3L1. Int Immunopharmacol 2021; 92:107326.
7. Gursoytrak B, Kocaturk Ö, Koparal M, Gulsun B. Comparison of Dexmedetomidine and Ketamine for Managing Postoperative Symptoms After Third-Molar Surgery. J Oral Maxillofac Surg 2021; 79:532-536.
8. Seppänen SM, Kuuskoski R, Mäkelä KT, Saari TI, Uusalo P. Intranasal Dexmedetomidine Reduces Postoperative Opioid Requirement in Patients Undergoing Total Knee Arthroplasty Under General Anesthesia. J Arthroplasty 2021; 36:978-985.e1.
9. Perrin J, Ratnayake B, Wells C, et al. Epidural Versus Transabdominal Wall Catheters: A Comparative Study of Outcomes After Pancreatic Resection. J Surg Res 2021; 259:473-479.
10. Wu B, Shan J, Zhou Q, Wang L. Determination of the ED95 of a single bolus dose of dexmedetomidine for adequate sedation in obese or nonobese children and adolescents. Br J Anaesth 2021; 126:684-691.
11. Corrigendum to "Deep Tracheal Extubation Using Dexmedetomidine in Children With Congenital Heart Disease Undergoing Cardiac Catheterization: Advantages and Complications". Semin Cardiothorac Vasc Anesth 2021; 25:78.
12. Shen R, Pan D, Wang Z, Jin X, Li Z, Wang H. The Effects of Dexmedetomidine Post-Conditioning on Cardiac and Neurological Outcomes After Cardiac Arrest and Resuscitation in Swine. Shock 2021; 55:388-395.
13. Pegu J, Purang AK, Dubey S, et al. Effect of dexmedetomidine on intraocular pressure as an additive in peribulbar block during glaucoma surgery. Indian J Ophthalmol 2021; 69:612-616.
14. Rajan R, Sage M. Successful Emergency Treatment of Refractory Neuroleptic Malignant Syndrome With Electroconvulsive Therapy and a Novel Use of Dexmedetomidine: A Case Report From California in the Era of COVID-19. J ECT 2021; 37:71-73.
15. Loop T. Does thoracic epidural anaesthesia constitute over-instrumentation in video- and robotic-assisted thoracoscopic lung parenchyma resections? Curr Opin Anaesthesiol 2021; 34:199-203.
16. Uddin MM, Sebastian J, Usama M, Raziq FI, Saydain G, Rossi NF. Dexmedetomidine Induced Polyuria in the Intensive Care Unit. Case Rep Crit Care 2021; 2021:8850116.
17. Nicolás-Barceló P, Facchin M, Martínez-Taboada F, et al. Effects of Sedation with Medetomidine and Dexmedetomidine on Doppler Measurements of Ovarian Artery Blood Flow in Bitches. Animals (Basel) 2021; 11:538.
18. Park JH, Derry KL, Owens RL. Dexmedetomidine as add-on sedation to reduce continuous infusion sedative use in mechanically ventilated patients. Am J Health Syst Pharm 2021; 78:S1-S9.
19. Siow WS, Chiew WA. Anaesthesia challenges of a parturient with paramyotonia congenita and terminal filum lipoma presenting for labour and caesarean section under epidural anaesthesia - a case report. BMC Anesthesiol 2021; 21:57.
20. Simon ER, Hsu J, Nwokeabia D, Leong M, Keeyapaj W. Thoracic epidural analgesia in a lung transplant patient with an activated partial thromboplastin time falsely elevated by C-reactive protein. Can J Anaesth 2021.
21. Di Pietro S, Giannetto C, Falcone A, et al. Dexmedetomidine and Tear Production: Evaluation in Dogs as Spontaneous Model for Ocular Surface Disorders. Vet Sci 2021; 8:28.
22. Singer M, Grebenyuk E, Ackroyd S, Hart L. 868 Patient controlled epidural analgesia for post-caesarean pain management in women with opioid use disorder. Am J Obstet Gynecol 2021; 224.
23. D'Souza RS, D'Souza S, Sharpe EE. YouTube as a source of medical information about epidural analgesia for labor pain. Int J Obstet Anesth 2021; 45:133-137.
24. Nguyen LD, Nguyen AD, Farber MK, et al. Sociodemographic Factors Associated with Request for Labor Epidural Analgesia in a Tertiary Obstetric Hospital in Vietnam. Biomed Res Int 2021; 2021:8843390.
25. Qiu Y, Zhao Z, Wu J, Lu Y, Xu M. Effects of dexmedetomidine and epidural block on perioperative inflammatory factors in patients undergoing thoracoscopic lung cancer surgery under general anesthesia. Int J Anesthesiol Resusc 2020; 2020: 43-47.