International Journal of Pharmacology

ISSN 1811-7775

science alert

ansinet
Asian Network for Scientific Information

OPEN ACCESS International Journal of Pharmacology

ISSN 1811-7775
DOI: 10.3923/ijp.2024.742.747

Research Article
Evaluation of the Combined Effect of the Local Effect of Epidural Anesthesia with General Anesthesia in Thoracic Surgery

[#]JingSheng Lai, [#]ZhiHui Zhang, LeHua Xie, Xin Liang, XianZhu Liang, HongJian Zhou and QiuNing Pan

Department of Anaesthesia, Central People's Hospital of Zhanjiang, Zhanjiang 524045, Guangdong, China
[#]Authors contributed equally to this work

Abstract

Background and Objective: General anesthesia (GN) may cause thoracic surgery patients to lose consciousness and block the Central Nervous System (CNS). The present investigation was carried out to assess the combined effects of the local impact of epidural anaesthesia (EA) with GN in thoracic surgery. **Materials and Methods:** The investigation included 100 chest surgery participants. The 50 patients were randomly assigned untreated or investigational based on admission time. The investigating group got epidural and GN, whereas the untreated group received general. Both groups' routine indicators, anaesthesia conditions and surgical side effects were assessed. **Results:** Both groups had similar preoperative oxygen saturation, systolic and diastolic blood pressure, mean arterial pressure and heart rate ($p>0.05$). The experimental group showed significant reductions in intraoperative and postoperative blood oxygen saturation, systolic and diastolic blood pressure, mean arterial pressure and heart rate compared to the untreated group ($p<0.05$). A 32.6 ± 3.4 mL inhaled anaesthetic dose, 9.46 ± 3.61 min intraoperative eye-opening time and 18.13 ± 6.29 min speech function recovery time were seen in the untreated group. Significantly higher than the investigational group (14.2 ± 2.5 mL, $6.1\,3\pm2.78$ min) and 9.26 ± 4.07 min, $p<0.05$. The experimental group had significantly less postoperative side effects than the untreated group ($p<0.05$). **Conclusion:** Epidural and GN increase thoracic surgery safety and effectiveness.

Key words: General anesthesia, epidural anesthesia, chest operation, central nervous system

Citation: Lai, J., Z. Zhang, L. Xie, X. Liang, X. Liang, H. Zhou and Q. Pan, 2024. Evaluation of the combined effect of the local effect of epidural anesthesia with general anesthesia in thoracic surgery. Int. J. Pharmacol., 20: 742-747.

Corresponding Author: QiuNing Pan, Department of Anaesthesia, Central People's Hospital of Zhanjiang, No. 2 Cunjin Road, Chikan, Zhanjiang 524045, Guangdong, China

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

During thoracic surgery, the restricted operating space increases the risk of damage to the thoracic innervation muscle tissue and the intercostal nerve. This can lead to overexcitation of the patient's vagus nerve, causing significant fluctuations in hemodynamics. These disturbances disrupt the body's internal environment and reduce the patient's ability to tolerate the surgery[1,2]. To ensure the smooth implementation of thoracic surgery, GN is usually adopted in clinical practice. Patients with GN during thoracic surgery can completely lose consciousness during surgery and inhibit the central nervous function of patients[3,4]. However, due to the large area of thoracic surgery, GN cannot completely block the surgical area, which can still lead to large fluctuations in the operative center rate and BP of patients with thoracic surgery[4,5]. In addition, although the anesthetic dose is effectively controlled during the implementation of GN, due to patients' metabolic problems, the blood drug concentration is not easily controlled and the incidence of postoperative adverse reactions is high[6,7]. In recent years, some medical researchers have proposed that thoracic surgery patients should be combined with EA based on GN to improve the safety of surgical treatment[7]. In this research, an overall of 100 patients who had thoracic surgery and were admitted to Guangdong Zhanjiang Central People's Hospital between April 2023 and December 2023 were selected as participants. The study intended to examine the effectiveness of combining EA with GN in thoracic surgery patients.

MATERIALS AND METHODS

General data: Overall, 100 chest operation cases admitted to Guangdong Zhanjiang Central People's Hospital between April, 2023 and December, 2023 were chosen as the objects of the study. Based on the admission time order, randomly they were classified as untreated group and investigational group, each group contains 50 cases. In the untreated group, there were 23 males and 27 females. Patients ranged in age from 18 to 79 years, with an average age of (44.8±6.5) years. There were 25 males and 25 females in the investigational group. Patients ranged in age from 19 to 78 years, with an average age of (43.5±6.3) years.

Ethical consideration: This research has received approval from the Ethics Committee of our hospital and all enrolled patients have provided a signed written informed consent.

The Ethics Committee of Zhanjiang Central People's Hospital (No. GD2023412) approved the investigation.

Inclusion and exclusion criteria

Inclusion criteria: (1) All cases in this study required thoracic surgery and (2) All patients gave informed consent to this study.

Exclusion criteria: (1) Patients with puncture site infection or puncture site lesions were excluded, (2) Exclude patients with confirmed blood system diseases, (3) Exclude patients with lumbar disc herniation, spinal deformity and lumbar and leg pain and (4) Exclude patients with confirmed mental illness or severe neurological disorder.

Method of anesthesia: The patient was placed in a horizontal position and pushed into the operating room. With the connection of monitoring equipment, medical staff should always contemplate to the alterations of important indicators like blood oxygen saturation, systolic and diastolic blood pressure, mean arterial pressure (MAP) and heart rate (HR) of the patient and then prepare to implement GN. The control group underwent endotracheal intubation with drug induction. The specific induction drugs and dosage were as follows: 0.15 mg/kg dexmedetomidine, 2 mg/kg cisatracurium, 4 μg/kg sufentanil and 0.3 mg/kg etomidate. They were connected to anesthesia ventilator for assisted ventilation. During the respiratory control stage of the patient, an anesthesia machine was used and then the patient was given inhalation anesthesia, allowing the patient to inhale 1-2 g/L of heptafluoro and propofol with 0.01 g/L concentration was injected intravenously to maintain the state of GN until the operation was completed. When the patient's muscles showed relaxation, cisatracurium was injected intravenously. The experimental group underwent routine epidural puncture and the puncture location was selected at the interval of T6-7. After a successful puncture, the patient was injected with 4 mL of 0.2 g/L lidocaine. If the patients did not feel total spinal anesthesia 5 min after the injection and the anesthesia plane of the patients did not meet the basic needs of the patients for surgery, these patients were maintained with the same induction anesthetic as the control group. After the surgery, the patient regained the ability to breathe on his own, could breathe without a breathing device and the blood oxygen saturation reached more than 95% before the intubation of the patient could be removed.

Observational index: (1) Blood oxygen saturation, systolic and diastolic blood pressure, heart rate (HR), mean arterial pressure (MAP) and other indexes of the two groups were analyzed and compared before, during and after the operation; (2) Evaluate the basic situation of anesthesia in the 2 groups and

(3) The occurrence of postoperative side effects was compared among both groups.

Statistical analysis: The WPS2019 software of Kingsoft was applied to organize the data of each stage into an Excel table and the statistical software SPSS26.0 was imported for analysis and processing. Using the χ^2 test, the data were compared among groups. Measurement data were represented by ($\bar{\chi}\pm$sec). After the Shapiro-Wilk normality test, an independent sample t-test was employed for inter-group comparison for those meeting the normal distribution. Using the Mann-Whitney U test, compare those who did not conform to normal distribution. Comparison of intra-group count data and measurement data that did not conform to normal distribution by Wilcoxon signed rank sum test and comparison of intra-group measurement data that did conform to normal distribution by paired t-test. Measurement data comparison between groups was a bilateral test. The $p<0.05$ was regarded as statistically significant.

RESULTS

Preoperative, intra-operative and postoperative hemodynamic changes comparison among both groups: The indexes of blood oxygen saturation, systolic and diastolic blood pressure, heart rate and mean arterial pressure of the 2 groups before, during and after surgery were analyzed and there was no remarkable variation among both groups before surgery ($p>0.05$). Intra-operative and postoperative blood oxygen saturation, systolic and diastolic blood pressure, heart rate and mean arterial pressure of the investigational group were all lesser than the untreated group and the variations between them were statistically significant ($p<0.05$). Specific results were displayed in Table 1.

Comparison of the basic situation of anesthesia among both groups: In the untreated group, the dosage of inhaled anesthetic drugs was (33.5±4.2) mL, the intraoperative eye-opening time was (9.38±3.42) min and the speech function recovery time was (17.68±6.41) min. Other indexes were remarkably greater compared to those of the experimental group (16.3±2.1) mL, (6.02±2.14) min and (9.46±4.21) min and the variations were statistically significant ($p<0.05$), as shown in Table 2.

Comparison of the occurrence of postoperative side effects among both groups: An occurrence of postoperative side effects in the investigational group was remarkably lesser headache 2 (4.00%), nausea 3 (6.00%) and emesis 2 (4.00%) compared to the untreated group, with statistical significance ($p<0.05$), as shown in Table 3. The occurrence of side effects was showed 7 (14.00%) compared to the untreated group.

Table 1: Preoperative, intra-operative and postoperative hemodynamic changes comparison among both groups

Index	Hemodynamic changes	Untreated group	Investigational group	t-value	p-value
Oxyhemoglobin saturation (%)	Preoperative	94±3	94±4	2.45	>0.05
	Intraoperative	95±5	94±5	8.96	<0.05
	Postoperative	95±4	94±3	9.48	<0.05
Systolic pressure (mmHg)	Preoperative	131.2±8.7	130.8±9.2	1.87	>0.05
	Intraoperative	149.3±11.7	121.6±10.8	8.65	<0.05
	Postoperative	134.5±12.8	124.5±8.9	9.42	<0.05
Diastolic pressure (mmHg)	Preoperative	78.1±6.7	77.7±7.1	2.04	>0.05
	Intraoperative	92.4±11.8	67.3±9.2	10.43	<0.05
	Postoperative	80.3±7.8	72.3±8.5	11.26	<0.05
Mean arterial pressure (mmHg)	Preoperative	94.7±6.5	94.9±6.8	2.57	>0.05
	Intraoperative	125.6±10.4	82.9±11.7	12.14	<0.05
	Postoperative	104.2±9.5	89.5±8.7	13.62	<0.05
Heart rate (times/min)	Preoperative	71.8±6.4	71.2±5.8	3.11	>0.05
	Intraoperative	95.4±7.3	74.8±8.9	9.67	<0.05
	Postoperative	89.5±10.4	80.2±9.6	10.48	<0.05

Table 2: Comparison of the basic situation of anesthesia among both groups

Group	Cases	Dosage of inhaled anesthetic drugs (mL)	Eye-opening time (min)	Language function recovery time (min)
Untreated group	n = 50	32.6±3.4	9.46±3.61	18.13±6.29
Experimental group	n = 50	14.2±2.5	6.13±2.78	9.26±4.07
t-value		9.51	10.13	8.25
p-value		<0.05	<0.05	<0.05

Table 3: Comparison of the occurrence of postoperative side effects among both groups

Groups	Cases	Headache (%)	Nausea (%)	Emesis (%)	Occurrence of side effects (%)
Untreated group	n = 50	8 (16.00)	9 (18.00)	7 (14.00)	24 (48.00)
Investigational group	n = 50	2 (4.00	3 (6.00)	2 (4.00)	7 (14.00)
χ^2 value					6.785
p-value					<0.05

DISCUSSION

During thoracic surgery, the heart, lungs and other organs are protected by the ribs, so to successfully carry out cardiopulmonary surgery, an intercostal retractor should be used to pull the ribs and the ribs are prone to damage in the process of pulling the ribs[7,8]. In addition, the operation space of thoracic surgery is limited, the operation scope is wide and the incision nerve innervates rich muscles during the operation, which is easy to cause stress reactions in patients like elevated BP, accelerated heart rate and hemodynamic fluctuations like heart rate and blood pressure, which is very unfavourable to the smooth development of thoracic surgery[9,10]. To reduce the stress caused by sexual stimulation in patients with breast surgery operations, mainly adopt the mode of GN. The GN was also widely applied in clinical anesthesia and the anesthetic way through inhalation and intravenous drip anesthesia drug delivery will anesthetic drug into the patient's body, but the GN to dose often cannot get effective control[10,11]. Because traditional GN only blocks the projection response of the cerebral cortex, hypothalamus and limbic system, it cannot completely reduce the interference and injury caused by the operation on the body so that it does not excite the sympathetic nervous system. This often causes the patient's sympathetic nervous system to be excited, which leads to the increased release of the patient's adrenal hormones and catecholamines, which raises the heart rate and BP of the patient, which will seriously affect the operation[12-14]. To inhibit the excitation of the sympathetic nervous system, it is necessary to increase the use of anesthetic agents, which will lead to a slow recovery of postoperative consciousness and be prone to postoperative adverse reactions and complications[14].

The combined effect of GN with EA can not only block the above projective response of GN, but also block the transmission of injury stimuli to the sympathetic nervous center and decrease the excitement of the sympathetic nervous system[15,16]. The combined effect of EA with GN can significantly decrease the use of anesthetic agents, significantly reduce the appearance of cardiovascular adverse symptoms caused by systemic drug anesthesia, reduce the negative pressure of the patient's heart during the operation, maintain good muscle relaxation, reduce the oxygen consumption of the myocardium and reduce the phenomenon of excessive intra-operative bleeding induced by a sudden rise in blood pressure and maintenance[17]. After surgery, the blood oxygen saturation, systolic and diastolic blood pressure (BP), heart rate, mean arterial pressure and other important indicators can be quickly restored to normal levels, which is conducive to postoperative recovery[18-20].

This study explored the clinical efficacy of a combination of EA and GN for patients undergoing thoracic surgery. The results found that patients undergoing combination of EA and GN had no remarkable changes in blood oxygen saturation during surgery, while diastolic and systolic BP and mean arterial pressure all decreased and heart rate increased to a certain extent. However, the range of changes is not enough to threaten patients' lives and is within an acceptable range. However, the blood oxygen saturation, systolic and diastolic BP, mean arterial pressure and heart rate of patients using GN alone increased and accelerated significantly and the changes were more significant, especially when the systolic BP reached (149.3±11.7) mmHg during the operation and the heart rate reached (95.4±7.3 times/min), which was more dangerous during the operation. It is a major interference in the lives and safety of patients.

This indicates the safety and feasibility of a combination of EA with GN in thoracic surgery, which can reduce the risk. At the same time, patients using GN combined with EA used a small amount of inhaled anesthesia drugs, only (14.2±2.5 mL), thus reducing the adverse effects of drugs on the body and speeding up the intra-operative eye-opening time and speech function recovery time, which also indicated the safety and reliability of this anesthesia method and could calm the anxious mood of patients' families. Help to deal with and prevent disputes between doctors and patients. The study results are similar to those of previous scholars in their experience with the combination of EA with GN for chest surgery, which all indicate the advantages of GN combined with EA[21,22]. In addition, a combination of EA with GN can reduce the intra-operative additional dose of related drugs and reduce the incidence of postoperative adverse reactions[23,24]. Previous clinical studies have shown that the occurrence in the investigational group with EA combined

with GN is remarkably lesser compared to the untreated group with GN and the research results were compatible with the study results[11,25,26].

CONCLUSION

The combination of EA and GN for cases undergoing thoracic surgery offers clear benefits. The changes in various vital signs of patients during surgery are minimal, the duration of intra-operative anaesthesia fading is brief and the incidence of side effects is low, indicating a high level of safety and dependability.

SIGNIFICANCE STATEMENT

Patients who are undergoing thoracic surgery may have loss of consciousness and a blockage of the central nervous system as a result of general anaesthesia. This research was conducted with the intention of determining the combined effect that EA and GN have on thoracic reconstruction. In conclusion, the usage of epidural epidural anaesthesia in conjunction with general anaesthesia for patients having thoracic surgery offers a number of obvious benefits. In general, it is safe and dependable since the changes that occur in various important indicators of patients during surgery are modest, the amount of time it takes for the anaesthesia to wear off during the operation is brief and the number of adverse effects that occur is limited.

ACKNOWLEDGMENT

The authors acknowledge the facilities offered by the higher authorities.

REFERENCES

1. Xu, Z.Z., H.J. Li, M.H. Li, S.M. Huang and X. Li *et al*., 2021. Epidural anesthesia-analgesia and recurrence-free survival after lung cancer surgery: A randomized trial. Anesthesiology, 135: 419-432.
2. Yan, H., W. Chen, Y. Chen, H. Gao and Y. Fan *et al*., 2023. Opioid-free versus opioid-based anesthesia on postoperative pain after thoracoscopic surgery: The use of intravenous and epidural esketamine. Anesth. Analg., 137: 399-408.
3. Onoe, K., H. Ogata, T. Okamoto, H. Okutani and R. Ueki *et al*., 2022. Association between thoracic epidural block and major complications after pleurectomy/decortication for malignant pleural mesothelioma under general anesthesia. Reg. Anesth. Pain Med., 47: 494-499.
4. Raft, J. and P. Richebé, 2019. Anesthesia for thoracic ambulatory surgery. Curr. Opin. Anaesthesiology, 32: 735-742.
5. Hamilton, C., P. Alfille, J. Mountjoy and X. Bao, 2022. Regional anesthesia and acute perioperative pain management in thoracic surgery: A narrative review. J. Thoracic Dis., 14: 2276-2296.
6. Li, Y., H. Dong, S. Tan, Y. Qian and W. Jin, 2019. Effects of thoracic epidural anesthesia/analgesia on the stress response, pain relief, hospital stay, and treatment costs of patients with esophageal carcinoma undergoing thoracic surgery: A single-center, randomized controlled trial. Medicine, Vol. 98. 10.1097/MD.0000000000014362.
7. Zhang, W., X. Cong, L. Zhang, M. Sun and B. Li *et al*., 2020. Effects of thoracic nerve block on perioperative lung injury, immune function, and recovery after thoracic surgery. Clin. Transl. Med., Vol. 10. 10.1002/ctm2.38.
8. Medina, M., S.R. Foiles, M. Francois, C.V. Asche, J. Ren, D.K. Mueller and R.C. Anderson, 2019. Comparison of cost and outcomes in patients receiving thoracic epidural versus liposomal bupivacaine for video-assisted thoracoscopic pulmonary resection. Am. J. Surg., 217: 520-524.
9. Homma, T., Y. Shimada and K. Tanabe, 2022. Decreased postoperative complications, neuropathic pain and epidural anesthesia-free effect of uniportal video-assisted thoracoscopic anatomical lung resection: A single-center initial experience of 100 cases. J. Thorac. Dis., 14: 3154-3166.
10. Xie, H., J. Zhou, W. Du, S. Zhang, R. Huang, Q. Han and Q. Guo, 2019. Impact of thoracic paravertebral block combined with general anesthesia on postoperative cognitive function and serum adiponectin levels in elderly patients undergoing lobectomy. Videosurgery Miniinv, 14: 538-544.
11. Pi, J., Y. Sun, Z. Zhang and C. Wan, 2019. Combined anesthesia shows better curative effect and less perioperative neuroendocrine disorder than general anesthesia in early stage NSCLC patients. J. Int. Med. Res., 47: 4743-4752.
12. Szabo, Z., C. Fabo, A. Oszlanyi, F. Hawchar, T. Géczi, J. Lantos and J. Furák, 2022. Anesthetic (r)evolution from the conventional concept to the minimally invasive techniques in thoracic surgery-Narrative review. J. Thorac. Dis., 14: 3045-3060.
13. Nobukuni, K., M. Hatta, T. Nakagaki, J. Yoshino, T. Obuchi and N. Fujimura, 2021. Retrolaminar versus epidural block for postoperative analgesia after minor video-assisted thoracic surgery: A retrospective, matched, non-inferiority study. J. Thorac. Dis., 13: 2758-2767.
14. Zhang, S., X. Han, D. Zhou, M. Sun, J. Cang, C. Miao and C. Liang, 2021. The effects of erector spinae plane block on perioperative opioid consumption and rehabilitation in video assisted thoracic surgery. BMC Anesthesiol., Vol. 21. 10.1186/s12871-021-01536-x.

15. Busser, M.J., S.M. Kunju and U. Gurunathan, 2023. Perioperative pain management in thoracic surgery: A survey of practices in Australia and New Zealand. Anaesth. Intensive Care, 51: 348-358.
16. Kurihara, C., B. Tolly, A. DeWolf, A. Nader and S. Kim *et al*., 2020. Thoracoscopic lung biopsy under regional anesthesia for interstitial lung disease. Reg. Anesth. Pain Med., 45: 255-259.
17. Li, Y., S. Li, L. Jiang, Y. Liu, C. Miao and C. Liang, 2023. Effect-site concentrations of remifentanil for smooth emergence from combined epidural-general anesthesia or general anesthesia in patients using video double-lumen tube: A randomized trial. Heliyon, Vol. 9. 10.1016/j.heliyon.2023.e18897.
18. Tupper, H.I. and J.B. Velotta, 2023. Expanding clinicians' armamentarium for regional pain control after thoracic surgery. J. Thoracic Dis., 15: 2359-2362.
19. Niedmers, H., J.M. Defosse, F. Wappler, A. Lopez and M. Schieren, 2022. Current approaches to anesthetic management in thoracic surgery-An evaluation from the German Thoracic Registry. Anaesthesiologie, 71: 608-617.
20. Booka, E., Y. Nakano, K. Mihara, S. Nishiya and R. Nishiyama *et al*., 2020. The impact of epidural catheter insertion level on pain control after esophagectomy for esophageal cancer. Esophagus, 17: 175-182.
21. Tsuboi, E., Y. Azuma, T. Makino, T. Terada and H. Otsuka *et al*., 2020. Mediastinal tumor resection in a patient with spinocerebellar degeneration. J. Cardiothorac. Surg., Vol. 15. 10.1186/s13019-020-01218-8.
22. Aydin, G., A.T. Sahin, I. Gencay, Z.N. Akcabay and N. Gunal *et al*., 2020. Which is more effective for minimally invasive pectus repair: Epidural or paravertebral block? J. Laparoendoscopic Adv. Surg. Tech., 30: 81-86.
23. Tarradas, J.M.G., G.P. Fontrodona, M. López-Baamonde, D. Sánchez, M.J. Jiménez and R. Navarro-Ripoll, 2020. Perioperative anesthetic management of patients with malignant pleural mesothelioma undergoing cytoreductive surgery and intraoperative chemotherapy. Rev. Esp. Anestesiología Reanimación, 67: 15-19.
24. Kuroiwa, K.K., Y. Shiko, Y. Kawasaki, Y. Aoki and M. Nishizawa *et al*., 2021. Phrenic nerve block at the azygos vein level versus sham block for ipsilateral shoulder pain after video-assisted thoracoscopic surgery: A randomized controlled trial. Anesth. Analg., 132: 1594-1602.
25. Khajavi, M.R., M.A. Asadian, F. Imani, F. Etezadi, R.S. Moharari and A. Amirjamshidi, 2013. General anesthesia versus combined epidural/general anesthesia for elective lumbar spine disc surgery: A randomized clinical trial comparing the impact of the two methods upon the outcome variables. Surg. Neurol. Int., Vol. 4. 10.4103/2152-7806.116683.
26. Pei, J.P., C.D. Zhang, Y. Liang, C. Zhang, K.Z. Wu, Z.M. Zhao and D.Q. Dai, 2020. Effects of epidural combined with general anesthesia versus general anesthesia alone in gastric cancer surgery: A propensity score matching analysis. Ann. Transl. Med., 8: 473-473.