Int J Clin Exp Med 2020;13(6):4105-4112
www.ijcem.com /ISSN:1940-5901/IJCEM0109407

Original Article

The application of ultrasound-guided nerve block combined with general anesthesia in lower limb fracture surgery and its effect on patients' quality of recovery from anesthesia

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Received February 17, 2020; Accepted March 18, 2020; Epub June 15, 2020; Published June 30, 2020

Abstract: Objective: To observe the efficacy of ultrasound-guided nerve block combined with general anesthesia in lower limb fracture surgery and to explore its effect on patients' quality of recovery from anesthesia. Methods: Seventy-four patients with lower limb fracture who received lower limb fracture surgery were divided into two groups: the control group (which received an application of general anesthesia) and the research group (which received an application of ultrasound-guided nerve block combined with general anesthesia). Results: No significant differences were found in the patients' heart rates (HR) at T1-T5 or in their oxygen saturation (SpO_2) levels at T1 and T2 in the two groups (both P>0.05). The SpO_2 levels at T3-T5 in the research group were lower than they were in the control group (T3 and T4: P<0.01; T5: P<0.05). The patients in the research group showed less agitation (P<0.01), higher Steward recovery scores (P<0.05), a shorter mean operation time and length of stay (both P<0.05), smaller intraoperative blood loss (P<0.05), lower treatment costs (P<0.05), lower coagulation function-related indicator levels at 1 h during the operation and at the time of removing the laryngeal mask (P<0.05), and lower visual analogue pain scale scores (P<0.01) compared with the control group. Conclusion: Ultrasound-guided nerve block combined with general anesthesia in lower limb fracture surgery can significantly reduce intraoperative hemodynamic fluctuation, agitation, and patients' visual analogue pain scale scores, and improve the quality of recovery from anesthesia.

Keywords: Lower limb fracture, nerve block, ultrasound guidance, general anesthesia, coagulation function, quality of recovery from anesthesia

Introduction

The number of patients who suffer from lower limb fracture is increasing. Lower limb fracture seriously affects patients' minds and bodies. The goal of nerve block is to accurately locate the nerve to ensure the adequate diffusion of anesthetics in the predetermined region. Ultrasound guidance can distinctly increase the accuracy of nerve block in lower limb fracture surgery, improving the anesthetic effect. Lower limb fracture surgery can be carried out on the basis of spinal anesthesia, epidural anesthesia, or nerve block anesthesia. However, single nerve block easily leads to an incomplete block, impeding a smooth operation. Moreover, spinal anesthesia and epidural anesthesia have strict requirements for patients' body position. It is difficult to maintain patients with lower limb fracture in an accurate position due to local pain. The hyperostosis in many elderly patients tends to increase the difficulty of the puncture, increasing the surgical risk and the probability of complications [1]. Therefore, it is vital to choose the right anesthesia method and take some auxiliary measures. In this study, we applied ultrasound-guided nerve block combined with general anesthesia in lower limb fracture surgery and analyzed its effect on patients' quality of recovery from anesthesia to provide a scientific basis for the clinical treatment of patients with lower limb fracture. In this study, 74 patients with lower limb fracture admitted to The First Affiliated Hospital of

Anhui Medical University from March 2018 to September 2019 were selected as the study cohort and received routine general anesthesia with or without ultrasound-guided nerve block.

Materials and methods

General data

Seventy-four patients with lower limb fracture who were admitted to The First Affiliated Hospital of Anhui Medical University from March 2018 to September 2018 were selected. All the patients received lower limb fracture surgery in The First Affiliated Hospital of Anhui Medical University and were randomly divided into two groups.

Inclusion criteria: All the patients met the clinical diagnostic criteria for lower limb fracture through an imagological examination; anesthesia risk scoring before the surgery showed that the patients were at levels II-III [2]; patients who did not have a history of limb surgery; patients who were well-informed the study and signed the informed consent form. Exclusion criteria: Patients with a bleeding tendency; patients with coagulation insufficiency or disorder; patients with tumors; patients with severe organ insufficiency and dysfunction; patients with infections.

There were 37 patients in the control group, including 20 males and 17 females, aged 25-57 with an average age of 51.9±1.5, among whom there were 17 patients with ankle fractures, 15 patients with tibiofibula fractures, and 5 patients with patellar fractures. There were 37 patients in the research group, including 21 males and 16 females, aged 24-57 with an average age of 51.5±1.3, among whom there were 18 patients with ankle fractures, 15 patients with tibiofibula fractures, and 4 patients with patellar fractures. There were no differences in the general data in the two groups ($P>0.05$). This study obtained approval from the Ethics Committee of The First Affiliated Hospital of Anhui Medical University.

Methods

The patients in the control group received general anesthesia. Their vital signs were closely monitored after they entered the operating room. Then anesthesia induction was performed using a slow injection of 0.15 mg/kg cisatracurium (Jiangsu Hengrui Pharmaceutical Co. Ltd., China), 3 μg/kg fentanyl (Jiangsu Nhwa Pharmaceutical Co. Ltd., China), 1 mg/kg-1.5 mg/kg propofol (Sichuan Shule Pharmaceutical Co. Ltd., China), 0.05 mg/kg midazolam (Jiangsu Jiuxu Pharmaceutical Co. Ltd., China) and 0.5 mg penehyclidine hydrochloride (Chengdu List Pharmaceutical Co. Ltd., China). The patients inhaled oxygen through face masks. After the patients lost consciousness and maintained good muscle relaxation, the laryngeal mask was inserted and connected to the anesthesia machine to control their breathing.

The patients in the research group received general anesthesia combined with an ultrasound-guided nerve block. The dose and methods of medication for anesthesia induction in the research group were the same as those in the control group. The patients inhaled oxygen through face masks. After the patients lost consciousness and maintained good muscle relaxation, a laryngeal mask was inserted and connected to the anesthesia machine to control their breathing. Then the patients' sciatic and femoral nerves were blocked using ultrasound guidance. Specific methods: The location about 2 cm outside the femoral artery and about 2 cm from the coterminous site of the anterior superior spine and the pubic tubercle was selected as the puncture point, and then 15 mL ropivacaine hydrochloride (0.375%) (Hebei Yipin Pharmaceutical Co. Ltd., China) was slowly injected. The specific methods for blocking the sciatic nerve: The patients were placed in a lateral position; the puncturing was performed at the highest point of the greater trochanter of the femur and the midline of the line connecting the sacral hiatus; the puncture site was viewed directly using ultrasound guidance, and then 15 mL ropivacaine hydrochloride (Hebei Yipin Pharmaceutical Co. Ltd., China) was slowly injected. During surgery, 0.05 μg/kg/h remifentanil (Yichang Humanwell Pharmaceutical Co. Ltd., China) and 1-8 mg propofol (Jiangsu Nhwa Pharmaceutical Co. Ltd., China) were continuously pumped. At the same time, the patients were given intermittent intravenous injections of 5 mg cisatracurium to administer anesthesia. At 5 min before the end of the surgery, the drugs were stopped. The laryngeal mask was removed after the patient regained consciousness and spontaneously began breathing. If the patient's blood pressure was elevated or lowered more than 20% of the base value during surgery, fluid infusion was performed, and ephedrine (Guiyang Xinglintang Pharmaceutical Co. Ltd., China) or nitroglycerin (Shandong Xinyi Pharmaceutical Co. Ltd., China) was used for the symptomatic intervention. If the heart rate was less than 50 beats/min, the patient was given atropine (Jiaozuo Furuitang Pharmaceutical Co. Ltd., China).

Outcome measurements

The related hemodynamic parameters at the different time points, including oxygen saturation (SpO_2) and heart rate (HR), were compared between the two groups. T1: Before anesthesia induction; T2: after anesthesia induction; T3: at the time of inserting the laryngeal mask; T4: 30 min after inserting the laryngeal mask; T5: 1 h after inserting the laryngeal mask [3]. The hemodynamic parameters were recorded with an electrocardiogram monitor.

The quality of the recovery from anesthesia in the two groups was compared and evaluated by the degree of agitation after the recovery from anesthesia and was classified into one of five grades. Grade 5: The enforcement measures were performed on the patient; grade 4: the patient was intensely agitated and difficult to comfort; grade 3: the patient was crying and agitated; grade 2: the patient was quiet and conscious; grade 1: the patient was asleep [4]. The recovery situations in the two groups were compared using the Steward Recovery Rating Scale, which includes three main items: activity, breathing, and consciousness. Each item is scored from 0-3, and the highest possible score is 9. The higher the score, the better the recovery.

The related surgical and therapeutic parameters including the length of the operation, the intraoperative blood loss, the length of stay, and the treatment costs were compared between the two groups.

The coagulation function-related indicators, including the activated partial thromboplastin time, the prothrombin time, and the thrombin time were compared in the two groups. 5 mL venous blood was drawn after the patients entered the operating room, at 1 h during surgery, and at the time of removing the laryngeal mask, respectively. Then blood was tested using a biochemistry analyzer [5].

The pain situations were compared in the two groups. The pain situation was assessed using a visual analogue pain scale before and after the treatment. The score range was 0-10. The higher the score, the more severe the pain [6].

Statistical analysis

All the data in this study were analyzed using SPSS 22.0 statistical software. The enumeration data that conformed to a normal distribution were shown as %; the measurement data were expressed as $\bar{x} \pm$ sd. The comparisons between groups were carried out using χ^2 and T tests. $P<0.05$ indicated a statistically significant difference.

Results

Comparison of the hemodynamics at different time points

No significant differences were observed in the HR at T1-T5 or in the SpO_2 levels at T1 and T2 in the two groups (both $P>0.05$). The SpO_2 levels at T3-T5 in the research group were lower than they were in the control group (T3 and T4: $P<0.01$; T5: $P<0.05$, **Table 1** and **Figure 1**).

Comparisons of the agitation degrees and the Steward recovery scores

The degree of agitation in the research group was lower than it was in the control group ($P<0.01$), but the Steward recovery scores were higher in the research group than they were in the control group ($P<0.05$, **Table 2** and **Figure 2**).

Comparisons of the relevant surgical and therapeutic parameters

The patients in the research group had shorter mean operation times and lengths of stay, smaller intraoperative blood losses, and lower treatment costs, compared with the control group (all $P<0.05$, **Table 3** and **Figure 3**).

Comparison of the coagulation function indicators

The relevant coagulation function indicator levels at 1 h during surgery and at the time of

Table 1. Comparison of hemodynamics at different time points ($\bar{x}$ ± sd)

	Group	T1	T2	T3	T4	T5
SpO_2 (%)	Control	98.22±1.31	69.35±9.42	85.53±10.33	84.24±10.73	84.22±10.12
	Research	97.83±1.80	70.32±8.51	76.72±10.65	77.92±9.84	75.23±8.75
T	/	1.231	1.006	12.679	12.567	12.904
P	/	0.068	0.058	0.0012	0.0014	0.016
HR (beats/min)	Control	76.31±9.02	98.23±1.14	98.92±1.61	98.02±1.52	97.95±1.41
	Research	77.73±9.61	98.63±1.32	98.61±1.42	98.14±1.85	98.93±1.42
T	/	1.458	1.333	1.400	1.389	1.238
P	/	0.678	0.112	0.234	0.126	0.128

Note: T1: Before anesthesia induction; T2: after anesthesia induction; T3: at the time of inserting the laryngeal mask; T4: 30 min after inserting the laryngeal mask; T5: 1 h after inserting the laryngeal mask; HR: heart rate; SpO_2: oxygen saturation.

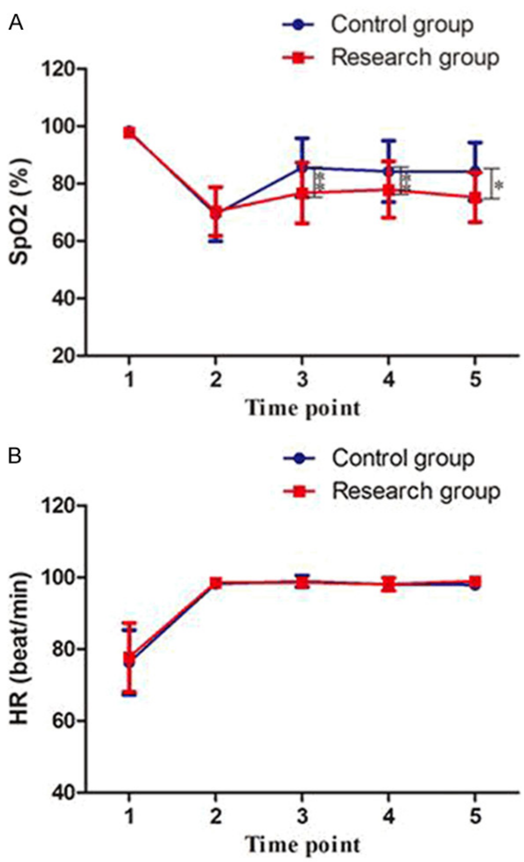

Figure 1. The SpO_2 levels and HR at different time points. A: SpO_2; B: HR (beats/min). Compared with the control group, $^{*}P<0.05$, $^{**}P<0.01$. Time points: T1: Before anesthesia induction; T2: after anesthesia induction; T3: at the time of inserting the laryngeal mask; T4: 30 min after inserting the laryngeal mask; T5: 1 h after inserting the laryngeal mask; HR: heart rate; SpO_2: oxygen saturation.

removing the laryngeal mask were lower in the research group than they were in the control group (P<0.05, **Table 4**).

Comparison of the visual analogue pain scale scores

The visual analogue pain scale scores in the research group were lower than they were in the control group after the treatment (P<0.01, **Table 5** and **Figure 4**).

Discussion

Lower limb fracture mainly occurs in young adults in the clinic. Long-term bedrest due to fracture significantly increases the risk of lower limb venous thrombosis and urinary tract infections [7, 8]. Therefore, it is very important to choose the right anesthesia method [9, 10]. With the development of anesthesiology, nerve block has been widely used in clinical practice, with the advantages of few surgical contraindications and postoperative complications and no large effect on the patients' respiratory and circulatory systems [11, 12].

Nerve block has little effect on patients' systems and few contraindications and has been widely used in the clinical treatment of lower limb fractures recently [13, 14]. The lower limbs are mainly innervated by the femoral and sciatic nerves, and nerve block anesthesia can anesthetize most parts of the lower limbs [15, 16]. Relevant studies have indicated that nerve localization is the key to ensuring the efficacy of nerve block, and accurate catheter placement into the nerve area significantly reduces damage to the peripheral blood vessels, nerves and tissues and achieves a good anesthetic effect [17].

Conventional nerve block is blinded, is highly difficult to localize, and is unable to confirm the

Table 2. Comparisons of the agitation degree and the Steward recovery scores (n)

Group	n	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Steward recovery scores
Control	37	3	9	14	6	5	4.32±0.52
Research	37	14	10	10	2	1	5.52±0.61
T/χ^2	/			12.504			15.803
P	/			0.006			0.019

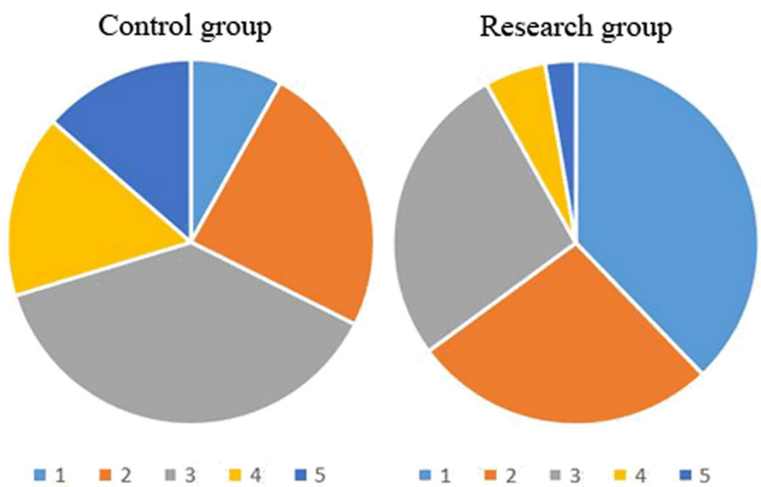

Figure 2. Comparison of the agitation degree after recovery from anesthesia. 1: Grade 1; 2: Grade 2; 3: Grade 3; 4: Grade 4; 5: Grade 5.

Table 3. Relevant surgical and therapeutic parameters in the two groups ($\overline{x}$ ± sd)

Group	Operation time (h)	Intraoperative blood loss (mL)	Length of stay (days)	Treatment cost (yuan)
Control	1.23±0.41	85.42±9.51	9.53±1.52	9545.94±108.93
Research	0.43±0.11	61.71±7.53	5.52±1.22	6254.72±169.34
T	12.468	16.798	13.369	22.645
P	0.012	0.043	0.015	0.049

adequate anesthetizing level and diffusion of the drugs. Moreover, it can cause damage to the surrounding tissues, nerves, and blood vessels. General anesthesia can affect the central nervous system of the cerebral cortex, affecting the quality of recovery from anesthesia [18, 19]. However, nerve block only impacts the nerve plexus and will not trigger a surgical stress response, and patients recover quickly after surgery [20]. In this study, the patients in the research group had a lower degree of agitation and higher Steward recovery scores compared with the control group. This suggests that general anesthesia combined with ultrasound-guided nerve block in patients with lower limb fracture surgery can effectively reduce the dosage of anesthetics, improve the quality of recovery, lower the degree of agitation, and allow the laryngeal mask to be removed early, which is similar to the findings of other researchers.

During the process of lower limb fracture surgery in fracture patients, the combination of ultrasound-guided nerve block and general anesthesia can further ensure that the coagulation function indicators and hemodynamic parameters do not fluctuate greatly, reducing the risk and ratio of agitation after recovery, and decreasing postoperative pain [21]. In this study, the visual analogue pain scale scores in the research group were lower than those in the control group, suggesting that general anesthesia combined with ultrasound-guided nerve block in patients with lower limb fracture surgery can effectively relieve pain and improve the degree of comfort.

General anesthesia combined with ultrasound-guided nerve block in patients with lower limb fracture surgery can effectively lessen the dosage of analgesics, reduce postoperative agitation, and maintain the stability of the hemodynamic and coagulation function indicators. In this study, no significant differences were found in the HR at T1-T5 or in the SpO_2 levels at T1 and T2 in the two groups. The SpO_2 levels at T3-T5 in the research group were lower than those in the control group; the relevant coagulation function indicators levels at 1 h during surgery and at the time of removing the laryngeal mask were lower in the research group than in the control group. The results indicated that general anesthesia combined with ultrasound-guided nerve block in

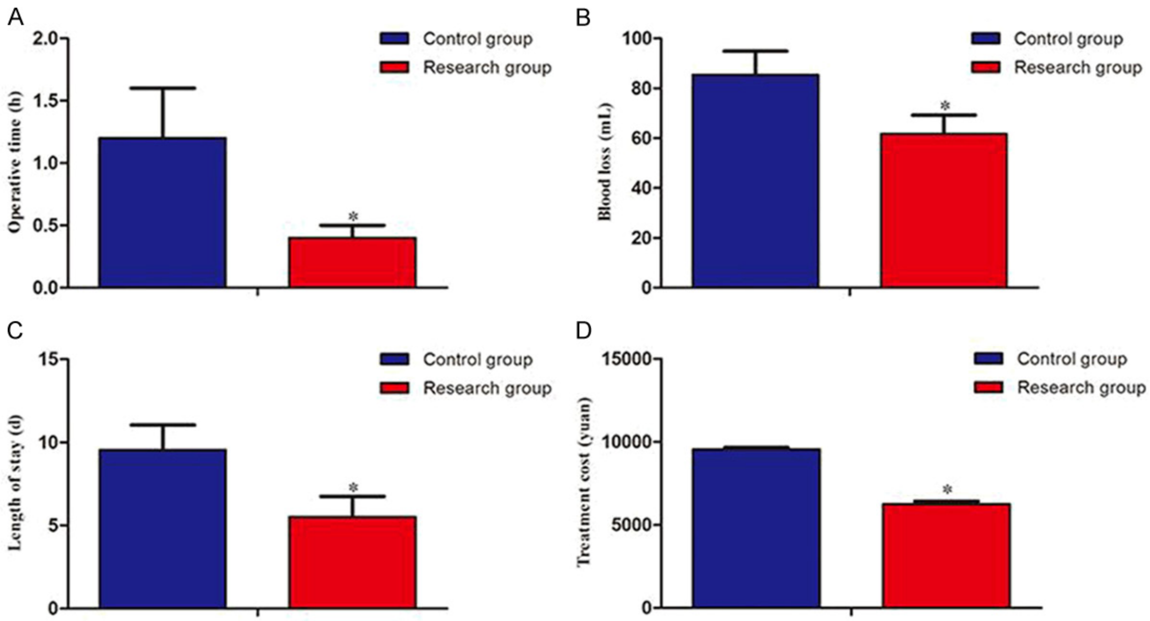

Figure 3. Comparison of the operation times, intraoperative blood losses, lengths of stay and treatment costs. A. Comparison of the operation time. The mean operation time was shorter in the research group than in the control group (P=0.012); B. Comparison of the intraoperative blood loss. The intraoperative blood loss was smaller in the research group than in the control group (P=0.043); C. Comparison of the length of stay. The length of stay was shorter in the research group than in the control group (P=0.015); D. Comparison of the treatment cost. The treatment cost was lower in the research group than in the control group (P=0.049). Compared with the control group, *P<0.05.

Table 4. Comparison of the coagulation function indicators ($\overline{x}$ ± sd)

	Group	After entering the operating room	1 h during surgery	At the time of removing laryngeal mask
PT (s)	Control	10.43±0.20	11.44±0.63	12.74±0.85
	Research	10.32±0.34	9.84±0.91	10.33±0.70
T	/	1.144	12.613	13.005
P	/	2.890	0.014	0.017
APTT (s)	Control	21.62±1.41	22.62±1.51	24.84±1.61
	Research	21.63±1.51	20.53±1.72	20.62±1.74
T	/	1.460	12.335	14.673
P	/	0.245	0.011	0.020
TT (s)	Control	13.81±0.83	14.33±0.84	15.74±0.95
	Research	13.71±0.62	12.03±0.92	13.12±1.04
T	/	1.555	12.407	12.836
P	/	0.081	0.009	0.011

Note: PT: prothrombin time; APTT: activated partial thromboplastin time; TT: thrombin time.

patients with lower limb fracture surgery can effectively maintain the stability of the hemodynamic and coagulation function indicators. Steward recovery scoring is a commonly used clinical method to evaluate the quality of recovery from anesthesia. Steward recovery scoring shows a fast recovery turnover and a high efficiency, and it is clinically conducive to implement timely treatment for patients according to the Steward scores [22].

In this study, we found that general anesthesia combined with ultrasound-guided nerve block in patients with lower limb fracture surgery can effectively improve the hemodynamic and coagulation function indicators, improve the quality of recovery from anesthesia, and reduce postoperative pain, which is similar to the findings of other researchers. Our findings provide a scientific basis and reference value for the clinical treatment of lower limb fracture as well as some reference for other clinical researchers. However, there were some shortcomings in this study. The small sample

Table 5. Comparison of the visual analogue pain scale scores (points, $\overline{x}$ ± sd)

Group	Before treatment	After treatment
Control	5.35±1.20	3.83±0.95
Research	5.44±0.11	2.74±0.94
T	1.342	12.398
P	0.067	0.008

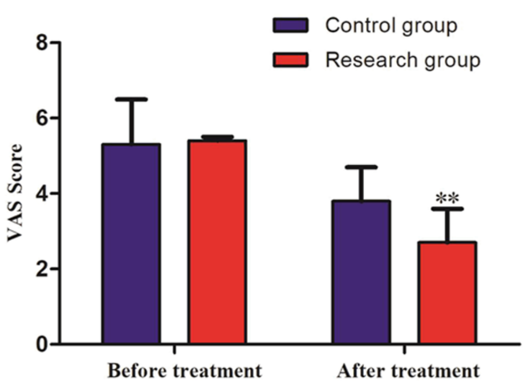

Figure 4. Comparison of the visual analogue pain scale scores before and after the treatment. Compared with the control group, **P<0.01. VAS: visual analogue pain scale.

size might obtain limited and inaccurate results; the selected outcome measurements were few and not comprehensive enough. In the future, more in-depth, multi-center and large-sample clinical studies will be conducted to confirm and demonstrate the results of this study.

Outlook: Through this study, the combination of ultrasound-guided nerve block and general anesthesia is expected to become the best clinical method for the treatment of patients with lower limb fracture, and the combination is expected to be applied more and more widely in the future.

In summary, ultrasound-guided nerve block combined with general anesthesia in patients with lower limb fracture surgery can significantly reduce the fluctuation of intraoperative relevant hemodynamic parameters, lower the degree of agitation and the visual analogue pain scale scores, and improve the quality of recovery from anesthesia.

Disclosure of conflict of interest

None.

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References

[1] Hou P, Bao H, Li J and Si Y. Effect of ultrasound-guided thoracic paravertebral nerve block on the quality of recovery and postoperative analgesia in patients undergoing thoracoscopic surgery. J Clin Anesthesiol 2019; 67: 421-424.

[2] Hou R, Wang H, Chen L, Qiu Y and Li S. Effect of nerve block combined with general anesthesia at different anesthesia depths on postoperative cognitive function of elderly patients undergoing knee replacement surgery. Shanghai Med J 2018; 33: 289-292.

[3] Hu S, Wang S, Xu S, Chen T and Ju X. Effect of ultrasound-guided thoracic nerve block on postoperative recovery in patients undergoing endoscope-assisted breast cancer surgery. Guangdong Med J 2018; 39: 80-82, 87.

[4] Kikuchi S, Miyake K, Okuda H, Uchida D, Koya A and Azuma N. FT14. The usefulness of ultrasound-guided lower extremity nerve blockage (UGNB) in infrapopliteal artery bypass grafting for frail patients with critical limb ischemia. J Vasc Surg 2017; 65: 20S-21S.

[5] Huang C, Lian C, Xia Y, Nan Y, Li T and Li J. Effect of dexmedetomidine on postoperative outcomes in pediatric patients undergoing open reduction and internal fixation following upper limb fracture performed under sevoflurane anesthesia combined with brachial plexus block. Chin J Anesthesiol 2018; 33: 70-73.

[6] Zhou X, Luo Y and Sun J. Modifiying efficacy of pectoral nerve block combined with general anesthesia in patients undergoing radical mastectomy. Chin J Anesthesiol 2018; 38: 978-980.

[7] Zhang L, Li C, Chen M, Duan S, Lin X, Zhang H and Huang Z. Application of dexmedetomidine combined with ropivacaine in lumbosacral plexus nerve block in elderly patients with lower limb fracture surgery. Guangdong Med J 2018; 39: 112-116.

[8] Ma H, Wang Y, Zhao Q and Chen H. Study on deposits containing rich fluorine, boron, and ammonium on the heating surface of a flue gas cooler in a 300 MW coal-fired boiler. Energy Fuels 2017; 31: 4742-4747.

[9] Xie Z and Yao J. Comparison of anesthetic effects of two ultrasound-guided approaches for sciatic nerve block in patients with ankle fracture. Shanghai Med J 2018; 41: 31-34.

[10] Wang C, Cao Y and Wang A. Feasibility of skin temperature in evaluating the efficacy of ultra-

sound-guided brachial plexus block in children. Shanghai Med J 2018; 41: 26-29.

[11] Yin H, Yi M, Zhao C, Luo L, Chen L and Wang J. Application of ultrasound-guided bilateral quadratus lumborum block combined with general anesthesia in total laparoscopic hysterectomy. Chongqing Med 2018; 47: 60-63.

[12] Guan Q, Tang H, Wei S, Hu Y and Yin Z. Insight into Influence of Glycerol on Preparing α-CaSO4•1/2H2O from flue gas desulfurization gypsum in glycerol-water solutions with succinic acid and NaCl. Ind Eng Chem Res 2017; 56: 9831-9838.

[13] Wu P and Jiang Q. Effect of ultrasound-guided femoral nerve block combined with general anesthesia on postoperative analgesia in patients with high ligation and continuous stripping of great saphenous vein. Chongqing Med 2017; 46: 4408-4410.

[14] Liu T, Hua L and Wan L. Comparison of ultrasound-guided erector spinae plane block and retrolaminal block combined with general anesthesia for patients undergoing vertebral surgery. J Clin Anesthesiol 2019; 35: 83-87.

[15] Zhu W, Zhou R, Wang Q, Bao N and Xu X. Effect of ultrasound-guided mid-humeral block on motor function of upper extremities of patients undergoing day-case surgery in a department of hand surgery. Chin J Anesthesiol 2017; 37: 267-270.

[16] Lee SY, Lee SG, Kang Y, Chun YM, Kim CY and Kong ID. Investigation of the lower extremity static postures predicting valgus collapse during drop landing in Korean male and female - logical analysis of data (lad) approach. Brit J Sport Med 2017; 51: 348.343-349.

[17] Yao H and Huang H. Clinical observation of ultrasound-guided posterior spinal nerve block combined with general anesthesia for posterior approach lumbar fusion internal fixation. Guangdong Med J 2018; 39: 84-87.

[18] Liu J, Pan C, Zhou H and Yin P. Efficacy of ultrasound-guided great auricular nerve block with different concentrations of ropivacaine for postoperative analgesia in patients undergoing tympanic and mastoid surgery. Chin J Anesthesiol 2017; 37: 1124-1126.

[19] Kong X, Li H, Song C, Wang K and Li C. Role of ultrasound-guided adductor tube block in multi-mode combined analgesia after total knee replacement. Shandong Med J 2017; 44: 64-67.

[20] Ganderup T, Jensen C, Holsgaard-Larsen A and Thorlund JB. Recovery of lower extremity muscle strength and functional performance in middle-aged patients undergoing arthroscopic partial meniscectomy. Knee Surg Sports Traumatol Arthrosc 2017; 25: 347-354.

[21] Bi L, Yuan Z, Liu J, Meng G, Li Y and Gao J. Anti-infective reconstituted bone xenograft combined with external fixator for treatment of posttraumatic long bone infection in lower extremities. Chin J Trauma 2017; 33: 153-158.

[22] Kong X, Zhu Y, Yang T, Gao X, Ma J, Zhu A, Xu X, Wang J and Zheng X. Buttress plate fixation alone or combined with hollow screws for treatment of posterior tibial pilon fractures. Chin J Trauma 2017; 33: 164-170.