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Safety and Effectiveness of Nerve Block Anesthesia and Low Specific Gravity Anesthesia in Unilateral Lower Extremity Trauma Surgery for Elderly Patients

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ABSTRACT

Objective: To compare the safety and effectiveness of nerve block anesthesia and low specific gravity anesthesia in the unilateral lower extremity trauma surgery for elderly patients.

Methods: A total of 60 elderly patients undergoing unilateral lower extremity trauma surgery in our hospital from January 2018 to December 2019 were selected and divided into observation group (n=30) and control group (n=30) using a random number table. Control group received low specific gravity ropivacaine lumbar anesthesia, while observation group received combined lumbar plexus and sciatic nerve block. Then the anesthetic effect, onset time and duration of block, vital signs, incidence rate of intraoperative adverse reactions, recovery time of postoperative urination and lower extremity movement, and postoperative pain score were compared.

Results: The excellent-good rate of anesthesia was 93.33% in observation group and 96.67% in control group, showing no statistically significant difference (P>0.05). There were no statistically significant differences in the onset time and duration of block between the two groups (P>0.05). After anesthetic injection, the systolic blood pressure, diastolic blood pressure and heart rate declined in the two groups compared with those before injection (P<0.05), while they were higher in observation group than those in control group (P<0.05). The incidence rates of chills, nausea and vomiting, and headache during operation had no statistically significant differences between the two groups (P>0.05), while the incidence rates of hypotension and bradycardia during operation were lower in observation group than those in control group (P<0.05). The recovery time of postoperative urination and lower extremity movement was shorter in observation group than that in control group (P<0.05). No statistically significant difference was observed in the pain score between the two groups at 12-48 h after operation (P>0.05).

Conclusion: Both low specific gravity lumbar anesthesia and combined lumbar plexus and sciatic nerve block have a good anesthetic effect in the unilateral lower extremity trauma surgery for elderly patients. However, combined lumbar plexus and sciatic nerve block has higher anesthetic safety than low specific gravity lumbar anesthesia, which can reduce the incidence of intraoperative hypotension and bradycardia, and accelerate the recovery of postoperative urination and lower extremity movement.

KEYWORDS: elderly; lower extremity trauma surgery; anesthesia; low specific gravity; nerve block

INTRODUCTION

Lower extremity trauma is a common traumatic disease in clinic, and such a disease is mostly treated with surgery. Some patients with lower extremity trauma are older with decline in organ function and tolerance to anesthetics, leading to an increased risk in anesthesia. Therefore, the choice of anesthesia method is an important problem to be solved in the anesthesia management of lower extremity trauma surgery for elderly patients [1-3]. To explore this issue, a total of 60 elderly patients undergoing unilateral lower extremity trauma

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surgery were selected for a randomized controlled study in this paper. They were given nerve block and low specific gravity lumbar anesthesia, respectively, aiming to explore the safety and effectiveness of the two anesthesia methods in the unilateral lower extremity trauma surgery for elderly patients.

MATERIALS AND METHODS

Baseline clinical data

From January 2018 through December, 60 elderly people were selected and divided into observation groups (n=30) and control groups, using the randomised numerical table, undergoing unilateral lower extremity trauma surgery in the hospital. 16 men and 14 women were aged 60-79, with a median age of (69.73 ± 5.42) years in the control group. There were 10 Class I and 20 Class II cases with respect to the ASA rating. In the observation group, the average age (69.98 ± 5.39) years was 18 males and 12 females between 60 and 80 years. With regard to the ASA classification, the age , gender and ASA classes were comparable between the two groups (P>0,05). Class I and Class 21 are 9 cases in Classe II. Approved by the Committee on Medical Ethics, the study was notified and consent was signed before an operation.

Inclusion criteria: (1) Patients aged ≥60 years old, (2) those in ASA class I-II, (3) those undergoing lower extremity surgery due to unilateral lower extremity trauma, and (4) those with clear consciousness.

Exclusion criteria: (1) Patients with contraindications for lumbar anesthesia, (2) those complicated with neurological abnormality in both lower extremities, (3) those with mental disorders or disturbance of consciousness, (4) those complicated with severe infection, or (5) those who quit the study halfway.

Methods

Low specific gravity of ropivacaine lumbar anaesthesia has been performed in the control group. The patient was placed in the lateral position with the affected extremity upward. The pinch needle was inserted in the arachnoid from the intervertebral space between L3 and L4 and the needle core was removed. Anesthetics were injected if the cerebrospinal fluid could be removed without abnormalities. 11.25 mg of 0.75 per cent ropivacaine and 2 mL of sterile water for injection were prepared in a low-specific gravity mixture. Then 1.4 mL of low-specific gravity mixture was injected into the subarachnoid area at 0.1 mL / s. The puncture needle was finally removed, the anaesthesia plane was adjusted to the level below T10 and the patient remained on the side for 10 minutes.

In the observation group, lumbar plexus and sciatic nerve blocks were taken together. The patient was placed in a lateral position with the affected limb upward. The L4 was scanned horizontally using the Doppler colour ultrasound probe, the puncture needle was inserted from the median spine next to the L4 space to the L4 nerve root, and the needle core was removed. Following the extraction of cerebrospinal fluid without abnormalities, 20 mL of 0.75 percent ropivacaine was slowly injected into the nerve root. The patient's body position was changed from a lateral position to a prone position, and the abdomen was underlaid with a soft pillow. The needle was pushed to the site near the sciatic nerve from the interval between ischial tuberosity and the larger femur trochanter. It was connected to the site. Only 20 ml of 0,75% of ropivacaine had been injected close to a sciatic nerve after cerebrospinal fluid was extracted without abdominalities.

Observation indices

The following indexes were compared between the two groups: (1) Anesthetic effect: According to the patient's conditions during operation, the anesthetic effect was excellent (During intraoperative skin cutting, no pain and no stretch reflex occurred, and the patient had a calm expression and always kept quiet), good (During intraoperative skin cutting, slight pain occurred accompanied by mild stretch reflex and satisfactory muscle relaxation, and the patient had slight changes in expression, and mild and tolerable discomfort), or poor (During intraoperative skin cutting, severe pain occurred accompanied by significant stretch reflex, and the patient had an expression of obvious suffering, and significant discomfort, and failed to keep quiet). Excellent-good rate = (excellent cases + good cases)/total cases × 100% [4]. (2) Block starts: the start time of the sensory block and motor block was included. (3) Block duration: the sensory block and the engine block duration included. (4) Vital signs: before and after anaesthetic injection systemic blood pressure, diastolic pressure and heart rate were detected. (5) Incidence of adverse events, including chills, nausea and vomiting, headache, hypotension and bradycardia; (6) Postoperative urination recovery time. (7) Lower extremity movement recovery time. (7) The visual analogue scale (0-11 point) has been used and the score is directly proportional to the pain 's severity (5). (8) Post-operative pain score: It was postoperatively assessed at 12-48 hours.

Statistical analysis

SPSS 22.0 software was used. Numerical data were expressed as n, and χ^2 test was performed. Quantitative data were expressed as ($\bar{\chi}$±s), and *t* test was performed. P<0.05 was considered to be statistically significant.

RESULTS

Excellent-good rate of anesthesia

In the observation group, the excellent rate of anaesthesia was 93.33% and in the control group 96.67% with no statistically important difference (P>0.05) (Table 1).

Table 1. **Excellent-good rates of anesthesia [n (%)]**

Group	n	Excellent	Good	Poor	Excellent-good rate
Control	30	14 (46.67%)	15 (50.00%)	1 (3.33%)	29 (96.67%)
Observation	30	12 (40.00%)	16 (53.33%)	2 (6.67%)	28 (93.33%)

Onset time and duration of block

The start time and block duration of both groups (P>0.05) was statistically not different (Table 2).

Table 2. **Onset time and duration of block ($\bar{\chi}$ ± s)**

Group	Onset time of Sensory block (s)	Duration of Sensory block (min)	Onset time of motor block (s)	Duration of motor block (min)
Control (n=30)	68.27±14.90	60.57±7.43	109.74±23.68	82.46±11.85
Observation (n=30)	67.36±14.47	61.29±7.52	108.91±22.49	82.97±12.93

Vital signs

In both groups, systemic blood pressure and blood diastolic blood pressure and heart rate decreased in comparison with pre-injection (P < .05) and were higher than in the control group (P < 0.05) after anaesthetic injection (Table 3).

Table 3. **Vital signs ($\bar{\chi}$ ± s)**

Group	Time	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	Heart rate (beats/min)
Control (n=30)	Before anesthetic injection	116.42±4.13	83.51±3.21	79.24±3.18
	After anesthetic injection	108.57±3.46$^{\#}$	77.24±2.35$^{\#}$	72.16±2.27$^{\#}$
Observation (n=30)	Before anesthetic injection	116.34±4.05	83.37±3.19	79.03±3.12
	After anesthetic injection	112.19±3.72$^{\#*}$	80.02±2.87$^{\#*}$	75.68±2.54$^{\#*}$

$^{\#}$P<0.05 *vs.* before anesthetic injection in the same group, *P<0.05 *vs.* control group.

Incidence rates of intraoperative adverse reactions

Chills, nausea, vomiting, and headache did not show statistically significant differences between two groups (P>0.05) incidents during the surgery, while the hypotension and bradycardia rates were lower in the group than in the group of observations (P<0.05) during the surgery (Table 4).).

Table 4. **Incidence rates of intraoperative adverse reactions [n (%)]**

Group	n	Chills	Nausea and vomiting	Headache	Hypotension	Bradycardia
Control	30	1 (3.33%)	1 (3.33%)	1 (3.33%)	8 (26.67%)	4 (13.33%)
Observation	30	2 (6.67%)	0 (0%)	0 (0%)	2 (6.67%) *	0 (0%) *

*P<0.05 *vs.* control group.

Recovery time of postoperative urination and lower extremity movement

The time and lower extremity in the observer group were shorter than in the control group after surgery (P<0.05) (Table 5). Table 5.

Table 5. **Recovery time of postoperative urination and lower extremity movement ($\bar{\chi}$ ± s)**

Group	Recovery time of urination (h)	Recovery time of lower extremity movement (h)
Control (n=30)	4.98±0.52	1.37±0.31
Observation (n=30)	4.12±0.41*	1.09±0.26*

*P<0.05 *vs.* control group.

Postoperative pain scores

No statistically significant difference in pain score between the two groups was observed at 12-48 h after surgery (P>0.05) (Table 6).

Table 6. **Postoperative pain scores ($\bar{\chi}$ ± s)**

Group	Postoperative pain score (point)			
	12 h	24 h	36 h	48 h
Control (n=30)	3.52±1.08	3.03±0.95	2.56±0.85	2.20±0.73
Observation (n=30)	3.46±0.97	2.96±0.94	2.47±0.82	2.13±0.70

DISCUSSION

The clinical treatment of lower extremity trauma is dominated by surgery, and there are many options for intraoperative anesthesia [6]. The young patients with lower extremity trauma have good tolerance to surgery, whose blood pressure and heart rate will return to normal within a short time even though they decline after intraoperative anesthetic injection. Besides, there are also many elderly patients with lower extremity trauma, whose organ reserve function and body function decline, with poor tolerance to anesthetics. After intraoperative anesthetic injection, vasodilatation tends to occur, resulting in the decreases in blood pressure and heart rate, even causing intraoperative adverse reactions such as hypotension and bradycardia, and often affecting postoperative urination and lower extremity movement [7-9]. Therefore, the choice of anesthesia method for elderly patients with lower extremity trauma remains to be explored.

Lumbar anesthesia is a commonly used anesthesia method in lower extremity surgery, characterized by fast onset of anesthesia and good anesthetic effect, and ropivacaine is mainly used as the anesthetic, which can effectively block sensory and motor nerves [10]. One study suggested that to improve the safety of anesthesia, low specific gravity ropivacaine lumbar anesthesia can be adopted for elderly patients undergoing lower extremity surgery, and its anesthetic effect is comparable to that of heavy specific gravity ropivacaine anesthesia, with less impact on the recovery of postoperative urination and lower extremity movement [11]. In another study[12], it was noted that the nerve block is effective and safe in the anaesthesia of lower extremity surgery and can exert sedative and analgesic effects by temporarily blocking sensory and motor nerves in the innervation area. In addition, the combination of lumbar plexus and sciatic nerve block is mostly used in low-extremity surgery, which can effectively block lower-extremity sensory and motor nerves in patients and thus have a good anaesthetic effect[13,14]. In this study, safety and efficacy were analysed and compared between nerve block and low-specific lumbar anaesthesia in lower extremity surgery in elderly patients. It was found that (1) the excellent rate of anaesthesia, onset time and duration of block and postoperative pain score had no statistically significant differences between the observation group and the control group (P>0.05). It can be inferred that both nerve block and low-specific lumbar anaesthesia can have a significant anaesthetic effect in lower extremity surgery in elderly patients and a sedative effect during surgery with little effect on postoperative pain. (2) Following anaesthetic injection, systolic blood pressure, diastolic blood pressure and heart rate decreased in both groups compared to pre-injection (P<0.05) and were higher in the observation group than in the control group (P<0.05). The incidence rates of hypotension and bradycardia during operation were lower in the observation group than in the control group (P<0.05). In addition, the recovery time for postoperative urination and lower extremity movement was shorter in the observation group than in the control group (P<0.05). The above findings indicate that the nerve block has lower effects on the blood pressure and heart rate of elderly patients than low-specific lumbar anaesthesia, which can reduce intraoperative adverse reactions and reduce postoperative urination and lower extremity movement disorders.

In conclusion, in unilsidual lower extremity trauma procedures of elderly patients both low-specific lumbar and combined lumbar plexus and sciatic nerve block have a good anaesthetic effect. The combined lumbar plexus and sciatic nervous block, however, have greater anaesthetic protection than the low level of lumbar anaesthesia which can reduce the incidence of intra-operative hypotension and bradycardia and speed up recovery and lower limb movement.

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