# Clinical Study on the Application of Ultrasound-guided Quadratus Lumborum Block Combined with Ilioinguinal/ Iliohypogastric Nerve Block in Inguinal Surgery in the Elderly

#### Jian Zhang<sup>1</sup>, Guohai Sun<sup>2</sup>, Lei Zhang<sup>2</sup>, Lihui Zhang<sup>3</sup>\*

<sup>1</sup>Department of Ultrasound Medicine, Tianjin Beichen Traditional Chinese Medicine Hospital, Tianjin, China, <sup>2</sup>Department of Anesthesiology, Tianjin Beichen Traditional Chinese Medicine Hospital, Tianjin, China, <sup>3</sup>Department of Critical Care, Tianjin Beichen Traditional Chinese Medicine Hospital, Tianjin, China

# Abstract

Background: This study aimed to investigate the effects of combining an ilioinguinal/iliohypogastric nerve block with an ultrasound-guided quadratus lumborum block during inguinal surgery in older patients. Methods: Between December 2020 and June 2023, 300 elderly patients who underwent inguinal surgery at our institution were randomly divided into an observation group (n = 150) and a control group (n = 150). The observation group received ultrasound-guided quadratus lumborum block in addition to ilioinguinal/iliohypogastric nerve block, whereas the control group received only ultrasound-guided ilioinguinal/iliohypogastric nerve block. The postoperative conditions and anesthesia dose (propofol and remifentanil) during surgery were recorded. The average arterial pressure and heart rate of the two groups were compared 10 min before anesthesia, 10 min after anesthesia, and postoperatively. Pain intensity was measured during and 30 min after the procedure using the pain Visual Analog Scale (VAS). The levels of malondialdehyde (MDA), aldosterone (ALD), and total antioxidant capacity (TAC) were evaluated before surgery and 1 day later, and the incidence of postoperative complications was noted and compared between the two groups. Results: The propofol and remifentanil dosages in the observation group were much lower than those in the control group, and hospital stay and recovery times were significantly shorter (P < 0.05). Ten minutes before anesthesia, there was no significant difference in the mean arterial pressure and heart rate between the two groups, and no difference at any other time point in the observation group (P > 0.05). Ten minutes after anesthesia and postoperatively, the average arterial pressure and heart rate of the observation group were lower than those of the control group, whereas those of the control group were higher than those observed preanesthesia (P < 0.05). The postoperative MDA and ALD levels in the observation group were significantly higher than those in the control group ( $P \le 0.05$ ), and the postoperative TAC level in the observation group was significantly lower than that in the control group (P < 0.05). The VAS scores in the observation group were significantly lower than those in the control group. No discernible difference in the frequency of complications was observed between the two groups (P > 0.05). Conclusion: The combination of ilioinguinal/iliohypogastric nerve block with ultrasound-guided quadratus lumborum block can significantly minimize the amount of anesthesia used during surgery, exert a good analgesic effect, shorten hospitalization time, stabilize hemodynamics, and reduce stress response with high safety.

Keywords: Ilioinguinal/iliohypogastric nerve block, inguinal region operation, old age, ultrasound-guided quadratus lumborum block

### INTRODUCTION

Inguinal region surgery in the elderly includes inguinal hernia repair, high ligation of the spermatic vein, and varus spermatic sac inversion.<sup>[1]</sup> Intraspinal anesthesia is a popular anesthetic technique for elderly patients undergoing inguinal surgery. However, due to their poor physical state, older patients frequently have severe conditions such as diabetes and hypertension, which increase the risk of

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 DOI:

 DOI:
 10.4103/jmu.jmu\_146\_23

Received: 12-11-2023 Revised: 22-12-2023 Accepted: 11-01-2024 Available Online: 30-06-2024

anesthesia. Therefore, these patients cannot receive surgical treatment.<sup>[2]</sup> In recent years, ultrasonic visualization technology has matured.<sup>[3]</sup> High-resolution ultrasound is increasingly used for pain treatment and has achieved good results.<sup>[4]</sup>

Address for correspondence: Dr. Lihui Zhang, Department of Critical Care, Tianjin Beichen Traditional Chinese Medicine Hospital, No. 436, Jing-Jin Road, Beichen, Tianjin 300400, China. E-mail: 13002201927@163.com

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**How to cite this article:** Zhang J, Sun G, Zhang L, Zhang L. Clinical study on the application of ultrasound-guided quadratus lumborum block combined with ilioinguinal/iliohypogastric nerve block in inguinal surgery in the elderly. J Med Ultrasound 2025;33:35-40.

However, the analgesic effect during surgery is poor. Therefore, pain-relieving drugs are needed after surgery, which affects the postoperative recovery of patients.<sup>[5]</sup> The ultrasound-guided quadratus lumborum block is a relatively new technology that has dual analgesic effects on the body and visceral pain, and its analgesic effect lasts for a long time.<sup>[6]</sup> According to previous reports, ultrasound-guided lumbar muscle blocks and ilioinguinal/iliohypogastric nerve blocks complement each other, and their combined application can play a synergistic role.<sup>[7]</sup> However, few researchers in China have combined these two methods for inguinal surgery in elderly patients. This study aimed to evaluate the clinical effectiveness and safety of two different types of blocks in combination with ultrasound guidance.

# METHODS

# Participants and study design

A total of 300 elderly patients admitted to our hospital between December 2020 and June 2023 were assigned to observation and control groups (n = 150 for each group) [Figure 1]. The observation group comprised 31 women and 119 men, mean age 68.72 ± 5.86 years. According to the American Society of Anesthesiologists (ASA) grading standards,<sup>[8]</sup> 63 cases were Grade I, 48 were Grade II, and 39 were Grade III. The types of operation were open tension-free inguinal hernia repair surgery in 87 cases, high ligation of the spermatic vein in 37 cases, and spermatic cord sheath cavity inversion in 26 cases. The control group consisted of 121 men and 28 women, age range 51–75 years, with an average age of (68.16 ± 5.93) years. According to ASA classification, 66 cases were Grade I, 50 were Grade II, and 34 were Grade III. The types of operations included inguinal hernia repair in 93 cases, high ligation of the spermatic vein in 35 cases, and spermatic cord sheath cavity inversion in 22 cases. The fundamental data did not differ significantly between groups (P > 0.05). The inclusion criteria were: (1) patients who underwent inguinal surgery; (2) age between 60 and 75 years; (3) indications for anesthesia and surgery; and (4) written informed consent was provided. The exclusion criteria were: (1) serious cardiovascular, cerebrovascular, and pulmonary vascular diseases; (2) coagulation dysfunction; (3) mental illness; (4) severe liver and renal problems; (5) cognitive dysfunction; and (6) advanced malignant tumors. This study was conducted in accordance with the Declaration of Helsinki and was approved by the ethics committee of the Tianjin Beichen Traditional Chinese Medicine Hospital (2022-022KT).

#### Anesthesia methods

All patients underwent inguinal surgery under anesthesia. Before the operation, the patients were forbidden from eating and drinking water and the relevant examinations improved. The patients entered the operating room, received a balanced solution (1.5 L) intravenously, breathed oxygen through a mask, and underwent the procedure; their vital signs were measured. The acoustic anatomical positions of the ilioinguinal and iliohypogastric nerves were determined.<sup>[9,10]</sup> The control group received an ilioinguinal/iliohypogastric nerve block under ultrasound guidance. High-frequency ultrasound probes were positioned at the iliac spine and lower border of the waist to examine the transverse, internal oblique and external oblique muscles. When the ultrasound probe was



Figure 1: Recruitment flowchart. VAS: Visual Analog Scale, MDA: Malondialdehyde, ALD: Aldosterone, TAC: Total antioxidant capacity

turned 90°, the anterior superior iliac spine served as a bone marker, and the abdominal and external oblique muscles were scanned. The lower end of the probe was located at the anterior superior iliac spine and the higher end at the navel. The image showed a hyperechoic signal around the nerve adventitia. After the fascial layer was injected from inside to outside or from outside to inside in the inner plane without using a blood pump, local anesthetic is administered between the abdominal oblique muscle and the nerve where the tip of the needle is placed. An ilioinguinal/iliohypogastric nerve block and an ultrasound-guided quadratus lumborum block were administered to the observation group. The inferior inguinal nerve was located using the same ultrasonic device and procedure as in the control group, and then the ultrasonic probe was slid backward to observe the thoracolumbar muscles, erector spinae, and psoas muscles. Second, the needle was used from front to back below the external abdominal oblique muscle and after the quadratus lumborum, and the local anesthetic drugs were injected without returning to the blood pump [Figure 2].

#### **Observation indicators**

(1) The respective propofol and remifentanil dosages, hospital stays, and recovery times for activities of daily living in the two groups were recorded. (2) The average arterial pressure and heart rate of the two groups were assessed using a TD-3200A ECG monitor (Shenzhen Taiji Medical Technology Co., Ltd., Shenzhen, China) 10 min before anesthesia, 10 min after anesthesia, and postoperatively. (3) During and 30 min after the operation, patients were scored using the Visual Analog Scale (VAS).<sup>[11]</sup> Scores ranged from 0 (no pain), 1–3 (tolerable pain), 4-9 (unbearable pain), and up to 10 (unbearable intense pain). (4) Fasting venous blood samples of 5 mL were taken the day before and the day after surgery, and the upper serum was separated by centrifuging the sample for 10 min at 3000 rpm. The levels of malondialdehyde (MDA), total antioxidant capacity (TAC), and aldosterone (ALD) were measured using a UniCel DxI800 full active immunity analyzer (Beckman Coulter Co., Ltd., Brea, CA, USA). (5) The incidence of postoperative serum swelling, hypotension, scrotal edema, and urinary retention was observed in the two groups.



Figure 2: Ultrasound anatomical legend

#### **Statistical analyses**

The dosage of narcotic drugs, postoperative situation, hemodynamics, VAS score during and after operation, and stress index levels were expressed by  $\overline{x} \pm s$ , while the pain and complication rates were expressed as a percentage using *n* (%), and the t test and rank sum test were employed. *P* < 0.05 was statistically significant. Statistical analysis SPSS 22.0 (SPSS Inc., Chicago, IL, USA) was used to process the data.

# RESULTS

#### **Comparison of anesthesia dose**

The anesthetic dose was much lower in the observation group than in the control group, and hospitalization and activity recovery times were also significantly shorter [P < 0.05, Table 1].

#### Comparison of the hemodynamics

Ten minutes before anesthesia, no discernible difference was observed between the hemodynamic measures of the observation and control groups. Similarly, at each time point, the observation group showed no discernible difference in average arterial pressure and heart rate (P > 0.05). Although the average arterial pressure and heart rate of the control group were higher than those of the control group at 10 min after anesthesia and surgery, the average arterial pressure and heart rate of the observation group were lower than those of the control group at 10 min after anesthesia and surgery, the average arterial pressure and heart rate of the observation group were lower than those of the control group [P < 0.05, Table 2].

#### **Comparison of Visual Analog Scale scores**

In the observation group, considerably more patients reported not having any pain than in the control group, and their VAS ratings both during and after surgery were much lower [P < 0.05, Tables 3 and 4].

# Comparison of the stress indices before and after the procedure

The preoperative levels of MDA, ALD, and TAC did not differ significantly between the two groups (P > 0.05). After the procedure, the levels of MDA and ALD in the observation group were substantially higher than those in the control group, whereas the levels of TAC were significantly lower before and after the operation [P < 0.05, Table 5].

#### Comparison of the negative response rates

After the procedure, the incidence of complications was lower in the observation group than in the control group; however, the difference was not significant [P > 0.05, Table 6].

## DISCUSSION

Inguinal hernia, varicocele, and hydrocele of the spermatic cord are common diseases of the inguinal region and surgery is the most effective treatment. Inguinal hernia repair and ligation of the spermatic vein and varus spermatic cord are the most frequently performed surgery procedures.<sup>[12]</sup> Local infiltration anesthesia, continuous epidural anesthesia, combination spinal-epidural anesthesia, and general anesthesia are options for inguinal surgery.<sup>[13,14]</sup> Ultrasound-guided nerve

Table 1: Subject demographic information						
Group	Propofol (mg)	Remifentanil (mg)	LOS (days)	Activity recovery time (days)		
Observation group ( <i>n</i> =150)	424.69±65.36	1.28±0.31	3.92±1.15	1.51±3.47		
Control group ( <i>n</i> =150)	342.16±75.43	$1.54 \pm 0.46$	4.88±1.32	2.36±0.72		
t	10.127	5.741	6.716	2.937		
Р	< 0.001	< 0.001	< 0.001	0.004		
LOS: Longth of story						

LOS: Length of stay

Table 2	2:	Comparison	of	hemody	vnamics	between	two	arour	os of	patients

Item	MAP (mmHg)			HR (times/min)			
	Before anesthesia 10 min	After anesthesia 10 min	After the operation	Before anesthesia 10 min	After anesthesia 10 min	After the operation	
Observation group ( <i>n</i> =150)	83.62±8.42	82.26±6.78	82.48±6.47	73.69±7.14	75.26±7.28	76.12±7.63	
Control group (n=150)	84.66±7.92	86.34±8.411	$87.63 \pm 8.98$	72.31±7.97	$78.35 \pm 8.63$	79.27±7.58	
t	1.102	4.626	5.699	1.579	3.352	3.587	
Р	0.271	< 0.001	< 0.001	0.115	0.001	< 0.001	

MAP: Mean arterial pressure, HR: Heart rate

Table 3: Visual Analog Scale score comparison between two groups of patients								
Item	Severe pain, <i>n</i> (%)	Moderate pain, <i>n</i> (%)	Mild pain, <i>n</i> (%)	Painless, n (%)				
Observation group ( <i>n</i> =150)	28 (19.05)	25 (16.67)	27 (16.67)	70 (47.62)				
Control group ( <i>n</i> =150)	43 (30.95)	31 (19.05)	20 (14.29)	56 (35.71)				
Ζ		2.270						
Р		0.023						

# Table 4: Comparison of intraoperative and postoperative Visual Analog Scale between the two groups ([ratings. (s)] $\overline{x}\pm$ s)

([							
Item	Intraoperative VAS	Postoperative VAS					
Observation group (n=150)	1.69±0.62	0.85±0.29					
Control group (n=150)	$2.12{\pm}1.02$	$1.26\pm0.37$					
t	4.412	10.681					
Р	< 0.001	< 0.001					

VAS: Visual Analog Scale

blocks such as the ilioinguinal/iliohypogastric nerve block and ultrasound-guided psoas block have been developed in recent years as ultrasound visualization anesthesia has become more common in clinical practice.<sup>[15,16]</sup>

This study demonstrates that the propofol and remifentanil dosages in the observation group were much lower than those in the control group, the hospitalization time and activity recovery time were significantly shorter, and the ilioinguinal/ iliohypogastric nerve block and ultrasound-guided quadratus lumborum block have been shown to successfully minimize the anesthesia dose during surgery, hasten patient recovery, and shorten hospital stay. This may be because the anesthetic method used in the observation group can break through the lumbar and thoracic fascia and spread to the intervertebral disc space, thus playing a better analgesic role and reducing the dosage of anesthetic and operation time. According to a related study, an ultrasound-guided quadratus lumborum block and other types of anesthesia can be used to minimize the amount of anesthetics used during surgery and shorten hospital stays.<sup>[17]</sup> The findings of this study are consistent with those of previous studies.

Hemodynamics refers to the mechanics of blood flow through the cardiac circulatory system and mainly studies blood flow, blood flow resistance, blood pressure, and their relationship.<sup>[18]</sup> According to this study, there were no appreciable differences in the average arterial pressure and heart rate in the observation group at any given time. In contrast, the average arterial pressure and heart rate in the control group were higher than those before anesthesia at 10 min, indicating that the hemodynamic indices in the control group fluctuated more erratically than those in the observation group. The average arterial pressure and heart rate in the observation group were lower than those in the control group 10 min after anesthesia and after surgery. This might be because the target nerve distribution was simpler and the procedure was less complicated in the observation group than in the control group, reducing needless injuries sustained during the procedure and promoting hemodynamic parameter stability. Ragab et al.[19] showed that ultrasound-guided lumbar plexus block can effectively stabilize the hemodynamic parameters of patients, which was corroborated by this study.

The results of this study suggest that ultrasound-guided quadratus lumborum block combined with ilioinguinal/ iliohypogastric nerve block can effectively reduce pain both

Table 5: Comparison of stress indexes before and after operation between the two groups									
MDA (µmol/L)		TAC (U/mL)		ALD (ng/L)					
Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative				
21.39±3.23	28.96±5.75	12.84±2.31	7.84±2.12	19.67±2.84	29.85±4.81				
21.15±3.12	25.61±5.47	$12.58 \pm 2.68$	9.62±2.38	19.79±3.03	$26.54 \pm 5.66$				
0.654	5.169	0.900	6.839	0.354	5.458				
0.513	< 0.001	0.369	< 0.001	0.724	< 0.001				
	MDA (j           Preoperative           21.39±3.23           21.15±3.12           0.654           0.513	MDA (μmol/L)           Preoperative         Postoperative           21.39±3.23         28.96±5.75           21.15±3.12         25.61±5.47           0.654         5.169           0.513         <0.001	MDA (µmol/L)         TAC (           Preoperative         Postoperative         Preoperative           21.39±3.23         28.96±5.75         12.84±2.31           21.15±3.12         25.61±5.47         12.58±2.68           0.654         5.169         0.900           0.513         <0.001	MDA (μmol/L)         TAC (U/mL)           Preoperative         Postoperative         Preoperative         Postoperative           21.39±3.23         28.96±5.75         12.84±2.31         7.84±2.12           21.15±3.12         25.61±5.47         12.58±2.68         9.62±2.38           0.654         5.169         0.900         6.839           0.513         <0.001	MDA (µmol/L)         TAC (U/mL)         ALD           Preoperative         Postoperative         Preoperative         Postoperative         Preoperative           21.39±3.23         28.96±5.75         12.84±2.31         7.84±2.12         19.67±2.84           21.15±3.12         25.61±5.47         12.58±2.68         9.62±2.38         19.79±3.03           0.654         5.169         0.900         6.839         0.354           0.513         <0.001				

MDA: Malondialdehyde, TAC: Total antioxidant capacity, ALD: Aldosterone

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Table 6: Comparison of the incidence of adverse reactions between the two groups								
Item	Serum swelling, <i>n</i> (%)	Low blood pressure, <i>n</i> (%)	Hydrocele, n (%)	Uroschesis, n (%)	Total occurrence, n (%)			
Observation group ( <i>n</i> =150)	5 (3.33)	12 (8.00)	3 (2.00)	2 (1.33)	22 (14.67)			
Control group ( <i>n</i> =150)	8 (5.33)	15 (10.00)	4 (2.67)	2 (1.33)	29 (19.33)			
$\chi^2$					1.157			
Р					0.282			

during and after surgery because the VAS score of patients in the observation group was significantly lower than that of the control group. This may be because the anesthesia mode in the observation group blocks the body fascia, which slows the absorption of local anesthesia and prolongs the action time of the drug. Through local anesthesia, it spreads to the ligaments outside and at the back of the thoracic cavity, reaching the lateral thoracic space, effectively paralyzing the thoracic vertebrae, and serves as a postoperative analgesic for lower abdominal and lower limb surgery. The control group only used anesthesia to act on the quadratus lumborum nerve, which could not block all signal pathways, leading to a poor analgesic effect. According to related studies, the analgesic effect of an ultrasound-guided quadratus lumborum block in combination with other anesthetics can significantly reduce patient discomfort.<sup>[20,21]</sup> The findings of this study are comparable with those of a previous study.

When the human body is stimulated by anesthesia, surgery, trauma, or other factors, it produces a stress reaction, increases the secretion of the adrenal cortex, and excites the sympathetic nerve, leading to changes in various systems.<sup>[22]</sup> This study found that the MDA and ALD levels in the observation group were noticeably higher than those in the control group, while the TAC level was noticeably lower, indicating that an ultrasound-guided quadratus lumborum block in conjunction with an ilioinguinal/iliohypogastric nerve block can significantly lessen postoperative oxidative stress responses. Patients in the observation group had stable hemodynamics and minimal discomfort both during and after the procedure, thus reducing the oxidative stress reaction, while the patients in the control group had severe pain, which led to postoperative stress reactions. Alves Brandão et al.[23] showed that an ultrasound-guided quadratus lumborum block has a strong analgesic effect, thus reducing the stress response, which is corroborated by this study. In addition, there was no significant difference in the incidence of complications between the two groups, suggesting that both anesthetic treatments were safe.

This study had several limitations. First, the study population was drawn from a single hospital in Tianjin, which is not an accurate representation of the entire Chinese population. Second, the follow-up time was relatively short, and we will continue to follow up in future research to observe the long-term prognosis.

# CONCLUSION

In elderly patients undergoing inguinal surgery, an ultrasound-guided quadratus lumborum block in conjunction with an ilioinguinal/iliohypogastric nerve block can effectively reduce the dosage of anesthetics used during the procedure, exert a good analgesic effect, shorten hospital stay, stabilize hemodynamics, reduce stress response, and have high safety.

### **Financial support and sponsorship**

This work was supported by The Beichen District Health Commission (SHGY-2022010).

## **Conflicts of interest**

There are no conflicts of interest.

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