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ORIGINAL ARTICLE

Retrospective Study

Effect of ultrasound-guided lumbar square muscle block on stress response in patients undergoing radical gastric cancer surgery

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Abstract

BACKGROUND

Radical surgery is a common treatment for patients with gastric cancer; however, it can lead to postoperative complications and intestinal barrier dysfunction. Ultrasound-guided quadratus lumborum block is often used for postoperative analgesia, but its effects on stress response and intestinal barrier function are not well understood.

AIM

To investigate the effects of an ultrasound-guided quadratus lumborum block on stress response and intestinal barrier function in patients undergoing radical surgery for gastric cancer.

METHODS

A total of 100 patients undergoing radical surgery for gastric cancer were randomly categorized into observation and control groups. Plasma adrenaline and cortisol levels, intestinal mucosal barrier indexes, and complication rates were compared between the two groups before, during, and 1 day after surgery.

RESULTS

The observation group had significantly lower plasma adrenaline and cortisol levels during surgery and at 1 day postoperatively than that of the control group ($P < 0.05$). Additionally, intestinal barrier indexes (endotoxin and D-dimer) at 1 day postoperatively were significantly lower in the observation group than in the control group ($P < 0.05$).

CONCLUSION

Ultrasound-guided quadratus lumborum block could reduce stress response, protect intestinal barrier function, and decrease the incidence of complications in patients undergoing radical surgery for gastric cancer. This technique has the

potential for clinical applications.

Key Words: Ultrasound-guided quadratus lumborum block; Radical gastric cancer surgery; Stress response; Intestinal barrier function; Postoperative analgesia; Rehabilitation

Core Tip: Ultrasound-guided quadratus lumborum block reduces stress response and preserves intestinal barrier function following radical surgery for gastric cancer, potentially lowering the associated complications. This technique shows promise in providing postoperative analgesia and for improving patient outcomes. It protects the intestinal barrier function and reduces the incidence of complications in patients who undergo radical gastric cancer surgery, highlighting its potential clinical use.

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INTRODUCTION

Ultrasound-guided quadratus lumborum block exhibited promising effects in reducing stress response and improving intestinal barrier function in patients undergoing radical surgery for gastric cancer[1-5]. The decline in the plasma adrenaline and cortisol levels[5-10], improved intestinal barrier indexes, and reduced incidence of postoperative complications underscores the potential clinical application of this technique[11-15]. However, further studies are needed to optimize its clinical application[16-21], and explore its combination with other interventions to enhance postoperative recovery and minimize complications[22,23].

MATERIALS AND METHODS

Ultrasound-guided quadratus lumborum block has made significant progress as a pain management and rehabilitation promotion technique for clinical applications[24-27]. This study investigated the effects of ultrasound-guided quadratus lumborum block on stress response and intestinal barrier function in patients undergoing radical surgery for gastric cancer.

Furthermore, we did not evaluate the onset and maintenance times of the quadratus lumborum block; therefore, further studies are warranted to assess these parameters.

First, we anticipated that the ultrasound-guided quadratus lumborum block group would demonstrate improved outcomes in terms of postoperative physiological indicators and pain scores, reflecting a reduced stress response[28-30]. This could be partly attributed to the analgesic effect of the ultrasound-guided quadratus lumborum block, which diminishes pain transmission at the surgical site through local anesthesia, thereby reducing postoperative pain perception and stress response. Additionally, quadratus lumborum blocks may modulate stress response by blocking sympathetic activity and reducing the release of inflammatory mediators[31-33].

Second, regarding the assessment of intestinal barrier function, we anticipated that the ultrasound-guided quadratus lumborum block group would demonstrate enhanced outcomes[34], including reduced intestinal permeability and inflammatory response[35]. Surgical trauma and stress may lead to intestinal barrier dysfunction, increased intestinal permeability, and an inflammatory response, potentially leading to postoperative complications. Ultrasound-guided quadratus lumborum block may protect intestinal barrier function by reducing the inflammatory response to surgical trauma and maintaining intestinal blood perfusion[36,37]. In addition, some studies have suggested that these blocks may maintain intestinal health by regulating the balance of the intestinal microbiota. However, intestinal barrier function is influenced by a number of factors, with ultrasound-guided quadratus lumborum block being just one of them; other interventions and factors may also have an impact on intestinal barrier function[38,39].

First, the sample size may be limited, necessitating studies with larger sample sizes to further validate the reliability of our results. Second, the clinical application of ultrasound-guided quadratus lumborum blocks may involve the collaboration of multiple medical personnel, potentially introducing differences in operating techniques that could affect the results; hence, uniform operating standards are needed. In addition, this study only focused on the effects of postoperative stress and intestinal barrier function; other clinical outcomes and the long-term prognosis of patients require further investigation.

Table 1 Comparison of plasma inflammatory factor levels before and after treatment between the observation and control groups (*X* ± s)

		Pro-adrenaline (pg/L)	Cortisol (ng/L)	IL-6 (ng/L)	C-reactive protein (mg/L)
Control group (*n* = 50)	Before treatment	1.16 ± 0.12	24.55 ± 2.54	36.47 ± 1.64	34.22 ± 1.64
	After treatment	0.88 ± 0.18	21.66 ± 2.16	30.08 ± 1.72	27.84 ± 1.19
Observation group (*n* = 50)	Before treatment	1.15 ± 0.19	24.51 ± 2.08	36.39 ± 1.66	34.35 ± 1.91
	After treatment	0.51 ± 0.09	17.08 ± 1.52	22.51 ± 1.58	16.78 ± 1.49
t/*P*		8.682/< 0.001	5.814/< 0.001	18.037/< 0.001	21.122/< 0.001
t/*P*		20.421/< 0.001	19.347/< 0.001	40.629/< 0.001	48.655/< 0.001
t/*P* post-treatment inter-group values		12.333/< 0.001	11.632/< 0.001	21.743/< 0.001	38.908/< 0.001

Values are expressed as mean ± SD.

Table 2 Comparison of perioperative indicators between the observation and the control groups (*X* ± s)

Group	*n*	Sufentanil dosage (μg)	Post-operative awakening time (min)	Postoperative time in bed (h)	Time taken for anal discharge (h)
Observation group	50	25.56 ± 4.56	14.52 ± 1.72	21.26 ± 3.41	12.26 ± 1.65
Control group	50	71.12 ± 7.45	25.62 ± 2.51	30.23 ± 4.56	20.17 ± 2.36
t value	28.380	20.533	8.861	15.458	0.000
P value	0.000	0.000	0.000		

Table 3 Comparison of the incidence of adverse reactions between the observation and the control groups [*n* (%)]

	Leukopenia	Hepatic impairment	Nausea and vomiting	Bone marrow suppression	Renal impairment	Incidence
Control group (*n* = 50)	5 (11.11)	3 (6.67)	5 (11.11)	4 (8.89)	7 (15.56)	24 (53.33)
Observation group (*n* = 50)	2 (4.44)	1 (2.22)	1 (2.22)	1 (2.22)	2 (4.44)	7 (15.56)
χ^2						14.221
P value						0.000

RESULTS

Comparison of plasma epinephrine and cortisol levels and indicators of intestinal mucosal barrier between the two groups before, during, and 1 day after surgery

The plasma adrenaline, cortisol, interleukin-6, and C-reactive protein levels were significantly lower in both the groups after treatment in comparison to their levels before treatment, and the reduction in these indicators was more significant in the observation group than in the control group ($P < 0.05$, Table 1).

Perioperative indicators

Compared with the patients in the control group, those in the observation group demonstrated significantly improved outcomes in terms of sufentanil dosage, postoperative awakening time, postoperative time in bed, and time taken for anal discharge ($P < 0.05$, Table 2).

Statistics on complication rates

The incidence of adverse reactions was significantly lower in the observation group than in the control group ($P < 0.05$, Table 3).

Effect of ultrasound guidance on immunity of two groups of patients

Compared with the control group, the observation group exhibited a significant decrease in the CD4+/CD8+ ratio and

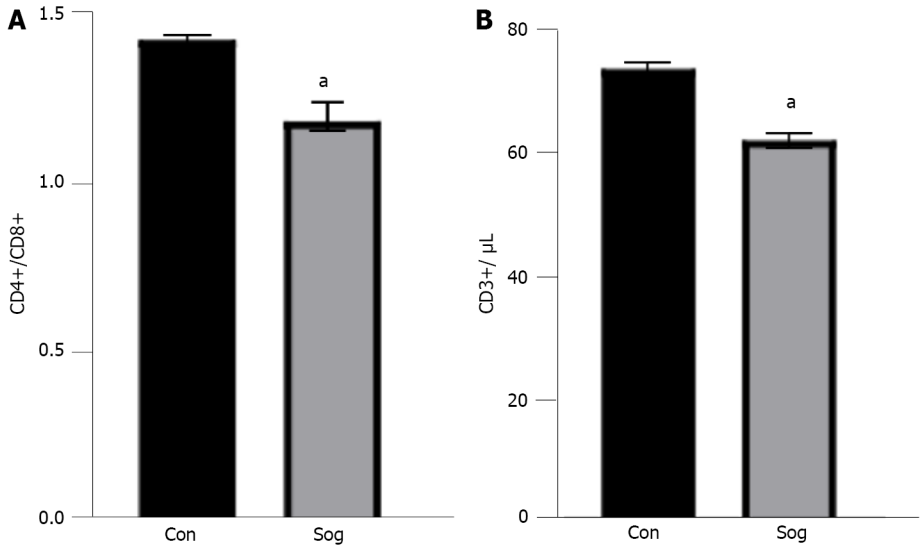

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Figure 1 Effect of ultrasound on immunity of the observation and control groups. A and B: CD4+/CD8+ (A) and CD3+ (B) (n = 50, ^aP < 0.01).

CD3+ count, indicating that ultrasound guidance exerts a substantial influence on the body's immune response and a positive effect on the recovery and prognosis of the disease. In patients undergoing radical gastrectomy, ultrasound-guided quadratus lumborum block, administered at the same dose, could achieve an ideal postoperative analgesic effect and significantly reduce postoperative immune function suppression (Figure 1).

DISCUSSION

General information

A total of 100 patients with gastric cancer who underwent radical surgery between February 2019 and July 2020 were enrolled in this study[40]. The inclusion criteria were as follows: (1) Confirmation of gastric cancer through pathological examination; (2) absence of allergies to anesthetic drugs; and (3) absence of contraindication for surgery or use of drugs affecting neuromuscular function. The patients were randomly categorized into two groups using the random number table method. The observation group included 50 patients (28 male and 22 female), aged 35–58 years (mean: 46.24 ± 1.63 years), with ASA classification grade I in 31 and grade II in 19 patients. The control group comprised 50 patients (27 male and 23 female), aged 33–58 years (mean: 45.98 ± 1.58 years), with ASA classification grade I in 32 and grade II in 18 patients.

Methodology

Before surgery patients in both the groups were prepared by administering oxygen at room air; promptly establishing intravenous access; and assessing vital signs, including electrocardiography, heart rate, and blood pressure.

In the control group, the anesthetic induction protocol comprised 0.05 mg/kg imipramine + 0.3 μg/kg sufentanil + 2.0 mg/kg propofol + 0.6 mg/kg rocuronium bromide. In the observation group, an ultrasound-guided quadratus lumborum block was performed alongside the standard anesthesia protocol. Postoperatively, both the groups were connected to a self-controlled analgesic pump delivering a mixture of 2 μg/kg sufentanil + 8 mg ondansetron mixed with 100 mL saline; the pump was devoid of a background dose, and delivered a single-pressed dose of 2 mL with a lock time of 15 min.

Observation indicators

The plasma epinephrine and cortisol levels, as well as indicators of intestinal mucosal barrier were compared between the two groups before, during, and one day postsurgery. The amount of sufentanil in both the groups was quantified, and the postoperative parameters, including awakening time, time in bed, and time taken for anal discharge were recorded in both the groups.

Additionally, the complication rate was determined at the time of discharge, and patient satisfaction was assessed using a self-designed questionnaire.

Data analysis

Statistical analyses were performed using the SPSS 21.0 software. The t-test was used to analyze measurement data, whereas the χ^2 test was used for count data. A P value of < 0.05 indicated a statistically significant difference.

CONCLUSION

Gastric cancer is a common malignancy, and radical surgery for gastric cancer is one of the main treatment modalities. Surgical trauma and stress reactions may lead to postoperative complications and intestinal barrier dysfunction. Ultrasound-guided quadratus lumborum block is widely used for providing postoperative analgesia and promoting recovery; however, its effects on stress response and intestinal barrier function are unclear. The laparoscopic approach offers many advantages, such as less trauma, faster postoperative recovery, and fewer postoperative complications; however, surgery inevitably causes stress and unavoidable postoperative pain; therefore, a suitable surgical anesthetic is needed to ensure a successful outcomes of surgery. In the past, laparoscopic surgery for gastric cancer has often been performed under general anesthesia, yielding good results; however, general anesthesia can easily lead to central sensitization, and require a considerable amount of analgesic drugs during surgery. The use of large amounts of analgesic drugs during surgery potentially cause nausea, vomiting, intestinal paralysis, and other adverse reactions, which can easily affect the smooth implementation of surgery and may even lead to failure. With the advancements in ultrasound technology and anesthesia practices, studies have demonstrated that the combination of an ultrasound-guided anterior lumbar muscle block with conventional general anesthesia during laparoscopic surgery can achieve improved satisfactory anesthetic and analgesic effects. However, its efficacy in reducing the use of analgesics and promoting postoperative recovery remains unclear. In this study, we aimed to investigate the effects of ultrasound-guided quadratus lumborum combined with general anesthesia in laparoscopic surgery for gastric cancer to provide a valuable reference for those involved in such procedures.

ARTICLE HIGHLIGHTS

Research background

Future studies should focus on optimizing the clinical application of ultrasound-guided quadratus lumborum block and exploring its efficacy in combination with other interventions to enhance postoperative recovery and minimize complications.

Research motivation

To investigate the effects of an ultrasound-guided quadratus lumborum block on stress response and intestinal barrier function in patients with gastric cancer.

Research objectives

The observation group exhibited significantly lower plasma adrenaline and cortisol levels during surgery and on the first day postoperatively compared to the control group ($P < 0.05$).

Research methods

A total of 100 patients who underwent radical surgery for gastric cancer were randomly assigned to either the observation or the control group (50 patients each). Plasma adrenaline and cortisol levels, intestinal mucosal barrier indexes, and complication rates were compared between the two groups before, during, and on the first day after surgery.

Research results

The observation group exhibited significantly lower plasma adrenaline and cortisol levels during surgery and on the first day postoperatively compared to the control group ($P < 0.05$).

Research conclusions

Ultrasound-guided quadratus lumborum block aids in preserving intestinal barrier function and reducing the incidence of postoperative complications, thereby demonstrating its potential clinical applicability.

Research perspectives

Radical surgery for gastric cancer can lead to postoperative complications and intestinal barrier dysfunction owing to surgical trauma and stress.

FOOTNOTES

Co-first authors: Xin-Ran Wang and Dan-Dan Xu.

Author contributions: Wang XR and Xu DD contributed equally to this work; Wang XR, Xu DD, Guo MJ, Wang YX, Zhang M, and Zhu DX designed the research study; Wang XR, Xu DD, Guo MJ, Wang YX, Zhang M, and Zhu DX performed the research; Xu DD and Guo MJ contributed new reagents and analytic tools; Wang XR, and Zhu DX analyzed the data and wrote the manuscript; All authors have read and approve the final manuscript. Wang XR and Xu DD contributed equally to this work as co-first authors. The decision to designate Wang XR and Xu DD as co-first authors is based in three primary reasons. First, the research was performed as a collaborative

effort, and the designation of co-first authors accurately reflects the distribution of responsibilities and burdens associated with the time and effort required to complete the study and the resultant manuscript. Designating two first authors will ensure effective communication and management of post-submission matters, which will enhance the paper's quality and reliability. Second, the research team consisted of authors with diverse expertise and skills from various fields, and the designation of two co-first authors best reflects this diversity. This also promotes the most comprehensive and in-depth examination of the research topic, ultimately enriching readers' understanding by offering various expert perspectives. Third, both Wang XR and Xu DD Made substantial and equal contributions throughout the research process. Selecting these researchers as co-first authors acknowledges and respects their equal contribution and exemplifies the collaborative spirit and teamwork within this study. In summary, we believe that designating Wang XR and Xu DD as co-first authors is fitting for our manuscript as it accurately reflects our team's collaborative spirit, equal contributions, and diversity.

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