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Quadratus lumborum block combined with multidimensional psychological intervention (CBT + mindfulness) on recovery and psychological status after gasless laparoscopic surgery in elderly patients with gynecological malignancies: A randomized controlled trial

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CITATION

Wang D, Wu H, Tang J, et al.
Quadratus lumborum block combined with multidimensional psychological intervention (CBT + mindfulness) on recovery and psychological status after gasless laparoscopic surgery in elderly patients with gynecological malignancies: A randomized controlled trial. *Psycho-Oncologie*. 2026; 20(1): 4234.
<https://doi.org/10.18282/po4234>

ARTICLE INFO

Received: 7 March 2025

Revised: 19 March 2025

Accepted: 24 March 2025

Available online: 5 January 2026

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Abstract: Background: Postoperative pain and negative emotions are common in elderly patients with gynecological malignancies. High-quality evidence is lacking on how to achieve effective analgesia and psychological improvement during gasless laparoscopic surgery. **Objective:** To explore the effects of quadratus lumborum block combined with cognitive behavioral therapy and mindfulness training on postoperative pain control, relief of negative emotions, and functional recovery in this population. **Methods:** A single-center, prospective, randomized controlled trial was conducted. A total of 120 elderly patients with gynecological malignancies meeting the inclusion criteria were enrolled and randomly assigned in a 1:1 ratio to the intervention group or control group. In the intervention group, quadratus lumborum block and multidimensional psychological intervention were applied perioperatively, in addition to routine analgesia and health education. The primary outcomes included pain scores at 6, 24, and 48 h postoperatively. Opioid consumption and patient-controlled analgesia (PCA) bolus counts within 48 h were recorded. Secondary outcomes were postoperative changes in SAS and SDS scores, functional recovery, and complications. Statistical methods were used to analyze differences between groups. **Results:** Pain scores in the intervention group at 24 and 48 h postoperatively were significantly lower than those in the control group ($P < 0.05$, repeated-measures ANOVA). Total opioid consumption and PCA bolus counts within 48 h were significantly reduced ($P < 0.01$, t -test). SAS and SDS scores decreased more significantly at 24 and 48 h postoperatively in the intervention group ($P < 0.05$, t -test). Times to ambulation and first flatus and defecation were significantly shorter ($P < 0.05$, t/U test), and hospital stay was reduced ($P < 0.05$, t -test). SF-36 scores before discharge were higher than in the control group ($P < 0.05$, t -test), but no significant difference in complication rates was observed ($P > 0.05$, χ^2 or Fisher test). **Conclusion:** Quadratus lumborum block combined with multidimensional psychological intervention effectively reduced postoperative pain, decreased opioid requirements, improved anxiety and depression, and promoted functional recovery and quality of life, proving to be safe and feasible.

Keywords: quadratus lumborum block; multidimensional psychological intervention; elderly gynecological malignancy; gasless laparoscopy

1. Introduction

Gynecological malignancies in elderly women remain an important global health concern, with patients often presenting comorbidities such as diabetes, hypertension, or cardiovascular diseases, making perioperative management complex and high-risk [1]. Gasless laparoscopy has gradually been applied in gynecological oncology surgery to

reduce cardiopulmonary load associated with conventional pneumoperitoneum, showing favorable outcomes. Multi-modal analgesic strategies have garnered attention in perioperative management; combining regional nerve blockade with comprehensive pharmacological therapy can reduce opioid usage and related complications [2]. Quadratus lumborum block provides posterior abdominal wall and visceral nerve blockade within a certain range, effectively alleviating postoperative incision and visceral pain. Current reports mostly focus on general laparoscopic or cesarean section populations, with insufficient systematic observation regarding this technique in elderly women undergoing gasless laparoscopic surgery for gynecological malignancies [3,4]. The holistic management approach emphasizing mind-body integration is advocated by enhanced recovery after surgery (ERAS) concepts. Psychological intervention effectively alleviates pre- and postoperative anxiety and depressive symptoms [5]. Cognitive-behavioral therapy and mindfulness training have demonstrated effectiveness in chronic pain, cancer rehabilitation, and psychosomatic disorders [6]; however, high-quality randomized controlled trials examining intervention strategies and clinical outcomes specifically for elderly women undergoing gynecological cancer surgery are lacking. Although some scholars have attempted integrating psychological interventions into comprehensive perioperative management, most studies lack standardized procedures or feasible follow-up schemes, complicating accurate assessment of the impact of cognitive-behavioral therapy and mindfulness training on postoperative recovery and psychological status improvement [7]. Previous literature predominantly addresses analgesic medications or single psychological interventions for elderly patient recovery, but evaluations involving both regional blockade and multidimensional psychological intervention simultaneously are scarce, and it remains unclear whether these interventions provide synergistic benefits or significantly reduce adverse reactions and improve quality of life [8]. Based on these clinical needs, this prospective randomized controlled trial evaluates the analgesic efficacy of quadratus lumborum block in elderly patients undergoing gasless laparoscopic surgery for gynecological malignancies, and assesses the additive effects of multidimensional psychological interventions on patients' emotional state and functional recovery. By comparing clinical outcomes following conventional analgesia and standard health education combined with these two intervention strategies, the study aims to reduce opioid dependence and enhance physical and psychological support, thus promoting further application of ERAS principles in elderly oncology surgery populations, expanding limitations inherent in previous single-intervention models, and providing a comprehensive perioperative management protocol applicable to more departments and patient populations.

2. Materials and methods

2.1. Study design and participants

This study is a single-center, prospective, randomized controlled clinical trial based on multimodal analgesia and the bio-psycho-social model guided by Enhanced Recovery After Surgery (ERAS) principles. Previous literature indicates that regional nerve blockade can effectively alleviate postoperative pain and reduce opioid use, while psychological interventions can improve patients' subjective perception of pain

and relieve anxiety and depressive symptoms [9]; combining the two might produce synergistic effects, further promoting postoperative functional recovery and overall comfort. Considering sample size and ethical considerations, this study has not set up independent “QLB-only” or “psychological intervention-only” groups. Instead, it mainly compares the effects of “quadratus lumborum block combined with multidimensional psychological interventions (cognitive behavioral therapy and mindfulness training)” on analgesia, psychological status, and functional recovery in elderly patients undergoing gasless laparoscopic surgery for gynecological malignancies, based on a control group receiving routine analgesia and standard health education. The study interventions and measurements are carried out continuously before and after surgery, lasting two years in total.

The study is jointly conducted by the Department of Gynecologic Oncology and the Department of Anesthesiology at No. 924 Hospital of PLA Joint Logistic Support Force. The study commenced in January 2022 and ended in January 2024. All surgeries are completed by the same gynecologic oncology surgical team, anesthesia and perioperative management are carried out by the same anesthesia team, and psychological interventions are performed by two licensed psychotherapy professionals. All study procedures have been reviewed and approved by the hospital’s medical ethics committee (Approval number: 2022-03).

The primary outcome measure is postoperative pain score at 24 h (Visual Analogue Scale, VAS). Based on the means and standard deviations of similar studies in previous literature, combined with pre-experimental data from our hospital, the significance level (α) was set at 0.05 (two-sided), power ($1-\beta$) was set at 0.80, assuming a difference of 1.0 point on the VAS scale between the two groups at 24 h with a standard deviation of 1.5 points. Sample size calculation using PASS software determined that at least 54 patients per group were required. Considering a potential dropout rate of 10%, each group planned to enroll 60 patients, totaling 120 cases.

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Female patients aged between 65 and 80 years; (2) diagnosed by histopathology and imaging with gynecological malignancies, including cervical cancer, endometrial cancer, or ovarian cancer, and assessed by the surgical evaluation team as suitable for gasless laparoscopic surgery; (3) American Society of Anesthesiologists (ASA) classification I, II, or III [10]; (4) without severe visual or auditory impairments, able to accurately understand and complete survey scales; (5) voluntarily participates in this study and signs written informed consent.

Exclusion criteria: (1) Known allergy to local anesthetics or related analgesic drugs; (2) severe mental disorders (requiring long-term hospitalization or psychiatric medication intervention) resulting in inability to cooperate with psychological intervention and scale assessments; (3) history of multiple major abdominal surgeries resulting in significantly abnormal abdominal anatomy, making safe and effective quadratus lumborum block impossible; (4) presence of coagulation disorders (significant thrombocytopenia or markedly prolonged prothrombin time) unsuitable for regional blockade; (5) other special conditions that prevent adherence to completing interventions or scale assessments during the study.

Withdrawal or dropout criteria: (1) Unable to continue participation due to severe intraoperative or postoperative complications requiring special treatment; (2) strong subjective patient desire to withdraw from the study; (3) occurrence of major events affecting research operational procedures during follow-up or intervention, leading to incomplete collection of evaluation data.

2.3. Randomization and blinding

After patient enrollment, the study coordinator uses computer software to generate a randomized numerical sequence from 1 to 120. These random numbers are individually sealed in opaque envelopes. After patients sign informed consent forms and their eligibility criteria are confirmed, the study coordinator immediately selects an envelope to allocate patients to the control or intervention group at a 1:1 ratio. To ensure the objectivity of observational outcomes, pain assessments and psychological scale evaluations are conducted by independent evaluators who are unaware of the grouping information, termed observer blinding. Anesthesiologists performing quadratus lumborum blocks and therapists conducting multidimensional psychological interventions are aware of the intervention contents but are not involved in postoperative data collection or outcome analyses.

2.4. Intervention measures

In this study, both the control and intervention groups received gasless laparoscopic surgery, conventional perioperative analgesia, and standard health education as the baseline treatment. Additionally, the intervention group underwent quadratus lumborum block (QLB) and multidimensional psychological interventions (cognitive behavioral therapy and mindfulness training). Since purely “placebo” psychological interventions (e.g., simple conversations without actual cognitive behavioral therapy or mindfulness training) are difficult to standardize operationally and may exert uncertain psychological effects on patients, and because the primary objective of this study is to compare against conventional perioperative management, the regimen of “conventional analgesia + standard health education” was ultimately determined as the control group approach.

2.4.1. Procedure for quadratus lumborum block

(1) After patients enter the operating room, connect them to an electrocardiogram monitor, non-invasive blood pressure cuff, and pulse oximetry device; (2) establish intravenous access and conduct routine anesthetic induction; (3) patients assume the supine position with both arms placed alongside the body; an ultrasound device (SonoSite M-Turbo, SonoSite, USA) is used to identify anatomical structures of the psoas major and quadratus lumborum muscles; (4) under ultrasound guidance, a disposable puncture needle (size 22G) is inserted into the fascial plane between the quadratus lumborum and psoas major muscles or posterior to the quadratus lumborum muscle fascia; (5) after negative aspiration confirming no blood or cerebrospinal fluid, inject 0.375% ropivacaine at a total volume of 20 mL per side, not exceeding the safe dose based on patient body weight (3 mg/kg); (6) After injection, continuously monitor blood pressure, heart rate, and oxygen saturation. If systolic blood pressure drops below 90 mmHg or heart rate decreases below 50 bpm, promptly administer

vasopressor medication or atropine; (7) after confirming the blockade level, maintain routine general anesthesia throughout surgery. If other conditions occur intraoperatively, manage accordingly based on clinical judgment, without affecting data recording related to blockade efficacy.

2.4.2. Multidimensional psychological intervention protocol

Multi-dimensional psychological intervention integrates cognitive behavioral therapy and mindfulness training [11], carried out by two individuals who have obtained nationally recognized psychotherapy licenses and received intensive training in cognitive behavioral therapy and mindfulness techniques prior to surgery. The training process includes theoretical lectures, practical demonstrations, and on-site exercises, with a focus on the identification and intervention of postoperative anxiety and pain. The research team compiled a standardized manual containing structured interview outlines, intervention procedures, language prompts, and evaluation forms, and applied it to each stage of the intervention. In order to ensure consistency in intervention content and methods among therapists, the team conducts a weekly case discussion or process supervision, promptly identifying and correcting any deviation from the procedures specified in the manual by reviewing interview recordings and patient feedback. Cognitive behavioral therapy focuses on identifying and correcting negative automatic thoughts, emotional regulation, deep breathing, and progressive muscle relaxation techniques. On the day before surgery, the therapist meets with the patient one-on-one to guide the patient in understanding the relationship between perioperative emotions and pain and formulating a coping plan, and on the first and second days after surgery, about 30 min of face-to-face communication is arranged again, during which cognitive restructuring and relaxation training are conducted according to the current psychological state. Mindfulness training involves demonstrating about 10 min of breathing awareness on the day before surgery, allowing the patient to become familiar with focusing on the breath, and after surgery, arranging two 10-minute mindfulness practice sessions each day, including body scanning and awareness of emotions or tension. The therapist or trained nurse provides one-on-one guidance in the ward and intervenes according to the processes and prompts outlined in the manual. To monitor patients' adherence to mindfulness practice in the ward or at home, patients are required to fill out a training record form or provide oral feedback after each practice; the therapist verifies completion during the next communication and records it in the intervention manual. In the study, the time of each intervention, the executor, and the patient's immediate response were also thoroughly documented to ensure intervention quality and reproducibility.

2.4.3. Gasless laparoscopic surgical procedure

Epidural combined with general anesthesia or total intravenous anesthesia is adopted. Anesthesiologists select appropriate maintenance medications based on patients' underlying conditions without using carbon dioxide insufflation. After surgical instruments are inserted into the abdominal cavity through the surgical incisions, a specialized retractor is utilized to achieve surgical field exposure. The surgical team performs tumor resection or radical surgery, with the scope and procedural steps determined by surgical indications. Intraoperative monitoring includes heart rate, blood pressure, respiration, and oxygen saturation;

anesthesiologists adjust anesthesia depth or administer vasoactive drugs in case of hemodynamic fluctuations. Drainage tubes are placed as needed after surgery; the abdominal wall incisions are closed, and surgical site hemostasis is verified.

2.4.4. Routine management

Routine analgesic regimen: Perioperative pain management involves opioids combined with non-steroidal anti-inflammatory drugs (NSAIDs). Ten minutes before the end of surgery, an appropriate dose of sufentanil is intravenously administered, and subsequently, patients are connected to a Patient Controlled Analgesia (PCA) pump. The PCA pump contains analgesic medications such as sufentanil and tramadol, with proportions and concentrations prepared according to hospital guidelines for pain management. Researchers record postoperative opioid consumption and adverse effects.

Routine health education: Prior to surgery, patients receive explanations about the surgical procedure, postoperative precautions, and the importance of appropriate physical activity. Patients are instructed to perform basic rehabilitation exercises and maintain emotional stability. This component does not include specialized cognitive behavioral therapy or mindfulness training, being limited to general, easily understood health education and hospitalization instructions.

2.5. Observation indicators and data collection

2.5.1. Primary observation indicators

Postoperative pain scores were measured using the Visual Analogue Scale (VAS) [12] at 6 h, 24 h, and 48 h postoperatively. The VAS uses a straight line measuring 10 cm in length, where 0 cm indicates no pain and 10 cm indicates extreme pain. The total opioid consumption within 48 h postoperatively (calculated as morphine-equivalent doses) and the number of additional requests made via the patient-controlled analgesia (PCA) pump were recorded. Opioid-related adverse reactions, including nausea, vomiting, pruritus, respiratory depression, and increased sedation, were also documented.

2.5.2. Secondary observation indicators

Anxiety status: Evaluated using the Self-Rating Anxiety Scale (SAS) [13]. The scale comprises 20 items scored from 1 to 4; the total score is multiplied by 1.25, and the integer portion of the result is recorded as the standardized score. A standardized score of ≤ 50 indicates no significant anxiety, scores of 50–59 indicate mild anxiety, 60–69 indicate moderate anxiety, and ≥ 70 indicate severe anxiety. Assessments were performed at 1 day preoperatively, and at 24 h and 48 h postoperatively.

Depression status: Evaluated using the Self-Rating Depression Scale (SDS). The scale similarly contains 20 items, with standard scores obtained by multiplying the total score by 1.25 and then rounding down to an integer. Standard scores of ≤ 53 indicate no significant depression, scores of 53–62 indicate mild depression, 63–72 moderate depression, and ≥ 72 severe depression.

Perioperative complications: Complications including poor wound healing, pulmonary infection, deep vein thrombosis, and cardiovascular events occurring during the perioperative period were recorded, along with the time of occurrence and treatment outcomes.

Functional recovery assessment: The total opioid consumption postoperatively (calculated in morphine-equivalent doses), the frequency of additional analgesic demands via PCA, and the incidence of opioid-related adverse reactions were documented. The timing and occurrence of complications and their management outcomes were recorded.

Quality-of-life assessment: Evaluated using the Short Form-36 Health Survey (SF-36) before hospital discharge [14]. The SF-36 consists of 36 items measuring health-related quality of life over eight domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. Scores range from 0 to 100, with higher scores indicating better quality of life in that domain.

2.6. Statistical methods

Patient data were independently entered by two research assistants. Data with normal distribution were expressed as mean and standard deviation, and comparisons between the two groups were conducted using independent-samples *t*-tests. Data with skewed distribution were presented as median and interquartile range, and comparisons between the two groups were conducted using Mann-Whitney *U* tests. The χ^2 test or Fisher's exact test was used for categorical data comparisons. Anxiety and depression levels were described using median and interquartile range for skewed data, with comparisons between groups performed using repeated Mann-Whitney *U* tests. The χ^2 test or Fisher's exact test was applied to categorical variables. All statistical analyses were performed using SPSS version 26.0 software.

3. Results

3.1. Baseline characteristics and surgery-related information of the two groups

Independent-samples *t*-tests showed no statistically significant differences in age, height, weight, and BMI between the control group and the intervention group ($P > 0.05$). Chi-square tests indicated no significant differences in ASA classification, comorbidities, tumor type, tumor stage, and history of previous surgeries (all $P > 0.05$), suggesting good baseline comparability between the two groups (Table 1). No statistically significant differences were observed between the two groups in surgical time, intraoperative blood loss, intraoperative fluid volume, and changes in body temperature (all tested by independent-samples *t*-test, $P > 0.05$). In addition, there were no significant differences between the two groups regarding the proportion of patients requiring vasoactive drugs intraoperatively, type of anesthesia, or placement of pelvic drainage tubes (tested by χ^2 test, all $P > 0.05$) (Table 2).

Table 1. Baseline characteristics and disease status of the two groups.

Indicator	Control Group ($n = 60$)	Intervention Group ($n = 60$)	Test Value	<i>P</i> -Value
Age (years)	68.45 $\pm$ 5.26	68.72 $\pm$ 5.12	$t = 0.254$	0.799
Height (cm)	158.62 $\pm$ 6.25	159.03 $\pm$ 6.17	$t = 0.337$	0.737
Weight (kg)	60.37 $\pm$ 6.42	61.52 $\pm$ 6.09	$t = 0.883$	0.379

Table 1. (Continued).

Indicator	Control Group (n = 60)	Intervention Group (n = 60)	Test Value	P-Value
BMI (kg/m ²)	23.98 ± 2.07	24.26 ± 2.14	$t = 0.656$	0.512
ASA classification (I/II/III)	12/38/10	13/36/11	$\chi^2 = 0.122$	0.941
Comorbidities (none/present)	20/40	22/38	$\chi^2 = 0.139$	0.709
Tumor type (cervical/endometrial/ovary)	26/20/14	24/21/15	$\chi^2 = 0.061$	0.970
Tumor stage (early/advanced)	35/25	34/26	$\chi^2 = 0.045$	0.832
Previous surgery (cases, %)	18 (30.00%)	15 (25.00%)	$\chi^2 = 0.392$	0.531

Table 2. Surgical and perioperative data (gasless laparoscopic surgery-related indicators).

Indicator	Control Group (n = 60)	Intervention Group (n = 60)	Test Value	P-Value
Surgery time (min)	137.54 ± 11.23	135.29 ± 10.18	$t = 0.694$	0.489
Intraoperative blood loss (mL)	158.47 ± 22.35	164.82 ± 23.14	$t = 0.860$	0.392
Intraoperative fluid volume (mL)	1574.36 ± 210.42	1590.67 ± 198.53	$t = 0.410$	0.682
Use of vasoactive drugs (cases, %)	14 (23.33%)	16 (26.67%)	$\chi^2 = 0.183$	0.668
Anesthesia maintenance method (TIVA/Inhalation/Epidural + GA)	28/20/12 (46.67%/33.33%/20.00%)	29/19/12 (48.33%/31.67%/20.00%)	$\chi^2 = 0.251$	0.882
Placement of pelvic drainage tube (cases, %)	50 (83.33%)	49 (81.67%)	$\chi^2 = 0.047$	0.827
Lowest intraoperative body temperature (°C)	36.10 ± 0.22	36.08 ± 0.19	$t = 0.471$	0.639
Highest intraoperative body temperature (°C)	37.45 ± 0.23	37.41 ± 0.26	$t = 0.681$	0.497

3.2. Postoperative pain and opioid usage

In the intervention group, VAS scores at each postoperative time point were lower than those in the control group, with the difference becoming more pronounced over time (repeated-measures analysis of variance, group $\times$ time interaction: $F = 6.245$, $P = 0.003$). Statistically significant differences between groups were observed at 24 and 48 h postoperatively (independent-samples t test, both $P < 0.05$) (**Figure 1A**). The total amount of opioids used within 48 h after surgery and the additional requests made via the patient-controlled analgesia (PCA) pump were both significantly lower in the intervention group than in the control group (both tested by independent-samples t test, both $P < 0.01$). The left Y-axis represents the total amount of opioid consumption, and the right Y-axis represents the number of PCA additional requests (**Figure 1B**).

3.3. Psychological status and functional recovery

Preoperatively, there were no statistically significant differences in anxiety (SAS) or depression (SDS) scores between the two groups (t test, both $P > 0.05$). At 24 and 48 h postoperatively, the differences between the two groups were statistically significant (t test, both $P < 0.05$), and these differences became increasingly pronounced over time (repeated-measures analysis of variance, group $\times$ time interaction: Anxiety $F = 5.432$, $P = 0.006$; depression $F = 5.432$, $P = 0.006$) (**Figure 2**). The time to get out of bed, first flatus, first bowel movement, and total hospitalization duration were all significantly shorter in the intervention group compared with the control group (using t test and Mann-Whitney U test, respectively, all $P < 0.05$) (**Table 3**).

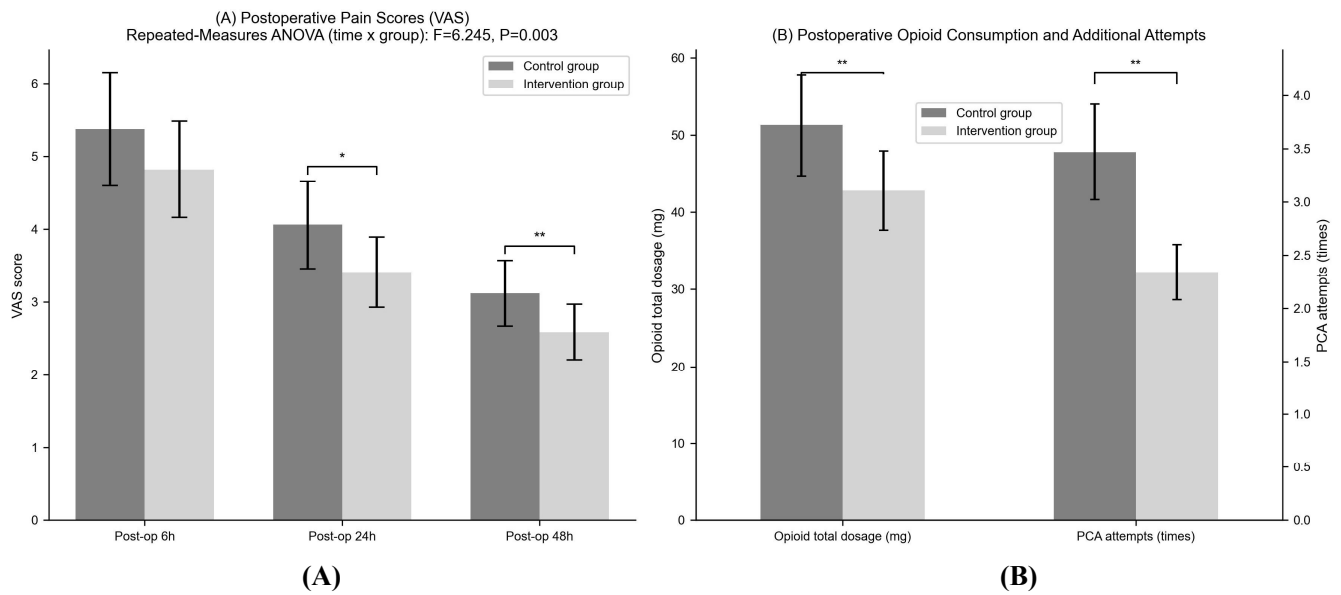


Figure 1. Effects of QLB with Psychological Intervention on Pain and Opioid Use **(A)** Changes in postoperative pain scores over time; **(B)** Postoperative opioid usage and number of additional PCA requests. Between-group comparisons were performed using independent-samples *t*-test (* $P < 0.05$, ** $P < 0.01$).

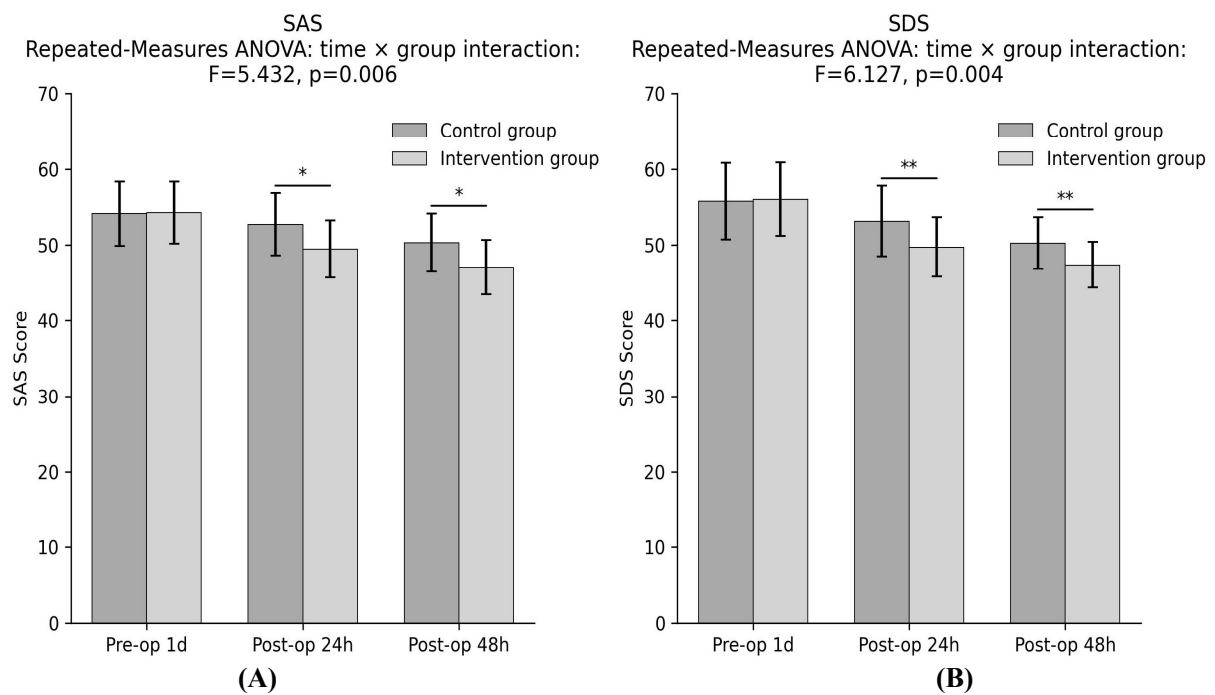


Figure 2. Postoperative anxiety (SAS) and depression (SDS) score comparisons. Between-group comparisons were performed using independent-samples *t*-test (* $P < 0.05$, ** $P < 0.01$).

Table 3. Comparison of functional recovery and length of hospital stay.

Indicator	Control Group ($n = 60$)	Intervention Group ($n = 60$)	Test Value	<i>P</i> -Value
Time to first postoperative ambulation (h)	28.41 ± 4.08	25.87 ± 3.44	$t = 2.361$	0.021
Time to first flatus (h)	$36.23 [32.04, 40.87]$	$33.14 [30.12, 35.75]$	$Z = 2.243$	0.025
Time to first bowel movement (h)	$50.69 [45.78, 54.51]$	$46.52 [42.25, 50.72]$	$Z = 2.561$	0.010
Length of hospital stay (days)	7.22 ± 1.02	6.71 ± 0.91	$t = 2.552$	0.012

3.4. Complications and quality of life

A comparison of the incidence of postoperative complications and adverse events between the two groups showed no statistically significant differences (χ^2 test or Fisher's exact test, all $P > 0.05$), suggesting that the interventions did not increase the risk of perioperative adverse events (**Table 4**). Scores on the SF-36 quality-of-life scale—specifically in the domains of physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health—were all significantly higher in the intervention group than in the control group (independent-samples t test, all $P < 0.05$), indicating that the intervention had a positive impact on patients' postoperative quality of life (**Figure 3**).

Table 4. Incidence of postoperative complications and adverse events.

Complication/Adverse Event Type	Control Group (cases, %)	Intervention Group (cases, %)	Test Value	<i>P</i> -Value
Nausea	8 (13.33%)	6 (10.00%)	$\chi^2 = 0.321$	0.571
Vomiting	4 (6.67%)	3 (5.00%)	$\chi^2 = 0.145$	0.703
Respiratory depression	2 (3.33%)	1 (1.67%)	Fisher's test	0.512
Hypotension (systolic BP < 90 mmHg)	5 (8.33%)	3 (5.00%)	$\chi^2 = 0.505$	0.477
Poor wound healing	2 (3.33%)	2 (3.33%)	Fisher's test	1.000
Infection	3 (5.00%)	2 (3.33%)	$\chi^2 = 0.210$	0.647
Cardiovascular events	1 (1.67%)	2 (3.33%)	Fisher's test	0.561
Deep vein thrombosis (DVT)	2 (3.33%)	1 (1.67%)	Fisher's test	1.000
Other serious adverse events	1 (1.67%)	1 (1.67%)	Fisher's test	1.000

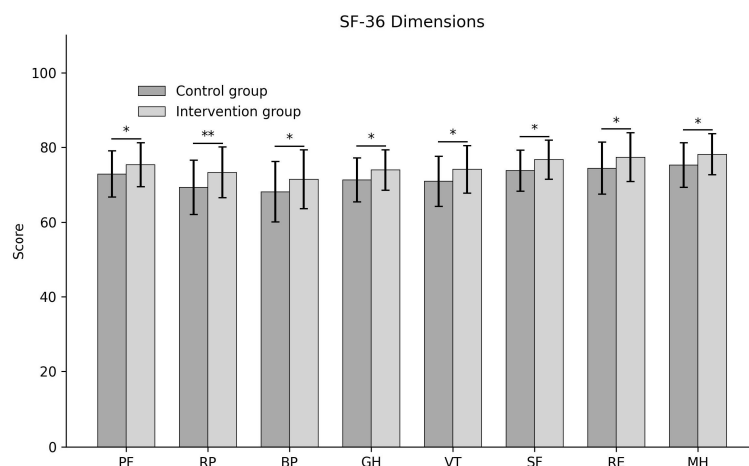


Figure 3. Comparison of SF-36 scores across different domains before discharge. Between-group comparisons were performed using independent-samples t -test (* $P < 0.05$, ** $P < 0.01$).

4. Discussion

This study found that patients who received quadratus lumborum block combined with multidimensional psychological interventions showed a significant advantage in early postoperative pain control, with the effect on pain reduction becoming more evident over time. Meanwhile, there was a marked decrease in postoperative opioid use and in additional requests for patient-controlled analgesia (PCA), suggesting that

this combined analgesic regimen has clear clinical benefits for postoperative pain management in elderly patients with gynecologic malignancies. Since elderly patients often have multiple comorbidities and reduced physiological reserve, excessive opioid usage can increase the risk of respiratory depression, nausea, vomiting, and postoperative delirium, as well as delay early ambulation and overall functional recovery [15]. Therefore, reducing opioid use has always been one of the key objectives in Enhanced Recovery After Surgery (ERAS). In this study, quadratus lumborum block was performed under ultrasound guidance for accurate localization, effectively achieving multi-segment abdominal sensory blockade and substantially alleviating both visceral and somatic pain resulting from laparoscopic surgery. This technique is convenient to perform, accurately targeted, and is particularly suitable for elderly patients, as it avoids the high technical demands of paravertebral block and the hemodynamic fluctuations often associated with epidural block [16]. Quadratus lumborum block offers a more stable and prolonged analgesic effect and is highly compatible with general anesthesia, allowing it to be seamlessly integrated into perioperative anesthesia and monitoring protocols for elderly patients. Previously, transversus abdominis plane block (TAPB) was commonly adopted as the main postoperative analgesic for laparoscopic procedures, but its coverage area is relatively limited, and its postoperative analgesic effect is not as robust as that of quadratus lumborum block [17]. The data in this study confirm that quadratus lumborum block combined with psychological interventions can effectively optimize postoperative analgesia strategies for elderly patients, warranting further promotion.

This study found that patients who received multidimensional psychological interventions exhibited significant improvements in postoperative anxiety and depression scores, with the differences progressively widening over time. This highlights the importance of proactive psychological regulation in alleviating postoperative psychological stress and promoting rehabilitative behavior. Cognitive behavioral therapy centers on correcting negative thought patterns by engaging patients in in-depth discussions and addressing excessive concerns about pain, surgical outcomes, or potential complications, thereby enhancing patients' sense of control over their health status and willingness to participate proactively in postoperative rehabilitation and self-management [18]. Mindfulness training fosters patients' awareness of their internal and physical sensations in the present moment, helping them to reduce negative perceptions during episodes of pain or discomfort by focusing on breathing and relaxation techniques, consequently lowering anxiety levels and pain sensitivity [19]. Elderly patients with gynecologic malignancies often face potential endocrine changes, multiple comorbidities, and concerns about body image or social roles, further compounded by perioperative psychological burdens. These factors impede postoperative functional recovery and increase the risk of anxiety and depression [20]. The results of this study show that multidimensional psychological interventions not only mitigated negative emotions but also enhanced overall compliance with rehabilitation, allowing patients to engage more actively in in-bed or out-of-bed exercises following pain relief. This, in turn, increased their trust in the treatment plan, without avoidance of necessary functional training due to fear of pain or complications. Baseline data indicated no differences in demographic characteristics or surgical methods between the two groups; under equivalent objective

conditions, the intervention group demonstrated superior psychological coping and postoperative cooperation, suggesting that the main benefits stemmed from the adjunctive effects of Cognitive behavioral therapy and mindfulness training. As patients' mindsets shifted and anxiety and depression levels decreased, stress responses likewise diminished, better maintaining internal homeostasis. This facilitates tissue repair and functional recovery and is of heightened clinical value in elderly populations [21]. Taken together with the observed postoperative functional recovery indicators, multidimensional psychological interventions can be regarded as a crucial component of this study's intervention protocol, providing a practical and clinically significant mind-body support regimen for elderly patients undergoing gynecologic surgery.

The results of this study indicate that the combined use of quadratus lumborum block and multidimensional psychological interventions not only significantly alleviates postoperative pain but also creates a better physiological and psychological environment for patients, enhancing their willingness and ability to engage in early mobilization. This approach has clinical significance in reducing time to ambulation, promoting the recovery of bowel function, and shortening hospitalization duration. Once patients' anxiety and depression are alleviated, they find it easier to cooperate with rehabilitation training and experience less fear of postoperative complications, effectively minimizing barriers that delay recovery [22]. The results suggest that the combined intervention does not increase surgical complications, providing safe and effective perioperative support for elderly patients with gynecologic malignancies. This method aligns well with Enhanced Recovery After Surgery principles, offering targeted analgesia and psychological support to achieve a more manageable overall treatment process, thereby improving patients' quality of life [23]. The data show that in domains such as physical functioning, role-physical, social functioning, and mental health, the combined intervention more prominently improves perceptions of health, indicating that synergy between pain management and emotional regulation can help maintain a more balanced internal environment. Clinically, this postoperative management pathway helps medical teams expedite patient progress and reduce bed turnover pressure without increasing risk. Postoperative efficacy evaluation should not be limited to pain scores but should also include comprehensive assessments of patients' psychological experiences, functional recovery, and overall quality of life, thus more thoroughly evaluating the clinical value of these interventions for elderly patients with gynecologic malignancies.

This study did not include a separate quadratus lumborum block group or a separate psychological intervention group in its design, making it impossible to quantify the independent contribution of each intervention and also limiting further analysis of their interaction effects. The sample size was confined to a single center; although it met statistical requirements, the potential differences in patient populations, surgical techniques, and perioperative nursing procedures among various medical institutions may affect the external validity of the results. To further enhance reproducibility and generalizability, future research could consider conducting multicenter trials in multiple hospitals across different geographic regions and medical environments, thereby better accounting for clinical practice variations and strengthening the external validity of the study. Although the study attempted to

balance baseline characteristics through strict inclusion and exclusion criteria and random grouping, employed the same anesthesia team, and adopted uniform surgical and intervention procedures while excluding severe mental disorders or significant cognitive impairment that could markedly influence pain and psychological outcomes, there remain unquantifiable differences in individual pain thresholds and patients' proactive acceptance of psychological interventions. For these hard-to-quantify differences in psychological adherence or pain thresholds, future research could consider using multivariate regression or subgroup analysis for more in-depth evaluation. Statistical estimates based on the primary outcome (24-hour postoperative pain scores) were sufficient for the study's requirements, but there is a risk of insufficient statistical power for detecting differences in multiple secondary outcomes (such as psychological status, functional recovery, and quality of life) involved in this study, necessitating cautious interpretation of related findings. The intervention protocol requires a certain allocation of psychotherapists and dedicated mindfulness training time; in clinical practice, departments often face personnel and financial constraints, and its value for broad promotion remains to be balanced. In resource-limited settings, how to assess the cost-effectiveness of this combined intervention also merits attention. Future research could consider conducting economic analyses to quantitatively compare the relationships among intervention expenses, personnel allocation, and clinical benefits, thereby providing more persuasive evidence for healthcare decision-makers. Despite these limitations, this study suggests that the combination of quadratus lumborum block and multidimensional psychological interventions can play a positive role in perioperative analgesia and rehabilitation management for elderly gynecologic malignancy patients, providing a basis for subsequent practice and exploration. This model is consistent with Enhanced Recovery After Surgery principles and offers insights for populations with high demands for postoperative pain control and psychological support. Future research could further refine the intervention process or compare different psychological intervention models, optimizing details such as intervention duration and training frequency. If this combined intervention can be extended to other surgical procedures or applied across various age groups, along with multidisciplinary collaboration to improve resource utilization, it may offer even broader prospects for clinical application.

5. Conclusions

This study indicates that quadratus lumborum block combined with multidimensional psychological interventions can effectively improve postoperative pain, anxiety, and depression in elderly patients undergoing gasless laparoscopic surgery for gynecologic malignancies, reduce postoperative opioid requirements, expedite functional recovery, and enhance overall quality of life, without increasing the risk of perioperative adverse events. This combined regimen is safe and effective, aligns with Enhanced Recovery After Surgery principles, and holds promising clinical application prospects and value for wider promotion.

Author contributions: Conceptualization, HW and JT; methodology, SM; software, RZ; validation, HL, YH and HW; formal analysis, DW; investigation, JT; resources, SM; data curation, RZ; writing—original draft preparation, XZ; writing—review and editing, DW; visualization, HL; supervision, YH; project administration, XZ; funding acquisition, XZ. All authors have read and agreed to the published version of the manuscript.

Ethical approval: The study was approved by Ethics Committee of No. 924 Hospital of PLA Joint Logistic Support Force, approval number is 2022-03. The date of approval is December, 2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflict of interest: The authors declare no conflict of interest.

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