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Meta analysis of ultrasound-guided lumbar quadratus muscle block and traditional lumbar quadratus muscle block for postoperative pain relief and adverse reactions in abdominal surgery

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Abstract: *The purpose of this article is to compare the analgesic effects and adverse reactions of ultrasound-guided quadratus lumborum block (QLB) and traditional QLB in abdominal surgery patients using meta-analysis and systematic evaluation methods.Computer searches were conducted on PubMed, Embase, Ovid, Web of Science, Cochrane Library, CNKI, VIP Database, Wanfang Database, and China Biomedical Full text Database. The search was conducted from the establishment of the database to January 10, 2024. A randomized controlled trial (RCT) was conducted to compare the analgesic effects of ultrasound-guided QLB on the arcuate ligament and traditional QLB on abdominal surgery. The main outcome measure was the resting and motor pain scores at 1, 2, 4, 6, 8, 12, 24, and 48 hours postoperatively. The secondary outcome measures were intraoperative remifentanil and postoperative 24-hour morphine use; the number of cases of salvage analgesia and the time of first press of the analgesic pump within 24 hours after surgery; the incidence of postoperative nausea, vomiting, and itching; first time out of bed, first exhaust time, length of hospital stay, and satisfaction score. Perform statistical analysis on the data using RevMan 5.4 software. A total of 7 RCT studies were included, with a total of 514 cases, including 256 cases in the QLB group on the arcuate ligament under ultrasound guidance (experimental group) and 258 cases in the traditional QLB group under ultrasound guidance (control group). The results of Meta-analysis showed that compared with the control group, the resting pain scores at 1h after surgery (MD=-0.90, 95%CI -1.00--0.81, P<0.00001), 2h after surgery (MD=-0.81, 95%CI -1.32--0.29, P=0.002), 4h after surgery (MD=-0.27, 95%CI -0.40--0.15, P<0.00001), 6h after surgery (MD=-0.40, 95%CI -0.70--0.10, P=0.009), 8h after surgery (MD=-0.55, 95%CI -0.76--0.34, P<0.00001), 12h after surgery (MD=-1.13, 95%CI -1.26-0.99, P<0.00001), 24h after surgery (MD=-0.61, 95%CI -0.74-0.48, P<0.00001), 2h after surgery (MD=-0.39, 95%CI -0.61--0.17, P=0.004), 24h after surgery (MD=-0.21, 95%CI -0.38-0.05, P=0.01), intraoperative consumption of remifentanil (MD=-0.13, 95%CI -0.24--0.03, P=0.01), 24h after surgery consumption of morphine (MD=10.91, 95%CI -12.68--9.14, P<0.00001), incidence of postoperative nausea and vomiting (RR=0.45, 95%CI 0.24-0.83, P=0.01), first time out of bed (MD=-1.16, 95%CI -1.56--0.75, P<0.00001), first time exhaust time (MD=14.00, 95%CI 13.54-14.47, P<0.00001), first time pressing time of analgesia pump (MD=4.01, 95%CI 3.04-4.97, P<0.00001), and satisfaction score (MD=-1.09, 95%CI -1.42--0.76, P<0.00001) in the experimental group were significantly decreased; the first time pressing time of analgesia pump (MD=4.01, 95%CI 3.04-4.97, P<0.00001) and satisfaction score (MD=-1.09, 95%CI -1.42--0.76, P<0.00001) were significantly increased. There was no significant difference in resting pain score 48 h after surgery (MD=-0.00, 95%CI -0.00-0.00, P=0.76), exercise pain score 4 h after surgery (MD=-0.00, 95%CI -0.00--0.00, P=1.00), exercise pain score 6 h after surgery (MD=-0.28, 95%CI -0.59--0.02, P=0.07), exercise pain score 8 h after surgery (MD=-0.03, 95%CI -0.32-0.26, P=0.84), exercise pain score 12 h after surgery (MD=-0.16, 95%CI -0.35-0.03, P=0.11), exercise pain score 48 h after surgery (MD=-0.00, 95%CI -0.25-0.25, P=0.97), number of cases requiring rescue analgesia 24 h after surgery (RR=0.55, 95%CI 0.28-1.08, P=0.08), incidence of postoperative pruritus (RR=0.83, 95%CI 0.25-2.78, P=0.76), satisfaction score (MD=-1.09, 95%CI -1.42--0.76, P<0.00001) and length of hospital stay (MD=0.00, 95%CI -0.24--0.24, P=1.00) between the two groups. Existing evidence suggests that ultrasound-guided QLB on the arcuate ligament is more effective than traditional QLB for postoperative pain relief in abdominal surgery, while accelerating rapid postoperative recovery without increasing the incidence of adverse reactions.*

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Keywords: *Ultrasound; Arched ligament; Lumbar quadratus muscle block; Abdominal surgery; Meta analysis*

1. Introduction

The large trauma caused by abdominal surgery, the impact of surgical procedures on intestinal motility, combined with abdominal wall incision injuries, visceral traction reactions, etc., can lead to the release of inflammatory factors in large quantities, causing severe postoperative pain. Opioid analgesics commonly used after surgery [1] have adverse reactions such as inhibiting intestinal peristalsis, nausea and vomiting, and respiratory depression, which are not conducive to the recovery of patients undergoing abdominal surgery. Multiple enhanced recovery after surgery (ERAS) protocols [2-3] recommend the use of multimodal analgesia strategies, with nerve block being an important component. Ultrasound guided lumbar block (QLB) is widely used for postoperative pain relief in abdominal surgery due to its excellent pain sensation blocking effect and high safety. According to current research, QLB has four pathways [4-5]: QLB1 (lateral pathway), QLB2 (posterior pathway), QLB3 (anterior pathway), and QLB4 (intramuscular). Except for QLB4, which is not widely used in clinical practice, the other three traditional approaches are widely used for perioperative analgesia. Quadratus lumborum block at the lateral superior ligament (QLB-LSAL) is a new blocking approach proposed by Li et al. in 2020[6]. It belongs to QLB3 and is gradually used for postoperative abdominal pain relief, similar to QLB that penetrates the lateral arcuate ligament. Due to the short clinical application time of QLB-LSAL, the difference in analgesic effect compared to other traditional QLB approaches is unclear, and there is no consensus on adverse reactions. Therefore, this study intends to conduct a meta-analysis of randomized controlled trials (RCTs) that have been completed both domestically and internationally, and screen literature that meets quality standards. The aim is to systematically evaluate and compare the analgesic effects and adverse reactions of QLB-LSAL and traditional QLB in patients undergoing abdominal surgery, in order to provide reference for clinical practice.

2. Materials and Methods

2.1 Data Sources and Retrieval Strategies

A systematic review was conducted on the analgesic effects and adverse reactions of ultrasound-guided QLB on the arcuate ligament and traditional QLB after abdominal surgery according to the PRISMA principle. Two researchers independently searched English databases such as PubMed, Embase, Ovid, Web of Science, Cochrane Library, as well as Chinese databases such as CNKI, VIP, Wanfang, and China Biomedical Full text Database to search for published randomized controlled studies comparing RLB and EPSB for postoperative analgesia in abdominal surgery. The retrieval time is from the establishment of each database to January 2024. Chinese search terms include ultrasound, ultrasound-guided ultrasound, B-ultrasound, arcuate ligament, lumbar quadratus block, open surgery, and laparoscopy. The English search terms include ultrasonic guided, ultrasonic, type-b ultrasonic, acute ligament, quadratus lumbar block, laparotomy, and laparoscopy. Follow the requirements of Cochrane Collaboration Network for literature search.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria: ① Study subjects: Patients undergoing abdominal surgery, regardless of race, age, gender, height, or weight; ② Intervention measures: Comparison of two nerve blockade methods, QLB and traditional QLB, on the arcuate ligament under ultrasound guidance; ③ Research type: Randomized controlled trial (RCT); ④ Main outcome measures: Pain scores in resting and moving states at 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 12 hours, 24 hours, and 48 hours postoperatively; ⑤ Secondary outcome measures: Intraoperative use of remifentanil and postoperative 24-hour morphine, number of cases of salvage analgesia and time of first press of analgesic pump after surgery, incidence of postoperative nausea, vomiting, itching, first time out of bed, first time to exhaust gas, length of hospital stay, and satisfaction score.Exclusion criteria: ① Case reports, reviews, or conference papers; ② Non RCT; ③ Unable to obtain full text, unable to extract data, and duplicate published research; ④ Animal experimental research; ⑤ Corpse experimental research.

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2.3 Literature screening and quality evaluation

Firstly, by using the Cochran Handbook risk bias assessment tool (https://www.cochrane.org) evaluate the methodological quality of the included literature [7]. The evaluation content mainly includes: random sequence generation, allocation concealment, double-blind trial subjects and researchers, blind evaluation of research outcomes, completeness of outcome data, selective reporting of research results, and other biases. Each evaluation content is divided into low bias, unclear bias risk, or high bias risk. Two independent researchers strictly followed the inclusion and exclusion criteria to independently screen and evaluate the quality of the retrieved literature. In case of disagreement, the third independent researcher reviewed and discussed to determine the final result. In order to obtain more complete raw data, contact the corresponding author if necessary. Data extraction: Name and publication year of the first author, sample size, age, gender, BMI, ASA grading, surgical type, surgical time, traditional lumbar block type, local anesthetic dosage, primary and secondary indicators, etc.

2.4 Statistical analysis

Using the Rev Man 5.4 software provided by the international Cochrane collaboration network (https://www.cochrane.org/)Perform statistical analysis on the data. Quantitative data is represented by mean difference (MD) and its 95% confidence interval (CI). The binary variable is represented by the relative risk (RR) and its 95% CI to indicate its effect size. Use Q-test and I2 test to evaluate heterogeneity between studies. When $P>0.1$, $I^2 <$ At 50%, it is considered that the heterogeneity of the results is small, and a fixed effects model is used for analysis; On the contrary, it is considered that there is heterogeneity in the results, and a random effects model is used for analysis. If $P<0.05$, it is considered that the difference has reached a significant level. Use funnel plots to visually determine publication bias, and if necessary, conduct sensitivity analysis to explore the stability of the results. For quantitative data represented by median and interquartile spacing or full sample range, if there is no response from the original author, an online calculator with compiled formulas by Wan et al. [8] and Luo et al. [9] should be used(http://www.math.hkbu.edu.hk/ ~Convert tongt/papers/median2mean. HTML to standard deviation. When the research data is only presented in images and there is no response from the original author, Web Plot Digitizer is used to extract the data [10].

3. Results

3.1 Literature search results

42 articles were initially retrieved, and after layer by layer screening, 7 articles were ultimately included, including 4 Chinese articles and 3 English articles, with a total of 514 patients. See Figure 1.

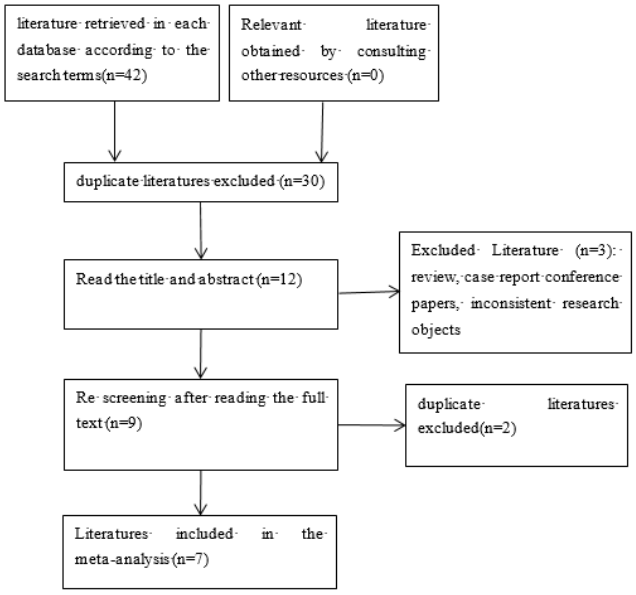

Figure 1: Flow chart of literature screening

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3.2 Basic information and risk assessment of bias included in the literature.

The basic characteristics of the included literature are shown in Table 1; The risk assessment of literature bias is shown in Figure 2.

Table 1: Basic characteristics of included studies

literature	sample size		Age (years)		Gender (male/female)		BMI(kg/cm^2)		ASA classification (Level I/II/III)		Surgical type	operative time（min）		Local anesthetic dosage		Outcome indicators	
	Experimental group	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group	Control group		Experimental group	Control group	Experimental group	Control group	Experimental group	Control group
Li H 2021[11]	48	48	57.1 ± 11.7	53.0 ±13.8	27/21	21/27	25.6 ±2.6	24.7 ± 2.5	42/6	40/8	Laparoscopic nephrectomy			0.5% ropivacaine 25 mL	0.5% ropivacaine 25 mL	1、4、6-9、12、14-16、18-19、21-22、26	
Cai M 2022[12]	19	19	48. 8±2. 8	51. 3±5. 1	0/19	0/19	23. 4±2. 3	23. 6±2. 9	19/0	19/0	Laparoscopic total	151. 8±28. 1	134. 5±34. 8	0. 3% ropivacaine 20 ml	0. 3% ropivacaine 20 ml	2、4、6-8、10、12、14-16、21、25	
Guo M2022[13]	46	46	32.7 ± 3.6	31.7 ± 4.6	0/46	0/46	27.9 ± 4.6	27.4 ± 6.5	42/4	43/3	Cesarean section	43.2 ± 6.8	41.5 ± 8.3	0.375% ropivacaine 20 mL	0.375% ropivacaine 20 mL	3、5-7、11、13-15、19、21-22、26	
Li YM 2023[14]	42	42	47.37 ± 12.95	44.88± 12.39	14/28	17/25	24.32±2.64	23.63 ± 4.09	42/0	42/0	Laparoscopic cholecystectomy	70.24 ±17.21	65.71 ± 13.28	0.375% ropivacaine 20 mL	0.375% ropivacaine 20 mL	2-3、5-7、10-11、13-15、21-24	
Sun J 2023[15]	29	30	65.61±0.21	65.58±0.19	18/12	17/13	23.1±2.0	23.2±2.1	29/0	30/0	radical nephrectomy	262.9±61.1	277.1±77.1	0. 3% ropivacaine 20 ml	0. 3% ropivacaine 20 ml	1、6-8、17、19、21、23、25	
Li X 2023[16]	39	39	60.33 ± 8.48	62.88 ± 9.99	25/14	23/16	22.95 ± 1.93	23.04 ± 1.97	39/0	39/0	Laparoscopic radical resection of rectal cancer	196.98 ± 35.91	192.78 ± 27.61	0. 375% ropivacaine 20 ml	0. 375% ropivacaine 20 ml	2、4、6-8、10、12、14-17、20-21、23-24	
Shi R 2024[17]	33	34	62.6±11.0	66.2±9.2	21/12	23/11	24.2±4.0	25.0±3.5	25/8	27/7	Laparoscopic radical resection of colorectal cancer	179 (153–229)	182 (146–237)	0.375% ropivacaine 0.3 mL/Kg	0.375% ropivacaine 0.3 mL/Kg	1、4、6-7、9、12、14-15、17-21、26	

1, 2, 3, 4, 5, 6, 7 and 8 were the resting state pain scores at 1H, 2h, 4h, 6h, 8h, 12h, 24h and 48h after operation, respectively; 9. 10, 11, 12, 13, 14, 15 and 16 were the pain scores of motor state at 1H, 2h, 4h, 6h, 8h, 12h, 24h and 48h after operation, respectively; 17. 18 were the amount of remifentanil used during operation and the amount of morphine used 24 hours after operation; 19. 20 are the number of rescue analgesia cases and the first press time of analgesic pump 24 hours after operation, respectively; 21 and 22 are the incidence of postoperative nausea, vomiting and pruritus respectively; 23, 24, 25 and 26 were the first time out of bed, the first exhaust time, the length of hospital stay and satisfaction score, respectively.

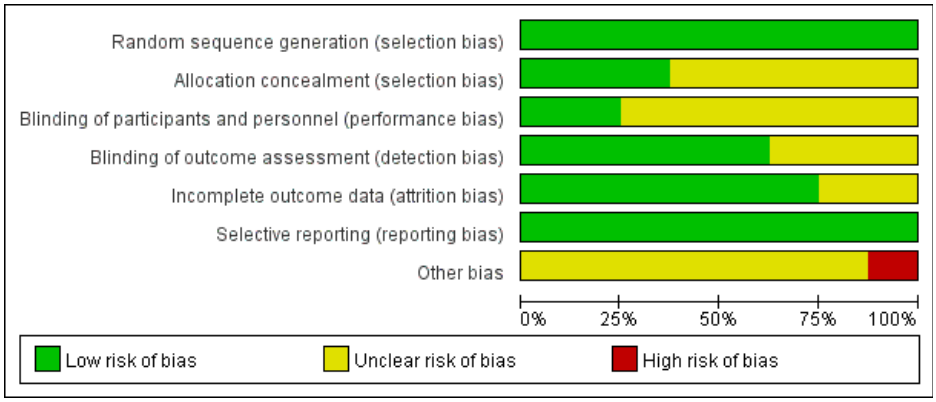

Figure 2: Bias Risk Assessment Chart

3.3 Meta analysis results

3.3.1 Resting state pain scores at different time points after surgery for two groups of patients

Three articles [11, 15, 17] compared the resting state pain scores at 1 hour post surgery, with no significant heterogeneity (I2=53%, P=0.12). Using a fixed effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group at 1 hour post surgery (MD=-0.90, 95% CI -1.00 to -0.81, P<0.0001) (Figure 3-A). Three articles [12, 14, 16] compared the resting state pain scores at 2 hours post surgery, with no significant heterogeneity (I2=0%, P=0.88). Using a fixed effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group at 2 hours post surgery (MD=-0.81, 95% CI -1.32-0.29, P=0.002) (Figure 3-B). Two studies [13-14] compared the resting state pain scores at 4 hours after surgery, with no significant heterogeneity (I2=0%, P=0.89). Using a fixed effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group at 4 hours after surgery (MD=-0.27, 95% CI -0.40-0.15, P<0.0001) (Figure 3-C). Four articles [11-12, 16-17] compared the resting state pain scores at 6 hours post surgery, showing significant heterogeneity (I2=64%, P=0.04). Using a random effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group at 6 hours post surgery (MD=-0.40, 95% CI -0.70-0.10, P=0.009) (Figure 3-D). Two studies [13-14] compared the resting state pain scores at 8 hours after surgery, showing significant heterogeneity (I2=76%, P=0.04). Using a random effects model, meta-analysis results showed that the resting state pain scores at 8 hours after surgery in the experimental group were significantly lower than those in the control group (MD=-0.55, 95% CI -0.76-0.34, P<0.0001) (Figure 3-E). Seven articles [11-17] compared the

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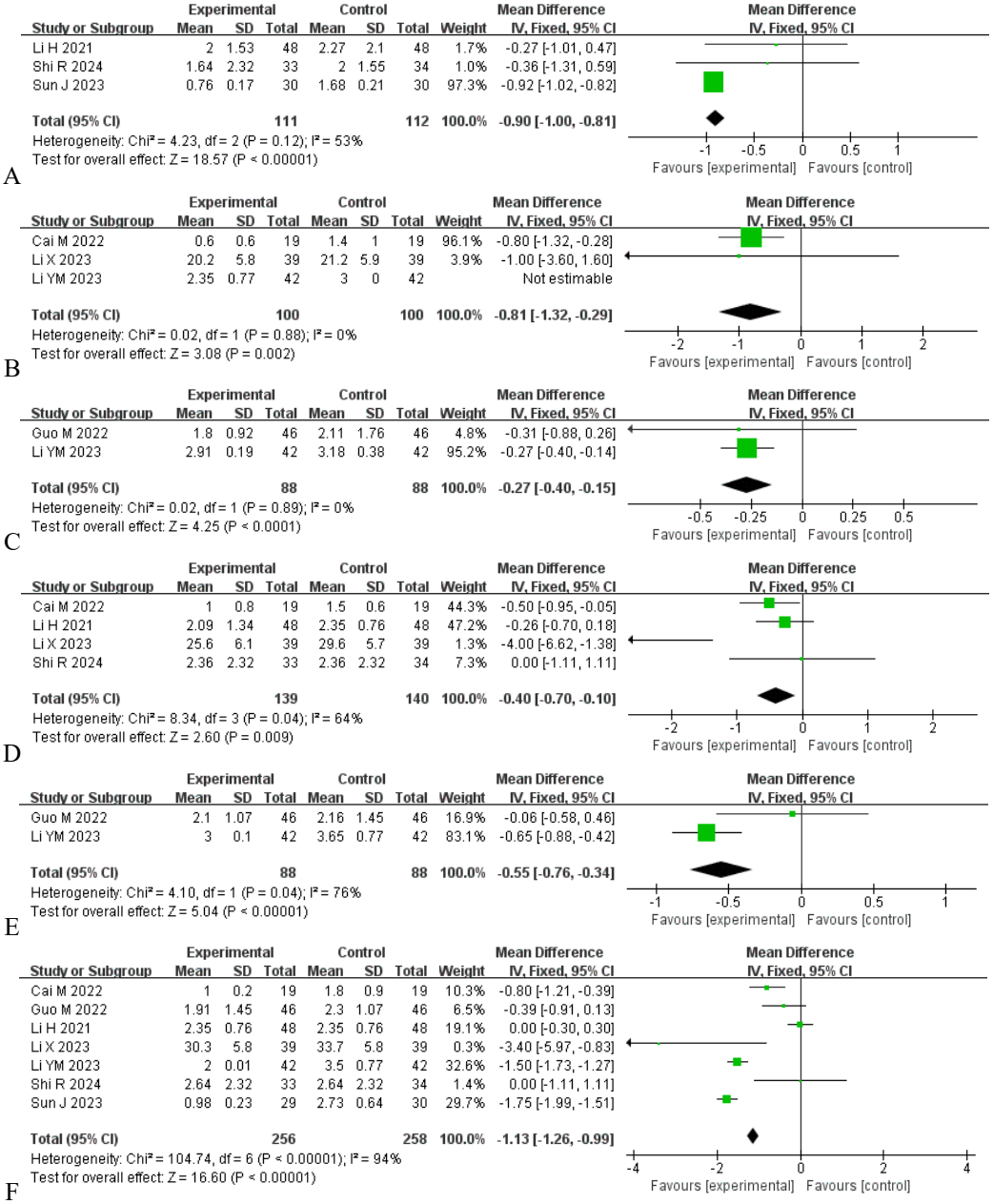
resting state pain scores at 12 hours post surgery, showing significant heterogeneity (I2=94%, P<0.0001). Using a random effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group at 12 hours post surgery (MD=-1.13, 95% CI -1.26-0.99, P<0.0001) (Figure 3-F). Seven articles [11-17] compared the resting state pain scores at 24 hours after surgery, showing significant heterogeneity (I2=91%, P<0.0001). Using a random effects model, meta-analysis results showed that the resting state pain scores in the experimental group were significantly lower than those in the control group (MD=-0.61, 95% CI -0.74-0.48, P<0.0001) (Figure 3-G). Four articles [11-12, 15-16] compared the resting state pain scores at 48 hours post surgery, showing significant heterogeneity (I2=99%, P<0.0001). Using a random effects model, meta-analysis results showed no statistically significant difference in resting state pain scores between the two groups of patients at 48 hours post surgery (MD=-0.00, 95% CI -0.00-0.00, P=0.76) (Figure 3-H).



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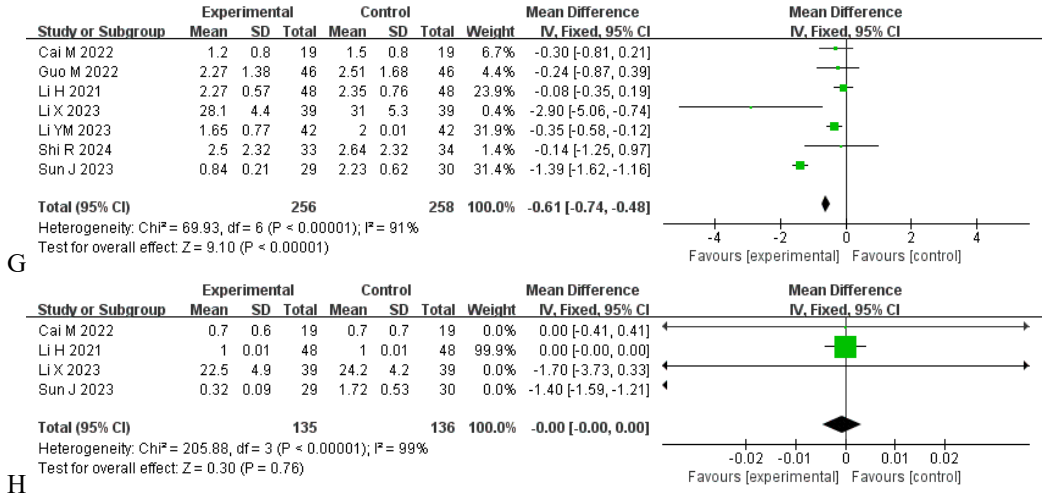
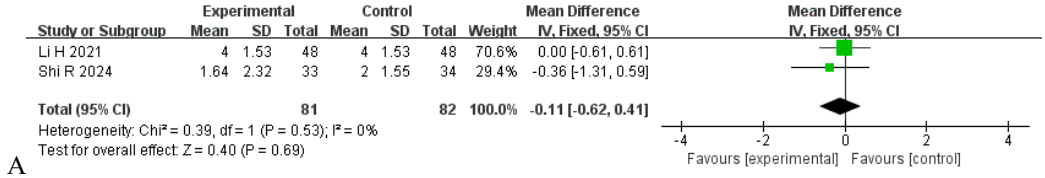


Figure 3: Resting state pain scores at different time points after surgery

3.3.2 Postoperative pain scores of two groups of patients at different time points

Two articles [11, 17] compared the postoperative 1-hour motor state pain scores without significant heterogeneity (I2=0%, P=0.53). Using a fixed effects model, meta-analysis results showed no statistically significant difference in the postoperative 1-hour motor state pain scores between the two groups of patients (MD=-0.11, 95% CI -0.62-0.41, P=0.69) (Figure 4-A). Three articles [12, 14, 16] compared the postoperative 2-hour motor state pain scores without significant heterogeneity (I2=0%, P=0.49). Using a fixed effects model, meta-analysis results showed that the experimental group had significantly lower postoperative 2-hour motor state pain scores than the control group (MD=-0.39, 95% CI -0.61-0.17, P=0.0004) (Figure 4-B). Two articles [13-14] compared the postoperative 4-hour motor state pain scores without significant heterogeneity (I2=7%, P=0.30). Using a fixed effects model, the meta-analysis results showed no statistically significant difference in the postoperative 4-hour motor state pain scores between the two groups of patients (MD=-0.00, 95% CI -0.00-0.00, P=1.00) (Figure 4-C). Four articles [11-12, 16-17] compared the postoperative 6-hour motor state pain scores without significant heterogeneity (I2=57%, P=0.07). Using a fixed effects model, meta-analysis results showed that there was no statistically significant difference in the postoperative 6-hour motor state pain scores between the two groups of patients (MD=-0.28, 95% CI -0.59-0.02, P=0.07) (Figure 4-D). Two studies [13-14] compared the postoperative 8-hour motor state pain scores, showing significant heterogeneity (I2=0%, P=0.73). Using a random effects model, meta-analysis results showed no statistically significant difference in the postoperative 8-hour motor state pain scores between the two groups of patients (MD=-0.03, 95% CI -0.32-0.26, P=0.84) (Figure 4-E). Six articles [11-14, 16-17] compared the postoperative 12 hour motor state pain scores, showing significant heterogeneity (I2=60%, P=0.03). Using a random effects model, meta-analysis results showed no statistically significant difference in the postoperative 12 hour motor state pain scores between the two groups of patients (MD=-0.16, 95% CI -0.35-0.03, P=0.11) (Figure 4-F). Six articles [11-14, 16-17] compared postoperative 24-hour motor state pain scores without significant heterogeneity (I2=29%, P=0.22). Using a fixed effects model, meta-analysis results showed that the experimental group had significantly lower postoperative 24-hour motor state pain scores than the control group (MD=-0.21, 95% CI -0.38-0.05, P=0.01) (Figure 4-G). Three articles [11-12, 16] compared the postoperative pain scores at 48 hours and showed no significant heterogeneity (I2=0%, P=0.96). Using a fixed effects model, meta-analysis results showed no statistically significant difference in pain scores at 48 hours between the two groups of patients (MD=-0.00, 95% CI -0.25 to 0.25, P=0.97) (Figure 4-H).



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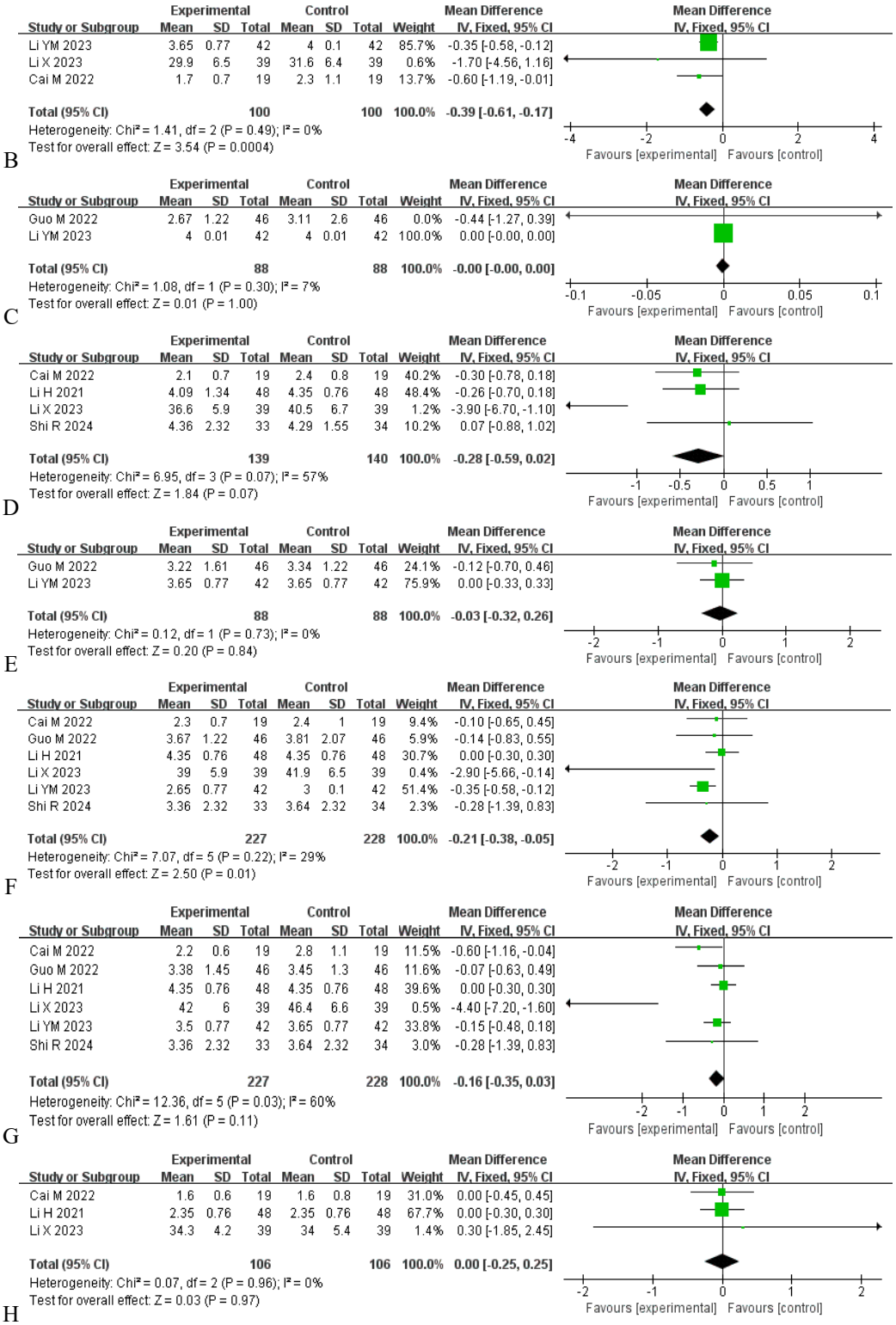

Figure 4: Postoperative pain scores at different time points during exercise

3.3.3 Other analgesic needs during the perioperative period

Three studies [15-17] compared the intraoperative fentanyl dosage without significant heterogeneity (I2=0%, P=0.70). Using a fixed effects model, meta-analysis results showed that the intraoperative fentanyl dosage in the experimental group was significantly lower than that in the control group (MD=-0.13, 95% CI -0.24-0.03, P=0.01) (Figure 5-A). Two articles [11, 17] compared the postoperative 24-hour morphine dosage without significant heterogeneity (I2=0%, P=0.82). Using a fixed effects model, the meta-analysis results showed that the postoperative 24-hour morphine dosage in the

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experimental group was significantly lower than that in the control group (MD=10.91, 95% CI -12.68-9.14, P<0.0001) (Figure 5-B). Four articles [11, 13-14, 17] compared the number of cases of postoperative 24-hour salvage analgesia without significant heterogeneity (I2=24%, P=0.27). Using a fixed effects model, meta-analysis results showed no statistically significant difference in the number of cases of postoperative 24-hour salvage analgesia between the two groups of patients (RR=0.55, 95% CI 0.28-1.08, P=0.08) (Figure 5-C). Two studies [16-17] mentioned significant heterogeneity in the first press time of the analgesic pump 24 hours after surgery (I2=96%, P<0.0001). Using a random effects model, meta-analysis results showed that the experimental group had a significantly longer first press time of the analgesic pump 24 hours after surgery than the control group (MD=4.01, 95% CI 3.04-4.97, P<0.0001) (Figure 5-D).

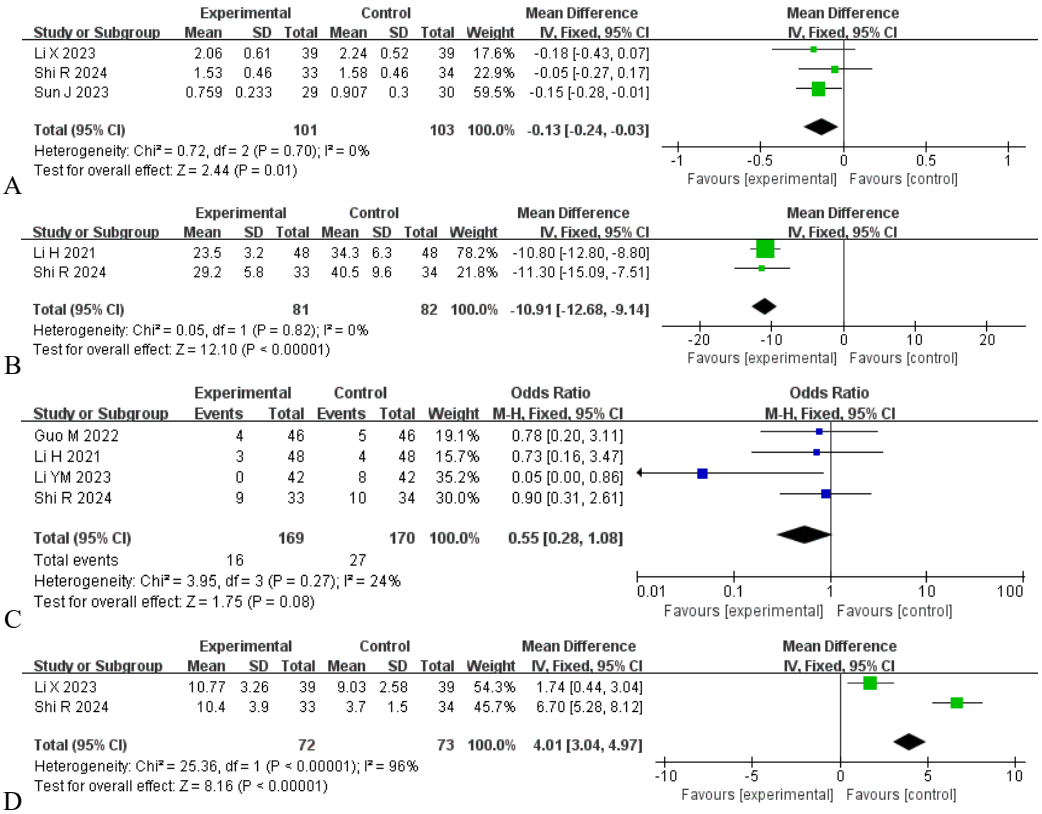
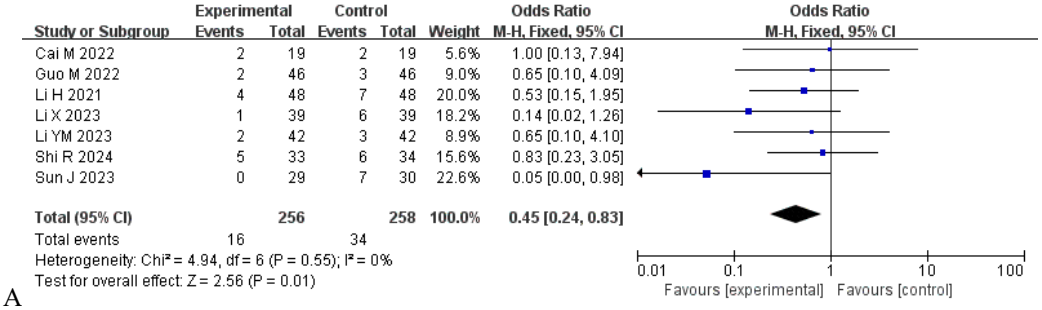


Figure 5: Other analgesic needs during the perioperative period

3.3.4 Incidence of postoperative adverse reactions

Seven studies [11-17] mentioned the incidence of postoperative nausea and vomiting without significant heterogeneity (I2=0%, P=0.55). Using a fixed effects model, meta-analysis results showed that the incidence of postoperative nausea and vomiting in both groups of patients was significantly lower than that in the control group (RR=0.45, 95% CI 0.24-0.83, P=0.01) (Figure 6-A). Three studies [11,13-14] mentioned the incidence of postoperative itching without significant heterogeneity (I2=0%, P=0.88). Using a fixed effects model, meta-analysis results showed no statistically significant difference in postoperative itching incidence between the two groups of patients (RR=0.83, 95% CI 0.25-2.78, P=0.76) (Figure 6-B).



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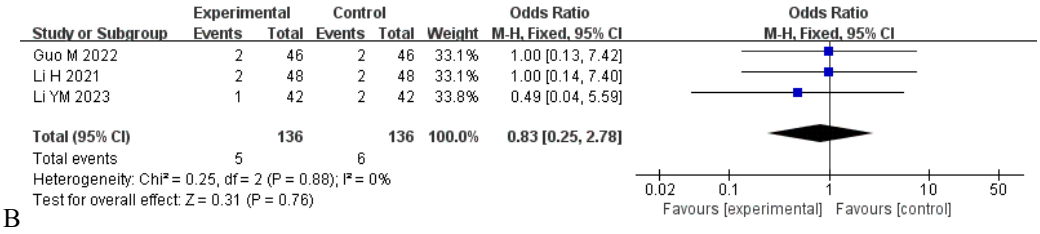
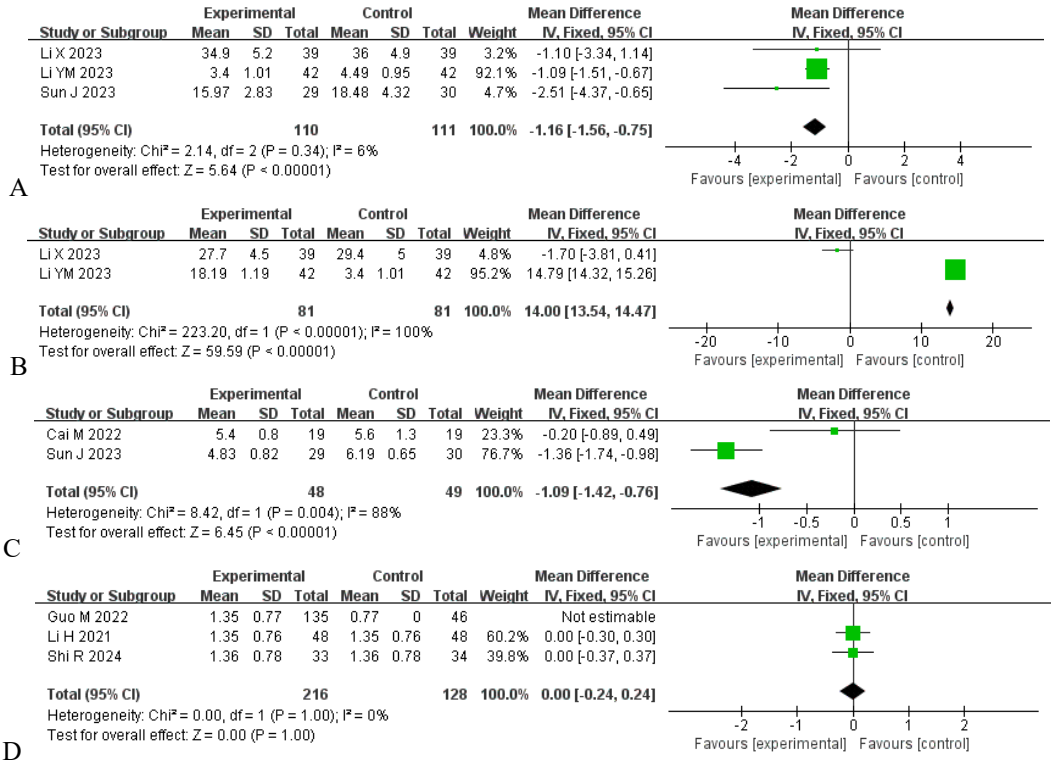


B

Figure 6: Incidence of postoperative adverse reactions

3.3.5 Postoperative recovery indicators

Three studies [14-16] mentioned the first time of getting out of bed, with no significant heterogeneity (I2=6%, P=0.34). Using a fixed effects model, meta-analysis results showed that the experimental group had a significantly shorter first time of getting out of bed than the control group (MD=-1.16, 95% CI -1.56-0.75, P<0.0001). (Figure 7-A). Two studies [14,16] mentioned significant heterogeneity in the first exhaust time (I2=6%, P=0.34). Using a random effects model, meta-analysis results showed that the experimental group had significantly shorter first exhaust time than the control group (MD=14.00, 95% CI 13.54-14.47, P<0.0001) (Figure 7-B). Two studies [12,15] mentioned satisfaction scores with significant heterogeneity (I2=88%, P=0.004). Using a random effects model, meta-analysis results showed that the satisfaction scores of the experimental group were significantly higher than those of the control group (MD=-1.09, 95% CI -1.42-0.76, P<0.0001) (Figure 7-C). Three studies [11, 13, 17] mentioned hospitalization time without significant heterogeneity (I2=0%, P=1.00). Using a fixed effects model, meta-analysis results showed no statistically significant difference in hospitalization time between the two groups of patients (MD=0.00, 95% CI -0.24-0.24, P=1.00) (Figure 7-D).



A

B

C

D

Figure 7: Postoperative recovery indicators

3.3.6 Publication bias

A funnel plot was drawn based on the resting state pain scores of two groups of patients at 12 hours after surgery, and the results showed that there was a small bias in the distribution of included studies. (Figure 8)

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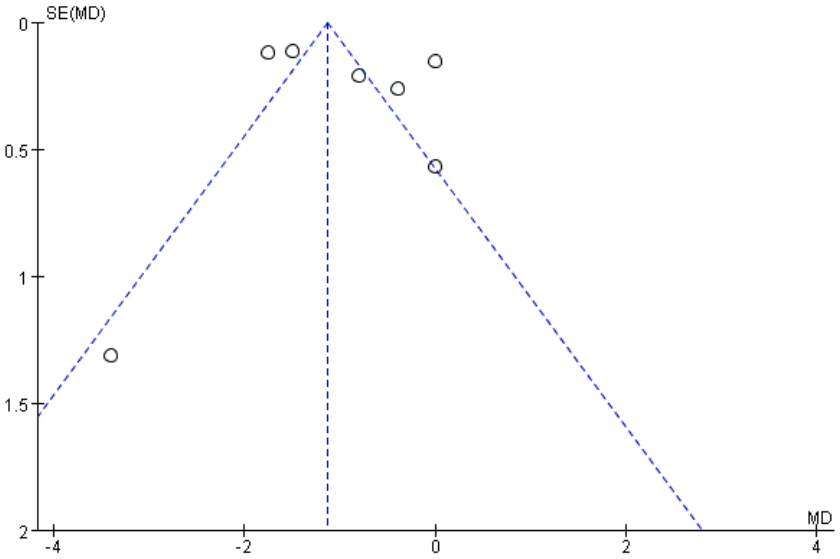

Figure 8: Funnel plot of publication bias in resting state pain scores at 12 hours post surgery

4. Discussion

Abdominal surgery can cause severe trauma stress reactions due to factors such as pneumoperitoneum, visceral traction, and posture, leading to severe postoperative pain. Pain causes patients to breathe shallowly and quickly, restricts early activity, leads to hypoxia and pulmonary complications, deep vein thrombosis and thromboembolic complications, and affects postoperative recovery. The opioid drugs in the commonly used intravenous patient-controlled analgesia formula after surgery not only have inhibitory effects on the gastrointestinal tract, but also cause respiratory depression, which is not conducive to rapid recovery of patients. Therefore, for patients undergoing abdominal surgery, seeking suitable pain relief plans has become an urgent issue that needs to be addressed during the perioperative period. Regional block is considered a good way to control postoperative pain and practice the concept of low opioid drugs. QLB is mainly used for perioperative analgesia in obstetrics and gynecology, abdominal surgery, and hip joint surgery [18-20], and its effectiveness has been confirmed by many clinical studies. QLB1 [21] injection point is located on the lateral edge of the lumbar quadratus muscle and the superficial surface of the transverse abdominal fascia, blocking the T12-L1 spinal nerve sensory branch, which can cover the analgesic range required for abdominal surgery, but this injection point happens to be on the lateral side of the perirenal fat. The QLB2 [22] injection site is located in the lumbar fascia triangle area between the quadratus lumbosae muscle and the thoracolumbar fascia, but this pathway has a slow onset and unstable blocking effect. The T7-L1 spinal nerve anterior and lateral cutaneous branches of QLB3 have a wide range of analgesic effects, but there is a possibility of spreading to the lumbar plexus and causing a decrease in lower limb muscle strength. The QLB-LSAL injection site [23-24] is located at the anterior lateral edge of the lumbar quadratus muscle above the level of the lateral arcuate ligament. This approach crosses the obstruction of the arcuate ligament and allows local anesthesia to quickly spread through the thoracolumbar fascia at the injection point to the thoracic paravertebral space, which is directly connected to the lumbar paravertebral space. Therefore, injecting the medication for 5 minutes can block the T7-L1 segment, producing a faster, wider, and longer lasting analgesic effect than other QLBs.

This meta-analysis showed that compared to the traditional QLB group, the QLB-LSAL group had a significant decrease in postoperative resting state pain scores and early postoperative motor state pain scores, proving that the lateral arcuate ligament approach has better efficacy in pain blockade after abdominal surgery. There is no significant difference in the efficacy of pain blockade in the exercise state 24 hours after surgery. This may be due to increased local blood flow caused by activity, promoting the entry of inflammatory mediators into the bloodstream, resulting in no difference in pain scores. It is also possible that the traditional QLB injection point is located on the outer side of the perirenal fat, and local anesthetic drugs slowly diffuse and block the peripheral nerves in the adipose tissue, leading to a decrease in pain scores 24 hours after surgery. The first press time of the analgesic pump in the QLB-LSAL group was significantly prolonged 24 hours after surgery, indicating that

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QLB-LSAL has a longer duration of anesthesia than traditional QLB. In addition, qlb-lsal can not only block the transmission of nociceptive stimuli caused by surgery to the central nervous system, but also block some sympathetic nerves in the thoracolumbar fascia, so as to block somatic pain and visceral pain, and reduce the production of catecholamines and inflammatory mediators [25-26]. The above effects may be the reason for the reduction of intraoperative and postoperative opioid consumption and related side effects (nausea and vomiting) in QLB-LSAL group. This study also confirms this result. In this study, the traditional QLB group took longer time to get out of bed for the first time after surgery, which may be due to the fact that the traditional QL has a certain blocking effect on lumbar plexus [22, 25], which weakens the muscle strength of lower limbs and prolongs the start time of getting out of bed.

5. Result

The results of meta-analysis of this study suggest that compared with the ultrasound-guided traditional QLB approach, the ultrasound-guided qlb-lsal group had significantly lower pain scores in the early postoperative period (2h, 12h and 24h after surgery) at rest, and the perioperative opioid consumption was also significantly reduced. Therefore, ultrasound-guided qlb-lsal combined with patient-controlled intravenous analgesia pump can significantly improve the analgesic effect after abdominal surgery, improve the quality of postoperative recovery, and promote the early rehabilitation of patients.

This systematic review has the following shortcomings: (1) some of the included studies have different ultrasound scanning methods, surgical methods, local anesthetic drug concentrations and doses, which may increase clinical heterogeneity; (2) Relatively few high-quality literatures were included; (3) The assessment methods of pain degree were different among the studies, which may cause measurement bias; (4) The funnel plot suggested that there might be publication bias. Combined with the above shortcomings, due to the current number of original studies, the conclusions of this study still need to be verified by multi center, large sample and high-quality RCT.

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