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Meta-analysis of the efficacy of anterior quadratus lumborum block and pudendal nerve block in postoperative analgesia after abdominal surgery

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Abstract: *The purpose of this article is to evaluate the efficacy and safety of anterior quadrate lumborum block combined with pudendal nerve block in postoperative analgesia after abdominal surgery. The computer searched six major databases at home and abroad. Randomized controlled trials comparing anterior quadrate lumborum block combined with pudendal nerve block and anterior quadrate block alone were included. The two researchers conducted literature screening, data extraction and quality evaluation of included studies independently. Quality was assessed using the Cochrane Collaboration's bias risk assessment tool. Data analysis was performed using Rev Man5.3, and the mean difference (MD) and 95% confidence interval (CI) were calculated for the measurement data. A total of 280 patients were included in 3 studies. The results showed that compared with the control group the experimental group showed a significant decrease at the resting pain score at 2h after surgery (MD=-1.40; 95%CI -1.54 ~ -1.26, P<0.00001), 6h after surgery (MD=-1.32; 95% CI-1.71 ~ -0.92, P<0.00001) ,12h after surgery, (MD=-0.88; 95% CI-1.03 ~ -0.73, P<0.00001), 24h after surgery (MD=-0.76; 95%CI -0.88 ~ -0.65, P<0.00001), the amount of propofol used during the operation (MD=-132.37; 95%CI -150.90~ -113.83, P<0.00001) ,the amount of remifentanil used during the operation (MD=-395.30; 95% CI-432.07 ~ -358.53, P<0.00001) , the number of postoperative remedial analgesia (RR =0.04; 95% CI 0.01 ~ 0.16, P<0.00001) , the recovery time of general anesthesia (MD=-1.42; 95%CI -1.81~ -1.03, P<0.00001) ,the first time to get out of bed after surgery (MD=-1.32; 95%CI -2.11~ -0.54, P=0.0009),the first time to exhaust the anus (MD=-1.50; 95%CI -2.67~ -0.34, P=0.01), the length of hospitalization, (MD=-11.31; 95%CI -19.60~ -3.03, P=0.007) , the incidence of nausea and vomiting (RR =0.11; 95% CI 0.04 ~ 0.32, P<0.00001). Anterior quadrate lumborum block combined with pudendal nerve block has advantages in postoperative analgesia and promoting early postoperative recovery after abdominal surgery, but more high-quality RCTs are needed for further study.*

Keywords: *Ultrasound; Anterior quadrate lumborum block; pudendal nerve block; abdominal surgery; analgesia; Meta analysis*

1. Introduction

There are many types of abdominal tumors, early malignant tumors and benign tumors are mostly without obvious symptoms, with the progress of the disease may be different types of tumors triggered by different symptoms, mostly surgical resection, but the surgical trauma can cause postoperative pain and related complications, affecting the patient's postoperative recovery and increasing the patient's pain [1]. The concept of accelerated rehabilitation surgery refers to the use of a series of optimized therapeutic measures based on evidence-based medicine to alleviate the stress response of patients in the perioperative period, thereby reducing complications and promoting early recovery, while reducing medical costs [2-3]. Multimodal analgesia is the combination of multiple analgesic drugs and methods with different mechanisms of action to achieve the best analgesic effect, so as to avoid the adverse effects caused by a single type of drug or method, and multimodal analgesia dominated by regional nerve block is the mainstream analgesic modality at present [4]. Quadratus lumborum block (QLB) and pudendal nerveblock (PNB) are some of the commonly used nerve blocks, and many studies have reported the effects of these two nerve blocks on reducing the amount of anesthesia, improving postoperative analgesia and rehabilitation [5-6]. However, fewer studies have been conducted on the combined use of these two methods. Therefore, the present study was included in the relevant literature to provide a basis for the clinical application of anterior quadratus lumborum block combined with pudendal nerve block.

2. Data and methods

2.1 Literature retrieval strategy

According to the search strategy suggested by the Cochrane Musculoskeletal Group, the Cochrane Collaboration network, search the Cochrane Library, Pub Med, EMBASE, Web of Science and other English databases as "(abdominal surgery)AND(anterior quadrate lumbus block)AND(anterior quadrate lumbus block AND pudendal nerve block)". Using "(abdominal surgery)AND(anterior quadrate lumbus block)AND(anterior quadrate lumbus block AND pudendal nerve block)" as search terms, Chinese databases such as CNKI, Wanfang Database and Weipu Information Database were searched, and the search deadline was May 2024.

2.2 Inclusion and exclusion criteria

2.2.1 Inclusion criteria

(1) Study type: randomized controlled clinical trial, no limitation on study region, only Chinese and English literature; (2) Subjects: Patients undergoing abdominal surgery, regardless of race, age, sex, height, weight and primary disease; (3) Intervention measures: Comparison of anterior quadrate block combined with pudendal nerve block and anterior quadrate block alone. Any disagreement shall be decided by the two researchers through consultation or by a third party arbitration.

2.2.2 Exclusion criteria

(1) Duplicate publications, but different literatures from the same study with different indicators are not excluded; (2) Case reports, summaries or expert opinions.

2.3 Literature screening and quality evaluation

Two researchers screened the retrieved literature strictly according to the inclusion and exclusion criteria. The title and abstract of each literature were carefully read by two researchers, and the controversial literature was submitted to a third-party review. The data extracted from the literature include :(1) the basic characteristics of the included studies: author, publication date, sample size, and measurement indicators; (2) Included patients' baseline characteristics: age, sex, body mass index (BMI), ASA rating, duration of operation, type and dose of local anesthesia drugs. For more detailed information, contact the author if necessary. The methodological quality of the included literature was evaluated according to the evaluation criteria of randomized controlled trials recommended in the Cochrane Handbook of Systematic Reviewers 5.0.2, including random assignment, protocol hiding, blind (subjects or investigators), loss of follow-up and withdrawal, selective reporting of findings, and other source bias (such as baseline variation). According to the above six criteria, the judgments of "yes "(low degree of bias)," no "(high degree of bias) and "unclear "(uncertain bias) were made for the included literatures. Methodological quality evaluation is conducted independently by two authors, and in case of disagreement, it is submitted to a third party review.

2.4 Statistical analysis

First, the clinical and methodological heterogeneity between the studies was analyzed, and statistical heterogeneity was tested and data pooled by Revman5.3 software. I^2 was calculated to evaluate the statistical heterogeneity between the included studies. When there was no heterogeneity between the studies or the heterogeneity was small (e.g. $I^2 \leq 35\%$), the Fixed effect model was used for meta-analysis. If there was large inter-study heterogeneity ($35\% < I^2 \leq 85\%$) and clinical heterogeneity was not obvious, a random effects model (Ran dom model) was used for meta-analysis. When the heterogeneity was particularly large ($I^2 > 85\%$), quantitative data were not pooled and only individual findings were described. When there is significant clinical heterogeneity, the source of heterogeneity should be analyzed. When the data were combined for analysis, the data were measured: the combined mean difference (MD) and its 95% confidence interval (CI) were calculated; Counting data: Combined relative risk (RR) and 95%CI were calculated.

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3. Results

3.1 Literature search results

Eleven literatures were initially retrieved, and 3 literatures [7-9] were finally included after layer by layer screening, with a total of 280 patients. See Figure 1.

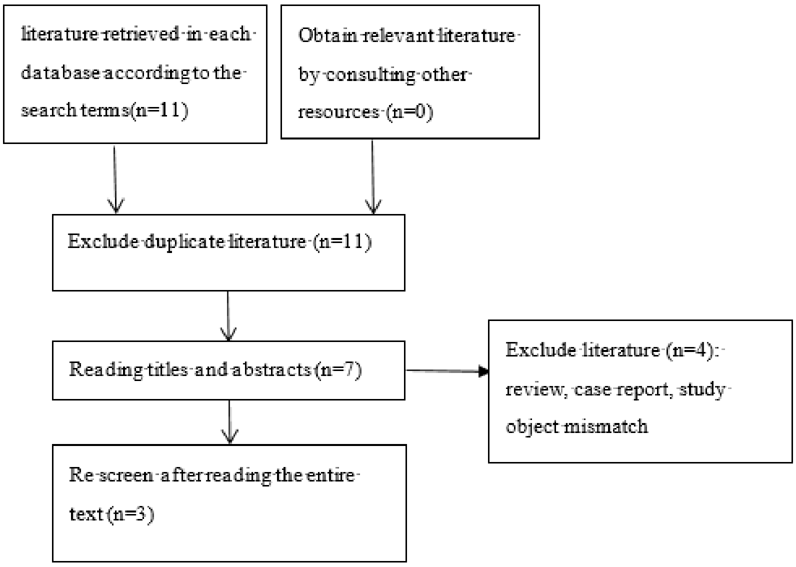

Figure 1: Literature Screening Process

3.2 Basic information and bias risk assessment of included 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 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	
Yang L 2021 [7]	30	30	63.5±7.1	64.2±6.5	15/15	16/14	24.8±5.5	24.4±4.3	6/15/9	5/18/7	326.1±24.2	330.6±23.1	0.33% ropivacaine 20ml	0.33% ropivacaine 20ml	2-4、6-12
Li SY 2022 [8]	60	60	37.44 ±1.37	37.22 ±1.69	30/30	33/27	24.50±2.12	24.60 ±2.17					0.33% bupivacaine 30ml	0.33% bupivacaine 30ml	1-5
Wang YJ 2023 [9]	50	50	46.92±5.29	46.06±5.39	0/50	0/50	22.41 ± 1.87	22.17 ± 1.93	25/16/9	29/14/7	177.23±21.15	180.16±20.87	0.375% ropivacaine 20ml	0.375% ropivacaine 20ml	1、3-12

1, 2, 3 and 4 were resting pain scores at 2h, 6h, 12h and 24h, respectively. 5 and 6 were the amount of propofol and remifentanil used during the operation, respectively. 7 was the number of postoperative remedial analgesia; 8, 9, 10 and 11 were the recovery time of general anesthesia, the first time to get out of bed after surgery, the first time to exhaust the anus and the length of hospitalization, respectively. 12 was the incidence of nausea and vomiting.

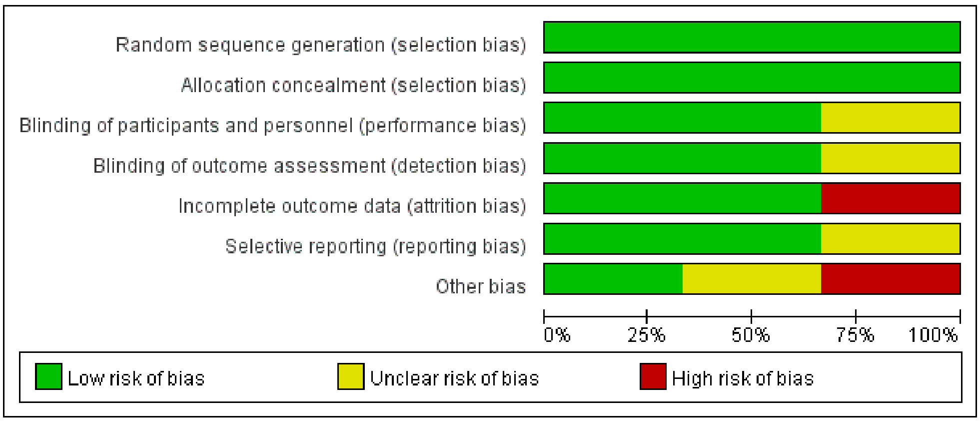

Figure 2: Bias Risk Assessment Chart

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3.3 Results of meta-analysis

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

Two literatures [8-9] compared the resting pain score at 2h after surgery, showing without significant heterogeneity (I^2=69%, *P*=0.07). Using the fixed effects model, the results of meta-analysis showed that the resting pain score at 2 h after surgery in the experimental group was significantly lower than that in the control group (MD=-1.40; 95%CI -1.54 ~ -1.26, *P*<0.00001) (Figure 3-A). Two literatures [7-8] compared the resting pain score at 6h after surgery, showing without significant heterogeneity (I^2=42%, *P*=0.19). Using the fixed effects model, the results of meta-analysis showed that the resting pain score at 6h after surgery in the experimental group was significantly lower than that in the control group (MD=-1.32; 95% CI-1.71 ~ -0.92, *P*<0.00001) (Figure 3-B). Three literatures [7-9] compared the resting pain score at 12h after surgery, showing significant heterogeneity (I^2=95%, *P*<0.00001). Using the random effects model, the results of meta-analysis showed that the resting pain score at 12h after surgery in the experimental group was significantly lower than that in the control group (MD=-0.88; 95% CI-1.03 ~ -0.73, *P*<0.00001) (Figure 3-C). Three literatures [7-9] compared 24h postoperative resting state pain scores, showing significant heterogeneity (I^2=89%, *P*=0.0001). Using the random model, meta-analysis results showed that 24h postoperative resting state pain scores in the experimental group were significantly lower than those in the control group (MD=-0.76; 95%CI -0.88 ~ -0.65, *P*<0.00001) (Figure 3-D).

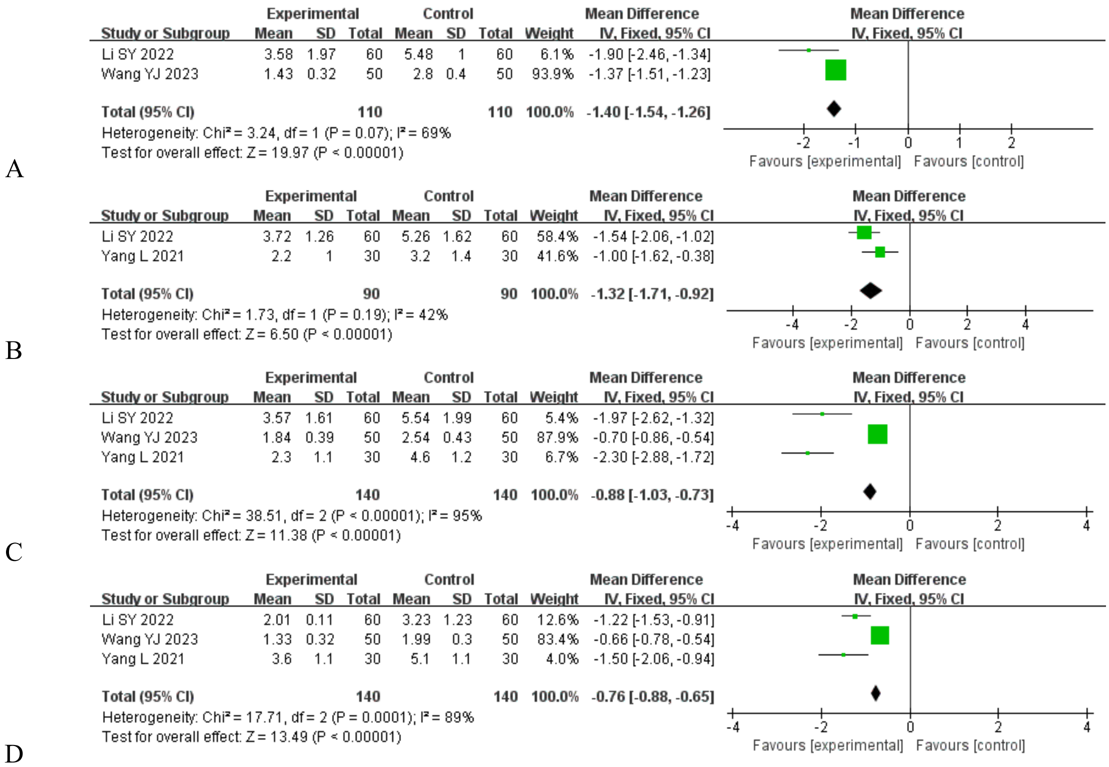

Figure 3: Resting state pain scores at different time points after surgery

3.3.2 The amount of propofol and remifentanil used during the operation

Two literatures [8-9] compared the amount of propofol used during the operation, showing significant heterogeneity (I^2=77%, P=0.04). Using the random effects model, the results of meta-analysis showed that the amount of propofol used during the operation in the experimental group was significantly lower than that in the control group (MD=-132.37; 95%CI -150.90~ -113.83, *P*<0.00001) (Figure 4-A). Two literatures [7,9] compared the amount of remifentanil used during the operation, showing without significant heterogeneity (I^2=0%, *P*=1.00). Using the fixed effects model, the results of meta-analysis showed that the amount of remifentanil used during the operation in the experimental group was significantly lower than that in the control group (MD=-395.30; 95% CI-432.07 ~ -358.53, *P*<0.00001) (Figure 4-B).

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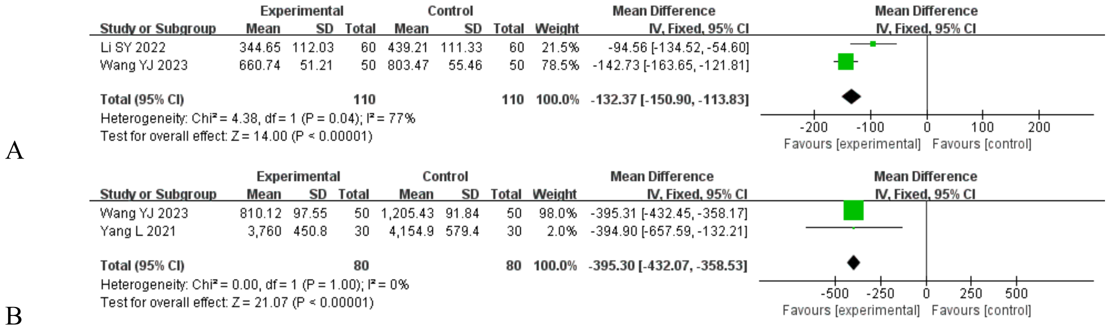


Figure 4: The amount of propofol and remifentanil used during the operation

3.3.3 The number of postoperative remedial analgesia

Two literatures [7,9] compared the number of postoperative remedial analgesia, showing without significant heterogeneity (I^2=72%, P=0.06). Using the fixed effects model, the results of meta-analysis showed that the number of postoperative remedial analgesia in the experimental group was significantly lower than that in the control group (RR =0.04; 95% CI 0.01 ~ 0.16, P<0.00001) (Figure 5).

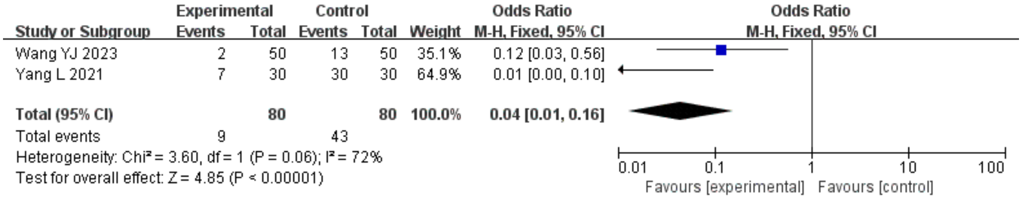
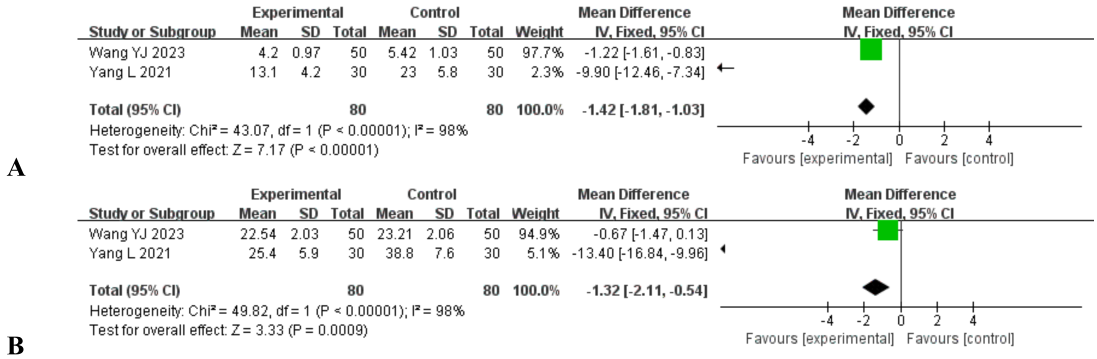


Figure 5: The number of postoperative remedial analgesia

3.3.4 Indicators associated with rapid recovery after surgery

Two literatures [7,9] compared the recovery time of general anesthesia, showing significant heterogeneity (I^2=98%, P<0.00001). Using the random effects model, the results of meta-analysis showed that the recovery time of general anesthesia in the experimental group was significantly lower than that in the control group (MD=-1.42; 95%CI -1.81~ -1.03, P<0.00001) (Figure 6-A). Two literatures [7,9] compared the first time to get out of bed after surgery, showing significant heterogeneity (I^2=98%, P<0.00001). Using the random effects model, the results of meta-analysis showed that the first time to get out of bed after surgery in the experimental group was significantly lower than that in the control group (MD=-1.32; 95%CI -2.11~ -0.54, P=0.0009) (Figure 6-B). Two literatures [7,9] compared the first time to exhaust the anus, showing significant heterogeneity (I^2=93%, P<0.00001). Using the random effects model, the results of meta-analysis showed that the first time to exhaust the anus in the experimental group was significantly lower than that in the control group (MD=-1.50; 95%CI -2.67~ -0.34, P=0.01) (Figure 6-C). Two literatures [7,9] compared the length of hospitalization, showing significant heterogeneity (I^2=90%, P=0.002). Using the random effects model, the results of meta-analysis showed that the length of hospitalization in the experimental group was significantly lower than that in the control group (MD=-11.31; 95%CI -19.60~ -3.03, P=0.007) (Figure 6-D).



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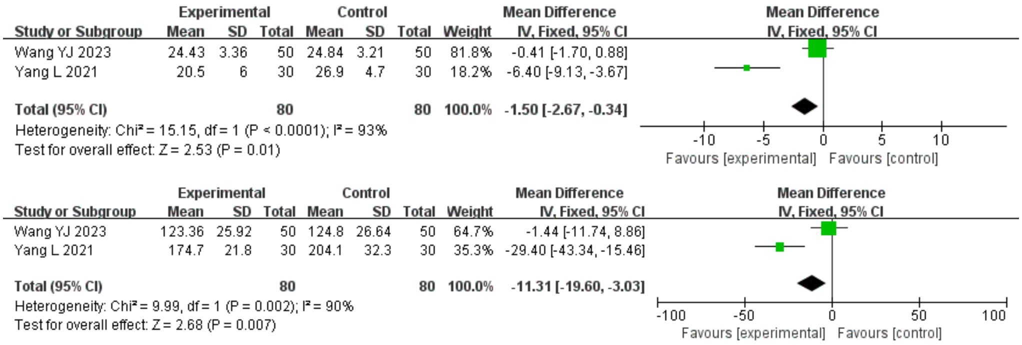

C

D

Figure 6: Indicators associated with rapid recovery after surgery

3.3.5 The incidence of nausea and vomiting

Two literatures [7,9] compared the incidence of nausea and vomiting, showing significant heterogeneity (I^2=84%, P=0.01). Using the random effects model, the results of meta-analysis showed that the incidence of nausea and vomiting in the experimental group was significantly lower than that in the control group (RR =0.11; 95% CI 0.04 ~ 0.32, P<0.00001) (Figure 7).

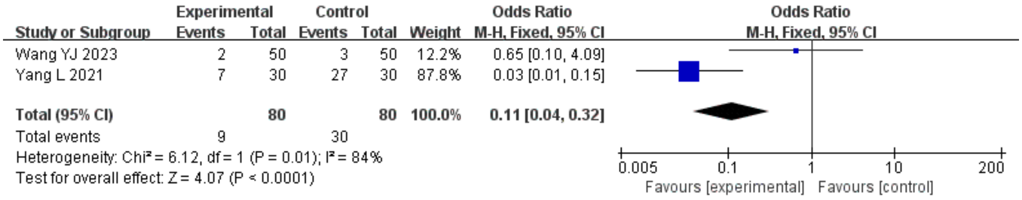

Figure 7: The incidence of nausea and vomiting

3.3.6 Publication bias

A funnel plot was drawn based on the 24h postoperative resting state pain scores. The funnel plot was symmetrically distributed, and the results indicated a relatively large publication bias. (Figure 8)

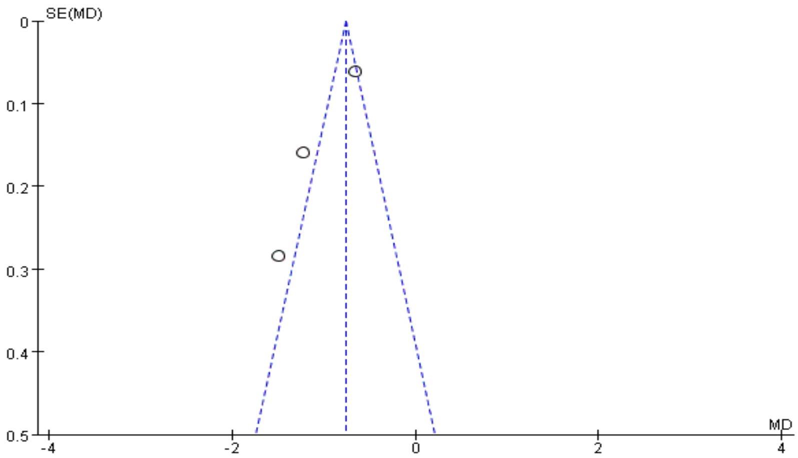

Figure 8: Funnel plot of publication bias in the 24h postoperative resting state pain scores

4. Discussion

Abdominal surgery incisions are concentrated in the abdominal wall, especially open abdominal surgery, the incision is wide and deep, which will cause great trauma to the patient, and the postoperative pain is severe and intolerable, affecting the patient's postoperative recovery. In abdominal surgery, common intestinal surgery and uterine surgery require invasive operations in the perianal area, which is rich in vascular and nerve distribution, and postoperative oedema, infection, scar contraction and other factors can cause severe pain, but the anterior lumbar muscle block does not provide effective analgesia for the perianal area. The combined use of anterior lumbar muscle block and pubic nerve block can block the innervating nerves of the relevant surgical area and cover a wide range of areas, so as to achieve satisfactory analgesic effects.

Ultrasound-guided lumbar square muscle block (Quadratus Lumborum Block, QLB) is a new method of trunk block first proposed by Blanco in 2007 [10]. The lumbar square block is based on the transversus abdominis plane block, and as a new technique developed by extension of the transversus abdominis plane block, the lumbar square block has been widely used in abdominal surgeries, pelvic-pelvic and other surgeries [11]. Anterior lumbar platysma block is to inject local anesthetic into the anterior side of the lumbar platysma, between the lumbar platysma and psoas major, reaching the anterior layer of the thoracolumbar fascia, and mainly blocking the T11, T12, and L1 dermatoneural nodes, which can provide effective analgesia to the middle part of the anterior abdominal wall on the side of the block[12].The perineal nerve is the main nerve innervating the perineum, mainly originating from the anterior branch of the S2-4 nerve, with small nerve fibers connecting with the sciatic nerve, the inferior celiac plexus, and the posterior femoral cutaneous nerve, and it is a mixed nerve consisting of sensory, motor, and autonomic nerves, and is divided into three branches, namely, the subrectal nerve, the dorsal nerve of the penis, and the perineal nerve [13]. Pubic nerve blocks are used in perianal and perineal surgery to provide effective postoperative analgesia [14-17].From this, we concluded that anterior quadratus lumborum nerve block combined with pudendal nerve block can be applied to most patients undergoing abdominal surgery and provide efficient postoperative analgesia, so we included articles combining the two types of nerve blocks applied to abdominal surgery for meta-analysis to explore the quality of analgesia and adverse events in the postoperative period.

5. Conclusion

The results of this Meta-analysis suggest that, compared with general anesthesia alone, the resting pain scores of patients undergoing abdominal surgery under general anesthesia with anterior quadratus lumborum nerve block combined with pudendal nerve block were significantly decreased at 2 hours, 6 hours, 12 hours and 24 hours after surgery, and the dosage of isoproterenol, remifentanil and the number of remedial analgesia in the operation were also significantly decreased, which may be due to the fact that the nerve block can suppress the peripheral or central sensitization in the post-op period and reduce the need for analgesic drugs. The reason may be that nerve block can inhibit postoperative peripheral or central sensitization, inhibit the pain sensitivity reaction, reduce the degree of postoperative pain, and reduce the need for analgesic drugs. At the same time, the recovery time of general anesthesia, the time of the first postoperative bed movement, the time of the first postoperative anal defecation, and the hospitalization time of the patients in the experimental group were also significantly shortened, and the incidence of postoperative adverse events, such as nausea and vomiting, was significantly reduced, which indicated that the combination of anterior quadratus lumborum nerve block combined with pudendal nerve block promotes the early recovery of the postoperative period of abdominal surgery, and improves the quality of the patient's recovery.

In conclusion, the analysis results of this study suggest that compared with general anesthesia alone, ultrasound-guided anterior quadratus lumborum muscle nerve block combined with pudendal nerve block can significantly reduce the early postoperative pain, and at the same time the perioperative opioid dosage is also significantly reduced, the incidence of adverse reactions is reduced, the patients' time to get out of bed is advanced, and the length of hospitalization is shortened, which proves that ultrasound-guided anterior quadratus lumborum muscle nerve block combined with pudendal nerve block significantly improves the analgesic effect of the abdominal postoperative period, improves the patients' quality of recovery after the operation, and promotes the early recovery of the patients.

References

[1] Sun Jin, Gao Yi, Lu Fei. Application of homemade modified wrist restraining belt combined with holistic nursing care in anesthesia care of thoracic and abdominal tumor patients receiving general anesthesia[J]. General Practice Nursing, 2022, 20(10):1362-1364.

[2] Batchelor T J P, Ljungqvist O.A surgical perspective of ERAS guidelines in thoracic surgery[J].Curr Opin Anaesthesiol, 2019,32(1):17-22.

[3] Baimas-George M, Cochran A, Tezber K, et al. A 2-Year Experience With Enhanced Recovery After Surgery: Evaluation of Compliance and Outcomes in Pancreatic Surgery[J].J Nurs Care Qual, 2020, 31(2): 24-29.

[4] NA.Practice guidelines for acute pain management in the perioperative setting[J]. Anesthesiology,

ISSN 2616-5791 Vol.5, Issue 5: 41-48, DOI: 10.25236/AJMHS.2024.050506

2004, 100(6):1573-1581.

[5] Qing Shuai, Xu Liansheng, Wang Xiaojun. Influence of ultrasound-guided posterior lumbar square muscle block on postoperative analgesic effect and inflammatory reaction in patients undergoing laparoscopic total hysterectomy[J].Modern Oncology Medicine, 2021, 29(12):2138-2143.

[6] Wang Shengyan, Qiu Qing, Yao Yibing, et al. Progress of clinical application of pubic nerve block [J]. Zhejiang medicine, 2022, 44(6):661-666.

[7] Yang Lei, Li Aijun, Zhang Shuai, et al. Efficacy of anterior quadrate lumbo-pudendal nerve block combined with general anesthesia in laparoscopic rectal cancer surgery [J]. Chinese Journal of Anesthesiology, 2021, 40(11):1367-1370.

[8] Li S Y, An X F, Xue C H, et al. Effect of anterior quadratus lumbo-pudendal nerve block on pain control and injury stress response after staghorn kidney stone operation [J]. International Journal of Urology, 2012, 42(2):254-258.

[9] Wang Yajuan, Han Yi, Wei Ling, et al. Application value of anterior quadrate lumbo-pudendal nerve block combined with general anesthesia in the treatment of total vaginal hysterectomy [J]. Journal of Hebei Medical University, 2019, 44(11):1307-1311.

[10] Blanco R. TAP block under ultrasound guidance: the description of a”non pops”technique:271[J]. Reg Anesth Pain Med, 2007,32(5):130.

[11] Wang Delong, Fan Xiaoqing, He Keqiang, et al. Effect of ultrasound-guided lumbar-square muscle block on analgesia after laparoscopic total hysterectomy[J]. Anhui Medicine, 2020,41(05):537-540.

[12] Lu Y, Wang QG, Shi KJ, et al. Effect of anterior lumbar muscle block on various regions of the abdomen and back [J]. Chinese Journal of Anesthesiology, 2017,37(6):697-699.

[13] Wadhwa V, Hamid AS, Kumar Y, et al. Pudendal nerve and branch neuropathy:magnetic resonance neurography evaluation[J].Acta Radiologica,2017,58(6):726-733.

[14] Xia Shijun, Wu Wenjiang, Fan Xiaohua. Observation on the efficacy of pubic nerve block under nerve stimulator localization for postoperative analgesia of mixed hemorrhoids [J]. Colorectal and anal surgery, 2019, 25(5):570-573.

[15] Gao Xucan. Wang Dong. WU Haixiong. Study on the analgesic effect of nerve stimulator-guided pubic nerve block in postoperative hemorrhoidal surgery [J]. Journal of Qiqihar Medical College, 2019,40 (23):2927-2930.

[16] Jiang JJ, Feng L, Xue WL, et al. Observation on the effect of ultrasound-guided pubic nerve block for postoperative analgesia after PPH [J]. Chinese Electronic Journal of Colorectal Diseases, 2017, 6(5):392-396.

[17] Kovacs P, Gruber H, Piegger J, et al. New, simple, ultra- sound-guided infiltration of the pudendal nerve[J].Dis Color Rectum, 2001, 44:1381-1385.