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Review Article

Efficacy of Acupuncture Combined with Patient-Controlled Analgesia in the Treatment of Acute Pain after Back Surgery: A Meta-Analysis

Daling Deng, Feng Xu, Yafeng Wang, Lulin Ma, Tianhao Zhang, Wenjing Zhao, and Xiangdong Chen

Department of Anesthesiology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430022, China

Correspondence should be addressed to Xiangdong Chen; xiangdongchen2013@163.com

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Objectives. Acupuncture is used worldwide to relieve both acute and chronic pain. Patient-controlled analgesia (PCA) is also frequently used for postoperative pain relief. However, there are few meta-analyses of the efficacy of acupuncture with PCA in reducing acute postoperative pain. This meta-analysis aimed to assess the effectiveness of acupuncture with PCA in relieving acute pain after back surgery. *Methods*. We searched seven databases (Cochrane Library, Web of Science, PubMed, China National Knowledge Infrastructure (CNKI), Wanfang database, Chongqing VIP (VIP), and Chinese BioMedical Literature Database (CBM)-from 1949 until now) without language restrictions for randomized controlled trials, including patients undergoing back surgery and receiving PCA alone or treated with acupuncture/sham acupuncture + PCA for pain relief. This meta-analysis assessed pain intensity, with visual analogue scale (VAS) score and postoperative opioid dosage as primary outcomes. *Results*. A total of 12 randomized controlled trials ($n = 904$) met the inclusion criteria. Compared with the control group (standard mean difference (SMD) = −0.42, 95% CI = −0.60 to −0.25, $P < 0.01$) or sham acupuncture + PCA (SMD = −0.7, 95% CI = −0.94 to −0.46, $P < 0.01$), acupuncture + PCA treatment reduced the VAS score in patients after back surgery. Acupuncture + PCA decreased the use of opioids after surgery compared to sham acupuncture + PCA (SMD = −0.35, 95% CI = −0.63 to −0.07, $P = 0.01$) or control group (SMD = −0.82, 95% CI = −1.03 to −0.61, $P < 0.01$). Furthermore, the use of acupuncture with PCA reduced the incidence of postoperative PCA-related total complications (odds ratio = 0.44, 95% CI = 0.23 to 0.85, $P = 0.01$), but may not reduce the incidence of postoperative nausea and vomiting (odds ratio =0.82 , 95% CI =0.49 to 1.36, $P = 0.44$). *Conclusion*. This systematic review found that acupuncture with PCA relieved acute pain after back surgery more effectively than PCA alone and could reduce opioid use and the incidence of postoperative PCA-related total complications

1. Introduction

A recent survey showed that 47.3% of patients worldwide suffer from back pain [1]. Back surgery results in a high incidence of acute postoperative pain [2], which is the most common clinical symptom for patients undergoing back surgery [3, 4]. A research showed that the incidence of postoperative pain in adolescent idiopathic scoliosis (AIS) is as high as 12%, and about one in ten patients may have a worse prognosis due to postoperative pain [5]. Therefore, acute postoperative pain management is pivotal for patients recovering from all types of back surgery. Lack of acute pain management after back surgery may cause an emotional disturbance, prolonged hospital time, delayed recovery, and even development of chronic pain [6, 7].

There are various methods to relieve acute pain after back surgery, including acupuncture, patient-controlled analgesia (PCA), physical exercise and drugs. Due to the complexity of the pain mechanism, no single analgesic agent provides a satisfactory analgesic effect [8].

PCA is usually used to control postoperative pain in back surgical patients, and its safety and efficacy are well

established [9–11]. According to a meta-analysis, PCA provides patients with better analgesic effects than other physical therapies [12]. However, PCA may produce some adverse reactions such as dizziness and postoperative nausea and vomiting (PONV) [13]. Therefore, multimodal analgesia is currently advocated to maximise the analgesic effect and reduce mutual side effects [8].

As a potent therapeutic technique to relieve pain, acupuncture has more than 2,000 years of history and can be used to relieve various types of pain [14, 15]. Acupuncture is cost-effective and safe compared to other medications [16]. Acupuncture may be used as an auxiliary treatment to PCA, improving postoperative pain in back surgery patients and possibly helping reduce the adverse effects of opioid usage.

A study has shown that acupuncture can relieve postoperative pain in patients undergoing back surgery [17]. Previous clinical studies have demonstrated that acupuncture combined with PCA was more effective than PCA alone for relieving postoperative pain and reducing opioid dosage after back surgery [18, 19]. However, there is currently a lack of more advanced evidence to support this conclusion. In addition, it remains uncertain whether acupuncture combined with PCA can reduce postoperative opioid use and related adverse reactions such as PONV. Thus, this meta-analysis will focus on the effectiveness of acupuncture combined with PCA in alleviating acute postoperative pain and reducing the opioid dosage after back surgery.

2. Materials and Methods

2.1. Search Methods. We searched relevant medical literature without language restrictions in Web of Science, the Cochrane Library, PubMed, China National Knowledge Infrastructure (CNKI), Wanfang database, Chongqing VIP (VIP), and Chinese BioMedical Literature Database (CBM). The search time span is limited to the period from 1949 to the present. Key words including "(acupuncture OR electroacupuncture) AND (back surgery OR discectomy OR vertebra surgery OR spinal fusion OR laminectomy OR vertebroplasty OR "failed back surgery syndrome" OR FBSS OR lumbar surgery OR spinal fusion OR foraminotomy OR spinal surgery OR thoracolumbar surgery)." The corresponding Chinese translations are used in the Chinese database. Automatically, exclude a subset of irrelevant articles based on title and abstract. We then checked the rest of the articles carefully to determine whether they were in accord with inclusion criteria met our inclusion criteria. The process was carried out independently by two reviewers.

2.2. Study Selection

2.2.1. Types of Studies. Inclusion criteria include the following: firstly, the study was a randomized controlled trial. Secondly, the study population included patients undergoing back surgery. Lastly, patients' postoperative analgesia received a combination of PCA and acupuncture or PCA only.

Exclusion criteria include the following: no acupuncture treatment after surgery, no PCA after surgery, chronic pain after surgery, animal studies, and case studies.

2.2.2. Types of Participants. We included patients with acute postoperative pain within 1 week after back surgery. There were no restrictions on patients' age, gender, the type of back surgery, and the reason for surgery.

2.2.3. Types of Interventions. Traditionally, acupuncture is considered a unique nondrug treatment method based on the meridian theory [20]. Acupuncture mainly consists of variations such as electroacupuncture, transcutaneous nerve stimulation, and hand acupuncture. Thus, in the treatment group, we included classical acupuncture, electroacupuncture (EA), and acupoint electrical stimulation (AES) and auricular acupuncture. Acupuncture treatment was regarded as the intervention group. Any other treatment other than acupuncture, including placebo/sham acupuncture, such as superficial penetration on nonacupoints or nonpenetration on acupoints, no treatment, or conventional therapy for postoperative pain such as drugs, rehabilitation, and so on was considered as the control group [21–23]. Meanwhile, both the treatment and control groups underwent postoperative PCA.

2.2.4. Outcome Measures. Pain intensity, evaluated using a VAS, and opioid dose after surgery were considered primary outcomes. Secondary outcomes included the incidence of postoperative PCA-related complications.

2.2.5. Quality of Included Studies. This systematic review is based on the QUOROM statement [24] and the PRISMA statement [25]. Each study's risk of bias and methodological quality was assessed using the Cochrane Risk of Bias Assessment tool (Cochrane Collaboration) [26]. Data are extracted by two investigators independently. Any disagreement was resolved by discussion until consensus was reached or by a third investigator for adjudication.

2.2.6. Statistical Analysis. Odds ratio/risk ratio or standardised mean difference was used to analyse data. For continuous data, mean difference with 95% confidence interval (95% CI) was calculated. For dichotomous data, odds ratio/risk ratio with 95% CI was calculated. A meta-analysis can be performed when an outcome data included at least two trials.

We used P value and I^2 statistics to detect heterogeneity [27]. When heterogeneity was observed ($P < 0.05$ and/or $I^2 > 50\%$), we adopted the random effect model. Otherwise, we adopted a fixed effects model. Subgroup and sensitivity analyses were performed to dissect the heterogeneity. If more than 10 trials were contained in a meta-analysis, we used the funnel plot, Begg's test, or Egger's test to evaluate publication bias. A P value < 0.05 was considered to be

significant [28, 29]. Data of meta-analyses were analysed using Review Manager (RevMan) version 5.4 (Cochrane Collaboration, Oxford, UK) software.

3. Results

3.1. Study Selection. As shown in Figure 1, we identified 2,895 articles by searching the databases. Two reviewers carried out review and exclusion independently after excluding 386 duplicated articles. According to the title and abstract, we excluded 2,435 articles that did not accord with the selection criteria. Of the remaining 74 articles, we subsequently excluded 62 additional articles. The reasons are as follows: 15 studies were not RCTs, data related to the effects of anaesthesia during surgery in 19 studies; in 11 studies, the experimental group received acupuncture plus medicine; one article did not report acupuncture sites; one article did not distinguish between acute and chronic postoperative pain; patients did not receive PCA analgesia after back surgery in seven articles, and eight studies were on chronic pain after back surgery. Thus, 12 articles on acute postoperative pain were included in this meta-analysis.

3.2. Study Characteristics. Twelve RCTs with 904 participants were included in this review. All 12 studies [18, 19, 30–39] included reports that receiving acupuncture-related treatment within 1 week after back surgery, and there were no differences between the two groups. Meanwhile, all patients received PCA analgesia postoperatively. In outcome assessment, pain intensity was assessed by VAS and opioid dose. The summarised characteristics of the 12 studies are shown in Table 1.

3.3. Risk of Bias. Figure 2 provides an overview of the risk of bias assessment. All the included trials mentioned randomization. Only one study [31] did not clearly report the randomization method, showing that the selection bias has increased. Five articles [18, 19, 30, 31] stressed the importance of allocation concealment. Six studies [18, 19, 30–32, 34] were single-blind, sham control studies, so the risk of performance bias was reported as "low risk," and the rest of the studies were considered as an "unclear risk of bias" due to a lack of detailed description. All 12 included studies did not explicitly describe selective reporting, and we estimate the risk of reporting bias in these studies to be "unclear." The risk of incomplete outcome data bias assessed as low risk in 11 studies [18, 19, 30, 32–39], because these studies reported the dropouts and withdrawals of these data in detail. Due to baseline features being correctly described and no significant differences between the experiment and control groups, 12 trials [18, 19, 30–39] were assessed to be at low risk of bias. In total, eight studies [31–33, 35–39] were considered to be of moderate quality, the rest of the studies were regarded as high quality.

3.4. Acupuncture and Control Intervention. Typically, both the treatment group and the control group received PCA analgesia after back surgery. In all 12 RCTs, the selection of acupoints followed the theory of traditional Chinese medicine (TCM) (Table 2). Four RCTs [18, 19, 30, 31] adopted acupoint electrical stimulation with nonpenetration, two RCTs [33, 34] used transcutaneous electrical nerve stimulation, three RCTs [32, 37, 38] used acupressure on the ear, two RCTs [35, 36] adopted wrist-ankle acupuncture and one RCT [39] used classic acupuncture.

4. VAS

In terms of acupuncture + PCA vs. sham acupuncture + PCA, four RCTs [18, 19, 30, 31] assessed the effect of acupuncture in comparison to sham acupuncture. In the first study, pain intensity was evaluated using a VAS before acupuncture, 0.5 h after first acupuncture, 0.5 h after second acupuncture, and at 24 h, 48 h, and 72 h after surgery. In the second study, the VAS score of pain intensity was evaluated at 24 h, 48 h, and 72 h after surgery. In the third study, the VAS score of pain intensity was evaluated before acupuncture, immediately after acupuncture, and at 0.5 h, 1 h, 2 h, and 6 h after acupuncture. In the fourth trial, the VAS score of pain intensity was measured before operation, and at 1 h, 2 h, and 24 h after the operation (Table 1).

All four trials concluded that the effect of acupuncture was superior to sham acupuncture. The pooled meta-analysis showed that acupuncture significantly decreased the patients' VAS score for pain intensity after back surgery (standard mean difference (SMD) = −0.7, 95% CI = −0.94 to −0.46, $P < 00001$; $I^2 = 7\%$), as shown in Figure 3.

In terms of acupuncture + PCA vs. control (only PCA used), eight RCTs [18, 19, 30–38] assessed the effect of acupuncture combined with PCA in comparison to PCA used alone. The time points for assessing VAS are shown in Table 1. The pooled meta-analysis showed that the VAS score of pain intensity after surgery showed significant improvements (SMD = −0.42, 95% CI = −0.60 to −0.25, $P < 0.00001$; $I^2 = 44\%$), as shown in Figure 3.

4.1. Postoperative Opioid Consumption. Three RCTs [19, 30, 31] reported the difference in postoperative opioid or morphine consumption between an acupuncture + PCA group and a sham acupuncture + PCA group. We assessed the overall equianalgesic opioid consumption between acupuncture and sham acupuncture.

As shown in Figure 4, three RCTs revealed acupuncture combined with PCA reduced the consumption of opioids in comparison to sham acupuncture combined with PCA. The meta-analysis demonstrated that acupuncture combined with PCA resulted in significant improvements in overall postoperative opioid dose demands (SMD = −0.35, 95% CI = −0.63 to −0.07, $P = 0.01$; $I^2 = 0\%$).

In terms of acupuncture + PCA vs. control, seven trials [19, 30–33, 35, 36] reported the postoperative opioid consumption between an acupuncture + PCA group and a no treatment group. The pooled SMD was −0.95 (−1.16 to −0.74,

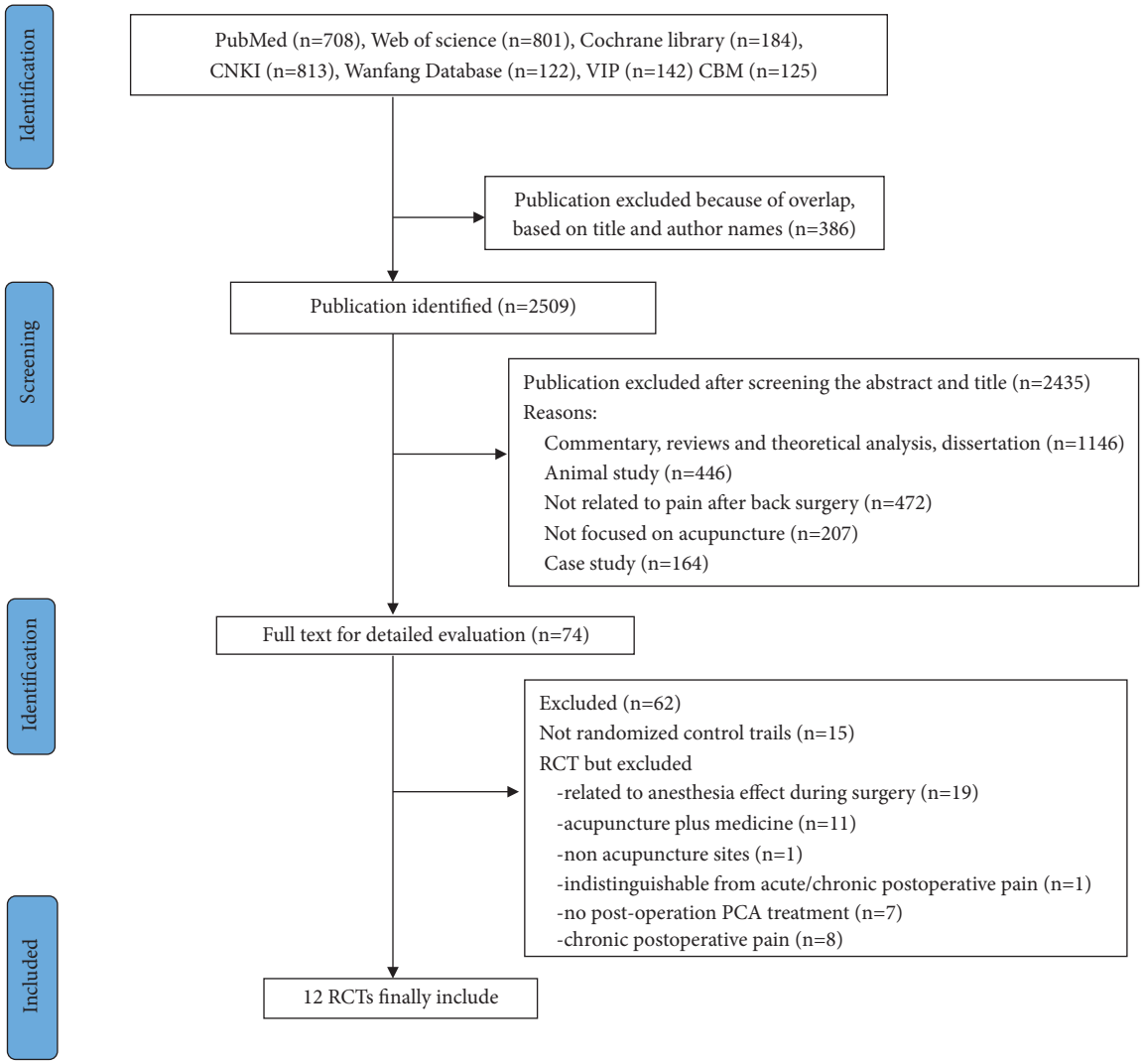


Figure 1: Literature screening flow chart.

$P < 0.00001$), which revalued significant improvements in postoperative opioid dose demands after back surgery. Nevertheless, the results were significantly heterogeneous ($I^2 = 93\%$, $P < 0.0001$). We further analysed all studies, conducted trim analysis. We eventually found the source of heterogeneity. After removing one studies [35], the result was still robust (SMD = −0.82, −1.03 to −0.61, $P < 0.00001$). Thus, the heterogeneity was not significant ($I^2 = 45\%$, $P = 0.11$) (Figure 4).

4.2. Postoperative PCA-Related Complications. A large number of studies have shown that after using PCA, patients experience related side effects such as PONV, dizziness, hypotension, and so on. In this analysis, we found three trials reported the incidence of postoperative PCA-related total complications. As shown in Figure 5, this pooled meta-analysis showed that acupuncture with PCA can effectively reduce incidence of postoperative PCA-related total complications after back surgery (odds ratio = 0.44, 95% CI = 0.23 to 0.85, $P = 0.01$; $I^2 = 9\%$).

In addition, eight trials reported instances of PONV. One randomized controlled trial [30] compared the incidence of PONV between the treatment and control groups, which was assessed at 0–24 h after surgery, 24–48 h after surgery and 48–72 h after surgery. Moreover, four other randomized controlled trials [32–39] revealed that the incidences of PONV after surgery in the experimental and control groups. As shown in Figure 6, this pooled meta-analysis showed that acupuncture with PCA may not reduce the incidence of PONV after back surgery (odds ratio = 0.82, 95% CI = 0.49 to 1.36, $P = 0.44$; $I^2 = 39\%$). Another three RCTs [30, 31, 37] lacked any raw data on the incidence of PONV, and thus they were not applicable in this study.

5. Discussion

We conducted a meta-analysis of 12 trials including 904 patients. Our results showed that the combination of acupuncture with PCA reduced pain intensity and opioid dosage after back surgery compared to the sham

Table 1: Baseline characteristics of included RCTs in systematic review.

Authors	Types of surgery	Sample sizes (A/B/C)	At time	Outcomes
Chung	Spinal stenosis, spondylolisthesis, and herniated intervertebral disk	127 (40/42/45)	1 h after returning to the ward 3 h after returning to the ward Day 1 after surgery Day 2 after surgery	(1) VAS (pain) 1 h after returning to the ward 1 h after returning to the ward 2 h after returning to the ward 4 h after returning to the ward Postoperative 24 h Postoperative 48 h Postoperative 72 h (2) Opiate dose Postoperative 24 h Postoperative 24–48 h Postoperative 48–72 h
Yeh	Lumbar disk herniation, spondylolisthesis, and lumbar spinal stenosis	90 (30/30/30)	Postoperative 3 h Postoperative 4 h	(1) VAS (pain) 1 h after operation 2 h after operation 24 h after operation (2) Opiate dose Postoperative dose during first 24 h
Yeh	Lumbar disk herniation and lumbar vertebra dislocation lumbar spinal stenosis	94 (33/30/31)	1 h before surgery 1 h after operation 2 h after operation	(1) VAS (pain) 1 h after operation 2 h after operation 24 h after operation (2) Postoperative opiate dose during first 24 h
Axel	Lumbar interbody fusion	38 (13/14/11)	8 h after skin closure, 30 minutes on the first postoperative day	(1) Postoperative opiate dose
Chung	Spinal stenosis, spondylolisthesis, and herniated intervertebral disk	127 (40/42/45)	1 h after returning to the ward 3 h after returning to the ward Day 1 after surgery Day 2 after surgery	(1) VAS (pain) Postoperative 24 h Postoperative 48 h Postoperative 72 h (2) Postoperative opiate usage dose Postoperative 24 h Postoperative 24–48 h Postoperative 48–72 h (3) Postoperative nausea and vomiting 24 h after operation 48 h after operation 72 h after operation

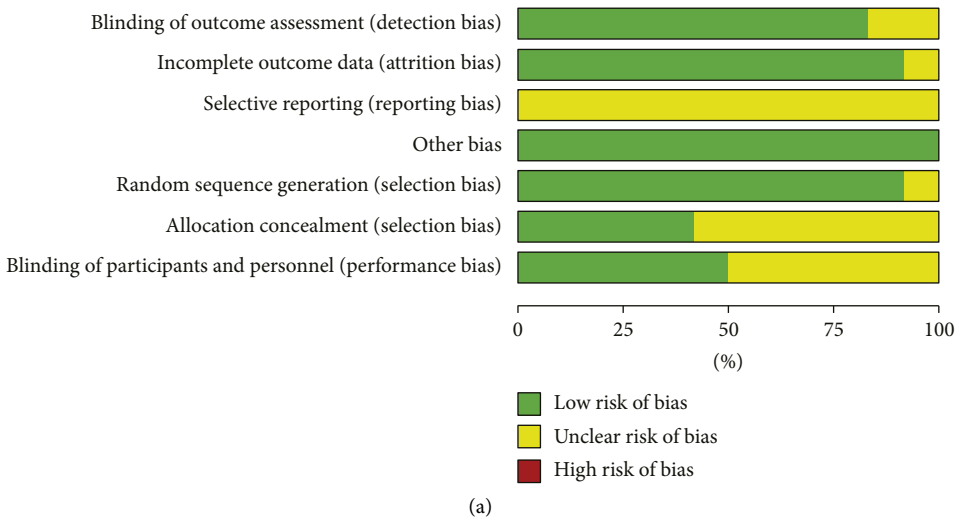
Table 1: Continued.

Authors	Types of surgery	Sample sizes (A/B/C)	At time	Outcomes
Yeh	Lumbar spine surgery	74 (36/38)	1–3 days after surgery	(1) VAS (pain) 24 h after operation 48 h after operation 72 h after operation (2) Postoperative opiate usage dose During first 24 h after operation During 24–48 h after operation During 48–72 h after operation
Bilge	Open lumbar discectomy	54 (29/25)	Second and third hours after surgery	(1) VAS (pain) 24 h after operation 48 h after operation (2) Postoperative opiate usage dose During first 24 h after operation
Zhang	Lumbar spinal canal decompression, pedicle screw fixation, and bone graft fusion	60 (30/30)	Day 1 before surgery 1-2 days after surgery	After 24 h (1) VAS (pain) before surgery 24 h after surgery 72 h after surgery
Xia	Lumbar spine surgery	60 (30/30)	1–5 days after surgery	(1) VAS (pain) 12 h after surgery 24 h after surgery 36 h after surgery (2) postoperative opiate usage dose 12 h after surgery 24 h after surgery 36 h after surgery (3) Biochemical index levels 1 d after surgery 5 d after surgery (4) Postoperative complications
Zheng	Spine surgery	60 (20/20/20)	Immediately after surgery	(1) Postoperative nausea and vomiting (2) T lymphocyte subsets and NK cell levels

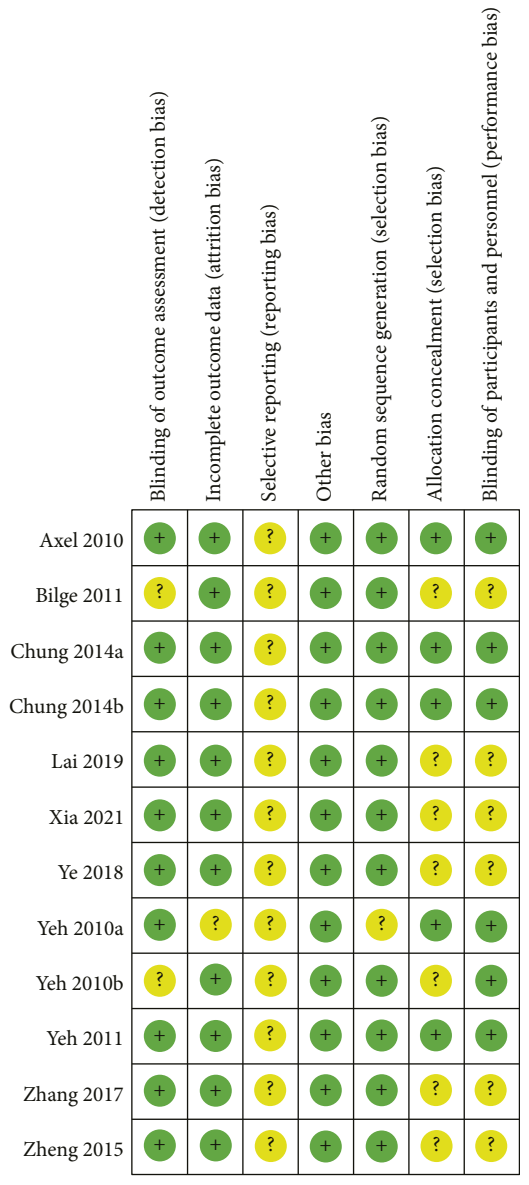
Table 1: Continued.

Authors	Types of surgery	Sample sizes (A/B/C)	At time	Outcomes
Lai	Lumbar internal fixation	60 (30/30)	1–5 days after surgery	(1) VAS (pain) 12 h after surgery 24 h after surgery 36 h after surgery 48 h after surgery 3 d after surgery 4 d after surgery 5 d after surgery (2) postoperative opiate usage dose 12 h after surgery 24 h after surgery 36 h after surgery 48 h after surgery
Ye	The simple extraction and repair of nucleus pulposus for lumbar intervertebral disc herniation	60 (30/30)	Immediately after surgery	(1) VAS (pain) 24 h after surgery 48 h after surgery (2) Postoperative nausea and vomiting (3) Number of postoperative analgesia pump compressions

Note. AT: acupuncture.



(a)



(b)

Figure 2: Risk of bias. (a) Overall quality assessment. (b) Individual quality assessment.

Table 2: Descriptive table of information about acupuncture treatment.

First authors	The experimental group (intervention)	Total number of treatment (times)	Maintenance time	Acupuncture acupoints	Adverse events
Chung	AES	10	15 min	TF4 (shenmen), AH10 (lumbosacral vertebrae), CW8 (kidney), AT5 (subcortex), CO4 (stomach), BL40 (weizhong), and GB34 (yanglingquan)	Not reported
Yeh	AES	2	20 min	HT7 (shenmen), BL40 (weizhong), P6 (neiguan), and GB34 (yanglingquan)	No adverse Effect
Yeh	AES	3	20 min	HT7 (shenmen), BL40 (weizhong), P6 (neiguan), and GB34 (yanglingquan)	Not reported
Axel	TENs	2	30 min	—	Not reported
Chung	IAS	10	15 min	TF4 (shenmen), AH10 (lumbosacral vertebrae), CW8 (kidney), AT5 (subcortex), CO4 (stomach), BL40 (weizhong), and GB34 (yanglingquan)	Not reported
Yeh	Auricular acupressure	12	15 min	TF4 (shenmen), CO18 (endocrine), CO4 (stomach), AT3 (occipital), CO3 (cardia), and AH9 (lumbar-sacrum vertebra)	Not reported
Bilge	TENs	2	30–40 min	—	No adverse Effect
Zhang	Auricular acupressure	15–18	5-6 min	AH6a (sympathetic), TF4 (shenmen), CO18 (endocrine), AH9 (lumbar-sacrum vertebra), and AT4 (subcortical)	Not reported
Lai	Wrist-ankle acupuncture	7	30 min	GB39 (xuanzhong) and SP6 (sanyinjiao)	Not reported
Xia	Wrist-ankle acupuncture	7	30 min	GB39 (xuanzhong) and SP6 (sanyinjiao)	Not reported
Ye	Auricular acupressure	9	3 min	AH9 (lumbar-sacrum vertebra), TF4 (shenmen), AT4 (subcortical), and CO17 (sanjiao)	Not reported
Zheng	Classic acupuncture	1	20 min	P6 (neiguan)	Not reported

Note. AES: acupoint electrical stimulation; IAS: integrative acupoint stimulation; TENs: transcutaneous electrical nerve stimulation.

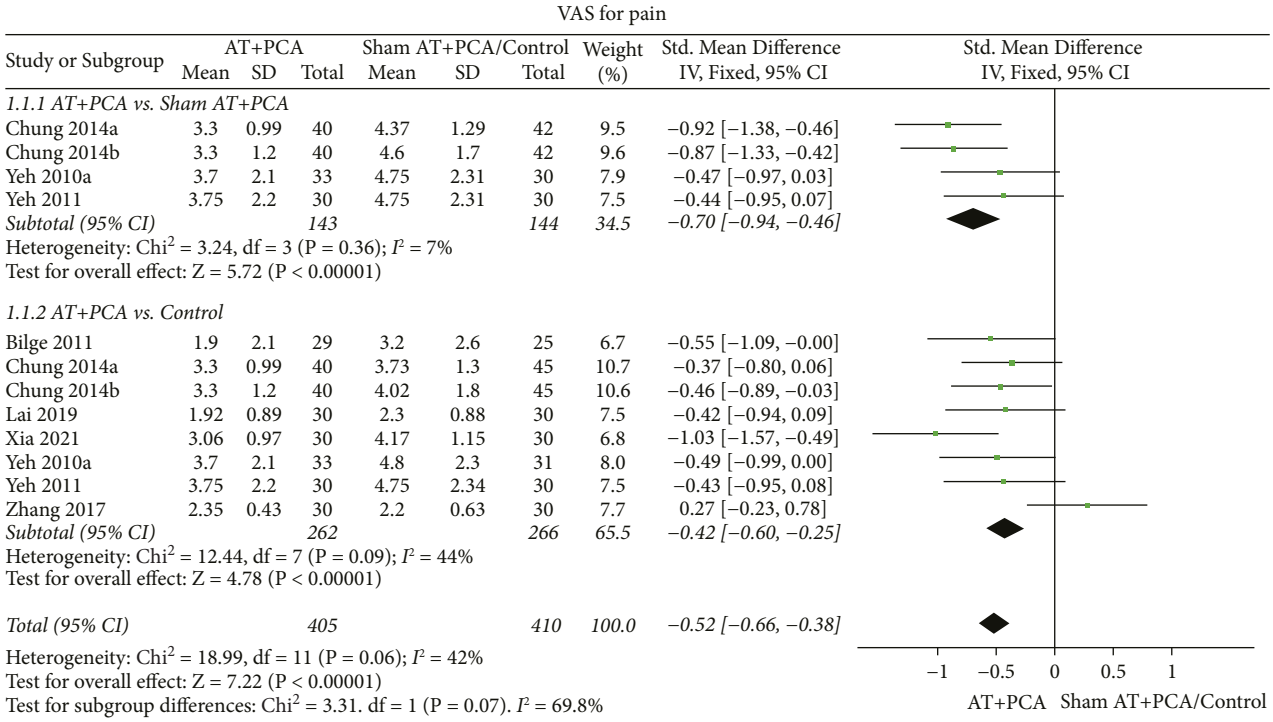


Figure 3: Forest plots of VAS. AT: acupuncture.

Table 3: Summary of the meta-analyses.

Variables	Studies (n)	Participants (n)	Values (95% CI)	I^2 (%)
VASact			Std (mean difference)	
AT + PCA vs. Sham AT + PCA	4	287	− 0.70 (−0.94, −0.46)	7
AT + PCA vs control	8	528	− 0.42 (−0.60, −0.25)	44
Postoperative opioids consumption				
AT + PCA vs. Sham AT + PCA	3	205	− 0.35 (−0.63, −0.07)	0
AT + PCA vs. control	6	387	− 0.82 (−1.03, −0.61)	45
Incidence of postoperative PCA-related total complications			Odds ratio	
AT + PCA vs. control	3	205	0.44 (0.23, 0.85)	9
Incidence of PONV			Odds ratio	
AT + PCA vs. control	5	319	0.82 (0.49, 1.36)	39

Note. AT: acupuncture; PONV: postoperative nausea and vomiting; I^2 describes the heterogeneity.

acupuncture group or control group, but the incidence of PONV was not significantly different. Results are shown in the summary table of our study (Table 3).

The main results of our study revealed the beneficial effects of acupuncture combined with PCA for patients undergoing back surgery. In addition, the acupuncture + PCA approach was associated with lower VAS scores for pain. The results are consistent with previous clinical studies in the field of back surgery [30, 31], thus our meta-analysis confirms and strengthens the prior key findings that acupuncture plus PCA was significantly more effective in reducing acute postoperative pain after back surgery than either sham acupuncture plus PCA or PCA alone. In this study, a novel finding is that patients receiving acupuncture + PCA treatment needed significantly less opiate analgesia postoperatively after back surgery compared with sham acupuncture + PCA or PCA alone. However, another study [17] suggested that acupuncture does not reduce opiate use after back surgery. The main reasons why our results differ from those of the previous study are as follows: the previous study mainly looked at the use of opioids within 24 h after surgery, and its meta-analysis only involved two randomized controlled trials. We now have sufficient data to conduct a meta-analysis for postoperative opioid consumption. Furthermore, we mainly analysed the total postoperative opioid use in patients undergoing back surgery. Summarily, we point out the potential beneficial effects of adjunctive acupuncture complementary to PCA in this meta-analysis.

Furthermore, we assessed the incidence of postoperative PCA-related complications. Our results found that compared with PCA alone, acupuncture combined with PCA can

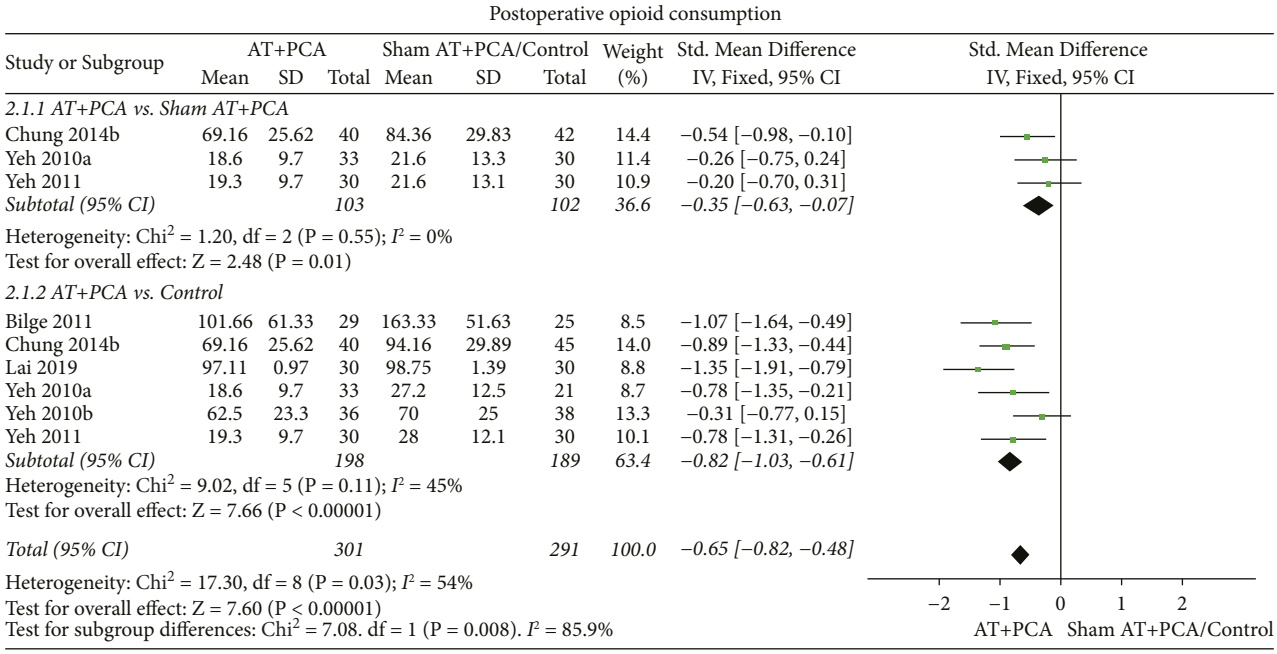


Figure 4: Forest plots of postoperative opioids consumption. AT: acupuncture.

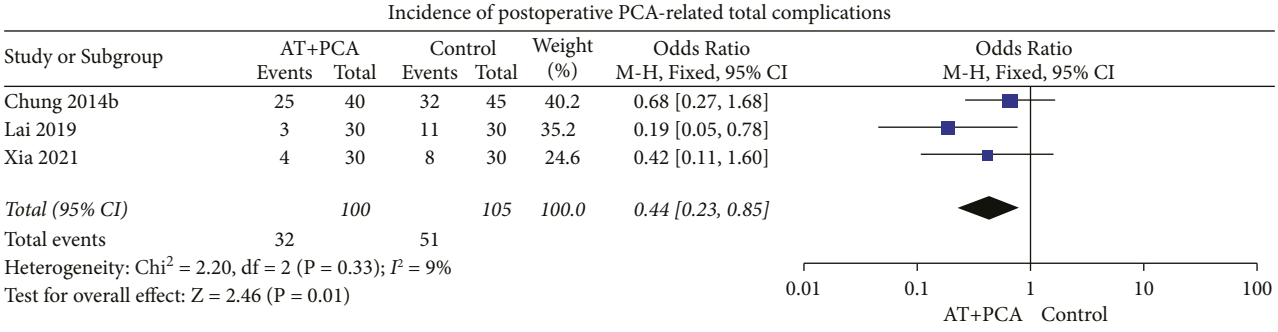


Figure 5: Forest plots of the incidence of postoperative PCA-related total complications. AT: acupuncture.

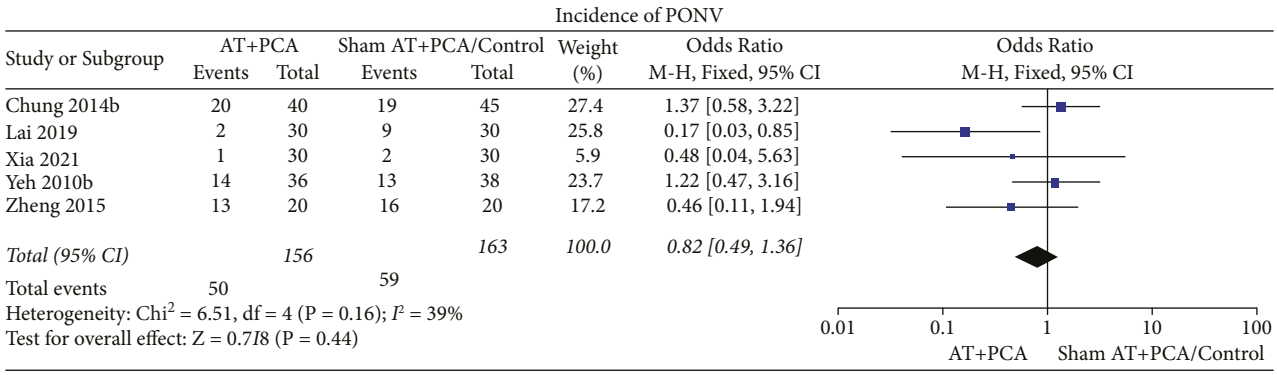


Figure 6: Forest plots of the incidence of PONV. AT: acupuncture.

effectively reduce the incidence of postoperative PCA-related overall complications, which further confirms the positive effect of acupuncture in back surgery [40]. Surprisingly, regarding the index for the incidence of PONV, the results of the five RCTs [30, 32, 35, 36, 39] were combined for analysis in this study. Our meta-analysis showed that acupuncture did not reduce the incidence of PONV. However, previous clinical studies [41, 42] have shown that

acupuncture reduces the incidence of PONV. Due to the small sample size, we only analysed five studies, which may partially explain why acupuncture did not reduce the incidence of PONV after back surgery. This discrepancy may be caused by the study's small sample size.

In the treatment of acute or chronic pain, more and more people advocate multimodal analgesia to reduce the related adverse reactions between drugs and exert a synergistic effect. At present, the commonly used methods of postoperative pain relief include physical therapy and drug therapy. However, the use of excessive analgesic drugs will be accompanied by serious side effects, which is not conducive to the early recovery of patients. As a safe, effective, and simple treatment method, acupuncture can be used as a better auxiliary method compared with other treatment methods. A large number of studies have been conducted on the combined use of acupuncture and PCA. Chen et al. [43] found that after electroacupuncture plus PCA, the pain caused by total knee arthroplasty was reduced at different time points. Likewise, Wu et al. [44] used electroacupuncture or acupuncture combined with PCA for pain relief after Caesarean section. However, serious events related to the safety of acupuncture are still occasionally reported [45–47], but studies have shown that adverse events rarely occur during acupuncture to relieve pain after neck and lower back surgery [48, 49], and acupuncture is a relatively safe method to relieve pain. In this systematic review, only two RCT [19, 33] described no acupuncture-related side effects, but acupuncture has little to do with severe adverse effects. Observations on the safety of acupuncture should be added in future clinical trials.

To our knowledge, this is the first meta-analysis summarising results regarding the efficacy of acupuncture with PCA. Furthermore, most of the publications included in this meta-analysis were of high quality, so the results have some credibility. These data suggest that acupuncture with PCA can provide a more effective method for the clinical treatment of postoperative pain management.

However, this study still has certain limitations. First, due to the particularity of acupuncture, there may be some differences in acupuncture therapy among the various studies, and it cannot be guaranteed that all patients received exactly the same acupuncture therapy. Second, because there are currently few studies related to acupuncture combined with PCA after back surgery, it is impossible to clearly distinguish acupuncture methods. Third, due to the small sample size, the lack of knowledge regarding the exact mechanism of action of acupuncture, and differences in the time and frequency of VAS measurement between the various studies, we are unable to draw specific conclusions about the impacts of acupuncture on the treatment regimen.

6. Conclusions

This meta-analysis mainly summarises the effects of acupuncture plus PCA for acute postoperative pain after back surgery. For patients undergoing back surgery, acupuncture plus PCA can significantly reduce acute postoperative pain compared with PCA alone, and acupuncture may also potentially reduce the postoperative opioid use. Acupuncture, as a relatively safe traditional treatment method, may be used as a supplementary or alternative method to alleviate the adverse reactions associated with PCA.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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