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ORIGINAL RESEARCH

Continuous Wound Infiltration with Local Anesthetic Is an Effective and Safe Postoperative Analgesic Strategy: A Meta-Analysis

Xuan-zhang Huang · Jun-hua Zhao · Peng Gao · Xiao-wan Chen · Yong-xi Song · Yan Xu · Qiong Xiao · Song-chen Dai · Jia-yi Li · Zhen-ning Wang

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ABSTRACT

Introduction: Postoperative pain management is an essential module for perioperative care, especially for enhanced recovery after surgery programs. Continuous wound infiltration (CWI) with local anesthetic may be a promising postoperative analgesic strategy. However, its analgesic efficacy and safety remain debatable.

Methods: Embase and PubMed databases were systematically searched for relevant randomized controlled trials (RCTs). RCTs assessing the analgesic efficacy and safety of CWI with local anesthetic for postoperative analgesia were selected. The outcomes contained pain scores during rest and mobilization, total opioid consumption, time to the first request of rescue analgesia, length of hospital stay, satisfaction with analgesia, time to return of bowel function, postoperative nausea and vomiting, total complication, wound infection, hypotension, and pruritus. The weighted mean difference and risk ratio were used to pool continuous and dichotomous variables, respectively.

Results: A total of 121 RCTs were included. CWI with local anesthetic reduced postoperative pain during rest and mobilization at different time points, increased satisfaction with analgesia, shortened recovery of bowel function, and reduced postoperative nausea and vomiting compared with the placebo group, especially for laparotomy surgery. There were no significant differences in these clinical outcomes compared to epidural and intravenous analgesia. CWI with local anesthetic reduced the total opioid consumption and hypotension risk and did not increase total complications, wound infection, or pruritus. CWI with local anesthetic had a better analgesic efficacy without increased side effects for sternotomy surgery. However, CWI with local anesthetic did not translate into favorable analgesic benefits in laparoscopic surgery.

Conclusion: CWI with local anesthetic is an effective postoperative analgesic strategy with good safety profiles in laparotomy and sternotomy surgery, and thus CWI with local anesthetic may be a promising analgesic option enhancing recovery after surgery programs for these surgeries.

Xuan-zhang Huang and Jun-hua Zhao are contributed equally to this work.

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PLAIN LANGUAGE SUMMARY

Continuous wound infiltration (CWI) with local anesthetic may be a promising postoperative analgesic strategy, but its effect remains debatable. We performed this meta-analysis based on 121 high-quality articles (RCTs) to evaluate the analgesic efficacy and safety of CWI with local anesthetic. We found that CWI with local anesthetic could reduce postoperative pain, increase satisfaction with analgesia, shorten recovery of bowel function, and reduce postoperative nausea and vomiting, especially for laparotomy surgery. However, CWI with local anesthetic did not show favorable analgesic benefits in laparoscopic surgery.

Keywords: Analgesic efficacy; Continuous wound infiltration; Local anesthetic; Postoperative analgesia; Surgery

Key Summary Points
Why carry out this study?
Postoperative pain management has become a vital component of perioperative care.
Continuous wound infiltration (CWI) with local anesthetic may be a promising postoperative analgesic strategy, but its effect remains debatable.
We performed this meta-analysis to assess the efficacy and safety of CWI with local anesthetic after surgery.
What was learned from the study?
CWI had favorable analgesic efficacy and did not increase complications, especially in laparotomy, but CWI did not translate into favorable analgesic benefits in laparoscopic surgery.
CWI with local analgesic is a safe and effective postoperative analgesic strategy.

DIGITAL FEATURES

This article is published with digital features, including a summary slide, to facilitate understanding of the article. To view digital features for this article go to https://doi.org/10.6084/m9.figshare.13713235.

INTRODUCTION

Postoperative pain management has become a vital component of perioperative care [1, 2]. Effective postoperative analgesia is helpful for accelerating perioperative recovery and improving clinical outcomes, which is an essential module for enhanced recovery after surgery programs and consistent with the aim of enhanced recovery after surgery programs [3, 4]. However, surveys show that approximately 80% of patients experience acute pain after surgery, and 86% of these patients have moderate, severe, or even extreme pain [5]. Inadequate postoperative analgesia can lead to increased mortality and morbidity, chronic pain, and poor life quality after surgery [6–10]. Opioid-related side effects, including postoperative nausea and vomiting (PONV) and intestinal obstruction, can contribute to longer lengths of hospital stay, [11, 12], and opioid-based analgesia may increase the risk of persistent or chronic opioid use after surgery [13]. Even epidural analgesia, with typical side effects including arterial hypotension and urinary retention, is also adverse to early mobilization [6]. Thus, additional efforts for a safe and effective analgesic strategy are urgently needed to improve postoperative pain.

Continuous wound infiltration (CWI) with local anesthetic is an analgesic technique that uses catheters, which are inserted into the wound at the end of surgical procedure to continuously deliver local anesthetic directly into the wound sites for analgesia [10, 14]. CWI with local anesthetic has potential to provide effective postoperative analgesia, reduce opioid consumption, and shorten hospital stay with good safety profiles, because local anesthetics rather than opioids are used for CWI to provide continuous analgesia even over the course of

several days [10, 15]. Considering the use of wound catheters and local anesthetics, CWI may also effectively avoid opioid- and epidural analgesia-related side effects. Thus, CWI with local anesthetic may be a valuable alternative option for a postoperative analgesic strategy. However, almost all of the randomized controlled trials (RCTs) only focus on a certain type of surgery when evaluating the analgesic efficacy and safety of CWI with local anesthetic, and their clinical outcomes are not all-sided. Although CWI with local anesthetic is growing in popularity and is widely used for postoperative analgesia following several surgery types, recent meta-analyses still yield contradictory conclusions; thus, its analgesic efficacy and safety remain uncertain and controversial [16, 17].

Therefore, it is important to perform a comprehensive meta-analysis that evaluates the analgesic efficacy and safety of CWI with local anesthetic following surgery. The analysis also evaluated the influence of surgery type and analgesic regimen of the control group on clinical outcomes, such as pain scores during rest and mobilization at different time points, total opioid analgesic consumption, time to the first request of rescue analgesia, length of hospital stay, satisfaction with postoperative analgesia, time to return of bowel function, PONV, total complications, wound infection, hypotension, and pruritus.

METHODS

Literature Search

A systematical literature search using the PubMed and Embase databases (up to November 2019) was performed for RCTs that evaluated postoperative analgesic efficacy and safety of CWI with local anesthetic in patients who had undergone surgery. The following search terms were used: "wound infusion," "continuous wound infusion," "continuous infusion," "local infusion," "continuous local infusion," "continuous wound infiltration," "wound infiltration," "local wound infiltration," "local analgesia," "continuous local analgesia," "randomised trial," "randomized trial," "randomised study," "randomized study," and "pain." In addition, references from the included RCTs and relevant reviews were manually searched to identify additional eligible RCTs.

Eligibility Criteria

The RCTs that met the following eligibility criteria were included in this study: (1) participants: adults and/or children who received surgery irrespective of surgery type and who were administered rescue analgesia when they could not tolerate the pain; (2) intervention: CWI with local anesthetic (CWI group) was administered for postoperative analgesia after surgery; (3) comparison: any conventional analgesia that was administered for postoperative analgesia after surgery, including placebo group (standard pain care plus no additional treatment or CWI with placebo), epidural analgesia, and intravenous analgesia; (4) outcome: analgesic efficacy and safety of CWI with local anesthetic consisting of pain score during rest and mobilization at different time points (4, 6, 12, 24, 36, and 48 h), total opioid analgesic consumption (12, 24, 48, 72, and 96 h), time to the first request of rescue analgesia, length of hospital stay, satisfaction with postoperative analgesia, time to return of bowel function, PONV, total complication, wound infection hypotension, and pruritus; (5) study design: only RCTs were included. Furthermore, the most recent study was included in this research when duplicated studies were identified based on the same participants.

Data Extraction

Two authors (Xuan-Zhang Huang and Jun-hua Zhao) independently reviewed the included RCTs and the extracted data. The following data were extracted from each included study: first author, publication year and country, patient number, age, gender, surgery type, analgesic regimens, pain score at rest and during mobilization at different time points, total opioid analgesic consumption at different time points, time to the first request of rescue analgesia,

length of hospital stay, satisfaction with postoperative analgesia, time to return of bowel function, PONV, total complications, wound infection hypotension, and pruritus. For continuous variables provided as medians with ranges and medians with interquartile ranges, the values were used to calculate the means and corresponding standard deviations according to the methods reported by Hozo et al. and the Cochrane handbook, respectively [18]. All postoperative opioid analgesic consumption was converted into morphine equivalents [19]. For pain scores, the 101-point scale (0–100) used in the RCTs was converted into an 11-point scale (0–10). Any problems during data extraction were resolved by discussion.

Statistical Analysis

The weighted mean difference (WMD) with the corresponding 95% confidence interval (CI) was used as an effect measure to pool continuous variables. The risk ratio (RR) with the corresponding 95% CI was used as an effect measure to pool dichotomous variables. The overall analysis was performed by including all of the RCTs according to different outcomes. Subgroup analysis was performed for each outcome based on different factors, including surgical type and analgesic regimen.

Considering the existing heterogeneity among RCTs, a random-effects model was used to pool the data because it could obtain more conservative results than a fixed-effects model and was thus more suitable for pooling RCTs from different centers [20]. Heterogeneity between studies was assessed using the Cochran Q test and I^2 statistic [21]. Publication bias was evaluated using Begg's and Egger's tests [22–24].

All statistical analyses were conducted in Stata software version 12.0 (Stata Corp., College Station, TX, USA). A two-sided $p < 0.05$ was considered statistically significant.

Ethics Compliance

This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

RESULTS

Study Selection and Study Characteristics

A total of 12,990 studies were initially identified from the literature search, of which 3885 studies were excluded because of duplications; 8154 studies were excluded based on eligibility criteria after reviewing the titles and abstracts. The 951 remaining studies were further full-text reviewed, and 830 studies were excluded. Finally, 121 RCTs were eligible for this quantitative analysis (Fig. 1).

A total of 121 RCTs enrolling 9574 patients were eligible for the study. The included RCTs were published between 2000 and 2019, with 91 RCTs in the past decade. Regarding the surgical type, 43 RCTs evaluated CWI with local anesthetic in laparotomy, 14 RCTs evaluated CWI with local anesthetic in laparoscopic surgery, 15 RCTs evaluated CWI with local anesthetic in cardiac or pulmonary surgery with sternotomy, 6 RCTs evaluated CWI with local anesthetic in mastectomy, and 31 RCTs evaluated CWI with local anesthetic in orthopedic surgery. The main characteristics of the included studies are listed in eTable 1.

Pain Score During Rest and Mobilization at Different Time Points

To evaluate the analgesic efficacy of CWI with local anesthetic, most RCTs reported the pain score at 24 h after surgery; 95 RCTS and 52 RCTs reported the pain score at rest and mobilization, respectively. In general, compared with the placebo group, postoperative CWI with local anesthetic could significantly reduce pain during both rest [Fig. 2a, 60 RCTs, WMD = − 0.81 (− 1.03 to − 0.60)] and mobilization [Fig. 2b, 29 RCTs, WMD = − 0.98 (− 1.44 to − 0.52)]. Postoperative CWI with local anesthetic also showed similar analgesic efficacy as epidural analgesia [Fig. 3a, at rest, 13 RCTs, WMD = 0.04 (− 0.19 to 0.28); at mobilization, 9 RCTs,

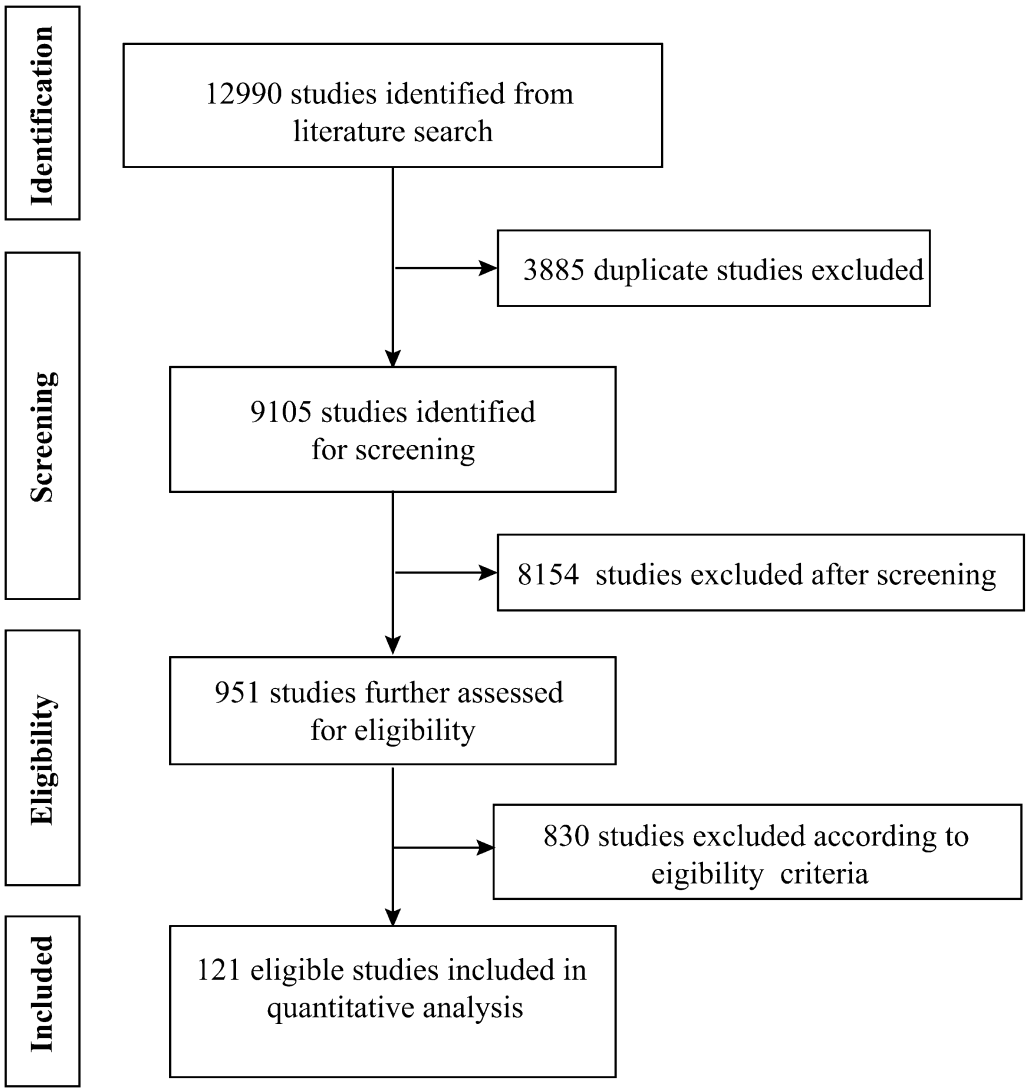

Fig. 1 Literature search and study selection

WMD = 0.22 (− 0.12 to 0.56)] and intravenous analgesia [Fig. 3a, at rest, 14 RCTs, WMD = − 0.54 (− 1.16 to 0.08); at mobilization, 9 RCTs, WMD = − 1.15 (− 2.83 to 0.54)] at 24 h after surgery.

Another time point that many studies considered was 48 h after surgery. Seventy-eight RCTs and 48 RCTs reported the pain score at rest and mobilization, respectively. Compared with the placebo group, postoperative CWI with local anesthetic could significantly reduce pain during both rest [Fig. 3a, Figure S1, 52 RCTs, WMD = − 0.58 (− 0.78 to − 0.37)] and mobilization [Fig. 3a, Figure S2, 31 RCTs, WMD = − 0.75 (− 1.18 to − 0.32)]. Postoperative CWI with local anesthetic also showed similar analgesic efficacy as epidural analgesia (Fig. 3a). Compared with intravenous analgesia, CWI with local anesthetic showed a similar effect at mobilization and significantly better analgesic efficacy at rest (Fig. 3a).

Studies also reported the pain score at 2, 4, 6, 12, and 36 h after surgery. Compared with the placebo group, CWI with local anesthetic significantly reduced pain at these time points after surgery during both rest and mobilization (Fig. 3a). The CWI group showed similar

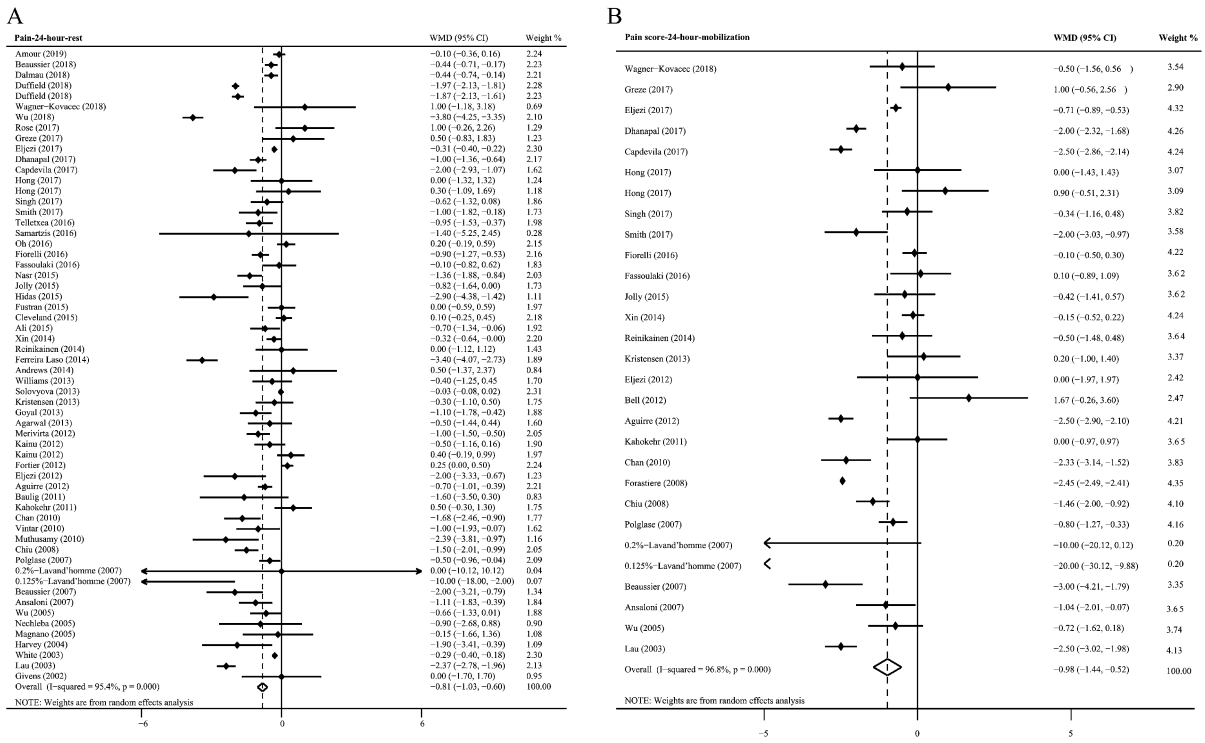

Fig. 2 Forest plot for the pain score at 24 h during rest (**a**) and mobilization (**b**) comparing the continuous wound infiltration group with the placebo group

analgesic efficacy as epidural analgesia and intravenous analgesia (Fig. 3a).

Subsequently, we performed subgroup analysis stratified by surgical types. For laparotomy surgery (Fig. 3b), CWI with local anesthetic resulted in a significant reduction in pain during both rest and mobilization at 4, 6, 12, 24, and 48 h after surgery compared with the placebo group. The CWI group showed similar analgesic efficacy as epidural analgesia.

However, for laparoscopic surgery, CWI with local anesthetic did not reduce pain compared to the placebo group at the abovementioned time points during both rest and mobilization. Moreover, its analgesic efficacy was even worse than that of epidural analgesia at 2, 12, and 24 h after surgery during rest (Figure S3).

As for sternotomy surgery, the CWI group showed a significant reduction in pain at 4, 24, 36, and 48 h during rest and 36 and 48 h during mobilization compared with the placebo group, but no significant differences were present 6 and 12 h after surgery during both rest and mobilization (Figure S4).

In orthopedic surgery, a statistically significant reduction in pain was present at 2, 4, 24, and 36 h during rest, but no statistically significant differences were found at 6 and 48 h during rest and 12, 24, and 48 h when comparing CWI with local anesthetic to placebo (Figure S5).

Total Opioid Consumption

Studies also evaluated opioid consumption after surgery to show the efficacy of CWI with local anesthetic. Most studies compared the CWI group to the placebo group at 24 h (Fig. 4a, 30 RCTs) and 48 h (Fig. 4b, 30 RCTs) after surgery. Results showed that CWI with local anesthetic could significantly reduce opioid consumption [for 24 h, WMD = − 5.94 mg (− 8.20 to − 3.68); for 48 h, WMD = − 10.96 mg (− 13.05 to − 8.87)]. We also found that CWI with local anesthetic could significantly reduce opioid

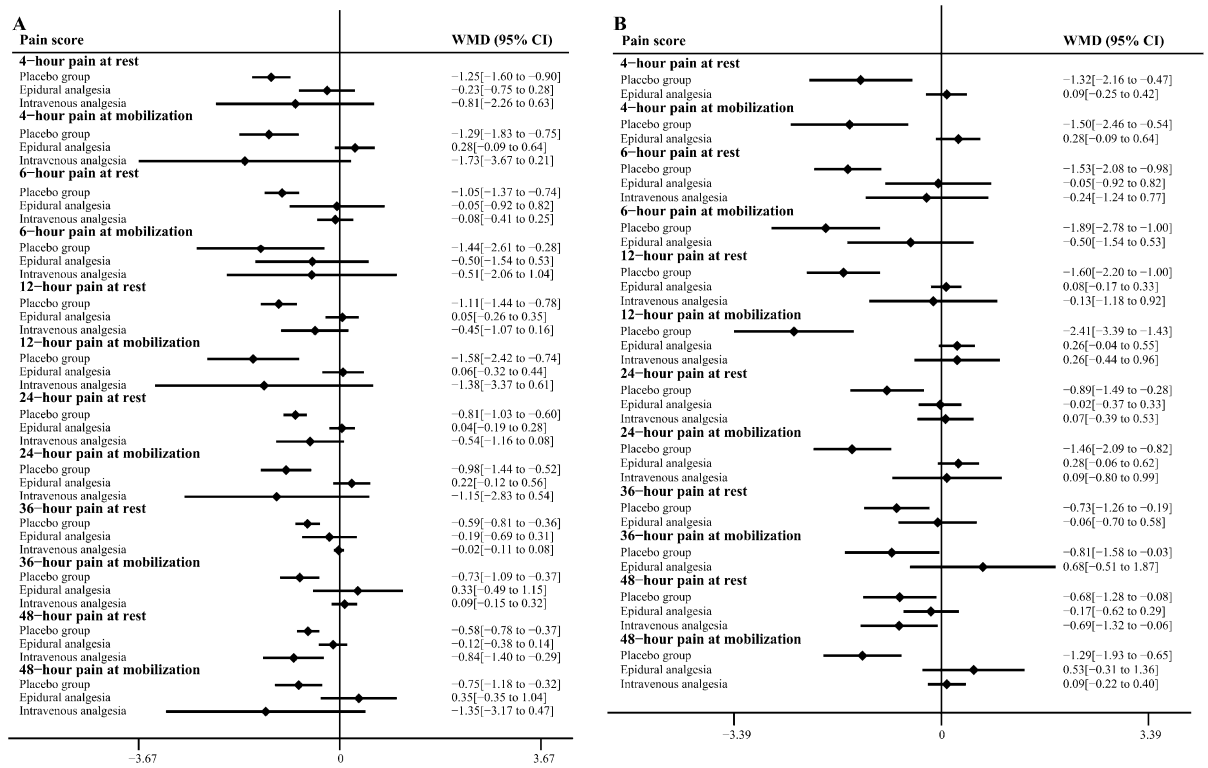

Fig. 3 The pain score of continuous wound infiltration in overall surgery (**a**) and laparotomy surgery (**b**)

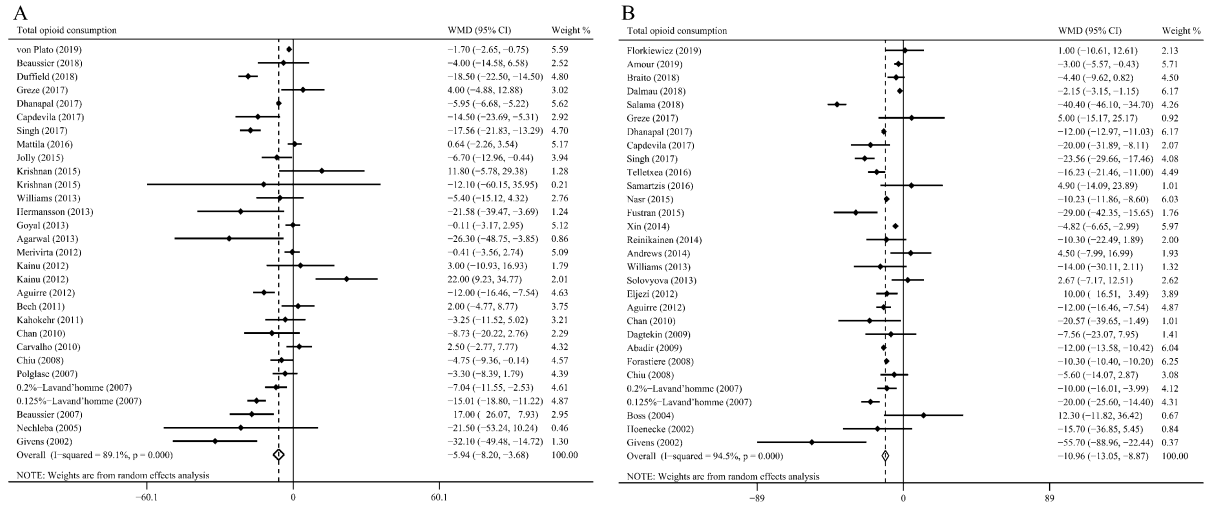

Fig. 4 Forest plot for the total opioid consumption at 24 h (**a**) and 48 h (**b**) in the continuous wound infiltration group compared with the placebo group

consumption compared to the placebo group at 12 h (Figure S6A) and 72 h (Figure S6B) after surgery.

Moreover, the CWI group showed similar opioid consumption compared with epidural analgesia (Fig. 5a) at 24, 48, and 72 h after surgery. Also, the CWI group showed similar

opioid consumption compared with intravenous analgesia (Fig. 5a) at 24 h and 48 h after surgery.

Subsequently, we performed subgroup analysis stratified with surgical types. The effects of CWI with local anesthetic on laparotomy surgery were similar to those in all kinds of surgeries (Fig. 5b). The CWI group showed significantly reduced opioid consumption compared with the placebo group at 12, 24, 48, and 72 h after surgery. Simultaneously, the CWI group showed similar opioid consumption compared with epidural analgesia at 24, 48, and 72 h after surgery.

However, for laparoscopic surgery, CWI with local anesthetic failed to reduce opioid consumption after surgery (Fig. 5b). For sternotomy surgery, CWI with local anesthetic showed a

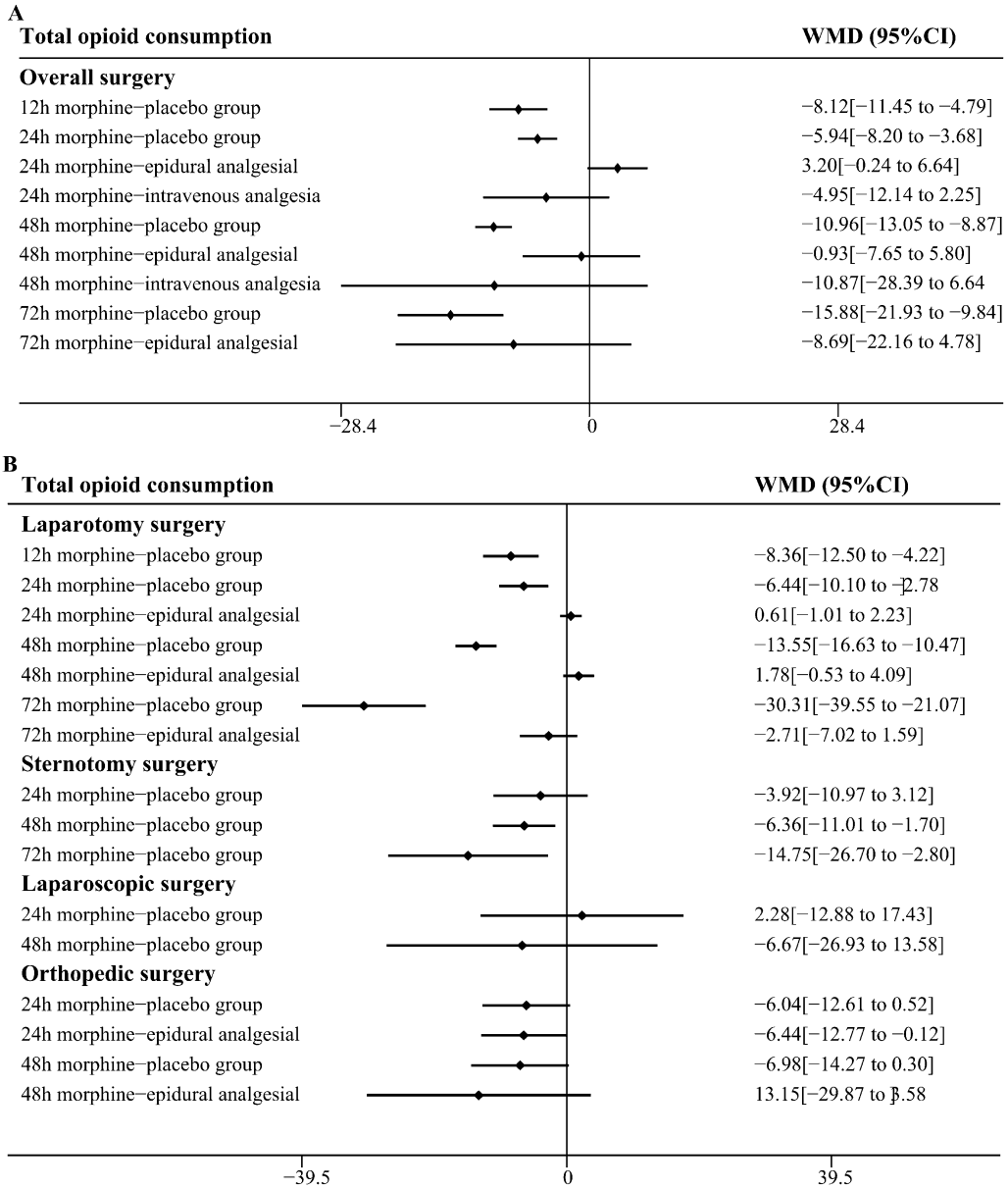

Fig. 5 The total opioid consumption of continuous wound infiltration in overall surgery (**a**) and different types of surgery (**b**)

significant reduction in opioid consumption at 48 h and 72 h after surgery, but no significant differences were present at 12 h after surgery (Fig. 5b).

In orthopedic surgery, no statistically significant differences were found at 24, 48 h, and 72 h after surgery when comparing the CWI group to the placebo group. Interestingly, however, a significant reduction was found at 24 h after surgery when comparing the CWI group to epidural analgesia (Fig. 5b).

Time to the First Request for Rescue Analgesia and Satisfaction With Analgesia

Compared to the placebo group, only a very slightly longer time to the first request for rescue analgesia was observed in the CWI group [5RCTs, WMD = 1.38 h (0.17–2.58)] (Figure S7). Simultaneously, there were no significant differences when comparing the CWI group to epidural analgesia. When performing subgroup analysis based on surgical type, the CWI group did not show benefit compared with placebo in laparotomy and sternotomy (Figure S7).

Compared with the placebo group, patients in the CWI group had significantly higher satisfaction with analgesia (Figure S8A) [WMD = 0.85 (0.19–1.51)]. Patients had similar satisfaction rates when comparing the CWI group to epidural analgesia and intravenous analgesia (Figure S8A). Subsequently, we performed subgroup analysis stratified by surgical type (Figure S8B). In laparotomy surgery and sternotomy surgery, the CWI group had significantly higher satisfaction with analgesia compared with the placebo group. In laparotomy surgery, the CWI group had similar satisfaction with analgesia compared with epidural analgesia and intravenous analgesia. Patients also had similar satisfaction levels when comparing the CWI group to the placebo group and intravenous analgesia in orthopedic surgery.

Length of Hospital Stay

The results indicated that CWI with local anesthetic shortened the length of hospital stay (Figure S9A) compared to intravenous analgesia, but there was no obvious difference in length of hospital stay when the CWI group was compared with the epidural analgesia and placebo groups (Figure S9A). A similar result was obtained for laparotomy surgery (Figure S9B). There was a shorter length of hospital stay for the CWI group compared with the placebo group for sternotomy surgery [9RCTs, WMD = − 0.47 day (− 0.93 to − 0.01), Figure S9B] and when the CWI group was compared to intravenous analgesia in orthopedic surgery [3RCTs, WMD = − 1.97 day (− 2.97 to − 0.97), Figure S9B]. However, CWI did not shorten the length of hospital stay for laparoscopic surgery.

Time to Return of Bowel Function

Compared with the placebo group, CWI with local anesthetic significantly promoted the recovery of bowel function [Figure S10A, WMD = − 10.74 h (− 13.58 to − 7.91)]. There were no significant differences in recovery of bowel function between the CWI group and epidural analgesia and intravenous analgesia (Figure S10A).

In subgroup analysis stratified by surgical types (Figure S10B), CWI with local anesthetic showed significant benefits for bowel function recovery in laparotomy surgery compared with placebo. No significant differences were observed for other comparisons.

Side Effects

The PONV for the CWI group was significantly lower than that for the placebo group [35RCTs, RR = 0.71 (0.60–0.83), Fig. 6a]. The PONV for the CWI group was similar to that for epidural and intravenous analgesia (Fig. 6a). Moreover, hypotension in the CWI group was significantly lower compared with the placebo group (Fig. 6a) and epidural analgesia (Fig. 6a). In subgroup analysis based on surgical type, compared with the placebo group, the CWI group showed significantly lower PONV in laparotomy (Fig. 6b), but a similar PONV in sternotomy (Fig. 6c), laparoscopic surgery (Fig. 6d) and orthopedic surgery (Fig. 6e).

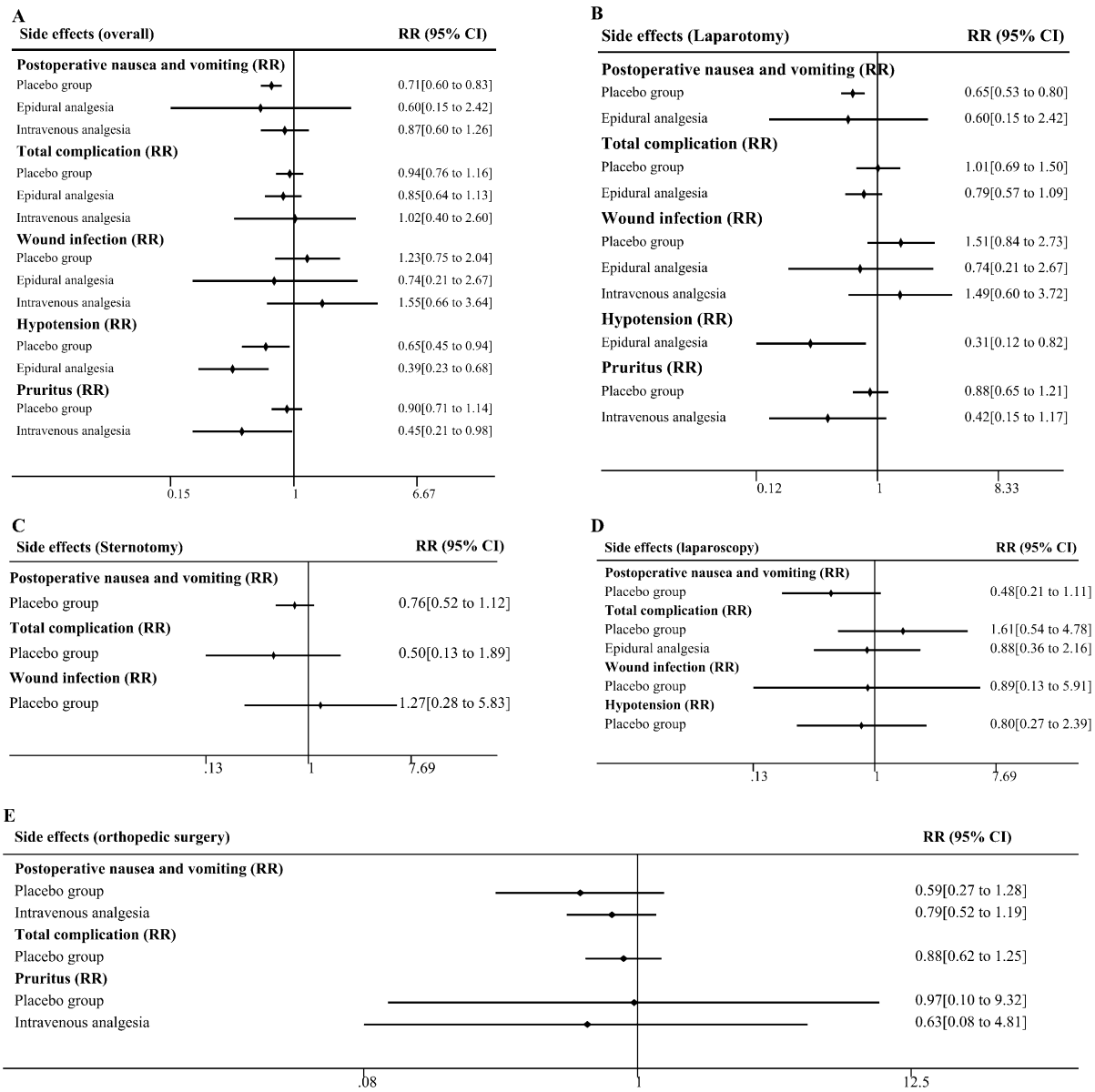

Fig. 6 Side effects of continuous wound infiltration in overall surgery (**a**), laparotomy (**b**), sternotomy (**c**), and laparoscopy (**d**) and orthopedic surgery (**e**)

Besides, the wound catheter used in the CWI group did not increase or decrease total complications, wound infection, or pruritus regardless of surgery type and analgesic regimen (Fig. 6a–e).

Compared with Continuous Nerve Blocks

In addition to the comparison with placebo, epidural analgesia, and intravenous analgesia, CWI with local anesthetic was also compared with continuous nerve blocks by several studies. The results showed that two methods have similar pain scores at 6, 12, and 36 h after surgery at rest and 24 h after surgery during mobilization. Continuous nerve blocks showed better pain scores at 24 h and 48 h after surgery at rest (Figure S11). Besides, two methods also showed similar results for opioid consumption (48 h after surgery) and PONV (Figure S11).

DISCUSSION

The present study included 121 eligible RCTs containing a total of 9574 patients who had undergone surgery. In general, the benefits of CWI with local anesthetic in pain relief, reducing opioid consumption, satisfaction with analgesia, recovery of bowel function, and PONV were all significant in comparison with placebo, which indicates CWI with local anesthetic is an effective method for perioperative pain control. In detail, for the laparotomy surgery subgroup, the results indicated that CWI with local anesthetic resulted in favorable outcomes in postoperative pain during rest and mobilization, opioid consumption, satisfaction with analgesia, recovery of bowel function, and PONV. Moreover, CWI with local anesthetic led to lower hypotension and did not increase total complications, wound infections, or pruritus. For sternotomy surgery, CWI with local anesthetic had favorable analgesic benefits compared to the placebo group with no significant differences in side effects. However, CWI with local anesthetic did not translate into favorable analgesic benefits for laparoscopic surgery. In orthopedic surgery, CWI with local anesthetic reduced pain during mobilization rather than during rest compared to intravenous analgesia. Finally, we compared the CWI group to continuous nerve blocks. Two methods showed comparable results in general, and continuous nerve blocks showed better performance in pain scores at two time points at rest. The differences in efficacy need further analysis based on surgical type. However, due to the limitation in study number, we did not perform subgroup analysis and call for more RCTs on this issue.

In the present study, CWI with local anesthetic demonstrated benefits in pain relief as well as opioid consumption reduction, especially for laparotomy surgery. Effective postoperative analgesia is a prerequisite to enhance postoperative recovery and reduce postoperative morbidity, and the use of local anesthetic techniques has attracted increasing attention due to their safety [3, 25, 26]. Unlike single-dose techniques whose value is limited by their short analgesic duration [25], CWI with local anesthetic at the wound site is a rational approach to reduce the afferent nociceptive barrage and thereby pain and stress responses [27]. In the present study, CWI with local anesthetic significantly relieved pain in laparotomy surgery during both rest and mobilization compared with the placebo group. Moreover, the benefits of CWI with local anesthetic for total opioid consumption in laparotomy surgery were also uniformly significant regardless of time points. The present evidence has shown that local anesthetics directly block nociceptive afferent transmission from the wound surface [16, 28]. Kahokehr et al. suggested that local anesthetics may create a transient chemical block of vagal afferents at the surgical site, which thereby block the gut-brain axis that transmits painful, nociceptive stimuli and decrease the neuroendocrine response to the surgical injury [29]. Moreover, local anesthetic may also reduce the inflammatory response to injury at the wound site, and this inflammatory response can contribute to pain and hyperalgesia by sensitizing nociceptive receptors [30].

However, the present results do not support the usage of CWI with local anesthetic in laparoscopic surgery. Subgroup analysis revealed that CWI with local anesthetic could neither benefit pain relief nor reduce total opioid consumption for laparoscopic surgery. This may be caused by the relatively small size of the wound incision in laparoscopic surgeries, which results in a low level of pain intensity in laparoscopic surgery [31]. As for sternotomy or orthopedic surgery, the effect of CWI on pain relief varied according to time point or movement status. These types of surgeries perform operations on bones. The possible explanation was that the additional pain from bones makes the pain components in these surgeries more complex and different from those in laparotomy surgery whose pain originates in the soft tissue.

Admittedly, no analgesic technique can perfectly fulfill all requirements of optimal anesthetic efficacy with no side effects, low costs, high patient compliance, and improvement in outcome. Consequently, multiple analgesic techniques have been introduced with a focus on opioid sparing as well as improving

analgesia and recovery [27]. There is also a need to compare CWI with other local anesthetic techniques. In the present study, the overall effects of CWI were comparable to epidural analgesia and intravenous analgesia. Of note, CWI yielded the best performance for the side effect of hypotension. Moreover, considering CWI's low technical failure rate and low cost [14, 16, 27], it is indeed the most rational approach to reducing the nociceptive barrage and pain response [27].

Clinical safety of a new analgesic technique is an essential factor for its application in clinical practice, no matter how good its analgesic efficacy is. However, in general, CWI safety was not a primary outcome considered in the RCTs. Some RCTs did not even report the results of CWI safety. In addition, the incidence of side effects was low because of the improvement of perioperative care, and thus small-sample RCTs may not be able to detect and evaluate the differences in side effects [32–34]. Therefore, expansion of sample size through meta-analysis of RCTs is important to detect and explore the differences relevant to CWI safety.

Infection of the wound catheter was an important concern for patients, anesthetists, and surgeons. The present results found that CWI with local anesthetic did not increase the risk of wound infection, pruritus, and total complications regardless of surgery type. As the most common side effect for postoperative analgesia, PONV can contribute to poor patient comfort and satisfaction with analgesia, increased nursing burden, and delayed discharge after surgery [35]. CWI with local anesthetic resulted in lower PONV incidence compared to standard pain care, especially in laparotomy surgery. Thus, taken together, CWI with local analgesic is a safe and effective postoperative analgesic strategy. Future large-scale RCTs are urgently needed to explore more detailed types of side effects associated with CWI.

There were some limitations to this study. First, this meta-analysis was performed based on the published data from the included studies without detailed individual data to control for the confounding bias. A few studies compared the CWI group with other kinds of analgesic methods. Due to the limited number of studies, we did not perform a meta-analysis of the results and still included them in Table S1. Second, there was a considerable degree of heterogeneity among the included RCTs. The sources of heterogeneity may originate from the differences of treatment strategies and patient characteristics. Third, we could not explore the optimal dosage, infusion speed and duration, and cost-effectiveness of CWI in postoperative analgesia because of the lack of related data. In addition, the limited number of some subgroup analyses may affect the statistical power of these results.

CONCLUSIONS

CWI with local anesthetic is an effective postoperative analgesic strategy with good safety profiles in laparotomy and sternotomy surgery. However, CWI with local anesthetic did not result in favorable analgesic efficacy in laparoscopic surgery. Thus, CWI with local anesthetic may be a promising postoperative analgesic strategy for enhanced recovery after surgery programs for laparotomy and sternotomy surgeries.

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Disclosures. All the authors declare that there are no any conflicts of interest.

Compliance with Ethics Guidelines. This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

Data Availability. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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