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Review Article

Wound Infiltration with Local Anesthetics Versus Transversus Abdominis Plane Block for Postoperative Pain Management in Gynecological Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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ABSTRACT **Objective:** Postoperative pain management significantly influences recovery speed, hospital stay duration, and healthcare costs. In light of inconsistencies in clinical trial outcomes, we conducted a systematic review and meta-analysis to assess the efficacy of the Transversus Abdominis Plane (TAP) block compared to local anesthetic wound infiltration (WI) for post-operative pain management in gynecological surgery.

Data Sources: Systematic searches were conducted across PubMed/MEDLINE, ScienceDirect, the Cochrane Library, and Web of Science databases to identify all randomized controlled trials comparing TAP block and WI in adult patients undergoing gynecological surgical procedures. Additionally, the reference lists of the identified studies were manually reviewed. Only studies published in English were eligible for inclusion in the analysis.

Methods of Study Selection: The Population, Intervention, Comparison, and Outcome framework for the review included: (1) adult patients who underwent gynecological surgical procedures; (2) postoperative TAP block as the intervention; (3) comparison with local anesthetic WI; (4) primary outcome: postoperative pain at 1, 4, 12, and 24 hours; secondary outcomes: postoperative opioid consumption, opioid-related side effects, and patient satisfaction. STATA software, version 18 (Stata Corp, College Station, TX, USA), was used for the analysis.

Tabulation, Integration, and Results: A total of 213 papers were initially identified. Of these, 10 randomized controlled trials encompassing a total of 604 patients met the inclusion criteria. The meta-analysis studying minimally invasive surgery showed that TAP block was associated with lower pain scores at rest and 1, 4, 12, and 24 hours compared to the WI group. Furthermore, the TAP block resulted in a reduction in opioid consumption at 24 hours, although there was no significant difference in opioid-related adverse effects. Two studies presented data on patient-reported satisfaction, and a pooled analysis was not feasible due to heterogeneity.

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Conclusion: TAP block seems to provide better postoperative pain control after laparoscopic gynecologic procedures and reduces opioid use compared to WI in gynecologic surgery. Journal of Minimally Invasive Gynecology (2024) 00, 1−11. © 2024 AAGL. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

Keywords: Gynecological surgery; Postoperative pain; Transversus abdominis plane block; Wound infiltration; Local anesthetic

Introduction

Expedited recovery following surgical procedures has become crucial in gynecological surgery [1−3]. Effective pain management significantly contributes to hastening recovery, as postoperative pain is associated with prolonged hospital stays, increased readmission rates, and escalated healthcare expenses [4,5]. To mitigate postoperative pain and reduce opioids consumption, various multimodal analgesia options have been proposed [6−8]. Wound infiltration (WI) with local anesthetic demonstrated inconclusive results in gynecological surgery [9,10]. Among the available approaches, the Transversus Abdominis Plane (TAP) block, introduced in 2001, involves the administration of local anesthetic into the neurovascular plane between the internal oblique and transversus muscles of the abdominal wall, targeting the lower thoracic spinal nerves (T7−T12) and the ilio-hypogastric and ilioinguinal nerves (L1) [9]. Since its introduction, the efficacy of TAP block has been investigated in numerous clinical trials for patients undergoing abdominal and pelvic procedures [10,11]. Some authors have reported that TAP-block contributes to reduced postoperative pain scores in both open and minimally invasive surgeries compared to a placebo [1,12]. However, data comparing TAP block and WI in terms of postoperative pain control remains inconsistent, and the superiority of one technique over the other has not been demonstrated in gynecological surgery [7,10,13]. Furthermore, the impact of these techniques on postoperative opioids consumption and the incidence of related adverse effects remains unclear [13]. Discrepancies in findings from studies comparing these two approaches prompted our objective to evaluate the available literature. Therefore, we aimed to explore the current evidence through a systematic review and meta-analysis to evaluate the effectiveness of TAP blocks versus WI in gynecological surgery. The primary outcomes assessed were postoperative pain and opioid requirement, while secondary outcomes included the time to rescue analgesia, opioid-related side effects, and patient satisfaction.

Methods

Protocol and Registration

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and was registered in the International Prospective Register of Systematic Reviews (PROSPERO, ID CRD42023420882).

Search Strategy

A certified professional librarian from BibliotecaMeneghetti, University of Verona, conducted a literature search from January 1996 to January 2024 in the electronic databases Scopus, PubMed/MEDLINE, ScienceDirect, and the Cochrane Library. The search strategy included combinations of medical terms such as “local anesthetic wound infiltration,” “port site infiltration,” “tap block,” “transversus abdominis plane block,” “gynecological surgery,” “gynecologic surgical procedures,” “post-operative pain,” and “pain control.” The complete search strategy is available in the Supplementary Material. The references of all identified studies were systematically reviewed to identify other eligible publications.

Inclusion and Exclusion Criteria

We included all full-text manuscripts published in English that met the pre-specified PICOS criteria: (P) adult patients who underwent gynecological surgical procedures; (I) intervened with postoperative TAP block (C) compared with WI with a local anesthetic; (O): studies measuring any pain scale and opioid requirement; (S) randomized, blinded clinical trials. Studies published in English up to January 31, 2024, were considered eligible for inclusion in the present analysis. Only full-text randomized controlled trials (RCTs) providing sufficient data on study design were included. Literature reviews, systematic reviews, non-randomized clinical studies, case reports, and cohort studies were excluded.

Study Selection and Data Extraction

An initial screening of titles and abstracts was conducted prior to full-text evaluation. The screening process was independently conducted by two review authors (FAF and BC) and any disagreements over the eligibility of studies were resolved through discussion with a third author (SU).

A standardized form was developed and used to extract data from the studies: characteristics of trial participants (eg, body mass index [BMI], surgical approach, and the number of patients per arm), type of intervention (drug and dilution used), and outcomes measures with details regarding their assessment and used definition (postoperative pain at 1, 4, 6, 12, 24 hours; postoperative opioids consumption, time to first rescue analgesic, number of rescue analgesic use and opioids-related side-effects, patient satisfaction). Pain intensity reported on a 0−100 mm visual analog scale or numeric rating scale was converted to a 0−10 scale. Postoperative opioid consumption was standardized by

converting the dosage to morphine equivalent dose. If data were not reported, we attempted to contact the authors and in case of no response within 60 days, the study was excluded from statistical analysis for the specific outcome under consideration. One review author (MP) extracted the data from the included studies, and a second author (FAF) verified the extracted data. Disagreements were resolved through discussion between the two review authors; if no agreement could be reached, a third author (SU) made the final decision.

Quality Assessment

Two review authors (FAF, LT) independently assessed the risk of bias in included studies according to the Cochrane Risk of Bias tool for RCTs. Any disagreements were resolved through discussion with a third author (SU) [14]. The quality of evidence and the strength of the recommendations of the results of this systematic review and meta-analysis were evaluated according to the Grading of Recommendations, Assessment, Development, and Evaluation criteria [15].

Statistical Analysis

A meta-analysis was conducted on 9 out of 10 of the included studies. The relative risk (RR) was calculated for categorical variables related to opioid side effects, while Hedges's g was used to adjust for potential biases in small sample sizes and to quantify the effect size of continuous variables across studies. To assess variability among the studies, a heterogeneity test was performed, along with the I^2 statistic, which quantifies the proportion of total variation in effect estimates across studies attributed to heterogeneity rather than sampling error. Significant heterogeneity was considered absent when the heterogeneity test yielded non-significant results ($p > .050$) and I^2 was less than 30%. In such cases, a fixed-effects model was utilized to pool and evaluate results using the Mantel and Haenszel method. Conversely, a random-effects model was employed when significant heterogeneity was detected, with result pooling conducted using the DerSimonian and Laird methods. Egger's test and the funnel plot were employed to assess the presence of a small study effect. The level of statistical significance was set at 5%, and confidence intervals (CI) were calculated at 95%.

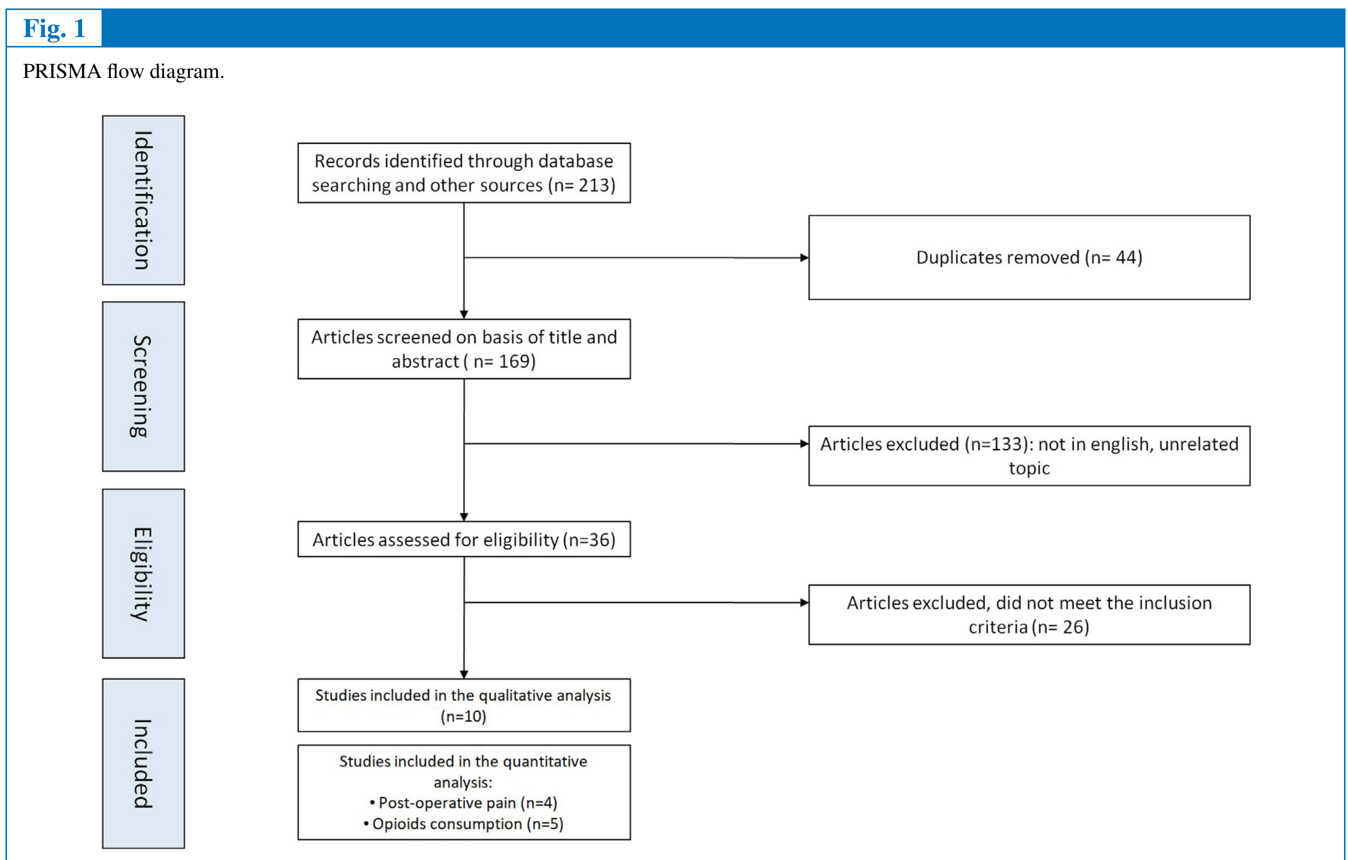
Results

Study Selection

A flowchart of the literature search process is shown in Fig. 1. Our literature search identified 213 papers, including studies detected with cross-reference review. Duplicates

Fig. 1

PRISMA flow diagram.



were excluded, and after the initial screening of titles and abstracts, 36 potentially relevant articles were identified and underwent full-text assessment for eligibility. A total of 26 studies were excluded because they failed to meet the inclusion criteria. The remaining 10 RCTs were included in the qualitative analysis, comprising 304 patients in the TAP block group and 300 patients in the WI group. One RCT was excluded due to the lack of blinding [16]. Five studies were excluded from the quantitative analysis of opioids consumption [17−21] and six studies were excluded from the postoperative pain pooled analysis because they did not report adequate data [19,20,22−25].

Study Characteristics

All analyzed studies were RCTs, with their features summarized in Table 1. Of the 10 studies, seven were double-blinded trials [17−19,21,23−25] and three were single-blinded trials [20,22,26]. We included 604 patients: 300 in the WI group and 304 in the TAP group.

Among the studies using TAP blocks, eight employed bupivacaine as the drug of choice [17−20,23−26], with three of these using a dilution with epinephrine [18,23,26]. One study used levobupivacaine, an optical isomer of bupivacaine, as the drug of choice [20]and another used liposomal bupivacaine [22]. In contrast, nine studies in the WI group used bupivacaine [17−20,22−26], while one used levobupivacaine [20]. Five studies involved laparoscopic procedures [17,18,21,23,26] and one RCT included also cases of robotic-assisted laparoscopy [23]. The remaining four studies reported results from laparotomic surgery [18,19,21,23]. One study [25] did not specify the type of surgery, whether minimally invasive or open. Two studies included patients with malignant diseases [18,23], with one of these [24] also comprising patients with benign diseases. Except for four other studies [17,21,24,26] exclusively conducted in benign conditions, the remaining studies did not provide specific information on the potential malignancy of the treated pathologies [20,22,25]. Two studies reported data on the length of stay, with neither indicating a significant difference between the two comparison groups [18,23]. None of the 10 studies included in the analysis reported significant differences in the duration of surgical procedures between the TAP block group and the WI group. No procedure-related complications were observed in any of the study subjects, regardless of whether they received a TAP block or local infiltration, throughout the study period. Four out of all the analyzed studies reported postoperative pain scale scores as an outcome [17,18,21,26], assessed using visual analog scales or numeric rating scales. Five studies assessed opioid requirements within the first 24 hours postsurgery and were included in the quantitative analysis, with four focused on laparotomic surgery [22,24,25] and two on laparoscopic procedures [23,26].

Among these, El Sharkwy et al [26] assessed specific opioid consumption at 4, 6, 12, and 24 hours postsurgery. Two studies reported the time to first rescue dose after either analgesic TAP block or WI [24,25]. Three studies specifically reported the incidence of postoperative nausea, vomiting, or other opioid-related side effects [22,23]. Finally, one study [26] evaluated patient satisfaction in terms of the quality of postoperative pain relief.

Risk of Bias Assessment

Fig. 2 summarizes the results of the risk of bias assessment. Among the 10 studies, three reported an overall low risk of bias, two RCTs showed an unclear risk, and five were evaluated as having an overall high risk of bias (Table S1).

Postoperative Pain Score

This outcome was evaluated in four of the analyzed studies for a total of 353 patients [17,18,21,26]. All the studies evaluated the postoperative pain at 4, 6, 12, and 24 hours and three reported an early evaluation 1 hour after the surgical procedure [18,21,26]. All the included studies addressed laparoscopic surgery. Our analysis demonstrated that TAP block was associated with lower pain scores at 1 hour (Hedge's g = 0.46; 95% CI [0.21;0.71]; I^2 = 0%), 4 hours (Hedge's g = 0.60; 95% CI [0.37;0.83]; I^2 = 0%), 6 hours (Hedge's g = 1.03; 95% CI [0.63;1.43]; I^2 = 62.64%), 12 hours (Hedge's g = 1.01; 95% CI [0.08;1.95]; I^2 = 92.66%) and 24 hours (Hedge's g = 0.33; 95% CI [0.03; 0.63]; I^2 = 39.78%)compared to WI group (Fig. 3).

Opioid Requirement

Five of the included RCTs reported opioid consumption at 24 hours, comprising a total of 328 patients [22−26]. Despite the high level of heterogeneity, the pooled analysis demonstrated a statistically significant reduction of opioid use in the TAP block group (Hedge's g = 2.93; 95% CI [1.24; 4.61]; I^2 = 97.29%) compared to the WI group (Fig. 4).

Time to Rescue Dose

Only two studies reported the mean time to the first rescue dose, preventing us from performing a quantitative analysis [24,25]. Both studies demonstrated a longer mean time in the TAP group: 170 (SD 13.8) versus 240 (SD 57.4) minutes [24] and 85.38 (SD 38.07) versus 148 (SD 46.7) minutes [25].

Nausea and Vomiting

Data on Postoperative Nausea and Vomiting (PONV) were reported in two studies comprising 120 patients [22,23] (Table 2). In the pooled analysis, no significant differences in opioid-related adverse effects were found

Table 1

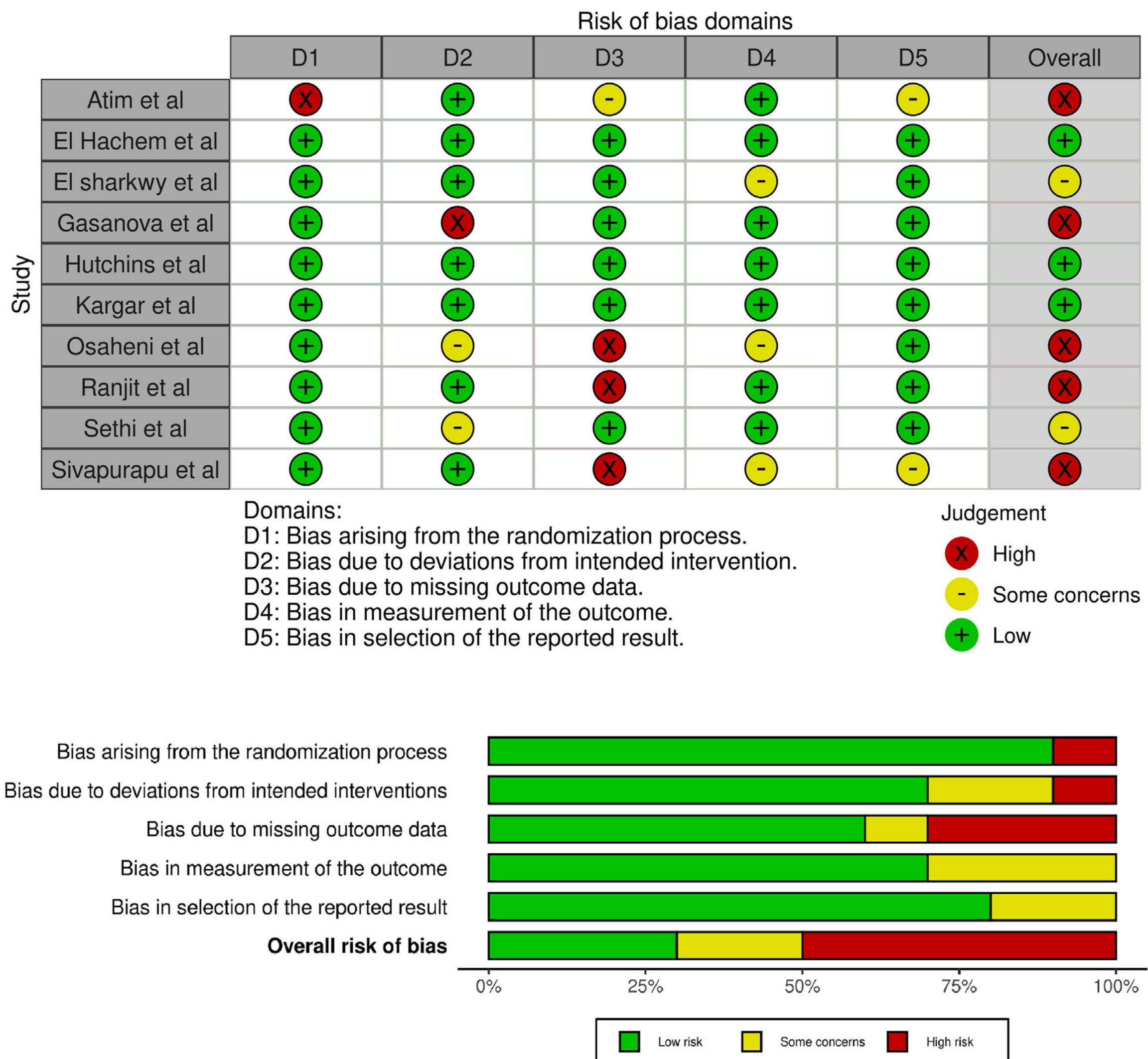
Features of the included studies

Author	Yr	Blinding	N TAP	N WI	BMI TAP	BMI WI	Anesthesia	Type of Surgery (LPS/LPT)	Indication (Benign/Malignant)	Anesthetic Agent, Dose, Volume Per Side	Post-op Analgesia Protocol
Atim et al	2011	Double blinding	18	19	NR	NR	GA	LPT	NR	Bupivacaine, 0.25%, 20 mL	PCA, tramadol 3 mg/mL 20 mg bolus max 150 mg
El Hachem et al	2014	Double blinging	45	45	28.2	28.2	GA	LPS	Benign, malignant	Bupivacaine, 0.25%, 30 mL	Morphine sulfate max 9.35 mg post-op
El Sharkwy et al	2018	Single blinding	42	40	26.9	27.2	GA	LPS	Benign	Bupivacaine, 0.25%, 20−25 mL	Meperidine 20 mg as needed
Gasanova et al	2015	Single blinding	29	29	31.2	32.3	GA	LPT	NR	Bupivacaine, 0.5%, 20 mL	PCA morphine first 24 h, hydrocodone/acetaminophen 5 mg/325 mg 1−2 tab as needed
Hutchins et al	2019	Double blinding	31	31	33.1	32.4	GA	LPS	Malignant	Bupivacaine, 0.25%, 10 mL	Oxycodone 5 mg every 4 h
Kargar et al	2019	Double blinding	24	21	24.8	24.3	GA	LPS	Benign	Bupivacaine, 0.25%, 0.6 mL/kg	Morphine 4 mg as needed
Osaheni et al	2020	Double blinding	37	37	24.6	24.5	Subarachnoid block	LPT	Benign	Bupivacaine, 0.25%, 20 mL	Pentazocine 30 mg every 6 h
Ranjit et al	2014	Single blinding	15	15	NR	NR	GA	LPT	NR	Bupivacaine, 0.25%, 20 mL	Tramadol 50 mg IV as needed
Sethi et al	2021	Double blinding	37	37	NR	NR	GA	LPS	Benign	Levobupivacaine, 0.25%, 20 mL	Fentanyl 1 ug/kg IV as needed
Sivapurapu et al	2013	Double blinding	26	26	NR	NR	GA	LPT	NR	Bupivacaine, 0.25%, 0.6 mL/kg	PCA morphine 1 mg/mL bolus, then 0.2 mg/kg 4 hourly limit

BMI = body mass index; GA = general anesthesia; LPS = laparoscopy; LPT = laparotomy; NR = not reported; TAP = transversus abdominis plane; WI = wound infiltration.

Fig. 2

Risk of bias assessment for the included studies.



between WI and TAP groups (RR = 1.34, 95% CI 0.93 −1.95) (Fig. 5).

Patient-Reported Satisfaction

Two studies presented data on patient-reported satisfaction [23,26]. El Sharkwy et al [26] demonstrated a statistically significant higher level of patient satisfaction in the TAP group (p = .003), while Hutchins et al [23] reported the percentage of satisfaction with pain management (96.8% vs 77.4% in the TAP and WI groups, respectively).

Surgical Routes

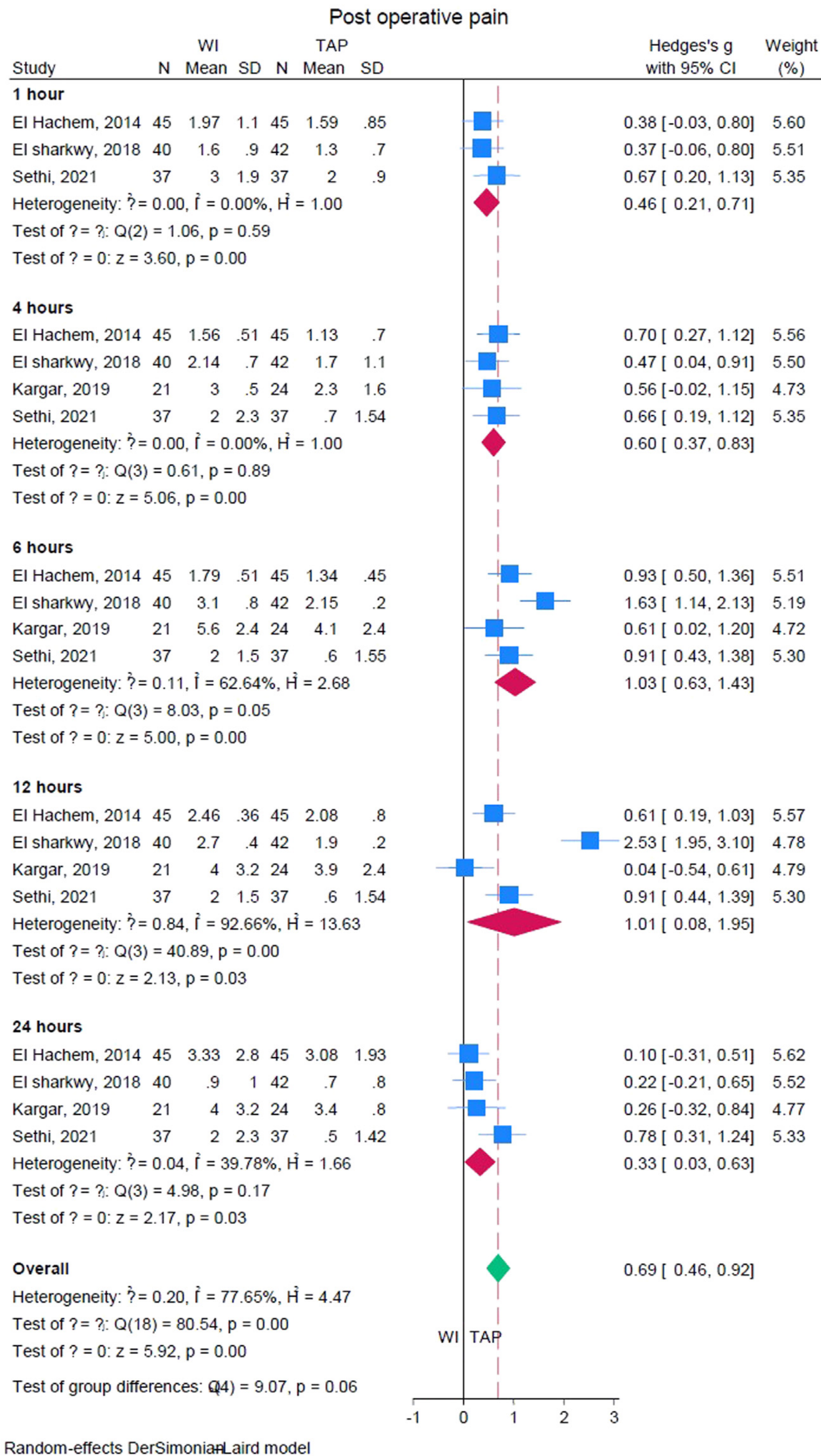
Following our comprehensive analysis of surgical approaches, we found that postoperative pain and patient satisfaction in our study primarily reflected outcomes associated with minimally invasive procedures. Notably, our evaluation of opioid consumption and its related side effects includes studies that consider both open and laparoscopic procedures. Regarding the time to rescue dose, the two studies providing this data focused specifically on laparotomic surgery. However, due to limitations in the reported data, conducting a statistical analysis of patient satisfaction and time to rescue dose was not feasible.

Discussion

Our study indicates that the TAP block may reduce postoperative pain in laparoscopic gynecologic surgery, both in the early postoperative phases and up to 24 hours following the surgical procedure. Additionally, the TAP block appears to decrease morphine consumption in gynecological procedures when compared to WI.

Fig. 3

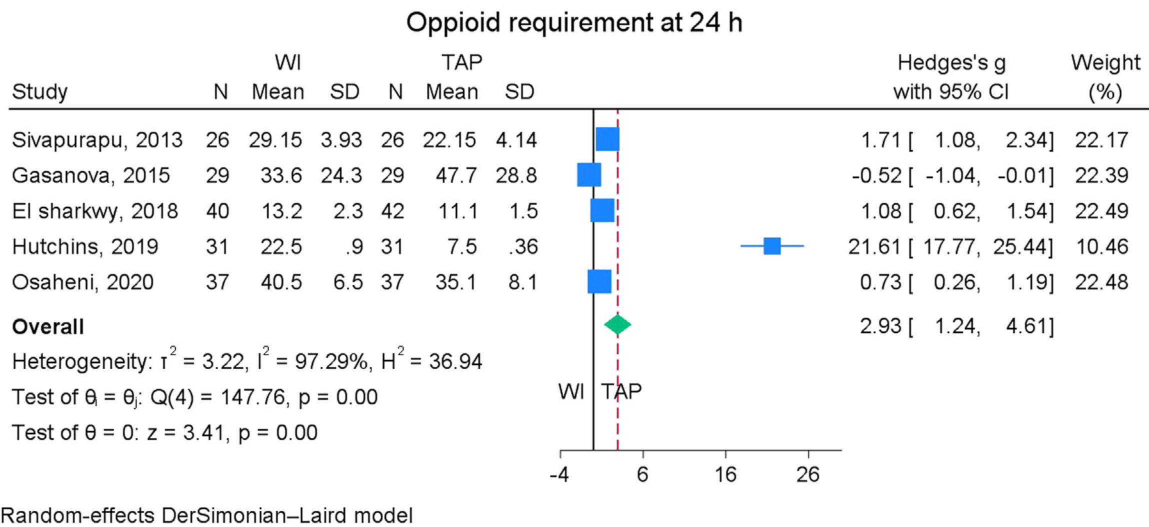
Postoperative pain score at 1, 4, 6, 12, and 24 hours. RR = relative risk; TAP = transversus abdominis plane; WI = wound infiltration.



The efficacy of TAP block and WI has been investigated in numerous trials, leading to their application in both open and laparoscopic gynecological surgeries [10,12,18]. However, data regarding their effectiveness were inconsistent. While some comparative trials have demonstrated no additional analgesic benefit of TAP block compared to WI, others have shown clear superiority in pain management [7,10,13]. The optimal approach to perioperative pain

Fig. 4

Opioids requirement at 24 hours in the included studies.



control remains a subject of debate, with ongoing discussions regarding the most effective form of local anesthesia to achieve clinically significant relief of postoperative pain. Currently, there is no established standard of care, and management practices vary according to the preferences of surgeons and anesthesiologists.

The results of our meta-analysis regarding postoperative pain scores align with those found in other meta-analyses [7,27,28]. Our statistical analysis demonstrated that the TAP block is significantly superior to WI in controlling postoperative pain during laparoscopic gynecological surgery, particularly in early pain management (within the first

Table 2

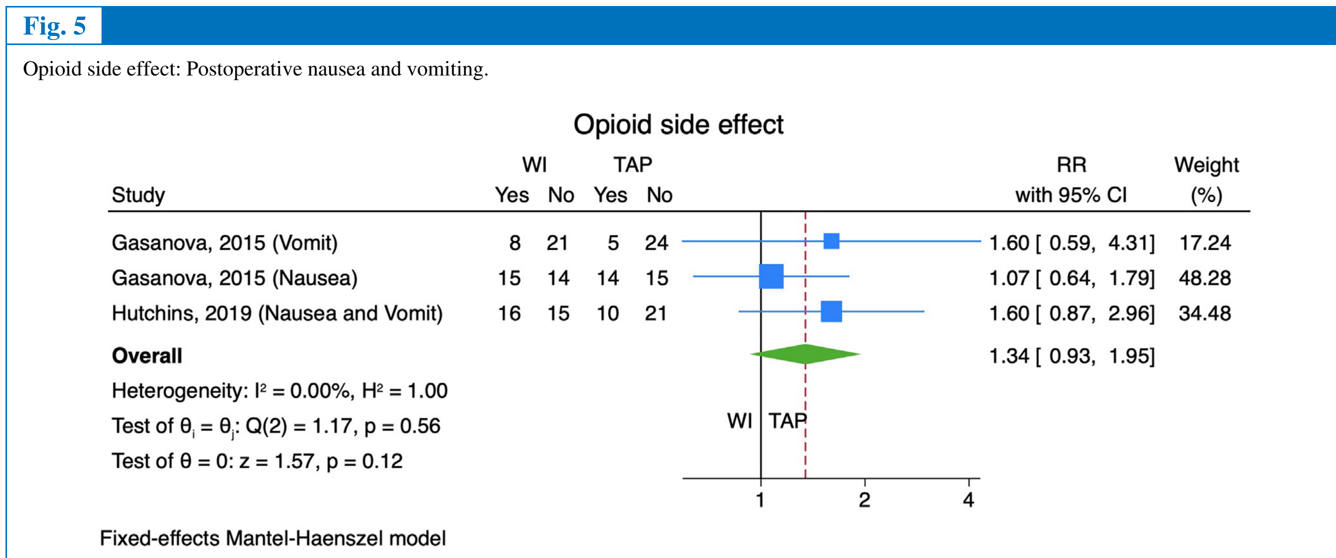
Postoperative nausea and vomiting

Study	Treatment Groups	Sample Size	Nausea (*n*)	%	Vomiting (*n*)	%
Atim et al	TAP block	18	NR	NR	NR	NR
	Wound infiltration	19				
El Hachem et al	TAP block	45	NR	NR	NR	NR
	Wound infiltration	45				
El Sharkwy et al	TAP block	42	NR	NR	NR	NR
	Wound infiltration	40				
Gasanova et al	TAP block	29	14	48.3	5	17.2
	Wound infiltration	29	15	51.7	8	27.6
Hutchins et al	TAP block	31	10	32.2	10	32.2
	Wound infiltration	31	16	51.6	16	51.6
Kargar et al	TAP block	24	NR	NR	NR	NR
	Wound infiltration	21				
Osaheni et al	TAP block	37	NR	NR	NR	NR
	Wound infiltration	37				
Ranjit et al	TAP block	15	NR	NR	NR	NR
	Wound infiltration	15				
Sethi et al	TAP block	37	NR	NR	NR	NR
	Wound infiltration	37				
Sivapurapu et al	TAP block	26	NR	NR	NR	NR
	Wound infiltration	26				

GA = general anesthesia; LPS = laparoscopy; LPT = laparotomy; *N* = number of participants; NR = not reported; NR = not reported; TAP = transversus abdominis plane block; WI = wound infiltration.

Fig. 5

Opioid side effect: Postoperative nausea and vomiting.



hour). This effectiveness is sustained, with a large effect size observed at both 12 and 24 hours postsurgery (Hedges' g = 1.01 and 0.33, respectively). These results suggest that TAP block might provide much longer analgesic action than WI with conventional local anesthetics after laparoscopic gynecologic surgery.

Postoperative pain may lead to increased opioid consumption, resulting in adverse effects such as nausea, delayed bowel function, and prolonged length of stay [29]. Our pooled statistical analysis demonstrated that TAP block is associated with significantly reduced opioid consumption at 24 hours. Our results demonstrate a reduction in opioid consumption in gynecologic surgery for the TAP block group. The individual studies included in the pooled analysis consistently show a significant decrease in opioid requirements at 24 hours for the TAP block group, with the exception of Gasanova et al The inclusion of both open and laparoscopic procedures in the analysis of opioid consumption may represent a limitation due to the inherent differences between these surgical approaches. However, this inclusion was intentional, as it allows for a more comprehensive understanding of opioid use patterns across gynecologic surgery as a whole, which is the primary aim of our review. Additionally, the high heterogeneity observed may be related to differences in postoperative analgesia protocols and potential, inadequately analyzable disparities in baseline characteristics. While statistically significant, it is crucial to acknowledge that these variances in narcotics use were minimal, and their clinical significance is yet to be determined.

Nausea and vomiting are frequent postoperative complications, often occurring after surgery, a phenomenon referred to as PONV [30,31]. The mechanisms contributing to this outcome remain unclear [31]. Studies included in the present meta-analysis found no difference between TAP block and WI in relation to PONV, nausea, and vomiting.

Consequently, the strength of evidence derived from this meta-analysis is deemed moderate, according to the Grading of Recommendations, Assessment, Development, and Evaluation criteria, despite including randomized controlled clinical trials. Conversely, the small sample sizes in these trials underscore the importance of further studies with efficient randomization techniques to ensure baseline characteristic balance. Moreover, it is crucial for forthcoming research to consider preoperative conditions that could potentially influence outcomes, such as diseases linked to pelvic pain, to bolster the strength of evidence.

This study is strengthened by the inclusion of RCTs and the implementation of a systematic methodology in both study inclusion and exclusion, along with the rigorous exclusion of studies that did not adequately report the outcomes or failed to meet quality assessment criteria. However, this study also has limitations. It was not possible to estimate the real impact of distinguishing between benign and malignant pathologies, as a sub-analysis for this variable could not be conducted. Despite the lack of clear evidence in the literature, it is plausible to speculate that women undergoing surgery for malignant conditions may experience higher levels of pain, which could be attributed to several factors associated with the greater complexity of these procedures. Such factors may include the necessity for a more extensive operative field, as seen in cases involving lymph node dissection, prolonged operative durations, and an increased likelihood of postoperative complications [32,33]. Additionally, the baseline perceived stress related to future uncertainty could play a significant role in undermining the accuracy of assessments [34]. Another possible limitation of our study is the inclusion of both open and laparoscopic surgery procedures. While the inclusion of both types of surgeries provides a broader view of opioid use patterns in gynecologic surgery, it may also introduce variability that could impact the interpretation of the results.

Moreover, it was not possible to stratify by BMI because some studies did not report adequate data for the analysis, and because in only two studies the BMI exceeded 30 [22,23]. It is crucial to recognize that pain is a subjective and emotional experience, shaped by multiple factors, including physiological, sensory, emotional, cognitive, sociocultural, and behavioral influences, such as the patient's anxiety levels and expectations concerning pain control [35]. Preoperative anxiety has been identified as a significant predictor of postoperative pain, with higher anxiety levels before surgery correlating with increased pain afterward [36,37]. Additionally, heightened preoperative anxiety is associated with greater postoperative opioid use and reduced quality of life following surgery [35,38]. Identifying patient anxiety and treatment expectations was not addressed in the included studies but should be considered in future research designs. Lastly, Enhanced Recovery After Surgery protocols have been shown to positively impact postoperative pain management in gynecological procedures [2,39,40]. However, these protocols are not always implemented. None of the studies in our analysis explicitly mentioned Enhanced Recovery After Surgery protocol adoption, a factor to consider when interpreting the results and their translation into clinical practice.

Conclusions

This meta-analysis suggests that TAP blocks, compared to WI, may enhance early postoperative pain management in laparoscopic gynecologic surgeries. TAP blocks may also reduce opioid requirements in gynecologic surgery; however, caution should be exercised when interpreting our results. Future studies examining the efficacy of TAP blocks should be adequately powered to explore various types of local anesthetics, assess opioid-related adverse events, and evaluate patient satisfaction.

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Table S1

Description and rationale for risk of bias assessment for included studies

Study	Randomization Process	Deviations from the Intended Interventions	Missing Outcome Data	Measurement of the Outcome	Selection of the Reported Result
Atim	High Quote "Patients were randomized in equal numbers within blocks of 20," however, it is unclear how the sequence was generated. "Allocation was by sealed envelope," however it is unclear if the envelopes were opaque or sequentially numbered.	Low Quote "Patient, anaesthetists and the staff providing postoperative care were blinded to the group assignment." Despite there being a sham group, it is unlikely that the anesthesiologist performing the block was blinded to the treatment groups as the wound infiltration group would have to be unblinded. However, all patients received standardized anestesia intraoperatively.	Unclear Quote "Patients whose surgery did not proceed to TAH were also excluded from the study" "Two patients from TAP group, two patients from the control group and one patient from infiltration group were excluded because the surgeons decided to perform vaginal hysterectomy." Missing outcomes are balanced between groups.	Low Quote "All measurements were taken by the same anaesthesist who was blinded to the study group."	Unclear Quote "There were no differences between the groups for complications." The specific complications were not described. There is no protocol to determine risk of bias.
El Hachem	Low Quote "Patients were randomized according to a computer-generated randomization list in sealed white envelopes."	Low Quote "Patients and postoperative assessors were blinded to the treatment assignment" and "by treating opposite sides of the abdomen in patients with symmetrical port placement, we used patients as their own controls" eliminating the potential confounding factor arising from the variability of pain perception between patients.	Low Quote "Five patients were excluded: 1 because of an intraoperative conversion to a laparotomy secondary to malignancy and 4 requiring an additional laparoscopic port." Of the eligible patients, none lost to follow-up.	Low The data were analyzed across time using the mixed regression model.	Low Reported outcomes are consistent with protocol.
El Sharkwy	Low Quote "Randomization was created by the computer. Allocation was concealed in opaque, sealed, and serially numbered envelopes."	Low Quote "Patients and postoperative assistants were blinded to the procedure while surgeons and anesthetists were not."	Low Quote "Two women in each group were excluded from analysis due to insertion of intraperitoneal drain." Missing outcomes are balanced between groups.	Unclear Quote "Pain scores on movement were not assessed, blinding of surgeons and anesthetists was difficult and it did not focus on side effects."	Low Reported outcomes are consistent with protocol.
Gasanova	Low Quote "Patients were randomized according to a computer-generated randomization schedule." "Group allocations were concealed in sealed opaque envelopes until all the entry criteria for the study had been verified."	High Anesthesiologists were not blinded. Patients were not blinded. A sham group was not utilized, and anesthesiologists could give additional boluses of fentanyl intra-operatively.	Low One participant who was randomized to group 2 was excluded due to protocol violation.	Low Quote "An investigator blinded to group assignment assessed the intensity of pain."	Low Reported outcomes are consistent with protocol.

Table S1

Continued

Study	Randomization Process	Deviations from the Intended Interventions	Missing Outcome Data	Measurement of the Outcome	Selection of the Reported Result
Hutchins	Low Quote "Patients were randomly assigned after obtaining informed consent by a research assistant using a randomization sequence from www.random.org. Treatment allocation was 1:1 using block allocation."	Low Quote "Both the patient and the treating team (surgeon, anesthesiologist, and nurses) were blinded to the treatment assignment; and medications were repackaged by our investigational pharmacy to precluded incidental identification."	Low Quote "Six patients did not receive the allocated intervention due to a change in surgical plan after allocation. One patient discontinued intervention and seven were lost to follow-up. Eleven patients required a conversion to laparotomy (nine in the experimental and two in the bupivacaine infiltration groups)." Anyway missing outcomes are balanced between groups, because in the end in each group 31 patients were analyzed.	Low Quote "The effect size was defined a priori and at a level which was felt to be clinically relevant. The inclusion of multiple surgeons as well as both laparoscopic and robotic-assisted approaches suggests the data can be extrapolated to the most common used minimally invasive approaches."	Low Reported outcomes are consistent with protocol. Quote "There were no alterations in the protocol during the course of this study."
Kargar	Low Quote "Random allocation was performed by random envelopes containing the paper code of intervention. Allocation concealment was ensured by sealed, opaque, sequentially labelled envelopes. The envelopes were opened on the day of surgery upon arrival of the patient in the operation room by a member of the anaesthetic team who was not involved in the study or in the post-operative care of the patients."	Low Quote "The surgical team, study investigators and participants were all blinded to the treatment assigned."	Low Quote "Of the 75 participants, 5 became ineligible after randomization and were excluded (3 required excision of abdominal wall endometriosis involving the rectus sheath and 2 required segmental bowel resections). Data from 70 participants were included in analysis." The missing outcomes in the end were balanced in the groups.	Low Quote "Postoperative outcomes were assessed by a healthcare professional who was blinded to the intervention throughout the study."	Low Reported outcomes are consistent with protocol.
Osaheni	Low Quote "Patients were randomized using a folded labeled paper into two equal groups consisting of 37 patients per group. They randomly picked their group from an opaque envelope, which contained 74 labeled white papers."	Unclear Quote "The sealed envelopes bearing the group that the patient belonged to were given to a second anesthetist who was responsible for the coding and preparation of the study drug." However, it is not clear if the surgeons and the first anaesthesist in the operating room were blinded.	High Quote "Six patients were excluded from this study: three patients from each group. One patient from each group respectively was excluded on account of analgesic protocol violation while two others from both groups were also excluded because the anesthetic technique was converted from	Unclear It is not clear how the data were collected.	Low Reported outcomes are consistent with protocol.

Table S1

Continued

Study	Randomization Process	Deviations from the Intended Interventions	Missing Outcome Data	Measurement of the Outcome	Selection of the Reported Result
			subarachnoid block to general anesthesia." Authors did not reported VAS value and results of statistical analysis but only figures.		
Ranjit	Low Quote "Included patients were randomized in one of the three groups with sealed envelope."	Low Quote "The blinded investigator was an intern from gynaecology department who was not participating in the operation."	High It is not reported if any patients who were enrolled lost to follow-up or were excluded due to changes in the surgery procedure. Authors did not report mean and median value.	Low Adequate description. Quote "The blinded investigator was an intern from gynaecology department who was not participating in the operation."	Low Reported outcomes are consistent with protocol.
Sethi	Low Quote "The patients were randomized using a computer-generated random numbers list, and the allotment was concealed using sealed envelopes."	Unclear Quote "The patients were assessed for pain by another anesthesiologist who was blinded to the group allocation." It is not clear if the surgeon nor the anaesthesist in the operating room where blinded to the groups.	Low Quote "Of the 80 patients enrolled in the study, six were excluded from the final analysis due to the conversion of the laparoscopic procedure to open surgery by the surgeon." Missing data are balanced in the groups.	Low Quote "Statistical analyses were performed using the SPSS pro-gram for Windows (version 17.0)." The data were assessed by an anaesthesist blinded to the allocation.	Low Reported outcomes are consistent with protocol.
Sivapurapu	Low Quote "Patients were randomized by means of a computer-generated random number."	Low Quote "The patients and the investigator who assessed the patient's parameters postoperatively were blinded to the group assignment."	High Data concerning PONV incidence were not reported clearly, as it was one of the aims of the study.	Unclear Quote "Statistical analysis was performed using Statistical Package for the Social Sciences 16 (SPSS 16)." However, it is not clear who assessed the data postoperatively.	Unclear Reported outcomes are not fully consistent with protocol, as PONV incidence analysis is not reported clearly.

Search strategy

((((local anesthetic wound infiltration) OR (port site infiltration)) OR ((tap block) OR (transversus abdominis plane block))) AND ((gynecological surgery) AND (pain control))) OR (((("Gynecologic Surgical Procedures"[Mesh]) AND ("Pain, Postoperative"[Mesh])) AND (((("Anesthetics, Local"[Mesh]) OR ("Analgesics, Opioid"[Mesh])) OR ("Anesthesia, Local"[Mesh])) OR ("Nerve Block"[Mesh]))) AND ((tap block) OR (transversus abdominis plane block))).