

# BMJ Open Optimal approach for ultrasound-guided transversus abdominis plane (TAP) blocks for abdominal surgeries: a protocol for systematic review and meta-analysis

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## ABSTRACT

**Introduction** Transversus abdominis plane (TAP) blocks are commonly used for postoperative analgesia after various abdominal surgeries. There are several different approaches for performing TAP blocks, mainly including posterior, lateral and subcostal approaches. An increasing number of randomised controlled trials (RCTs) have compared the analgesic effects of different TAP block approaches, but the results have not been consistent. This protocol aims to determine the optimal approach of ultrasound-guided TAP blocks for postoperative analgesia after abdominal surgery.

**Methods and analysis** Four databases, including Web of Science, PubMed, EMBASE and the Cochrane Library will be systematically searched to identify RCTs that compared the analgesic effects of different ultrasound-guided TAP block approaches. The search interval will range from the inception of the databases to 30 July 2024. The postoperative opioid consumption over 24 hours will be defined as the primary outcome. The secondary outcomes will include the analgesia duration, postoperative pain scores at rest and during movement at different timepoints and the incidence of adverse effects. All the statistical analyses will be conducted using RevMan V.5.4. The quality of evidence will be evaluated by the Grading of Recommendations Assessment, Development and Evaluation approach.

**Ethics and dissemination** Ethical approval will not be needed. The results will be submitted to one peer-reviewed journal when completed.

**PROSPERO registration number** CRD42024510141.

## INTRODUCTION

Ultrasound-guided transversus abdominis plane (TAP) blocks are now widely used for postoperative analgesia after various abdominal surgeries, such as caesarean section,<sup>1</sup> laparoscopic cholecystectomy,<sup>2</sup> inguinal hernia repair,<sup>3</sup> hysterectomy<sup>4</sup> and laparoscopic colorectal surgery.<sup>5</sup> Accumulated evidence indicates that ultrasound-guided TAP blocks can significantly alleviate postoperative pain severity, reduce opioid consumption and decrease the incidence of adverse effects.<sup>6–8</sup> Therefore, ultrasound-guided TAP blocks are

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Subgroup analysis and meta-regression will be used to identify the source of the high heterogeneity.
- ⇒ The Grading of Recommendations Assessment, Development and Evaluation approach will assess the quality of the evidence.
- ⇒ Substantial heterogeneity might exist among the included studies because of several factors, such as surgery type, surgical approach, definition of outcomes, local anaesthetics and volume and adjuvants.

suggested to be an effective component of multimodal analgesia for abdominal surgeries.<sup>9 10</sup> Currently, ultrasound-guided TAP blocks can be performed in several different ways, mainly via posterior, lateral and subcostal approaches.<sup>11</sup> An increasing number of randomised controlled trials (RCTs) have compared the analgesic effects of different ultrasound-guided TAP block approaches; however, the results are conflicting. For example, several RCTs have shown that posterior TAP blocks were more effective for postoperative analgesia than the lateral approach in patients who underwent laparoscopic gynecologic surgery<sup>12</sup> or caesarean section,<sup>13</sup> whereas other RCTs have demonstrated that subcostal TAP blocks were better than the posterior approach for postoperative analgesia in surgeries involving the supraumbilical region.<sup>14</sup> Therefore, identifying the optimal approach for ultrasound-guided TAP blocks, which provides longer analgesia without increasing the incidence of side effects, is important. Furthermore, we will use subgroup analysis to determine the preferred approach for performing ultrasound-guided TAP blocks for specific surgery types.

## METHODS AND ANALYSIS

### Study registration

This protocol has been registered in PROSPERO and was conducted based on the guidelines of the Preferred Reporting Items for Systematic Evaluation and Meta-Analysis Protocols.

### Search strategy

Two authors (QZ and DZ) will independently search the Web of Science, PubMed, EMBASE and the Cochrane Library from the inception of the databases to 30 July 2024. The planned start and end dates will be 30 July 2024 and 30 January 2025, respectively. The key search terms will include “Transversus abdominis plane block” and “randomized controlled trials” without language restrictions. The detailed search plan for all databases is shown in online supplemental file 1.

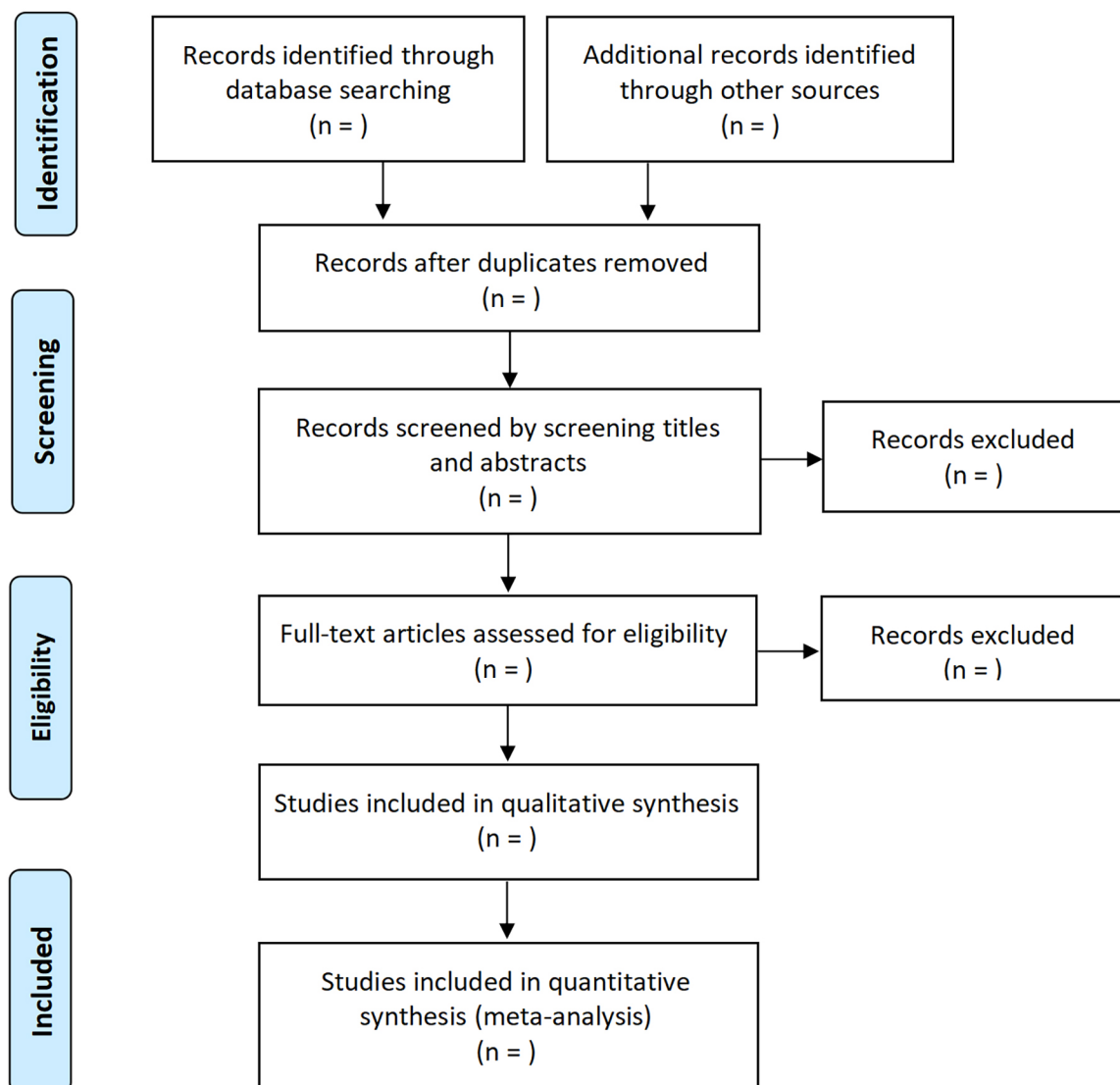
### Inclusion and exclusion criteria

The inclusion criteria will be as follows: (1) study design: RCTs; (2) participants: adult patients who underwent

abdominal surgeries; (3) comparisons: differential approaches to ultrasound-guided TAP blocks and (4) primary outcome: the postoperative opioid consumption over 24 hours and (5) secondary outcomes: analgesia duration, postoperative pain scores at rest and during movement at 2 hours, 6 hours, 12 hours and 24 hours, and the incidence of adverse effects. The postoperative opioid consumption over 24 hours will be defined as the total morphine-equivalent consumption<sup>15</sup> during the first postoperative 24 hours. The analgesic duration will be defined as the time from TAP block performance to the time at first analgesic request. Pain scores presented by the 0–100 mm visual analogue scale (VAS) will be converted to the 0–10 cm (0: no pain, 10: worst pain) scale. Numeric rating scale will be equivalent to VAS. Studies that do not meet the abovementioned criteria will be excluded.

### Study selection

First, two authors (QZ and DZ) will identify potentially relevant studies by screening the titles and abstracts. The



**Figure 1** The flow diagram of study selection.

full texts of the remaining articles will be subsequently reviewed to determine the final inclusion criteria. Disagreements will be resolved by discussion. The flow-chart used for study selection is shown in [figure 1](#).

### Data extraction

Data extraction will be independently performed by two authors (QZ and DZ). The following information will be extracted: publication date, country, patient characteristics, sample number, approach used for TAP blocks, anaesthesia and surgery type, local anaesthetics and adjuvants, comparisons, primary and secondary outcomes, and postoperative analgesia methods. Disagreements will be resolved by discussion.

### Risk of bias assessment

Two authors (QZ and DZ) will perform the risk of bias assessment using the Cochrane Collaboration's tool as previously described,<sup>16</sup> which focuses on these domains: random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias) and other bias. Within each domain, assessments are performed for several items, which may cover different aspects of the domain, or different outcomes. The estimated results will be rated as 'high', 'low' or 'unclear'. Disagreements will be resolved by discussion.

### Statistical analysis

RevMan V.5.4 software will be used for statistical analysis. Dichotomous data and continuous data will be presented as risk ratios and mean differences with 95% CIs, respectively. The  $I^2$  test will be used to calculate the statistical heterogeneity. An  $I^2 > 50\%$  indicates high heterogeneity, and the random effects model will be used to pool the data. A fixed-effects model will be used when  $I^2 < 50\%$ . Subgroup analysis and meta-regression will be used to identify the source of heterogeneity. Sensitivity analyses will be conducted to evaluate whether the pooled results are robust. The quality of evidence will be determined by the Grading of Recommendations Assessment, Development and Evaluation approach. P value  $< 0.05$  indicates statistical significance.

### Patient and public involvement

None.

### Ethics and dissemination

Ethical approval is not required because this study is a secondary analysis of the data. The results will be submitted to one peer-reviewed journal on completion.

## DISCUSSION

Currently, different ultrasound-guided TAP block approaches are performed to provide postoperative analgesia for various abdominal surgeries. For certain surgical

types, the analgesic effects of different ultrasound-guided TAP block approaches might not be comparable. An increasing number of RCTs have attempted to compare the analgesic effects of different approaches to ultrasound-guided TAP blocks, but the results have not been consistent. This protocol for a systematic review and meta-analysis aims to determine the optimal approach for performing ultrasound-guided TAP blocks for abdominal surgeries, which will provide better analgesia without increasing adverse effects. Nevertheless, there might be substantial heterogeneity among the included studies because of several factors, such as surgery type, patient characteristics, surgical approach, timing of TAP blocks, the different definition of outcomes, local anaesthetics and volumes, and adjuvants. We will perform subgroup analysis and meta-regression to identify the source of the high heterogeneity, and the results also will recommend the preferred ultrasound-guided TAP block approach for specific conditions. This study will also provide a feasible method for exploring the optimal approach of other types of nerve blocks for postoperative analgesia. In recent years, laparoscopic TAP blocks were recommended to control postoperative pain, and several studies have compared the analgesic efficacy between laparoscopic TAP blocks and ultrasound-guided TAP blocks.<sup>17–20</sup> The synthesised evidence from one recent meta-analysis<sup>21</sup> revealed that the efficacy and safety between laparoscopic TAP blocks and ultrasound-guided TAP blocks were similar in colorectal surgeries; however, whether this conclusion suits for other surgeries remains unclear and needs to be determined in future studies.

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