Review Article

Analgesic Efficacy and Outcomes of Ultrasound-guided Erector Spinae Plane Block in Patients Undergoing Bariatric and Metabolic Surgeries: A Systematic Review

Abhijit Sukumaran Nair[1]*, Manamohan Rangaiah[2], Ujjwalraj Dudhedia[3], Nitinkumar Bhajandas Borkar[4]

[1]Department of Anaesthesiology, IBRA Hospital, Ministry of Health-Oman, Ibra, Sultanate of Oman, [2]Department of Anaesthetics and Pain Management, Walsall Manor Hospital, Walsall, United Kingdom, [3]Department of Anaesthesiology and Pain Management, Dr. L. H. Hiranandani Hospital, Mumbai, Maharashtra, India, [4]Department of Pediatric Surgery, All India Institute of Medical Sciences, Raipur, Chhattisgarh, India

Abstract

Erector spinae plane block (ESPB) has been used as an intervention for providing postoperative analgesia in patients undergoing bariatric and metabolic surgeries. After registering the protocol in PROSPERO, randomized controlled trials and nonrandomized observational studies were searched in various databases till July 2022. The primary outcome was 24-h opioid consumption; the secondary outcomes were intraoperative opioid use, pain scores, time to rescue analgesia, and complications. The risk of bias and Newcastle-Ottawa scale were used to assess the quality of evidence. From the 695 studies identified, 6 studies were selected for analysis. The 24-h opioid consumption was significantly lesser in ESPB group when compared to control (mean difference [MD]: −10.67; 95% confidence interval [CI]: −21.03, −0.31, $I^2 = 99\%$). The intraoperative opioid consumption was significantly less in the ESPB group (MD: −17.75; 95% CI: −20.36, −15.13, $I^2 = 31\%$). The time to rescue analgesia was significantly more in the ESPB group (MD: 114.36; CI: 90.42, 138.30, $I^2 = 99\%$). Although pain scores were significantly less at 6 and 24 h in ESPB group (MD: −2.00, 95% CI: −2.49, −1.51; $I^2 = 0\%$ and MD: −0.48; 95% CI: −0.72, −0.24; $I^2 = 48\%$), at zero and 12 h, the pain scores were comparable (MD: −1.53, 95% CI: −3.06, −0.00, $I^2 = 97\%$ and MD: −0.80; 95% CI: −1.80, 0.20, $I^2 = 88\%$). Bilateral ESPB provides opioid-sparing analgesia and better pain scores when compared to control. These results should be interpreted with caution due to high heterogeneity among the included studies.

Keywords: Bariatric surgery, meta-analysis, perioperative care, regional anesthesia, systematic review

Introduction

Bariatric surgery also known as weight reduction surgery is performed laparoscopically. This leads to lesser bowel handling, lesser length of stay (LOS), and a faster recovery. However, appropriate postoperative pain management is important to achieve these goals. Usually, a multimodal analgesic protocol is utilized involving around-the-clock opioids (continuous infusion or patient-controlled analgesia [PCA]), acetaminophen, and nonsteroidal anti-inflammatory drugs (NSAIDs), if not contraindicated, adjuvants such as gabapentinoids. Inadequately managed postoperative pain can have deleterious consequences such as basal atelectasis, pneumonia, increased hospital stays, and increased cost of treatment.[1-4]

Regional anesthesia techniques can provide opioid-sparing and better-quality analgesia if incorporated into the multimodal regimen. Thoracic epidural analgesia (TEA) could be an important modality, but the challenges are difficulty in securing the space due to obesity. Moreover, a TEA for laparoscopic surgery is difficult to justify.[5,6] Intraperitoneal instillation of local anesthetics (IPILA) was used in a study that was associated with better pain relief in the recovery room but did not reduce postoperative opioid use or an overall LOS.[7] Ultrasound-guided transversus abdominis plane (TAP) block

Address for correspondence: Dr. Abhijit Sukumaran Nair, Department of Anaesthesiology, IBRA Hospital, Ministry of Health-Oman, P. O. Box 275, Ibra-414, Sultanate of Oman.
E-mail: abhijitnair95@gmail.com

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has been used successfully by many researchers in patients undergoing bariatric surgery.[8,9] The safety and efficacy of TAP block in bariatric surgeries were attested in systematic review and meta-analysis (SRMA).[10,11]

Forero *et al*. described ultrasound-guided erector spinae plane block (ESPB) which has been one of the most popular blocks of the last decade.[12] The block has been used for varying indications such as thoracic surgeries, abdominal surgeries, and cardiac surgeries.[13,14] US-guided ESPB has been successfully used as a part of multimodal analgesia in patients undergoing bariatric surgeries.[15,16]

This SRMA aimed to investigate the efficacy and safety of US-guided ESPB as an intervention providing perioperative analgesia in patients undergoing bariatric and metabolic surgeries by comparing it with placebo or sham block and other interventions.

Methods

Strategy and criteria

The protocol for this systematic review was registered with PROSPERO, an international prospective register of systematic reviews with the following registration number: CRD42022360941. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations and the Cochrane Handbook for Systematic Reviews of Interventions were followed for conducting this SRMA.[17] The databases searched were PubMed/Medline, the Cochrane Reviews Library (CENTRAL), Scopus, Ovid, and clinical trials.gov from the year 2016 to July 2022. The language was restricted to English. The searches were rerun before final analysis.

The search approach made use of the following keywords: (Erector Spinae Plane Block OR ESPB) AND (Bariatric surgery OR Metabolic surgery) AND (postoperative analgesia). Our study covered research comparing ESPB with a placebo or ESPB with any other intervention used to provide perioperative analgesia for bariatric and metabolic surgeries. Studies that compared only one pathway or lacked a control group were excluded. Case reports, editorials, commentaries, reviews, publications with only abstracts, and all other types of writing were disregarded.

Study selection and data extraction

The titles and abstracts were separately reviewed, and duplicates were removed by two authors (AN and MR). The final included studies were chosen after consideration by both authors who also read the complete texts. Any disagreement and inconsistency were settled by a third author (NB). For studies in which data were not reported in the results or not available in supplementary files, the corresponding author was contacted via email for providing the necessary information to access suitability for analysis. Conference abstracts having incomplete details regarding study design or data were excluded from the analysis. The inclusion criteria based on PICO were:

- Patient/population (P): adult patients undergoing bariatric surgery/metabolic surgery
- Intervention (I): bilateral ESPB
- Comparator (C): placebo (saline), or no intervention, or any other regional anesthesia intervention
- Outcomes (O): pain scores, total opioid consumption, intraoperative opioid consumption, time to rescue analgesia.

Two authors (AN and MR) gathered pertinent data, including author details, publication dates, sample size, age, sex, and various other outcomes. Studies that had less than two outcomes were excluded. The outcomes compared were intraoperative opioid consumption, pain scores postoperatively at various time intervals, postoperative opioid consumption, time to rescue analgesia, adverse events such as postoperative nausea/vomiting (PONV), and sedation. Any disagreement and inconsistency were settled by a third author (NB).

Methodological quality assessment

The Revised Cochrane risk-of-bias tool for randomized trials (RoB 2) was used to access the methodologic quality and risk of bias of the included randomized control trials.[18] Six categories were taken into consideration for bias assessment: bias due to randomization, bias due to deviation from intended intervention, bias due to missing data, bias due to outcome measurement, bias due to selection of reported result, and overall bias. The quality of nonrandomized trials was assessed independently by two authors (AN and NB) based on the Newcastle-Ottawa scale (NOS).[19]

Meta-analysis

After a qualitative review, a quantitative review was performed. All included studies that directly compared outcomes between patients who underwent bariatric and metabolic surgeries and received ESPB and were compared with placebo/no intervention or any other regional anesthesia intervention was included in the quantitative meta-analysis.

Statistical analysis

Mantel–Haenszel technique was used to assess dichotomous variables and the risk ratio with the associated 95% confidence interval (CI) was determined. For units-unified continuous variables, the mean difference (MD) with the accompanying 95% CI was determined using the inverse variance approach. We evaluated the heterogeneity between studies using the I^2 statistic which was defined as 0%–40% – might not be important, 30%–60% – may represent moderate heterogeneity, 50%–90% –may represent significant heterogeneity, and 75%–100% – considerable heterogeneity.[20]

Review Manager version 5.4.1 (Cochrane Collaboration, Software Update, Oxford, UK) was used for analysis.[21] The results were compared with the random effects model and fixed effects model, and the reliability of the combined results was eventually analyzed according to the consistency degree of the results. When $P > 0.01$ and $I^2 < 50\%$, the fixed effects model

was used and when $P < 0.01$ and $I^2 > 50\%$, the random effects model was used for meta-analysis.

Results

Results of literature search

We searched PubMed/Medline, EMBASE, CENTRAL, Ovid, and clinical trials.gov for randomized-controlled trials (RCTs) and observational studies comparing ESPB with placebo or no block in patients undergoing bariatric and metabolic surgeries. We identified 695 articles by searching the above-mentioned databases and registries. After removing duplicates and also articles that were not relevant, we identified 16 articles for scrutiny. A total of 13 studies were considered eligible. From these, 7 studies were excluded (study with no control group – 3, review articles – 3, unrelated primary and secondary outcomes –1). Finally, we included 6 studies which included 335 patients for analysis (157 in ESPB group and 178 in the control group) [Figure 1a].[22-27] For retrieving details of one study, the corresponding author was contacted twice requesting relevant data which was not available in the results but was described in the methodology. As we did not receive any reply from them, we excluded that study from the analysis. In few studies, outcomes were depicted in graphs without any mention in the results and tables. The authors were contacted for the details, but there was no reply. Therefore, the numbers were derived from the box plots and used for analysis. Out of the 6 studies selected, in 3 studies, ESPB was compared with placebo/sham block.[22-24] and in three studies ESPB was compared with bilateral TAP block.[25-27] Therefore, we analyzed the pooled data of all 6 studies initially and then by dividing into two groups: ESPB with placebo/sham block or no block and ESPB with bilateral TAP block. The summary of all the included studies is presented in Table 1.

Risk of bias

The risk of bias within the trials according to ROB2 is shown in Figure 1b. The summary plot of the quality assessment is shown in Figure 1c. The bias from the randomization process was low in 4 studies.[23-25,27] and high in 2 studies.[22,26] Bias due to deviations from intended interventions (allocation concealment) was low in 4 studies.[23-25,27] and high in 2 studies.[22,26] Bias arising due to missing outcome data was low in 5 studies.[22-25,27] and high in one study.[26] Bias in measurement of outcome was low in 3 studies.[23,24,27] and there was no information in 3 studies.[22,25,26] Bias arising due to selection of reported result was low in 4 studies.[22,25] and there was no information in 2 studies.[26,27] The overall bias was low in 4 studies.[23-25,27] and high in 2 studies.[22,26] Methodological quality assessment of the two nonrandomized studies included in our meta-analysis by NOS showed that both studies are of good quality as per NOS scale.

Primary outcomes analysis

Out of the 6 studies which were included for quantitative review, in 3 studies ESPB was compared with either no block or placebo/sham block.[22-24] In another 3 studies, ESPB was compared with bilateral TAP block.[25-27] For pooled analysis, initial outcomes in all 6 studies (as reported) were analyzed. Thereafter, a sub-group pooled analysis of ESPB with no block

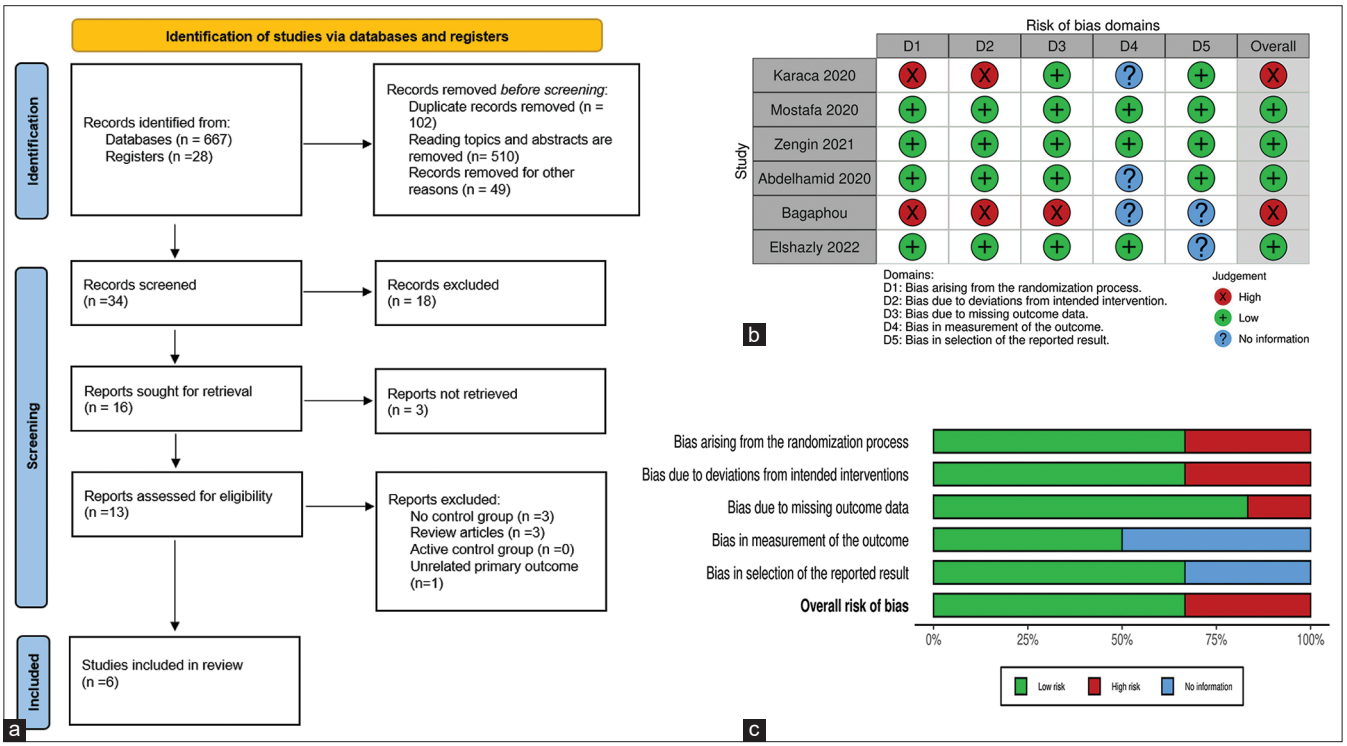

Figure 1: (a) PRISMA flow diagram. (b) Traffic light plot showing risk of bias within the trials. (c) Summary plot showing quality assessment for each included study. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Table 1: Characteristics of included studies

Authors/ year	Country	Type of study	Number of patients	Comparator	Primary outcome	Secondary outcome	Conclusions
Karaca *et al*./2020	Turkey	Retrospective, comparative cohort study	38	No block	Postoperative analgesia	Intraoperative and 24-h opioid consumption, time to rescue analgesia, stay in recovery room, complications, opioid adverse events, time to unassisted walking, LOS in hospital	Bilateral US-guided ESPB provide superior analgesia and shortens unassisted walking time and hospital stay
Mostafa *et al*./2020	Egypy	Randomized-controlled trial	60	Placebo	Postoperative analgesia	Perioperative opioid consumption	US-guided ESPB provided satisfactory postoperative analgesia following laparoscopic bariatric surgery with decreased analgesic consumption
Zengin *et al*./2021	Turkey	Randomized-controlled trial	60	No block	Intraoperative opioid consumption	Postoperative opioid consumption, pain scores, time to rescue analgesia	Bilateral ESPB is a simple and effective technique to reduce perioperative pain in patients undergoing bariatric surgeries
Abdelhamid *et al*./2020	Egypt	Randomized, double-blinded trial	66	TAP block and no block	Postoperative analgesic efficacy	24-h opioid consumption, time to rescue analgesia, adverse events due to opioids	Ultrasound-guided ESPB lowers postoperative pain scores, reduces perioperative opioid consumption compared with both the subcostal TAP block and the control group
Bagaphou *et al*./2020	Italy	Comparative study	51	TAP block	Postoperative analgesic efficacy	24-h opioid consumption, adverse events due to opioids	Postoperative pain scores were significantly higher in TAP block group when compared to ESPB at 6 and 12 h and comparable at other times
Elshazly *et al*.	Egypt	Randomized, comparative study	60	TAP block	Postoperative pain scores	Time to rescue analgesia, time to first flatus, postoperative opioid consumption	Bilateral ESPB is a more feasible and an effective method for intra and postoperative analgesia than TAP block

ESPB: Erector spinae plane block, US: Ultrasound, LOS: Length of stay, TAP: Transversus abdominis plane

or placebo (subgroup A) and a pooled analysis of ESPB with TAP block (subgroup B) were performed separately. There were different types of opioids used in the studies which were converted to IV morphine for analysis. The article by Abdelhamid *et al.* includes 3 groups (22 patients in ESPB group, 22 patients in TAP group, and 22 patients with no block).[25] This study was utilized for meta-analysis in both subgroups as they reported outcomes separately.

Meta-analysis of 24-h opioid consumption

Four studies reported 24-h opioid consumption (101 patients in ESPB group and 101 in the control group).[23,24,25,27] The 24-h opioid consumption was significantly lesser in ESPB group when compared to control group (MD: −10.67; 95% CI: −21.03, -0.31, $P < 0.00001$). A random effect model was applied ($P < 0.00001$; $I^2 = 99\%$) which was suggestive of considerable heterogeneity [Figure 2a].

Three studies compared ESPB with no block or placebo (ESPB-71, no block-71) in subgroup A.[22,23,25] The 24-h opioid consumption was significantly less in ESPB group when compared with no block (MD: −12.69, CI: −24.00, −1.38, $P = 0.03$). However, based on a random effect model, there was considerable heterogeneity [$P < 0.00001$, $I^2 = 99\%$, Figure 3a]. Two studies reported 24-h opioid consumption in subgroup B (ESPB-52, TAP-52)[25,27] which on pooled analysis revealed that there was significantly less opioid consumption in ESPB group than TAP (MD: −3.23; 95% CI: −5.71, −0.75, $P = 0.01$). However, based on a random effect model there was considerable heterogeneity [$P = 0.02$, $I^2 = 82\%$, Figure 3b].

Meta-analysis of intraoperative opioid consumption

Intraoperative opioid consumption was reported by 3 studies (ESPB-82, control-82).[23-25] The intraoperative opioid consumption was significantly less in the ESPB group when compared to the control group (MD: −17.75; 95% CI: −20.36, −15.13, $P < 0.00001$). A fixed effect model was applied ($P = 0.23$; $I^2 = 31\%$) which was with minimal heterogeneity [Figure 2b].

For pooled analysis of subgroup-A, 3 studies were taken into consideration (ESPB-82, no block-82).[23-25] The intraoperative opioid consumption was significantly less in ESPB group than in no block (MD: −17.75, 95% CI: −20.36, −15.13, $P < 0.00001$). Based on a fixed effect model, there was minimal heterogeneity between these studies [$P = 0.23$, $I^2 = 31\%$, Figure 3c]. No pooled analysis was performed in subgroup B as there was one study that reported intraoperative opioid consumption.

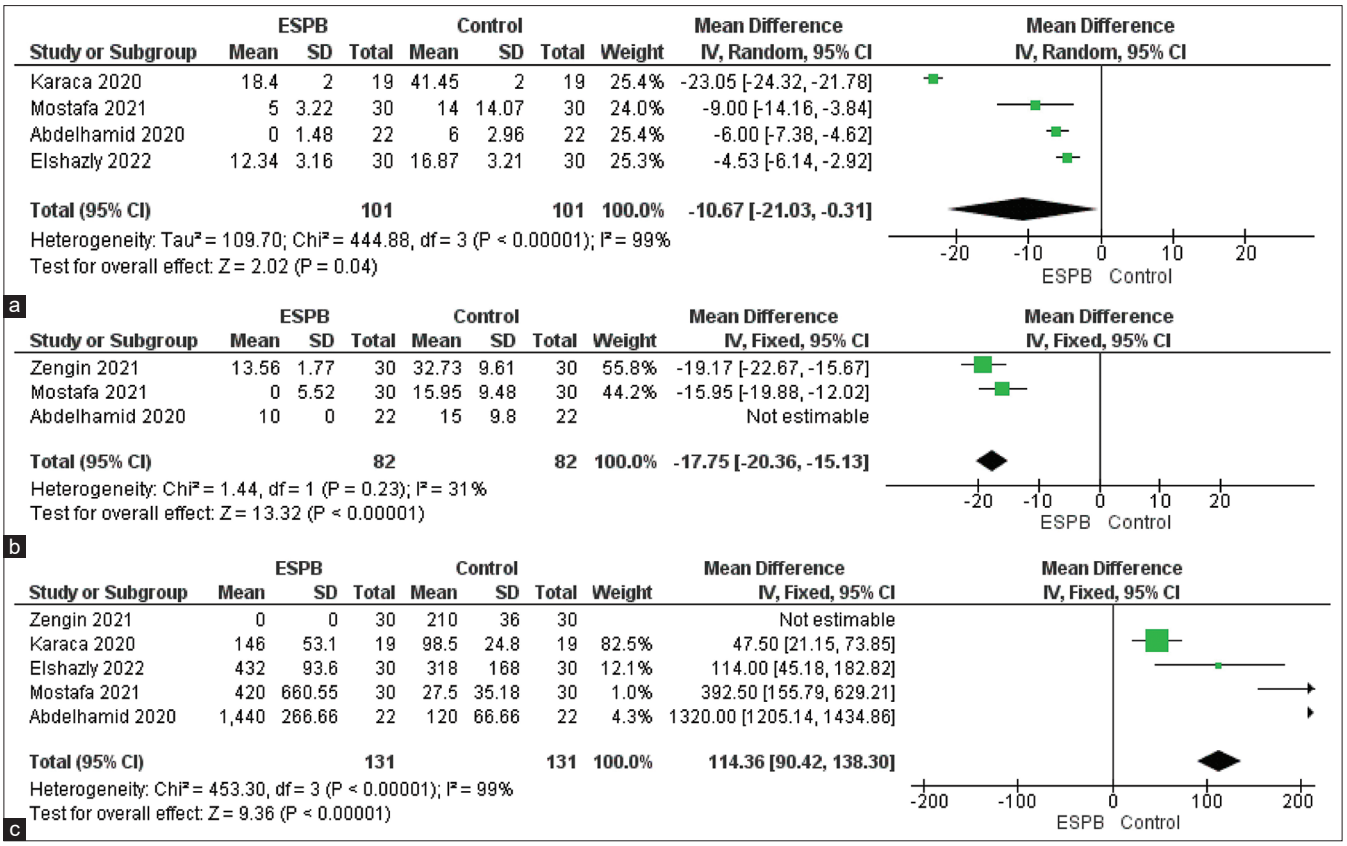

Figure 2: (a) Forest plot showing comparison of 24 h opioid consumption. (b) Forest plot showing comparison of intraoperative opioid consumption. (c) Forest plot showing comparison of time to rescue analgesia

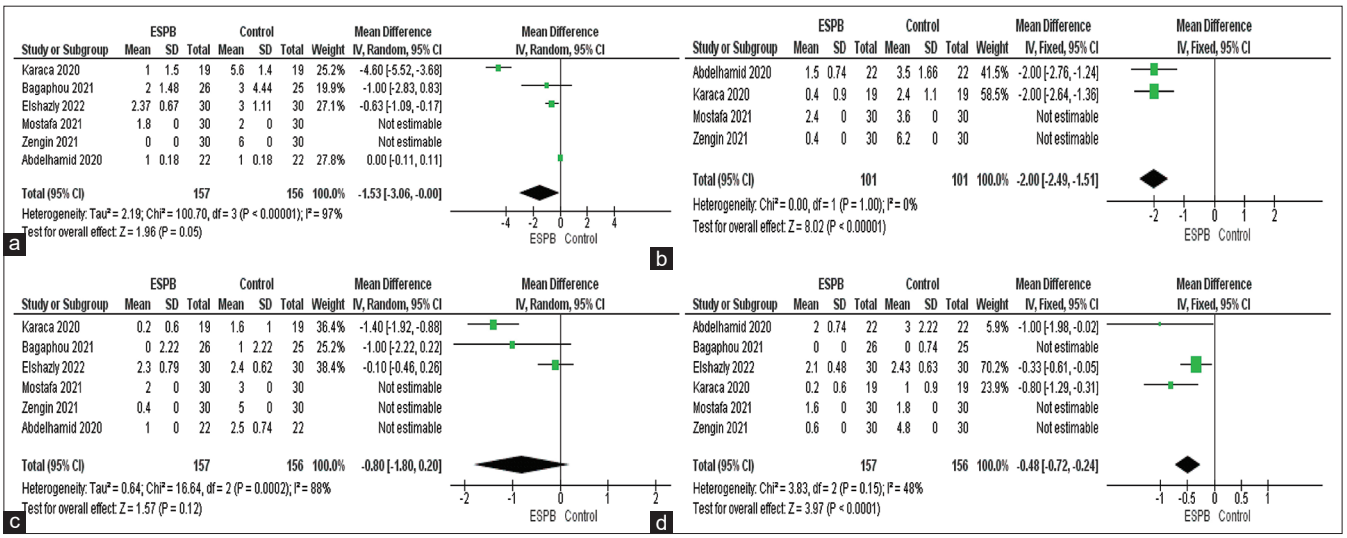

Figure 3: (a) Forest plot showing comparison of pain scores at zero hrs (b) Forest plot showing comparison of pain scores at 6 hrs (c) Forest plot showing comparison of pain scores at 12 hrs (d) Forest plot showing comparison of pain scores at 24 hrs

Meta-analysis of time to rescue analgesia

Time to rescue analgesia was reported in 5 studies (ESPB-131, control-131).[22-25,27] On pooled analysis, the time to rescue analgesia was significantly more in the ESPB group when compared to the control group (MD: 114.36; 95% CI: 90.42, 138.30, $P < 0.00001$). A random effect model was applied which was suggestive of considerable heterogeneity [$P < 0.00001$; $I^2 = 99\%$, Figure 2c].

Four studies reported time to rescue analgesia in subgroup A (ESPB-101, no block-101).[22-25] Pooled analysis revealed that the time to rescue analgesia was comparable in both groups (MD: 586.85; 95% CI: −337.59, 1511.30, $P = 0.21$).

On pooled analysis, it was evident that there was significant heterogeneity [$P < 0.00001$, $I^2 = 100\%$, Figure 3d]. Two studies reported time to rescue analgesia in subgroup B (ESPB- 52, TAP block-52).[25,27] Pooled analyses revealed that the time to rescue analgesia was comparable in both groups (MD: 595.22; 95% CI: −351.43, 1541.88 $P = 0.22$). Based on a random effect model, there was significant heterogeneity in the studies [$P < 0.00001$, $I^2 = 99\%$, Figure 4e].

Meta-analysis of pain scores at different time intervals

For 0 h/first score noted, pain scores were reported by 6 studies (ESPB-157, control-156),[22-27] at 6 h by 4 studies (ESPB-101, control-101),[22-25] at 12 h by 6 studies (157, control-156),[22-27] at 24 h by 6 studies (ESPB-156, control-157).[22-27]

At 0-h, pain scores were comparable in ESPB and control group (MD: −1.53, 95% CI: −3.06, −0.00, $P = 0.05$). A random effect model was applied which was suggestive of significant heterogeneity [$P < 0.00001$; $I^2 = 97\%$, Figure 4a]. In sub-group A, 4 studies reported pain scores at 0 h.[22-25] Pooled analysis revealed that pain scores were comparable in ESPB and no group (MD: −2.77, 95% CI: −6.30, 0.75, $P = 12$). A random effect model revealed significant heterogeneity [$P < 0.00001$, $I^2 = 98\%$, Figure 5a]. Three studies reported pain scores at 0 h in subgroup B.[25-27] Pooled analysis revealed that the pain scores were comparable in both groups (MD: −0.33; 95% CI: −0.90, 0.24, $P = 0.26$). A random effect model revealed moderate heterogeneity [$P = 0.02$, $I^2 = 74\%$, Figure 5b]. At 6 h, pain scores were significantly lower in ESPB group when compared to control group (MD: −2.00; 95% CI: −2.49, −1.51, $P < 0.00001$]. A fixed effect model was applied which was without heterogeneity [$P = 1.00$, $I^2 = 0\%$, Figure 4b]. In subgroup A, pain scores were reported by 4 studies.[22-25] significantly less in ESPB group than no block (MD: −2.00, 95% CI: −2.49, −1.51; $P < 0.00001$). A fixed effect model did not reveal any heterogeneity [$P = 1.00$, $I^2 = 0\%$, Figure 5c]. No studies reported pain scores at 6 h in subgroup B. At 12 h, pain scores were comparable in both groups (MD: −0.80; 95% CI: −1.80, 0.20, $P = 0.12$). A random effect model was applied which was suggestive of significant heterogeneity [$P = 0.0002$; $I^2 = 88\%$, Figure 4c]. Four studies reported pain scores in subgroup A at 12 h.[22-25] Pooled analysis revealed that pain scores at 12 h were significantly low in ESPB group when compared to no block (MD: −1.40, 95% CI: −1.92, −0.88; $P < 0.00001$). Heterogeneity could not be assessed for these studies [Figure 5d]. Three studies reported pain scores in subgroup B at 12 h.[25-27] Pooled analysis revealed that pain scores were comparable at 12 h [MD: −0.17, 95% CI: −0.52, 0.17, $P = 0.32$, Figure 5e]. A fixed effect model revealed moderate heterogeneity ($P = 0.16$, $I^2 = 49\%$).

At 24 h, the pain scores were significantly lower in the ESPB group when compared to the control group (MD: −0.48; 95% CI: −0.72, −0.24, $P < 0.00001$). A fixed effect model was applied which was suggestive of moderate heterogeneity [$P = 0.15$, $I^2 = 48\%$, Figure 4d]. In subgroup A, pain scores were reported by 4 studies.[22-25] and was significantly low in ESPB at 24 h compared to no block (MD: −0.84, 95% CI: −1.28, −0.40, $P = 0.0002$). There was no heterogeneity in the studies included [$P = 0.72$, $I^2 = 0\%$, Figure 5f]. In subgroup B, pain scores were reported by 3 studies.[25-27] and were comparable in both groups (MD: −0.23; 95% CI: −0.47, 0.01, $P = 0.06$). A fixed effect model was suggestive of minimal heterogeneity [$P = 0.21$, $I^2 = 35\%$, Figure 5g].

Postoperative nausea/vomiting

Three studies reported PONV as an adverse event.[23,25,26] On

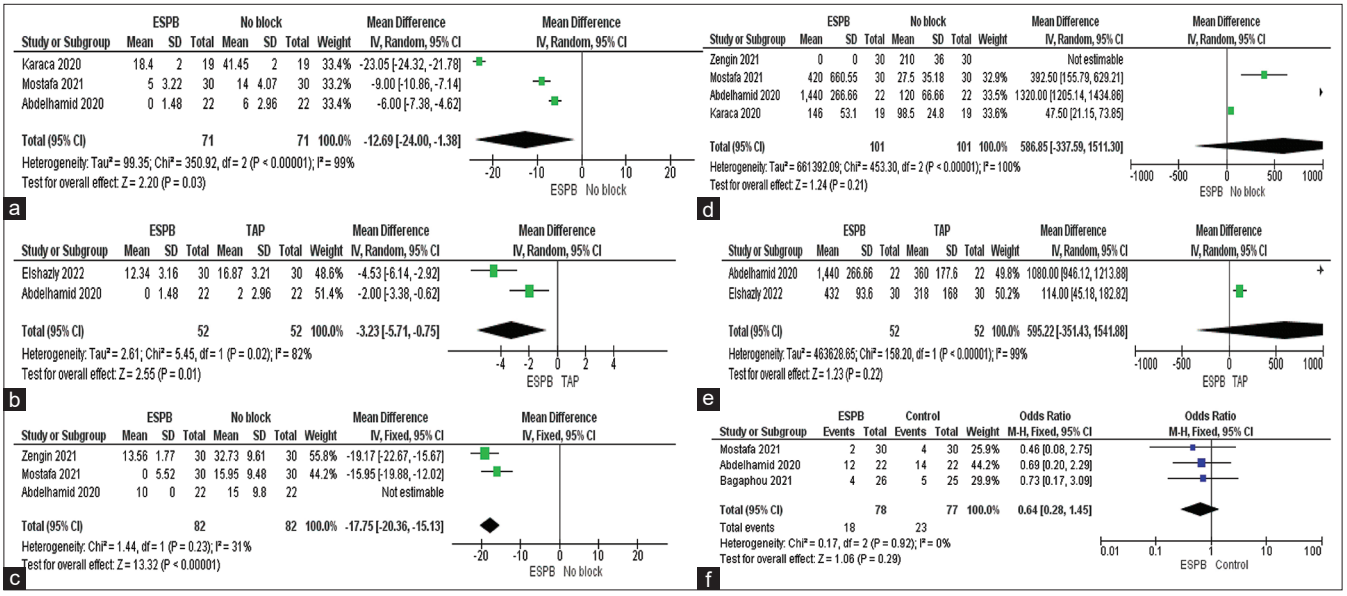

Figure 4: (a) Forest plot showing comparison of 24 hr opioid consumption in subgroup A (b) Forest plot showing comparison of 24 hr opioid consumption in subgroup B (c) Forest plot showing comparison of opioid consumption in subgroup A (d) Forest plot showing comparison of time to rescue analgesia in subgroup A (e) Forest plot showing comparison of time to rescue analgesia in subgroup B (f) Forest plot showing comparison of PONV

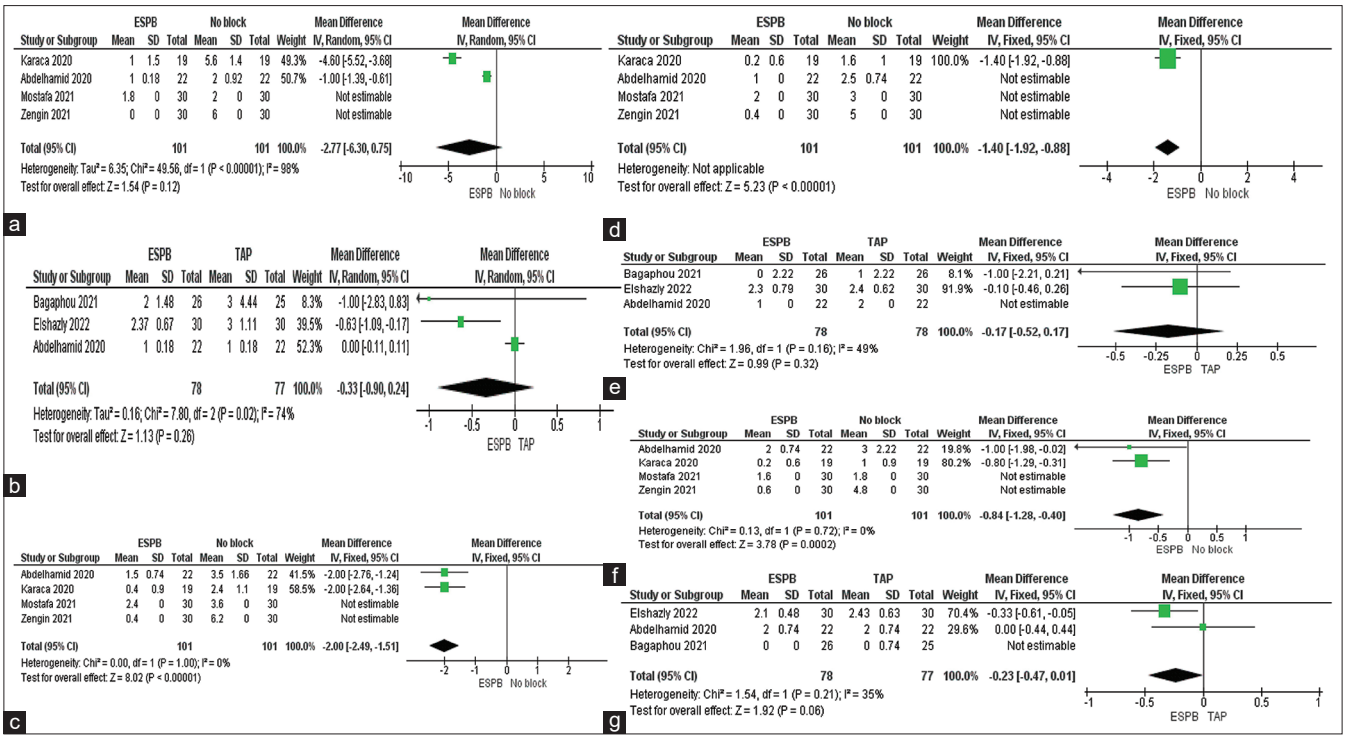

Figure 5: (a) Forest plot showing comparison of pain scores at 0 h in subgroup A. (b) Forest plot showing comparison of pain scores at 0 h in subgroup B. (c) Forest plot showing comparison of pain scores at 6 h in subgroup A. (d) Forest plot showing comparison of pain scores at 12 h in subgroup A. (e) Forest plot showing comparison of pain scores at 12 h in subgroup B. (f) Forest plot showing comparison of pain scores at 24 h in subgroup A. (g) Forest plot showing comparison of pain scores at 24 h in subgroup B

pooled analysis, PONV was comparable in ESPB and control group (RR: 0.64; 95% CI: 0.28, 1.45, $P = 0.29$). A fixed effect model revealed no heterogeneity [$P = 0.92$, $I^2 = 0\%$, Figure 4f].

Discussion

Summary of results

This SRMA demonstrate the benefits of adding bilateral ESPB in patients undergoing bariatric and metabolic surgeries. In a thoracic ESPB, the local anesthetic is deposited after identifying the erector spinae muscle, the needle is placed in the myofascial plane between the transverse process and the muscle [Figure 6]. The pooled analysis revealed that a bilateral ESBP led to a reduced 24-h opioid consumption, lesser intraoperative opioid consumption, a significantly delayed time to rescue analgesia, and significantly lesser pain scores at 6 and 24 h. However, PONV was comparable in both groups. The control group involved either a placebo/sham block, no block, or TAP. Therefore, a subgroup analysis was done comparing ESPB group with placebo/no block (group A) and TAP block (group B). On pooled subgroup analysis, 24-h opioid consumption was lesser in ESPB in both groups. The intraoperative opioid consumption was lesser in group A and was analyzed in group B as no studies reported the outcome. The time to rescue analgesia and pain scores at 0 h was comparable with ESPB and no block or TAP block. At 6 h, ESPB provided significantly better pain scores in group A. As no studies were reported, subgroup analysis of group B was not performed at 6 h. At 12 and 24 h, pain scores were significantly low in ESPB patients in group A and comparable in group B analysis. To the best of our knowledge, this is the first SRMA that has investigated the efficacy of bilateral ESPB with the control group in patients undergoing bariatric and metabolic surgeries.

It is well known that pain after laparoscopic surgeries is less when compared to open surgeries due to the minimal access approach, and less tissue handling. However, adequate analgesia is essential to facilitate early mobilization, and early recovery of bowel activity, thus leading to lesser opioid use which facilitates faster recovery.[28,29] Ultrasound-guided interventions have demonstrated effective analgesia in several acute and chronic pain conditions.[30,31] There are several modalities of providing comprehensive multimodal analgesia for a patient undergoing bariatric and metabolic surgeries. The clinician could use opioid-sparing strategies such as lidocaine, ketamine, dexmedetomidine, and magnesium sulphate infusion intraoperatively.[32-35] Preoperative gabapentinoids (gabapentin and pregabalin) in various doses were found to provide opioid-sparing analgesia, minimal sedation, and acceptable adverse events when used in patients undergoing bariatric surgeries.[36,37]

The ERAS society updated the recommendations in 2021 and suggested a multimodal analgesic approach comprising acetaminophen, PCA with opioids, NSAIDs, and infiltration of local anesthetics (LA) at surgical port sites.[38] Unfortunately,

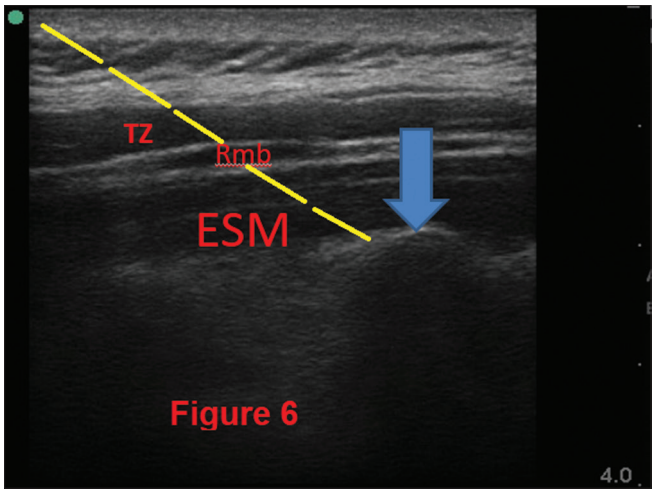

Figure 6: Picture illustrating a thoracic erector spinae plane block. ESM: Erector spinae muscle, TZ: Trapezius muscle, Rmb: Rhomboid muscle, Yellow interrupted line: Path of the needle, Blue arrow: Point of injection

there has been no mention of a specific regional anesthesia modality that could be offered to these patients to provide better quality, opioid-sparing analgesia.

Chin *et al.* performed single-shot, bilateral ESPB at T7 transverse process level in three patients who underwent laparoscopic Roux-en-Y gastric bypass surgery (two blocks were given postoperatively in the recovery room, and one was administered preoperatively).[15] The authors concluded that the blocks provided opioid-sparing, effective analgesia without any adverse events. Later, there were RCTs published which described the safety and efficacy of bilateral ESPB in providing opioid-sparing analgesia after bariatric and metabolic surgeries when compared to placebo.[22] Karaca *et al.* retrospectively analyzed data from 38 patients undergoing laparoscopic sleeve gastrectomy (19-received bilateral ESPB with 50 ml of 0.25% bupivacaine, 19- were in the control arm and received no block). The authors concluded that the addition of ESPB provided superior analgesia with a shorter hospital stay. In a prospective RCT involving 60 patients undergoing laparoscopic bariatric surgeries, Mostafa *et al.* randomized them into two groups of 30 patients each.[23] In ESPB group, the patients received 20 ml of 0.25% bupivacaine at T7 level bilaterally (total volume of 40 ml) and in the control group, patients received a sham block with the same volume using saline. The author concluded that patients in the ESPB group had overall lesser narcotic consumption without significant difference in postoperative pulmonary functions. Zengin *et al.* randomized 60 patients undergoing bariatric surgery into two groups of 30 each.[24] In ESPB group, the patients received 25 ml LA at the T9 level, and in the control group, patients received 25 ml LA at the trocar insertion sites. The authors concluded that the addition of bilateral ESPB resulted in better pain scores and lesser opioid consumption postoperatively.

Bilateral US-guided TAP blocks are the most extensively utilized RA intervention in patients undergoing bariatric surgeries. Several researchers compared TAP block with bilateral ESPB in various studies. Abdelhamid *et al.* randomized 66 patients undergoing laparoscopic sleeve gastrectomy into three groups.[25] In ESPB group, the 22 patients received 15 ml of 0.25% bupivacaine on each side at the T9 level. In the TAP group, 22 patients received bilateral subcostal TAP block with 30 ml of 0.25% bupivacaine on each side. The control group did not receive any blocks. On analysis, the authors concluded that bilateral ESPB provided statistically significant analgesia and reduced opioid consumption perioperatively. Bagaphou *et al.* randomized 51 patients undergoing bariatric surgery into two groups.[26] Bilateral ESPB was performed in 26 patients at T7-9 levels using 0.375% levobupivacaine 20 ml on each side. Bilateral subcostal TAP blocks were performed using 40 ml of 0.375% bupivacaine- 20 ml on each side. The authors concluded on analysis that both interventions were comparable in terms of postoperative pain scores and opioid consumption. Elshazly *et al.* randomized 60 patients undergoing bariatric surgeries to receive either bilateral ESPB or bilateral TAP blocks.[27] Thirty patients in ESPB received 40 ml of 0.25% bupivacaine (20 ml on each side). In the TAP group, 30 patients received 20 ml of 0.25% bupivacaine on each side. On analysis, the authors concluded that bilateral ESPB was more effective in providing better analgesia during the intraoperative and postoperative periods. Both blocks could be technically challenging in obese patients although ESPB could be relatively feasible when compared to the TAP block with ultrasound guidance. Postoperatively, the patients could be offered an opioid PCA along with acetaminophen, NSAIDs (if not contraindicated), and adjuvants such as gabapentinoids depending on patient characteristics and the choice and comfort of the anesthesiologist.

The strengths of this study are that this is the first systematic review that investigated the efficacy of bilateral ESPB used in patients undergoing bariatric surgery. This review not only compared ESPB with placebo or no block but also did a subgroup analysis with TAP block.

There were several limitations in this SRMA. Since prospective RCTs were few, the overall sample size was small, and outcomes were inconsistent. We could find RCTs comparing ESPB with placebo or TAP block only and not with IPILA or TEA. The concentration, volume, and LA used for the blocks were not similar. Even the level at which ESPB was performed was not consistent in all the studies. There was heterogeneity in the quantitative analysis of several variables which could be explained due to different study designs, variable sample size, and inconsistent reporting and analysis of data. Well-designed and adequately powered RCTs are the need of the hour to conclude if ESPB is comparable to no block/TAP block, superior, or less effective in providing favorable perioperative outcomes after bariatric surgeries.

Conclusion

Bilateral ESPB is an effective and safe intervention that can

provide opioid-sparing analgesia and better pain scores when used in patients undergoing bariatric surgeries when compared to placebo/no block and also bilateral TAP blocks. However, the overall quality of evidence is very low due to the small sample size, significant heterogeneity in the included studies, and inconsistent outcomes described. Further adequately powered, well-designed studies need to be conducted to explore the efficacy and safety of bilateral ESPB along with the determination of a suitable level of injection, appropriate concentration, and volume of LA used for the block.

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Conflicts of interest

There are no conflicts of interest.

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