# Efficacy of laparoscopic-guided TAP block in postoperative pain management of laparoscopic bariatric patients

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**Received:** 15 October 2021
**Accepted:** 01 January 2022
**Published:** 10 October 2022

**The Egyptian Journal of Surgery** 2022, 41:279–286

**Background and objective**
Postoperative pain management is a critical aspect of patient care after surgery. It is especially important in obese patients, who have a higher risk of inadequate postoperative ventilation and chest expansion, as well as respiratory depression and obstructive sleep apnea. The usage of opioid drugs for pain management exacerbates these consequences. In these patients, opioid-free regimens incorporating regional anesthetic procedures like the transversus abdominis plane (TAP) block become indispensable. The laparoscopic-guided TAP (L-TAP) block is a new procedure that has shown promise in the treatment of postoperative pain. The main objective of the present study was to demonstrate the effectiveness and safety of TAP block for postoperative pain management under laparoscopic vision undergoing laparoscopic bariatric surgery.
**Methodology**
This is a randomized clinical trial including 46 patients, who were divided into two groups, 23 each, one to receive L-TAP and one as control. Postoperative pain in the first 24 h was assessed by Visual Analog Scale (VAS) scores, need for narcotic rescue analgesia, number of rescue doses required, pain scores on ambulation, and incidence of postoperative nausea and vomiting.
**Results**
Significantly fewer patients in the intervention group required rescue analgesia (30.4% in the intervention group to 65.2% in the control group, *P*=0.018). The intervention group also exhibited significantly better pain scores on ambulation (*P*=0.006). All other parameters showed no statistically significant difference between the two groups.
**Conclusion**
L-TAP is a promising technique for the alleviation of postoperative pain in obese patients undergoing bariatric surgery. Further studies are needed to delineate the limits and extents of its efficacy.

**Keywords:**
analgesic effect, laparoscopic bariatric, laparoscopy, postoperative pain, transversus abdominis plane block TAP

Egyptian J Surgery 2022, 41:279–286

1110-1121

## Introduction

Bariatric surgery, which is commonly done laparoscopically, is an efficient way to help morbidly obese individuals lose weight and keep it off [1]. Postoperative pain relief is an imperative facet of postoperative patient care. Not only does adequate pain management improve patient satisfaction but it also plays a vital role in patient's physiological and psychological recovery from surgery. Postoperative pain alleviation is of particular importance in the obese patient, a population plagued with a predisposition for poor postoperative ventilation and chest expansion, respiratory depression, and obstructive sleep apnea [2]. While the use of narcotics in the relief of postoperative pain has stood the test of time, their employment in the postoperative pain management of obese patients only increases the risk of these undesirable respiratory complications. Opioid-sparing regimens are therefore encouraged in this context. These rely on non-narcotic medications along with regional anesthetic techniques such as transversus abdominis plane (TAP) blocks to minimize the reliance on narcotic analgesia and mitigate their harmful effects [3].

The first TAP block was described in 2001 [4] and has since been employed in numerous abdominal operations, demonstrating a decrease in postoperative pain and narcotic requirement postoperatively [5]. The administration of TAP block through laparoscopic guidance was first proposed in 2011 and has shown favorable results in the form of improved pain relief and reduced overall cost [6]. This relatively novel technique has shown promise in alleviating postoperative pain

and decreasing reliance on opioid analgesics, a much-needed concept in the management of postoperative pain in obese patients.

The TAP block has been shown to enhance pain-related outcomes during laparoscopic cholecystectomy, open appendectomy, and caesarean section, among other upper and lower abdominal surgical procedures [7]. The administration of the local anesthetic in the proper spot directed by the laparoscopic camera is a new variation of the ultrasound-guided TAP block. The use of local anesthetic infiltration at the surgical incision site as a postoperative analgesic has proven effective [8].

The purpose of the study was to see whether a postoperative laparoscopic-guided TAP block, in addition to preoperative port-site infiltration, provides an additional analgesic effect in patients undergoing laparoscopic bariatric surgery.

## Patients and methods

### Study design and populations

This is a randomized clinical pilot study carried out over 6 months to test the postoperative analgesic effect of laparoscopic-guided TAP block in patients scheduled to undergo laparoscopic bariatric surgery. Forty-six morbidly obese patients undergoing laparoscopic bariatric surgery in Kasr Al-Aini Hospital, Cairo University, between October 2020 and March 2021 were enrolled in the study. The related sociodemographic data including age and gender and clinical data including body mass index (BMI) were collected using a questionnaire.

#### *Ethics approval*

The Ethics Clearance Committee approved the project of the Faculty of Medicine at Cairo University before the start of the study. Informed consent, including consenting to the proposed operative procedure, its possible risks/complications, the possibility of receiving laparoscopic TAP block and its possible complications, and the perioperative management protocol, was obtained from all patients before their inclusion in the study.

#### *Inclusion criteria*

The target group for this study was adults between the ages of 18 years to less than 60 years at the time of surgery, patients undergoing laparoscopic bariatric surgery for morbidly obese patients with BMI of 40 or higher and for BMI 35 or higher with comorbidities, willingness to give consent and comply with the study protocol, and fitness for general anesthesia and surgery.

#### *Exclusion criteria*

The excluded group for this study was psychologically unstable patients, redo bariatric surgery, patients who required intraperitoneal drain insertion, allergy to local anesthetics, bleeding disorders, and vulnerable groups, that is, prisoners.

### Patient allocation

Morbidly obese patients presenting for bariatric surgery in elective departments were randomized into two groups using computer-generated tables (Fig. 1):

(1) Group A ($n$=23): received L-TAP at the end of their bariatric procedure with port-site infiltration.
(2) Group B ($n$=23): did not receive L-TAP or any other type of block and served as control.

### Preoperative care

All patients were subjected to full preoperative evaluation. This included thorough history-taking and physical examination, routine laboratory tests, endocrine workup, chest X-ray, pulmonary function testing, cardiological assessment, abdominal ultrasonography, as well as upper gastrointestinal endoscopy. Patients received nutritional counseling by a dietician before and after surgery. They were placed on a low-calorie diet preoperatively for 1–3 weeks, according to their BMI. All comorbidities that increase perioperative risk were controlled before surgery as much as possible.

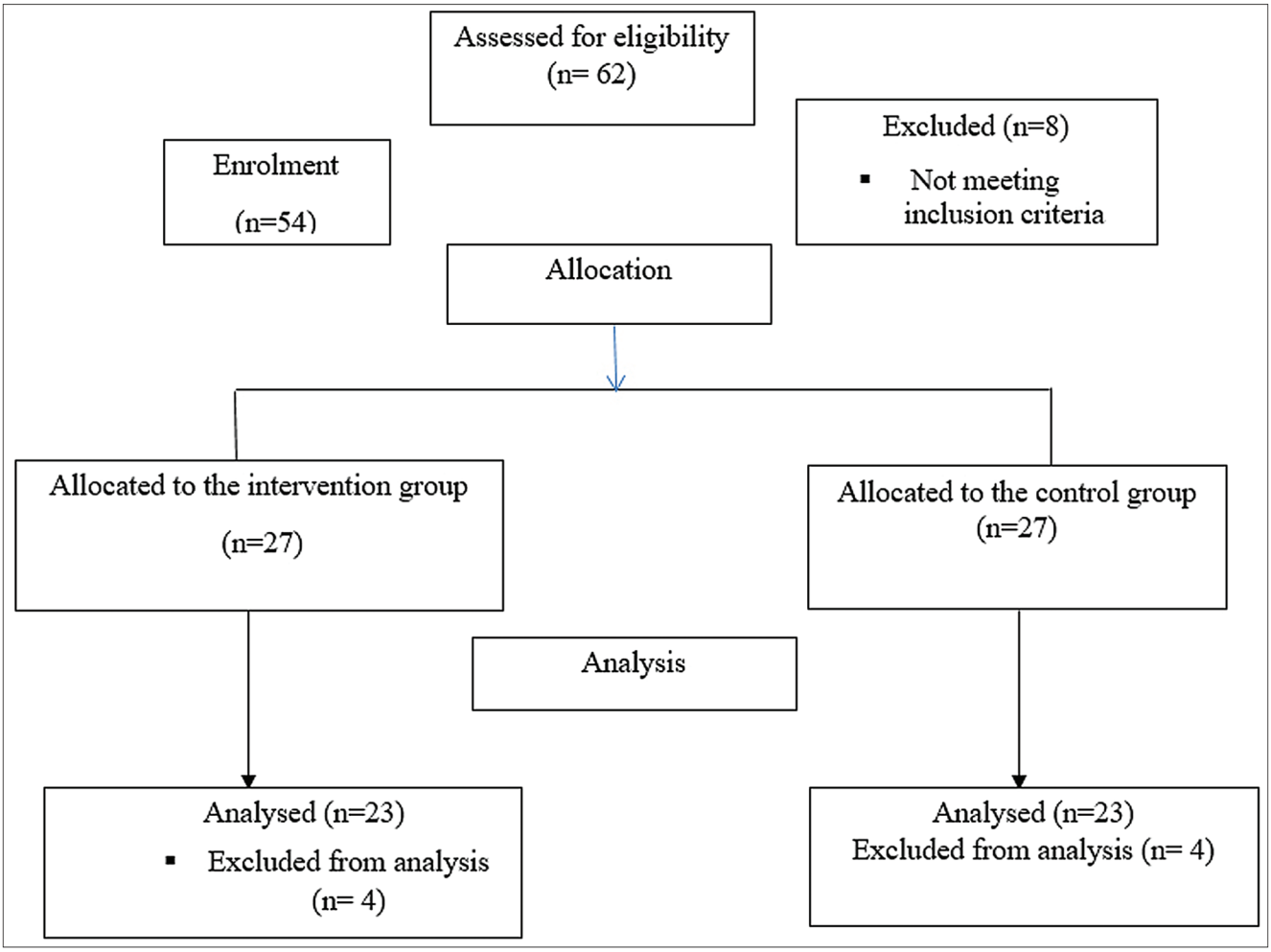
### Induction

In all patients, general anesthesia was induced using propofol 1–2 mg/kg over 20–30 s, fentanyl 2 μg/kg, and atracurium 0.5 mg/kg to facilitate endotracheal intubation. Anesthesia was maintained using isoflurane 1.5%, and atracurium infusion with a dose of 0.3 mg/kg/h. For all patients, fluid management was strict according to body weight and blood loss was adequately estimated and replaced.

### L-TAP procedure patients

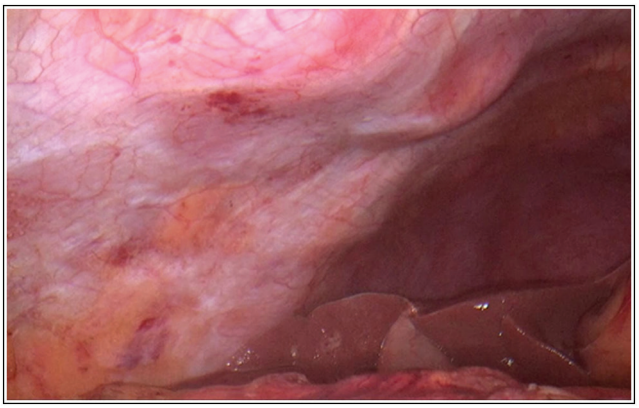
Group A received L-TAP at the end of their bariatric procedure with port-site infiltration as follows: Utilizing the laparoscopic camera, a subcostal injection of (10 ml lidocaine 2%+10 ml bupivacaine 0.5%) is given just lateral to the rectus muscle on either side and another injection of (10 ml bupivacaine 0.5%+10 ml saline 0.9%) at the anterior axillary line midway between the costal margin and iliac crest on either side. Effective site injection at the TAP is ensured using a laparoscopic camera by observing the so-called Doyle's Bulge (Fig. 2), not to be confused with a peritoneal blister that would indicate erroneous injection into preperitoneal space. Effective injection into the TAP ensures anesthetization of nerve levels T7–L1 that supply the anterior abdominal wall and run in the TAP beneath the internal oblique

**Figure 1**




Participant flow chart diagram.

**Figure 2**



Doyle's Bulge.

muscle, while patients in the Group B did not receive L-TAP or any other kind of block.

#### Preoperative port-site infiltration

All layers of the surgical incision must be infiltrated in a controlled and thorough way under direct visualization. A 22-G, 1.5-inch needle is suitable for infiltration. The needle is introduced into the tissue plane (e.g., peritoneal, musculofascial, or subdermal planes) and local anesthetic solution is injected while slowly withdrawing the needle, reducing the danger of intravascular injection. A constant motion fanning technique (also known as a 'moving needle technique') is necessary for proper penetration. The injection consists of 10 ml of 0.25% bupivacaine with epinephrine followed by 20 ml of liposomal bupivacaine saline mixture or 10 ml of saline followed by 20 ml of saline and then repeated on the contralateral side.

#### Routine postoperative analgesia

Postoperatively, all patients received intravenous (i.v.) paracetamol 1 gm every 8 h and NSAIDs (in the form of diclophenac sodium 75 mg i.v. infusion over 100 cc saline) every 12 h, and Ondansetron Hydrochloride 8 mg i.v. every 12 h. As a rescue analgesic, meperidine (0.5 mg/kg) was used when Visual Analog Scale (VAS) score was more than 4.

### Measurement tools

(1) VAS for pain was applied postoperatively at rest and during movement. The pain was assessed with a 10-cm ruler ranging from no pain (0) to severe pain (10). The evaluation was performed 1, 6, 12, and 24 h postoperatively.
(2) The number of patients who required rescue analgesia in both groups.
(3) The number of doses of rescue analgesia required by patients of both groups.
(4) Incidence of postoperative nausea and vomiting in patients of both groups in the first 24 h.

### Potential risks

There are many potential risk factors for this procedure including infection at the injection site, hematoma at the injection site, allergy to local anesthetic, bleeding, and systemic injection (avoided by aspiration test during the injection. Patients were thoroughly monitored postoperatively in the recovery room to detect such events).

### Outcomes

The primary outcome of this study was to assess the number of patients who required rescue analgesia after receiving L-TAP, while the secondary outcomes include the VAS for pain at 1, 6, 12, and 24 h postoperatively in both study groups, pain scores on ambulation in both groups, postoperative nausea and vomiting in both groups, and correlating age and BMI with the incidence of rescue analgesia.

### Power analysis

A table from 'Determination of sample size in experimental investigations where the *t*-test was performed' was used to establish the sample size for the power analysis. Assuming a 20% difference between the experimental and control groups, a two-tailed alpha value of 0.05 was chosen, the power was determined to be sufficient at 0.80, and the number of people to be included in the study group was determined. The intersection of these points indicated a sample size of 20 people, that is, 23 people were required for a single group. A standardized effect size of 0.80 was accepted, a two-tailed=0.05 and =0.10 was used, and the intersection of these points indicated a sample size of 20 people, that is, 23 people were required for a single group. Thus, 46 people were recruited for the experimental and control groups [9].

### Statistical analysis

Data were coded and entered using the Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, New York, USA). Data were summarized using mean, standard deviation, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (%age) for categorical data. Comparisons between quantitative variables were done using the nonparametric Mann–Whitney test [10]. For comparing categorical data, $\chi^2$ test was performed. An exact test was used instead when the expected frequency was less than 5 [11]. Correlations between quantitative variables were done using Spearman correlation coefficient [12] *P*-values less than 0.05 were considered as statistically significant.

## Results

### Demographic characteristics

During the study period, a total of 46 patients, ranging in age from 20 to 57 years were allocated into two groups: A would receive L-TAP and B would not receive L-TAP. Group A patients ranged in age from 21 to 57 years (mean=39.7), while group B patients ranged in age from 20 to 54 years (mean=32.57). The difference in ages between groups was statistically significant with a *P*-value of 0.008. BMI ranged from 36 to 60 (mean=48), with no significant statistical difference in the BMI distribution across both groups (Table 1). Group A had a male-to-female ratio of 6 : 17 (26.1%:73.9%), whereas Group B had a male-to-female ratio of 7 : 16 (30.4% to 69.6%) with no statistical difference in patient gender distribution (Fig. 3).

### Comorbidities

Out of the 23 patients in group A, 4 had diabetes mellitus, 2 were hypertensive, and 6 had both diabetes and hypertension, whereas 11 had no such comorbidities. Out of the 23 patients in group B, 2 had diabetes, 2 were hypertensive, and 4 had both diabetes and hypertension, leaving 15 patients without such comorbidities (Table 2). Pre-existing comorbidities did not differ significantly between the two groups statistically.

**Table 1 Comparison between groups with regard to age and BMI of enrolled patients**

| | (*n*) | Group A, (*n*=23) | | Group B, (*n*=23) | | *P* value |
|---|---|---|---|---|---|---|
| | | Mean | Standard deviation | Mean | Standard deviation | |
| Age | 46 | 39.70 | 8.80 | 32.57 | 8.63 | 0.008 |
| BMI | 46 | 52.87 | 9.16 | 48.00 | 7.71 | 0.080 |

Data are represented as mean and standard deviation. BMI, body mass index. *P*-value is statistically significant at less than 0.05.

### Need for narcotics

In the first 24 h after surgery, 15 out of 23 patients (65.2%) in Group B required at least one dosage of rescue analgesia, whereas 7 out of 23 patients (30.4%) in Group A required at least one dose of rescue analgesia. With a *P*-value of 0.018, this is statistically significant, with fewer individuals in group A requiring narcotic rescue analgesia (Fig. 4).

In the first 24 h after surgery, there was no significant difference in the number of narcotic doses required as rescue analgesia between the two groups (Table 3).

### Visual analog scores

Table 4 shows that there was no statistically significant difference between the VAS in both groups at 1, 6, 12, and 24 h postoperatively.

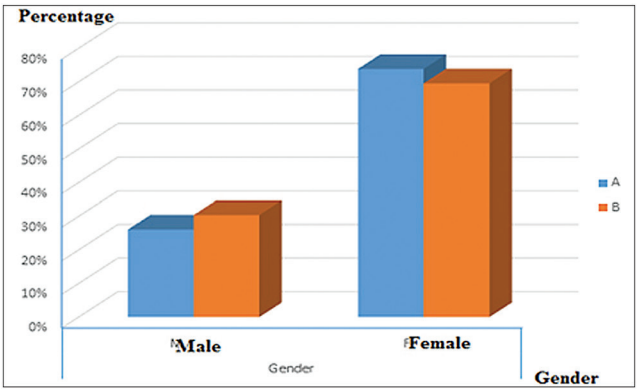
### Pain on ambulation

The VAS for pain on ambulation was lower in Group A than in Group B, with a mean of 3.61 in Group A and 5.61 in Group B, as shown in Fig. 5. This difference was statistically significant with a *P*-value of 0.006.

### Postoperative nausea and vomiting

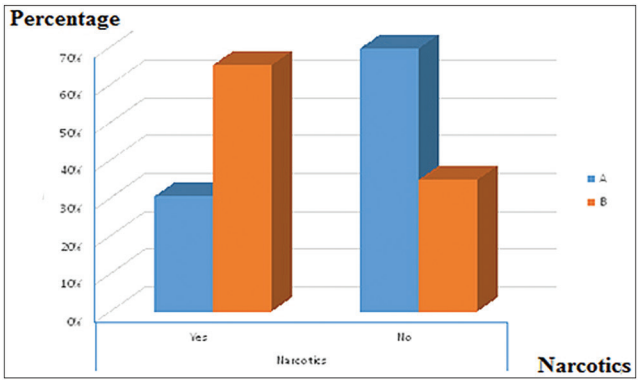
As demonstrated in Fig. 6, there was no statistically significant difference in the frequencies of postoperative

**Figure 3**




Comparison between groups with regard to the gender of enrolled patients.

**Figure 4**




Comparison of the number of patients requiring rescue analgesia in both groups. Number of doses of rescue analgesia.

**Table 2 Comparison of pre-existing comorbidities across both groups**

| Comorbidities | Group A count (*n*=23) (%) | Group B count (*n*=23) (%) | *P* value |
|---|---|---|---|
| DM | 4 (17.4) | 2 (8.7) | 0.674 |
| HTN | 2 (8.7) | 2 (8.7) | |
| DM, HTN | 6 (26.1) | 4 (17.4) | |
| None | 11 (47.8) | 15 (65.2) | |

Data are expressed as number and percentage. DM, diabetes mellitus; HTN, hypertension. *P*-value is statistically significant at less than 0.05.

**Table 3 Number of doses of rescue analgesia across both groups**

| Number of doses | Group A count (*n*=23) (%) | Group B count (*n*=23) (%) | *P* value |
|---|---|---|---|
| 0 | 16 (69.6%) | 8 (34.8%) | 0.144 |
| 1 | 1 (4.3%) | 1 (4.3%) | |
| 2 | 1 (4.3%) | 5 (21.7%) | |
| 3 | 2 (8.7%) | 4 (17.4%) | |
| 4 | 3 (13.0%) | 5 (21.7%) | |

Data are expressed as number and percentage. *P*-value is statistically significant at less than 0.05.

**Table 4 VAS pain scores across both groups**

| | Group A (*n*=23) | | Group B (*n*=23) | | *P* value |
|---|---|---|---|---|---|
| | Mean | Standard deviation | Mean | Standard deviation | |
| Pain 1 h | 2.61 | 1.44 | 3.22 | 2.54 | 0.718 |
| Pain 6 h | 3.35 | 1.77 | 4.30 | 2.20 | 0.115 |
| Pain 12 h | 3.83 | 1.83 | 4.70 | 1.84 | 0.087 |
| Pain 24 h | 4.00 | 2.02 | 5.39 | 2.43 | 0.053 |

Data are expressed as mean and standard deviation. *P*-value is statistically significant at less than 0.05.

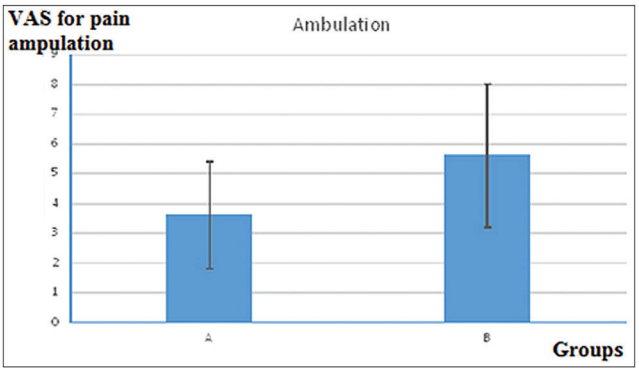
nausea and vomiting in the first 24 h after surgery between the two groups, *P*-value=0.267.

When age, BMI, gender, and comorbidities were correlated to the need for rescue narcotic analgesia, no statistical significance was observed (Figs 7 and 8).

## Discussion

The management of postoperative pain in obese patients after bariatric surgery remains a challenge. Because these individuals are more prone to respiratory depression and obstructive sleep apnea, using a traditional opioid analgesic raises the risk of complications. Nonetheless, in many patients, poor postoperative pain control prevents sufficient chest expansion, exposing them to a new set of pulmonary complications, such as infection and atelectasis. Multimodal analgesia regimens that use regional anesthetic procedures like TAP block and rely less on narcotic analgesics have become a necessary part of postoperative patient care [3].

**Figure 5**

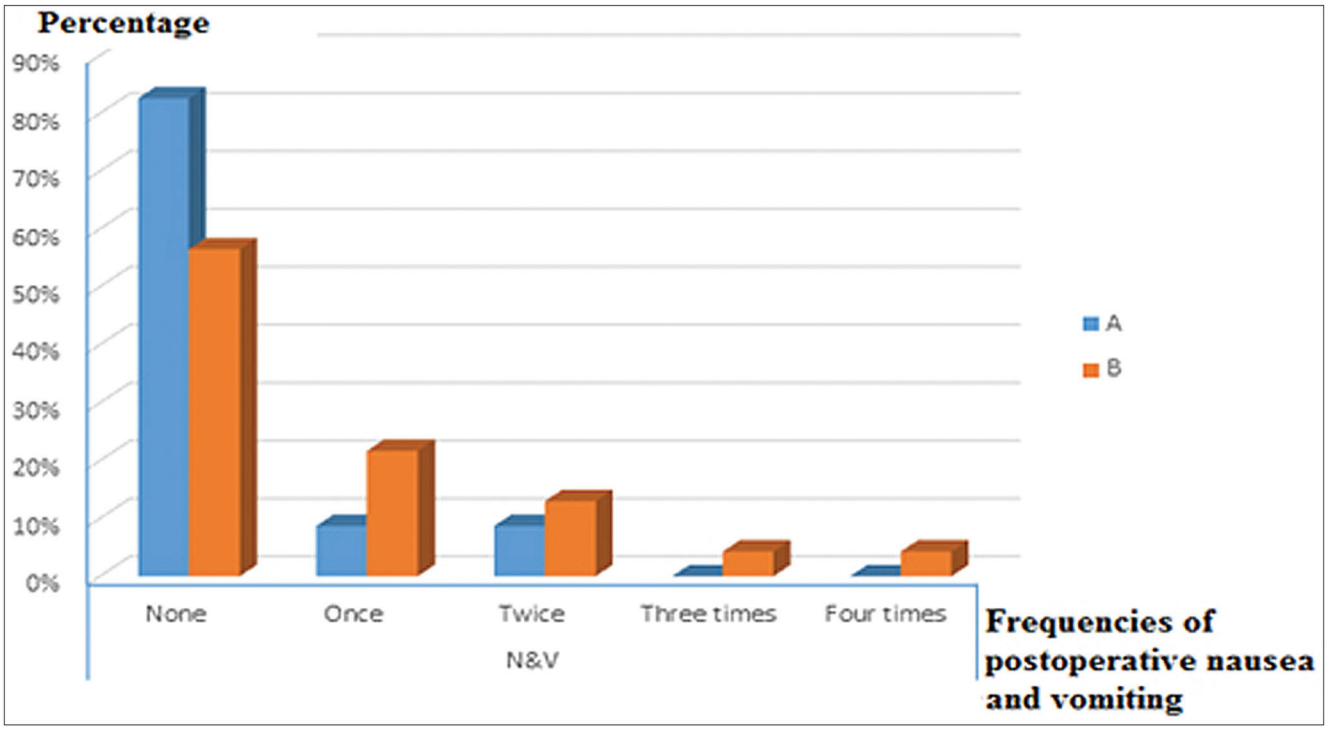



Comparison of Visual Analog Scale for pain on ambulation between both groups.

The ultrasound-guided TAP block, first described by Rafi in 2001 [4], has been used in a variety of abdominal procedures and has been shown to reduce postoperative discomfort and narcotic use [5]. Magee *et al.* advocated the delivery of TAP block under laparoscopic guidance in a single case of laparoscopic cholecystectomy in 2011 [6]. Chetwood *et al.* published a study in the same year using laparoscopically given TAP block in laparoscopic cholecystectomy, with positive outcomes in terms of pain relief and cost reductions [13].

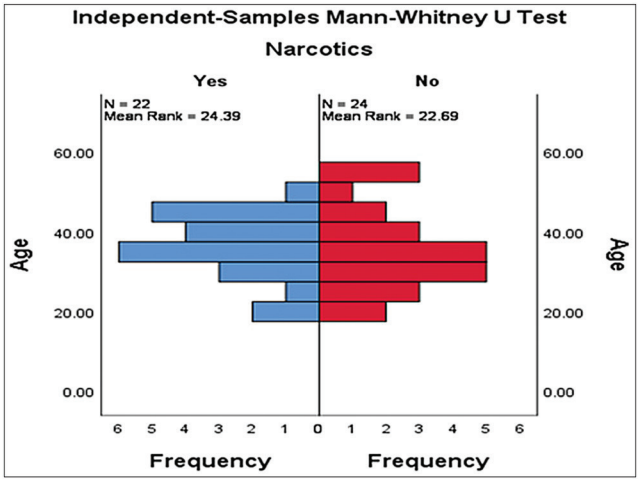
Our study evaluates the effectiveness of L-TAP in the management of postoperative pain following bariatric surgery. We enlisted 46 patients who were randomly assigned to one of the two groups: one that received L-TAP and the other that served as a control. The L-TAP group had a statistically significantly decreased number of patients who needed rescue analgesia, as well as superior pain scores on ambulation. There was no significant statistical difference in pain scores in the first 24 h after surgery (assessed at 1, 6, 12, and 24 h, respectively), and the incidence of postoperative nausea

**Figure 6**



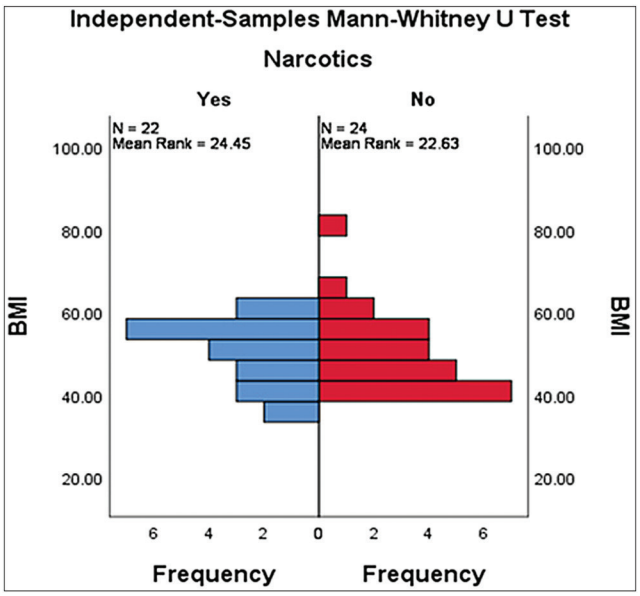

Comparison in the incidence of postoperative nausea and vomiting between both groups.

**Figure 7**




Correlating age with the incidence of rescue analgesia requirement.

**Figure 8**




Correlating body mass index with the incidence of rescue analgesia requirement.

and vomiting was comparable in both groups. When rescue analgesia was required, neither group had a different number of doses.

Ruiz-Tovar *et al.* conducted a study on 140 patients who were scheduled to undergo one anastomosis gastric bypass surgery and were divided into two groups: intervention and control. Their findings showed that the L-TAP group required fewer narcotics than the control group, with just 2.8% of L-TAP patients requiring narcotics compared to 14.2% in the control group, a statistically significant difference that matches our findings. Furthermore, at 6 and 24 h after surgery, participants in the L-TAP group exhibited lower VAS scores [1].

Tülübaş *et al.* tested L-TAP against a placebo injection in a cohort of 165 patients undergoing laparoscopic sleeve gastrectomy. There was no significant statistical difference in frequencies of postoperative nausea and vomiting, as well as the need for cumulative rescue analgesia, which matched our findings. Their findings also revealed no differences in pain scores 24 h after surgery [14].

The study by Said *et al.* compared the postoperative analgesic impact of laparoscopically placed catheters for continuous TAP block during bariatric surgery to a placebo group. The trial results demonstrated statistically significant lower pain scores in the group receiving the block in the first 24 h postoperatively, with fewer patients requiring rescue narcotic analgesia and better pain on ambulation than patients in the control group, correlating with our findings. While this study includes a variation on the conventional TAP block, rendering it a continuous infusion through the use of laparoscopically implanted catheters, the premise remains the same, indicating that L-TAP has significant efficacy in the management of postoperative pain [15].

Fields *et al.* compared L-TAP to a placebo injection following laparoscopic ventral hernia repair in 100 patients and found a significant statistical difference in pain on ambulation, which is consistent with our findings. Despite our findings, patients who received L-TAP in their trial required much less cumulative rescue analgesia than the control group. Fields *et al.* used six injection sites (three on each side), whereas we only used four injection sites in our investigation (two on either side) [16].

Siriwardana *et al.* compared L-TAP to a control group in a 90-patient study of laparoscopic cholecystectomy. Their findings revealed no statistical differences in postoperative pain scores, except for those 6 h after surgery, which was significantly higher in the L-TAP group, contradicting our findings. There was no statistically significant difference between the two groups in terms of postoperative nausea and vomiting. In addition, more patients in the L-TAP group required rescue narcotic analgesia than those in the control group, which contradicts our findings. The pain experienced while ambulation was not taken into account by Siriwardana *et al.* [17].

In a study of minimally invasive colorectal surgery, Zaghiyan *et al.* compared the postoperative pain-alleviating effects of L-TAP to ultrasound-guided TAP and no TAP. Their studies found that L-TAP is superior to ultrasound-guided TAP and no TAP, with patients

who received L-TAP requiring less narcotic rescue analgesia and using lower doses when they do. This is consistent with our findings, which show that patients in the L-TAP group required less rescue analgesia than those in the control group. This study by Zaghiyan *et al.* was on minimally invasive colorectal surgery, mainly for inflammatory bowel disease, and included larger incisions, that is, Pfannenstiel incision for delivery of the colorectal specimen. This lends credence to the efficacy of L-TAP in controlling postoperative pain in laparoscopic procedures, even those which employ larger incisions [18].

There was no statistically significant difference in cumulative rescue analgesic required in research by El Sharkawy *et al.* comparing L-TAP with local trocar site infiltration in gynecologic laparoscopy performed on 82 patients divided into two groups. There were no statistically significant differences in pain scores 1, 18, or 24 h after surgery. However, their study found a statistical difference in reduced pain scores at 3, 6, and 12 h postoperatively, but ours found no statistical difference in all pain scores postoperatively. El Sharkawy *et al.* did not test for pain on ambulation nor the number of patients requiring rescue analgesia [8].

Mughal *et al.* conducted a study on 60 patients undergoing laparoscopic extraperitoneal inguinal hernia repair who were divided into two groups to compare the postoperative analgesic effect of L-TAP versus not giving a block and found that the L-TAP group required less narcotic rescue analgesia, which is consistent with our findings. Nonetheless, their study found statistically significant decreased pain scores at 3 and 6 h after surgery, with pain scores at 24 h being comparable in both groups [19].

## Conclusion

According to the findings of this study, laparoscopic-guided TAP block is one of the most cost-efficient, safest, easiest, and effective supplemental techniques as part of a multimodal postoperative analgesic regimen, making it a potential novel postoperative pain management procedure. It also aids in the management of pain and the reduction of pain scores in minimally invasive bariatric surgery. Further studies are necessary to confirm the limitations and scope of its efficacy.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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