The Egyptian Journal of Hospital Medicine (October 2025) Vol. 101, Page 4917-4921

Dexamethasone as adjuvant for Pre-emptive Transversus Abdominis Muscle Plane Block in Patients Undergoing Bariatric Surgery

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ABSTRACT

Background: A local anaesthetic (LA) solution is injected into the internal oblique and transversus abdominis muscles of the face during a localized analgesic technique called a transversus-abdominus muscle plane (TAP) block. This technique successfully inhibits the sensory nerves of the front abdominal wall, providing significant postoperative parietal pain relief. Laparoscopic bariatric procedures, while minimally invasive, can still result in considerable pain that may hinder early mobilization and recovery. Adjuvants like dexamethasone (DXM) are commonly used to prolong the duration of peripheral nerve blocks.

Objective: This study aimed to evaluate the efficacy of adding of DXM for TAP in management of postoperative pain in laparoscopic bariatric procedures.

Methods: This is a prospective controlled study enrolled 40 adult patients (aged 20 to 65 years). Scheduled for laparoscopic bariatric surgery. Participants were randomly allocated in two equal groups: Group D (dexamethasone) included 20 patients received bilateral ultrasound-guided (USG)-TAP block with total of 40 ml of 0.375% levobupivacaine plus 8 ml DXM and C (Control) group involved 20 patients subjected to bilateral (USG-TAP) by 40 ml 0.375% levobupivacaine only.

Results: There was a significant difference regarding VAS scores between groups D and control C at movement and on rest. Patient satisfaction score in group D was higher than in group C. Patients in group D demonstrated early discharging time, also early time to ambulate, early intestinal activity regain and there was reduction of incidence of postoperative nausea and vomiting (PONV) in comparison with control group.

Conclusion: The addition of dexamethasone to USG-TAP is a practicable and can be used with others different modes of analgesia in obese patients undergoing gastric sleeves operations.

Keywords: Levobupivacaine, Dexamethasone, TAP, VAS, Bariatric surgery, Analgesia.

INTRODUCTION

Postoperative pain following bariatric surgery, even laparoscopic procedures, remains a significant clinical challenge that can impede recovery and increase patient morbidity [1]. This is particularly concerning in the morbidly obese population, which has concomitant conditions including CVD and obstructive sleep apnea at high rates. Inadequate pain control can discourage early ambulation and compromise respiratory function, thereby elevating the risk of thromboembolic events and pulmonary complications [2].

A substantial portion of post-laparoscopic pain originates from the abdominal wall port sites (somatic pain) [3]. The need to extract a large gastric specimen often necessitates extending a fascial incision, which further contributes to parietal pain. Traditional pain management relying on systemic opioids is combined with a high incidence of PONV, depression of respiration and sedation [4].

The noticed incidence of PONV after gastric sleeves operations from 30% to 50%, contributing to increased healthcare costs, extended hospital stays, and delayed recovery [5, 6]. While effective, neuraxial techniques like epidural analgesia can be technically difficult in overweight patients. Furthermore, non-steroidal anti-inflammatory drugs (NSAIDs) are often contraindicated due to concerns about gastrointestinal bleeding and potential toxicity after gastric reduction surgery [7].

By inserting LA between the internal oblique and transversus abdominis muscles, TAP, a localized analgesic technique, illustrates the sensory nerves of the anterior abdominal wall (T6-L1) [8]. It offers efficient parietal analgesia and lowers opioid use when used as part of a multimodal analgesic regimen. By enabling real-time imaging of needle insertion and LA distribution, USG improves this block's accuracy and safety [9].

Dexamethasone, a potent corticosteroid, is known to increase the duration of peripheral nerve blocks when demonstrated as an additives. Its mechanisms are believed to include local anti-inflammatory action and the systemic inhibition of nociceptive C-fiber transmission. Therefore, this study was to evaluate the efficacy of adding of dexamethasone for TAP in management of postoperative pain in laparoscopic bariatric procedures.

The primary outcome was evaluation of pain and satisfaction postoperatively using VAS and 'Capuzzo' satisfaction score. Secondary outcomes was to assess nausea and vomiting (PONV) postoperatively, ambulation time, discharge time and patient satisfaction.

Received: 08/05/2025
Accepted: 12/07/2025

PATIENTS AND METHODS

Study design: This was a prospective controlled trial that included 40 patients, aged 20-65 years, scheduled for laparoscopic sleeve gastrectomy (LSG).

Inclusion criteria: Age 20 to 65 years, Elective LSG, ASA grade 1, 2, 3, and BMI > 40 kg/m^2.

Exclusion criteria: Pregnancy, ASA grade 4 or more, patient with renal diseases, hepatic patients and asthmatic patients.

Patients were divided into 2 equal groups:

Group D (Dexamethasone): Received a bilateral ultrasound-guided TAP block with a total of 40 mL of 0.375% levobupivacaine + 8 mg (2 mL of 4 mg/mL) dexamethasone.

Group C (Control): Received a bilateral ultrasound-guided TAP block with a total of 40 mL of 0.375% levobupivacaine + 2 mL of normal saline (to maintain volume equivalence and blinding).

All patients underwent preoperative assessment conducted by a team included, internal medicine, nutrition, psychotherapy, surgeon and anesthetist. Standard general anesthesia (GA) technique utilizing endotracheal intubation and neuromuscular blockade. Premedication consist of intra venous (1–2 mg) of midazolam that was administered 20 min prior to induction. Standard intraoperative monitoring encompassed pulse oximetry, electrocardiography (ECG), noninvasive BP measurement and capnography

Induction of anesthesia by propofol (1.5–2 mg/kg) with fentanyl (3 µg/kg). To facilitate endotracheal intubation, cis-atracurium as muscle relaxant (0.1 mg/kg) was administered. Isoflurane with 1MAC was used for maintenance of general anaesthesia (GA), and no supplemental intraoperative opioids were required prior to surgical incision, a linear ultra sound probe was placed in the anterior-axillary line to identify the facial plane between the internal oblique and the transversus-abdominis muscle.

Following careful aspiration, a total of 40 ml of 0.375% levobupivacaine combined with 8 ml dexamethasone was injected in the facial plane to achieve bilateral sensory block. Patient in control group received bilateral (TAP) with 40 ml of 0.375% levobupivacaine alone.

Postoperative pain was assessed using visual analogue scale (VAS) (where 0 represent no pain and 10 represent the worst imaginable pain) at rest and upon movement at 30 minutes, 3, 6, 12, 24, and 48 h. additional recorded outcomes included the incidence of PONV, ambulation time, discharge criteria defined as (stable vital signs, adequate pain control, independent mobility & tolerance to oral intake), and patient satisfaction scores. Satisfaction was measured using the validated 'Capuzzo' satisfaction score [10]. A 10 item instrument where patients rate their satisfaction on Numerical Rating Scale from 0 (no satisfaction) to 10 (maximum satisfaction possible) Mean satisfaction score was calculated for each patient.

Outcome measures:

· **Primary Outcome:** Postoperative pain intensity assessed using the VAS.

· **Secondary Outcomes:** Total amount of postoperative opioid that used. PONV. Time that taken by patient to ambulate. Time to meet the discharging criteria. Patient satisfaction score (e.g., Capuzzo score).

Ethical approval: This study was done in Sohag faculty of medicine after Ethical Committee approval which taken with IRB registration number (Soh-med-24-12_1PD) and [Clinical Trial No: NCT06970548]. Informed written consents were gained from the cases or their legal representatives based on the case's condition prior to enrollment. The Helsinki Declaration was followed throughout the course of the study.

Statistical analysis

SPSS software, version 26.0 for Windows, was used to process all of the data. For regularly distributed continuous values, the summary was Mean ± SD, for skewed distributions, it was mean (range). Numbers and percentages were used to characterize categorical data. The independent samples t test was used to compare groups for continuous variables with normal distribution, whereas the Mann–Whitney U test was used for data that was not normally distributed. Fisher's exact test or the X^2-test were used to compare categorical variables. Based on how applicable it is. Statistical significance was defined as a p value ≤ 0.05.

RESULTS

We included all 40 patients with no loss to follow-up. As regarding the demographic data (age, gender, height, weight, and BMI), there was no statistically significant difference between them (Table 1).

Table (1): comparison between two group study regard to Demographic data

	Group C (*n*=20)	**Group D (*n*=20)**	***p*-value**
	Mean ± SD	**Mean ± SD**	
Height (cm)	159.60±12.47	160.67±13.32	0.632
Weight (kg)	122.07±21.26	117.65±17.56	0.457
BMI (kg/m^2)	43.34±5.15	44.22±6.58	0.576

VAS scores for pain at rest and on movement were significantly lower in group D (TAP block with dexamethasone) at all measured time points (30 min, 3, 6, 12, 24, and 48 hours) in comparison with group C ($p < 0.05$ for all comparisons) (Tables 2 & 3).

Table (2): Comparison between two group study as regards VAS score at rest

	Group C (*n*=20)	Group D (*n*=20)	*p*-value
	Mean±SD	Mean±SD	
30 min	8.06 ± 2.013	6.50 ± 0.614	< 0.005
3 h	6.57 ± 0.40	5.23 ± 1.025	< 0.003
6 h	6.32 ± 0.80	5.03 ± 0.00	< 0.001
12 h	4.53 ± 1.16	3.20 ± 0.347	< 0.007
24 h	4.37 ± 0.80	2.12 ± 0.307	< 0.001
48 h	1.77 ± 0.50	0.37 ± 0.461	< 0.001

Table (3): Comparing between two groups as regards mean of 'postoperative pain' score (VAS) at movement

	Group C (*n*=30)	Group D (*n*=20)	*p*-value
	Mean ± SD	Mean ± SD	
30 min	8.37 ± 0.80	5.53 ± 0.60	< 0.006
3 h	6.16 ± 1.03	4.00 ± 0.11	< 0.001
6 h	7.27 ± 1.13	5.32 ± 1.03	< 0.001
12 h	6.50 ± 0.73	4.14 ± 0.42	< 0.001
24 h	5.12 ± 0.32	2.23 ± 1.03	< 0.005
48 h	4.12 ± 1.023	3.12 ± 0.01	< 0.001

Concerning Recovery Metrics, patients in group D demonstrated a significantly faster return of bowel activity ($p < 0.047$) and earlier discharging criteria compared to group C. Regarding patient satisfaction, satisfaction scores as measured by the Capuzzo scale were significantly higher in group D than in group C ($p < 0.002$) (Table 4).

Table (4): Comparison between two group study as regard to 'time to ambulate' and 'patient satisfaction score'

	Group C	Group D	*p*-value
	Mean ± SD	Mean ± SD	
Time to ambulate in hours	8.47 ± 2.521	7.11 ± 3.295	0.047
Patient satisfaction by composite score	6.37 ± 0.321	8.40 ± 0.444	< 0.002

Regarding rescue analgesia, the required doses of rescue analgesic was statistically significantly higher in the control group (Group C) than in the dexamethasone (Group D) ($p < 0.003$) (Table 5).

Table (5): Comparison between the two groups study as regard to rescue analgesia that taken.

	Group C	Group D	*p*-value
	Mean ± SD	Mean±SD	
No. of doses of rescue medication	3.50 ± 0.521	2.21 ± 0.452	< 0.003

PONV: The incidence of PONV was significantly lower in group D than in group C ($p < 0.004$) (Table 6).

Table (6): PONV of studied

	Group C (n=20)	Group D (n=20)	*p*-value
PONV	16 (80%)	8 (40%)	**0.02***

DISCUSSION

Postoperative pain management following bariatric surgery is complex. Patients in this cohort are more likely to experience pain-related complications as well as opioid-induced co-morbidities, notably respiratory depression [10]. In light of the continuing opioid crisis [11], identifying effective non-opioid analgesic procedures is essential. TAP block has emerged as one such option, demonstrating efficacy in reducing pain after various abdominal surgeries [10-14].

This study found that adding 8 mg of DXM to 40 mL of 0.375% levobupivacaine for bilateral TAP blocks significantly reduced VAS pain scores over the first 48 postoperative hours. The analgesic mechanism of corticosteroids, when combined with LAs, has been explored in animal studies using microsphere-based sustained-release formulations [10, 12]. For instance, dexamethasone incorporated into bupivacaine microspheres prolonged intercostal nerve blockade in sheep [10], while a similar formulation extended sciatic nerve blockade in rats [12]. These effects are often attributed to the anti-inflammatory properties of steroids. It is important to note that microsphere technology allows for prolonged drug release, unlike the aqueous solution used in our investigation.

The safety of corticosteroid administration near neural structures is supported by several animal studies [14-16]. Repeated intrathecal administration of triamcinolone diacetate in rats showed no evidence of neurotoxicity [14], and intrathecal betamethasone was found to be safe in sheep [15]. Furthermore, extensive use of intrathecal dexamethasone in humans with post-

traumatic visual disturbances has been reported without significant adverse effects [16-18].

In human studies, the adjunctive use of corticosteroids has proven beneficial. For example, adding dexamethasone to lidocaine for axillary brachial plexus blockade significantly extended the duration of both sensory and motor blocks compared to controls [19]. Similarly, methylprednisolone added to a LA mixture for axillary block resulted in longer analgesia and motor blockade [9]. Other studies on supraclavicular brachial plexus blocks with dexamethasone reported a faster onset of action and a prolonged analgesic duration without increased adverse effects [20, 21].

The exact mechanism by which corticosteroids enhance analgesia is multifactorial. Proposed theories include a direct effect on nerve membranes to inhibit ectopic discharges [22-23], modulation of pain signaling within the spinal cord [24], vasoconstrictive effects, and mechanism on special glucocorticoid receptors [25, 26]. It is critical to understand that steroids alone do not produce a nerve block but appear to potentiate LAs, possibly by modulating potassium channels in excitable cells [27].

Numerous studies evaluating TAP blocks in abdominal surgery have reported significant reductions in cumulative opioid consumption and PONV [12-14]. The laparoscopic-assisted technique for TAP block relies on visualizing a peritoneal bulge upon injection to confirm correct placement [15]. Studies in patients undergoing LSG have involved that USG-TAP blocks are not only applicable in obese patients but also provide superior immediate postoperative analgesia compared to intravenous patient-controlled analgesia (IV-PCA), leading to lower pain scores, reduced opioid use, and earlier ambulation [18, 19].

Consistent with this literature, our study found that pain scores at rest and on movement were significantly lower at all-time intervals in the group that received TAP blocks with dexamethasone. The excessive use of opioid analgesics is associated with adverse effects like PONV and sedation, which delay ambulation [17]. We observed a statistically significant reduction in the incidence and severity of PONV in the dexamethasone group (40%) compared to the control group (80%). The time to ambulation was also shorter in the study group, and it was higher as regards patient satisfaction scores. Furthermore, we noted an earlier resumption of bowel function and discharging criteria in the TAP block with dexamethasone group. While our results align with **Chetwood *et al.*** [15] who reported a pain-relieving effect limited to 6 hours post-surgery, other studies have found analgesia extending up to 24 hours [21, 22]. This discrepancy may be explained by the use of different LAs (e.g., ropivacaine). As suggested by **Higgins and Simons** [27], a continuous infusion of LA via a TAP catheter could achieve sustained analgesia beyond 24 hours.

Although USG-TAP block requires additional time for ultrasound setup, it ensures accurate needle placement in the correct tissue plane. While obesity was initially considered a contraindication for landmark-based TAP blocks due to difficulty identifying the triangle of Petit, USG allows for clear visualization of abdominal wall layers even in obese patients, making the procedure both simple and safe [17, 23].

The benefits of TAP block with dexamethasone also included significantly lower PONV scores, which is corroborating with the findings of **Kishore and Agarwal** [21] and **Mittal *et al.*** [28] who link reduced pain to decreased opioid consumption and PONV. However, our study did not find a significant difference in the dose of antiemetic medication needed between groups, a result consistent with **Saber *et al.*** [29].

The earlier return of bowel function, indicated by a shorter time to pass flatus, is another significant finding. Effective pain control mitigates sympathetically mediated inhibition of gastrointestinal motility, promoting faster recovery [30]. Although the effect of TAP block on intestinal function following bariatric surgery is a novel finding of this study, which aligns with data from colorectal surgery where TAP blocks were related to sooner return of bowel function [31].

CONCLUSION

Addition of dexamethasone to USG-TAP was practicable and can be used with others different modes of analgesia management in obese patients subjected to gastric sleeves operations. It decrease requirement for opioid postoperatively, with reduction of the incidence and severity of PONV, increasing quality of patient satisfaction, and facilitating earlier discharge.

No funding.

No conflict of interest.

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