Effect of Different Doses of Dexmedetomidine with Erector Spinae Plane Block on Postoperative Analgesia in Patients Undergoing Laparoscopic Sleeve Gastrectomy

Alaaeldin Abdel Sami Aiad*[1], Ayman Ahmed Rady[1], Mohamed Atef Abd Elsattar[2], Ahmed Hashem Ismail[1]

[1]Department of Anesthesia and Intensive Care, Faculty of Medicine, Menoufia University, Egypt

[2]Department of Anesthesia, Neurosurgical Hospital, Mit Khalaf, Shiben Al kom City, Menoufia, Egypt

***Corresponding author:** Alaaeldin Abdel Sami Aiad, **Mobile:** (+20) 01012343971, **E-mail:** alaa22aiad@gmail.com

ABSTRACT

Background: The erector spinae plane block (ESPB) is a modern interfascial block method to reduce postoperative pain. Dexmedetomidine (DEX), when utilized as an adjuvant to bupivacaine, is believed to enhance analgesia and prolong the period of various anesthetic strategies. **Objective:** This study aimed to estimate the impact of adding different doses of DEX to ultrasound-guided ESPB (UG-ESPB) on postoperative analgesia following laparoscopic sleeve gastrectomy (LSG). **Patients and Methods:** A prospective double-blinded randomized study included 72 patients, aged 20-60 years, ASA II-III, undergoing LSG under general anesthesia. Patients were divided into 3 groups: Group A (control group) received ESPB with 20 ml of 0.25% bupivacaine, group B received ESPB with 20 ml of 0.25% bupivacaine + DEX 0.5 µg/kg and group C that received ESPB with 20 ml of 0.25% bupivacaine + DEX 1 µg/kg. Bilateral UG-ESPB was provided before the surgery at the T7 vertebral level. Intraoperative total fentanyl requirements, postoperative pain, hemodynamic parameters, and patient satisfaction were evaluated. **Results:** Groups B and C had significantly delayed time to the first analgesic requirement and decreased total ketorolac and morphine consumption compared to group A. Intraoperative fentanyl requirements were similar across groups. Ramsay sedation scores were higher in groups B and C. Side effects like bradycardia, hypotension, and nausea were not significantly different among groups. **Conclusions:** Adding DEX (0.5 or 1 µg/kg) to bupivacaine in UG-ESPB for LSG significantly enhanced analgesic outcomes, provided higher sedation scores, and maintained better hemodynamic parameters without increasing intraoperative fentanyl requirements or postoperative complications. This makes it a valuable adjunct in pain management protocols, with the 1 µg/kg dose showing superior results.

Keywords: Dexmedetomidine, UG-ESPB, LSG.

INTRODUCTION

The WHO classified obesity into three levels based on BMI. Class I: 30-34.9kg/m², class II: 35-39.9kg/m², and class III ≥ 40 kg/m² [(1)]. LSG is a beneficial bariatric surgery. Nonetheless, it frequently produces substantial postoperative discomfort [(2)]. Effective pain management is essential to prevent major morbidities and pulmonary complications [(3)]. In morbidly obese patients, opioids can cause respiratory depression, obstructive sleep apnea, hypoxemia, sedation, ileus, and prolonged hospital stays [(4)]. Multimodal analgesia, recommended by the ASA, includes local and regional anesthesia and NSAIDs, reducing opioid use and promoting early mobilization, thus minimizing DVT and respiratory impairment risks[(5)].

UG-ESPB is a modern, simple, and safe procedure expressed by **Forero *et al.*** [(6)] it concerns infiltrating a local anesthetic (LA) in the fascial plane beneath the erector spinae muscle, allowing for a craniocaudal sweep that is easily visualized. The LA disperses to the ventral and dorsal roots of the spinal nerves, providing adequate postoperative analgesia [(8)]. ESPB at T7 level is effective for upper abdominal and thoracic operations, covering the T5 to T9 dermatomes [(8)]. ESPB offers procedural simplicity, recognizable sono-anatomy, and avoids vital structures, providing hemodynamic stability without extensive monitoring requirements. Moreover, it offers ample analgesia with a single prick [(9)]. Dexmedetomidine (DEX), a powerful alpha 2 agonist, is an effective adjuvant to local anesthetics to significantly prolong analgesia and enhance block effects, reducing opioid use and hospital stays without significant side effects [(10)]. Our study aimed to estimate the impact of adding different doses of DEX to bilateral UG-ESPB on postoperative analgesia following LSG.

PATIENTS AND METHODS

Our prospective randomized double-blinded study was conducted from June 2023 to September 2024 at Menoufia University Hospitals. The study included 72 patients of both sexes aged 20-60 years with a BMI ≥ 35 kg/m² and ASA II-III physical status undergoing LSG under general anesthesia (GA).

Patients were randomized into three equal groups, utilizing computer generated numbers, with allocation codes kept in closed opaque envelopes: Group A (Control group) received UG-ESPB with 20 ml of 0.25% bupivacaine + 2 ml saline bilaterally, group B received UG-ESPB with 20 ml of 0.25% bupivacaine+ 2 ml DEX 0.5 µg/kg bilaterally and group C that received UG-ESPB with 20 ml of 0.25% bupivacaine + 2 ml DEX 1 µg/kg bilaterally.

Exclusion criteria: Patient refusal, bleeding disorders, hepatic/renal insufficiency, severe uncontrolled cardiovascular/respiratory conditions, learned allergies to local anesthetics or DEX, skin infections at the needle insertion area, and unsuccessful ESPB blocks.

Preoperative evaluation: It comprised history, clinical assessment, and laboratory analyses (complete blood count, liver and kidney function tests, and coagulation profile). Patients adhered to an adequate fasting period of 6 hours for light meals and 2 hours for clear fluids. All patients were preoperatively instructed on using the

Received: 13/06/2024
Accepted: 14/08/2024

VAS for pain assessment, where 0 corresponds to no pain and 10 to the direst possible pain. A pharmacist prepared the medications, and the patients and the outcome assessors were blinded to the group assignments.

A peripheral intravenous line (18-gauge cannula) was secured, and basic monitors (pulse oximetry, electrocardiogram, end-tidal capnography, and non-invasive blood pressure) were connected to the patients, and baseline values were recorded.

Ultrasound-guided ESPB procedure: Bilateral ESPB was administered at the level of T7 transverse process before induction of GA with the patient seated. A low-frequency curved array ultrasonic probe was used to view the relevant anatomy. A three-ml lidocaine 2% solution was used for skin infiltration, followed by a 22-gauge hyperechoic needle advanced to the transverse process of T7. The needle spike was placed in the fascial plane, behind the erector spinae muscle. Accurate implantation was validated by infiltrating 1 ml saline, lifting the erector spinae muscle from the transverse process without muscular expansion and attending the craniocaudal spread. The LA mixture was injected bilaterally according to group assignments. Block success was evaluated 30 minutes post-injection using pinprick tests along the midclavicular line.

Intraoperative management: After adequate preoxygenation, GA was induced with the patient in the ramped position using intravenous 1 µg/kg fentanyl, 2 mg/kg propofol, and 0.15 mg/kg cisatracurium. Endotracheal intubation was secured. Isoflurane 1-1.5% was used for the maintenance of anesthesia, and it is integrated into oxygen and air 1:1. Repeated shots of 0.03 mg/kg cisatracurium were allocated every 20 minutes. Volume-controlled ventilation was employed, with a tidal volume (Tv) of 6 ml/kg of estimated body weight, a respiratory rate adjusted to maintain $EtCO_2$ from 30 to 40 mmHg, and a PEEP (positive end-expiratory pressure) of 8 cm H_2O.

Inadequate intraoperative analgesia, denoted by increasing hemodynamic parameters more than 20% beyond baseline values, was handled with 1 µg/kg fentanyl blouses. Hypotension, defined as a decline more than 20% below baseline MAP or a MAP below 60 mmHg, was handled with i.v. saline and 5 mg ephedrine increments. i.v. atropine 0.2 mg was allocated for bradycardia, described as a HR less than 60/min.

To preclude postoperative nausea and vomiting, i. v. dexamethasone 4 mg was given after GA induction, and ondansetron 4 mg at the end of the surgery. 1 g paracetamol i.v. infusion was allocated to all patients 15 minutes before the end of the operation. Awake extubation was performed after an acceptable reverse of neuromuscular blockade utilizing 0.05 mg/kg neostigmine and 0.02 mg/kg atropine.

Postoperative management: In the post-anesthesia care unit (PACU), patients were positioned in a semi-sitting posture and provided with oxygen through a nonrebreathing facemask equipped with a reservoir bag. Patients were transferred to the ward only after achieving full recovery from GA, maintaining hemodynamic stability, and ensuring effective pain relief.

Postoperative pain was managed with i.v. ketorolac 30 mg and i.v. infusion of paracetamol 1 g every 8 hours for 24 hours. If the VAS > 4, i.v. morphine was given in 3 mg increments every 15 minutes until the VAS was < 4 or until serious morphine-related side effects occurred, such as deep sedation (Ramsay sedation scale (RSS) > 3), respiratory depression (SpO_2 less than 95% and/or respiratory rate less than 12 breaths/min.

Measurements: The primary outcome measured was the period of postoperative analgesia, defined as the time to the first demand for analgesia (VAS > 4). Secondary outcomes included postoperative pain intensity (VAS) and hemodynamics that were recorded intraoperatively, then at PACU entry, 2, 4, 8, 12, and 24 hours postoperatively, also, intraoperative fentanyl usage, postoperative analgesic consumption, patient satisfaction, and incidence of postoperative complications were recorded during the first 24-hour period. Patient sedation levels were assessed using a 6-point (RSS) [(11)] (1: a patient is anxious, 2: a patient is cooperative, orientated, 3: cooperative, orientated but drowsy, 4: a fast response to a stimulus, 5: a lag response to a stimulus, and 6: no response to any stimulus. Anesthesia residents, blinded to the patient's group appointment, evaluated and documented the research findings.

Based on an **Elkholy *et al.*** [(12)] study, the time to first demand of rescue analgesia (the primary outcome) was 7.5 ± 2.5 h in the bupivacaine group and 10.1 ± 1.4 h in the DEX group. Utilizing G. power 3.1.9.2 (Universitat Kiel, Germany), the minimal sample size was 21 patients in each group required to attain 95% power with 0.05 α error to demonstrate a 30% difference (3 h) between groups. To account for a potential dropout, the sample size was 24 participants per group.

Ethical approval: After receiving permission from our Institutional and Regional Ethics Committees [Al Menoufia University Hospital, IRB number: 6/2023ANET29] and obtaining written informed permissions from patients. The study adhered to the Helsinki Declaration throughout its execution.

Statistical analysis: Software called SPSS version 21.0 was used to statistically evaluate the data. The distribution's normality was examined using the Kolmogorov-Smirnov test. The mean ± SD was used to give the numerical variables. Groups were compared using analysis of variance (ANOVA), and if a significant difference was discovered, LSD (Post-hoc tests) were performed. The X^2-test was used to analyze categorical variables, which were provided as percentages and the number of instances. Scores were described as median (Min.-Max.) and analyzed by the Kruskall-Wallis H test. If a significant difference was noticed, comparisons between groups were achieved utilizing post hoc tests

(Mann-Whitney U test). To compare several variables of non-normally distributed data within the same group, use the Wilcoxon signed-rank test. The results' significance was limited to the 5% level.

RESULTS

A total of 89 patients were screened for eligibility, 12 did not meet the inclusion standards, and 5 declined participation. Ultimately, 72 patients were enrolled in the study and evenly distributed into three equal groups of 24 participants each **(Figure 1)**. Demographic data, included age, sex, BMI, surgery duration, and comorbidities, were equivalent across all groups (**Table 1)**.

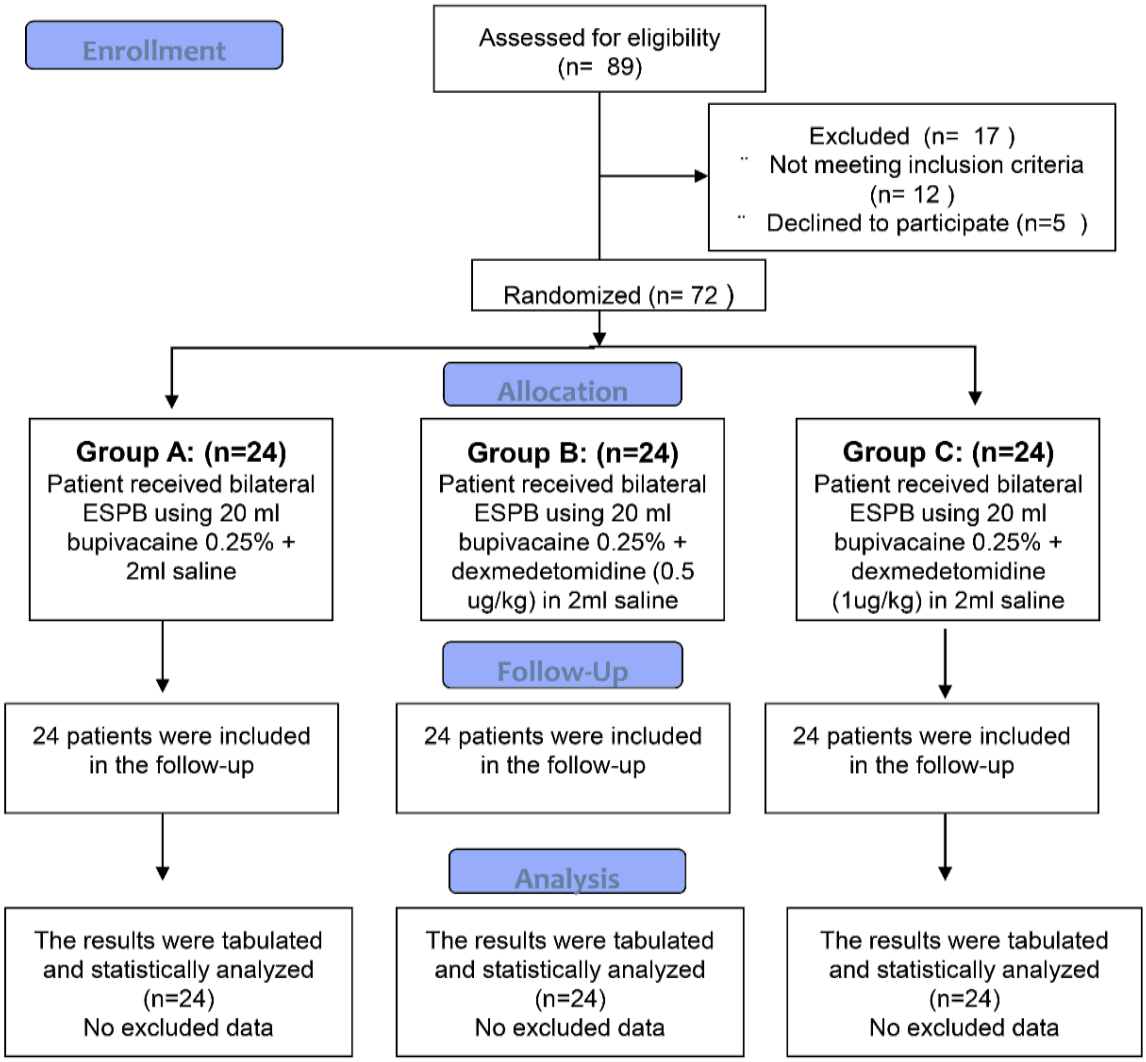


Figure (1): CONSORT flowchart of the enrolled patients.

Table (1): Patients' characteristics and duration of surgery

		Group A (n=24)	Group B (n=24)	Group C (n=24)	P
Age (years)		34.7±7.64	38.6±9.52	37.2±9.17	0.310 ^{F}
Sex	**Male**	9 (37.5%)	7 (29.2%)	11 (45.8%)	0.491 $^{\chi^2}$
	Female	15 (62.5%)	17 (70.8%)	13 (54.2%)	
Weight (kg)		103.3±6.86	104.5±7.69	105.04±7.74	0.730 ^{F}
Height (m)		1.66±0.06	1.64±0.07	1.67±0.08	0.316 ^{F}
BMI (kg/m^2)		37.67±1.83	39.08±3.29	37.87±2.29	0.125 ^{F}
ASA	**II**	20 (83.3%)	18 (75.0%)	19 (79.2%)	0.777 $^{\chi^2}$
	III	4 (16.7 %)	6 (25.0%)	5 (20.8 %)	
Medical Disease	**Hypertension**	9 (37.5%)	10(41.7%)	8 (33.3%)	0.837 $^{\chi^2}$
	DM	9 (37.5%)	12 (50%)	11 (45.8)	0.675 $^{\chi^2}$
	OSA	12(50%)	14(58.3%)	15(62.5%)	0.673 $^{\chi^2}$
Duration of surgery (min.)		120.9±16.81	126.3±16.10	119.2±18.28	0.331 ^{F}

Data are given as mean ± SD or frequency (%); BMI: Body Mass Index; ASA: American Society of Anesthesiologists; F: ANOVA test; χ^2: Chi-square test; y: year. m: meter; Kg: Kilogram; DM: diabetes mellitus; OSA: obstructive sleep apnea.

The time to first rescue analgesia was significantly shorter in the control group compared to the two DEX groups (P<0.001), with group C showing a significantly longer time than group B (P<0.001). The frequency of intraoperative fentanyl requirements and total intraoperative fentanyl consumption did not differ significantly among the groups (P=0.217 and P=0.420, respectively). However, total postoperative consumption of paracetamol, ketorolac, and morphine was significantly higher in the control group compared to both DEX groups (P<0.001 for all), with group C showing a notable reduction (P<0.001) (Table 2).

Table (2): Intraoperative fentanyl, time of the 1st rescue analgesia, and total paracetamol, ketorolac, and morphine consumption

Analgesia	Group A (n=24)	Group B (n=24)	Group C (n=24)	P
Patients need IO. fentanyl	8 (33.3 %)	5 (20.8 %)	3 (12.5 %)	0.217 χ^2
Fentanyl rescue dose (µg)	52.5 ± 4.63	54 ± 5.48	53.3 ± 5.77	0.854 F
IO fentanyl consumption (µg)	120.9±26.95	115.7±22.27	111.7±22.40	0.420 F
Time to 1st rescue of analgesia (h)	8.5±2.26	12.9±2.79	19.3±2.69	**<0.001** F
Post hoc	**P1<0.001, P2<0.001, P3<0.001**			
Paracetamol consumption mg	3000.0±884.65	2416.7±583.59	1416.7±653.86	**<0.001** F
Post hoc	**P1=006, P2<0.001, P3<0.001**			
Ketorolac consumption (mg)	110.0±14.44	72.5±15.11	48.8±17.27	**<0.001** F
Post hoc	**P1<0.001, P2<0.001, P3<0.001**			
Morphine consumption (mg)	12.1±2.07	9.6±1.76	3.8±2.03	**<0.001** F
Post hoc	**P1<0.001, P2<0.001, P3<0.001**			

Data are given as mean ± SD; P1: P value between groups A & B; P2: P value between groups A & C; P3: P value between groups B & C; F: ANOVA test; X^2: Chi-square test.

Postoperative VAS scores were equivalent among the three groups at PACU, during the first 8 hours, and at 24 hours. VAS measurements were significantly higher in the control group than in the two DEX groups with insignificant difference between them at 12th h. At 18th h group C showed a significant reduction of VAS than the other two groups with no significant difference between them. Furthermore, VAS scores were significantly higher than the PACU level after 8, 12, and 18 hours in groups A, B, and C, respectively. Ramsay sedation scores were similar among the three groups at PACU. After that, RSS was significantly higher in group C compared to the other 2 groups up to 12 postoperative hours, while they were significantly more elevated in group B than in group A up to 8 hours only **(Table 3).**

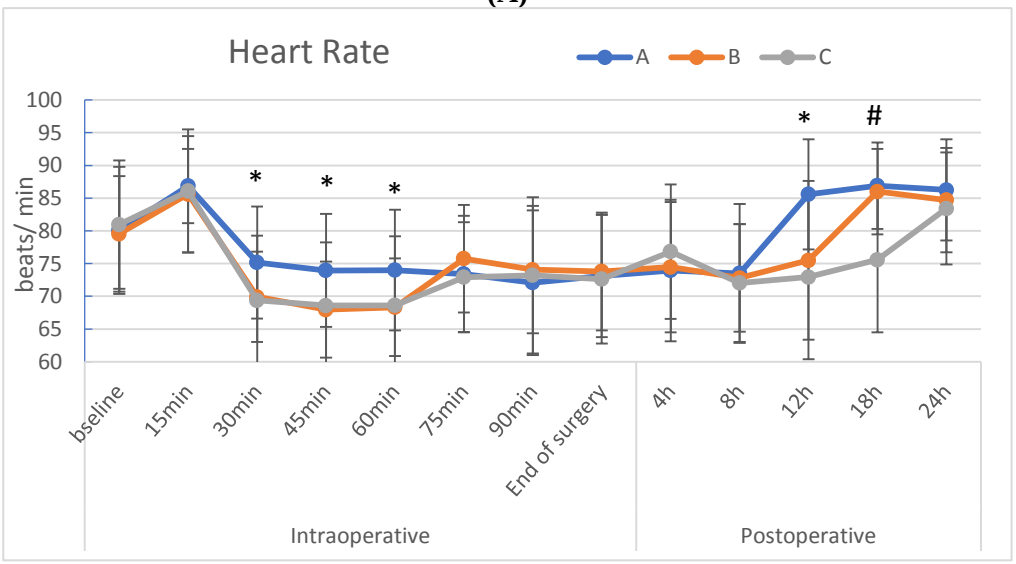
Table (3): VAS and Ramsay sedation score measurements

	Group A(n=24)	Group B (n=24)	Group C (n=24)	P	
VAS score					
At PACU	2 (0 - 3)	2 (1 - 3)	1 (1 - 3)	0.121	
2h	1 (0 - 3)	1 (1 - 3)	1 (1 - 2)	0.488	
P#	0.128	0.107	0.458		
4h	1 (0 - 3)	1 (1 - 3)	1 (1 - 2)	0.663	
P#	0.660	0.115	0.414		
8h	2 (1 - 3)	2 (1 - 3)	2 (1 - 4)	0.099	
P#	**0.041***	0.132	0.088		
12h	4 (2 - 7)	2 (1 - 4)	2 (1 - 3)	**<0.001**	**P1<0.001, P2<0.001,** P3=0.054
P#	**<0.001**	**0.022***	0.057		
18h	4 (2 - 6)	4.5 (1 - 7)	3 (1 - 4)	**<0.001**	P1=0.081**, P2=0.001, P3<0.001**
P#	**<0.001**	**<0.001**	**<0.001**		
24h	4 (2 - 6)	4 (1 - 7)	4 (1 - 6)	0.308	
P#	**<0.001**	**<0.001**	**<0.001**		
Ramsay sedation score					
At PACU	3 (2 - 4)	3 (2 - 5)	4 (2 - 6)	P=0.198	
2h	3 (1 -3)	3 (2 - 4)	4 (3 - 4)	**<0.001**	**P1=0.028, P2<0.001, P3=0.013**
4h	2 (1 - 3)	2.5 (1 - 4)	3 (2 -4)	**<0.001**	**P1=0.006, P2<0.001, P3=0.022**
8h	2 (1 - 2)	2 (1 - 4)	3 (2 - 4)	**<0.001**	**P1=0.002, P2<0.001, P3<0.001**
12h	2 (1 - 3)	2 (1 - 3)	3 (1 - 4)	**<0.001**	P1=483**, P2=0.001, P3<0.001**
18h	3 (1 - 3)	3 (1 - 3)	3 (2 - 4)	P=0.697	
24h	2 (1 - 3)	2 (1 - 4)	2.5 (1 - 3)	P=0.734	

Data are given as median (min-max); * Significant as P value≤0.05; P1: P value between groups A & B; P2: P value between groups A & C; P3: P value between groups B & C; PACU: post-operative care unit; Kruskal-Walli's test; Mann-Whitney U test between every 2 groups, Wilcoxon signed ranks for intergroup comparison.

In comparison with baseline measurements, HR and BP were significantly higher in all groups at 1st 15 min, after the 8th postoperative hour in group A, after the 12th postoperative hour in group B, and after the 18th postoperative hour in group C. Conversely, HR and BP were significantly lower than baseline measurements from 30 minutes to the 8th postoperative hour in group A, as well as from 30 minutes to the 12th postoperative hour in group B, and 30 minutes to the 18th postoperative hours in group C. Intraoperative HR and mean arterial pressure (MAP) were significantly higher in group A compared to both DEX groups at 30, 45, and 60 minutes. Beyond this point, there were insignificant differences between the three groups for the first 8 postoperative hours or at the 24-hour mark. At the 12-hour mark, both HR and MAP were significantly lower in both DEX groups than in group A. Additionally, at the 18-hour mark, HR and MAP were significantly lower in group C than in other groups (P <0.05) **(Figure 2)**.

(A)



(B)

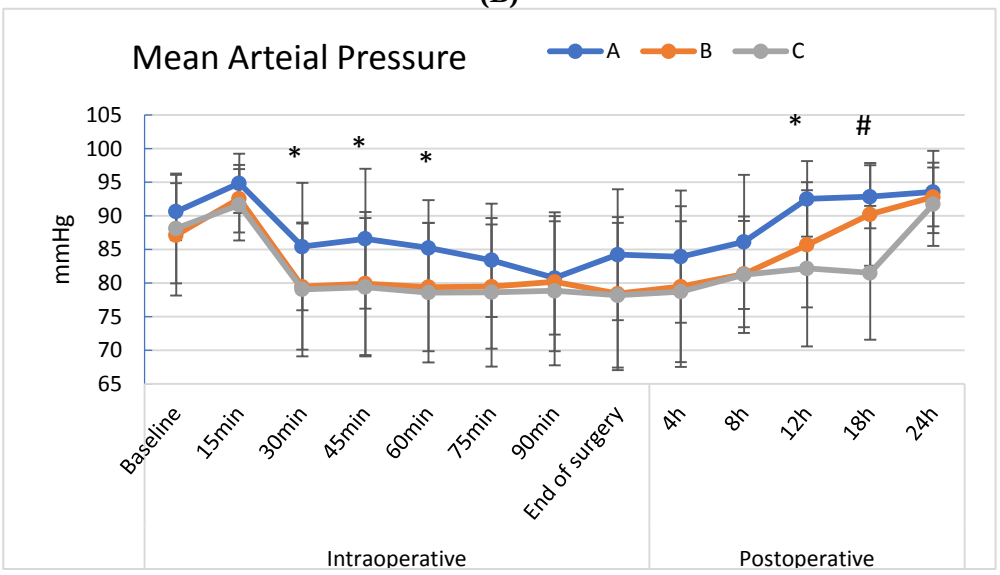


Figure (2): (A) Heart rate and (B) MAP measurements.
* Group A significant than groups B and C; # Group C significant than groups A and B

Regarding the complications, five patients in the control group complained of postoperative nausea and vomiting (PONV) compared to four and three patients in group B and group C respectively with no significant difference (P=0.741). Two cases in group C and one case in group B complained of deep sedation (RSS > 4) in the PACU but this difference was also not significant (P=0.352). All patients were satisfied with the postoperative pain killer protocol with no significant difference among the groups. The incidence of bradycardia and hypotension was similar across the groups. No patients acquired any side effects that required intercepting of morphine titration. No cases of failed block, LA toxicity, or hematoma at the site of injection were detected in any group **(Table 4)**.

Table (4): Side effects and patients' satisfaction

		Group A (n=24)	Group B (n=24)	Group C (n=24)	P
Bradycardia		1 (4.2 %)	2 (8.3 %)	4 (16.7 %)	0.330 χ^2
Hypotension		2 (8.3 %)	4 (16.7 %)	7 (29.2 %)	0.168 χ^2
PONV		5 (20.8 %)	4 (16.7 %)	3 (12.5 %)	0.741 χ^2
Local anesthetic toxicity		0 (0 %)	0 (0 %)	0 (0 %)	---
Deep sedation		0 (0 %)	1 (4.2 %)	2 (8.3 %)	0.352 χ^2
Patients' Satisfaction	**Excellent**	8 (33.3 %)	12 (50.0 %)	13 (54.2 %)	0.380 χ^2
	Very good	9 (37.5 %)	8 (33.3 %)	9 (37.5 %)	
	Good	4 (16.7 %)	2 (8.3 %)	1 (4.2 %)	
	Poor	3 (12.5 %)	2 (8.3 %)	1 (4.2 %)	

DISCUSSION

Bariatric surgery is recommended for severely obese patients to reduce weight and associated health risks, with LSG being an efficient approach. Regional techniques for analgesia in obese patients help reduce opioid consumption with its side effects and promote early mobilization, minimizing risks of deep vein thrombosis, and respiratory impairment [13].

Several localized anesthetic techniques have been used for postoperative pain management in abdominal laparoscopic surgeries. Trocar site LA infiltration and transversus abdominis plane blocks have limited efficacy in controlling visceral pain [14]. Thoracic epidural anesthesia or paravertebral block may face technical difficulties in morbidly obese patients and may be contraindicated with anticoagulant therapy [9]. In contrast, UG-ESPB is a rather safe regional approach that offers high success rates for visceral and somatic analgesia and recognizable sonographic landmarks for LA needle insertion and injection [7].

Our study demonstrated that adding DEX (either 1 µg/kg or 0.5µg/kg) to 0.25% bupivacaine during bilateral UG-ESPB for laparoscopic bariatric surgery significantly extended the analgesic duration, reduced pain intensity, and reduced 24-hour postoperative analgesic consumption. This combination also maintained a proper hemodynamic profile compared to ESPB with bupivacaine alone, with dexmedetomidine at 1 µg/kg showing superior results. Besides, there were no considerable differences in intraoperative fentanyl consumption or complications among the three groups. The mechanisms behind the improved analgesic efficacy of DEX included its ability to decline the liberation of substance P, hinder potassium channel-mediated discharge of C-fibers, and cause neuronal hyperpolarization, all of which decrease sympathetic outflow and potentiate analgesia [15]. Additionally, DEX can induce vasoconstriction at the injection site, which delays the absorption and prolongs the effect of the local anesthetic. Its intrinsic analgesic properties further contribute to the enhanced observed pain relief [10]. Our findings align with those of **Mostafa *et al.*** [16]**,** who reported that preemptive bilateral ESPB at the T7 vertebral level using 20 ml of 0.25% bupivacaine alone effectively reduced pain scores during the first 8 postoperative hours and significantly reduced 24-hour postoperative morphine consumption following laparoscopic bariatric surgery. However, in our study, when DEX was added as an adjuvant, this duration increased by 50% and 125% for 0.5 µg/kg and 1 µg/kg DEX respectively. Highlighting the significant impact of DEX on prolonging analgesia in a dose-dependent manner.

Similar, to our results, **Guo *et al.*** [17] reported that combined DEX with ropivacaine significantly extended the duration of the ESPB for thoracoscopic lobectomy surgery in a dose-dependent manner (12.5 hours for DEX 0.5 ug/kg to 20 hours for DEX 1ug/kg). Moreover, ropivacaine plus DEX 1 µg/kg provided superior postoperative analgesia, reduced postoperative analgesic consumption, and postoperative nausea and vomiting, without raising the postoperative side effects associated with dexmedetomidine.

Different doses of DEX (0.5, 0.75, and 1 µg/kg) were added as an adjunct to LA in UG-ESPB in multiple studies [12, 18-20] aligned with our results, showing DEX can significantly prolong the analgesic duration (12-24 hours), notably reducing postoperative VAS scores and analgesic consumption. Consistency with **Wang *et al.*** [21]**,** our study revealed no considerable disparity in the VAS score among the three groups during the first 8 hours post-surgery, suggesting that ESPB with bupivacaine alone can sustain sufficient analgesia for 8 hours. However, the variations in VAS scores at 12 and 18 hours among the groups demonstrated that combining DEX with bupivacaine greatly extended the analgesic effects of ESPB in a dose-dependent fashion. Furthermore, previous study [22] have shown that high dosages of DEX (20–40 µg/kg) mixed with bupivacaine for sciatic nerve blocks did not result in notable neurotoxicity or cause axonal or myelin damage 14 days post-injection, suggesting a favorable safety profile when used to prolong the duration of regional anesthesia. Additionally, The results of our study support and extend the findings of **Hassan and Abdelgalil** [23] about the safety and the efficacy of 1 µg/kg DEX in prolonging the duration of analgesia of UG-ESPB with bupivacaine 0.5% for modified radical mastectomy.

However, in contrast to our study they observed no differences with or without DEX on the postoperative pain intensity and postoperative morphine consumption (11 mg versus 13 mg/24 hours, respectively), This can be explained by the use of patient-controlled analgesia (PCA), which resulted in higher postoperative morphine consumption in both groups compared to our study (12 versus 3.8 mg/24 hours with or without DEX, respectively).

In our study, RSS was initially comparable among the three groups in the PACU. After that, notable differences emerged postoperatively. Where DEX at both dosages provided higher RSS compared to bupivacaine alone, which are supported by results of Wang [21]. Moreover, it significantly extended the duration of the sedation in a dose-dependent manner (8 hours for DEX 0.5 µg/kg to 12 hours for DEX 1 µg/kg).

That aligns with the pharmacodynamics of DEX, and also, highlights the need to monitor sedation levels and adjust postoperative care particularly when higher doses of DEX are used. Our results are supported by **Elkholy *et al.*** [12] and **Hamed *et al.*** [24] as for eight postoperative hours, there was no discernible difference in the groups' HR and MAP, indicating a convergence in recovery paths. However, the addition of DEX to UG-ESPB led to a sustained reduction in hemodynamic parameters over time. This is particularly evident with DEX 1 µg/kg group, where the effects were most pronounced for 18 hours postoperatively. The patterns of hemodynamic fluctuations suggest that DEX promotes a longer duration of autonomic stability, possibly through its sympatholytic effects, compared to the control group. This highlights its potential advantages in reducing stress responses and stabilizing cardiovascular parameters.

We did not detect any significant differences in PONV among the groups, while **Xu *et al.*** [25] reported a significant reduction in PONV in DEX groups likely due to direct inhibition of PONV by reducing plasma catecholamines and/or lowering postoperative opioid use.

Consistent with earlier reports [12, 17-18] on the safety of DEX 0.5–1 µg/kg as an adjuvant to regional anesthesia we did not observe serious DEX-related side effects. Therefore, UG-ESPB with dexmedetomidine can significantly extend block duration, provide comfortable analgesia throughout the first postoperative night, ensure early mobilization, and avoid opioid-induced side effects, especially in obese patients who are vulnerable to airway obstruction, desaturation, and pulmonary complications. However, **Gad and El-Metwally** [26] and **Das *et al.*** [27] reported that adding DEX can seriously decline blood pressure and heart rate, while **Fritsch *et al.*** [28] found that DEX 100-150 µg lowers HR without affecting BP. Hence, continuous monitoring of hemodynamic parameters after DEX administration is essential in clinical practice. To guarantee the low frequency of systemic side effects linked to perineural DEX, a bigger sample size is required, which is a limitation of our study.

CONCLUSIONS

Adding DEX (0.5 or 1 µg/kg) to bupivacaine in UG-ESPB for LSG significantly enhanced analgesic outcomes, provided higher sedation scores, and maintained better hemodynamic parameters without increasing intraoperative fentanyl requirements or postoperative complications. This makes it a valuable adjunct in pain management protocols, with the 1 µg/kg dose showing superior results.

- **Acknowledgment:** We want to thank the professors of the Anesthesia, Intensive Care, and Pain Management Department of Menoufia Faculty of Medicine for their great effort, and support in this study.
- **Conflict of Interests:** No conflict of interests.
- **Fund:** Non-fundable.

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