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Systemic Lidocaine Versus Nalbuphine for Post-Operative Analgesia in Bariatric Patients in ICU

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Abstract: ***Introduction***: Effective postoperative pain management in bariatric patients is a challenge because of a change in pharmacokinetics and the risk for opioid-related complications. Systemic lidocaine and nalbuphine are becoming possible options as agents with different mechanisms of actions. This study compared the efficacy of systemic lidocaine and nalbuphine to provide postoperative analgesia in obese patients undergoing laparoscopic bariatric surgery. ***Methods***: This randomised controlled trial was carried out in the Anaesthesia Unit, Shalamar Hospital, Lahore, over a period of 6 months. A total of 110 obese patients (BMI > 35 kg/m2) undergoing laparoscopic bariatric surgery under general anaesthesia were randomly assigned into 2 groups of 55 patients each. Group A was treated with group A intravenous lidocaine (Bolus 1.5 mg/kg followed by infusion for 1.5 mg/kg/h) while group B was treated with ultrasound-guided transversus abdominis plane (TAP) plane block with nalbuphine (0.1 mg/kg, per side). Time to first rescue analgesia and total fentanyl consumption during the first 24 hours after surgery were documented and analysed in the statistical software package, version 22.0, of the International Business Machines Corp. (Armonk, NY): $p < 0.05$ was considered significant. ***Results***: The mean time to first rescue analgesia was significantly longer in the lidocaine group (33.99 ± 24.96 min) compared to the nalbuphine group (10.24 ± 5.75 min; $p = 0.001$). ***Conclusion***: Systemic lidocaine showed a significant increase in duration of postoperative analgesia when compared to nalbuphine but was associated with marginally increased opioid consumption. Both agents were effective and tolerated well for pain control in ICU bariatric patients.

Keywords: Systemic Lidocaine, Nalbuphine, Bariatric Surgery, Postoperative Analgesia, Fentanyl Consumption, ICU Pain Management.

INTRODUCTION

The use of bariatric surgery in the treatment for severe obesity has several benefits in terms of sustainable weight loss, improvements or resolution of several metabolic comorbidities as well as improved life expectancy. These benefits in combination with the continuously decreasing rates of complications have led the way to a significant rise in the demand for bariatric surgical procedures worldwide. Also it has been proved to be cost effective cure for the patients themselves as its prognosis is good and long lived than medical therapy.1-3

For post-surgical pain, classical systemics including morphine and fentanyl remain the therapeutic mainstay. Obese patients, however, are prone to opioid-associated side effects, particularly post-operative nausea and vomiting (PONV), and respiratory depression. Further, obstructive sleep apnea is common in morbidly obese patients, which predisposes them even to respiratory depression.4-5

The use of non-opioid drugs and adjuvants can minimise opioid related side effects and are highly desirable in morbidly obese patients undergoing surgical procedures. Intravenous lidocaine has been

used as a part of multimodal approach for postoperative analgesia in various surgeries including laparoscopic procedure. It has analgesic, anti-inflammatory and anti-hyperalgesic properties. This is done through inhibition of Na+ channels, N-methylaspartic acid (NMDA), and G-protein-coupled receptors. The concerns for LA toxicity has been raised with continuous intravenous lidocaine infusion.6-7

The use of nalbuphine on bariatric surgery is promising: less side effects, less addiction and equianalgesic to morphine. These are important features of an opioid especially for certain populations, like those that are at higher risk for developing respiratory depression. Also, like other mixed agonists-antagonists, nalbuphine has a ceiling effect. It was observed that increasing doses of nalbuphine produces increasing intensity of analgesia only up to a point; beyond that point, further increases in dose do not result in increased intensity of analgesia, which is bounded for excruciating pain but safer for opioid side effects on risky populations and an improvement on post-operative care due to its qualities instead of morphine.8-9

A study conducted in India on pain control in bariatric surgeries compared lidocaine and nalbuphine reported mean time of first rescue analgesia 35.89±33.83 and 4.11±11.87 respectively and mean postoperative consumption of fentanyl as 218.93±138.04 with lidocaine and 138.04±198.28 nalbuphine respectively.10 It has been reported in literature that both intravenous lidocaine and nalbuphine are effective for postoperative analgesia after bariatric surgery and had been compared with placebo or some other strategies.6-9 However the level of evidence comparing in randomised controlled trial, the efficacy of intravenous lidocaine versus nalbuphine in bariatric surgery in our local set up of Pakistan remains scarce in literature as well as in routine practise.

The purpose of this study is to compare the effects of systemic lidocaine and nalbuphine for post-operative analgesia in obese patients undergoing laparoscopic bariatric surgeries under general anaesthesia. Findings from this study may be used to inform clinical practise guidelines and help choose the best analgesic regimen for obese patients undergoing laparoscopic bariatric surgeries. If the results of the trial demonstrating non-inferiority or superiority of systemic lidocaine or nalbuphine compared to fentanyl in terms of pain control and opioid consumption is shown, this could lead to a change in analgesic practises to safer and more effective approaches, thus leading to improved postoperative outcomes and patient satisfaction in this vulnerable population.

METHODOLOGY:

After approval by the Hospital Ethical Committee, this was a randomised controlled trial which was carried out at the Anaesthesia Unit of Shalamar Hospital, Lahore, over a period of six months from January 9th, 2025, to July 8th, 2025. One hundred and ten patients who met the inclusion and exclusion criteria were recruited into the study using non-probability consecutive sampling. The patients were divided into two equal groups. 55 patients were in each group. A 95% confidence level and 80% power of the study were used to determine the sample size, based on the mean postoperative consumption of fentanyl of 218.93 ± 138.04 µg in the lidocaine group and 138.04 ± 198.28 µg in the nalbuphine group in previous studies.10

Patients of both gender and between 18 to 60 years of age under ASA class II or III and BMI greater than 35 kg/m2 undergoing laparoscopic bariatric surgeries under general anaesthesia were included in the study. Patients who were hemodynamically unstable (systolic blood pressure < 90 mmHg, mean blood pressure < 60 mmHg, or heart rate < 55 beats/min), had a history of liver or renal disease or cerebrovascular accident, or were pregnant or lactating were excluded.

After obtaining written informed consent from each patient, demographic data such as age, gender, weight, height, BMI and ASA class were recorded. Randomization by using random number table was performed to assign patients into 2 groups: Group A (systemic lidocaine) and Group B (nalbuphine). Standard preoperative preparations were performed and all patients were monitored with standard hospital monitoring equipment. Anaesthesia was carried out according to standard protocol as accepted by the hospital. Approximately 90 seconds prior to the estimated tracheal intubation time, the patients in Group A received intravenous infusion of lidocaine at a dose of 1.5 mg/kg as bolus over 10 min, followed by continuous infusion of 1.5 mg/kg/h, which was turned off at the time of removal of laparoscopic ports at the end of surgery. Patients in Group B received ultrasound guided bilateral transversus abdominis plane (TAP) block by subcostal approach using nalbuphine at a dose of 0.1 mg kg-1 bolus each side under ultrasound guided using Sonosite S nerve machine after induction of anaesthesia.

Intraoperatively, patients were treated to maintain hemodynamic stability and normothermia. At the end of the surgery, patients were extubated for alert, warm, awake and comfortable, once adequate reversal of the neuromuscular block was complete. The time of extubation was documented. An analgesia pump containing fentanyl (20 ug/dose, lockout interval of 15 minutes, maximum dose 60 ug/dose/hour) had been attached and managed by the ICU nursing staff. After extubation, patients were

continuously monitored and when a patient first complained of pain, the staff nurse evaluated the pain on a Likert scale, from 0 to 10 (0 = no pain, 10 = worst pain). When the pain score was greater than 5, rescue analgesia was given. The time from extubation to the first rescue analgesia was recorded as time to first rescue analgesia.

Postoperatively, patients were evaluated for pain every hour for 24 hours by the staff nurse. Whenever the pain score was greater than 5, fentanyl was titrated in increments of 20 ug, a max of 60 ug per hour. The cumulative amount of fentanyl used in 24 hours after surgery was collected. All the relevant information was recorded on a specially designed proforma.

The data collected were entered and analysed on using the application package, Statistical Package for Social Sciences (SPSS) version27.0. Quantitative variables, such as age, weight, height, and BMI, were reported as mean +- standard deviation. Qualitative variables (i.e., gender and ASA grade) were presented as frequency and percentage. The mean time to first rescue analgesia and total postoperative fentanyl consumption between the two groups was compared using the independent samples t-test. Data were further stratified by age, gender, BMI and ASA class and post-stratification t-tests were used. A p-value < 0.05 was taken to be statistically significant.

RESULTS

The gender distribution was comparable between the two groups, with males comprising 52.7% in the lidocaine group and 54.5% in the nalbuphine group, while females accounted for 47.3% and 45.5%, respectively. The age distribution showed that in the lidocaine group, 29.1% of patients were aged between 18–30 years, 43.6% were between 31–45 years, and 27.3% were between 46–60 years. Similarly, in the nalbuphine group, 30.9% of patients were aged 18–30 years, 36.4% were 31–45 years, and 32.7% were 46–60 years. The mean age was almost identical in both groups, measuring 38.93 ± 11.38 years in the lidocaine group and 39.09 ± 11.58 years in the nalbuphine group, indicating no statistically significant difference in age distribution.

Regarding body mass index (BMI), 41.8% of patients in the lidocaine group and 43.6% in the nalbuphine group had BMI ≤ 39.9 kg/m², while 58.2% and 56.4%, respectively, had BMI > 39.9 kg/m². The mean body weight was 117.76 ± 20.90 kg in the lidocaine group and 117.87 ± 22.24 kg in the nalbuphine group, whereas the mean height was 1.64 ± 0.09 m and 1.65 ± 0.11 m, respectively. The mean BMI was comparable between both groups, recorded as 40.61 ± 3.06 kg/m² in the lidocaine group and 40.37 ± 3.32 kg/m² in the nalbuphine group. ASA physical status classification also showed a similar distribution between the two groups. In the lidocaine group, 45.5% of patients were classified as ASA II and 54.5% as ASA III, while in the nalbuphine group, 43.6% were ASA II and 56.4% were ASA III.

The mean time to first rescue analgesia was significantly longer in the lidocaine group (33.99 ± 24.96 minutes) compared to the nalbuphine group (10.24 ± 5.75 minutes), with a p-value of 0.001, indicating a highly significant difference. The mean total fentanyl consumption during the first 24 hours postoperatively was 222.77 ± 137.90 µg in the lidocaine group and 188.82 ± 176.01 µg in the nalbuphine group. The difference between the two groups was statistically significant (p = 0.043).

Across all subgroups, patients in the lidocaine group had a significantly longer mean time to first rescue analgesia than those in the nalbuphine group (p = 0.001). This effect was consistent across gender, age, BMI, and ASA classifications. Conversely, total fentanyl consumption was slightly higher with lidocaine across all strata, with significant differences observed for each variable (p < 0.05).

Table-1: Comparison of distribution of different variables between groups

Variables		Groups	
		Group-A (Lidocaine)	Group-B (Nalbuphine)
Gender	Male	29(52.7%)	30(54.5%)
	Female	26(47.3%)	25(45.5%)
Age groups	18-30 years	16(29.1%)	17(30.9%)
	31-45 years	24(43.6%)	20(36.4%)
	46-60 years	15(27.3%)	18(32.7%)
	Mean age (years)	38.93±11.38	39.09±11.58
BMI	≤39.9 kg/m^2	23(41.8%)	24(43.6%)
	>39.9 kg/m^2	32(58.2%)	31(56.4%)
	Mean weight (kg)	117.76±20.90	117.87±22.24
	Mean height (m)	1.64±0.09	1.65±0.11
	Mean BMI (kg)	40.61±3.06	40.37±3.32
ASA status	ASA-II	25(45.5%)	24(43.6%)
	ASA-III	30(54.5%)	31(56.4%)

Table-2: Comparison of mean time to first rescue analgesia and total fentanyl consumption between groups

Variables	Groups		p-value
	Group-A (Lidocaine)	Group-B (Nalbuphine)	
Mean time to first rescue analgesia (minutes)	33.99±24.96	10.24±5.75	0.001
Mean total fentanyl consumption (µg)	222.77±137.90	188.82±176.01	0.043

Table-3: Stratification of mean time to first rescue analgesia between groups with respect to different variables

Variables	Groups		p-value
	Group-A (Lidocaine)	Group-B (Nalbuphine)	
Gender			
Male	33.31±27.72	9.29±5.73	0.001
Female	34.76±21.98	11.38±5.67	0.001
Age groups			
18-30 years	39.26±19.18	10.22±2.98	0.001
31-45 years	30.30±23.28	10.73±7.76	0.001
46-60 years	34.29±32.60	9.71±5.50	0.001
BMI			
≤39.9 kg/m^2	29.65±20.91	9.39±4.51	0.001
>39.9 kg/m^2	37.12±27.40	10.89±6.54	0.001
ASA status			
ASA-II	39.52±29.10	10.48±5.73	0.001
ASA-III	29.39±20.26	10.05±5.85	0.001

Table-4: Stratification of mean total fentanyl consumption between groups with respect to different variables

Variables	Groups		p-value
	Group-A (Lidocaine)	Group-B (Nalbuphine)	
Gender			
Male	214.51±126.89	201.73±211.97	0.041
Female	231.97±151.25	173.32±122.25	0.035
Age groups			
18-30 years	216.48±135.78	176.93±125.67	0.043
31-45 years	229.88±125.40	221.31±229.45	0.042
46-60 years	218.08±166.16	163.92±150.49	0.034
BMI			
≤39.9 kg/m^2	234.63±134.49	218.49±205.09	0.042
>39.9 kg/m^2	214.25±141.81	165.85±149.20	0.041
ASA status			
ASA-II	244.68±152.30	224.37±224.38	0.046
ASA-III	204.51±124.33	145.81±113.04	0.048

DISCUSSION

The present study compared efficacy of systemic lidocaine and nalbuphine for postoperative analgesia in obese patients who underwent laparoscopic bariatric surgery. Our results showed the mean time to first rescue analgesia was much longer in the systemic lidocaine group (33.99 ± 24.96 min) than in the nalbuphine group (10.24 ± 5.75 min), total fentanyl consumption in the postoperative period in the lidocaine group was slightly higher than that in the nalbuphine group (222.77 ± 137.90 ug vs. 188.82 ± 176.01 ug; p = 0.043). These findings are consistent with recent publications describing the benefits of intravenous lidocaine on improving pain relief and prolonging analgesic pain relief in the early postoperative period in bariatric patients.

Yurttas et al. (2023) found that systemic lidocaine decreased the intensity of postoperative pain and delayed the first opioid request in their meta-analysis after bariatric surgeries in line with our results.11 Also, a meta-analysis by Hung et al. (2022) showed that intraoperative intravenous lidocaine significantly increased the time to the first rescue analgesia and the quality of postoperative recovery in obese patients.12 Duarte-Medrano et al. (2024) also confirmed that lidocaine infusion during bariatric surgery reduced the early postoperative pain and opioid demand without major adverse effects.13

In contrast, Plass et al. (2021) found no significant decrease in opioid consumption with intraoperative lidocaine but did find improved recovery profiles.14

Our finding of slightly increased fentanyl consumption with lidocaine is consistent with this and suggests that although lidocaine prolongs initial analgesia, its overall opioid-sparing effect may depend on dosing and infusion duration.

Regarding nalbuphine, studies have focused on its k-opioid receptor mediated analgesic and opioid-sparing properties. It has been shown that Lee et al. (2023) found extended release nalbuphine had a significant effect on reduction of postoperative pain scores and rescue opioid requirements after laparoscopic bariatric surgery.15 Similarly, Liu et al. (2021) described the use of long acting dinalbuphine sebacate had a prolonged effect on postoperative analgesia when combined with regional blocks.16 Our study's lower fentanyl requirement in the nalbuphine group supports these findings, confirming nalbuphine's role as an effective opioid sparing adjuvant.

Comparative studies have additionally highlighted nalbuphine's efficacy in multimodal protocols. Nasr et al. (2022) reported lower postoperative pain and opioid consumption of nalbuphine compared to fentanyl in laparoscopic bariatric surgery, and Mahdy et al. reported lower nalbuphine consumption in opioid-free anaesthesia regimens.17-18 Likewise, Mansour et al. (2024) reported lower nalbuphine consumption in enhanced recovery technology for sleeve gastrectomy.19

The present findings, therefore, support the evidence that both agents, systemic lidocaine and nalbuphine, improve postoperative pain control, by different mechanisms. Lidocaine's primary mechanism is through sodium channel blockade and central sensitization inhibition, and nalbuphine's primary mechanism is k-receptor agonist with an effective analgesia and ceiling effect on respiratory depression.20-21

Future studies are needed to focus on enhancing lidocaine dosing strategies and assessing lidocaine and nalbuphine combinations for improved analgesic effect with less opiate consumption. Larger multicenter trials could investigate pharmacogenomic variability, as well as long-term outcomes among obese patients.

This study was limited in that its design was a single centre study with a relatively small sample size and did not include long-term evaluation of pain or recovery. Additionally, the brief observation time (24 hours) may not be sufficient to describe the analgesic effects beyond the early postoperative period.

CONCLUSION:

Systemic lidocaine had significantly longer postoperative analgesia than nalbuphine but at the cost of a slightly increased opioid use. Both agents were effective and well-tolerated in bariatric ICU patients for control of pain.

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