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Intravenous Lidocaine Infusion for Pain Management After Laparoscopic Bariatric Surgery: A Double-Blinded, Placebo-Controlled Trial

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Abstract:
Surgical treatment is still the sole evidence-based strategy for weight loss in patients with severe obesity (class II or III obesity). While there are a number of surgical methods, the most popular ones are laparoscopic gastric banding and gastric bypass. The growing understanding of the advantages of effective acute pain management on short-term outcomes, patient satisfaction, quality of life, and the prevention of chronic pain syndromes—a crucial factor that could otherwise jeopardize overall recovery following laparoscopic procedures—is reflected in the recent adoption of standardized criteria for pain assessment and management. There is ongoing discussion over postoperative analgesia for patients having a gastrectomy. Acetaminophen, nonsteroidal medications, bupivacaine infiltration before surgery, opioids for extreme pain, and epidural analgesia are some of the techniques utilized to manage pain following surgery. This randomized, double-blind, placebo-controlled trial was carried out at Zliten Medical Center (Zliten, Libya) and two specialized laparoscopic clinics in Tripoli, Libya, from January 2020 to June 2021, with 42 patients of both sexes. All patients were randomized into two groups: Group I received an intravenous lidocaine infusion (n = 21), while Group II received a placebo (n = 21). The study found that systemic lidocaine infusion in obese patients undergoing laparoscopic bariatric surgery was associated with lower postoperative morphine requirements, lower pain intensity as measured by VAS, longer time to first morphine request, earlier mobilization, earlier bowel movement and flatus passage, shorter ICU stay, and shorter hospital length of stay. These findings, in the absence of major problems, suggest that lidocaine infusion is a viable perioperative opioid-sparing analgesic in obese individuals.

Keywords: Morbid obesity, Bariatric surgery, Laparoscopic gastrectomy, Postoperative analgesia, Intravenous lidocaine, Opioid-sparing, Pain management.

حقن الليدوكايين الجهازي لإدارة الألم بعد الجراحة في جراحة السمنة بالمنظار: تجربة عشوائية مزدوجة التعمية خاضعة للتحكم الوهمي

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الملخص
العلاج الجراحي لا يزال الاستراتيجية الوحيدة المبنية على الأدلة لفقدان الوزن لدى المرضى الذين يعانون من السمنة المفرطة (السمنة من الدرجة الثانية أو الثالثة). وبينما توجد عدة طرق جراحية، فإن الأكثر شيوعًا هي ربط المعدة بالمنظار وتحويل مسار المعدة. ويُعكس الفهم المتزايد لفوائد التحكم الفعال في الألم الحاد على النتائج قصيرة المدى، ورضا المرضى، وجودة الحياة، والوقاية من متلازمات الألم المزمن — وهو عامل حاسم قد يهدد التعافي الكلي بعد الإجراءات بالمنظار — في الاعتماد الأخير لمعايير موحدة لتقييم وإدارة الألم. لا يزال موضوع مسكنات ما بعد العملية لدى المرضى الذين يخضعون لاستئصال المعدة محل نقاش مستمر. ومن بين التقنيات المستخدمة للتحكم في الألم بعد الجراحة: الباراسيتامول، الأدوية غير الستيرويدية، حقن البوبيفاكائين قبل الجراحة، الأفيونيات للألم الشديد، والتخدير فوق الجافية. تم إجراء هذه الدراسة العشوائية مزدوجة التعمية،

والتي خضعت لمجموعة ضابطة باستخدام الدواء الوهمي، في مركز زليتن الطبي (زليتن، طرابلس) ومركزين متخصصين في جراحة المناظير في طرابلس، ليبيا من يناير 2020 حتى يونيو 2021، وشملت 42 مريضًا من كلا الجنسين. تم تقسيم جميع المرضى عشوائيًا إلى مجموعتين: تلقت المجموعة الأولى تسريب الليدوكايين الوريدي(n = 21) ، بينما تلقت المجموعة الثانية دواءً وهميًا.(n = 21) وأظهرت نتائج الدراسة أن التسريب النظامي لليدوكايين لدى المرضى البدناء الذين يخضعون لجراحة السمنة بالمنظار ارتبط بانخفاض الحاجة للمورفين بعد العملية، وانخفاض شدة الألم كما قيس بمقياس VAS، وطول الوقت حتى أول طلب للمورفين، وتحريك مبكر للجسم، وحركة أمعاء ومرور الغازات مبكرًا، وتقليل مدة الإقامة في وحدة العناية المركزة، وتقليل طول فترة الإقامة بالمستشفى. وتشير هذه النتائج، في غياب أي مضاعفات كبيرة، إلى أن تسريب الليدوكايين يُعد مسكنًا فعالًا يقلل من استخدام الأفيونيات خلال الفترة المحيطة بالعملية لدى الأفراد البدناء.
الكلمات المفتاحية: السمنة المفرطة، جراحة السمنة، استئصال المعدة بالمنظار، مسكنات ما بعد العملية، الليدوكايين الوريدي، تقليل استخدام الأفيونيات، علاج الألم

Introduction

Since its introduction, bariatric surgery continues to rise as the preferred method for even less overweight persons with chronic diseases such as diabetes and metabolic syndrome.[1]. However, despite a wide range of bariatric surgeries available, Laparoscopic Roux-en-Y Gastric Bypass and Sleeve Gastrectomy (SG) is the most widely practiced procedure [2].

Recognizing the benefits of acute pain control on short-term outcomes, patient satisfaction, quality of life, and preventing the development of chronic pain syndromes has led to the recent implementation of pain assessment and management standards. Postoperative pain has been demonstrated to be a very important factor that, following laparoscopic operations, might affect the overall quality of recovery. [3]

Postoperative analgesia is frequently a source of controversy among individuals who have had laparoscopic sleeve gastrectomy (LSG). Acetaminophen administered intravenously (IV) lowers opioid intake following surgery, shortens hospital stays, and improves early return of bowel function. Bupivacaine infiltration before incision enhances the postoperative analgesia. [4], and therapy using non-opioid techniques. "Neuraxial analgesia and peripheral nerve block techniques" may increase pain relief and early mobility while lowering opioid side effects. [5] Epidural anesthesia and analgesia may restrict or eliminate perioperative physiologic stress reactions to surgery, therefore minimizing surgical difficulties and increasing outcomes, and having superiority over the TAP block. [6]

Opioids are still useful in the pharmacological treatment of acute postoperative pain, but they are less effective in the management of inflammatory or neuropathic pain. Furthermore, the use of opioids produces adverse side effects, "respiratory depression, depression of the central nervous system, sedation, circulatory depression, nausea, vomiting, pruritus, urinary retention, bowel function dysfunction, and sleep disturbance," which can impede or postpone recovery from surgery.[7]

Lidocaine is "an amide local anesthetic and a Class Ib anti-dysrhythmic agent, analgesia results from blockade of voltage-gated Na+ channels" that restricts action potential onset and propagation. This is a reversible procedure that does not damage the nerve. There is also evidence that systemic lidocaine can reduce and/or prevent the neo-proliferation of active sodium channels, as well as suppress their spontaneous firing, especially in traumatized and injured tissues. This route may contribute to the systemic effects of lidocaine. [8]

Systemic lidocaine has considerable analgesic, anti-hyperalgesic, and anti-inflammatory properties when used to treat acute pain. It also reduces the sensitivity and activity of spinal cord neurons (central sensitization) as well as the N-Methyl-D-aspartate receptor-induced post-synaptic depolarization. Furthermore, multiple studies have showed that persons receiving preoperative lidocaine had a clinically substantial reduction in systemic inflammatory markers. [9] Only a few research have investigated the effects of systemic lidocaine in morbidly obese individuals after laparoscopic bariatric surgery.[10]

The current study sought to investigate the postoperative analgesic effectiveness of systemic lidocaine in obese individuals undergoing laparoscopic bariatric surgery. The primary outcome was the postoperative pain score within the first 24 hours, while the secondary outcome measures included the first morphine request, the total amount of morphine consumed, the first flatus passage, the first bowel movement, the first mobilization, the length of ICU stay, the length of hospital stay, lidocaine toxicity, mean arterial pressure, and heart rate.

Methods

Study design and setting

This randomized, double-blinded, placebo-controlled trial was conducted at Zliten's Medical Center (ZMC), Zliten, Libya, and two other specialized laparoscopic surgery clinics in Tripoli, Libya, between January 2020 and June 2021. The study protocol was approved by the Institutional Research Board approval was obtained. Written informed consent was obtained from all participants before enrollment. The study adhered to the principles of the Declaration of Helsinki.

Participants

A total of 42 patients of both sexes, aged 18–50 years, with a body mass index (BMI) between 40 and 60 kg/m² and scheduled for elective laparoscopic bariatric surgery, were considered eligible. Exclusion criteria included

refusal to participate, pregnancy, history of chronic or recent narcotic use, liver cirrhosis or portal hypertension, severe intra-abdominal adhesions, allergy to lidocaine or opioids, and abnormal serum potassium, magnesium, alanine aminotransferase, or aspartate transaminase levels.

Randomization and blinding
Participants were randomized into two groups (n=21 each) using a computer-generated randomization sequence and sealed opaque envelopes. Group I (lidocaine group) received intravenous lidocaine infusion, while Group II (placebo group) received an equivalent volume of normal saline. Study medications were prepared by an anesthesiologist not involved in patient management or data collection. Surgeons, ICU staff, and patients were blinded to group assignment.

Intervention
In the lidocaine group, patients received an intravenous bolus of 1.5 mg/kg lidocaine (2%) over 2–3 minutes, followed by continuous infusion of 1 mg/kg/h intraoperatively and for 24 hours postoperatively in the ICU. The placebo group received an equal volume of 0.9% saline. All doses were calculated according to ideal body weight.

Anesthesia protocol
All patients underwent standard preoperative assessment, including complete blood count, liver function tests, serum creatinine, coagulation profile, ECG, pulmonary function test, and polysomnography. A 10 cm visual analogue scale (VAS; 0 = no pain, 10 = worst imaginable pain) was explained to each patient.
Anesthesia induction consisted of fentanyl (1 µg/kg), propofol (1–2 mg/kg), and succinylcholine (1–2 mg/kg). General anesthesia was maintained with isoflurane (0.8–1.5 MAC) in 50% oxygen, and rocuronium (0.1–0.2 mg/kg) as needed. At the end of surgery, residual neuromuscular block was reversed with sugammadex (4 mg/kg), and patients were extubated once adequate spontaneous breathing returned.

Sample size calculation
Sample size was calculated using Power Analysis and Sample Size software program (PASS) version 15.0.5 for Windows (2017) using the results published by S Gildasio et al (2014)[10] The post-operative pain score after 24 hours was the primary outcome. Patients will be classified into two groups: the Lidocaine group that will receive intravenous lidocaine infusion, and the placebo group. A sample size of 39 patients is needed in each group to achieve 80% power (1-β or the probability of rejecting the null hypothesis when it is false) and detect a mean difference between the groups 3.7 (29.8 for lidocaine group and 26.2 for placebo group) with standard deviation of 2.76 for lidocaine group and 7.84 for placebo group using two-sample unequal-variance t-test with a significance level of 0.05 (α or the probability of rejecting the null hypothesis when it is true). The expected number of dropouts is 4 patients in each group, so a total of 43 patients will be enrolled in each group.

Surgical procedure
All patients underwent laparoscopic sleeve gastrectomy using five trocars: one supraumbilical port for CO_2 insufflation (12–15 mmHg, 4–6 L/min), two ports at each flank, and two epigastric ports. A gastric bougie was placed to calibrate the sleeve, and patients were positioned in steep reverse Trendelenburg for exposure.

Postoperative management and outcome measures
Patients were transferred to the ICU postoperatively, where outcomes were recorded by a blinded observer.
Primary outcome: Postoperative pain scores measured by VAS at rest and on coughing at 0 (ICU arrival), 6, 12, 18, and 24 hours.
Secondary outcomes: Time to first morphine request, total morphine consumption, time to first bowel movement, time to first passage of flatus, time to mobilization, length of ICU stay, length of hospital stay, mean arterial pressure, and heart rate. Signs of lidocaine toxicity (e.g., metallic taste, circumoral numbness, dizziness, visual/auditory disturbances) were actively monitored.

Statistical Analysis

Data were analyzed using IBM SPSS version 25. Continuous variables were assessed for normality (Shapiro–Wilk test) and presented as mean ± standard deviation (SD) or median (interquartile range). Between-group comparisons were performed using independent t-tests or Mann–Whitney U-tests, as appropriate. Categorical variables were expressed as frequencies (%) and compared using chi-square tests. A p-value <0.05 was considered statistically significant.

Results
A total of 42 patients were enrolled; 2 patients were excluded before intervention (1 did not meet the inclusion

criteria and 1 declined participation). Forty patients were randomized equally into the lidocaine group (n=20) and the placebo group (n=20). Two patients in the lidocaine group were withdrawn due to signs of lidocaine toxicity (metallic taste), leaving 38 patients (lidocaine: n=18, placebo: n=20) for final analysis (Figure 1).

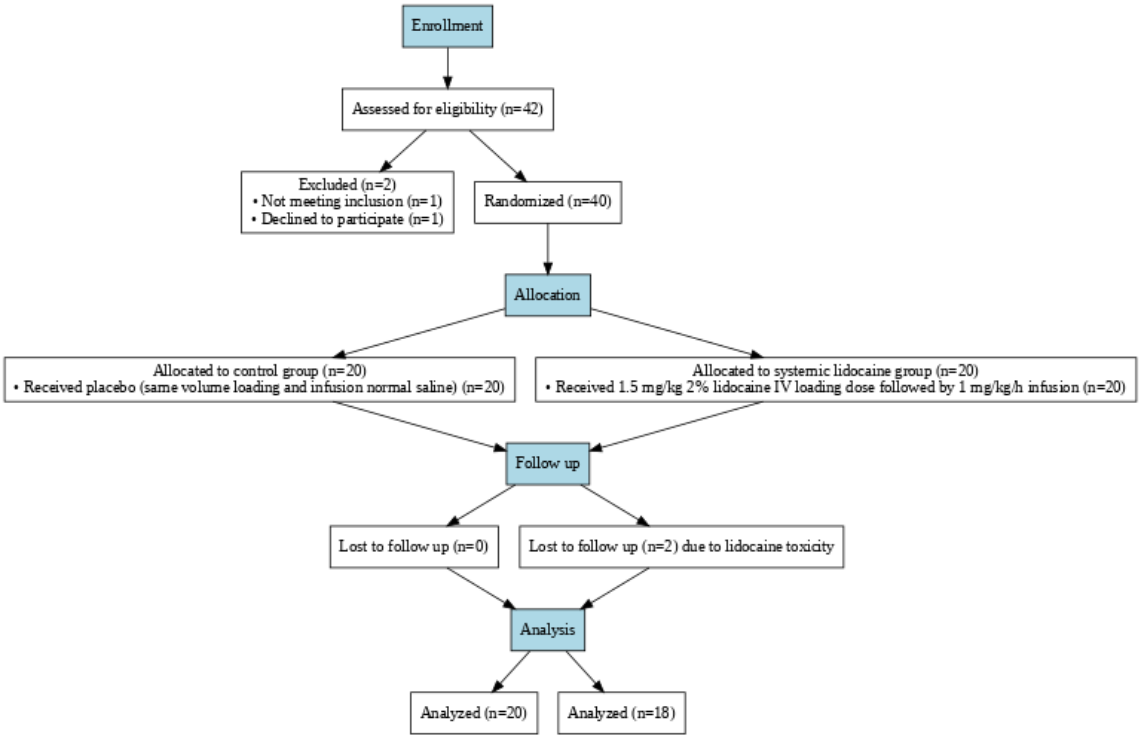

Figure 1. CONSORT flow diagram of patient enrollment, randomization, and follow-up.

Baseline demographic and clinical characteristics were comparable between groups with no statistically significant differences (Table 1).

Table 1. Baseline demographic and anthropometric characteristics of the study population

Variable	Lidocaine group (n=18)	Placebo group (n=20)	p-value
Gender (M/F)	6 / 12	11 / 9	0.163
Age (years)	32.8 ± 6.0	35.0 ± 10.1	0.452
Actual weight (kg)	132.1 ± 20.3	131.8 ± 24.7	0.964
Ideal weight (kg)	65.6 ± 11.7	72.3 ± 9.9	0.080
Height (m)	1.70 ± 0.10	1.69 ± 0.11	0.820
BMI (kg/m²)	45.6 ± 3.2	47.5 ± 2.5	0.069

Pain scores

VAS scores at rest were significantly lower in the lidocaine group compared to placebo at 6, 12, 18, and 24 hours (all $p < 0.001$), but not at baseline ($p=0.873$). A similar trend was observed for VAS on coughing, with significantly lower scores in the lidocaine group from 6 hours onward (all $p < 0.001$) (Tables 2 and 3, Figure 2).

Table 2. VAS pain scores at rest

Time point	Lidocaine (n=18)	Placebo (n=20)	p-value
Baseline	5 (1–6)	4 (3–6)	0.873
6 hours	3 (1–4)	4 (2–5)	<0.001*
12 hours	2 (1–2)	3 (2–3)	<0.001*
18 hours	1 (1–2)	2 (2–3)	<0.001*
24 hours	1 (0–1)	2 (2–3)	<0.001*

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Table 3. VAS pain scores on coughing

Time point	Lidocaine (n=18)	Placebo (n=20)	p-value
Baseline	6 (3–6)	5 (3–6)	0.177
6 hours	3 (1–5)	5 (4–6)	<0.001*
12 hours	2 (1–3)	3 (2–4)	<0.001*
18 hours	1 (1–2)	2 (2–4)	<0.001*
24 hours	1 (0–1)	3 (2–4)	<0.001*

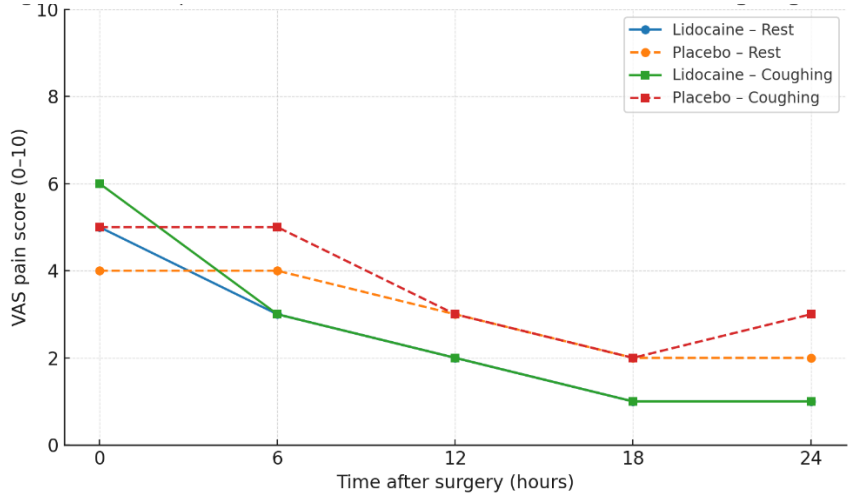

Figure 2. Postoperative pain scores (VAS) at rest and on coughing during the first 24 hours.

Postoperative recovery outcomes

The lidocaine group demonstrated significantly reduced postoperative morphine requirements (5.6 ± 2.3 mg vs. 7.7 ± 2.1 mg, p=0.003) and longer time to first morphine request (1.0 h vs. 0.5 ± 0.5 h, p=0.003). Recovery markers, including time to bowel movement, passage of flatus, mobilization, ICU stay, and hospital stay, were all significantly improved in the lidocaine group (Table 4).

Table 4. Postoperative recovery outcomes

Outcome	Lidocaine (n=18)	Placebo (n=20)	p-value
First morphine request (h)	1.0 ± 0.0	0.5 ± 0.52	0.003*
Total morphine use (mg)	5.6 ± 2.3	7.7 ± 2.1	0.003*
First bowel movement (h)	8.8 ± 5.7	12.5 ± 4.8	0.003*
First flatus (h)	14.4 ± 7.1	25.7 ± 9.3	0.001*
Mobilization (h)	7.8 ± 2.7	14.5 ± 12.8	0.001*
ICU stay (h)	24.0 ± 0.0	76.2 ± 58.9	0.001*
Hospital stay (h)	50.9 ± 8.3	97.2 ± 63.4	0.027*

Discussion

The main finding of this study was that systemic lidocaine infusion dramatically decreased postoperative pain and narcotic intake in morbidly obese patients undergoing laparoscopic bariatric surgery, according to the current randomized, double-blind, placebo-controlled study. Furthermore, with only mild and self-limiting side effects, lidocaine treatment was linked to quicker bowel recovery, mobilization, and shorter ICU and hospital stays. These results lend credence to lidocaine's use as a successful perioperative adjuvant in improved recovery procedures following bariatric surgery.

According to our findings, intravenous lidocaine offers better analgesia than a placebo, as demonstrated by noticeably lower VAS scores during the first 24 hours after surgery, both at rest and when coughing. These results are in line with earlier research conducted in various surgical contexts. In a meta-analysis of randomized controlled studies, Ventham et al. found that systemic lidocaine significantly decreased postoperative pain levels after laparoscopic surgery. [11]. Similarly, Selçuk et al. also showed that lidocaine improved analgesia during gynecological laparoscopy. [12], while Tikuišis et al. reported that laparoscopic colon surgery resulted in lower

pain levels. The wide-ranging analgesic potential of systemic lidocaine is demonstrated by the repeatability of these results across surgical populations. [13].

In our trial, lidocaine infusion led to a longer wait to first morphine request and a decrease in overall morphine demand. The bariatric population, which is more susceptible to opioid-related respiratory problems because of decreased pulmonary reserve and the high prevalence of obstructive sleep apnea, benefits greatly from this opioid-sparing effect. Lidocaine may help this susceptible group recover more quickly and safely by reducing opioid exposure. Similarly, De Oliveira et al. showed that bariatric patients receiving lidocaine infusion had better recovery outcomes and used fewer opioids. [14].

In addition to reducing pain, lidocaine was linked to improved recovery following surgery, including a quicker bowel movement and flatus passage. These results are in line with the initial hypothesis made by Rimback et al. that intravenous lidocaine would hasten the recovery of gastrointestinal function following open abdominal surgery. [15]. Trending theories about the mechanisms include anti-inflammatory effects, reduced sympathetic reflexes, and direct excitatory action on intestinal smooth muscle.[14]. Our results reinforce these hypotheses in the context of laparoscopic bariatric surgery, where early gastrointestinal recovery is critical for patient outcomes.

Lidocaine infusion was generally safe, with only two participants experiencing moderate toxicity symptoms (metallic taste) that cleared after they were removed from the research. There were no serious difficulties observed. Previous research has shown that lidocaine at doses of 1-2 mg/kg/h is safe and well-tolerated in perioperative settings. [16]. Our findings confirm that systemic lidocaine can be safely administered in morbidly obese patients when dosing is calculated according to ideal body weight and patients are closely monitored.

In spite of this study's randomized, double-blind design, standardized perioperative protocols, and the inclusion of numerous clinically relevant outcomes, limitations must be addressed. The sample size was limited and conducted at a single location, which may restrict generalizability. Furthermore, long-term effects beyond the immediate postoperative period were not evaluated. Larger multicenter trials are needed to confirm these findings and investigate the role of lidocaine in accelerated recovery after surgery (ERAS) pathways in bariatric populations.

Given the rising prevalence of obesity and the increased demand for bariatric surgery, initiatives to improve recovery and reduce opioid use are critical. Our findings indicate that systemic lidocaine infusion is a potential, cost-effective, and safe addition to multimodal analgesic strategies for bariatric surgery. Adding lidocaine to perioperative treatment may lead to higher patient satisfaction, fewer problems, and shorter hospital stays.

Conclusion

For morbidly obese patients following laparoscopic bariatric surgery, systemic lidocaine infusion dramatically improved recovery outcomes, decreased the need for opioids, and improved postoperative analgesia. There were relatively mild, self-limiting adverse effects, indicating that the intervention was safe. To improve patient outcomes and lessen dependency on opioids, these data imply that intravenous lidocaine is a useful complement to multimodal analgesia and could be included in improved recovery procedures following bariatric surgery.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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