RESEARCH

Comparison of the Effects of Continuous Infusion of Fentanyl 0.7 mcg/kgBW/hour versus Lidocaine 1.5 mg/kgBW/hour on Post-Anesthesia Recovery Quality Using QoR-40 Scoring in Laparotomy Surgery

Sherwin[*], Rr Sinta Irina[✉**], Andriamuri Primaputra Lubis[**]

[*]Faculty of Medicine, Universitas Sumatera Utara/Adam Malik Hospital, Medan, Indonesia
[**]Department of Anesthesiology and Intensive Care, Faculty of Medicine, Universitas Sumatera Utara/Adam Malik Hospital, Medan, Indonesia

[✉]Correspondence: sinta.irina@usu.ac.id

ABSTRACT

Background: Postoperative recovery quality is a critical measure of anesthetic effectiveness, particularly in major surgeries such as laparotomy. Both fentanyl and lidocaine are used in multimodal analgesia, but their comparative efficacy on recovery quality remains underexplored.

Objectives: To evaluate and compare the impact of continuous intravenous infusions of fentanyl as well as lidocaine on the quality of postoperative recovery in laparotomy patients undergoing general anesthesia, utilizing the quality of recovery-40 (QoR-40) score as the evaluation instrument.

Methods: This double-blind randomized controlled trial (RCT) included 40 patients undergoing laparotomy at Adam Malik Hospital, Medan. Subjects were randomly allocated to receive either fentanyl (0.7 mcg/kg/h) or lidocaine (1.5 mg/kg/h) infusion postoperatively. QoR-40 scores were assessed 24 hours post-surgery. Pain scores and rescue analgesia requirements were also evaluated.

Results: Subjects in the fentanyl group had substantially higher QoR-40 scores (173.35 ± 41.764) than those in the lidocaine group (148.95 ± 25.362; p = 0.0001). Fentanyl was superior in comfort and pain control. Rescue analgesia was needed less frequently and later in the fentanyl group (p = 0.0001).

Conclusion: Fentanyl infusion substantially improved postoperative recovery quality more effectively than lidocaine in patients undergoing laparotomy, particularly in pain management and comfort.

Keywords: fentanyl; general anesthesia; laparotomy; lidocaine; postoperative recovery; QoR-40

INTRODUCTION

Despite major advancements in anesthesia safety, postoperative complications following general anesthesia are still common. Patients often experience issues like nausea, vomiting, sore throat, and muscle aches, seemingly minor problems that can nonetheless delay recovery and a return to daily life.[1]

In Indonesia, laparotomy procedures account for about 32% of all surgeries, and managing the pain that follows remains a significant challenge. Studies report that 30.4% of patients experience severe postoperative pain, while 78% report mild to moderate levels.[2,3] In addition to impeding healing right away, poor pain management raises the likelihood of long-term opiate usage and chronic pain disorders, which can have a detrimental effect on the quality of life of a patient.[3]

Fentanyl is widely used for its fast-acting pain relief, thanks to its high lipid solubility. However, it also carries risks such as respiratory depression, urinary retention, and gastrointestinal side effects that can extend hospital stays.[4] In contrast, intravenous lidocaine, though traditionally a local anesthetic, offers systemic benefits. It has proved demonstrated to exhibit anti-inflammatory as well as analgesic properties, as well as to reduce opioid consumption, enhance gastrointestinal function, and abbreviate the duration of hospitalisation.[5,6,7]

To evaluate recovery from a more holistic perspective, clinicians are increasingly turning to the quality of recovery-40 (QoR-40) questionnaire, a tool that measures both physical and emotional aspects of recovery.[8,9] Although lidocaine has been linked to improved perioperative outcomes, direct comparisons of its effects on overall recovery quality versus fentanyl remain limited.[10]

METHOD

This research was executed as a double-blind randomized controlled trial (RCT) employing a comparative analytical framework. The primary objective was to assess as well as compare the impacts of continuous intravenous infusions of fentanyl as well as lidocaine on the quality of postoperative recovery in patients undergoing laparotomy under general anesthesia, as evaluated by the QoR-40 questionnaire. The study was conducted at Adam Malik Hospital, Medan, Sumatera Utara, subsequent to authorization from the Health Research Ethics Committee of Universitas Sumatera Utara (106/KEPK/USU/2025).

Adults between the ages of 18 as well as 65 who were scheduled for an elective laparotomy under general anaesthesia with endotracheal intubation made up the research population. Participants who gave written informed permission and were categorised as American Society of Anaesthesiologists (ASA) physical status I or II were eligible. Exclusion criteria comprised patients with known hypersensitivity to the study drugs, psychiatric disorders, chronic opioid use, intraoperative hemodynamic instability, delayed extubation, or significant intraoperative alterations to the surgical procedure.

The sample size was calculated based on an expected mean difference in QoR-40 scores of 4.47, with a pooled standard deviation of 4.183. Using a significance level (α) of 0.05 and a statistical power (β) of 80%, the minimum required sample was 17 patients per group. Accounting for a 10% dropout risk, A total of 38 patients were enrolled, with 19 in each group.

Using a web-based randomisation utility (randomizer.org), participants were randomly assigned to either the fentanyl or lidocaine group. To ensure a double-blind design, neither the patients nor the clinicians assessing the outcomes knew which treatment was given. A separate, uninvolved party was responsible for drug preparation and administration.

All patients received a standardized anesthetic induction using fentanyl (2 mcg/kg), propofol (2 mg/kg), and rocuronium (0.6 mg/kg). Anesthesia was sustained with isoflurane in a mixture of 50% oxygen and air. A multimodal strategy was used to address postoperative pain, which comprised IV paracetamol (1 g) as well as ibuprofen (600 mg), administered every six hours. The study groups were classified as follows: (1) Group 1 (fentanyl): Received a continuous infusion of fentanyl at 0.7 mcg/kg/h via syringe pump; (2) Group 2 (lidocaine): Received a continuous infusion of lidocaine at 1.5 mg/kg/h via syringe pump. Rescue fentanyl (1 mcg/kg) was permitted intraoperatively to manage hemodynamic stress and postoperatively if the numeric rating scale (NRS) for pain was ≥7.

The QoR-40 score, which was measured 24 hours following surgery, was the main outcome. Physical comfort, mental health, physical independence, patient support, and pain are the five dimensions in which this score assesses healing. The visual analogue scale (VAS) for measuring intensity of pain, haemodynamic stability, total rescue analgesic usage, and the incidence of adverse events were all considered secondary objectives.

IBM SPSS Statistics for Windows version 26.0 was used for the statistical analysis. The Shapiro-Wilk test was used to evaluate the normality of the data. An independent t-test for normally distributed data and the Mann-Whitney U test for non-normally distributed data were used to analyse continuous variables. The Chi-square test was used to assess categorical variables. Statistical significance was defined as a p-value of less than 0.05.

RESULTS

A total of 40 subjects undergoing elective laparotomy at Adam Malik Hospital, Medan, were recruited for this study. The cohort was divided into a pair of equal groups at random and given infusions of either lidocaine or fentanyl (Table 1).

The statistical analysis revealed that the two groups' fundamental features did not differ significantly, indicating that the sample was distributed evenly. However, when looking at how well the pain was controlled, the group that received fentanyl had much lower scores on the VAS compared to the group that received lidocaine. This finding suggests that fentanyl provided superior immediate postoperative pain control in this study population. Assessment of the QoR-40 was conducted at the 24-hour postoperative mark (Table 2).

The results indicate that the fentanyl group achieved significantly superior scores in the domains of physical comfort and pain management. As a result, the fentanyl group's overall global QoR-40 score was substantially greater than the lidocaine group's ($p < 0.001$). On the other hand, there were no significantly different intergroup differences in terms of patient support, physical independence, or emotional state.

The utilization of rescue analgesics during the first 24 hours after surgery (Table 3). Statistical analysis revealed that patients in the lidocaine arm required rescue analgesia significantly sooner and with greater frequency than those in the fentanyl arm. There were significant differences that favoured the fentanyl group in both the time to first analgesic request and the overall frequency of administration ($p < 0.001$).

Table 1. Patient demographics and baseline data

Variable	Drug	
	Fentanyl (n=20)	Lidocaine (n=20)
Age (Year)	42.45 ± 11.923	40.75 ± 11.461
Body weight (kg)	57 ± 11.253	56.2 ± 15.66
Height (cm)	157.35 ± 7.199	160.95 ± 6.557
Gender		
Male	3 (7.5%)	6 (15%)
Female	17 (42.5%)	14 (35%)
PS ASA		
PS ASA I	9 (22.5%)	11 (27.5%)
PS ASA II	11 (27.5%)	9 (22.5%)
Type of Surgery		
Digestive	7 (35%)	6 (30%)
Gynecology	12 (60%)	11 55%)
Oncology	1 (5%)	3 (15%)
Visual analogue scale	1.85 ± 0.745	4.8 ± 0.833

Table 2. QoR-40 scores between groups

Score QoR-40	Fentanyl	Lidocaine	p-*value*
Physical comfort	49.35 ± 5.696	32.55 ± 12.479	0.001
Emotional state	32.3 ± 2.105	32.55 ± 1.986	0.701
Patient support	18.7 ± 1.129	18.65 ± 1.040	0.05
Physical independence	22.8 ± 2.067	23 ± 2	0.758
Pain	59.55 ± 5.934	42.2 ± 13.364	0.001
Score QoR-40	173.35 ± 41.764	148.95 ± 25.362	0.0001

Table 3. Rescue analgesia requirements

Rescue Analgesia	Fentanyl	Lidocaine	p-value
Time to rescue analgesia (hour)	1.3 ± 0.4701	0.2 ± 0.523	0.0001
Number of rescue analgesics	0.15 ± 0.366	1.6 ± 0.598	0.0001

DISCUSSION

The results of this study clearly demonstrate that continuous infusion of fentanyl offers a better quality of postoperative recovery than intravenous lidocaine for patients undergoing laparotomy. This conclusion is supported by significantly higher QoR-40 scores in the fentanyl group, particularly in the areas of pain relief and physical comfort, both critical components of overall recovery.[11,12]

Pharmacologically, this difference is likely due to the way fentanyl works. As a strong μ-opioid receptor agonist, fentanyl provides effective relief for moderate to severe surgical pain. In

comparison, lidocaine, while beneficial through its sodium channel blockade and anti-inflammatory effects, may not deliver the same level of pain control in this type of major surgery.[13-16]

Interestingly, while fentanyl was more effective in physical domains, there were no significant differences between the groups in terms of emotional state, physical independence, or patient support. Non-pharmacological variables may have a greater impact on certain specific elements of recovery, including nursing care quality, emotional support, and the patient's psychosocial environment, rather than the choice of analgesic drug.[17-20]

Another key finding was the difference in rescue analgesia requirements. Patients in the fentanyl group needed fewer doses of additional pain relief, and those who did require extra medication did so later than patients in the lidocaine group. This reinforces fentanyl's stronger analgesic profile and its effectiveness in maintaining comfort during the first 24 hours post-surgery.[21,22] But it's crucial to weigh these advantages against the known dangers of opioid-related side effects, such as constipation and respiratory depression, which call for constant observation.[23]

On the other hand, lidocaine still holds value, especially in surgeries where faster return of bowel function, reduction of inflammation, and shorter hospital stays are clinical priorities. These benefits make it a useful component in enhanced recovery after surgery (ERAS) protocols, even if its impact on immediate postoperative comfort is not as strong as fentanyl's.[24-27]

While the QoR-40 questionnaire is a well-validated tool for assessing recovery across multiple domains, one limitation of this study was the absence of long-term pain tracking using the VAS.[28] Future studies could explore whether combining fentanyl and lidocaine in a multimodal analgesia approach might offer even better recovery outcomes, enhancing pain relief while minimizing opioid-related side effects.[29]

CONCLUSION

In conclusion, our findings demonstrate that for patients undergoing laparotomy, the continuous administration of fentanyl results in a superior quality of postoperative recovery compared to intravenous lidocaine. This advantage is evidenced by significantly higher aggregate QoR-40 scores in the fentanyl group. Specifically, fentanyl showed greater efficacy in optimizing physical comfort and pain management, underscoring its utility in enhancing recovery trajectories following general anesthesia.

REFERENCES

1. Lone PA, Wani NA, Ain Q ul, Heer A, Devi R, Mahajan S. Common postoperative complications after general anesthesia in oral and maxillofacial surgery. Natl J Maxillofac Surg. 2021;12(2):206–10.
2. Widayati DS, Firdaus AD, Handian FI. The Relationship Between Level of Knowledge About Early Mobilization with Pain Intensity of Post Laparotomy Patients. The Journal of Palembang Nursing Studies. 2022 May 5;1(2):28-33.

3. Toro MM, John S, Faruqui AR. Pattern of use of analgesics in post-operative pain management in adults undergoing laparotomy surgery: a prospective observational study. International Surgery Journal. 2018 Jan 25;5(2):662-7.
4. Hontoir S, Saxena S, Gatto P, Khalife M, Ben Aziz AM, Paesmans M, et al. Opioid-free anesthesia: what about patient comfort? A prospective, randomized, controlled trial. Acta Anaesthesiol Belg. 2016;67(4):183–90.
5. Estebe J-P, Intravenous lidocaine. Best Practice & Research Clinical Anaesthesiology. (2017), doi: 10.1016/j.bpa.2017.05.005
6. Song X, Sun Y, Zhang X, Li T, Yang B. Effect of perioperative intravenous lidocaine infusion on postoperative recovery following laparoscopic Cholecystectomy-A randomized controlled trial. International Journal of Surgery. 2017; 45:8-13
7. Nakhli M S, Kahloula M, Guizania T, Zedinib C, Chaoucha A, Naijaa W. Intravenous lidocaine as adjuvant to general anesthesia in renal surgery. Libyan Journal of Medicine. 2018; 13:1-8
8. HarijantoA E, Wijaya AA, Handayani D. Uji kesahihan dan keandalan qor-40 versi indonesia sebagai instrumen untuk menilai kualitas pemulihan Paska-anestesia umum. Majalah Anestesia dan Critical Care. 2016;34(2).
9. Alkandari Z, Kind SL, Spahn DR, Biro P. Early post-anaesthesia recovery parameters – a prospective observational study. Rom J Anaesth Intensive Care. 2015 Oct;22(2):103–10.
10. Guo Q, Ma M, Yang Q, Yu H, Wang X, Wu C, Li R. Effects of different sedatives/analgesics on stress responses in patients undergoing craniotomy and bone flap decompression. Journal of International Medical Research. 2021 Dec;49 (12):03000605211062789.
11. Fuica R, Krochek C, Weissbrod R, Greenman D, Freundlich A, Gozal Y. Reduced postoperative pain in patients receiving nociception monitor guided analgesia during elective major abdominal surgery: a randomized, controlled trial. J Clin Monit Comput. 2023;37(2):481-91.
12. Lee SY, Kim DH, Park JH, Chae MS. Impact of intraoperative nefopam on postoperative pain, opioid use, and recovery quality with parietal pain block in single-port robotic cholecystectomy: a prospective randomized controlled trial. Medicina (Kaunas). 2024;60(6):848.
13. Lv X, Li X, Guo K, Li T, Yang Y, Lu W, et al. Effects of systemic lidocaine on postoperative recovery quality and immune function in patients undergoing laparoscopic radical gastrectomy. Drug Des Devel Ther. 2021:1861-72.

14. Jawwad M, Dar DNA, Khan RFU, Chaudhry A, Arkam F, Rao AG, et al. Comparative effectiveness of epidural analgesia and intravenous lidocaine for postoperative pain in major abdominal surgery: a systematic review and meta-analysis. Anesthesiol Res Pract. 2025;2025(1):9822744.
15. Sethuraman RM. Comparative study of continuous surgical transverse abdominis plane block versus intravenous fentanyl infusion for postoperative pain management in open nephrectomy. 2023.
16. Gupta S, Attal P, Mehta N, Saini H, Banerjee S. Comparison of dose–response to two different doses of intravenous lidocaine for analgesia in patients undergoing elective laparoscopic cholecystectomy under general anesthesia. Ain-Shams J Anesthesiol. 2023;15(1):89.
17. Verhoeven JG, Horstink MMB, Jeekel J, Klimek M. The effect of unimodal, non-pharmacological, preoperative psychological prehabilitation interventions on preoperative anxiety and stress: a systematic review. Curr Anesthesiol Rep. 2024;14(2):330-8.
18. Tazreean R, Nelson G, Twomey R. Early mobilization in enhanced recovery after surgery pathways: current evidence and recent advancements. J Comp Eff Res. 2021;11(2):121-9.
19. Mithany RH, Daniel N, Shahid MH, Aslam S, Abdelmaseeh M, Gerges F, et al. Revolutionizing surgical care: the power of enhanced recovery after surgery (ERAS). Cureus. 2023;15(11).
20. Zhang L, Hao LJ, Hou XL, Wu YL, Jing LS, Sun RN. Preoperative anxiety and postoperative pain in patients with laparoscopic hysterectomy. Front Psychol. 2021;12:727250.
21. Abdellatif MK, Ibrahim TH. Intraoperative infusion of lidocaine 2% reduces postoperative fentanyl requirements for pain control in renal transplantation surgery. Ain-Shams J Anesthesiol. 2020;12(1).
22. Bi Y, Ye Y, Ma J, Tian Z, Zhang X, Liu B. Effect of perioperative intravenous lidocaine for patients undergoing spine surgery: a meta-analysis and systematic review. Medicine (Baltimore). 2020;99(48):e23332.
23. Park I, Hong S, Kim SY, Hwang JW, Do SH, Na HS. Reduced side effects and improved pain management by continuous ketorolac infusion with patient-controlled fentanyl injection compared with single fentanyl administration in pelviscopic gynecologic surgery: a randomized, double-blind, controlled study. Korean J Anesthesiol. 2024;77(1):77-84.

24. Lee IWS, Schraag S. The use of intravenous lidocaine in perioperative medicine: anaesthetic, analgesic and immune-modulatory aspects. J Clin Med. 2022;11(12):3543.
25. Foo I, Macfarlane AJR, Srivastava D, Bhaskar A, Barker H, Knaggs R, et al. The use of intravenous lidocaine for postoperative pain and recovery: international consensus statement on efficacy and safety. Anaesthesia. 2021;76(2):238-50.
26. Rodriguez G, Whiting E, Lee J. ERAS protocols and multimodal pain management in surgery. In: Pain Management—From Acute to Chronic and Beyond. IntechOpen; 2023.
27. Paterson H, Vadiveloo T, Innes K, Balfour A, Atter M, Stoddart A, et al. Intravenous lidocaine for gut function recovery in colonic surgery: A randomized clinical trial. JAMA. 2025;333(1):39-48.
28. Mishra R, Dhole S, Dutta D. Development of an objective pain scoring system and its correlation with visual analogue scale for evaluation of postoperative pain in patients undergoing elective off pump coronary artery bypass grafting surgery: a prospective observational study. J Surg Anesth Res. 2025;SRC/JSAR-286:2-7. doi:10.47363/JSAR/2025(6)244.
29. Geng Z, Bi H, Zhang D, Xiao C, Song H, Feng Y, et al. The impact of multimodal analgesia based enhanced recovery protocol on quality of recovery after laparoscopic gynecological surgery: a randomized controlled trial. BMC Anesthesiol. 2021;21(1):179.