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THE ROLE OF LIDOCAINE INFUSION IN REDUCING POSTOPERATIVE PAIN AFTER LAPAROSCOPIC COLORECTAL SURGERY: A RANDOMIZED TRIAL

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Abstract

Postoperative pain management remains a critical component in enhancing recovery after laparoscopic colorectal surgery. Intravenous lidocaine infusion has emerged as a potential adjunct for analgesia, yet its efficacy in this context requires further elucidation. This randomized, double-blind, placebo-controlled trial aimed to assess the impact of intraoperative intravenous lidocaine infusion on postoperative pain and opioid consumption in patients undergoing elective laparoscopic colorectal resections. Eighty patients were randomly assigned to receive either a bolus of lidocaine (1.5 mg/kg) followed by continuous infusion (2 mg/kg/h) during surgery or an equivalent volume of saline. Postoperative pain was evaluated using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours post-surgery, and opioid consumption was recorded. The lidocaine group demonstrated significantly lower VAS scores at all time points ($p < 0.05$) and reduced total opioid consumption within the first 24 hours postoperatively (mean difference: 15 mg morphine equivalents; $p = 0.01$). No significant adverse effects were observed. These findings suggest that intraoperative intravenous lidocaine infusion effectively reduces postoperative pain and opioid requirements in laparoscopic colorectal surgery, offering a viable strategy for enhanced recovery protocols.

Keywords: Intravenous lidocaine, postoperative pain, laparoscopic colorectal surgery

Introduction

Laparoscopic colorectal surgery has become the standard approach for various colorectal pathologies due to its minimally invasive nature, leading to reduced postoperative pain, shorter hospital stays, and faster recovery compared to open surgery. Despite these advantages, effective postoperative pain management remains a challenge, as inadequate control can impede recovery, increase morbidity, and prolong hospitalization.

Traditionally, opioids have been the cornerstone of postoperative analgesia; however, their use is associated with adverse effects such as nausea, vomiting, ileus, and respiratory depression, which can negate the benefits of minimally invasive surgery.[1-3]

In recent years, there has been a paradigm shift towards multimodal analgesia strategies that aim to minimize opioid consumption while providing effective pain relief. Among these strategies, intravenous lidocaine infusion has garnered attention for its analgesic, anti-inflammatory, and anti-hyperalgesic properties. Lidocaine, a local anesthetic, when administered systemically, has been shown to modulate pain pathways and reduce central sensitization, thereby potentially improving postoperative outcomes.[4-6]

Several studies have investigated the role of intravenous lidocaine in various surgical settings. For instance, a randomized controlled trial demonstrated that intravenous lidocaine infusion during laparoscopic colectomy significantly reduced postoperative pain scores and opioid consumption without increasing adverse events. Another study reported that patients receiving lidocaine infusion had improved quality of recovery scores and earlier return of bowel function. These findings suggest that lidocaine infusion could be a valuable component of enhanced recovery after surgery (ERAS) protocols.[7-9]

However, the evidence regarding the efficacy of intravenous lidocaine in laparoscopic colorectal surgery remains inconclusive. Some meta-analyses have reported no significant benefits in terms of pain reduction or opioid sparing, highlighting the need for further high-quality randomized controlled trials to clarify its role. Moreover, variations in study designs, dosing regimens, and outcome measures have contributed to the heterogeneity of results.[10-12]

Given the potential benefits and existing uncertainties, this study aimed to evaluate the effectiveness of intraoperative intravenous lidocaine infusion in reducing postoperative pain and opioid consumption in patients undergoing elective laparoscopic colorectal surgery. By employing a rigorous randomized, double-blind, placebo-controlled design, this trial seeks to provide robust evidence to inform clinical practice and optimize postoperative analgesia strategies.

Methodology

This prospective double-blind, placebo-controlled trial was conducted at Social Security Hospital a tertiary care hospital between January 2021 to December 2022. The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from all participants. Eighty adult patients (aged 18–65 years) scheduled for elective laparoscopic colorectal surgery under general anesthesia were enrolled. Inclusion criteria encompassed American Society of Anesthesiologists (ASA) physical status I–III and body mass index (BMI) between 18.5 and 30 kg/m². Exclusion criteria included known allergy to lidocaine, significant hepatic or renal impairment, chronic opioid use, and pregnancy.

Sample size calculation was performed using Epi Info software, based on a previous study that reported a mean difference of 1.5 in VAS scores between groups, with a

standard deviation of 2.0. To achieve a power of 80% and a significance level of 0.05, a minimum of 35 patients per group was required. Considering potential dropouts, 40 patients were recruited for each group.

Participants were randomly assigned to either the lidocaine group (Group L) or the placebo group (Group P) using a computer-generated randomization sequence. Group L received an intravenous bolus of lidocaine 1.5 mg/kg over 10 minutes before induction of anesthesia, followed by a continuous infusion at 2 mg/kg/h until the end of surgery. Group P received an equivalent volume of normal saline following the same protocol. Anesthesia was induced and maintained with standard agents, and all patients received standardized intraoperative and postoperative care, including multimodal analgesia with acetaminophen and nonsteroidal anti-inflammatory drugs.

Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours after surgery. Opioid consumption was recorded as the total amount of morphine equivalents administered within the first 24 hours postoperatively. Adverse events, including nausea, vomiting, and signs of lidocaine toxicity, were monitored and documented.

Results

Table 1: Demographic and Clinical Characteristics

Parameter	Group L (n=40)	Group P (n=40)	p-value
Age (years)	52.3 ± 10.2	51.7 ± 9.8	0.75
Gender (M/F)	22/18	20/20	0.65
BMI (kg/m²)	24.5 ± 2.8	24.8 ± 3.1	0.68
ASA I/II/III	10/25/5	12/23/5	0.88
Duration of surgery (min)	145.2 ± 30.5	147.8 ± 28.9	0.72

Explanation: No significant differences were observed between the two groups regarding demographic and clinical characteristics, ensuring comparability.

Table 2: Postoperative Pain Scores (VAS)

Time Post-Surgery	Group L (VAS)	Group P (VAS)	p-value
2 hours	3.2 ± 1.1	4.5 ± 1.3	0.001
6 hours	2.8 ± 1.0	4.2 ± 1.2	0.001
12 hours	2.5 ± 0.9	3.8 ± 1.1	0.001
24 hours	2.0 ± 0.8	3.2 ± 1.0	0.001

Explanation: Group L exhibited significantly lower VAS scores at all time points compared to Group P, indicating better pain control.

Table 3: Postoperative Opioid Consumption

Parameter	Group L	Group P	p-value
Total morphine equivalents (mg)	18.5 ± 5.2	33.7 ± 6.8	0.001
Patients requiring rescue analgesia (%)	25%	60%	0.002

Explanation: Group L had significantly lower total opioid consumption and fewer patients required rescue analgesia compared to Group P.

Discussion

The present study demonstrates that intraoperative intravenous lidocaine infusion significantly reduces postoperative pain and opioid consumption in patients undergoing laparoscopic colorectal surgery. These findings align with previous research indicating the analgesic benefits of systemic lidocaine administration. For instance, a randomized controlled trial reported that lidocaine infusion during laparoscopic colectomy led to lower pain scores and reduced opioid requirements without increasing adverse events.[13-15]

The analgesic effect of lidocaine is attributed to its ability to inhibit sodium channels, thereby stabilizing neuronal membranes and reducing ectopic discharges. Additionally, lidocaine possesses anti-inflammatory properties, which may contribute to decreased postoperative pain and improved recovery. A study investigating the impact of lidocaine on inflammatory markers found that patients receiving lidocaine had lower levels of C-reactive protein postoperatively, suggesting an attenuated inflammatory response.[16-18]

Moreover, the opioid-sparing effect observed in this study is clinically significant, as it may reduce the incidence of opioid-related adverse effects such as nausea, vomiting, and ileus, which can delay recovery. Enhanced Recovery After Surgery (ERAS) protocols emphasize the importance of minimizing opioid use to facilitate early mobilization and discharge. Incorporating lidocaine infusion.[19-20]

The present randomized controlled trial provides compelling evidence supporting the efficacy of intraoperative intravenous lidocaine infusion in reducing postoperative pain and opioid consumption in patients undergoing laparoscopic colorectal surgery. These findings are consistent with previous studies that have demonstrated the analgesic benefits of systemic lidocaine administration in various surgical settings. For instance, Ahn et al. reported significantly lower VAS scores and reduced fentanyl consumption in patients receiving lidocaine infusion during laparoscopic colectomy. The analgesic effect of lidocaine is primarily attributed to its ability to inhibit voltage-gated sodium channels, thereby stabilizing neuronal membranes and reducing ectopic discharges. Additionally, lidocaine possesses anti-inflammatory properties, which may contribute to decreased postoperative pain and improved recovery. A study by Thomas et al. demonstrated that perioperative lidocaine infusion significantly reduced postoperative opioid use in patients undergoing laparoscopic colectomy within an ERAS protocol. (SAGE Journals)

Moreover, the opioid-sparing effect observed in this study is clinically significant, as it may reduce the incidence of opioid-related adverse effects such as nausea, vomiting, and ileus, which can delay recovery. Enhanced Recovery After Surgery (ERAS) protocols emphasize the importance of minimizing opioid use to facilitate early mobilization and discharge. Incorporating lidocaine infusion into ERAS pathways could enhance patient outcomes by providing effective analgesia while mitigating opioid-related complications.

The findings of this study also align with the results of a meta-analysis by Mustafa et al., which concluded that intravenous lidocaine infusion may offer adjunctive benefits in postoperative pain management and gastrointestinal function recovery following laparoscopic colorectal surgery. However, the meta-analysis also noted that the impact of lidocaine on surgical outcomes remains inconclusive, highlighting the need for further high-quality randomized controlled trials to clarify its role.

In terms of safety, the current study observed no significant adverse effects associated with lidocaine infusion, corroborating the findings of previous research indicating the safety of systemic lidocaine administration within the recommended dosage range. Nevertheless, clinicians should remain vigilant for potential signs of lidocaine toxicity, particularly in patients with hepatic or renal impairment, as these conditions may affect lidocaine metabolism and excretion.

The study's methodology, including the use of a standardized anesthesia protocol and the assessment of pain using the Visual Analog Scale at multiple postoperative time points, strengthens the validity of the findings. Furthermore, the inclusion of a placebo-controlled design and the blinding of both patients and investigators minimize the risk of bias, enhancing the reliability of the results.

Despite these strengths, certain limitations should be acknowledged. The study's sample size, while adequately powered to detect differences in pain scores and opioid consumption, may not be sufficient to assess less common adverse events or long-term outcomes. Additionally, the study was conducted at a single center, which may limit the generalizability of the findings to other settings or patient populations. Future multicenter studies with larger sample sizes are warranted to confirm these results and to explore the potential benefits of lidocaine infusion on other postoperative outcomes, such as length of hospital stay and time to return of bowel function.

Conclusion

Intraoperative intravenous lidocaine infusion significantly reduces postoperative pain and opioid consumption in patients undergoing laparoscopic colorectal surgery, offering a safe and effective adjunct to multimodal analgesia strategies. This study addresses a critical gap in the literature by providing high-quality evidence supporting the incorporation of lidocaine infusion into ERAS protocols. Future research should focus on elucidating the long-term benefits and optimal dosing regimens of lidocaine infusion to further enhance postoperative recovery and patient outcomes.

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