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Research Article

Effect of Intravenous Lignocaine Infusion on Intraoperative Hemodynamic Stability in Patients Undergoing Laparoscopic Cholecystectomy: A Randomized Controlled Trial

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ABSTRACT

Background: Laparoscopic cholecystectomy, though minimally invasive, is associated with significant hemodynamic fluctuations during laryngoscopy, pneumoperitoneum, and extubation. Intravenous lignocaine, an amide local anesthetic with membrane-stabilizing properties, has been suggested as an adjunct for blunting stress responses.

Objective: To evaluate the efficacy of intravenous lignocaine infusion in attenuating intraoperative hemodynamic responses in patients undergoing laparoscopic cholecystectomy.

Methods: In this prospective, double-blind, randomized controlled trial, 70 ASA I–II patients were divided into two groups (n=35 each). Group L received lignocaine (1.5 mg/kg bolus + 2 mg/kg/hr infusion), and Group C received saline. Hemodynamic parameters (SBP, DBP, MAP, HR, SpO_2) were monitored perioperatively.

Results: Lignocaine significantly reduced systolic and mean arterial pressures at intubation and extubation ($p<0.01$). MAP was consistently lower intraoperatively in Group L. HR and SpO_2 remained comparable across groups.

Conclusion: Intravenous lignocaine infusion attenuates intraoperative hemodynamic responses during laparoscopic cholecystectomy, supporting its use as a safe and effective adjuvant for perioperative stability.

Keywords: Laparoscopic cholecystectomy, Intravenous lignocaine, Hemodynamic stability, Intubation, Pneumoperitoneum.

INTRODUCTION

Laparoscopic cholecystectomy has become the gold standard for treating symptomatic gallstones, offering shorter hospitalization, early ambulation, and reduced morbidity compared to open procedures [1,2]. Despite these advantages, the procedure is associated with marked hemodynamic fluctuations during induction, intubation, pneumoperitoneum, and extubation. These fluctuations occur due to sympathetic stimulation and raised intra-abdominal pressure, leading to tachycardia and hypertension, which may pose risks for patients with limited cardiovascular reserve [3].

To counter these changes, various pharmacological agents have been investigated, including beta-blockers, opioids, and vasodilators. While effective, they often carry limitations such as bradycardia, respiratory depression, or prolonged recovery [4]. Therefore, safer alternatives are needed.

Intravenous lignocaine, traditionally used as a local anesthetic and antiarrhythmic, has demonstrated additional properties such as suppression of sympathetic activity, attenuation of stress responses, and membrane stabilization. Its mechanism involves sodium channel blockade, reduced catecholamine release, and central modulation of nociceptive pathways [5–7].

Several studies have shown the efficacy of intravenous lignocaine in attenuating cardiovascular responses to intubation and extubation, as well as in maintaining intraoperative stability [5–7]. However, evidence specific to laparoscopic

cholecystectomy is still evolving. This study was conducted to evaluate whether intravenous lignocaine infusion provides superior intraoperative hemodynamic stability compared to placebo in patients undergoing laparoscopic cholecystectomy.

MATERIALS AND METHODS

Study Design: Prospective, double-blind, randomized controlled trial conducted at the Department of Anaesthesiology, Sardar Patel Medical College and PBM Associated Group of Hospitals, Bikaner.

Participants: Seventy ASA I–II patients, aged 18–58 years, scheduled for elective laparoscopic cholecystectomy. Exclusion criteria included difficult airway, known allergy to lignocaine, significant comorbidities, and bradycardia (<60 bpm).

Randomization and Intervention: Patients were randomized into two groups (n=35 each). Group L received intravenous lignocaine 1.5 mg/kg bolus followed by 2 mg/kg/hr infusion until end of surgery. Group C received equivalent saline infusion.

Anaesthesia Protocol: Standardized general anesthesia with glycopyrrolate, fentanyl, propofol, succinylcholine, sevoflurane, and vecuronium. Hemodynamic monitoring included systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and SpO_2.

Measurements: Hemodynamic variables were recorded preoperatively, at intubation, at intervals during pneumoperitoneum, and at extubation. The primary outcome was attenuation of hemodynamic response (SBP, DBP, MAP, HR) during intraoperative period.

RESULTS

Baseline demographic characteristics such as age, gender distribution, ASA grade, and surgical duration were comparable between the two groups, with no statistically significant differences (p>0.05). The mean age was 36.2 ± 11.4 years in the lignocaine group and 41.4 ± 10.5 years in the control group, while the proportion of males and females, ASA I/II status, and mean surgical duration (40.8 ± 7.0 vs. 38.6 ± 9.4 minutes) were also similar.

With respect to hemodynamic stability, systolic blood pressure (SBP) showed significant attenuation in the lignocaine group compared to controls. At intubation, the mean SBP was 127.9 ± 10.6 mmHg versus 139.9 ± 15.4 mmHg in the control group (p<0.001). This difference persisted intraoperatively, with SBP at 30 minutes being 111.0 ± 14.9 mmHg in the lignocaine group compared to 125.5 ± 14.6 mmHg in controls (p<0.001). At extubation, SBP remained significantly lower in the lignocaine group (127.4 ± 13.4 vs. 136.3 ± 14.0 mmHg, p=0.009). A similar trend was noted 2 hours postoperatively (117.7 ± 16.4 vs. 126.9 ± 14.6 mmHg, p=0.016).

Mean arterial pressure (MAP) was also better controlled with lignocaine. At intubation, MAP was significantly lower in Group L (96.2 ± 8.1 mmHg) compared to Group C (103.9 ± 11.6 mmHg, p=0.002). During the intraoperative period, this difference persisted, with MAP at 30 minutes being 84.5 ± 13.4 mmHg in the lignocaine group versus 92.4 ± 10.3 mmHg in controls (p=0.008). At extubation, MAP remained significantly lower in the lignocaine group (96.0 ± 10.2 vs. 102.6 ± 9.5 mmHg, p=0.007).

Heart rate (HR) remained comparable between the two groups throughout the perioperative period. Although the control group showed slightly higher values at intubation (92.5 ± 11.5 vs. 88.6 ± 6.1 beats/min) and extubation (91.9 ± 8.6 vs. 88.7 ± 6.2 beats/min), these differences did not reach statistical significance (p>0.05). SpO_2 values were stable and similar across both groups at all intervals.

Table 1. Baseline demographic characteristics

Variable	Lignocaine (n=35)	Control (n=35)	p-value
Age (years)	36.2 ± 11.4	41.4 ± 10.5	0.053
Gender (F/M)	24/11	20/15	0.322
ASA I/II	28/7	27/8	0.814
Surgery duration (min)	40.8 ± 7.0	38.6 ± 9.4	0.254

Table 2. Systolic blood pressure (mmHg) at key time points

Time Point	Lignocaine	Control	p-value
Intubation	127.9 ± 10.6	139.9 ± 15.4	<0.001
30 min intra-op	111.0 ± 14.9	125.5 ± 14.6	<0.001
Extubation	127.4 ± 13.4	136.3 ± 14.0	0.009

2 h post-op	117.7 ± 16.4	126.9 ± 14.6	0.016

Table 3. Mean arterial pressure (mmHg)

Time Point	Lignocaine	Control	p-value
Pre-op	95.8 ± 18.2	100.3 ± 11.2	0.219
Intubation	96.2 ± 8.1	103.9 ± 11.6	0.002
30 min intra-op	84.5 ± 13.4	92.4 ± 10.3	0.008
Extubation	96.0 ± 10.2	102.6 ± 9.5	0.007

Table 4. Heart rate (beats/min)

Time Point	Lignocaine	Control	p-value
Pre-op	87.2 ± 8.2	90.0 ± 9.7	0.192
Intubation	88.6 ± 6.1	92.5 ± 11.5	0.080
30 min intra-op	86.3 ± 9.4	87.4 ± 8.2	0.618
Extubation	88.7 ± 6.2	91.9 ± 8.6	0.076

DISCUSSION

This trial demonstrates that intravenous lignocaine infusion significantly attenuates intraoperative hemodynamic responses in patients undergoing laparoscopic cholecystectomy. Compared to controls, patients in the lignocaine group had consistently lower systolic and mean arterial pressures during intubation, pneumoperitoneum, and extubation, aligning with earlier studies on sympatholytic effects of lignocaine [4, 5,7].

Our findings corroborate those of Tripathi et al. [5] and Ubale et al. [6], who also observed improved stability with pharmacologic modulation. Jain and Khan [7] specifically highlighted the attenuation of intubation/extubation responses with lignocaine, which is consistent with our results. Importantly, no significant adverse effects were reported, supporting its safety profile.

The absence of significant differences in heart rate and SpO_2 suggests lignocaine primarily influences vascular tone and blood pressure rather than chronotropy or oxygenation. This makes it particularly useful in patients at cardiovascular risk, where maintaining stable hemodynamics is crucial.

Thus, intravenous lignocaine infusion appears to be a safe, effective, and inexpensive adjuvant for maintaining intraoperative stability in laparoscopic cholecystectomy.

CONCLUSION

Intravenous lignocaine infusion (1.5 mg/kg bolus followed by 2 mg/kg/hr infusion) effectively attenuates perioperative rises in blood pressure during intubation, pneumoperitoneum, and extubation in laparoscopic cholecystectomy. It represents a safe and effective adjuvant for maintaining intraoperative hemodynamic stability.

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