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Evaluation of the Effect of Intravenous Lidocaine on Propofol Requirements during General Anaesthesia- A Randomized Doubleblinded Study

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Abstract: ***Background: Inadequate general anesthesia results in intraoperative awareness with or without recall and the consequent postoperative morbidity. Bi Spectral Index (BIS) helps the anesthesiologist in assessing the conscious state of the patient and in modifying the dose of anesthetic drugs to maintain an adequate depth of anesthesia. Systemic lidocaine has been used in several studies to know its benefits on the outcome of anesthesia. Having inflammatory-modulating property, it significantly reduces pain and allows rapid discharge. We planned a study to evaluate the effect of intravenous lidocaine in reducing propofol requirements during maintenance of general anesthesia in laparoscopic cholecystectomies Methods randomized double-blinded controlled trial enrolling 40 patients in the study. Informed written consent was obtained from all the patients and they were then randomly allocated into two groups of 20 each, namely Group L (lignocaine)and Group C (control).BIS monitor Pulseoximetry NIBP Capnography (intraoperatively), ECG were measured in both groups ResultsStudy showed that the amount of propofol infused in the lidocaine group, to maintain BIS between 40 and 60 was significantly reduced, and also the intraoperative fentanyl requirements were significantly lower in the lidocaine group. It also significantly maintains the hemodynamic stability throughout the procedure and reduces the intraoperative analgesic requirements in patients undergoing laparoscopic surgeries.***

Keywords: Anesthesia, Lidocaine, Bispectral index, Propofol, Fentanyl

1. Introduction

General anesthesia can be defined as a drug-mediated reversible depression of the central nervous system resulting in the absence of response to and lack of perception of all external stimuli. The various components of anesthesia include unconsciousness, analgesia, amnesia, immobility, and suppression of autonomic responses to noxious stimulation.Consciousness is a complex state that can be divided into two components, namely, arousal and awareness, with both individually blocked by anesthetics. Awareness is the ability to process and store information that can be used to interact with internal or external environment. In contrast, arousal or wakefulness is the state of receptivity to the external environment and is likely mediated through subcortical structures such as the reticular activating system (RAS). An inadequate general anesthesia results in intraoperative awareness with or without recall and the consequent postoperative morbidity.Intraoperative electrophysiological monitoring using Bi Spectral Index (BIS) allows a reproducible, objective and continuous measurement of depth of anesthesia, even during the period when the patient is paralyzed and all reflexes are abolished. BIS monitor consists of a sensing electrode placed on the patient's forehead which reads out the patient's EEG in the form of a non-attributable number in the range of 0 to 100, by means of an integrated custom software. This value helps the anesthesiologist in assessing the conscious state of the patient and in modifying the dose of anesthetic drugs to maintain an adequate depth of anesthesia. Systemic lidocaine infusion has been used in several studies to assess its benefits on the outcome of anesthesia.[1] Having inflammation-modulatory properties, it significantly reduced pain. Similarly, studies have shown that intravenous lidocaine infusion causes a decrease in the minimum alveolar concentration (MAC) of volatile anesthetic agents, thereby decreasing their requirement.[2] There have been some studies postulating the reduction in intravenous anesthetic requirements by using lidocaine infusion.[3] This study aims at evaluating the role of intravenous lidocaine in reducing requirements of propofol during general anesthesia as monitored by the Bi Spectral Index (BIS). The BIS index is maintained between 40 and 60 to maintain an adequate depth of anesthesia, and the anesthetic agents are titrated accordingly.

2. Aim

Evaluate the effect of intravenous lidocaine in reducing propofol requirements during maintenance of general anesthesia in laparoscopic cholecystectomies

3. Materials and Methods

After obtaining institutional ethical committee approval, an informed written consent was obtained from all the patients participating in the study. 40 ASA I and II patients posted for elective laparoscopic cholecystectomy were enrolled in the study.

Inclusion Criteria: ASA I and II status**,** Age 18-60 years of both sex undergoing elective laparoscopic cholecystectomy

Exclusion Criteria: Age <18 and >60 years,unwillingness to participate in the study, Patients with BMI >35, Patients with history of allergic reaction to lidocaine, Patients with history of seizures, drug or alcohol abuse

After obtaining approval from our Government Rajaji Hospital (GRH) ethical committee, we conducted a randomized double-blinded controlled trial enrolling 40 patients in the study. Informed written consent was obtained from all the patients and they were then randomly allocated into two groups of 20 each, namely Group L and Group C.The patients' baseline pulse rate, blood pressure and SpO2 were noted preoperatively outside the operating theatre. No preoperative anxiolytics were given to the patient. Inside the OT, the following monitors were attached: BIS monitor Pulseoximetry NIBP Capnography (intraoperatively), ECGSeparate infusion pumps for either lidocaine or saline prepared by separate staff blinded to the study, were kept ready. After checking the anesthesia machine (Drager workstation), and with all emergency drugs at hand, the procedure was commenced.All patients were premedicated with Inj. Glycopyrrolate sodium 0.2 mg i.v. 15 minutes prior to surgery. All patients were preoxygenated with 100% oxygen and induced with Inj. Fentanyl citrate 2 µg/kg i.v. and Inj. Thiopentone sodium 5 mg/kg i.v. or till BIS drops to 40, and intubation facilitated with Inj. Succinylcholine 1.5-2 mg/kg i.v. and endotracheal tube of size 8.0-8.5 ID for men and 7.0-7.5 ID for women was used. Intubation stress was attenuated with Inj. Lidocaine 1.5 mg/kg i.v. in Group L. Saline was used in Group C. Following intubation, anesthesia was maintained with N2O:O2 at 2:1 and propofol infusion at 50-150 µg/kg/min, which was titrated to maintain the BIS value between 40 and 60. Infusion of lignocaine was started at 2 mg/kg/hr in Group L and in Group C, saline infusion was started. The patients were put on ventilator – controlled mode with tidal volume of 7-10 ml/kg, Respiratory rate of 12-16/minute according to EtCO2, PEEP of 3-5 cmH2O.Parameters monitored: Pulse rate ,Blood pressure, SpO2, BIS, EtCO2 , Rate of infusion of propofol Statistical analysis of the data was done using Student t test and Chi square test.

4. Results

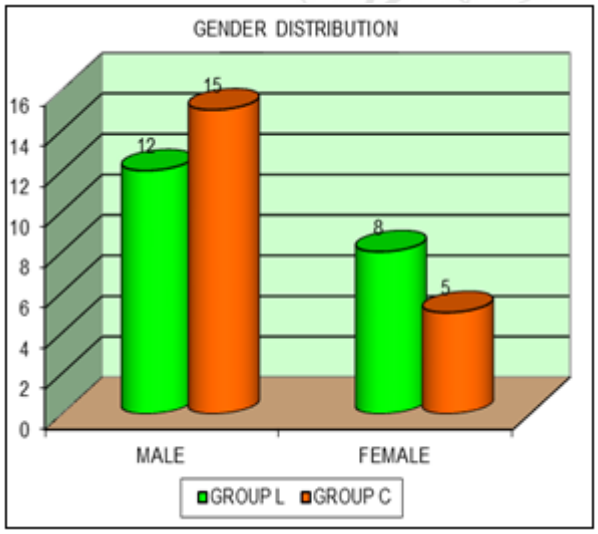

Figure 1: Gender Distribution

The two groups, Group L (lignocaine) and Group C (control) were comparable with respect to the demographic data like age, sex, weight. Duration of surgery was also comparable between the two groups. Duration of surgery was also comparable between the two groups. The flow rates were also same throughout the procedure and intraoperatively, the BIS value was maintained between 40 and 60, with average BIS value showing no significance. The study group was blinded to the investigator, and the hemodynamic parameters like heart rate, blood pressure and SpO2 were monitored.

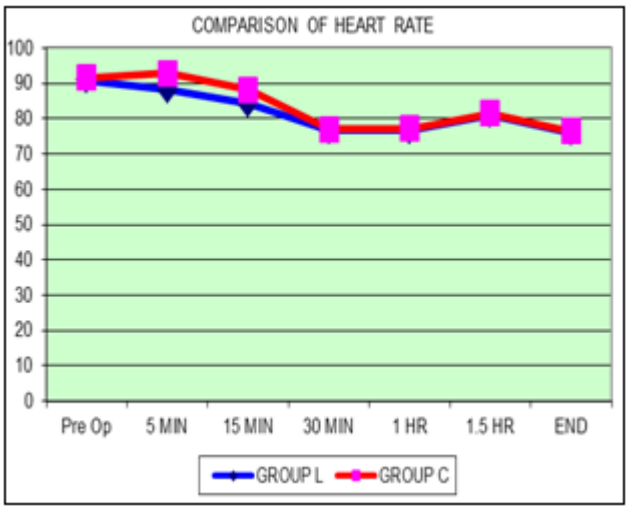

Figure 2: Comparison of Heart Rate

The mean heart rate shows significant decrease at 5 minutes and 15 minutes after intubation, which could be explained by the attenuation of pressor response by lignocaine. Thereafter, there is no significant change in heart rate in the two groups. Only the mean heart rate showed a significant fall in the lidocaine group at 5 and 15 minutes after intubation, suggesting the pressor attenuation action of lidocaine. Otherwise, all other hemodynamic variables did not show any statistical difference between the two groups, suggesting that lidocaine does not produce great hemodynamic stability

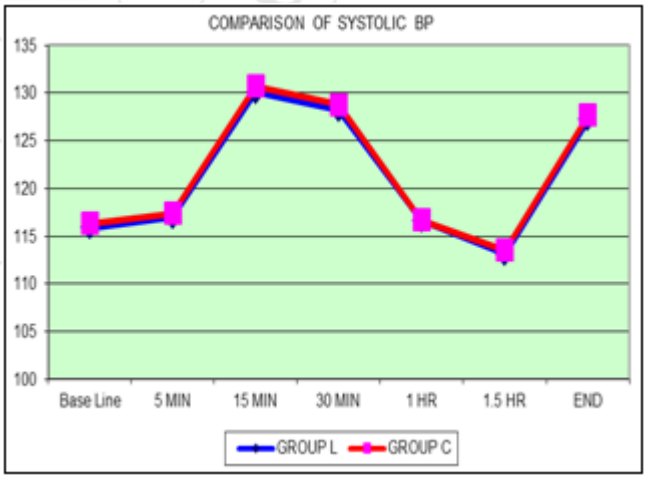

Figure 3: Comparison of Systolic Blood Pressure

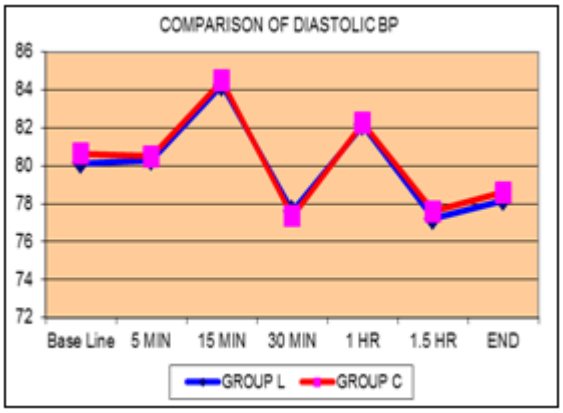

Figure 4: Comparison of Diastolic Blood Pressure

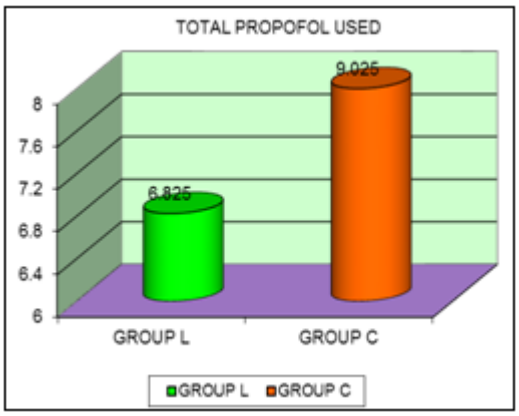

Figure 6: Comparision of Propofol Used Two Groups

Table 1: Bis Value in the Two Groups

BIS	GROUP L		GROUP C		P
	MEAN	SD	MEAN	SD	
Base Line	54.65	6.175	55.15	5.994	0.796
5 MIN	54.6	5.897	55.2	5.512	0.741
15 MIN	56.2	3.651	56.75	4.089	0.968
30 MIN	56.01	6.349	56.7	6.562	0.884
1 HR	57.4	4.441	57.75	4.621	0.917
1.5 HR	55.85	4.626	56.65	4.771	0.894
END	56.8	4.503	57.75	4.587	0.972

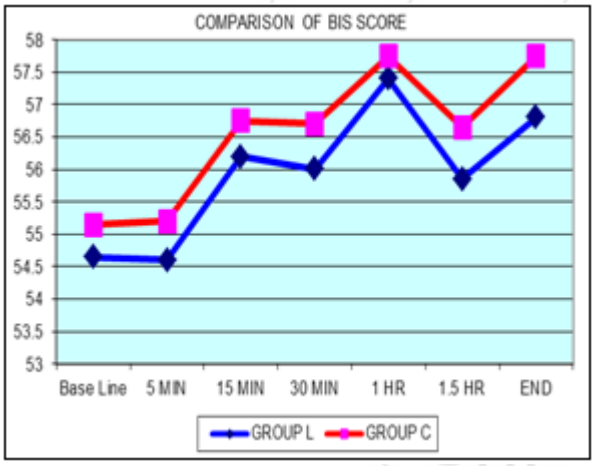

Figure 5: Comparison of Bis Score

The intraoperative BIS value is maintained the same in the two groups at the range of 40 to 60. This is the ideal BIS for surgical anesthesia.

Table 2: Propofol Used in the Two Groups

Total Propofol Used (mg)	Group L		Group C		P
	Mean	SD	Mean	SD	
Mean	6.825	1.48	9.025	1.642	< 0.001 Sig

Table 3: Fentanyl Citrate Used in the Two Groups

Total Fentanyl Used (µg)	Group L		Group C		P
	MEAN	SD	MEAN	SD	
Mean	111.5	7.452	117.75	8.656	0.019 Sig

5. Discussion

Systemic lidocaine has been used in several studies to know its benefits on the outcome of anesthesia. Having inflammatory-modulating property, it significantly reduces pain and allows rapid discharge. In a meta-analysis of 8 randomized, controlled, clinical trials, patients who underwent abdominal surgeries while receiveing continuous perioperative intravenous lignocaine, showed less duration of postoperative ileus, less pain, nausea and vomiting, and also shorter hospital stay.McKay et al proved that patients who received perioperative lignocaine infusion, required less opioid and less postoperative pain, thereby reducing the postoperative ICU stay.[3] Systemic lignocaine has been proved to reduce MAC in animals. Wilson et al observed that lidocaine, with or without ketamine significantly reduced the MAC of sevoflurane in dogs.[4] The study conducted by Altermatt et al showed that lidocaine infusion throughout the procedure significantly reduced the requirement of propofol, as measured by the plasma concentrations of propofol, for maintenance of anesthesia. This effect of lidocaine in reducing the requirements of intravenous anesthetics may be due to its effect on the cerebral metabolic rate – reduction of CMRO2 (cerebral oxygen demand). This reduces the anesthetic requirements.[5]Use of lidocaine in place of costlier anesthetic agents also speaks for the cost-effectiveness of this drug in maintenance during general anesthesia.

6. Conclusion

Intravenous lidocaine in the form of bolus followed by infusion reduces the propofol requirements to maintain BIS between 40 and 60, which is required to prevent intraoperative awareness and recall. It also significantly maintains the hemodynamic stability throughout the procedure and reduces the intraoperative analgesic requirements in patients undergoing laparoscopic surgeries.The results of the study showed that the amount of propofol infused in the lidocaine group, to maintain BIS between 40 and 60 was significantly reduced, and also the intraoperative fentanyl requirements were significantly

lower in the lidocaine group. Otherwise, the hemodynamic variables did not show significant variation between the two groups, except during the first few minutes after intubation when the heart rate increase to pressor response was significantly reduced in the lidocaine group.our study concluded that intravenous lidocaine in the form of bolus followed by infusion reduces the propofol requirements to maintain BIS between 40 and 60, which is required to prevent intraoperative awareness and recall. It also significantly maintains the hemodynamic stability throughout the procedure and reduces the intraoperative analgesic requirements in patients undergoing laparoscopic surgeries.The above effects of lidocaine have been attributed to its inflammatory-modulating property and also to its effect on the central nervous system where it reduces the cerebral metabolic oxygen consumption (CMRO2).

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