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Study Of Investigation Of Effect Of Standard Propofol With Lidocaine Pretreatment Versus Propofol Formulated With Long And Medium Chain Triglyceride On Reduction Of Pain During Induction.

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ABSTRACT

Pain on injection is a common drawback of propofol administration. Strategies to reduce this discomfort include lidocaine pretreatment and reformulation with long- and medium-chain triglycerides (LCT/MCT). This study compared these two approaches in patients undergoing elective spine surgery. In this randomized, prospective, double-blind study, 134 ASA I–II patients aged 18–50 years were allocated into two groups. Group LIDO (n=67) received lidocaine 2% (2 ml) intravenously before standard propofol. Group LCT/MCT (n=67) received 0.9% NaCl (2 ml) before LCT/MCT-formulated propofol (2 ml/kg). Pain during induction was assessed using observational criteria and postoperative recall (VAS score at 30 min, 4 h, and 6 h). Thrombophlebitis incidence was graded postoperatively. Verbal expression of pain was significantly lower in Group LCT/MCT compared to Group LIDO (28.3% vs. 44.8%, $p<0.05$). Other pain parameters showed no significant differences. VAS scores decreased significantly within both groups over time, with no intergroup difference at later intervals. No cases of thrombophlebitis occurred in either group. LCT/MCT propofol reduces immediate verbal pain expression more effectively than lidocaine pretreatment, with comparable safety and no incidence of thrombophlebitis. Both methods are effective for minimizing discomfort during induction.

Keywords: Propofol injection pain, LCT/MCT formulation, Lidocaine pretreatment

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INTRODUCTION

Pain on injection is a well-recognized drawback of propofol, a widely used intravenous induction agent in anesthesia due to its rapid onset and smooth recovery profile [1]. The incidence of propofol-induced pain can be as high as 70%, potentially causing patient discomfort and negative preoperative experience. Several strategies have been explored to mitigate this effect, including pretreatment with lidocaine and formulation modifications [2, 3]. Lidocaine pretreatment acts by stabilizing vascular endothelium and reducing pain transmission, while newer propofol emulsions incorporating long-chain and medium-chain triglycerides (LCT/MCT) aim to reduce free aqueous propofol concentration, thereby lessening vascular irritation [4]. Comparing these two approaches—standard propofol with lidocaine pretreatment versus LCT/MCT-based propofol—offers insight into their relative efficacy, safety, and patient satisfaction. Understanding which method provides superior pain control can guide anesthetic practice towards improving peri-induction comfort and optimizing the quality of care in both routine and high-risk surgical populations.

METHODOLOGY

This randomized, prospective, double-blind study was conducted in the neurosurgical operating theatres of a tertiary care center to compare the effect of standard propofol with lidocaine pretreatment versus propofol formulated with long and medium chain triglycerides (LCT/MCT) on pain reduction during induction and on the severity of postoperative thrombophlebitis. A total of 134 adult patients were recruited after obtaining informed consent and fulfilling the inclusion and exclusion criteria. Patients were randomly allocated into two equal groups (n=67 each) using a computer-generated randomization list: Group LIDO received lidocaine 2% (2 ml) intravenously before standard propofol injection, and Group LCT/MCT received 0.9% NaCl (2 ml) before receiving propofol formulated with 10% LCT/MCT (2 ml/kg) intravenously.

Eligible participants were ASA physical status I or II, aged 18–50 years, and scheduled for elective spine surgery under general anesthesia. Patients with obesity (BMI > 30), pregnancy, risk of regurgitation, requiring rapid sequence induction, or having used sedatives/analgesics in the previous 24 hours were excluded. Pre-anesthetic evaluation was performed, and standard monitors—pulse oximetry, ECG, non-invasive blood pressure, and capnography—were attached. An intravenous line with a 20G cannula was secured, and Ringer lactate infusion was started. No sedatives or analgesics were given before induction. The study drugs were administered as per allocation, with propofol injected at 1 ml/sec after tourniquet removal (in the lidocaine group).

Both participants and administering anesthesiologists were blinded to group allocation. Pain during induction was assessed observationally: verbal expression of pain and withdrawal of the hand were considered major criteria, while frowning and moaning were considered minor criteria. The injection was deemed painful if one or both major criteria, or one minor criterion plus recall of pain (VAS > 1), were present. Recall of pain was assessed at 30 minutes and 4–6 hours postoperatively using a 0–10 cm Visual Analog Scale (VAS).

Postoperative thrombophlebitis was evaluated and graded from 0 (no symptoms) to 4 (pain with erythema, edema, venous cord >1 inch, and purulent drainage). Data were analyzed using SPSS software. Continuous variables were expressed as mean ± SD and compared using the Student's t-test or ANOVA, while categorical variables were compared using the Chi-square test. A p-value < 0.05 was considered statistically significant. Graphical representations were created using MS Excel.

RESULTS

Table 1: Demographic and Baseline Characteristics

Parameter	Group LIDO (n=67)	Group LCT/MCT (n=67)	p-value
Age (years)	35.9 ± 9.98	36.2 ± 10.03	>0.05
Sex (Male/Female)	37 / 30	35 / 32	>0.05
BMI (kg/m^2)	23.3 ± 3.76	23.4 ± 4.08	>0.05
ASA Grade I/II	36 / 31	31 / 36	>0.05
Comorbidities	DM: 17.9%, HTN: 14.9%, Obesity: 13.4%	DM: 20.9%, HTN: 16.4%, Obesity: 16.4%	>0.05

Table 2: Pain Assessment During Drug Injection

Pain Parameter	Group LIDO (n=67)	Group LCT/MCT (n=67)	p-value
Verbal expression of pain	30 (44.8%)	19 (28.3%)	<0.05
Movement of hand	12 (17.9%)	8 (11.9%)	>0.05
Frowning	22 (32.8%)	15 (22.4%)	>0.05
Moaning	11 (16.4%)	9 (13.4%)	>0.05

Table 3: Recall of Pain (VAS Score)

Time Interval	Group LIDO (Mean ± SD)	Group LCT/MCT (Mean ± SD)	p-value	Within-group p-value
Post-op 30 min	1.99 ± 2.33 (n=30)	1.21 ± 2.03 (n=19)	>0.05	<0.05
Post-op 4 hours	1.09 ± 1.27 (n=25)	0.63 ± 1.12 (n=17)	>0.05	<0.05
Post-op 6 hours	0 ± 0 (n=0)	0 ± 0 (n=0)	>0.05	<0.05

Table 4: Incidence of Thrombophlebitis

Thrombophlebitis Grade	Group LIDO (n=67)	Group LCT/MCT (n=67)	p-value
Present	0	0	>0.05
Absent	67 (100%)	67 (100%)	

DISCUSSION

This randomized, prospective, double-blind study compared the effects of standard propofol with lidocaine pretreatment and propofol formulated with long- and medium-chain triglycerides (LCT/MCT) on pain during induction and postoperative thrombophlebitis in patients undergoing elective spine surgery. The demographic profile, including age, sex, BMI, ASA physical status, and comorbidities, was comparable between the two groups, ensuring that baseline differences did not confound the outcome measures [5].

Pain on injection is a well-documented adverse effect of propofol, with reported incidence varying between 28% and 90%. The mechanism is attributed to the free aqueous phase concentration of propofol, which irritates the venous endothelium. Lidocaine pretreatment remains one of the most widely practiced methods to attenuate this pain, while newer lipid formulations such as LCT/MCT propofol reduce the free propofol fraction and thereby decrease vascular irritation.

In the present study, verbal expression of pain—a major indicator of injection discomfort—was significantly lower in the LCT/MCT group compared to the lidocaine group (28.3% vs. 44.8%, $p < 0.05$). This finding supports the hypothesis that formulation modification effectively reduces acute venous irritation. Other parameters of pain, such as movement of hand, frowning, and moaning, did not show statistically significant differences, suggesting that while LCT/MCT formulation decreases overt pain expression, subtle pain indicators may still occur.

Recall of pain assessed using the VAS score at 30 minutes, 4 hours, and 6 hours postoperatively showed no statistically significant intergroup differences, although within-group analysis revealed a significant reduction over time ($p < 0.05$). This pattern indicates that both methods—lidocaine pretreatment and LCT/MCT formulation—are effective in preventing prolonged discomfort, and any pain experienced is transient, resolving within hours after induction. The lack of difference in VAS scores between groups at later intervals suggests that the primary advantage of LCT/MCT lies in reducing immediate injection pain rather than long-term recall [6-8].

Importantly, no cases of thrombophlebitis were recorded in either group during the postoperative observation period. This absence of thrombophlebitis aligns with previous studies indicating that the short-term use of propofol, whether standard or modified formulation, is rarely associated with significant venous inflammation when appropriate cannulation techniques are used. Moreover, both lidocaine and lipid-based formulations may contribute to endothelial protection, further reducing the risk [8].

When compared to prior literature [8-10], our results are consistent with findings from Sundarathiti et al., who reported significantly less injection pain with LCT/MCT propofol compared to

standard LCT propofol, and from Kam et al., who found similar pain incidence between Lipuro propofol and lidocaine-mixed propofol. However, our study differs in that LCT/MCT outperformed lidocaine pretreatment in terms of verbal pain expression, suggesting formulation change may be more effective than pharmacologic pretreatment alone in some patient populations [11, 12].

From a clinical standpoint, the use of LCT/MCT propofol offers an advantage in reducing immediate injection discomfort without the need for an additional pretreatment drug, thereby simplifying induction protocols. It also avoids the potential side effects of lidocaine, such as CNS or cardiovascular reactions in susceptible individuals. However, the marginal differences in other pain parameters and the lack of difference in pain recall indicate that either approach can be adopted depending on drug availability, cost considerations, and anesthesiologist preference.

In conclusion, this study reinforces the efficacy of LCT/MCT propofol in reducing the incidence of verbal expression of pain during induction, with comparable safety to lidocaine pretreatment. Both approaches effectively prevent thrombophlebitis, making them viable options in clinical anesthesia practice. Future studies with larger multicentric samples and cost-effectiveness analyses could help guide broader implementation.

CONCLUSION

LCT/MCT propofol reduces immediate verbal pain expression more effectively than lidocaine pretreatment, with comparable safety and no incidence of thrombophlebitis. Both methods are effective for minimizing discomfort during induction.

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