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INJECTION PAIN OF PROPOFOL IN CHILDREN WITH MEDIUM PLUS LONG CHAIN TRIGLYCERIDES AND LONG CHAIN PROPOFOL MIXED WITH LIGNOCAINE

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Abstract

Introduction*: Propofol is widely accepted drug because of its rapid and smooth induction, short context-sensitive time, rapid terminal half-life time and low incidence of postoperative nausea and vomiting. It is used for sedation and anaesthesia for almost all types of surgeries. During a propofol injection, pain due to the long-chain triglyceride (LCT) emulsion is experienced by 70% of adults and up to 85% of children. Despite various strategies to reduce propofol injection pain, this still poses a clinical problem in adults and children, and the incidence reported to be 30–90%. A medium-chain triglyceride/long-chain triglyceride (MCT/LCT) emulsion has been advised to reduce injection pain as compared to propofol LCT in adults and teenagers*

Material and Methods*: 100 children aged 5–13 years, in American Society Anaesthesiologists (ASA) class I or II, undergoing elective general anaesthesia without any contraindication to propofol anaesthesia were included in the study. Injection pain following injection propofol was assessed in all patients, but the anaesthetist was blinded for which formula was being used.*

Results*: The demographic characteristics like age, sex, weight, amount of propofol given, ASA physical status and recovery period was calculated. No statistically significant difference was observed in both the groups. Incidence of pain and severe pain in LCT group was 24 (48%) and 7 (14%) respectively while incidence of pain and severe pain in MCT/LCT group was 15 (30%) and 1 (2%) respectively. Pain score was found less in group MCT / LCT.*

Conclusion*: Medium plus long chain triglycerides and long chain propofol along with lignocaine significantly reduces the incidence as well as the severity of injection pain in the paediatric age group and can be used in children for sedation or induction of anaesthesia.*

Introduction

Propofol (2,6-diisopropylphenol) is a potent intravenous hypnotic drug [i]. It is widely accepted drug because of its rapid and smooth induction, short context-sensitive time, rapid terminal half-life time and low incidence of postoperative nausea and vomiting. It is used for sedation and anaesthesia for almost all types of surgeries[ii].

The adverse effects of propofol are well-known, and the most common being pain on injection. Other adverse effects are cardiovascular like bradycardia and hypotension, and metabolic effects like hyperlipidaemia secondary to infusion of lipid formulation[iii]. The concentration of free propofol in the aqueous phase is said to be associated with higher intensity of pain on injection[iv]. The mechanism of pain on injection of propofol is thought to be multifactorial but its exact cause is still not known. The most commonly identified mechanism is release of bradykinin as a result of the activation of the plasma kinin-kallikrein system by propofol[v].

Injection site and speed, aqueous phase free propofol concentration, the buffering effect of blood, temperature of propofol, injector material, and some addition of local anaesthetics or opioids have been studied. But, these factors could not explained injection pain, and unfortunately injection pain could not be prevented[vi].

During a propofol injection, pain due to the long-chain triglyceride (LCT) emulsion is experienced by 70% of adults and up to 85% of children. Despite various strategies to reduce propofol injection pain, this still poses a clinical problem in adults and children, and the incidence reported to be 30–90%[6]. A meta-analysis showed that lidocaine is most effective in preventing pain when given before propofol and by applying a tourniquet for up to 120 s after its administration[vii].

A medium-chain triglyceride/long-chain triglyceride (MCT/LCT) emulsion has been advised to reduce injection pain as compared to propofol LCT in adults and teenagers[viii].

This prospective observational study was carried out to examine the incidence and severity of injection pain with LCT and MCT-LCT propofol in children when lignocaine was added to both the groups.

Material and Methods

Present study was carried out in the Dept. of Anesthesiology at Prasad Institute of Medical Sciences and Hospital; Lucknow (UP).

After obtaining Ethical approval for this study, a 100 children aged 5–13 years, in American Society Anaesthesiologists (ASA) class I or II, undergoing elective general anaesthesia without any contraindication to propofol anaesthesia were included in the study. Children with allergy to eggs or with bradycardia and hypotension were excluded from the study. Children who continued to cry or did not calm down after 5 min of the medication were also excluded from the study. All patients were kept nil by mouth for 6 hours, No premedication was given. A 22-24G intravenous cannula was inserted and an intravenous line was attached. Electrocardiogram, systolic, diastolic, mean blood pressure, heart rate, and peripheral oxygen saturation (SpO_2) were monitored. Labelled propofol solutions were prepared by a blinded anesthetist.

The preparation of injection was done: in the syringe 4 mg/kg either of the propofol preparation (LCT/MCT-LCT) was aspirated and then, 0.4 mg/kg of preservative-free lignocaine was added using 1 ml syringe. Patients received either of the formulation of propofol at the attending anaesthesiologist's discretion. All patients receiving LCT propofol were labelled as Group LCT and patients receiving MCT-LCT propofol were labelled as Group MCT-LCT.

Injection pain following injection propofol was assessed in all patients, but the anaesthetist was blinded for which formula was being used.Blinded anaesthetists assessed injection pain according to both motor as well as verbalisation scale, for each patient group.

The SPSS software Chicago, was used for statistical analysis. A Student's *t*-test was used to compare parametric data, including demographic characteristics. Chi-square test was used for frequency comparisons. A p-value < 0.05 was considered as significant.

Observations and Results

A total of 100 children were included in the study and 50 each were in group receiving LCT propofol and were labelled as Group LCT and patients receiving MCT-LCT propofol were labelled as Group MCT-LCT.

The demographic characteristics like age, sex, weight, amount of propofol given, ASA physical status and recovery period was calculated. No statistically significant difference was observed in both the groups.

Table 1: Demographic characteristics

	Group LCT (n=50)	Group MCT/LCT (n=50)	P value
Male	31	32	NS
Female	19	18	NS
ASA I/II	42/8	40/10	NS
Age in years	6.24± 2.47	6.98± 2.14	NS
Recovery period (minutes)	10.55 ± 2.14	11.48 ± 3.41	NS

NS: Not significant

Injection pain according to both motor as well as verbalisation scale was calculated. Incidence of pain and severity of pain on injection propofol was observed and calculated

Table 2: Incidence and severity of pain

Pain	Group LCT (n(%))	Group MCT/LCT (n(%))	Total (n(%))	P value
Incidence(pain score $\geq$ 1)	24 (48%)	15 (30%)	39 (39%)	0.0664
Severe pain (pain score $\geq$ 3)	7 (14%)	1 (2%)	8 (8%)	0.0278

Incidence of pain and severe pain in LCT group was 24 (48%) and 7 (14%) respectively while incidence of pain and severe pain in MCT/LCT group was 15 (30%) and 1 (2%) respectively. Pain score was found less in group MCT / LCT.

Table 3: Pain score

Pain score	Group LCT (Mean rank)	Group MCT/LCT (Mean rank)	P value
Motor	90.24	78.55	0.02
Verbal	89.47	76.87	0.001
Total	93.42	77.72	0.09

No adverse events were seen in any of the patients.

Discussion and Conclusion

Propofol, 2,6-di-isopropylphenol, recently has become the most popular intravenous anaesthetic drug for induction and sedation. propofol-induced injection pain, is a major problem. Numerous attempts have been made in an effort to reduce propofol-induced injection pain, especially in children. Exact mechanism of pain is unknown and it is thought that concentration of free propofol in the aqueous phase is claimed to be associated with higher intensity of pain on injection. In a study it was observed that both bradykinin generation and complement activation were similarly higher with LCT and MCT-LCT propofol as compared with saline when blood obtained from 13 volunteers was mixed with one of these agents[4]. In a study of 2000 adults it was observed that significantly lower incidence of injection pain with MCT-LCT propofol compared to LCT propofol[ix].

Propofol is only suitable for intravenous use and not suitable for enteral or other routes of administration because of its bitter taste and low oral bioavailability caused by a high first-pass effect and the high hepatic extraction rate (> 90%.)[x]. Local anaesthetic lignocaine-either as a pre-treatment with venous occlusion or as an admixture has proven to be the most effective method for reducing this discomfort[7]. Inadequate expression of the degree of pain by children makes it difficult to evaluate pain during the induction of anaesthesia. Pain evaluation in our study was an investigator-based pain assessment. We used a pain score similar to the one used in a previous study which included both motor as well as verbal scale to appropriately evaluate pain in all the age groups[xi].

In some studies pre-medication was not used[6,xii]. In our study lignocaine as a pre-treatmenthas proven to be the most effective method for reducing this pain. Similar results were shown in other studies by Picard P et al[7]. and Cameron E etal[xiii].

In our study, the incidence of severe pain, was 1 (2%) in MCT/LCT group while in LCT group it was 7 (14%). These results were statistically significant. Similar results were observed in a study by Kobayashi et al[xiv] in which fentanyl with lidocaine was compared. Ohmizo H et al also observed that there was a significant difference in pain scores between groups, showing a lower incidence of injection pain in the LCT/MCT propofol group. Beyaz *et.al*. Reported in a study on 120 children and found that propofol MCT/LCT without lidocaine caused more injection pain than propofol LCT without lidocaine[6].

To conclude medium plus long chain triglycerides and long chain propofol along with lignocaine significantly reduces the incidence as well as the severity of injection pain in the paediatric age group and can be used in children for sedation or induction of anaesthesia.

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