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ORIGINAL ARTICLE

Efficacy of Methylprednisolone and Lignocaine on Propofol Injection Pain in Pediatric Surgical Patients: A Randomized Clinical Trial

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Abstract

Background: *Mild to severe pain or discomfort on injection of propofol used for the induction of anaesthesia is often observed in pediatric population.*

Objectives: *This study was designed to compare the efficacy of methylprednisolone and lignocaine in reducing the pain of propofol injection in patients scheduled for pediatric surgery.*

Methods: *Total 135 children scheduled for elective surgery were divided into three groups: saline (group S, n=45), lignocaine 20 mg (Group L, n=45) and methylprednisolone 125 mg diluted into 2 ml of distilled water (Group MP, n=45). Drugs were administered after tourniquet application and occlusion was released after 1 min and 25% of the total dose of propofol (2 mg/kg) was administered at the rate of 0.5 ml/s. Pain on propofol injection was evaluated by four-point verbal rating scale. Data were analyzed by using SPSS version 21.*

Results: *The overall incidence of pain was 65.9% in the saline group, 23.8% in the lignocaine group and 30.5% in the methylprednisolone group. Intensity of pain was significantly less in patients receiving methylprednisolone and lignocaine than those receiving saline ($p< 0.05$).*

Conclusion: *Pre-treatment with intravenous methylprednisolone was found to be as effective as lignocaine in reducing propofol injection-induced pain.*

Key words: *Methylprednisolone, lignocaine, pre-treatment, propofol injection induced pain.*

Introduction

Propofol is a popular anesthetic agent in pediatric practice, with the benefits of smooth induction characteristics, an antiemetic effect, rapid recovery, and pleasant waking up.[1] However, 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.[2-4] Many factors appear to affect the incidence of pain, which include site of injection, size of vein, speed of injection, buffering effect of blood, temperature of propofol and concomitant use of drugs such as local anaesthetics and opiates.[5,6]

The mechanism for propofol injection pain is unknown; however it could be due to irritation of

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the endothelium, osmolality differences, unphysiological pH and the activation of pain mediators.[7] The immediate vascular pain on propofol injection is attributed to direct irritation of the drug[8] by stimulating the venous nociceptive receptors or free nerve endings involving myelinated A´ fibres.[9] The delayed pain of injection has a latency of 10-20 s mediated by activation of kallikrein-kinin system.[10]

There are many strategies to reduce the incidence of pain on injection which include the following: pre-treatment with IV lignocaine, adding lignocaine to propofol,[11] cooling or warming propofol,[12] injection of propofol into a large vein,[13] pre administration of 5-HT3 receptor antagonist,[14] dexamethasone,[15] hydrocortisone[16] with or without tourniquet.[17] Among these studies, the most commonly accepted technique is the administration of lignocaine just before the injection of propofol.[18] The efficacy of dexamethasone pretreatment for alleviation of propofol injection pain has been studied.[19] Methylprednisolone sodium succinate for injection is used during cardiopulmonary bypass to reduce inflammatory response. So this study was designed to compare the efficacy of methylprednisolone and lignocaine in reducing the pain of propofol injection in patients scheduled for pediatric surgery.

Materials and Methods

In this study, 135 patients between 3 to 15years irrespective of sex belonging to the American Society of Anesthesiologists (ASA) physical Status I undergoing elective pediatric surgery were included. Patients with allergy to propofol, lignocaine, anticipated difficult venous access, patients with cardiac conduction defects, congenital heart disease, low ejection fraction, any congenital difficulty, haemodynamically instability, diabetes mellitus, convulsions, head injury and systemic fungal infections were excluded from the study.

The patients were fasted for 6 hour, but clear liquids allowed up to 2 hours before anesthesia. No premedication was given. EMLA cream was applied to an antecubital vein for 1 h and removed 15 min before anesthesia. A 22-24G intravenous cannula was inserted and an infusion line attached. Blood pressure, heart rate, and peripheral oxygen saturation (SpO_2) were monitored in the operating room. Patients were randomly assigned to three groups of 45 patients each according to a computer-generated random number sequence. Group S patients received 2 ml of normal saline as a placebo; Group L patients received pre-treatment with lignocaine (20 mg of 2% solution diluted to 2 ml with distilled water), and Group MP patients received pre-treatment with methylprednisolone sodium succinate (125 mg diluted into 2 ml of distilled water).

After limb elevation for 15s, venous drainage was occluded by placing a tourniquet inflated to 40 mmHg. According to the experimental group, respective drug was injected, and the investigator was blinded to the content of the solution. Tourniquet was deflated after 1 min, and then 0.5 mg/kg of propofol (long chain triglycerides LCT) was administered at the rate of 0.5 ml/s. The drugs used in the study were stored at room temperature. The intensity of pain on injection of propofol was assessed by a second anaesthesiologist who was unaware of the group to which the patient had been allocated. Assessment included standard questions asked to the patients about the comfort of the injection, verbal response and behavioural signs (such as facial grimacing, arm withdrawal or tears from the eyes). Pain was graded using a four-point scale: 0 = no pain, 1=mild pain (pain reported only in response to questioning without any behavioural signs), 2=moderate pain (pain reported in response to questioning and accompanied by a behavioural sign or pain reported spontaneously without questioning) and 3=severe pain (i.e., strong vocal response or response accompanied by facial grimacing, arm withdrawal or tears).[20] Anaesthesia induction was continued with fentanyl 3-5 ¼g/kg intravenously. Tracheal intubation was facilitated with atracurium and anaesthesia was maintained with sevoflurane. Haemodynamic parameters were monitored. In the post-operative period, the trachea was extubated and were assessed for pain, swelling or allergic reaction atthe site of injection by a blinded anaesthesiologist.

Continuous data are reported as mean±standard deviation. Comparison of age, sex, weight and ASA between the three groups was obtained by Student's *t*-test. Categorical data are reported as numbers and percentages and are analysed using Chi-square test or Fisher's exact test as appropriate. $P < 0.05$ was considered statistically significant

Results

Demographic characteristics were shown in Table-I which shows no significant differences in between

Table I
Demographic data of study population (n=135)

Patients characteristics	Group S (n=45)	Group L (n=45)	Group MP (n=45)
Age (years)	12.84±9.62	13.5610.00	13.499.33
Weight (Kg)	20.849.62	20.849.62	20.849.62
Sex (male/female)	33/10	35/10	36/9

Values are expressed as mean SD or number of patients. n-Number of patients; ASA-American Society of Anesthesiologists; SD-Standard deviation.

Table II
Incidence and severity of pain following propofol injection among groups

Groups	No pain n (%)	Pain n (%)	Mild n (%)	Moderate n (%)	Severe n (%)
Group S	12 (34.1)	23 (65.9)	4 (11.5)	8 (22.9)	11 (31.5)
Group L	27 (77.14)	8 (23.8)	5 (14.9)	2 (5.9)	1 (2.9)
Group MP	24 (68.5)	11 (30.5)	7 (19.4)	3 (8.3)	1 (2.8)

the three groups. No incidence of pain or discomfort was reported during the injection of pre-treatment solution in any group. The overall incidence of pain was 65.9% in the saline group, 23.8% in the lignocaine group, and 30.5% in the methylprednisolone group (Table II). The incidence of pain was significantly less ($p < 0.012$) in patients receiving drugs for pre-treatment than those receiving saline. Moderate to severe pain was observed in 3 (5.4%) and 4 (7.3%) patients in Groups L and MP respectively as compared to 20 (62%) patients in S group. The difference in moderate to severe pain between the study Groups (L and MP) was not statistically significant.

Discussion

In this study, the incidence of pain during the injection of propofol in the lignocaine group was 23.8%, whereas in the methyl prednisolone group, it was 30.5%. Moderate to severe pain was reported in 8.8% of the patients in the lignocaine group whereas 11.1% was reported in the methyl prednisolone group. There are very few studies on the use of pre-treatment with steroid-based drugs for the alleviation of pain on propofol injection.

A previous study found that 31% of patients felt pain ($p<0.01$) after dexamethasone pre-treatment and moderate to severe pain was noticed in 17.14%.[19] Another study comparing lignocaine, pethidine and dexamethasone as pre-treatment found that 48% of the patients with dexamethasone pre-treatment had no pain.[15] The combination of lignocaine 20 mg and dexamethasone 6 mg with venous occlusion for 1 min was more effective than lignocaine 20 mg (34.3%) or dexamethasone 6 mg (37.1%) alone for pain control during propofol injection. Dexamethasone given at higher analgesic doses reduces pain associated with the injection of propofol. These results show aneffective reduction in the incidence and severity of propofol injection pain after pre-treatment with dexamethasone.

Pre-treatment with either 10 mg or 25 mg of hydrocortisone was associated with no significant reduction of propofol injection pain (66.66% and 94.44% respectively) when compared to a placebo (94.44%). It was administered 30s before the administration of propofol, which may be a short contact time. Hydrocortisone might not be effective on immediate pain.[16]

In this study, the incidence of pain was 65.9% in the Group S whereas in those pre-treated with lignocaine and methylprednisolone, it was 23.8% and 30.5%, respectively. These results show that there is a significant reduction in the propofol injection pain, and both lignocaine and methylprednisolone

are equally effective. There is a significant decrease in moderate to severe pain (8.8% and 11.1% in each L and MP group) when compared with Group S (65.9%).

Conclusion

The analgesic efficacy of methylprednisolone given as pre-treatment with propofol is as effective as lignocaine in preventing propofol-induced pain. Therefore, it can be administered before propofol in patients who require methylprednisolone for other indications.

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