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Efficacy of Sufentanil and Lidocaine on Propofol Injection Pain

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Abstract

Propofol injection pain is one of the shortcomings with this popular medication. This study explored the effects of lidocaine and sufentanil on propofol injection induced pain during induction of anesthesia and evaluation of the hemodynamic condition of the patients. In an interventional study on patients planned for elective ophthalmic surgeries, a 20-gauge intravenous catheter was used on the back of the hand. Based on medications administered before propofol injections, the patients were assigned into four groups: Group L: lidocaine 20 mg in 5 cc; Group S: sufentanil 5 µg in 5cc; Group C: sufentanil 5µg and lidocaine 20 mg in 5 cc, Group P: normal saline 5cc. 1/4 of the propofol total calculated dose (2.5mg/kg) was injected after 1 min and after opening of the tourniquet, flow rate was set 20 mg/sec. Subsequently, the pain was evaluated. Ultimately, atracurium 0.5mg/kg, fentanyl (2µg/kg), and the propofol remaining calculated dose were given parenterally. The hemodynamic status was recorded before and after the injection of propofol. Two hundred patients participated in the study. Propofol injection pain was at the least in the C group followed by the L and S groups ranking next. The use of sufentanil or lidocaine reduced propofol injection pain (compared to normal saline), but it was more effective if the combination of the both medications was used.

Keywords: *Propofol, Sufentanil, Lidocaine, Pain, Anesthesia.*

Introduction

Propofol is a phenol commonly used owing to its fast mechanism of action and recovery. Since this compound is water-insoluble, it is prepared in oil emulsion (1). Due to the high lipid solubility of propofol, it induces painful intravenous injections (1) and brings immediate pain owing to the local vein stimulation (1). It can also result in delayed pain due to the activation of kallikrein and bradykinin (2). The pain after the injection of propofol has been reported as 28%-90% (2, 3). Visual analog scale (VAS) pain measurement system demonstrated that the propofol injection (pain score ranged from 0-10) has severe pain (4).

Different techniques have been suggested to diminish this pain, such as the addition of lidocaine, dilution of propofol, the use of larger vessels for injection, and cooling or heating (5-19). Moreover, some of the assessed pain-relief medications have yielded different results. They include various doses of non-steroidal anti-inflammatory drugs, lidocaine (5), metoclopramide (6), as well as such opiates as morphine, meperidine, fentanyl (7), tramadol (2), thiopental sodium (4), nafamostat mesylate (10), ketamine (8, 11), ondansetron (12) granisetron (13, 14) magnesium sulfate (8, 15-18) and paracetamol (5, 9, 19, 20).

Objectives

The present study aimed to assess the effect of sufentanil and lidocaine on the pain of propofol injection during and after anesthesia induction, as well as the hemodynamic status of the patients.

Methods

Study Population

The participants of this interventional case series study were selected via systematic sampling. The patients were randomly assigned to four groups using

block randomization and a random number table. Observation, field method, and the checklist were used to glean the data.

The participants were patients (within the age range of 16-60 years) who were candidates for elective ophthalmic surgery with the American Society of Anesthesiologists Classification (ASA Class) I and II. On the other hand, the exclusion criteria were as follows: thin veins in the back of the hand, allergy to propofol, severe mental disorders, neurological diseases, neuromuscular diseases, convulsion, pregnancy and breastfeeding, heart disease, and body mass index (BMI) above 30.

Intervention Procedure

The patients were randomly assigned to four groups of 50 using the random number table. They received no premedication, and a 20-gauge IV catheter was inserted into a large vein at the back of the hand of all patients. Moreover, 100 cc of Ringer (Iranian Parenteral and Pharmaceutical Co. IPPC, Tehran, Iran) serum infusion was administered to them. The drug under the study was prepared and encoded in 5 cc volume by a nurse who was blinded to the study groups. Thereafter, the following medications were administered before propofol injection: lidocaine (Iran Hormone Pharmaceutical Co., Tehran, Iran) 20 mg in 5 cc (group L), sufentanil citrate (Sufenta, Sandoz, Holzkirchen, Upper Bavaria, Germany) 5 micrograms in 5 cc (group S), sufentanil citrate 5 micrograms + lidocaine 20 mg in 5 cc (group C) and normal saline 0.9 % (Iranian Parenteral and Pharmaceutical Co. IPPC, Tehran, Iran) 5cc (group P). The tourniquet was released after 60 sec, and one-quarter of the total dose of propofol 2.5 mg/kg (Fresenius Kabi, Hamburg, Germany) was injected at a flow rate of 4 mg/sec.

Following that, the severity of the pain was explained to the patient. The data were collected using a five-point Likert scale (very low, low, intermediate, a lot, very much). Subsequently, anesthesia induction was performed using fentanyl 2µg/kg, atracurium 0.5 mg/kg, and the remaining dose of propofol. The vital signs, such as heart rate and blood pressure, were assessed before propofol injection and recorded at minutes 1, 3, 5, and 10.

Data Analysis

The data were analyzed in SPSS software (version 18.0), and the variables were expressed as the mean±standard deviation (SD). PASS16 Sample Size Software (NCSS LLC, Kaysville, UT) was employed to assess the sample size. The sample size was calculated at 200 subjects considering an effect size of 0.2, a test power of 80%, and a type 1 error of 0.05. The chi-square and one-way ANOVA tests were utilized for categorical and continuous data, respectively, considering the normal distribution of data and the statistical analysis. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations

The participants were provided with experimental procedures and informed written consent was obtained from all patients. This study was approved by the Committee of Ethics in Human Research at Mashhad University of Medical Sciences (IR.MUMS.fm.REC.1396.147).

Results

A total of 200 cases aged 33.5±14.4 years (age range of 16-59 years) were evaluated. The four groups of participants did not differ in terms of baseline demographics of age, gender, and ASA (American Society of Anesthesiology) score (Table 1). The results of the Chi-square test on the comparison of propofol injection pain among different groups pointed to a significant difference (P≤0.001) (Table 2). Propofol injection pain was the least in the C group, followed by the L and S groups (C

Discussion

The present study evaluated and compared the effects of sufentanil and lidocaine on propofol injection pain during anesthesia induction, as well as hemodynamic changes. The findings indicated that pain caused by propofol significantly differed in various groups since none of the patients in group P had very little pain, although all the patients in group C reported very little pain (P<0>

The obtained results demonstrated that 94% of patients in the lidocaine group had very little pain from propofol injection. In a randomized controlled trial, Walker et al. compared three groups, including a control group (saline pretreatment/saline admixture), a pretreatment group (lidocaine pretreatment/saline admixture), and an admixture group (saline pretreatment/lidocaine admixture). The initial and secondary results of the mentioned research were reported as verbal pain after injection and pain on injection, respectively. Fewer subjects in the pretreatment group experienced any injection pain, compared to the admixture group (20% vs. 44%, respectively; P=0.024). Therefore, tourniquet-controlled pretreatment with lidocaine is statistically preferable to the addition of lidocaine to propofol for the reduction of propofol injection pain intensity (21).

According to Dae Hee Kim et al., pretreatment with intravenous (IV) lidocaine 40 mg or 0.5 mg/kg with venous occlusion is advised to prevent pain following injection of lipid emulsion propofol. The pain was assessed using a 4-point Likert scale (severe, moderate, mild, none) based on physical responses to the injection. A total of 68 patients were included in the final analysis. Pain severity and incidence were significantly lower in patients in two groups of 60 mg lidocaine and 80 mg lidocaine, in comparison with their counterparts in group 40 mg lidocaine. Pain incidence or severity was not significantly different between the two groups of L60 and L80. (22)

Furthermore, the findings of the present study suggested that after the administration of sufentanil therapy, 82% of patients had little and very little pain. Moreover, it was revealed that although lidocaine and combined therapy (lidocaine- sufentanil) did not significantly differ, the latter was more effective.

In addition, Dong Hun Chung et al. assessed the effect and optimal dose of sufentanil in the reduction of injection pain of microemulsion propofol on 80 patients aged 19-60 years old with ASA I-II. The patients were randomly assigned to four groups and pretreated with normal saline, sufentanil 0.1 μg/kg, 0.2 μg/kg, or 0.3 μg/kg before the injection of microemulsion propofol. Moreover, 2 mg/kg of microemulsion propofol was injected five min after the administration of the pretreatment drug, and VAS was recorded. The groups did not significantly differ in the incidence of injection pain. The severity of injection pain was significantly lower in the sufentanil 0.3 μg/kg group, compared to normal saline and sufentanil 0.1 μg/ kg group. They declared that pretreatment with sufentanil 0.3 μg/kg reduced the pain severity of micro-emulsion propofol injection (23).

In their study, Shreyasi Ray et al. evaluated the effects of lignocaine or fentanyl pretreatment. They found that the incidences of pain on pretreatment drug injection were higher in the fentanyl group (33.3%), compared to that in lidocaine and normal saline (P<0>docaine pretreatment group (14.3%), as compared to two groups of fentanyl (42.9%) and normal saline (71.4%) (P<0>

The least incidence of propofol injection pain occurred in the lidocaine pretreatment group (14.3%), whereas in the normal saline pretreatment group, 71.4% of cases experienced the highest incidence of propofol injection pain. Participants of the fentanyl pretreatment group had a lower incidence of pain (42.9%), in comparison with the normal saline pretreatment group (71.4%); nonetheless, it was higher than that in the lidocaine pretreatment group. They stated that both lidocaine and fentanyl pretreatment reduced pain on propofol injection; however, lidocaine pretreatment was more efficacious (24). In the current study, the patients experienced lower pain in the lidocaine group than sufentanil.

In the same context, Kwak K et al. determined the effect of a combination of lidocaine (lignocaine) and remifentanil for the reduction of pain during propofol injection. They indicated that pretreatment with a combination of lidocaine and remifentanil is more effective than each pretreatment alone in the reduction of propofol injection pain (25). This was similar to the present study in which the combined treatment demonstrated a more profound effect on the reduction of injection pain.

In a comparative randomized, double-blind study, Khaled M et al. assessed the effect of IV pretreatment with lidocaine, IV paracetamol, or lidocaine mixed with fentanyl on the reduction of propofol injection pain. They reported that lidocaine-fentanyl (70% pain-free), and lidocaine (68% pain-free) significantly reduced propofol injection pain more than paracetamol (54% pain-free) and placebo (36% pain-free) (P<0>

In conclusion, given the advantages and disadvantages of other medicines, it is suggested to use lidocaine and sufentanil as a premedication to reduce propofol injection pain. Among different previously evaluated medications, lidocaine and sufentanil were found to be effective. As evidenced by the results of the present study, a combination of both medications was more effective in the reduction of pain, instead of using each medication alone.

Table 1: Baseline characteristics of the patients compared between the groups. Patients were categorized in four groups; Group L: lidocaine, Group S: sufentanil citrate, Group C: sufentanil citrate + lidocaine, Group P: normal saline 0.9 %.

		Group C	Group L	Group P	Group S	P Value
Age		*29.68±1 3.07*	*35.92±1 5.18*	*34.96±1 4.53*	*33.76±1 4.53*	*0.128*
Sex	*Male*	*32(64%)*	*32(64%)*	*34(68%)*	*35(70%)*	*0.643*
	Female	*18(36%)*	*18(36%)*	*16(32%)*	*15(30%)*	*0.523*
ASA Class1		*46(92%)*	*39(78%)*	*42(84%)*	*40(80%)*	*0.365*
ASA Class2		*4(8%)*	*11(22%)*	*8(16%)*	*10(20%)*	*0.206*

Table 2: Pain score after injection of lidocaine or sufentanil or normal saline of the patients compared between the groups. Patients were categorized in four groups; Group L: lidocaine, Group S: sufentanil citrate, Group C: sufentanil citrate + lidocaine, Group P: normal saline 0.9 %

Pain Score	Group C	Group L	Group P	Group S
Very Low	*50(100%)*	*47(94%)*	*0(0%)*	*20(40%)*
Low	*0*	*3(6%)*	*5(10%)*	*21(42%)*
Intermediate	*0*	*0*	*15(30%)*	*9(18%)*
A Lot	*0*	*0*	*21(42%)*	*0*
Too Much	*0*	*0*	*9(18%)*	*0*

Table 3: Mean arterial pressure of the patients compared between the groups. Patients were categorized in four groups; Group L: lidocaine, Group S: sufentanil citrate, Group C: sufentanil citrate + lidocaine, Group P: normal saline 0.9 %

Mean Arterial Pressure	Group C	Group L	Group P	Group S
Before injection	*91.36*	*92.62*	*91.52*	*91.08*
min st 1	*92.27*	*90.92*	*89.69*	*90.19*
min rd 3	*86.19*	*84.30*	*82.68*	*84.23*
min th 5	*83.01*	*82.02*	*79.94*	*79.86*
min th 10	*82.25*	*83.25*	*80.19*	*80.55*

Table 4: Pulse rate of the patients compared between the groups. Patients were categorized in four groups; Group L: lidocaine, Group S: sufentanil citrate, Group C: sufentanil citrate + lidocaine, Group P: normal saline 0.9 %

Pulse Rate	Group C	Group L	Group P	Group S
Before injection	*82.62*	*82.50*	*81.50*	*83.84*
min st 1	*83.90*	*81.14*	*81.40*	*80.38*
min rd 3	*73.22*	*77.36*	*74.40*	*77.06*
min th 5	*74.03*	*73.90*	*72.02*	*77.10*
min th 10	*72.52*	*74.94*	*72.00*	*77.23*

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None of the authors has a financial or proprietary interest in any material or method mentioned.

Conflict of interest

The author declares no conflict of interest.

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