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Anesthesiology

A Comparative study of effects of dexmedetomidine and lidocaine in alleviating propofol injection pain in a tertiary care centre.

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ABSTRACT

Objective: Diisopropyl group containing intravenous induction agent Propofol is a commonly used drug for general anesthesia. Propofol, can irritate the skin, mucous membrane, and venous intima. The main drawback is the pain on injection. We have compared the analgesic effects of lidocaine, dexmedetomidine, in reducing propofol injection pain.

Materials and Methods: Following the approval of the hospital's Ethics Committee, 140 adult patients of both sexes [aged 18-60 years, American Society of Anesthesiologists (ASA) I and II] were divided into two groups (n = 70) 0.25 mg/kg of dexmedetomidine, and 0.5 mg/kg of lidocaine diluted in 5 ml of saline injected just before the propofol injection in the same hand. The propofol injection pain was assessed according to the McCrirrick and Hunter scale.

Result: Among dexmedetomidine & lignocaine both reduces pain on propofol injection, even though lidocaine is better than dexmedetomidine.

Conclusion: Pretreatment with 0.25 µg/kg of dexmedetomidine with venous occlusion for one min is also as effective as IV lidocaine pretreatment in alleviating propofol injection pain, though lidocaine is better than dexmedetomidine.

KEYWORDS : Dexmedetomidine, Lidocaine, Pain, Propofol

Introduction:

Propofol also known as di isopropyl phenol is a widely used induction agent in anesthesia, but has the main drawback of pain on injection [1,2,8] .

Several interventions have been advocated to alleviate the pain associated with propofol injection, which include addition of lidocaine, cooling of propofol, dilution of propofol, injection of propofol into a large vein, and prior administration of ephedrine, ondansetron, metoclopramide, opioids[3], thiopental, ketamine,[4] acetaminophen,[5] tramadol,[6] different doses of lidocaine,[7] and different concentrations of propofol[8].

Among the interventions, amide local anaesthestics intravenous (IV) lidocaine, most commonly used drug. On the other hand, dexmedetomidine, a highly selective, specific, and potent α2 adrenoceptor agonist, has sedative, analgesic, and sympatholytic actions, anxiolytic property. It provides antinociception and also relief to propofol injection pain.[9]

The purpose of this study is to compare the effects of prior administration of dexmedetomidine, lidocaine in reducing propofol injection pain.

MATERIALS AND METHODS

A prospective, randomized, double blinded controlled study was conducted in the department of anesthesiology of a tertiary care hospital in AGMC & GBP Hospital from July 2016 to June 2017. After obtaining consent from the hospital's Ethics Committee and informed consent from the patients, 140 adult patients of American Society of Anesthesiologists (ASA) I and II status, aged 18-60 years who were scheduled for elective surgeries, were undergoing general anesthesia, and the patients were divided into two groups. To detect a 50% reduction at a significant level of 5% and probability of 80%, this study required at least 70 patients per group, estimating the frequency of 80% of the patients who were to experience pain withdrawal movement on injection of propofol based on a previous study.[10]

The patients of ASA III & IV , with difficulty in communication, history of adverse effects to propofol, study drugs, and emergency operation who required rapid sequence induction excluded from the study.

The patients enrolled were asked to report their pain according to the scale provided to them in the form of none, mild, moderate, and severe (verbal rating scale).[11]

In the operation room, a 18G cannula was inserted in the dorsum of hand. Standard monitors, namely, electrocardiogram (ECG) device, pulse oximeter, and automatic noninvasive arterial blood pressure monitor were attached. All the patients were premedicated with injections of 40 mg pantoprazole of IV pan and 0.005 mg/kg i.v glycopyrrolate at least 15min before the surgery. The study drug was prepared by an anesthesiologist ,not involved in the study and was divided into equal volumes of 5 ml with the addition of normal saline. The patients received 0.2µg/kg of dexmedetomidine IV diluted in 5 ml normal saline in Group I, and 0.5 mg/kg of lidocaine IV diluted in 5 ml normal saline in Group II.

The study drug was injected through the cannula over 5 s. After 1 min, propofol (2 mg/kg) was administered over 10 s .During propofol injection, the patients were asked standard questions regarding the comfort of the injection and were continuously observed for vocal response, facial grimacing, arm withdrawal, or tears suggesting severe pain.

Pain was graded using the four point scale of McCrirrick et al.[11] After the assessment of pain,after induction of anesthesia tracheal intubation was facilitated with the injection of succinylcholine. Anesthesia was maintained with isoflurane, injection of atracurium, nitrous oxide (66%) in oxygen, and injection of nalbuphine with controlled ventilation.

Assessment of propofol injection pain according to the McCrirrick and Hunter scale[11]

Degree of pain	Response
None (0)	No response to questioning
Mild (1)	Pain reported in response to questioning alone without any behavioral signs
Moderate (2)	Pain reported in response to questioning and accompanied by behavioral signs, or pain reported without any questioning
Severe (3)	Strong vocal response or response accompanied by facial grimacing, arm withdrawal, or tears

The data collected were tabulated and analyzed by using the statistical package for social sciences, Windows-based version 21.0 (SPSS Inc., Chicago, IL, USA). The patients characteristics were analyzed by using student t test , chi-square test was used for comparison of the categorical data.

RESULTS

The demographic profiles of the three groups are shown in Table 1. The sex distribution was as follows: Males/ females of 27/43, 22/48, and 7/28 in Group I, Group II,respectively. There was a female preponderance in all the groups, which was statistically insignificant (P = 0.69).

Table 2 and Figure 1 show the distribution of the pain in the two groups

during the injection of propofol.

The number of patients with no pain were 46 (65.7%) in Group I, and 58 (82.8%) in Group II. Mild pain was experienced by 14 (20%) in Group I and 8(11.4%) patients in Group II. Moderate pain was observed in 6(8.5%) patients in Group I & 3(4.2%) patients in Group II; Severe pain was observed in observed in 4 (5.7%) patients in Group I & 1 (1.4%) patients in Group II. Overall, the pain during injection was experienced by 24 (34%) patients in Group I, followed by 12 (17.1%) patients in Group II. This distributionof pain grades was statistically significant (P = 0.004).

Particulars	Group I	Group II	P value
Age (years)	36.68±12.36	40.51±13.14	0.25
Sex	18:52	20:50	0.69
Weight (kg)	49.11±6.86	51.74±9.15	0.44

Table 2: The distribution of pain during propofol injection among the patients in the two groups.

Pain score	Group I (dex) (n =70) (%)	Group II(ligno) (n = 70) (%)	P value And remarks
Pain	24 (34%)	12 (17.1%)	P value(0.004) significant
No pain	46 (65.7%)	58 (82.8%)	
Mild pain	14 (20%)	8(11.4%)	
Moderate pain	6(8.5%)	3(4.2%)	
Severe pain	4 (5.7%)	1 (1.4%)	
Total	70	70	

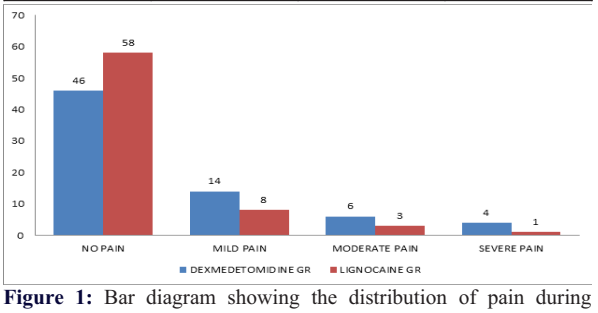

Figure 1: Bar diagram showing the distribution of pain during propofol injection among the patients in the two groups.

Discussion:

Propofol, an excellent IV anesthetic belonging to the phenol group, can irritate the skin, the mucous membrane, and the venous intima. The mechanism of pain is attributed to the activation of the kinin-kallikrein system that releases bradykinin, [12] causing vasodilatation and hyperpermeability, thereby increasing contact between the aqueous phase propofol and the free nerve endings.

Several authors have studied the mechanisms and methods of reducing propofol injection pain.

Cameron et al.[13]reported that the minimum effective dose of lignocaine, required to prevent propofol injection pain was 0.2 mg/kg when veins of the dorsum of the hand were used, and they concluded that injection pain should not limit the use of propofol in children if an adequate amount of lignocaine was immediately mixed prior to injection. In the present study, we used veins of the dorsum of the hand for propofol injection.

In a study by King et al,[1] they found lidocaine (20 mg IV) significantly reduced the incidence and severity of pain with propofol injection, but about 6% of patients still suffered pain if the dorsum of the hand was used.

Robert et al.[15] showed that lidocaine, (2 ml of 2% i.e. 40 mg) when mixed with propofol was more effective in reducing the pain on propofol injection (P < 0.001) than when given as a pretreatment.
Lee and Russel[16] reported a decreased incidence of propofol injection pain in the propofol mixed group (2 ml of 2% lidocaine) compared to the lidocaine (4 ml 1%) pretreatment group. We used 2% lidocaine concentration at a dose of 0.5 mg/kg, which was effective in reducing the pain of propofol injection.

In our study, 65.7% of dexmedetomidine group(I) of the cases had no pain, where as in lignocaine group (II) 82% of the cases had no pain & (P = 0.004) that is comparable to the study conducted by Tsubokura et al.,[7] who observed that the incidence of propofol-induced pain was significantly more frequent (P < 0.001) in the control group (70%) than in the other groups (20% each).

We observed that 34% of the patients in the dexmedetomidine group experienced pain as compared to 17% in the lidocaine group, which were comparable to that of Turan et al.[10] who had reported pain in 33.34% of the patients in the dexmedetomidine group as compared to 23.34% in the lidocaine group.

In our study number of patients with moderate and severe pain in the dexmedetomidine group was 8.5% and 5.7% as compared to 4.2% and 1.4%, respectively, in the lidocaine group. This pain grading was also comparable to that of Turan et al.[10] who showed that 3.33%, and 0% of the patients had experienced mild, moderate, and severe pain in the dexmedetomidine group as compared to 3.33% and 0% of the patients respectively in the lidocaine group.

The possible mechanism involved in decreasing propofol injection pain by dexmedetomidine is not fully understood. The possible mechanism might be due to alpha1 and alpha2 stimulation causing release of vasodilator prostaglandins that antagonize the vasoconstrictor response. This modulation of the sympathetic response of the venous smooth muscle might be important in endothelial dysfunction caused by propofol.[16] It may be due to hyperpolarization activated conductance in the peripherally mediated antinociception, but the peripheral analgesic effects of dexmedetomidine have not yet been fully elucidated. But as dexmedetomidine is more potent α2 adrenergic agonist compared to clonidine, the peripheral antinociception produced by clonidine-like drugs mediating the local release of enkephalin-like substances is also possible.

CONCLUSION

From the present study, it may be concluded that pretreatment with 0.25 µg/kg of dexmedetomidine is also as effective as IV lidocaine pretreatment in alleviating propofol injection pain and may be a useful alternative for reducing pain on propofol injection, even though lidocaine is better than dexmedetomidine.

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