



ORIGINAL RESEARCH

Medicine Science 2017;6(4):696-9

Comparison of hemodynamic response for intubation and propofol pain caused by lidocaine administration with infusion and tourniquet

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Received 09 February 2017; Accepted 30 May 2017

Available online 07.06.2017 with doi: 10.5455/medscience.2017.06.8643

Abstract

Propofol is one of the most widely used i.v. anesthetic agent. Nevertheless, pain following i.v. administration of propofol is an important problem in anesthesia induction. A wide range of studies have been performed related to lidocaine effects on propofol injection pain and hemodynamic response to intubation. However, effect of both situations are seldomly studied in the literature. In our study we compare lidocaine effects on propofol injection pain and hemodynamic response to intubation which is given by infusion or under tourniquet as i.v. bolus. 70 patients attended to the study are separated randomly into two groups of 35 patients. Prior to induction, lidocaine has been infused with infusion pump as to be completed in 2 minutes with concentration of 2%, total dosed 1mg/kg in infusion group (Group I, n=35). In this group, after half of the total lidocaine dose is infused (1st minute), anesthesia induction has been started by giving 40 mg propofol of 1% in 10 seconds with infusion pump. In tourniquet group (Group T, n=35) prior to induction 1mg/kg lidocaine has been given as bolus by applying tourniquet with 70 mm/Hg pressure to the arm that is established vascular access and tourniquet has been remained for 60 seconds. After opening the tourniquet, induction has been started by giving 40 mg propofol of 1% in 10 seconds with infusion pump. During induction, patient's consciousness was evaluated by questioning his/her name and age after administering 1/4 (VRS0), 1/2 (VRS1), and 3/4 (VRS2) of total propofol dose. Confused patients were eliminated and the sense of pain caused by propofol was evaluated in study patients. The results were recorded according to four-point categorical verbal rating scale (VRS). For groups, the pulse rates and mean arterial pressures before lidocaine administration (T0), after lidocaine (T1), immediately after intubation (T2) and 10th minute after intubation (T3) were recorded. No differences detected among the groups with regards to demographic data and side effects. ($p>0.05$). No significant differences statically detected when comparing the heart rate (HR), mean arterial pressure (MAP) and pain scores of groups for all times ($p>0.05$). It is concluded that administering lidocaine by infusion technic may be an alternative method for tourniquet method on suppressing hemodynamic response related to tracheal intubation and on preventing injection pain related to propofol.

Keywords: Novel oral anticoagulants, drug adherence, morisky scale, geographic differences

Introduction

Hemodynamic response related to endotracheal intubation and laryngoscopy arising from a reflex increment on sympathetic activity because of stimulating the laryngeal and tracheal tissues during this operation. Procedure is based on the increment on concentrations of catecholamine, such a response may cause tachycardia, hypertension, arrhythmias and particularly myocardial ischemia on the patient those have limited heart reserve [1].

Recently, propofol is one of the most preferred agent on induction of general anesthesia, mini-surgical procedures, intubation and invasive procedures performed during intensive care.

It is still a crucial problem that Propofol causes pain during infusing together with its benefits which are reason for preference, such as it reduces nausea and vomiting, does not causes histamine discharge, provides quick recovery and suppresses response stress well [2]. Propofol infusion pain may be so severe and occurred 28-90% frequent on adults [2,3]. For reducing the pain arising from propofol, a wide range of pharmacologic and non-pharmacologic approaches have been attempted. Adding lidocaine to propofol, adjusting pH of propofol, giving alfentanil, remifentanil, ketamine, metoclopramide, nafamostat, granisetron, oral clonidine, cold saline solution, ketorolac, thiopental, magnesium sulphate, ephedrine prior to injection; applying nitroglycerin to skin, applying EMLA or 60% lidocaine tape can be counted among the pharmacologic approaches [4,5].

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Some techniques intended to suppress hemodynamic response as follows;

1. Increasing the depth of anesthesia for 5-10 minutes by a strong volatile agent,

2. Bolus injection of any opioid agent
3. Intravenous or intratracheal lidocaine infusion
4. Providing beta adrenergic blockage
5. Topical airway anesthesia (glossopharyngeal and superior laryngeal nerve blocks) [6].

A wide range of studies have been performed related to lidocaine effects on propofol injection pain and hemodynamic response to intubation [7, 8]. However, there are not many studies that investigate the effect of both in the literature. We aimed to compare lidocaine effects on propofol injection pain and hemodynamic response to intubation which is given by infusion or under tourniquet as i.v. bolus.

Material and Methods

70 patients aged between 18-65 belong to the group of American Society of Anesthesiologist (ASA) I-II has been included into the study after local ethics committee approval and written informed consent has been provided. The patients who have serious organ failure, current arrhythmia and heart blocked, and the patients who use hypnotic and opioid analgesic, anticoagulant and pregnant, the patients who have peripheral neuropathy and who is diagnosed with diabetic are excluded from study. The patients are randomly divided into 2 groups of 35 patients which has equal patient number according to application method of lidocaine regardless of their age and gender differences.

Demographic characteristics (gender, age, weight, height, ASA) of all patients are recorded. DII ECG, non-invasive blood pressure and peripheral saturation monitorization by pulse oximeter has been applied to all patients. Vascular access has been established from left top back of hand with 18 Gauge cannula. 0, 9% NaCl has been used for fluid replacement and maintenance. Prior to induction, lidocaine has been infused with infusion pump as to be completed in 2 minutes with concentration of 2%, total dosed 1mg/kg to the patients in infusion group (Group I, n=35). In this group, after half of the total lidocaine dose is infused (1 minute later), anesthesia induction has been started by giving 40 mg propofol of 1% in 10 seconds with infusion pump.

To tourniquet group (Group T, n=35) prior to induction 1mg/kg lidocaine has been given as bolus by applying tourniquet with 70 mm/Hg pressure to the arm that is established vascular access and tourniquet has been remained for 60 seconds. After opening the tourniquet skipped to the induction and induction has been administered by giving 40 mg propofol of 1% in 10 seconds with

infusion pump. Total dose of propofol is calculated as 2.5mg/kg in both group during anesthesia induction, then respectively 1µg/kg fentanyl and 0.15 mg/kg cisatracurium have been administered. Resultant pain has been queried right after a quarter (VRS0), two quarters (VRS1) and three quarters (VRS2) of total propofol dose has been administered during induction. Prior to pain feeling queried, patient conscious state has been evaluated by asking his/her name and age. The patients who have somnolence excluded from study.

Obtained results were recorded according to 4 points verbal pain evaluation scale. In both group heart rates and average artery pressures are recorded preintervention of lidocaine (T0), post intervention of lidocaine (T1), right after intubation and following the intubation within the next 10th minutes (T3).

As evaluating the obtained results, SPSS (Statistic Package for Social Sciences) for Windows 14.0 has been used for statically analysis. As evaluating the study data, T-test was used on intergroup comparison of parameters which showed normal distribution on comparison of quantitative data together with the definer statically methods (medial, standard deviation) Mann-Whitney U test was used for detection of the group which led to difference. Ki-Kare test was used on comparison of quantitative data. Results were evaluated between confidence interval of 95% and significance level was on $p < 0.05$.

Results

No significant difference when demographic data of the patients are compared. According to this situation, no significant difference is found among the age, gender, weight and operation duration values of both groups (Table 2).

When intergroup and intragroup heart rate (HR) data are evaluated, in the period after endotracheal intubation (T2), despite the increment was observed in HR, it is detected that this increment is not significant in terms of statically values (Figure 1).

In the period after endotracheal intubation (T2), despite the increment was observed in mean arterial pressure (MAP), it is detected in the evaluation performed intergroup that this increment is not significant in terms of statically values.

When VRS data evaluated intergroup, each three period of propofol infusion, no significant difference is noticed on comparisons performed in both group in terms of statically values (Table 3, 4, 5).

Table 1. Verbal Rating Scale (VRS)

Point	Pain Level	Description
0	Painless	No pain on query
1	Mild Pain	No behavioral finding, pain is stated only when asked.
2	Moderate Pain	Concomitant findings are present, pain is stated only when asked or complaint is made without being asked.
3	Severe Pain	Severe visual response and concomitant grimacing and/or arm withdrawn behaviors.

Table 2. Demographic data

	Group I	Group T	(p)
Gender (M/F)	7/28	11/24	>0,05
Age (year)	46.0 ± 10.0	42.0 ± 13.0	>0,05
Height (cm)	163.4 ± 5.9	166.9 ± 6.9	>0,05
Weight (kg)	70.26 ± 13.4	75.34 ± 12.1	>0,05
Operation duration (min)	75.8 ± 2.1	74.9 ± 2.5	>0,05
ASA(I/II)	23/17	12/18	>0,05

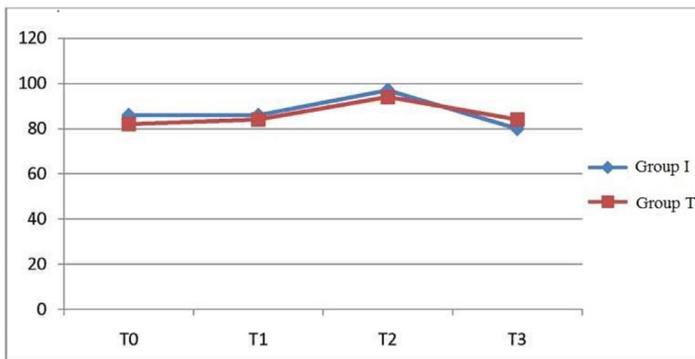


Figure 1. Peak level measurement graphic of heart rates in terms of groups. Preintervention of lidocaine (T0), post intervention of lidocaine (T1), right after intubation and following the intubation within the next 10th minutes (T3)

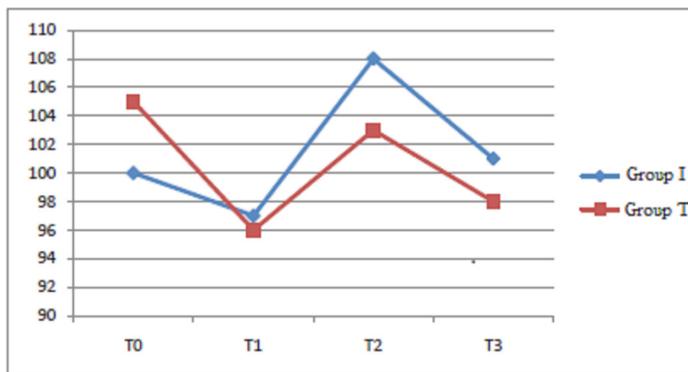


Figure 2. AMeasurements after one quarter of propofol is administered (VRS0)

Table 3. Demographic data

VRS ₀	Group I	Group T	P
0	25	30	>0,05
1	10	5	>0,05
2	0	0	>0,05
3	0	0	>0,05

Table 4. Measurements after two quarters of propofol is administered (VRS1)

VRS ₁	Group I	Group T	P
0	24	31	>0,05
1	10	3	>0,05
2	1	1	>0,05
3	0	0	>0,05

Table 5. Measurements after three quarters of propofol is administered (VRS2)

VRS ₂	Group I	Group T	P
0	26	27	>0,05
1	9	8	>0,05
2	0	0	>0,05
3	0	0	>0,05

Discussion

Injection pain arising from propofol application during general anesthesia is evaluated as complication [9, 10, 11, 12]. Macario et al. [9], evaluated frequency and severity of propofol injection pain

in a study which they examined routine surgical operations. And in this study which they evaluated postoperative complications, they positioned propofol pain on 7th place among 33 complications. There are numerous studies which indicate that propofol causes up to 100% pain particularly when it administered from the veins on the top of hand [10, 11, 13,14].

Lidocaine is used generally with two methods. Either it is used prior to the propofol injection with i.v. bolus or tourniquet application or by mixing with

propofol. Mangar et al. [15] proved that lidocaine given to proximal region of the arm after tourniquet apply is more effective on reducing the pain related to propofol injection compared to the placebo. Although there is no certain explanation for the mechanism of this case, it is a common idea that the possible effect of lidocaine by blocking the nerves can hinder the effect of stimulative membranes in veins [16].

Scott et al. [17] in their study proved that the pain has increased when injection slowly administered. The suggested point here is that propofol injection should be administered from wide veins in antecubital fossa. This mechanism may be explained by this means the agent which is infused into the high blood flow of wide veins effects minimum to the vein walls and goes on. Besides the process of interaction between venous wall and propofol extends in slow injections. Niazi et al. [18] informed that the pain shall be reduced or delayed only when total infused injection rate is 10-20 sec. Huang et al. [19] in their study, indicated that infusing IV liquid through cannulation effects the pain, and also fast moving liquid reduces contact to the vein periphery by diluting propofol and causes less pain. In our study, injection rate is adjusted in a way to administer 40 mg propofol in every 10 minutes, pain incidence inquiry has been performed nearly up to 30 seconds after injection (after 1/4, 2/4 and 3/4 of total propofol dose have been infused) and as this is in accordance with the injection rate specified in literature. The aim of adjusting the rate as such a way is to evaluate the delaying pain effect of propofol. Because the kinins occurred by contact are held responsible for this indirect effect of injection pain. Ewart et al. [20], in their study which they have measured the duration between lidocaine and propofol injection along with the pain frequency, they indicated that administering propofol within 30 seconds following lidocaine administering reduces the pain frequency. As the way Ewart et al suggested, we have switched to administering propofol right after lidocaine infusion.

In a study which esmolol, alfentanil, fentanyl and lidocaine are compared in terms of preventing the cardiovascular responds grow by laryngoscopy and intubation; on preventing heart rate increment esmolol and alfentanil are found as more effective in comparison with the placebo groups, and no difference is found on preventing increment of average blood pressure [21].

Tam et al. [22] in their study which they infused 1, 5 mg/kg lidocaine 2 min before laryngoscopy, they informed that artery pressure and increment on HR can't be prevented.

In conducted studies, administering lidocaine by tourniquet method is more frequent on reducing injection pain related to propofol. However, there are some risks such as anxiety, outstaying of tourniquet and interfusing to circulation high level

of local anesthetic by releasing tourniquet suddenly. Besides we consider that tourniquet causes stress. Some of the patients states that tourniquet tightens their arms. We consider according to the results obtained in our study that there is no significant statistical difference between both groups, infusion method is as effective as tourniquet method and also it is more comfortable technic for the patients.

As a result; we concluded that administering lidocaine by infusion technic may be an alternative method for tourniquet method on suppressing hemodynamic response related to tracheal intubation and on preventing injection pain related to propofol.

References

1. Lea-Febirger Endotracheal Anesthesia Complications. Collins VJ. Editor: Principles of Anesthesia; 3rd edition, Philadelphia. 1993;1:571-5.
2. Reddy MS, Chen FG, Ng HP. Effect of ondansetron pretreatment on pain after rocuronium and propofol injection: a randomised, doubleblind controlled comparison with lidocaine. *Anaesthesia*. 2001;56:902.
3. Tan CH, Onsiong MK. Pain on injection of propofol. *Anaesthesia*. 1998;53(5):468-76.
4. Kam E, Abdul-Latif MS, McCluskey. Comparison of propofol-lipura with propofol mixed with lidocaine 10 mg on propofol injection pain. *Anaesthesia*. 2004;59:1167-9.
5. Yokota S, Komatsu T, Komura Y. Pretreatment with topical 60% lidocaine tape reduces pain on injection of propofol. *Anesth Analg*. 1997;85:672-4.
6. Morgan GE, Mikhail MS. *Anaesthesia for patients with cardiovascular disease*. Clinical Anesthesiology, 3th edition. Appleton & Lange, Stamford. 2002:393-4.
7. Nakane M., Iwama H. A potential mechanism of propofol induced pain on injection based on studies using nafamostat mesilate. *BJA*. 1999;83(3):397-404.
8. Abdullah H. Yeşim E. Serdar Y. Laringoskopi ve entübasyona hemodinamik yanitin baskılanmasında lidokain, fentanil ve magnezyum sülfat'ın etkilerinin karşılaştırılması. *Göztepe Tıp Dergisi*. 2000;15(3):144-7.
9. Macario A, Weinger M, Truong P, Lee M. Which clinical anesthesia outcomes are both common and important to avoid? The perspective of a panel of expert anesthesiologists. *Anesth Analg*. 1999;88:1085-91.
10. Nitin S, Lakshmi J, Mamta S. Prevention of propofol pain: a comparative study. *Middle East J Anesthesiol*. 2009;20.1:71-4.
11. Hynynen M, Korttila K, Tammisto T. Pain on i.v. injection of propofol (IC135 868) in emulsion formulation: Short communication. *Acta Anaesthesiol Scand*. 1985;29:651-2.
12. McCrirrick A, Hunter S. Pain on injection of propofol: The effect of injectate temperature. *Anaesthesia*. 1990;45:443-4.
13. Lu Y, Zhang Y, Wong GT, Dong C, Yu J. Prevention of injection pain due to propofol by dezocine: A comparison with lidocaine. *Indian J Pharmacol*. 2013;45:619-21.
14. McCulloch MJ, Lees NW. Assessment and modification of pain on induction with propofol (Diprivan). *Anaesthesia*. 1985;40:1117-20.
15. Mangar D, Holak EJ. Tourniquet at 50 mm Hg followed by intravenous lidocaine diminishes hand pain associated with propofol injection. *Anesth Analg*. 1992;74:250-2.
16. Lai YY, Chang CL, Yeh FC. The site of action of lidocaine in intravenous regional anesthesia. *Ma Zui Xue Za Zhi*. 1993;31:3134.
17. Scott RPF, Saunders DA, Norman J. Propofol: Clinical strategies for the preventing the pain of injection. *Anaesthesia*. 1988;43 492-4.
18. Wilkinson D, Anderson M, Gauntlett I. Pain on injection of propofol: modification by nitroglycerin. *Anesth Analg*. 1993;77:1139-42.
19. Huang YW, Buerkle H, Lee TH. Effect of pretreatment with ketorolac on propofol injection pain. *Acta Anaesthesiol Scand* 2002; 46: 1021-420.
20. Ewart MC, Whitwam JG. Prevention of pain during injection of propofol. *Lancet*. 1990;335:798-9.
21. Memiş D, Alpaydın T, Pamukçu Z. Laringoskopi ve trakeal entübasyonla gelişen kardiyovasküler yanıtların önlenmesinde esmolol, alfentanil, fentanil ve lidokainin karşılaştırılması. *Türk Anesth Rean Cem Mecmuası*. 1999;27:513-6.
22. Tam S, Chung F, Campbell M. Intravenous lidocaine: Optimal time of injection before tracheal intubation. *Anesth Analg*. 1987;66:1036-9.