Original Article

Assessing the Effects of Dexmedetomidine and Labetalol on Changes in Heart Rate and Blood Pressure after Laryngoscopy Compared to a Control Group

Behzad Nazemroaya[1*], Mitra Jabalameli[1], Arsham Kamali[1]

1. Department of Anesthesiology and Critical Care, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Corresponding Author: Behzad Nazemroaya, Department of Anesthesiology and Critical Care, School of Medicine, Isfahan University of Medical Sciences, Hezar Jarib Ave, Isfahan, Iran.
Email: behzad_nazem@med.mui.ac.ir

Abstract

Background: One of the objectives of a smooth laryngoscopy is to minimize hemodynamic changes. The goal of this study was to assess the effects of dexmedetomidine and labetalol on heart rate and blood pressure changes after laryngoscopy compared to a control group.

Materials and Methods: This was a double-blind clinical trial conducted on 120 patients aged between 18 and 60 years, who were candidates for surgery, under general anesthesia, at Alzahra hospital in Isfahan during 2017-2018. Patients were randomly allocated to three groups of being administered dexmedetomidine or labetalol and a control group. The patient's age, weight, height, gender and clinical data including mean blood pressure (BP), heart rate, systolic BP, diastolic BP and oxygen saturation during 1, 3, 5 and 10 minutes after intubation were collected and analyzed using repeated measure analysis.

Results: The average age of patients who were candidates for surgery was 42.62 +/- 1.40. 52 percent (63 patients) were male subjects. The results showed no significant difference in mean BP, diastolic BP, systolic BP or oxygen saturation (p>0.05) in the three groups. But the difference in heart rate between the three groups was statistically significant. The heart rate in the dexmedetomidine group was significantly lower than the labetalol and control groups (p=0.00).

Conclusion: Results of the current study showed that using labetalol provided desirable hemodynamic stability compared to dexmedetomidine and caused less hemodynamic disturbances.

Keywords: Dexmedetomidine, Labetalol, Laryngoscopy

Please cite this article as: Nazemroaya B, Jabalameli M, Kamali A. Assessing the Effects of Dexmedetomidine and Labetalol on Changes in Heart Rate and Blood Pressure after Laryngoscopy Compared to a Control Group. J Cell Mol Anesth. 2020;5(2):79-83.

Introduction

Laryngoscopy and tracheal intubation during anesthesia increase the release of catechol amines along with sympathetic stimulation, resulting in increased blood pressure, heart rate, and arrhythmias, which can lead to dangerous conditions such as myocardial ischemia in patients with risk factors such as increased blood pressure and ischemic heart diseases (1-4). Various pharmacological drugs (opioids, lidocaine, beta-adrenergic antagonists and vasodilators) have been prescribed for suppressing sympathetic adrenal stimulation and hemodynamic changes before laryngoscopy and tracheal intubation;

however, none of such drugs were able to suppress hemodynamic responses without adverse effects (5).

Dexmedetomidine is an alpha 2 agonist that is highly selective for alpha 2 receptor (6) and is more inclined to alpha-2 receptor as opposed to clonidine (dexmedetomidine 1600/1 a2 / a1) and (clonidine a1 / 200 a1) (6). Dexmedetomidine activates the alpha2 adrenergic receptors and alleviates the patient and inserts the person in the second stage of non REM sleep and helps with postoperative recovery (6). Activating the alpha2 receptors inhibits the sympathetic center. This causes bladder hypotension and bradycardia, and the hemodynamic stability of the patient during surgery and reduces the need for opioid (1). Anxiolytic, relaxant and hypotensive effects are induced by stimulation of the central receptors a2a and imidazoline type1A1 (2). In two studies performed on 140 children aged 1-7 years, it was revealed that dexmedetomidine had a more sedative effect than midazolam or propofol (10). Labetalol is a receptor B antagonist, which also has antagonistic properties of alpha receptors (9), Labetalol and Esmolol both decrease systolic and diastolic blood pressure (10). Esmolol reduces heart rate, sometimes causing bradycardia, whereas Labetalol causes a decrease in average heart rate (10). Compared to Esmolol, Labetalol does not cause orthostatic hypotension and does not bring about serious complications such as tachycardia and bradycardia, and is more cost effective too (10). Labetalol may be an economically viable alternative to Esmolol, especially in elderly patients where the risk of unwanted hypotension is lower (10). Although hemodynamic impairment during operation is usually managed by increasing the concentration of anesthetic or opioid or both, it is more appropriate to use cardiovascular medicines to treat such disorders. Using Esmolol infusion instead of alfentanil to control heart rate reduces emergency problems after arthroscopy (11). In 1984, Cormack and Lehane described the grading system for laryngoscopic sights. In this system, in Grade 1, all laryngeal openings can be seen. In Grade 2, only the back side of the laryngeal openings can be seen. Furthermore, in Grade 3, only epiglottis is observed, and in Grade 4, no epiglottis nor larynx are seen (12). In various studies, the effect of dexmedetomidine or labetalol on hemodynamic changes alone has been studied; however, studies that compare these two drugs with one another with the control group are limited. Accordingly, we conducted a study that aimed to compare the effect of these two drugs on hemodynamic changes induced by anesthetic laryngoscopy.

Methods

This study was a randomized, prospective, double blind, clinical trial. Obtaining permission from the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1396.3.917) and written informed consent from patients. The study was registered in the Iranian clinical trial registry, coded IRCT20160812029310N3. A total of 120 male and female ASA I and II patients in the range of 18 to 60 years old who were candidates for surgery under general anesthesia in Alzahra hospital. They were randomly divided into three groups during the years of 2017 and 18. With regard to the formula for the comparison of the means, the sample size was at least 36 in each group, due to the probability of a 10% drop in the sample from the beginning, 40 people were selected in each group.

Inclusion criteria: All patients undergoing elective surgery at al-Zahra Hospital, aged between 18 and 60 years old under general anesthesia, were physically examined and were diagnosed with ASA I and II. None of them had alcohol and drug addiction.

Non-inclusion criteria: history of sensitivity, grade 3 cardiopulmonary block, asthma, heart failure, history of heart attacks in the last six months, IHD, TCA use, MAOI, fever, obesity (BMI greater than 27), neurological diseases, and respiratory diseases.

Exclusion criteria: Laryngoscopy lasts longer than 30 seconds, laryngoscopy more than once tried, and cardiopulmonary arrest.

Random collection sampling technique was used to randomly place the patients in three groups. Fluid therapy protocol at NPO time was the same in all patients and in accordance with the law 4-2-1 and according to law 6 -8-10 during the operation without heating the fluids. After placement of patients on the operating bed, after connecting standard monitoring, including pulse oximeter, capnography and ECG, the vital signs were recorded in three groups, and the drugs were first introduced as blouse and then infusion. In group A, 0.1 μg / kg of dexmedetomidine was given as blouse (7) and 0.1 µg in infusion for 10 minutes, and in group B, 0.1 mg/kg Labetalol in blouse and 0.1 mg in infusion for 10 minutes and in group C, normal saline was given in the same volume and form with two previous medications. Three minutes after administration of muscle relaxant, laryngoscopy and tracheal intubation were performed and the vital signs were recorded in 1, 3, 5, and 10 minutes later. All drugs were injected into the same form and volume into a single-syringe and injected to a patient in a blinded manner. After conducting intubation and ensuring its correct location, anesthesia was continued with isoflurane at MAC level and NO2 60% in O2 and 0.1 mg/kg morphine. The mean arterial blood pressure (MAP), heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded at 3, 5, 5, 10 minutes after intubation and then at 60 and 120 after induction of anesthesia in three groups. The patient's ventilation was maintained in such a way that $ETCO_2$ was maintained at about 30-35.

At the end of surgery, muscle relaxant, using atropine 0.02 mg/kg and neostigmine 0.04 mg/kg, and after complete awakening, the patient was extubated and transferred to recovery. During the extubation time (from the time the anesthetic gas was abated until extubation), duration of anesthesia, surgery and recovery, and duration of waking from anesthesia (from extubation to patient response to time, place, and person) were recorded. After the patient was entered into the recovery room, the patient was continuously administered oxygen through a nasal catheter at a rate of 3 liters per minute and then covered with a blanket.

Patient information including height, weight, age, gender and clinical symptoms were recorded in a checklist made by the registrar and entered into the SPSS software version 22. Statistical analyses were provided in descriptive and analytical sections. To analyze the data, descriptive statistics including frequency tables and central indices and dispersion were used to describe the most important characteristics of the subjects. Repeated measure test was used to perform comparisons between the three groups in several measurements. Other comparisons were made between the three groups using Chi-square, ANOVA and Kruskal-Wallis tests. The level of significance in all tests was less than and equal to 0.05.

Results

Of the 119 patients who were candidates for general anesthesia, 40 ones were assigned to the control group, 40 patients in the labetalol group, and 39 in the dexmedetomidine group. It should be noted that 63 patients (52%) were male and 57 (47%) were female. The mean age of the subjects was 42.62±1.40 years old (18-60 years old).

According to Table 1, the demographic variables did not differ significantly between the three groups (p>0.05). (Table1)

Results revealed significant difference in the MAP, SBP and DBP (P=0.00).However, the difference between the three groups for the HR, SpO2**,** Full Consciousness and Recovery duration variable was not statistically significant (p>0.05) (Table 2).

Discussion

Tracheal intubation is a process that is performed before surgery for oxygenation, and without it, performing the most surgeries under general anesthesia will be impossible in practice. On the other

Table 1: Comparison of variables and demographic characteristics of patients in the groups.

Variables	Control (N=40)	Labetalol (N=40)	Dexmedetomidine (N=39)	p
Age (yrs.)	42.85 ± 2.83	45.88 ± 2.31	39.69 ± 2.01	0.14
Weight (kg)	75.27 ± 1.73	71.05 ± 1.73	73 ± 1.43	0.47
Height (cm)	169.05 ± 1.33	168.91 ± 1.11	170.41 ± 1.02	0.54
Gender(%)n	F (42.5%) 17 M (55%) 22	F (60%) 24 M(40%) 16	F (37%) 15 M(62.5%) 25	0.17

F, Female; M, Male.

Table 2: Mean SBP, DBP, MAP, HR, SpO_2, full Consciousness and Recovery duration in three groups.

Variables	UNIT	Control(N=40)	Labetalol (N=40)	Dexmedetomidine (N=39)	P
SBP	mmHg	144.17 ± 3.60	130.77 ± 2.47	122.07 ± 2.89	0.00
DBP	mmHg	92.35 ± 2.25	84.77 ± 2.18	77.70 ± 2.21	0.00
MAP	mmHg	109.92 ± 2.81	101.95 ± 2.36	92.37 ± 2.33	0.00
HR	beat/Min	87.32 ± 2.41	83.37 ± 2.46	80.65 ± 1.53	0.09
SpO_2	(%)	97.12 ± 0.11	97.23 ± 0.14	96.75 ± 0.20	0.11
Full consciousness	Min	67.54 ± 6.90	77.71 ± 6.69	73.66 ± 6.21	0.41
Recovery duration	Min	108.64 ± 10.87	114.34 ±11.87	109.09 ±9.79	0.99

SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MAP, Mean arterial pressure; HR, Heart rate;SpO_2, saturation of peripheral oxygen.

hand, various studies and experiments have shown that intubation is associated with the occurrence of some hemodynamic disorders, including increased or decreased blood pressure and heart rate in the patient, which if not taken by the anesthesia specialist, can have harmful consequences and even lead to the patient's death.

In this regard, labetalol and dexmedetomidine are among the drugs that are currently widely used to maintain hemodynamic stability in patients undergoing various surgeries. Since there exists a dearth of studies on the effect of these two drugs, this study sought to determine the effect of prescribing labetalol and dexmedetomidine on changes in blood pressure and heart rate after laryngoscopy and tracheal intubation as compared to the control group.

According to the results of this study, there were no significant differences between the three groups receiving labetalol, dexmedetomidine and control in terms of demographic and basic variables. In the analyses, there was no detectable effect. Hence, the differences observed between the three groups are likely to be related to the type of drug used. The evaluation of hemodynamic parameters showed that during the study period, mean arterial blood pressure, systolic blood pressure, diastolic blood pressure and hemoglobin saturation were not observed. However, the difference between the three groups for the heart rate variable was statistically significant. Results of post hoc test showed that heart rate in the dexmedetomidine group was significantly less than that in labetalol group and control group. However, contrary to the results of the present study, in the study by Chung et al., the mean dose of labetalol blouse was associated with suppression of heart rate response to laryngoscopy and intubation, but had the slightest effect on hypertension (5).

In addition, time was considered as an effective factor in changing the mean arterial blood pressure, systolic blood pressure, diastolic blood pressure, hemoglobin saturation and heart rate. Interaction analysis also showed that the mean changes in mean arterial blood pressure, systolic blood pressure, diastolic blood pressure, hemoglobin saturation and heart rate varied in three groups over time.

In a study by Singh et al., 40 patients were divided into 4 groups of 10, each of whom received placebo (normal saline), 100 mg lidocaine, 5 mg labetalol and 10 mg labetalol in the two minutes before laryngoscopy and received a tracheal intubation as an intravenous blouse before the induction of anesthesia. The results showed that injection of 10 mg of labetalol inhibited cardiac pacing, and had a lower heart rate compared to those who received placebo or lidocaine or 5 mg labetalol after laryngoscopy, but the response to blood pressure in the four groups was not significantly different. In this study, it was concluded that administration of 10 mg intravenous labetalol before the induction of anesthesia was a safe and cost effective means to prevent increase in heart rate, but in preventing an increase in blood pressure in response to laryngoscopy and intubation, it was not effective (4).

Conclusion

With regard to the results of the study demonstrated that using labetalol provided more hemodynamic laryngoscopy and lower incidence of hemodynamic disorders is suggested in comparison with labetalol.

Acknowledgment

This research extracted from the dissertation of the Professional Doctorate of General Medicine, which was approved by the Research Deputy of the Faculty of Medicine; No. 396917 with the support of the deputy. Hereby, the authors appreciate all those who helped carry out the research.

Conflicts of Interest

The authors declare that they have no conflict of interest.

References

1. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987;59(3):295-9.
2. Inoue A, Okamoto H, Hifumi T, Goto T, Hagiwara Y, Watase H, et al. The incidence of post-intubation hypertension and association with repeated intubation attempts in the emergency department. PLoS One. 2019;14(2):e0212170.
3. Roy WL, Edelist G, Gilbert B. Myocardial ischemia during non-cardiac surgical procedures in patients with coronary-artery disease. Anesthesiology. 1979;51(5):393-7.
4. Singh SP, Quadir A, Malhotra P. Comparison of esmolol and labetalol, in low doses, for attenuation of sympathomimetic response to laryngoscopy and intubation. Saudi J Anaesth. 2010;4(3):163-8.
5. Blessberger H, Lewis SR, Pritchard MW, Fawcett LJ, Domanovits H, Schlager O, et al. Perioperative beta-blockers for preventing surgery-related mortality and morbidity in adults undergoing non-cardiac surgery. Cochrane Database Syst Rev. 2019;9(9):Cd013438.
6. Hashemian M, Ahmadinejad M, Mohajerani SA, Mirkheshti A. Impact of dexmedetomidine on hemodynamic changes during and after coronary artery bypass grafting. Ann Card Anaesth. 2017;20(2):152-7.
7. Wang CY, Chen F, Wu J, Fu SY, Xu XM, Chen J, et al. The association of the optimal bolus of dexmedetomidine with its favourable haemodynamic outcomes in adult surgical patients under general anaesthesia. Br J Clin Pharmacol. 2020;86(1):85-92.
8. Kim S, Hahn S, Jang MJ, Choi Y, Hong H, Lee JH, et al. Evaluation of the safety of using propofol for paediatric procedural sedation: A systematic review and meta-analysis. Scientific reports. 2019;9(1):12245..
9. Riddell JG, Harron DW, Shanks RG. Comparative effects of adimolol, labetalol and propranolol on heart rate and blood pressure in man. Br J Clin Pharmacol. 1985;19(4):405-10.
10. Singh PP, Dimich I, Sampson I, Sonnenklar N. A comparison of esmolol and labetalol for the treatment of perioperative hypertension in geriatric ambulatory surgical patients. Can J Anaesth. 1992;39(6):559-62.
11. Smith I, Van Hemelrijck J, White PF. Efficacy of esmolol versus alfentanil as a supplement to propofol-nitrous oxide anesthesia. Anesth Analg. 1991;73(5):540-6.
12. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984;39(11):1105-11.
13. Yu SH, Beirne OR. Laryngeal mask airways have a lower risk of airway complications compared with endotracheal intubation: a systematic review. J Oral Maxillofac Surg. 2010 Oct;68(10):2359-76.
14. Abrishami A, Zilberman P, Chung F. Brief review: Airway rescue with insertion of laryngeal mask airway devices with patients in the prone position. Can J Anaesth. 2010;57(11):1014-20.