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COMPARATIVE STUDY OF THE EFFICACY OF LIGNOCAINE AND FENTANYL AFTER PROPOFOL INDUCTION IN ATTENUATION OF HEMODYNAMIC CHANGES FOLLOWING LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION DURING GENERAL ANESTHESIA

Fatima Ali Nasir[*], Jasim M Salman[@] & Salam N Asfar[#]

*MB,ChB, FICMS Anesth. Basrah Teaching Hospital. [@]MB,ChB, DA, FICMS Anesth., Assist. Prof. & Consultant Anesthesiologist, College of Medicine, University of Basrah. [#]MB,ChB, MSc Anesth., Professor of Anesthesiology, College of Medicine, University of Basrah, Basrah, IRAQ.

Abstract

Laryngoscopy and tracheal intubation are constantly connected with a reflex sympathetic reaction bringing about tachycardia, hypertension and dysrrhythmias. This may cause harm in high hazard patients. Different pharmacological methodologies have been utilized to limit or weaken such a reaction.

This study aimed to assess the hemodynamic changes following laryngoscopy and endotracheal intubation following propofol induction utilizing a standard anesthesia procedure and to analyze the capability of lignocaine and fentanyl in lessening the cardiovascular reaction to laryngoscopy and intubation amid general anesthesia.

Sixty patients aged between eighteen to fifty years, of either gender and ASA class I, weighing between forty to ninety kilograms were planned for elective procedures and were haphazardly allotted into three groups of 20 each. Induction of anesthesia was standard for all patients who received propofol 2mg/kg i.v. and were relaxed with succinylcholine 1mg/kg i.v. The first group received 10cc. normal saline, the second group had fentanyl 2µg/kg i.v. bolus and the third group got lignocaine 1.5mg/kg 3 minutes before laryngoscopy and intubation. Heart rate and blood pressure were recorded noninvasively on arrival to the theatre and considered as a base line record, just after induction and then 1,3,5,7 and 10 minutes following intubation.

There were no difference in statistical analysis between the groups regarding number, gender, age, weight and ASA class. There is significant rise in heart rate, systolic BP, diastolic BP and MAP in control group particularly in the first 3 minutes following intubation ($p<0.05$). Both fentanyl and lignocaine gave minimal protection against rise in heart rate after laryngoscopy and intubation and there is no significant difference between the two drugs ($p>0.05$). Both fentanyl and lignocaine were equally effective in prevention of major rise in systolic blood pressure, diastolic blood pressure and mean arterial blood pressure.

In conclusion, Fentanyl 2µg/kg and lignocaine 1.5mg/kg are both equally effective for attenuation of laryngoscopy and endotracheal intubation pressor response.

Keywords: Attenuation, changes in hemodynamics, laryngoscopy, endotracheal intubation, propofol, fentanyl, lignocaine.

Introduction

The hemodynamic reaction to the act of laryngoscopy and intubation was first expressed by Reid and Brace in 1940[1]. The increase in heart rate and blood pressure is usually transient, variable, unpredictable and take place most frequently from reflex sympathetic & vagal discharge in response to laryngotracheal stimulation, which in sequence leads to rise in plasma norepinephrine concentration[2]. These changes are regularly tolerated by fit individuals, however, they may be deleterious in patients with hypertension, coronary artery disease, raised intracranial pressure, perioperative

myocardial ischemia, cardiac arrhythmias, acute heart failure and cerebrovascular accident[3], sudden death can occur and has been reported[4].

A variety of methods of attenuation of response to laryngoscopy and intubation are still in research from the date of its identification. Quite a lot of studies have been made in order to ease these hemodynamic responses to laryngoscopy and intubation. Many drugs have been used for the same reason[5] including: Lignocaine topical anesthesia of oropharynx, laryngotracheal instillation of lignocaine prior to intubation, intravenous lignocaine[6-8], beta adrenergic blockers[9-11], alpha adrenergic blockers[12], both alpha and beta adrenergic blockers[13], vasodilators such as hydrallazine, sodium nitroprusside[14], nitroglycerine[15], deep inhalational anesthesia[16,17], intravenous opioid[18,19] and calcium channel blockers[20]. No single agent had been recognized as the most suitable for this purpose.

Beside lowering the cardiovascular response, the induction of anesthesia for patients at risk have to also assure the following requirements: it must be appropriate regardless of patient collaboration, prevent harm of cerebral blood flow, stay away from arousal of the patient & it should neither be time consuming nor influence the duration or modality of the resultant anesthesia. Among the suggested procedures, intravenous lignocaine or fentanyl come into view to best fulfill to the stated criteria[21].

Lignocaine hydrochloride which is an amine ethylamide local anesthetic and antidysrrhythmic drug, is suitable for reduction of cardiovascular response to intubation, and can also reduce cough reflex, dysrrhythmias and increased intracranial pressure[3]. Lignocaine put off transmission of nerve impulses (conduction blockade) by inhibiting passage of sodium ions through ion discriminatory sodium channels in nerve membrane[22].

Fentanyl is a powerful synthetic narcotic analgesic with a quick onset and short length of action, It is 75-125 times more potent than morphine as an analgesic[23,24]. Fentanyl brings hemodynamic steadiness during perioperative period by its action on cardiovascular & autonomic regulatory regions. It decreases sympathetic tone & make rise in parasympathetic tone. Fentanyl reduce pituitary adrenal response directly or indirectly via hypothalamus. It soothe the response at 2µg/kg i.v. given before laryngoscopy & intubation[25].

This study aimed to evaluate the hemodynamic changes happened after endotracheal intubation by means of a standard anesthesia technique and to contrast the efficacy of lignocaine and fentanyl for the attenuation of the hemodynamic reaction to direct laryngoscopy and intubation during general anesthesia.

Patients and methods

Institute agreement was obtained from the Ethical Committee in College of Medicine at Basrah University. This study was carried out in the department of Anesthesiology at Al-Sadir Teaching Hospital in Basrah, it involved sixty patients of either sex aged between 18-50 years old, weighing between 40-90 kilograms and undergoing usual elective non-cardiac surgical measures requiring general anesthesia with endotracheal intubation. Patients who fulfill the subsequent criteria were included in the study after obtaining written informed consent in each case.

Inclusion criteria: Normotensive, Normal ECG, American Society of Anesthesiologists (ASA) class I.

Exclusion criteria: Hypertension, Ischemic heart disease, Heart failure, Cerebrovascular accident & intracranial hypertension, Dysrrhythmias, Pregnant and nursing women, Alcoholic and drug abuser, History of regular medication

which affect heart rate and blood pressure, Diabetes, Preoperative prediction for difficult intubation or intraoperative difficulty in intubation, and Emergency operations.

Pre-anesthetic evaluation: A careful pre-anesthetic assessment was done by taking history and clinical examination, related clinical signs and symptoms were recorded, pulse oximetry and non invasive arterial blood pressure were used on arrival to the theatre.

Distribution of the patients: All the selected patients were randomly allocated into three groups consisting of twenty patients each. Group A: received 10 cc normal saline. Group B: received fentanyl 2µg/kg body weight. Group C: received lignocaine 1.5mg/kg body weight.

Anesthetic technique: No atropine or other premedication was given to the patients. All the patients were pre-oxygenated utilizing 100% oxygen 10L/min. for about 5 minutes using Bain circuit with a close-fitting face mask. The tested drugs were given 3 minutes before intubation.

Induction of anesthesia was standardized for all patients and carried out 2 minutes after administration of the tested drugs, using propofol (2mg/kg) intravenous, and after loss of eye lash reflex the patient was relaxed with intravenous succinylcholine (1mg/kg). The lungs were manually ventilated with 100% oxygen 10L/min. followed by endotracheal intubation using the disposable cuffed endotracheal tube (size ranging from 7-8 mm) by the same person each time.

All the patients were intubated without difficulty with the help of direct laryngoscopy using a Macintosh laryngoscope blade, and fixed after confirmation of the position by auscultation of the chest by stethoscope. Anesthesia was maintained by oxygen 10L/min. with halothane 1MAC, adequate muscle relaxation was achieved with rocuronium (0.6 mg/kg).

No extra agents were given in the first 10 minutes post-intubation, nor any surgical stimulus was allowed at this period. Further anesthesia in all three groups of patients was carried out as per the requirement. All patients who necessitates a second try of intubation were excluded from the study.

Data were recorded in a special performa sheet for each patient, it included the following information: age, gender, weight, ASA class, type of surgery, past medical history, drug history. The heart rate and blood pressure were documented at the following intervals : A base line value during the time of pre-anesthetic check up, Just after induction, One minute following intubation, Three minutes after intubation, Five minutes subsequent to intubation, Seven minutes after intubation, and Ten minutes after intubation.

At the end of the 10 minutes monitored period through which the patient had been cleaned and draped, surgery was begun. Time span around intubation up to ten minutes had been looked particularly to separate the effect of the studied drugs at the time of intubation.

Data were analyzed by computer-based statistical program SPSS (Statistical Package for Social Science) for window (version 21). Student's T test was utilized for comparing means of quantitative data & chi-square test was applied for qualitative data. Difference was considered statistically significant if $p<0.05$.

Results

Sixty patients were included in this study and were assigned into three equal groups (each 20 cases). No statistical difference was noted between the groups in regard to gender, in the control group there was 12 (60%) males and 8 (40%) females, while in the fentanyl group there was 10 (50%) males and 10 (50%) females, in the lignocaine group there was 11(55%)

males and 9 (45%) females. Also no difference was found in regard to age (range 18-48 years); in the control group the mean age was 31±8 years, while in the fentanyl group was 31±7 years and in the lignocaine group 30±6 years. Also no statistical difference was found regarding the weight of the patients; in the control group the mean weight was 74±10 kilogram while in fentanyl group was 70±11 kilogram and in the lignocaine group was 71±5 kilograms as demonstrated in table I.

Table I: Characteristics of patients included in the study.

		Control group	Fentanyl group	Lignocaine group
Number of patients		20	20	20
Gender	Males No. (%)	12 (60%)	10 (50%)	11 (55%)
	Females No. (%)	8 (40%)	10 (50%)	9 (45%)
Age (mean±SD)		31±8	31±7	30±6
Weight (mean±SD)		74±10	70±11	71±5

Blood pressure changes: The systolic blood pressure showed that lignocaine had significant difference in systolic blood pressure only at one and three minutes following laryngoscopy and intubation and it is superior to fentanyl in this concept but statistically not significant in the other times as demonstrated in table II.

Table II: Systolic blood pressure changes between the groups.

Parameters		Control Group	Fentanyl Group	Lignocaine Group
		Mean±SD (N=20)	Mean±SD (N=20)	Mean±SD (N=20)
Base line		124±11	131±10	128±5
After induction		116±15	113±15	116±12
After laryngoscopy & intubation	1 Min.	134±15	138±17	129±19 *
	3 Min.	133±23	123±16	120±17 *
	5 Min.	119±13	118±12	118±9
	7 Min.	114±9	108±14	115±7
	10 Min.	114±6	116±10	113±9

*:Significant differences P<0.05

The diastolic blood pressure changes between the groups showed that lignocaine and fentanyl are equally effective in lowering the diastolic blood pressure compared with the control group as shown in table III.

Table lll: Diastolic blood pressure changes between the groups.

Parameters		Control Group	Fentanyl Group	Lignocaine Group
		Mean±SD (N=20)	Mean±SD (N=20)	Mean±SD (N=20)
Base line		79±8	77±9	70±8
After induction		71±10	67±12	71±15
After laryngoscopy & intubation	1 Min	85±7	82±16	83±17
	3 Min	85±14 *	76±14	75±15
	5 Min	72±9	67±17	74±10
	7 Min	70±7	65±14	71±10
	10Min	70±7	71±13	70±11

*: Significant difference P<0.05

The mean arterial pressure (MAP) showed that lignocaine and fentanyl also are equally effective in lowering the mean arterial blood pressure compared with the control group as shown in table IV.

Table IV: Mean arterial blood pressure changes between the groups.

Parameters		Control Group	Fentanyl Group	Lignocaine Group
		Mean± SD (N=20)	Mean±SD (N=20)	Mean±SD (N=20)
Base line		94±8	95±9	89±6
After induction		86±11	83±10	86±13
After laryngoscopy & intubation	1 Min	101±10	101±14	98±17
	3 Min	101±16 *	92±14	90±15
	5 Min	88±10	84±15	88±9
	7 Min	84±7	80±13	86±8
	10 Min	85±5	86±11	85±10

*: Significant difference P<0.05

The heart rate changes: There were no significant changes between the groups and within the same group as shown in table V.

Table V: Heart rate changes between the groups.

Parameters		Control Group	Fentanyl Group	Lignocaine Group
		Mean±SD (N=20)	Mean±SD (N=20)	Mean±SD (N=20)
Base line		91±14	103±13	91±12
After induction		94±10	104±16	99±16
After laryngoscopy & intubation	1Min	105±8	111±113	114±15
	3 Min	105±13	103±14	103±18
	5 Min	97±8	98±16	94±11
	7 Min	90±5	90±15	87±7
	10Min	85±5	87±15	84±7

*: Significant differences P<0.05

Discussion

Laryngoscopy and tracheal intubation produced stressful hemodynamic changes in form of high blood pressure and tachycardia attributed to increase in the circulating levels of catecholamines[26,27]. Control of such hemodynamic changes is very important to prevent hurtful effects, and the need for safe and effective therapeutic agents that may attenuate, blunt, suppress or abolish such changes became an important intervention during surgical procedures under G.A.

There was no significant difference between the groups regarding to number, gender, age and weight as demonstrated in table I.

The results obtained from this study revealed that all patients groups showed quantitatively and qualitatively similar hemodynamic pressor response during induction, intubation and post intubation; the differences, if present, failed to reach statistically significant values and both fentanyl and lignocaine are equally effective in attenuation of hemodynamic changes as shown in table III, IV and V except in mean systolic B.P. We observed that lignocaine causes significant attenuation of increase in mean systolic blood pressure at one and three minutes post-intubation and it is superior to fentanyl but statistically not significant (p>0.05) as shown in table II. In regard to the diastolic and mean arterial pressures

both drugs are equally effective and there is no statistical differences as shown in tables III&IV. Table V showed minimal protection of both drugs against the rise in the heart rate. This result was not in agreement with that of Bachofen M[21] who reported that fentanyl showed a significant pressure-lowering action over the whole observation period in all patients while no significant effect of lignocaine on the pressure response could be observed.

Malde and Sarode[3] concluded that given 5 minutes prior to intubation, lignocaine (l.5mg/kg) and fentanyl(2 g/kg) both attenuate the rise in pulse rate, though fentanyl was better.

Our findings were equivalent to the results of Abou-Madi, Keszer and Yacoub[28] who had used i.v. lignocaine in 1.5mg/kg and 0.7mg/kg doses. They had found that i.v. lignocaine in l.5mg/kg dose offer complete protection against arrhythmias, but only a borderline guard against increase in blood pressure and heart rate, while the dose 0.7mg/kg was inadequate in providing protection against arrhythmias, only preventing blood pressure rise. They have described the possible mechanism of action of lignocaine as direct myocardial depressant effect, peripheral vasodilating effect and effect of synaptic transmission. A review on "Prophylactic lidocaine use pre-intubation" they said that a dose of prophylactic lidocaine of 1.5mg/kg given i.v. 3 minutes before intubation is optimal. No studies document any harmful effects of prophylactic lidocaine given preintubation[29]. This results was in accordance with that of Asfar SN & Abdulla WY[6] study which revealed that lignocaine (as laryngotracheal spray, transtracheal injection or i.v. injection in a dosage of l mg/kg body weight administered prior to intubation) is effective to prevent significant increase in mean arterial pressure and prevent post-intubation arrhythmias but gave minimal protection against the rise in heart rate.

A study by Splinter demonstrated that lignocaine does not attenuate hemodynamic responses beneficially during laryngoscopy and intubation[30]. Miller and colleagues selected 45 ASA class I and II patients to study the effect of i.v. lignocaine in decreasing the cardiovascular response to laryngoscopy and intubation, but their study showed no significant difference between groups[31]. But our study showed an opposite results because it compare two drugs. Yushi et al., in his study concluded that fentanyl 2µg/kg suppresses the hemodynamic response to endotracheal intubation more than the response to laryngoscopy[32]. It was shown that supplementation of anesthetic induction with fentanyl 2µg/kg significantly attenuated the increase in heart rate, arterial pressure and rate pressure product after laryngoscopy and intubation, and fentanyl 6µg/kg completely abolished pressure responses[33].

Gupta and Tank[5] proved that fentanyl in a bolus dose of 2µg/kg before induction of anesthesia is effective in attenuating the hemodynamic response to laryngoscopy and intubation.

We used a low doses of fentanyl (2µg/kg) as done in previous study because a larger dose leads to muscle rigidity, bradycardia, nausea and vomiting. Large doses may also cause postoperative respiratory depression; especially in surgery with short duration of less than l hour[33,34]. McClain et al., reported apnoeic episodes in four out of seven patients who received 3.2-6.5µg/kg fentanyl[35] .

Failure to predict superiority for each pattern of drug intervention may be attributed to limited number of patients in each group, and our sample was a group of almost healthy patients (ASA-I), or may be due to the use of propofol at induction which reduces the hypertensive response to tracheal intubation. Hypotension is common with propofol, although; whether caused by direct

myocardial depression, reduced systemic vascular resistance, or both is controversial. Normo or bradycardia is common; resetting of the baroreceptor reflex has been suggested[36] .

In conclusion, fentanyl 2μg/kg and lignocaine 1.5mg/kg are both effective for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation following propofol induction. Therefore we can conclude that patients with hypertension, ischemic heart disease and brain tumor will get benefit by giving intravenous fentanyl or lignocaine preoperatively before laryngoscopy and endotracheal intubation.

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