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Original Research Article

Comparison of lignocaine and fentanyl for attenuation of cardiovascular response during laryngoscopy and tracheal intubation in cardiac surgery patients

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Abstract

Background: Prevention of stress injury by maintaining stable haemodynamic pressure is the corner stone of anaesthesia management. Lignocaine and fentanyl is the most common agent used for attenuation of presser response in healthy patients during intubation. Cardiac disease patient are more prone for stress injury. There was no previous study that compared their effect in cardiac surgery patient.

Methodology: 60 patients were registered in this prospective, randomized double blind study. Group A received Lignocaine 1.5mg/kg i.v and group B received an additional dose of injection Fentanyl 3 mcg/kg i.v. 3 min prior to laryngoscopy. During induction various hemodynamic parameters was recorded during induction and 10 min intervals after tracheal intubation.

Results: Both drug cause reduction in haemodynamic after induction of anaesthesia. At 1min after intubation the rise in pressure is more in lignocaine group as compared to fentanyl group. At 5min after intubation Group B showed a fall in pressure below base line whereas group A maintained above baseline. Both drug caused fall in pressure below baseline 10min after intubation. Both drug cause reduction heart rate (HR) after induction of anaesthesia. After intubation the rise in HR is more in lignocaine group but over a time showed a fall in HR below baseline in both group.

Conclusion: Lignocaine (1.5 mg/kg) and Fentanyl (3 µg/kg) both attenuated the rise in HR, though fentanyl was better. Both drugs can be safely used for attenuation of stress response in cardiac disease patient undergoing elective cardiac surgery.

Keywords: Lignocaine, Fentanyl, Cardiac.

1. Introduction

Laryngoscopy and TI (tracheal intubation) trigger response results in imbalance between myocardial oxygen supply and demand which may manifest in form of haemodynamic perturbation associated with ischemic changes in ECG. It may be well tolerated in healthy people, but may be hazardous in patients for cardiac Surgery [1]. Prevention of stress injury by maintaining stable haemodynamic pressure is the corner stone of anaesthesia management. Many methods and modalities are described to diminish or blunt the effect of TI on hemodynamic parameters [2]. No single agent has been proven to be most efficacious for this purpose. Lignocaine and fentanyl is the most common agent studied for Attenuation of presser response. Lignocaine injected intravenously blunts the cough reflex in awake and anesthetized patients, and additionally has potential cardio protective effect. It has been used in various studies to blunt the pressor effect of TI on patients with equivocal results. There are no strong and definitive recommendations for its use. Fentanyl is an opoid used for TI but there is lack of literature about optimum dose in cardiac disease patient. Of the 2 drugs fentanyl 4µg/kg bolus provides a consistent, reliable and effective attenuation of haemodynamic response to laryngoscopy and TI as compared to lignocaine 1.5mg/kg IV. Bolus in patients undergoing general surgical procedures [3]. There was no previous study that compared their effect in cardiac surgery patient.

2. Material and Method

This study was carried out at the tertiary level hospital in India. After Approval from the Institutional Ethics Committee, written informed consent was obtained from close relatives of the patients. Out of a total of 104 cardiac surgery patients admitted during the study period (August 2015 to October 2016), 12 patients did not meet inclusion criteria and 32 were excluded due to unavailability of investigator. A total of 60 patients with LVEF> 35%, between 30 and 75 years of age, undergoing elective cardiac surgery requiring laryngoscopy and intubation were enrolled for this prospective randomized double blind study. Patients with difficult airway, severe systemic disorders like uncontrolled diabetes mellitus, uncontrolled hypertension, respiratory disorders, advanced heart blocks, preoperative left bundle branch block were excluded from the study. Patients requiring Intubation time > 20 s or more than 1 attempt of intubation or history of allergy to Lignocaine, were also excluded from the study.

According to a computer-generated randomization chart, the patients were assigned to one of the two treatment groups. Patients in group A received injection Lignocaine 1.5mg/kg i.v 3 minutes prior to laryngoscopy and patients in group B received an additional dose of injection Fentanyl 3 mcg/kg i.v. 3 min prior to laryngoscopy. The test drug was prepared and administered by a nurse who was blinded to drug assignment. Either Lignocaine 1.5mg/kg or Fentanyl 3 mcg/kg was taken and diluted with NS to a volume of 20 ml in a 20 ml syringe and labeled as 'TEST DRUG'. Vitals were recorded by blinded treating clinician.

Sensitivity reaction to local anaesthetic was carried out and an informed consent was obtained. After wheeling the patient into Operation Theater, standard monitoring of ECG and pulse oxymetry was connected. Under strict asepsis and local anaesthesia, 16 G peripheral venous cannula was inserted for maintaining intravenous access. Patients were sedated with Inj Midazolam 0.03 mg/kg i.v and Inj Fentanyl 2 mcg/kg following which right radial artery was cannulated under local anaesthesia with 20 G arterial cannula for invasive blood pressure monitoring. Pre oxygenation was done for 3 minutes, following which patients were induced with injection Etomidate 0.3 mg/kg i.v. To facilitate intubation, injection Vecuronium 0.15mg/kg was used as muscle relaxant. Anaesthesia was maintained with 50 % air + 50 % oxygen and Sevoflurane 2 %. All male patients were intubated with 8.5mm ID PVC ETT and all female patients were intubated with 7.5mm ID PVC ETT. During induction, HR(Heart rate), SBP(Systolic Blood pressure), DBP(Diastolic Blood pressure), MAP(Mean blood Pressure) was recorded before induction(T1), 1min after induction(T2) and then 1, 3,5,10 min intervals after tracheal intubation(T3 to T6). Cleaning, draping and surgical incision was withheld till completion of recording. A 20% or more change vitals during the study period was considered signifcant. Hypotension was defined as ≥ 20% decrease in MAP from the average baseline value for more than 1 min was treated with intravenous bolus of 3 mg mephentermine hydrochloride. Bradycardia was defend as ≥ 20% decrease in HR from the baseline value and was treated if associated with hypotension or HR below 45 beats/min, with intravenous glycopyrrolate.

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 15.0 for Windows). Mean & medians were calculated for all quantitative variables and for measures of dispersion standard deviation or IQR were calculated. Normality of quantitative data was checked by measures of Kolmogorov Smirnov tests of normality. For normally distributed data means of two groups were compared using t-test. For skewed or ordinal data Mann–Whitney test was applied. Qualitative or categorical variables were described as frequencies and proportions. Proportions were compared by using Chi square or Fisher's exact test which ever was applicable. All statistical tests were two-sided and performed at a significance level of 0.05.

3. Observation and Results

Demographic parameters and clinical characteristics were comparable between the groups. Majority of patients were male (Table 1).

Table 1: Demographic profile and baseline clinical characteristics of patients in groups

Patient data		Group A (n=30) mean±SD	Group B (n=30) mean±SD	P value
Weight (kg)		66.3±13.1	74.3±1	0.06
ASA grade		2.7±0.4	2.6±0.4	0.27
EF (%)		51.7±4.7	53.4±3.0	0.09
Hb (gm %)		12.3±1	11.9±0.8	0.3
Blood sugar (mg/dl)		140.4±16.7	141±21.9	0.1
Urea (mg/dl)		18.6±5.3	17.9±5	0.7
Creatinine (mg/dl)		0.6±0.2	0.6±0.2	0.7
Gender M/F		20/10	18/12	0.09
Diagnosis	Aortic regurgitation	3	1	
	Aortic stenosis	2	5	
	CAD DVD	10	8	

(Values expressed as mean±SD or number). **EF**- Ejection fraction, **Hb**-Haemogloblin, **SBP**-Systolic blood pressure, **DBP**-diastolic Blood Pressure, **MAP**- Mean Arterial Pressure, **HR**-Heart rate, **M**-Male, **F**-female, **ASA**- Americal Society of Anaesthesia, **CA**D- Coronary artery disease, **DVD**- Double Vessel Disease.

Table 2: Systemic hemodynamic parameters (values expressed as mean±SD or number) during observation period in two groups

Value		T1	T2	T3	T4	T5	T6
HR	Group A	85.4±7.3	76.07±8.4	99.17±5.8	93.40±6.3	84.7±6.5	83±6.4
	Group B	83.2±9.5	71.80±4.4	82.50±4.3	81.53±4.2	77.4±4.3	74.5±3.6
	P value	0.06	0.01*	0.00*	0.02*	0.02*	0.01
SBP	Group A	120.6±6.5	107.6±7.0	144.3±9.5	134.7±10.4	126.3±10.2	114.3±7.6
	Group B	116.9±6.8	104.9±5.9	132.4±9.6	120.5±10	112.6±5.9	106.9±8.3
	P value	0.8	0.113	0.00*	0.00*	0.02*	0.00*
DBP	Group A	80.2±5	71.0±5.4	88.2±6.2	86.0±4.4	83.5±4.5	79.6±5.7
	Group B	79.8±5.6	72.37±5.3	83.7±5.5	81.4±4.3	74.6±3.1	70.9±4
	P value	0.4	0.36	0.005*	0.005*	0.010*	0.005*
MAP	Group A	93.7±4.1	82.2±4	106.9±5.1	102.2±4.6	97.7±4.7	91.1±4.8
	Group B	92.1±4.1	83.2±4	99.5±5.3	94.6±5	87.8±3.2	82.9±4
	P value	0.7	0.94	0.00*	0.01*	0.02*	0.01*

The baseline hemodynamic (HR, MAP, SBP, DBP) parameters were normal and comparable in both the groups (Table 2). After test drug SBP, MAP, DBP changed significantly from baseline values in both group at T4, T5 and T6 time points. HR was significantly different between the two groups at all time points. SBP, DBP, MAP and HR decreased in both groups 1 min after induction and the percentage change in the both groups was comparable. After 1 min of intubation all measured parameter increased in both the groups which was more in group A. 3 min after intubation all measured parameter was still more than the baseline in both the groups. 5 min after intubation group B patients had all measured parameter below baseline as compared to group A. 10 min after intubation all parameter was below baseline in both the groups.

4. Discussion

Laryngoscopy, TI and tracheal suctioning interventions are performed on all patients in perioperative period. The effect of these maneuvers on cerebral and cardiovascular dynamics are reported in the literature [4, 5]. These interventions are associated with a haemodynamic perturbation which can be deleterious in patients with poor cardiovascular reserve. About half the patient with coronary artery disease experience episodes of myocardial ischemia during TI when no specific prevention is undertaken. If no specific measures are taken to prevent hemodynamic response, the HR raises Upto 26%-66% and SBP Upto 36%-45% depending on the method of induction [6,7]. In our study also there was 17% rise in HR in lignocaine group and 7% rise in HR in fentanyl group. A 19% rise in SBP occurred in lignocaine group as compared to a rise of 13% in fentanyl group.

Different method like priming principle of induction agent and various drug were used to blunt haemodynamic perturbation during induction [8]. Various doses have been used in literature, however questioned lignocaine and fentanyl efficacy. In Singh *et al* [9], van den Berg *et al* [10] and Kindler *et al* [11] study IV Lignocaine 1.5 mg/kg was ineffective in controlling the acute hemodynamic response following laryngoscopy and TI. Bachofen [12] also revealed doses of lignocaine1.5 mg/kg or fentanyl6 mic/kg in intracranial vessel malformations and brain tumors patients have no significant difference in pressure response. Dahlgren and Messeter [13] found that Fentanyl 5 µg/kg treatment caused a significant attenuation of the blood pressure and pulse response to laryngoscopy and TI in patients undergoing elective intracranial surgery. Cork *et al* [14] found that fentanyl 5 µg/kg reduced norepinephrine rise during rapid-sequence induction of anesthesia. The discrete observation is probably due to timing of administration of lignocaine or fentanyl. In our study, in lignocaine group there was significant rise in SBP for 3 minutes after TI; SBP increased up to 11%; significant rise in HR was present for 3 minutes after TI; HR increased up to 10%. We injected lignocaine 3 minutes before TI.

We restricted our study period to 10 min because after commencement of surgery multiple factors play role in hemodynamic response. We chose midazolam (0.03mg/kg) as a premedication agent as it is having sedative, anxiolytic properties and has rapid and short duration of action. After giving the study drug, there was decrease in HR from baseline of 10% and 13% in lignocaine and fentanyl group respectively. Fentanyl is known to cause bradycardia but the fall in pulse rate associated with lignocaine can't be explained. Though none of the patients in our study had hypotension, by definition, 8.16% mean reduction in SBP in fentanyl group suggests its potential for hypotension, particularly in hemodynamically unstable patients. Fentanyl doses blunted the rise in the SBP at laryngoscopy and endotracheal TI better than lignocaine. MAP is a acquire value and is crucial in parallel to the auto- regulatory retaliation of the heart, brain and kidneys. After endotracheal TI, the MAP increased by 14.19% and 8.65% in lignocaine and fentanyl groups respectively from baseline. In fentanyl group, MAP was below baseline throughout the study period, except during first 3 minutes of TI. At the end of the study- at min 10, the MAP declined by 9.9% in fentanyl group from baseline as compared to 2% in lignocaine group. This fetches awareness for using fentanyl in patients with firm cardiac output illness.

5. Conclusion

In conclusion, given 3 minutes prior to intubation, lignocaine (1.5 mg/kg) and fentanyl (3 µg/kg) both attenuated the rise in HR, though fentanyl was better. We conclude that both lignocaine and fentanyl can be safely used for attenuation of stress response during laryngoscopy and TI in patients with cardiac disease undergoing elective cardiac surgery.

Reference

[1]. Kautto UM. Attenuation of the circulatory response to laryngoscopy and intubation by fentanyl. *Acta Anaesthesiol Scand.* 1982; 26: 217-21.

[2]. Black TE, Kay B, Henly TEJ. Reducing the hemodynamic responses to laryngoscopy and intubation: A comparison of alfentanyl and fentanyl. *Anaesthesia*. 1984; 39: 883-4.

[3]. Gurulingappa, Aleem MA, Awati MN, Adarsh S. Attenuation of Cardiovascular Responses to Direct Laryngoscopy and Intubation-A Comparative Study Between iv Bolus Fentanyl, Lignocaine and Placebo(NS). *J Clin Diagn Res.* 2012; 6: 1749-1752.

[4]. Edwards ND, Alford AM, Dobson PM, Peacock JE, Reilly CS. Myocardial ischaemia during tracheal intubation and extubation. *Br J Anaesth.* 1994; 73: 537–9.

[5]. Singh S, Chouhan RS, Bindra A, Radhakrishna N. Comparison of effect of dexmedetomidine and lidocaine on intracranial and systemic hemodynamic response to chest physiotherapy and tracheal suctioning in patients with severe traumatic brain injury. *J Anesth.* 2018; 32:518-523.

[6]. Chung KS, Sinatra RS, Halevy JD, Paige D, Silverman DG. A comparison of fentanyl, esmolol, and their combination for blunting the haemodynamic responses during rapid-sequence induction. *Can J Anaesth*. 1992; 39:774-9.

[7]. Helfman SM, Gold MI, DeLisser EA, Herrington CA. Which drug prevents tachycardia and hypertension associated with tracheal intubation: lidocaine, fentanyl, or esmolol? *Anesth Analg.* 1991; 72:482-6.

[8]. Biswal P, Singh S, Taank P. Application of 'Priming Principle' on the induction dose requirements of propofol - A Randomized Clinical Trial. *International Journal of Biomedical Research* 2018; 09: 320-324.

[9]. Singh H, Vichitvejpaisal P, Gaines GY, White PF. Comparative effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation. *Clin Anesth.* 1995; 7: 5-8.

[10]. Van den Berg AA, Savva D, Honjol NM. Attenuation of the haemodynamic responses to noxious stimuli in patients undergoing cataract surgery. A comparison of magnesium sulphate, esmolol, lignocaine, nitroglycerine and placebo given IV with induction of anaesthesia. *Eur J Anaesthesiol.* 1997; 14:134-47.

[11]. Schumacher PG, Schneider MC, Urwyler A. Effects of intravenous lidocaine and/or esmolol on hemodynamic responses to laryngoscopy and intubation: A double-blind, controlled clinical trial. *J Clin Anesth.* 1996 Sep; 8: 491-6.

[12]. Bachofen M. Suppression of blood pressure increases during intubation: Lidocaine or fentanyl? *Anesthesist*. 1988; 37:156-61.

[13]. Dahlgren N, Messeter K. Treatment of stress response to laryngoscopy and intubation with fentanyl. *Anaesthesia* 1981; 36:1022-6.

[14]. Cork RC, Weiss JL, Hameroff SR, Bentley J. Fentanyl preloading for rapid-sequence induction of anesthesia. *Anesth Analg*. 1984; 63:60-4.