

Can sodium channel blocker lidocaine attenuate haemodynamic responses to endotracheal intubation in patients with coronary artery disease effectively?

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To cite this article:

S. Singh, Kulsum, H. Shroff, A. Singh, A. Annamalai, D. E. Mahrous. Can Sodium Channel Blocker Lidocaine Attenuate Haemodynamic Responses to Endotracheal Intubation in Patients with Coronary Artery Disease Effectively?. *Journal of Anesthesiology*.

Vol. 1, No. 3, 2013, pp. 27-35. doi: 10.11648/j.ja.20130103.13

Abstract: Background: Tachycardia and hypertension are well documented sequels of laryngoscopy and endotracheal intubation; they are transient, highly variable and are generally well tolerated in healthy patients. In hypertensive patients with coronary artery disease (CAD) these cardiovascular responses to laryngoscopy and intubation is exaggerated. The aim of this study was to evaluate the efficacy of lidocaine in attenuating cardiovascular response to laryngoscopy and endotracheal intubation in patients posted for elective off pump coronary artery bypass grafting (OPCABG) as these patients are on a low dose of β -blockers. Materials and Methods: After obtaining institutional ethical approval, 60 patients aged 40 to 70 years from either sex of the American Society of Anaesthesiologists (ASA) physical status III with coronary artery disease (CAD) undergoing elective coronary artery bypass grafting (CABG) surgery under general anaesthesia were selected for the study. Participants were randomly allocated into two groups comprising 30 subjects each. Group I received lidocaine 1.5 mg/kg and group II (control) received a placebo (normal saline) 3 minutes prior to laryngoscopy. Changes in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and rate pressure product (RPP) were measured before induction as baseline, after intubation, at minute 1, 3, 5 and 7 minutes respectively after tracheal intubation while they were also observed for any complications. Results: There was a significant increase in HR, SBP, DBP, MAP and RPP in the control (placebo) group as compared to the lidocaine group ($P < 0.05$) at 1 minute with onward decreases at 3, 5, and 7 minutes respectively after intubation. Conclusions: Prophylactic therapy with lidocaine was found to be safe and effective in attenuating cardiovascular responses to laryngoscopy and tracheal intubation in patients posted for elective OPCABG on a low dose of β -blockers.

Keywords: Blood Pressure, Heart Rate, Intubation, Laryngoscopy, Lidocaine (Source: Mesh, NLM)

1. Introduction

Laryngoscopy and endotracheal intubation are often mandatory for patients undergoing a variety of surgical procedures. It is well known that laryngoscopy and endotracheal intubation following induction of anaesthesia is almost always associated with haemodynamic changes due to sympathoadrenal stimulation. Various drugs and techniques have been used for blunting the haemodynamic response to laryngoscopy and intubation with variable

degrees of success [1]. In hypertensive patients cardiovascular response to laryngoscopy and intubation is exaggerated. Increased sympathetic activity, arterial lumen narrowing, and blunted baroreflex response have been proposed to be factors responsible for exaggerated haemodynamic changes [2]. The acceleration of heart rate in CABG patient is one of the most important factors to increase the myocardial consumption of oxygen. The clinical investigation by Slogoff and Keats in 1023 cases for CABG patients showed that the tachycardia was the

dominant reason as the consequence of perioperatively myocardial ischaemia [3]. Tian-long et al. myocardial ischaemia was 28% and 62% respectively when heart rates were less than 70 beats per minute and faster than 110 beats per minute [4]. In addition, the accelerated heart rate not only increases myocardial consumption of oxygen, but also shortens the diastolic period of left ventricle and then reduces the myocardial delivery of oxygen. Beta-blockers can decrease the myocardial consumption of oxygen by effectively lowering heart rate and inhibiting myocardial contractility, and can improve the myocardial delivery of oxygen by prolonging cardiac diastolic period. Patients with CABG continue low dose of beta-blocker as premedication, beta-adrenoreceptor blockade attenuating the positive chronotropic and inotropic effects of increased adrenergic activity. If we increase the dose of beta-blockers in these patients then intraoperative hypotension develops at the time of enucleation and stabilizing of heart to access coronary arteries especially the obtuse marginal and right coronary artery during OPCABG the surgeon has to lift, displace and compress the heart.

Various studies have reviewed the effect of lidocaine to blunt these haemodynamic responses in normotensive patients. It is tried in various forms like intravenous, viscous lidocaine, orolaryngeal spray prior to induction of anaesthesia. Some studies have reported beneficial effects [5, 6] while others showed no effect of intravenous lidocaine administered 1, 2, or 3 min before laryngoscopy and intubation [7].

There is increasing evidence that the control of the heart rate and blood pressure response to endotracheal intubation is essential in preventing adverse cardiovascular outcomes, as rate pressure product (RPP) acts as an indicator of oxygen demand by the heart at the onset of ischaemia [8], there is therefore a need for assessment in this direction. Efforts are being made to practice safe anaesthesia, reduce perioperative complications and mortality. The purpose of this study was to determine the efficacy of intravenous lidocaine in attenuating haemodynamic response to laryngoscopy and intubation in patients with CAD posted for OPCABG on a low dose of beta blockers.

2. Materials and Methods

This study was undertaken after obtaining Ethical Committee approval and was conducted from October to July 2013. Informed consent was obtained from 60 patients. The study population consisted of ASA physical status III, male and female adults between the ages of 40-70 years scheduled for elective OPCABG surgical procedures.

2.1. Study Design

This study was a prospective, randomized, and double blinded clinical comparison study. The Sample size for the study was 60 generated using a sample size calculator. The study participants were randomly divided into two groups

by a computer generated randomization table. A study nurse (Person A) who was not involved in the randomization process prepared the study drug, diluted to 10 millilitres. Person B monitored the heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) with respect to time whilst Person C was responsible for intubation of the patients. Person A and C were kept constant throughout the study. Person B, C, and the patient were kept unaware of the drug injected to enable double blinding.

2.2. Inclusion Criteria

The study was conducted in adult patients of both genders, of age 40 to 70 years; belonging to ASA Grade III undergoing elective OPCABG surgery with general anaesthesia.

2.3. Exclusion Criteria

Exclusion criteria for the study included patients who were below 40 and above 70 years of age, poor left ventricular function, ejection fraction < 30 %, undergoing emergency surgery, morbidly obese, diabetes mellitus, bronchial asthma, patients with difficult laryngoscopy, patients showing stressful features during induction and laryngoscopy (bucking, coughing, vomiting). Total duration of laryngoscopy was noted and in cases where duration exceeded 15 sec were excluded from the study. Patients allergic to lidocaine and with beta blockers contraindication were excluded from this study.

2.4. Preoperative Preparation

The day prior to surgery all patients underwent a pre-anaesthetic evaluation with special consideration to elicit a history of hypertension, dyspnoea, chest pain, cough, wheezing, convulsions, and diabetes mellitus as well as previous anaesthetic history and drug sensitivity. Information collected also included weight, nutritional status, airway assessment by the Mallampatti scoring system, a detailed examination of the respiratory, cardiovascular, and central nervous system. A preoperative routine investigations such as haemoglobin, haematocrit, total lymphocyte count, differential lymphocyte count, serum electrolytes, blood group/ Rh typing, blood urea nitrogen, serum creatinine, fasting blood sugar, chest radiography, electrocardiogram, coronary angiography, and echocardiography in all patients.

Patients were advised to fast the night prior to surgery. All study patients received tablet diazepam 10mg /5mg and tablet atenolol 25 mg in the night prior to surgery and on day of surgery. All procedures were explained to the patients in an attempt to alleviate the anxiety of the patients.

2.5. Surgical Protocol

After patient identification a short preoperative history was taken, clinical examination and routine investigations were rechecked in all patients. Study objective and

procedure were explained to the participants and a written informed consent was obtained from each participant. Patients were then shifted to the operating room after which routine non-invasive monitor was applied and vital signs monitored. Patients were given oxygen with face mask then intravenous access was secured and infusion of Ringer's lactate solution started. The patients were premedicated with Midazolam 0.03mg/kg and fentanyl 1microgram/kg intravenously over 30 sec. After local infiltration with lidocaine arterial line for invasive blood pressure monitoring was secured. The patients were given fentanyl 5micrograms/kg and midazolam 0.03mg/kg intravenously over 30 sec then induced with etomidate 0.3mg/kg in incremental doses, pancuronium 0.12 mg/ kg IV was given fast, followed up by administering the study drugs (normal saline or lidocaine) 3min before laryngoscopy and intubation.

The study drug was randomly allocated to patients in a double blinded manner. Patients were ventilated with oxygen and 1% isoflurane using IPPV with a fresh gas flow of 6 litres/ min by Bain circuit until intubation. About 3min after IV pancuronium, laryngoscopy was performed with a Macintosh laryngoscope blade and trachea intubated with an appropriate size cuffed endotracheal tube. After confirmation of correct placement of ET tube, anaesthesia was maintained with oxygen and isoflurane. HR, SBP, DBP, MAP, RPP (rate pressure product), SpO₂ (oxygen saturation), and ECG (electrocardiogram) changes were recorded before induction (Basal) and after tracheal intubation, at 1, 3, 5, and 7 min for the purpose of this study. No manipulation like painting and draping the area of operation was allowed till 10min after the study drug administration. Injection fentanyl was repeated before sternotomy and during surgery as per requirement.

2.6. Parameters and Statistical Analysis

Summary statistics of patient gender, age, and weight for all three groups were reported as means \pm standard deviation. HR, SBP, DBP, and MAP were recorded before induction (Baseline), after tracheal intubation, at 1, 3, 5 and 7min during monitoring. From the data RPP was calculated by multiplying heart rate with systolic blood pressure. Patients were also observed for complications like hypotension, hypertension, arrhythmias, and hypoxaemia. Statistical analysis was done by student t-test and p-values were calculated. ANOVA with repeated measures was used to compare the changes in HR, SBP, DBP, MAP and RPP values. Haemodynamic variables were represented by mean \pm SD, median. Analyzed data were presented in the form of mean, where the level of significance was given as p-value in a separate column. A p-value less than 0.05 was taken as significant. Man-Whitney U test was used to analyze the data since the data were not following a normal distribution. Nominal data were compared using the Chi Square test. The statistical package SPSS 14.0 was used.

3. Results

The demographic characteristics of each group as shown in table 1-3. There were no statistical differences observed with respect to number of patients in each group, sex ratio or age. However, the male to female ratio of lidocaine group was 1:1.1 whereas that of placebo group was 1:1.3 ($p < 0.79$). No significant difference was observed in the mean age for lidocaine group patients (54.3 ± 10.5 years) when compared to those in placebo group (55.2 ± 9.2 years) ($p < 0.64$). The average weight was 55.0 ± 6.0 kg and 55.2 ± 5.8 kg in groups lidocaine and placebo respectively ($p < 0.95$).

Table 1. Gender distribution in the study groups

Gender	Lidocaine		Placebo	
	N	%	N	%
Male	14	46.67	13	43.33
Female	16	53.33	17	56.67
Total	30	100	30	100

Chi Square Test is used to compare p-value is 0.795, hence there is no significant difference since $P > 0.05$.

Table 2. Analysis of age in years

Group	Mean	SD	Median	Z	p-Value
Lidocaine	54.27	10.45	51.00	-0.467	0.641
Placebo	55.20	9.15	53.50		

Table 3. Comparison of weight (kilograms) in the two groups

Group	Mean	SD	Median	Z	p-Value
Lidocaine	55.00	6.09	56.50	-0.068	0.946
Placebo	55.20	5.79	56.00		

3.1. Comparison of Different Parameters in Lidocaine Group for Change from Baseline

Table 4. Comparison of heart rate in lidocaine group for change from baseline

Time interval	Mean	SD	Mean difference	T	p-Value
Baseline	80.50	4.27	7.233	10.897	<0.001*
Intubation	73.27	4.12			
Baseline	80.50	4.27	7.067	10.372	<0.001*
1 Mean	73.43	4.68			
Baseline	80.50	4.27	6.200	8.375	<0.001*
3 Mean	74.30	4.11			
Baseline	80.50	4.27	4.200	3.932	<0.001*
5 Mean	76.30	4.78			
Baseline	80.50	4.27	1.333	1.559	0.130
7 Mean	79.17	3.42			

*Denotes a significant difference, heart rate- per minute.

Table 5. Comparison of systolic pressure in lidocaine group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	130.33	3.24			
Intubation	144.23	3.30	-13.900	-19.619	<0.001*
Baseline	130.33	3.24			
1 Min	142.27	3.35	-11.933	-14.617	<0.001*
Baseline	130.33	3.24			
3 Min	138.13	2.46	-7.800	-10.649	<0.001*
Baseline	130.33	3.24			
5 Min	135.47	3.96	-5.133	-5.653	<0.001*
Baseline	130.33	3.24			
7 Min	133.50	3.51	-3.167	-3.763	0.001*

*Denotes a significant difference, systolic pressure in millimetre of mercury.

Table 6. Comparison of diastolic pressure in lidocaine group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	83.40	5.46			
Intubation	90.03	4.40	-6.633	-6.351	<0.001*
Baseline	83.40	5.46			
1 Min	89.10	4.20	-5.700	-5.807	<0.001*
Baseline	83.40	5.46			
3 Min	87.47	4.52	-4.067	-3.157	0.004*
Baseline	83.40	5.46			
5 Min	85.40	6.11	-2.000	-1.670	0.106
Baseline	83.40	5.46			
7 Min	85.03	3.97	-1.633	-1.424	0.165

*Denotes a significant difference, diastolic pressure in millimetre of mercury.

Table 7. Comparison of MAP in lidocaine group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	99.05	3.83			
Intubation	108.10	2.87	-9.055	-12.343	<0.001*
Baseline	99.05	3.83			
1 Min	106.82	2.98	-7.777	-10.030	<0.001*
Baseline	99.05	3.83			
3 Min	104.36	3.23	-5.311	-5.895	<0.001*
Baseline	99.05	3.83			
5 Min	102.09	4.35	-3.044	-3.322	0.002*
Baseline	99.05	3.83			
7 Min	101.19	2.78	-2.143	-2.620	0.014*

*Denotes a significant difference, MAP in millimetre of mercury.

Table 8. Comparison of RPP in lidocaine group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	10497.27	707.89			
Intubation	10570.87	105.22	73.600	-0.651	0.520
Baseline	10497.27	707.29			
1 Min	10443.47	651.11	53.800	0.491	0.627
Baseline	10497.27	707.89			
3 Min	10261.00	553.72	236.267	2.063	0.048
Baseline	10497.27	707.89			
5 Min	10331.73	649.77	165.533	0.977	0.336
Baseline	10497.27	707.89			
7 Min	10571.57	585.65	74.300	-0.489	0.628

*Denotes a significant difference

3.2. Comparison of Different Parameters in Placebo Group for Change from Baseline

Table 9. Comparison of heart rate in placebo group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	81.13	6.51			
Intubation	109.40	6.82	-28.267	-23.090	<0.001*
Baseline	81.13	6.51			
1 Min	110.57	7.30	-29.433	-21.971	<0.001*
Baseline	81.13	6.51			
3 Min	109.00	5.88	-27.867	-24.201	<0.001*
Baseline	81.13	6.51			
5 Min	106.50	5.73	-25.367	-25.038	<0.001*
Baseline	81.13	6.51			
7 Min	103.30	6.55	-22.167	-14.329	<0.001*

*Denotes a significant difference, heart rate- per minute.

Table 10. Comparison of systolic pressure in placebo group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	129.60	2.65			
Intubation	146.57	5.35	-16.967	-16.899	<0.001*
Baseline	129.60	2.65			
1 Min	145.90	3.97	-16.300	-20.495	<0.001*
Baseline	129.60	2.65			
3 Min	141.37	4.44	-11.767	-14.675	<0.001*
Baseline	129.60	2.65			
5 Min	137.53	4.35	-7.933	-9.460	<0.001*
Baseline	129.60	2.65			
7 Min	135.90	5.55	-9.300	-6.092	<0.001*

*Denotes a significant difference, systolic pressure in millimetre of mercury.

Table 11. Comparison of diastolic pressure in placebo group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	81.03	6.03			
Intubation	92.80	5.45	-11.767	-8.852	<0.001*
Baseline	81.03	6.03			
1 Min	92.43	6.22	-11.400	-10.015	<0.001*
Baseline	81.03	6.03			
3 Min	91.33	6.47	-10.300	-7.956	<0.001*
Baseline	81.03	6.03			
5 Min	89.63	5.46	-8.600	-7.277	<0.001*
Baseline	81.03	6.03			
7 Min	87.30	5.61	-6.267	-5.076	<0.001*

*Denotes a significant difference, diastolic pressure in millimetre of mercury.

Table 12. Comparison of MAP in placebo group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	97.22	4.19	-13.501	-15.865	<0.001*
Intubation	110.72	3.11			
Baseline	97.22	4.19	-13.033	-18.759	<0.001*
1 Min	110.25	3.92			
Baseline	97.22	4.19	-10.789	-12.947	<0.001*
3 Min	108.01	4.00			
Baseline	97.22	4.19	-8.379	-9.805	<0.001*
5 Min	105.60	3.48			
Baseline	97.22	4.19	-6.278	-7.059	<0.001*
7 Min	103.50	3.61			

*Denotes a significant difference, MAP in millimetre of mercury.

Table 13. Comparison of RPP in placebo group for change from baseline

Time Interval	Mean	SD	Mean Difference	T	p-Value
Baseline	10523.47	971.68	-5515.200	-	<0.001*
Intubation	16038.67	1202.67		27.337	
Baseline	10523.47	971.68	-5607.333	-	<0.001*
1 Min	16130.80	1123.09		28.681	
Baseline	10523.47	971.68	-4890.367	-	<0.001*
3 Min	15413.83	1033.01		27.791	
Baseline	10523.47	971.68	-4116.733	-	<0.001*
5 Min	14640.20	785.05		32.396	
Baseline	10523.47	971.68	-3505.933	-	<0.001*
7 Min	14029.40	930.82		16.109	

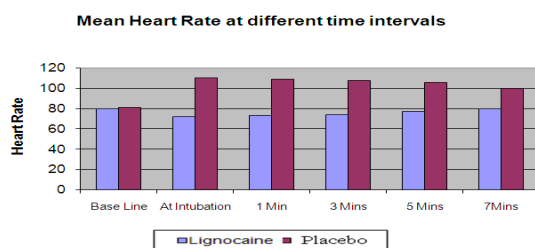
*Denotes a significant difference

3.3. Comparison between the Two Groups

Table 14. Comparison of heart rate between the two groups

Time Interval	Lidocaine		Placebo		Z	p-Value
	Mean \pm SD	Median	Mean \pm SD	Median		
Base Line	80.50 \pm 4.27	80	81.13 \pm 6.51	81	-0.232	0.817
At Intubation	73.27 \pm 4.12	72	109.40 \pm 6.82	110	-6.683	<0.001*
1 Min	73.43 \pm 4.68	73	110.57 \pm 7.30	109	-6.676	<0.001*
3 Mins	74.30 \pm 4.11	74	109.00 \pm 5.88	108	-6.671	<0.001*
5 Mins	76.30 \pm 4.78	77	106.50 \pm 5.73	106	-6.673	<0.001*
7Mins	79.17 \pm 3.43	80	103.30 \pm 6.55	100	-6.690	<0.001*

*Denotes a significant difference, heart rate- per minute.

**Fig 1.** Mean heart rate at different time intervals

The mean and median heart rates were found higher in the placebo group as compared to the lidocaine group at all time intervals (Table 4, 9, 14). However, no significant difference was found between the groups at baseline ($P>0.05$). At intubation, 1, 3, 5 and 7 min time intervals, the mean and the median difference between the two groups with respect to heart rates were found statistically significant ($P<0.001$).

Table 15. Comparison of systolic pressure between the two groups

Time Interval	Lidocaine		Placebo		Z	p- Value
	Mean \pm SD	Median	Mean \pm SD	Median		
Base Line	130.33 \pm 3.24	130	129.60 \pm 2.65	130	-1.129	0.259
At Intubation	144.23 \pm 3.30	144	146.57 \pm 5.35	148	-2.424	<0.015*
1 Min	142.27 \pm 3.35	142	145.90 \pm 3.97	146	-3.672	<0.001*
3 Mins	138.13 \pm 2.46	138	151.37 \pm 4.44	140	-2.753	0.006*
5 Mins	135.47 \pm 3.96	136	137.53 \pm 4.35	138	-2.889	0.004*
7Mins	133.50 \pm 3.54	134	135.90 \pm 5.55	138	-2.985	0.003*

* Denotes a significant difference, systolic pressure in millimetre of mercury.

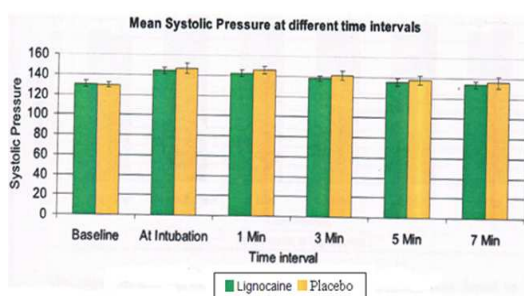


Fig 2. Mean systolic pressure at different time intervals

The mean systolic pressure was found higher in the lidocaine group as compared to the placebo group at baseline but this difference was not statistically significant ($P>0.05$) (Table. 5, 10, 15). At intubation, 1, 3, 5, and 7 min the mean and the median systolic blood pressures were found higher in the placebo group than in the lidocaine group. The median difference between the groups with respect to systolic pressures were found statistically significant ($P<0.01$) table 15.

Table 16. Comparison of diastolic pressure between the two groups

Time Interval	Lidocaine		Placebo		Z	p- Value
	Mean \pm SD	Median	Mean \pm SD	Median		
Base Line	83.40 \pm 5.46	83	81.03 \pm 6.03	82	-1.706	0.088
At Intubation	90.03 \pm 4.40	90	92.80 \pm 5.45	94	-2.625	0.009*
1 Min	89.10 \pm 4.21	90	92.43 \pm 6.22	92	-3.159	0.002*
3 Mins	87.47 \pm 4.52	90	91.33 \pm 6.47	92	-3.367	0.001*
5 Mins	85.40 \pm 6.11	87	89.63 \pm 5.46	90	-2.553	0.011*
7Mins	85.03 \pm 3.97	87	87.30 \pm 5.61	90	-1.761	0.078

*Denotes a significant difference, diastolic pressure in millimetre of mercury.

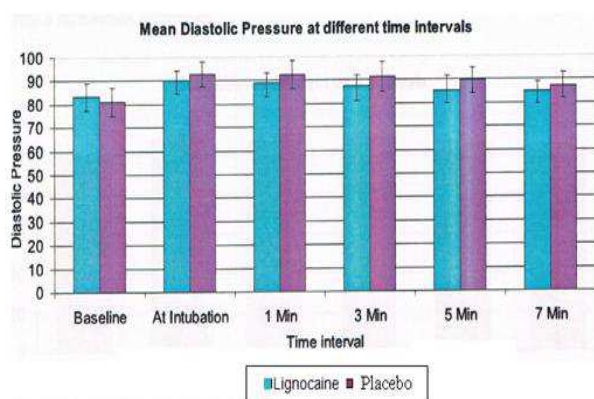


Fig 3. Mean diastolic pressure at different time intervals

The mean and median diastolic blood pressure in the lidocaine group was found higher than the placebo group but the median difference between the two groups were not statistically significant ($P>0.05$) (Table. 6, 11, 16). At intubation, 1, and 3 min the mean and the median diastolic pressures were found higher in the placebo group as compared to the lidocaine group and the median difference was found statistically significant ($P<0.01$). The median difference between the two groups were statistically significant at 5 min ($P<0.05$). Even though the mean and the median difference was found higher in the placebo group as compared to the lidocaine group at 7 min, the median difference was not statistically significant ($P>0.05$) table 16.

Table 17. Comparison of MAP between the two groups

Time Interval	Lidocaine		Placebo		Z	p- Value
	Mean \pm SD	Median	Mean \pm SD	Median		
Base Line	99.05 \pm 3.83	99	97.22 \pm 6.03	97	-1.601	0.054
At Intubation	108.10 \pm 2.87	108	110.72 \pm 5.45	111	-3.233	0.001*
1 Min	106.82 \pm 2.98	107	110.25 \pm 6.22	110	-4.282	<0.001*
3 Mins	104.36 \pm 3.23	105	108.01 \pm 6.47	110	-3.713	<0.001*
5 Mins	102.09 \pm 4.35	103	105.60 \pm 5.46	106	-3.096	0.002*
7Mins	101.19 \pm 2.78	100	103.50 \pm 5.61	103	-2.457	0.014*

*Denotes a significant difference, MAP in millimetre of mercury.

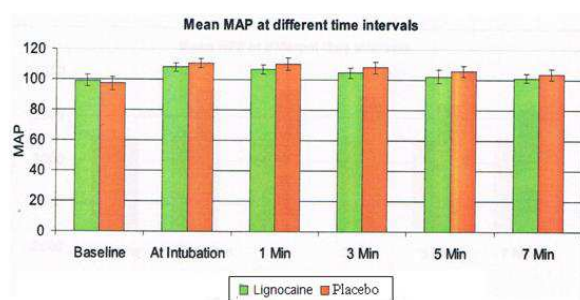


Fig 4. MPA at different time intervals

Higher mean and median MAP were noticed in the lidocaine group as compared to the placebo group at baseline but this difference was statistically not significant ($P>0.05$) (Table. 7, 12, 17). At intubation and later stages the mean and the median MAP was found higher in the placebo group as compared to the lidocaine group. The median difference in the MAP between the two groups at intubation was found statistically significant ($P<0.01$). The median and the median difference was found highly significant at 1 and 3 min ($P>0.001$). The median difference was significant at 5 and 7 min ($P<0.05$).

Table 18. Comparison of RPP between the two groups

Time Interval	Lidocaine		Placebo		Z	p- Value
	Mean \pm SD	Median	Mean \pm SD	Median		
Base Line	10497 \pm 708	10400	10523 \pm 972	10448	-0.059	0.953
At Intubation	10571 \pm 705	10438	16039 \pm 1203	16280	-6.655	<0.001*
1 Min	10443 \pm 65	10434	16131 \pm 1123	15984	-6.655	<0.001*
3 Mins	10261 \pm 554	10212	15414 \pm 1033	15012	-6.657	<0.001*
5 Mins	10332 \pm 650	10286	14640 \pm 785	14628	-6.655	<0.001*
7Mins	10572 \pm 586	10690	14029 \pm 931	13800	-6.657	<0.001*

*Denotes a significant difference

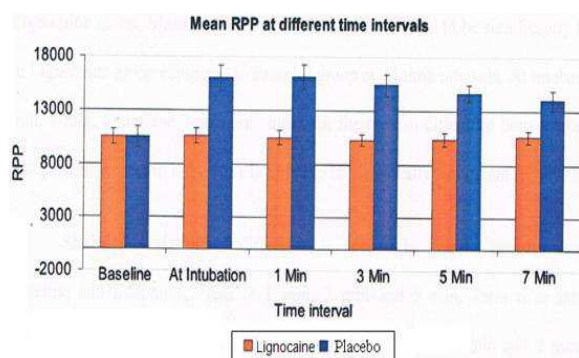


Fig 5. Mean RPP at different time intervals

The mean and the median RPP were found to be higher in the placebo group as compared to the lidocaine group at all time intervals. However, no significant difference was found between the groups at baseline ($P>0.05$) (Table. 8, 13, 18). At intubation, 1, 3, 5, and 7 min the mean and median difference between the two groups were found to be statistically significant ($P<0.001$).

4. Discussion

Intubation is associated with a cardiovascular response of elevated blood pressure and heart rate, occasional arrhythmias, ischaemia, increased intracranial pressure and intraocular pressure. If no specific measures are taken to prevent these haemodynamic responses, the HR can increase up to 20% and SBP can increase 40-50% depending upon the method of induction [9]. In patients with atherosclerotic heart disease, intracranial lesions, and potential penetrating eye injuries, these responses to intubation are of greater risk. About half the patient with

coronary artery disease experience episodes of myocardial ischaemia during intubation when no specific prevention is undertaken. Cardiovascular complications are one of the most common causes of postoperative morbidity and mortality [10].

Myocardial oxygen consumption has been correlated with the product of heart rate and peak systolic pressure called the Rate Pressure Product (RPP). Sener *et al.* (2012) the RPP with some limitations is generally accepted as an indirect measurement of myocardial oxygen demands. RPP exceeding 20,000 is commonly associated with myocardial ischaemia and angina. An increase in blood pressure without a change in heart rate may be better for myocardial oxygenation than an increase in heart rate along with an increase in blood pressure [11].

In our present study we have used the RPP as an indicator of myocardial oxygen consumption to compare both bolus dose of Placebo and lidocaine. The maximum RPP in the lidocaine group is 10572 \pm 586. This is below the safe limit of 12,000 and no statistically significant difference was noticed in RPP between baseline and any of the time intervals, which directs us to think that perhaps it has protective effects on ischaemic myocardium.

The maximum RPP in the Placebo group is 16131 \pm 1123. This is above the safe limit of 12,000 and a statistically significant difference was noticed between baseline and all the other time intervals with respect to RPP and can be correlated as an index of ischaemic stress of the myocardium.

The findings of our study are comparable to those of Manjunath *et al.*, who found the mean heart rate 21% below the control, systolic blood pressure at 11%, mean arterial pressure at 10% and rate pressure product at 31% below the

control at 1 minute after intubation. He also found a gradual return of these parameters to baseline as anaesthesia deepened at about five minutes [12]. Our study demonstrated significant reduction in unwanted haemodynamic changes to intubation in lidocaine groups ($p < 0.05$). The haemodynamic changes from baseline values in the lidocaine vs placebo group were as: HR = -8.8% vs 36.3%; SBP = 9.2% vs 12.6%; DBP = 6.8% vs 14.1%; MAP = 7.8% vs 13.4%; RPP = -00.5% vs 53.3%. Our study involving hypertensive patients with CAD exhibited some similarities and differences in terms of HR, SBP, DBP, MAP & RPP values with that of Manjunath's study. These differences might be explained to some extent that their patients were not on beta-blockers so that they were able to observe higher percentage changes from baseline values.

The timing of administration of lidocaine is equally important Tam *et al.* in their article "Intravenous lidocaine: optimal time of injection before tracheal intubation", showed that, when given intravenously before intubation, esmolol and lidocaine appear to have similar efficacies to attenuate moderate haemodynamic changes secondary to emergency intubation [13]. Wilson *et al.* reported irrespective of the timing of administration of injection lidocaine 2, 3 or 4 minutes, there was significant increase in heart rate with no significant increase in mean arterial pressure in response to intubation [14].

Mollick *et al.* observed that intravenous lidocaine given in patients received pethidine attenuate the sympathetic responses to laryngoscopy and endotracheal intubation, which came down to baseline before 5 minutes after intubation. But the group of patients which were treated only with lidocaine, their sympathetic responses did not come down to baseline at 5 minutes after laryngoscopy and endotracheal intubation [15]. In his study he included ASA physical status I and II without any cardiovascular disease.

Abou-Madi *et al.* discussed the possible mechanisms of intravenous lidocaine in blunting rise in heart rate and blood pressure for these observations include a direct myocardial depressant effect, a peripheral vasodilating effect and finally an effect on synaptic transmission [16]. None of the studies documented any harmful effects of prophylactic use of lidocaine pre-intubation. The difference in the results of various studies involving lidocaine, to some extent, can be explained by differences in study designs including variations in patient population, age, techniques used for induction, dose and timing of drug administration in relation to intubation [17].

5. Conclusion

The present data suggests that intravenous lidocaine 1.5 mg/kg 3minutes before laryngoscopy and tracheal intubation can blunt the cardiovascular responses. However, the prophylactic therapy of intravenous lidocaine in CAD patient for OPCABG is significantly effective for attenuating haemodynamic changes to laryngoscopy and tracheal intubation, without increased risk of tachycardia,

hypertension and ischaemia. The dosage and timing of administration of drugs are important factors that determine whether they will have beneficial effect on the laryngoscopy and tracheal intubation, therefore further studies are required to find out if lidocaine at higher dose could prevent the intubation response in totality and if this could be achieved without any side effects. The lidocaine appears to be very effective and safe and should be viewed as potential treatment strategy for attenuating haemodynamic changes during induction of anaesthesia especially in CAD patients on a low dose of beta blockers.

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