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Assessment of the cardiovascular response of Propranolol and lignocaine to endotracheal intubation

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ABSTRACT

Objective: assessment of the effect of propranolol and lignocaine on the cardiovascular response to endotracheal intubation, compared to placebo (IV normal saline). *Methods:* A case – control study included 60 subjects, and were divided into three groups (20 patients each), group A (control group, given normal saline), group B (given propranolol 0.01 mg/kg, slow IV injection for 4 minutes before laryngoscopy and endotracheal intubation). Group C (given lignocaine 1 mg/kg, slow IV injection for 4 minutes

before laryngoscopy and endotracheal intubation). *Results:* For all the three groups, blood pressure decreased after induction, with mean changes in MAP from pre-induction to intubation was -34 (-36.6%), -21 (-18.6%), -22 (-24.2%) mmHg for group A, B, and C; respectively. Heart rate was significantly lower in group B compared to group A (from intubation till 5 minutes post-intubation), while group C was significantly lower compared to group A only at intubation and after 1 minute, from 2nd minute till 5 minutes no significant difference were observed. Change in HR from pre-induction to intubation was -40 (-47.1%), -19 (-20.7%), -25 (-28.1%) mmHg for group A, B, and C; respectively. *Conclusion:* No single drug can completely attenuate the cardiovascular response to endotracheal intubation; both lignocaine and propranolol have similar effect on attenuation this response but the adverse effects of lignocaine is less than that of propranolol.

Keywords: beta – blocker, cell membrane stabilizer, endotracheal intubation, anesthesia, mean arterial pressure, heart rate

1. INTRODUCTION

Cardiovascular responses to laryngoscopy and intubation includes hypertension, tachycardia and arrhythmias, reflex bradycardia may occur with laryngoscopy and even cardiac arrest (Manne and Paluvadi, 2017). There was an occasional reports of sudden death following immediately on intubation (Abou-Madi *et al.*, 1975).

Post – anesthetic respiratory adverse effects the most prevalent issue in the immediate period after the procedure, and ranked the 2nd cause of complication after nausea and vomiting that require medical therapy after nausea and vomiting that require medical therapy (Belcher *et al.*, 2017). Various causes associated with this complications, which includes; abnormalities in the airways (lower and upper), abnormalities in the parenchymal tissue of the lung, pathologies in the peripheral nerves that supply the muscles responsible for controlling the breath (Grosse-Sundrup *et al.*, 2012; Berroa *et al.*, 2015).

The current work aimed to assess the effect of propranolol and lignocaine on the cardiovascular response to endotracheal intubation, compared to placebo (IV normal saline).

2. PATIENTS AND METHODS

Study sample

The study included 60 subjects, and were divided into three groups, group A (control group, given normal saline) included 20 subjects, group B (given propranolol 0.01 mg/kg, slow IV injection for 4 minutes before laryngoscopy and endotracheal intubation) included 20 subjects. Group C (given lignocaine 1 mg/kg, slow IV injection for 4 minutes before laryngoscopy and endotracheal intubation) included 20 subjects.

Study setting

A case – control study carried out in the department of anesthesia, Al-Shaheed Ghazi Al-Hariri hospital, Baghdad Medical city, during the period between January 2017 and December 2017.

Anesthesia given for all patients in the following sequence

Midazolam (300 µg/kg, fentanyl 1 µg/kg, propafol sleeping dose, until the eye lashes disappeared and atracurium (0.5 mg/kg) was given. Manual ventilation by facemask using 100% O_2, and 4% sevoflurane for 3 minutes after atracurium was given, until the attempt of direct laryngoscopy and oral tracheal intubation were done. Macintosh laryngoscope was used for performing the procedure (7.5 mm in size for females and 8.5 mm in size for males).

The cuff of endotracheal tube inflated until no audible leak. Breathe sound checked bilaterally and a volume control venation started then. All patients operated for various medical indications. All patients monitored by lead II ECG, pulse oximeter, and non-invasive blood pressure.

Collected data

Demographic data (age, gender and weight), mean arterial pressure, and heart rate.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee of Al-Shaheed Ghazi Al-Hariri hospital, Baghdad Medical City (Code: 2017/0264) and with the 1964 Helsinki declaration and its later amendments.

Informed consent

Informed written consent was obtained from all individual participants included in the study

Exclusion criteria

Any case of suspected or proved difficult intubation and any case of prolonged intubation (more than 15 seconds), were excluded from the study.

Statistical analysis

One way ANOVA used to analyze the differences in means between the three groups (if significant difference observed, *post hoc* Tukey test used to determine which pair of groups is significant), chi square test used to analyzed the difference for categorical variables. All analysis carried out using GraphPad Prism version 6.1.0 for Windows, GraphPad Software, San Diego, California USA, software package, p value considered when appropriate to be significant if less than 0.05

3. RESULTS

There was no significant difference in age, weight, baseline heart rate and mean blood pressure among the three groups, as illustrated in table 1. Additionally 4 patients 20% in group A had ventricular ectopic beats (one of these patients had mutltifocal ectopic), all ectopics ended spontaneously with 17 – 20 seconds after completion of the intubation.

Table 1 assessment of demographic and clinical data

Variables	Group A	Group B	Group C	p-value
Number	20	20	20	-
Male/ female	11:9	2:18	7:13	<0.001
Age (year)	28 ± 6	30 ± 7	27 ± 6	0.322
Weight (kg)	68 ± 9	64 ± 8	69 ± 10	0.189
Heart rate (beat /min)	85 ± 10	92 ± 8	89 ± 10	0.069
Mean blood pressure (mmHg)	93 ± 8	92 ± 8	91 ± 10	0.770
SD: standard deviation Data presented as mean ± SD (for continues data), n (%) for categorical variables				

For all the three groups, blood pressure decreased after induction, after intubation blood pressure increased significantly for all the three groups (p-value <0.05), also from intubation though the first five minutes after intubation both group B (propranolol) and group C (lignocaine) were significantly higher lower mean arterial blood pressure compared to group A (control), while no significant difference observed between group B and C, as illustrated in table 2 and figure 1.

Change in MAP from pre-induction to intubation was -34 (-36.6%), -21 (-18.6%), -22 (-24.2%) mmHg for group A, B, and C; respectively.

Table 2 assessment of changes in mean arterial pressure (mmHg)

Time	Group A	Group B	Group C	p-value
Number	20	20	20	
Pre-induction	93 ± 8	92 ± 8	91 ± 10	0.770

Induction	80 ± 8	76 ± 8	75 ± 10	0.168
Intubation	127 ± 7[a]	113 ± 6[b]	113 ± 7[b]	<0.001
1 minute after ETT	112 ± 6[a]	99 ± 7[b]	100 ± 7[b]	<0.001
2 minutes after ETT	103 ± 8[a]	93 ± 6[b]	93 ± 8[b]	<0.001
3 minutes after ETT	99 ± 7[a]	86 ± 9[b]	90 ± 5[b]	<0.001
4 minutes after ETT	98 ± 8[a]	83 ± 5[b]	87 ± 7[b]	<0.001
5 minutes after ETT	93 ± 7[a]	79 ± 8[b]	85 ± 9[b]	<0.001
Groups with similar letters indicate no significant difference (p-value≥0.05)				

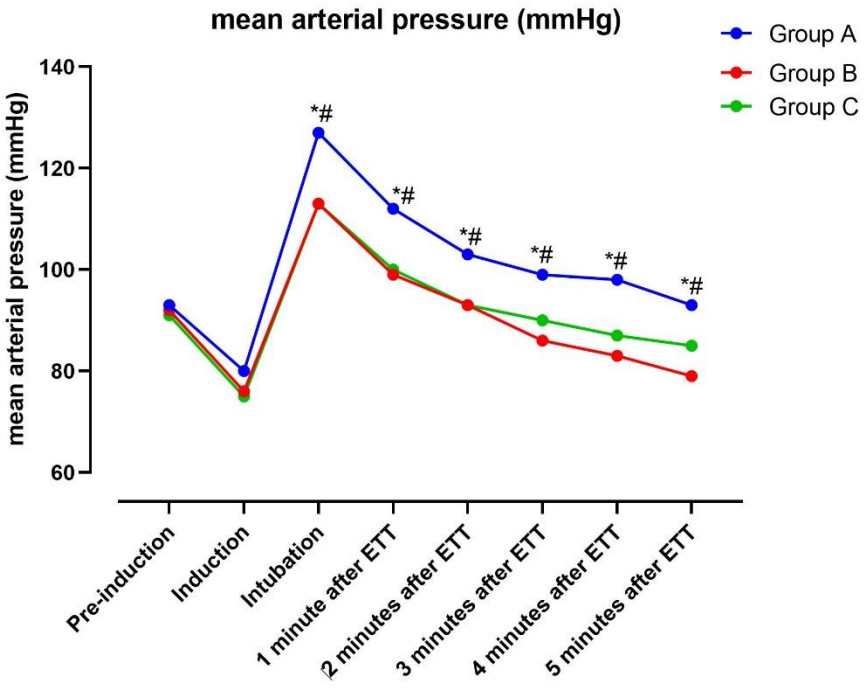

Figure 1 assessment of changes in mean arterial pressure (mmHg) [ETT: endotracheal tube, *: indicate significant difference between group A and B, #: indicate significant difference between group A and C]

For all the three groups, heart rate increased after induction till intubation, after intubation heart rate decreased till 5 minutes after intubation.

Table 3 assessment of changes in heart rate (beat/ minute)

Time	Group A	Group B	Group C	p-value
Number	20	20	20	
Pre-induction	85 ± 10	92 ± 8	89 ± 10	0.069
Induction	103 ± 9	103 ± 7	98 ± 8	0.085
Intubation	125 ± 11[a]	111 ± 8[b]	114 ± 6[b]	<0.001
1 minute after ETT	118 ± 9[a]	105 ± 10[b]	110 ± 8[b]	0.001
2 minutes after ETT	112 ± 7[a]	102 ± 6[b]	108 ± 11[ab]	0.001
3 minutes after ETT	111 ± 9[a]	100 ± 11[b]	105 ± 8[ab]	0.002
4 minutes after ETT	108 ± 11[a]	98 ± 10[b]	103 ± 10[ab]	0.013
5 minutes after ETT	106 ± 9[a]	97 ± 8[b]	101 ± 11[ab]	0.014
Groups with similar letters indicate no significant difference (p-value≥0.05)				

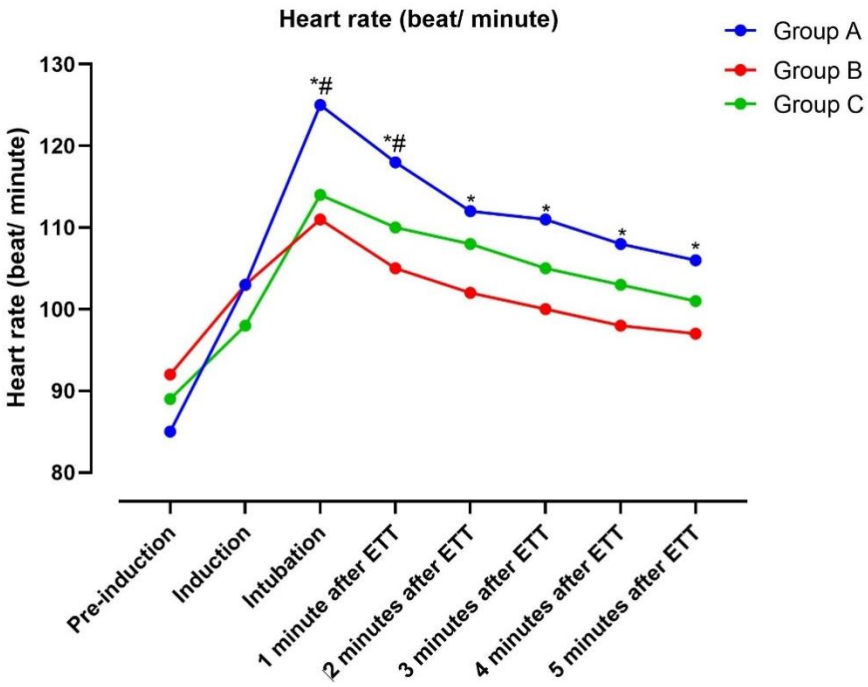

Figure 2 assessment of changes in heart rate (beat/ minute) [ETT: endotracheal tube, *: indicate significant difference between group A and B, #: indicate significant difference between group A and C]

Heart rate was significantly lower in group B compared to group A (from intubation till 5 minutes post-intubation), while group C was significantly lower compared to group A only at intubation and after 1 minute, from 2nd minute till 5 minutes no significant difference were observed, as illustrated in table 3 and figure 2.

Change in HR from pre-induction to intubation was -40 (-47.1%), -19 (-20.7%), -25 (-28.1%) mmHg for group A, B, and C; respectively.

4. DISCUSSION

The objective of the current work is to find a more safe and effective medication to reduce the incidence of cardiovascular adverse effects to laryngoscopy and tracheal intubation. Catecholamine increased during laryngoscope (Yoo *et al.*, 2001), which lead to increase in sympathetic outflow and cardiovascular adverse effects (Zhang and Anderson, 2014), beta – blockers are added to reduce such effects (Schechtman *et al.*, 2017).

Propranolol is readily available in our country, because of it low cost, its availability as injectable formulation, and rapid onset of action; all these make it a suitable agent to be given before staring the induction of anesthesia (Cenani *et al.*, 2017). Beta – blockers show partial attenuation of the sympathetic activation in response to intubation; despite that blood pressure and heart rate still increased after administration of beta – blocker, the degree of changes lower if no beta – blocker is given (Wong *et al.*, 2016). In the present study a similar outcome was observed, in which patients given propranolol had significantly lower heart rate and blood compare to control participants. Because propranolol has both β_1 and β_2 blocking effects, it may cause bronchospasm, heart block, and interaction with anesthetic agents leading to significant bradycardia (O'Rourke, 2007).

Another drug was investigated, which was lignocaine, its selection based on its action as cell membrane stabilizer on cardiac cells, since it may reduce the effectiveness of the myocardial cells to the increase in sympathetic stimulation that is caused by laryngoscopy and tracheal intubation (Blinov *et al.*, 2004). In the present study it was effective in reducing this response, but not abolishing it, lignocaine was as effective as propranolol in reducing blood pressure and heart rate.

In another study lignocaine was used in dose of 0.75 mg/kg and showed that the same dose prevented only the increase in systolic blood pressure (SBP), and the use of larger dose (1.5 mg/kg) completely protected against cardiac arrhythmia for all types (Roelofse *et al.*, 1987).

In systematic review that involved 37 studies and 1429 patients, they found that adding lignocaine resulted in mean change in SBP – 4.32 mmHg, change in MAP -2.72 mmHg, and change in HR -4.28 beat/ minute, and they concluded that IV lignocaine

attenuate cardiovascular responses to laryngoscope and tracheal intubation compared to placebo, which is in agreement with our findings (Qi *et al.*, 2013). Possible explanation for accounted for these observations are directs myocardial depression, central stimulant effect, peripheral vasodilation effect and effect on the synaptic transmission (Roelofse *et al.*, 1987).

5. CONCLUSION

No single drug can completely attenuate the cardiovascular response to endotracheal intubation; both lignocaine and propranolol have similar effect on attenuation this response but the adverse effects of lignocaine is less than that of propranolol.

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Conflicts of Interest: The authors declare no conflict of interest.

Author contribution

Isra Hamed Saeed: Conception and design of the work, the acquisition, analysis, and interpretation of data for the work, drafting the work, revising it critically for important intellectual content, and final version of the research.

Hayder Adnan Fawzi: statistical analysis, drafting the final version of the work and finally revising it critically for important intellectual content.

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