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STUDY ON EFFECT OF ESMOLOL INFUSION ON MYOCARDIAL OXYGEN CONSUMPTION DURING INTUBATION, EXTUBATION IN PATIENTS UNDERGOING GENERAL ANAESTHESIA

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ABSTRACT Mechanical stimulation of the receptors present in the larynx, trachea results in both respiratory and cardiovascular reflex responses during intubation. Heart rate is a major determinant of myocardial oxygen consumption and cardiac workload, so decreasing the heart rate will increase the ischemic threshold and improve the cardiac performance Aim: evaluation of the effect of esmolol infusion on myocardial oxygen consumption during intubation, extubation. Methodology: A prospective study including 100 patients undergoing elective surgeries under general anaesthesia. Group E (esmolol) 0.5mg/kg bolus dose over 30 s starting 5 min before intubation. 0.5mg/kg bolus dose over 30 s followed by a continuous esmolol infusion of 100 microgm/kg/min starting 10 min before end of surgery till 5 min after extubation Group C received saline as above, loading dose followed by same volume of infusion.The parameters monitored at HR, SBP,DBP,RPP at various time intervals Results:We found that in Group E (esmolol) patients had a stable hemodynamics with the start of the esmolol loading /infusion both during intubation and extubation when compared to the control group. Group E(esmolol) had a lower RPP when compared to the control group during laryngoscopy thereby reducing the myocardial oxygen demand ,hence by reducing the risk of periop ischemia. Conclusion: esmolol is a safe, effective drug that can be used in patients undergoing general anaesthesia to attenuate the laryngoscopy responses to both intubation and extubation , thereby reducing the myocardial oxygen consumption and perioperative risk of myocardial ischemia.

KEYWORDS : Esmolol, Intubation, Extubation, Anaesthesia.

1.INTRODUCTION

During laryngoscopy, mechanical stimulation of the receptors present in the larynx, trachea results in both respiratory and cardiovascular reflex responses. Respiratory responses can be aspiration, coughing, breath holding, or laryngospasm. The cardiovascular responses can be transient tachycardia, transient hypertension, arrhythmias, myocardial ischemia or infarction .The hemodynamic changes are due to sympathetic over activity during laryngoscopy will lead to increased serum level of epinephrine and nor epinephrine resulting in tachycardia and hypertension. These can be well tolerated in healthy individuals but will have deleterious effects in patients with coronary artery disease, hypertension and cerebro vascular diseases . Aging leads to change in vascular elasticity, the hemodynamic changes associated are more likely to be exaggerated and may lead to increase in oxygen consumption that results in myocardial ischemia and arrhythmia .Myocardial ischemia occurs due to imbalance between myocardial oxygen supply and oxygen demand.

Heart rate is a major determinant of myocardial oxygen consumption and cardiac workload, so decreasing the heart rate will increase the ischemic threshold and improve the cardiac performance .Myocardial ischemia is variable throughout the entire peri operative period, but it was found that postoperative myocardial ischemia occurs more often than preoperative and intra operative ischemia .Studies showed that postoperative myocardial ischemia can be used as a reliable predictor for in-hospital and long-term cardiac morbidity and mortality .Direct measurement of myocardial oxygen consumption is difficult .The rate pressure product (RPP) index was found to correlate strongly with myocardial oxygen consumption, so RPP index can be used for estimation of myocardial oxygen consumption .Rate pressure product (RPP):[1] is the product of systolic blood pressure (SBP) by heart rate (HR) and used for observation of myocardial oxygen consumption. It increases when myocardial oxygen requirements or consumption exceeds myocardial oxygen supply .

Esmolol [2]:An ultra-short acting cardio selective b1-receptor antagonist with half-life approximately 2 min and peak effect about 6–10 min. Because of these pharmacokinetic characteristics usually esmolol is used as a loading dose followed by continuous infusion . It has been used for prevention and treatment of intra-operative and postoperative tachycardia and hypertension. Also, it has been reported to decrease plasma catecholamine levels and preventing hemodynamic changes during intubation, laryngoscopy and extubation .The goal of this study was to evaluate the effect of esmolol infusion on myocardial oxygen consumption during intubation, extubation

2.AIMS AND OBJECTIVES:

To evaluate the effect of esmolol infusion on myocardial oxygen consumption using rate pressure product index as the marker.

3. METHODS AND MATERIALS

The institutional ethical committee approval for the study was obtained. The informed written consent was obtained from the patients participating in the study was obtained. SAMPLE SIZE: Sample size was calculated guided by the following data power of the test 80% with beta error 20% and alpha error accepted to be 5%. Confidence level was 95%, success rate of the technique was used in special formula for calculation to be 100. 100 ASA I and II patients of age 40 to 65 years undergoing elective surgeries under general anaesthesia were selected. Patients whose medical history, laboratory data, or physical examiation showed evidence of abnormal hepatic or renal function or severe cardiovascular, pulmonary, neurological, psychiatric, or metabolic disease were excluded from the study. Selected patients were divided randomly into two groups – either to receive 0.5mg/kg Esmolol as loading during intubation ,while a bolus of 0.5mg/kg followed by infusion 100mic/kg/min during extubation (n=50) or to receive placebo(saline) (n=50).

INCLUSION CRITERIA:

Elective surgeries
Both sexes
Age : 40 - 65 years
ASA I & II

EXCLUSION CRITERIA:

Patient's refusal
Patients with uncontrolled systemic illness
Patients with significant organ dysfunction
Patients with respiratory compromise
Patients with known allergy to beta blockers, calcium channel blockers, on NSAIDS, opioids
BMI > 40

METHODOLOGY:

Patients were randomly divided into two groups, Esmolol group (group E n =50) and Control group (group C n= 50). All patients were premedicated orally with perinorm and ranitidine (150 mg) 1–2 h preoperatively. Five minutes before induction Group E will receive 0.5mg/kg bolus of unknown solution (A)and also ten minutes before end of surgery till five minutes after extubation and maintained by infusion 100mic/kg/min, Group E patients will receive unknown solution (A), while group C patients will receive unknown solution (B) in a double blind fashion. In group E, patients received esmolol hydrochloride (10 mg/ml)0.5 mg/kg as bolus dose over 30 s given five minutes before induction to note the attenuation of stress response to laryngoscopy. A bolus of 0.5 mg/kg followed by a continuous esmolol infusion of 100 microgm/kg/min starting 10 min before end of surgery till 5 min after extubation. While patients in group C received normal

saline bolus of the same volume followed by a continuous normal saline infusion of the same volume per hour as group E

PARAMETERS MONITORED:

- Mean heart rate
- Systolic BP
- Diastolic BP
- Mean arterial pressure
- Rate pressure product index

Student's *t*-test and the Fisher's exact test for 2 * 2 contingency tables are used for statistical comparisons. A *P* _ 0.05 was considered significant

Table 1: Comparision Of Heart Rate-intubation

Heart rate	GROUP E		GROUP C		P VALUE
	MEAN	SD	MEAN	SD	
0 min	92.88	14.79	89.3	13.445	**0.2083**
2minafter esmolol	86.84	14.277	91.22	11.832	**0.0981**
Before intubation	81.72	13.321	97.74	10.752	**<0.0001**
After intubation	84.44	11.69	120.44	13.012	**0.0258**
5 mins	90.4	11.505	122.5	11.285	**<0.0001**
10 mins	97.48	9.179	105.4	9.5105	**<0.0001**

Table 2: Comparison Of Rate Pressure Product Index -intubation

RPP	GROUP E		GROUP C		P
	MEAN	SD	MEAN	SD	
0 MIN	12877.7	3098.74	12121.26	3258.8	**0.2371**
2MIN	11435.4	2823.76	12284.1	2916.73	**0.1425**
BEFORE INTUBATION	10151.88	2470.29	12486.9	2467.63	**0.0001**
AFTER INTUBATION	10700.38	2236.32	18769.38	3310.12	**0.0001**
5 MIN	12120	2038.377	18711.46	2992.99	**0.0001**
10 MIN	13614.98	2024.04	15526.38	2057.6	**0.0001**

Table 3: Heart Rate:extubation

HEART RATE	GROUP E		GROUP C		P VALUE
	MEAN	SD	MEAN	SD	
0 MIN	93.8	14.13	89.44	13.074	**0.3113**
BEFORE INTUBATION	83.16	13.06	97.46	10.8066	**0.0001**
AFTER INTUBATION	85.52	11.5332	120.56	12.90335	**0.0001**
5 MIN	91.26	10.8812	123.16	10.694	**0.0001**
10 MIN	97.5	9.4268	105.86	9.2516	**0.0027**

4. RESULTS:

There were no significant differences between the groups with respect to age, weight, preoperative heart rate, blood pressure, respiratory rate and duration of stay in recovery room. Males and females were almost evenly distributed between the two groups.As per the study, there was no statistically significant difference between group E (esmolol), group C(control) with respect to heart rate, systolic blood pressure, diastolic blood pressure from the time of loading dose to 2 min after it.While there was statistically significant difference among the patients in group E (esmolol) with respect to values of heart rate, systolic bp , diastolic bp , 2 mins post esmolol during intubation and extubation $p<0.005$ using student unpaired t test.With respect to Rate pressure product index , patients in group E(esmolol) had a lower RPP value 2 min post esmolol loading dose/infusion till 10 minutes, during intubation and extubation, and was found to be statistically significant($p<0.005$) using student unpaired t test.

Table 4: Rpp - extubation

RPP	GROUP E		GROUP C		P
	MEAN	SD	MEAN	SD	VALUE
0 MIN	12992.66	3042.27	12122.50	3225.995	**0.3314**
BEFORE EXTUBATION	10344.44	2542.78	12933.70	2493.295	***0.0007***
AFTER EXTUBATION	10838.9	2274.31	18796.84	3279.599	***<0.0001***
5 MIN	12266.18	2048.168	18820.16	2889.097	***<0.0001***
10 MIN	13617.64	2024.55	15585.22	1979.377	***<0.0001***

DISCUSSION:

One of the most painful stimulation for a patient undergoing surgery under general anaesthesia is laryngoscopy and endotracheal tube in situ responses. This causes a major hemodynamic changes in the form of increasing heart rate and systolic blood pressure. This is usually tolerated by healthy young adult. But as age increases, changing vascular tone, existing co morbidities make it detrimental to the patient as these hemodynamic changes are usually met with increased oxygen demand, which if not met will lead to development of myocardial ischemia .Rate pressure product index is one of the reliable indirect measure of myocardial oxygen consumption which is the product of heart rate and systolic blood pressure. Higher the RPP , higher is the incidence of myocardial ischemia. Many pharmacological measures have been adopted to reduce the stress associated with laryngoscopy and extubation. They are either in the form of opiates, airway blocks, lidocaine, dexmeditomidine, calcium channel blockers, esmolol. Most of the times, situation favors the use of ultra shorting acting b blocker like esmolol to be good alternative in attenuating the response.Current study showed that esmolol hydrochloride causes reduction in heart rate, systolic blood pressure, there by RPP at various time intervals starting 2 min post loading/ infusion of esmolol hydrochloride during both intubation and extubation. Thus, the cardiac work load will reduce .Hence myocardial oxygen consumption will be reduced, reducing the risk of perioperative myocardial ischaemia. This result was in agreement with other studies.In a study done by alkaya and etal in 30 patients esmolol was used in a dose of 2mg/kg during extubation and showed a statistically significant reduction in esmolol group with respect to HR, SBP, DBP, RPP ,without any serious side effect.[3]In another randomised control trial carried out between 80 preeclamptic patient's posted for lower segment c section received esmolol in various doses1 mg/kg, 2mg/kg with and without 1.5mg/kg lidocaine. It was concluded that esmolol 1mg/kg with 1.5mg/kg of lidocaine attenuate the hemodynamic changes associated with laryngoscopy with no adverse effects to both mother and the fetus.Gurracino et al[4] found that both esmolol and lidocaine suppressed the hemodynamic changes associated with laryngoscopy only during intubation and has no statistically significant effect during extubation, which is contrary to the present study.Also current study showed that people in Group E (esmolol) had a better quality of extubation when compared to the control group. This result is in accordance with study done by Alkaya and etal[3] regarding the effect of esmolol on hemodynamic changes to tracheal extubation after craniotomy surgeries .Hence with the present study it can be concluded that Esmolol, cardio selective and ultra short acting beta blocker can be a effective alternative to battle the hemodynamic responses associated with laryngoscopy during both intubation and extubation

6.REFERENCES:

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