

A comparative study of bolus and continuous infusion of esmolol on hemodynamic response to laryngoscopy, endo tracheal intubation and sternotomy in coronary artery bypass graft surgery

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Abstract

Background and Aims: Laryngoscopy and intubation, sternotomy always induces a stress response causing hemodynamic alterations which is deleterious to the patient, especially in CABG patients, who already have compromised coronary circulation. Many drugs like Lignocaine, Dexmedetomidine, Clonidine, Beta blockers are used in these demanding situations so as to avoid many problems that may accompany. Esmolol, being cardio selective and short acting is used safely in these cardiac patients. We have done this study to evaluate if a single bolus dose or continuous infusion of Esmolol is better in this respect.

Methods: 60 ASA II and III patients aged 20-70 years undergoing elective coronary artery bypass graft surgery (either on-pump (or) OFF pump) under General

Anaesthesia were chosen for the study and randomly allocated in to two groups, Group A received Esmolol 0.5 mg/kg/min infusion 10min before intubation up to the 5th minute of sternotomy, Group B received Esmolol 1.5 mg/kg bolus 2 min before intubation and sternotomy. Haemodynamic response in terms of Blood pressure, heart rate and saturation were monitored at various time intervals, the results were recorded and tabulated.

Results: There was a reduction in the heart rate and mean arterial pressure in response to intubation and sternotomy in both bolus group (B) and infusion group (A), but the reduction in blood pressure was sustained in infusion group. There was no significant hypotension or bradycardia in both the groups.

Conclusion: We conclude that esmolol infusion 0.5 mg/kg 10 minutes prior to induction results in sustained

reduction in mean arterial blood pressure compared to bolus dose of esmolol in response to laryngoscopy, intubation and sternotomy.

Keywords: Laryngo scopy, Intubation, Sternotomy, Esmolol.

Introduction

The rigid laryngo scopes used for intubation for visualising the larynx causes direct trauma to oropharynx and larynx; also induces sympathetic stimulation causing increased heart rate and blood pressures. Similarly, sternotomy during coronary artery bypass graft (CABG) also causes tachycardia and hypertension as it is one of the most painful stimulus in any cardiac surgery. Dealing with the stress response during laryngoscopy and sternotomy is a major challenge to the anesthesiologist. Various methods are being used for managing the stress response like intravenous lignocaine, vasodilators like calcium channel blockers, beta blockers, sodium nitroprusside, analgesics like fentanyl, alpha agonists like clonidine, dexmedetomidine. Beta blockers like metoprolol, labetalol, esmolol are commonly used for this purpose. Though esmolol is used widely, the exact method and dose still remains ambiguous. So we have done this study to evaluate if esmolol is effective when given as a bolus or as infusion during the stress responses that occur during CABG.

Methodology

After obtaining ethical committee clearance and informed consent from the patients, 60 ASA II and III patients, aged 20 to 70 years, of either sex, undergoing elective CABG (either on pump or off pump) under general anaesthesia were included in our study. Patients with myocardial infarction, on beta blocker therapy, heart block, heart rate < 50/ min, asthma, Mallampati score >II and where beta blocker is contraindicated. All

the patients enrolled in the study were assessed preoperatively by clinical assessment, blood investigations and radiological imaging. Patients were randomly allocated into 2 groups: Group A- Esmolol 0.5 mg/kg/ min infusion 10 minutes before intubation till 5 minutes after sternotomy Group B- Esmolol 1.5 mg/kg bolus 2 minutes before intubation and sternotomy.

All the patients were premedicated with Injection Midazolam 2 mg and Glycopyrrolate 0.2 mg intramuscularly 45 minutes prior to surgery. Baseline values of heart rate, systolic blood pressure, diastolic blood pressure and oxygen saturation were recorded after shifting the patient into the operating room.

Esmolol was given as infusion or bolus at the desired time prior to induction of general anaesthesia, according to which group the patient belonged. Preoxygenation with 100% oxygen was done after which injection thiopentone 5mg/kg, fentanyl 2mg/kg and vecuronium 0.08 mg/kg were given for induction. Endotracheal intubation was done 3 minutes after vecuronium injection.

Esmolol was given as infusion upto the 5th minute of sternotomy in group A; esmolol was repeated 2 minutes prior to sternotomy in group B. Anaesthesia was maintained with Sevoflurane in oxygen and nitrous oxide (in the ratio of 33% and 66% respectively). The haemodynamic parameters like heart rate, blood pressure and saturation were recorded after 1 minute of esmolol injection, after 1,3,5,10 and 15 minutes of intubation and sternotomy. The values were tabulated and analysed.

Statistical analysis

Chi-square test, Anova and post-hoc tests were used appropriately for analysis; p<0.05 was considered significant and p>0.05 considered insignificant. The results were represented as mean and standard deviation.

Discussion

Laryngoscopy, endotracheal intubation during general anaesthesia and sternotomy during cardiac surgery induces a significant stress response, though transient resulting in tachycardia, arrhythmias and hypertension even in normotensive individuals. This sympathoadrenal stress response leads to an increase in myocardial oxygen demand inducing ischemia and acute heart failure in susceptible patients. Beta receptors are responsible for such responses and so blocking them using beta blocking agents blunts the response and reduces the Anaesthetic requirements.

This study done to compare the bolus and infusion doses of a short acting beta blocker, esmolol in attenuating the stress response showed that esmolol when given as infusion was better than bolus dose, in contrary to the study by Reves J.G et al, which concluded that bolus dose of esmolol was safe and effective in preventing the stress response. Various studies using esmolol alone or in combination with fentanyl, lignocaine, dexme detomidine all showed that esmolol is definitely effective in attenuation of the stress response to laryngoscopy and intubation.

Sridevi et al¹, in their study to compare the efficacy of esmolol and lignocaine as bolus dose for attenuating the pressor response to laryngoscopy and intubation, showed that hemodynamics remained nearer to baseline with esmolol group. Prajwal Patel et al¹⁴, proved that esmolol was more efficient than labetalol at extubation and post extubation. Shailaja and Srikantu¹⁵ in their study on hyper tensive patients used normal saline, esmolol 1.5 mg/kg and emolol with fentanyl 2 mcg/kg during laryngo scopy and intubation, concluded that esmolol 1.5 mg/kg was effective in attenuating the laryngo

scopic reflex but when combined with fentanyl caused hypotension.

In our study, there was no significant difference between the groups with respect to baseline parameters and during induction of anaesthesia, but the difference was significant at other levels of anaesthesia. Though there was reduction in heart rate and mean arterial pressure in both the bolus and infusion group, the effects were sustained in the infusion group. The parameters after 5, 10 and 15 minutes of intubation and following sternotomy were significantly normal with the esmolol infusion group compared to bolus group.

Conclusion

We conclude that esmolol infusion 0.5 mg/kg 10 minutes prior to induction resulted in sustained reduction in mean arterial pressure and heart rate when compared bolus group. So esmolol when given as infusion is more effective than esmolol bolus injection in attenuation of stress response to intubation and sternotomy.

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