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"THE COMPARISON OF THE EFFECTS OF FENTANYL, ESMOLOL AND DEXMEDETOMIDINE FOR PREVENTION OF HAEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION"

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ABSTRACT

Introduction : The aim of this study was to evaluate and compare the effects of Fentanyl, Esmolol and Dexmedetomidine for prevention of haemodynamic response to laryngoscopy and endotracheal intubation.

Material and method: This study was carried out in 90, ASA grade I and II patients, aged 18 to 60 years who were scheduled for elective surgery under general anaesthesia and were divided into 3 groups of 30 each. Group A- received inj. Dexmedetomidine 1μg/kg diluted to 20 ml with normal saline, Group B - received inj. Fentanyl 2μg/kg, Group C received inj. Esmolol 2 mg/kg IV. Haemodynamic parameters like heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, SpO_2 were recorded.

Results: There was an increase in heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure d uring laryngoscopy and after endotracheal intubation in all the groups but increase was minimal in Dexmedetomidine group than Esmolol and Fentanyl group($P<0.05$).

Conclusion: Dexmedetomidine given 3 minutes prior to laryngoscopy and intubation is safe and more effective than Esmolol and Fentanyl in attenuating the haemodynamic response to direct laryngoscopy and endotracheal intubation.

INTRODUCTION

Laryngoscopy and intubation are known to cause exaggerated haemodynamic response. This response manifests as elevation in heart rate, systolic, diastolic and mean arterial blood pressure. These changes occurs in both normotensive and hypertensive patients but are more exaggerated in later [1,2]. These changes are due to mechanical and chemical stimuli. Mechanical stimulus causes reflex response in cardiovascular and respiratory systems. This response reaches its maximum level within 1 minute and ends within 5-10 minutes after intubation. Chemical stimulus results with catecholamines release via increase in sympathoadrenergic activity which leads to hypertension, tachycardia and arrhythmia.

There are many life-threatening complications associated with this response. Among them are cardiac dysrhythmias, myocardial infarction, acute left ventricular failure, increased intracranial pressure etc. These complications are mainly seen in patients with pre-existing cardiovascular and intracranial disorders[3].

Numerous efforts have been and are being made in the direction to attenuate this haemodynamic response but none of them gave satisfactory result. Lidocaine by both intratracheal and intravenous routes has been found to be effective but lacks consistency. It mainly attenuates the blood pressure and has very little effect on heart rate. Gabapentin attenuates the pressure response but has no effect on tachycardia associated with laryngoscopy and intubation. Alpha-blockers like labetalol are effective in suppressing the haemodynamic response to laryngoscopy and intubation but the longer duration of action overpasses the intubation response and may cause hypertension or bradycardia. Blocking of the central mechanisms of integration of sensory input by drugs like Fentanyl, Morphine, and Droperidol etc.

Esmolol is a cardioselective β-adrenergic blocker with rapid onset and ultra-short duration of action (9-10 minutes). This drug is more effective in preventing the changes in heart rate than the pressure response and has depressant effect on myocardium. Fentanyl is a short acting opioid agonist. In appropriate doses controls both heart rate and blood pressure but has associated respiratory depression and truncal rigidity at higher doses. Dexmedetomidine is a new, highly selective and potent -2 adrenoreceptor agonist. This drug reduces anaesthetic requirement, attenuates adrenergic, hormonal, and haemodynamic stress response to surgery, reduce anxiety and also cause sedation. Among the recommended procedures intravenous Lignocaine, Esmolol[13], Fentanyl, and Dexmedetomidine are commonly used drugs.

This study was designed to study and compare the effects of Dexmedetomidine, Fentanyl and Esmolol, on haemodynamic response to laryngoscopy and endotracheal intubation.

METHODS

After obtaining institutional ethical committee approval, this study was done in 90 patients aged between 18 - 60 years of either sex belonging to ASA class I and II posted for various elective surgeries under general anaesthesia at our institute after obtaining written informed consent.

Exclusion Criteria:

Patient refusal, Patient less than 18 and more than 60 years, Emergency surgeries, Patients with ASA Grade III, IV or V, Anticipated difficult intubation, Patients with hypertension, cardiovascular, renal, hepatic and respiratory diseases, Pregnant or lactating mother, Patients on hypnotics, narcotics, beta blockers, Calcium Channel blockers or sympatholytic drugs.

All the patients underwent a detailed pre anaesthetic check-up on the day before surgery and all the routine and specific investigations were done. The patients were electively kept nil by mouth for 6 hours before surgery and prior to operation informed consent were taken from patients' relatives. In the Operation Theatre, standard monitors like ECG, NIBP, and pulse oximetry were applied and baseline parameters [SpO2, Heart rate (HR), Systolic blood pressure (SBP), and Diastolic blood pressure (DBP), Mean arterial pressure (MAP)] were recorded. Two IV line with 18/20-gauge cannula were secured and IV fluid was started.

Premedication:

Patients were premedicated with: Inj. Ondansetron 0.15

mg/kg IV, Inj. Glycopyrrolate 4µg/kg IV. **Group A**: received Inj. **Dexmedetomidine** 1µg/kg diluted in 20 ml NS injected slowly over 10 min before induction. **Group B**: received Inj. **Fentanyl** 2 µg/kg before induction. **Group C**: received Inj. **Esmolol** 2 mg/kg before induction.

All the patients were preoxygenated with 100% oxygen by mask for 3 minutes before induction. Induction was achieved with inj. Propofol 2 mg/kg IV till loss of eyelash reflex and inj. succinylcholine 2mg/kg was given IV. After 30 seconds laryngoscopy was done using standard Macintosh blade. Oral Intubation was done with appropriate sized, portex cuffed endotracheal tube within 30 seconds. After checking bilateral air entry equal, endotracheal tube was fixed and positive pressure ventilation was started. Anesthesia was maintained with 50% O_2 + 50% N_2O + Sevoflurane + inj. Atracurium 0.5 mg/kg IV loading dose and 0.1 mg/kg maintenance dose and patients will be mechanically ventilated to maintain $EtCO_2$ 35 to 40 mm of Hg. HR, SBP, DBP, MAP and SpO_2 were recorded at Baseline, After premedication, After induction, After laryngoscopy and intubation, At 1, 2, 3, 5 and 10 minutes after intubation. At the end of surgery, anaesthesia was reversed with inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 8 µg/kg IV, after onset of spontaneous respiration.

Statistical Analysis:

Data was expressed as mean value ± standard deviation (SD). Quantitative data was analysed using t-test and qualitative by chi square test. Statistical calculations were carried out using Microsoft Office Excel 2010 and Graph Pad Prism 6.05 (quickcale) Software. Changes in haemodynamic variables from baseline and a comparison of means were analysed by unpaired t-test for each time interval. A P-value < 0.05 was considered statistically significant. P value < 0.001 was considered highly significant. P value > 0.05 was considered not-significant.

RESULTS

A total 90 patients were recruited and all patients were included for analysis, and there were no exclusions after recruitment as none of the patients had failed intubation or required more than one attempt for intubation. The demographic profile with respect to age, sex, height, weight and BMI was comparable in the three groups.

Baseline values of mean HR, SBP, DBP, MAP, SpO_2 were comparable in between three groups with no statistically significant difference (P>0.05). Changes in heart rate, SBP, DBP, MAP, SpO_2 after giving study drug and after induction were also not statistically significant between any of the group(P>0.05).

Figure 1 – Mean heart rate

Heart rate increased in all groups after intubation and increase was maximum in group B (102.46±15.13) and minimum in group A (88.73±9.44). In group C increase in heart rate (95.53±12.53) was more than group A but less than group B. In all groups maximum rise in heart rate was seen after 1minute of intubation (group A – 89.23±9.38, group B – 104.23±12.80, group C – 96.63±14.81). Heart rate started to return to baseline values after 2 minute in group A, after 10 minutes in group B and after 5 minutes in group C.

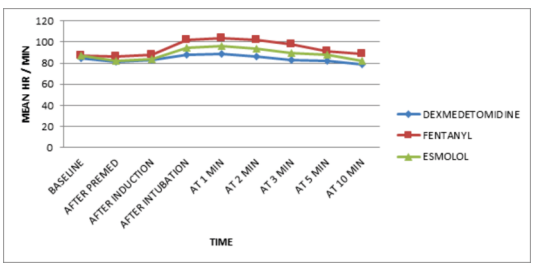


Figure 2 – Mean SBP

SBP increased in all groups after intubation and increase was maximum in group B (143.46±11.67) and minimum in group A (129.83±11.93). In group C increase in SBP (136.06±10.15) was more than group A but less than group B. In group A and group C maximum rise in SBP was seen after 1minute of intubation (group A – 130.76±12.29, group C – 136.86±10.07). While in group B maximum rise in SBP was seen after intubation. SBP started to return to baseline values after 2 minute in group A, after 5 minutes in group B and after 3 minutes in group C.

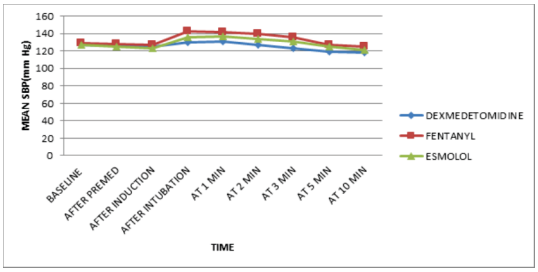


Figure 3 – Mean DBP

DBP increased in all groups after intubation and increase was maximum in group B (93.40±7.17) and minimum in group A (85.03±8.28). In group C increase in DBP (89.83±6.09) was more than group A but less than group B. Maximum rise in DBP was seen after intubation in all the groups. DBP started to return to baseline values after 2 minute in group A, after 5 minutes in group B and after 3 minutes in group C.

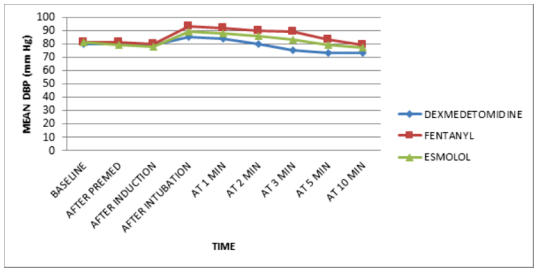
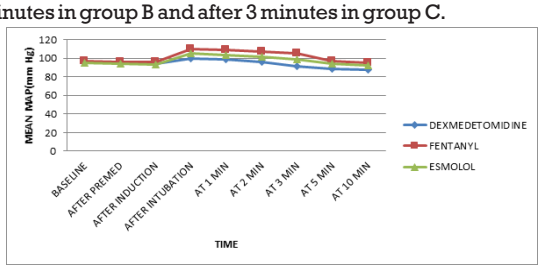


Figure -4 Mean Arterial Blood pressure

MAP increased in all groups after intubation and increase was maximum in group B (110.00±7.58) and minimum in group A (99.80±8.21). In group C increase in MAP (105.16±6.68) was more than group A but less than group B. Maximum rise in MAP was seen after intubation in all the groups. MAP started to return to baseline values after 2 minute in group A, after 5 minutes in group B and after 3 minutes in group C.



Mean oxygen saturation remained above 98% in all the groups. Changes in oxygen saturation was not statistically significant (P>0.05) between any of the groups at any point of time interval. No complications is seen in any of the groups.

DISCUSSION

The sequence of induction, laryngoscopy and intubation are associated with marked haemodynamic changes and autonomic reflex activity which may be a cause of concern in much high risk patient. Normal haemodynamic response to intubation is seen in all patients but well tolerated by healthy subjects. However, patients with cardiovascular or cerebral disease may be at increased risk of morbidity and mortality from the tachycardia and hypertension resulting from the

stress reflex caused by irritation of the respiratory tract.

Many factors like drugs, age, type of procedure, depth of anaesthesia, hypoxia, hypercarbia, status of myocardium and baseline catecholamine level etc. can influence the haemodynamic response associated with laryngoscopy and intubation. These haemodynamic responses need to be attenuated so as to decrease associated risk of myocardial ischemia, myocardial infarction, cerebral haemorrhage and raised intraocular tension.

In our study we compared the effects of Dexmedetomidine (1µg/kg), Esmolol hydrochloride (2mg/kg) and Fentanyl Citrate (2µg/kg) IV for attenuating hemodynamic responses to laryngoscopy and endotracheal intubation.

The most important laryngoscopy factor influencing the cardiovascular response is found to be duration of laryngoscopy. A linear increase in heart rate and mean arterial pressure during first 45 seconds has been observed. As duration of laryngoscopy and intubation is normally less than 30 seconds the result of studies in which it takes longer than this have less clinical relevance. In our study the duration of laryngoscopy and intubation was limited to ≤ 30 seconds.

Gupta K et al (2016)[7] compared three doses of dexmedet omidine - 0.5µg/kg, 0.8µg/kg and 1µg/kg. All doses were infused over 10 min as premedication before propofol induction. They found that, premedication with dexmedeto midine at doses of 1 µg/kg attenuated the adverse hemodyn amic response of laryngoscopy and intubation adequately. In our study, we used Dexmedetomidine in the dose of 1µg/kg diluted in 20 ml 0.9% normal saline infused over 10 minutes before induction of anaesthesia.

Manhas A et al (2016)[6] compared different doses of Esmolol hydrochloride for attenuation of haemodynamic response. They used 0, 1, 2 and 3 mg/kg of Esmolol hydrochloride and found that IV Esmolol in a dose of 1 mg/kg body weight is ineffective in blunting the haemodynamic responses to laryngoscopy, but Esmolol in a dose of 2 mg/kg body weight given 3 minutes before is effective in attenuating the haemodynamic responses, without any deleterious effects. In our study we gave Esmolol 2mg/kg, 3 minute prior to laryngoscopy and intubation.

Thakur D et al (2016)[5] have used Fentanyl as a single bolus, 2 µg/kg IV diluted to 10 ml with normal saline 5 min prior to laryngoscopy and intubation and concluded that Fentanyl attenuated the cardiovascular response to laryngoscopy & intubation. DBP was maintained in the fentanyl group. In our study we also gave Fentanyl 3 minutes prior to laryngoscopy and intubation in a dose of 2µg/kg IV to avoid postoperative respiratory depression.

Gogus N et al (2014)[4] compared the effects of Dexmedeto midine, Fentanyl and Esmolol on haemodynamic response to intubation. They observed that esmolol was more effective than Dexmedetomidine and Fentanyl in prevention of increase in systolic, diastolic and mean arterial pressures following endotracheal intubation. On the other hand, Dexmedetomidine was more effective than Esmolol[8, 9] and Fentanyl in preventing the increase in heart rate. These results differ from our study, where we observed that Dexmedetomidine is better than Esmolol and Fentanyl[10, 11] in controlling heart rate and SBP, DBP and MAP.

There are some limitations of our study which includes -ASA class III and IV patients especially with IHD, MI, HTN were not included in study. Influence of premedication with Glycopyrrolate, which cause tachycardia and midazolam cause decrease in mean arterial pressure and Succinylcholine can cause bradycardia occasionally. Adequate depth of anaesthesia and neuromuscular blockade were monitored only by clinical observations. Haemodynamic parameters would have shown a different picture in patients with difficult intubation.

CONCLUSION

There was an increase in heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure during laryngoscopy and after endotracheal intubation in all the groups but increase in haemodynamic parameters were minimal in dexmedetomidine group than esmolol and fentanyl group. Dexmedetomidine (1µg/kg), given 3 minutes prior to laryngoscopy and intubation is safe and more effective than Esmolol (2 mg/kg) and Fentanyl (2 µg/kg) in attenuating the haemodynamic response to direct laryngoscopy and endotracheal intubation in patients undergoing surgical procedures under general anaesthesia.

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