Efficacy of Dexmedetomidine and Esmolol for attenuation of cardiovascular response during laryngoscopy and endotracheal intubation in cases with controlled hypertension

Dr. Badri Narayana Chigullapally and Dr. Aerram Srinivas

DOI: https://doi.org/10.33545/26643766.2020.v3.i1d.100

Abstract
Background: Laryngoscopy and endotracheal intubation evokes tachycardia and hypertension in cases with cardiovascular diseases undergoing anaesthesia. This was successfully reduced by opioids, inhaled anaesthetics, vasodilators and adrenergic blockers. This study was designed to assess the efficacy of 1μg/kg Dexmedetomidine and 1.5 mg / kg Esmolol in attenuation of cardiovascular response during laryngoscopy and endotracheal intubation in cases with controlled hypertension

Materials and Methods: A total 100 controlled hypertensive cases undergoing general anaesthesia were randomly divided in to two groups Group 1 administered with 1μg/kg Dexmedetomidine in 100ml normal saline, 2 minutes before intubation and group 2, with 1.5 mg / kg Esmolol, 2 minutes before intubation. Heart rate, Systolic blood pressure, diastolic blood pressure, mean arterial pressure and SpO2 were recorded at baseline, after drug administration, after induction, at 0 min, 1min, 3min, 5min, 10min, 15 minutes after intubation.

Results: The mean difference of age (p=0.722), sex (p=0.358) and history of anti-hypertensive drug usage (p=0.562) between two study groups was statistically not significant. After induction, all raised baseline parameters were normalized after 10 minutes in group 1 and after 15 minutes in group 2.

Conclusion: Dexmedetomidine is efficient in attenuating the rise in mean heart rate, mean systolic blood pressure and mean diastolic blood pressure. Esmolol had longer duration in attenuation of cardiovascular response.

Keywords: 1μg/kg Dexmedetomidine, 1.5 mg / kg Esmolol, Endotracheal intubation, Controlled Hypertension.

Introduction
Laryngoscopy and endotracheal intubation produce marked sympathetic response that evokes hypertension and tachycardia. This leads to the severe haemodynamic disturbances in cases with cardiovascular complication [1, 2]. It required numerous pharmacological interventions to control the haemodynamic response. This was successfully reduced by opioids, inhaled anaesthetics, vasodilators and adrenergic blockers [3, 4].

Dexmedetomidine, an ideal n2-adrenergic agonist possess anxiolytic, sedative, analgesic and sympatholytic properties with minimal respiratory depression. It is effective in attenuation of haemodynamic stability and sympathoadrenal responses during laryngoscopy and endotracheal intubation [5, 6]. Esmolol, an ultra-short β-adrenergic blocking drug, rapid onset, water soluble, possesses little sedative effect, but no analgesic activity. It is effective in providing haemodynamic stability during laryngoscopy and endotracheal intubation [7, 8].

The present study was designed to assess the efficacy of 1μg/kg Dexmedetomidine and 1.5 mg / kg Esmolol in attenuation of cardiovascular response during laryngoscopy and endotracheal intubation in cases with controlled hypertension.

Materials and Methods
The present Prospective, randomized double blind study was conducted in the Department of Anaesthesia, MNR Medical College, Sangareddy in association with Department of Anaesthesia, Gandhi Medical College, Secunderabad during June 2018 to November 2019. A total 100 controlled hypertensive cases undergoing general anaesthesia for elective non cardiac surgery between 31-60 years were recruited. Case with controlled hypertension,
with SAP>160 mm of Hg or DAP>90 mm of Hg and ASA grade II were included, cases not willing to participate, with cardiovascular diseases, diabetes, with secondary hypertension and with longer intubation time and attempts were excluded. Informed consent was obtained from all the study participants and study protocol was approved by Institutional ethics committee. Based on drug administered study participants were randomly divided in to two groups Group 1 administered with 1μg/kg Dexmedetomidine in 100ml normal saline, 2 minutes before intubation and group 2, with 1.5 mg / kg Esmolol, 2 minutes before intubation. Prior to the surgery baseline parameters were noted and recorded. Study drugs were administered as per study protocol to both groups. After 2 min, cases induced with 5 mg/kg thiopentone sodium, 2 μg/kg fentanyl and 0.5mg/kg atracurium. Laryngoscopy and endotracheal intubation was done. Parameters such as Heart rate, Systolic blood pressure, diastolic blood pressure, mean arterial pressure and SpO2 were recorded at Baseline, after drug administration, after induction, at 0 min, 1min, 3min, 5min, 10min, 15 minutes after intubation. Study data was collected on to the Microsoft excel sheet and data analysis was conducted by SPSS excel version 16. Study data was represented as Mean ad standard deviation.

Results
A total 100 study participants were randomly divided in to two groups Group 1 administered with 1μg/kg Dexmedetomidine in 100ml normal saline, 2 minutes before intubation and group 2, with 1.5 mg / kg Esmolol, 2 minutes before intubation.

Table 1: Demographic data of study participants.

| Parameter           | Group 1 | Group 2 | P-value |
|---------------------|---------|---------|---------|
| Age                 | 43.9±6.8 | 45.2±7.6 | 0.722   |
| Sex                 |         |         |         |
| Male                | 21 (42%) | 24 (48%) | 0.358   |
| Female              | 29 (58%) | 26 (52%) |         |

Details of anti-hypertensive drugs
- Beta Blockers: 18 | 15
- ACEI: 20 | 14
- Diuretics: 09 | 06
- No drugs: 10 | 08

p-value: 0.562

Table 2: Mean heart rate and mean Arterial pressure in both the study groups.

| Time interval | Heart rate (HR) | Mean Arterial pressure (MAP) |
|---------------|-----------------|-----------------------------|
|               | Group 1 (Mean±SD) | Group 2 (Mean±SD) | p-value | Group 1 (Mean±SD) | Group 2 (Mean±SD) | p-value |
| At beginning  | 78.34 ± 4.06     | 78.85 ± 4.22              | 0.284   | 91.03 ± 7.27      | 91.89 ± 6.21      | 0.391   |
| After drug dose | 78.88 ± 4.52     | 83.26 ± 4.18              | 0.183   | 91.52 ± 8.39      | 92.28 ± 7.45      | 0.448   |
| after induction | 82.30 ± 5.51     | 89.08 ± 5.45              | 0.004   | 93.28 ± 7.81      | 97.73 ± 7.63      | 0.089   |
| At 0 min      | 79.98 ± 5.18     | 90.65 ± 4.33              | 0.0032  | 93.22 ± 7.10      | 98.59 ± 6.89      | 0.005   |
| At 1 min      | 84.18 ± 6.24     | 95.20 ± 6.74              | 0.0001  | 97.36 ± 8.98      | 100.11 ± 8.24     | 0.002   |
| At 3 min      | 82.68 ± 6.51     | 94.98 ± 6.82              | 0.00    | 99.14 ± 8.24      | 102.90 ± 8.05     | 0.004   |
| At 5 min      | 82.32 ± 7.28     | 96.39 ± 5.61              | 0.0001  | 99.67 ± 7.33      | 105.54 ± 7.78     | 0.0001  |
| At 10 min     | 80.15 ± 6.22     | 80.71 ± 7.08              | 0.436   | 95.23 ± 9.45      | 97.62 ± 9.31      | 0.391   |
| At 15 min     | 79.24 ± 7.74     | 78.43 ± 6.17              | 0.418   | 93.66 ± 9.17      | 97.05 ± 8.22      | 0.446   |

Table 3: Mean Systolic blood pressure (SBP) and diastolic blood pressure (DBP) in the study participants.

| Time interval | Systolic blood pressure (SBP) | Diastolic blood pressure (DBP) |
|---------------|------------------------------|--------------------------------|
|               | Group 1 (Mean±SD) | Group 2 (Mean±SD) | p-value | Group 1 (Mean±SD) | Group 2 (Mean±SD) | p-value |
| At beginning  | 121.09 ± 9.28      | 122.29 ± 10.02     | 0.202   | 77.25 ± 6.34      | 76.28 ± 7.24      | 0.489   |
| After drug dose | 120.50 ± 9.66      | 124.21 ± 9.56      | 0.241   | 77.18 ± 7.69      | 78.63 ± 6.61      | 0.650   |
| after induction | 121.41 ± 11.08     | 124.98 ± 9.35      | 0.287   | 79.32 ± 8.55      | 82.95 ± 7.39      | 0.244   |
| At 0 min      | 120.33 ± 11.87     | 125.67 ± 9.10      | 0.001   | 78.45 ± 8.41      | 83.27 ± 7.55      | 0.004   |
| At 1 min      | 126.22 ± 12.45     | 129.22 ± 10.84     | 0.003   | 81.06 ± 10.88     | 87.29 ± 8.82      | 0.001   |
| At 3 min      | 127.78 ± 11.77     | 129.6 ± 10.18      | 0.002   | 82.11 ± 9.98      | 86.11 ± 9.23      | 0.214   |
| At 5 min      | 129.91 ± 10.29     | 129.81 ± 9.44      | 0.002   | 84.98 ± 10.74     | 89.68 ± 7.11      | 0.002   |
| At 10 min     | 121.87 ± 9.71      | 128.04 ± 10.09     | 0.087   | 81.66 ± 10.02     | 83.54 ± 9.98      | 0.489   |
| At 15 min     | 121.01 ± 9.33      | 127.30 ± 11.68     | 0.355   | 80.48 ± 9.14      | 81.22 ± 8.56      | 0.224   |

Discussion
Direct Laryngoscopy and endotracheal intubation are the key events during surgery under general anaesthesia. They frequently induce cardiovascular stress response due to reflex sympathetic stimulation which is harmful to cases with hypertension, myocardial disease, cardiovascular complications and cerebrovascular disease [9, 10]. The present study was designed to evaluate the efficacy of Dexmedetomidine and Esmolol in supressing cardiovascular response during laryngoscopy and endotracheal intubation in cases with controlled hypertension. The study participants were randomly divided in to 2 groups. Group 1 administered with 1μg/kg Dexmedetomidine in 100ml normal saline, 2 minutes before intubation and group 2, with 1.5 mg/kg Esmolol, 2 minutes before intubation.

In this study, the mean difference of age (p=0.722), sex (p=0.358) and history of anti-hypertensive drug usage (p=0.562) between two study groups was statistically not significant (Table 1). Study by Amutharani et al., found that demographic profile and antihypertensive drug type were statistically not significant among two study groups [11]. In this study, the mean heart rate in group 1 was 78.34 beats/minute at the beginning, which was raised to 84.18 beats/minute after induction and was returned to the normal basal value 80.15 beats/minute at 10 minutes. In group 2, the mean heart rate was 78.85 beats/minute and reached a maximum of 95.20 beats/minute and was returned to the normal basal value 78.43 at 15 minutes (Table 2). The

~ 262 ~
findings of Amutharani et al., stated that, in group Dexmedetomidine, the mean heart rate was 79.97 at the beginning, which was raised to 87 after intubation and came down to 78.6 at 10 minutes. Whereas in Esmolol group, mean heart rate was 78.47 at the beginning, which was raised to 98.6 after intubation and came down to 78.37 at 15 minutes [11].

The mean arterial pressure in group 1 was 91.03 mm of Hg at the beginning, which was raised to 99.67 mm of Hg after induction and was returned to the normal basal value 95.23 mm of Hg at 10 minutes. In group 2, the mean arterial pressure was 91.89 mm of Hg and reached a maximum of 105.54 mm of Hg and was returned to the normal basal value 97.05 mm of Hg at 15 minutes (Table 2). The findings of Amutharani et al., stated that, in group Dexmedetomidine, the mean arterial pressure was 90.93 mm of Hg at the beginning, which was raised to 100.61 mm of Hg after intubation and came down to 95.67 mm of Hg at 15 minutes. Whereas in Esmolol group, mean arterial pressure was 92.6 mm of Hg at the beginning, which was raised to 114.8 mm of Hg after intubation and came down to 98.80 mm of Hg at 15 minutes [11].

In group 1, the mean systolic blood pressure was 121.09 mm of Hg at the beginning and was raised to 129.91 mm of Hg and was returned to 121.87 mm of Hg at 10 minutes. In group 2, the mean systolic blood pressure at the beginning was 122.29 mm of Hg and 128.04 mm of Hg at 15 min after induction. Study by Amutharani et al., found that, in Dexmedetomidine group, the mean systolic blood pressure was 122.2 mm of Hg at the beginning and was reached to normal level at 10 minutes. In Esmolol group the mean systolic blood pressure was 124.57 mm of Hg at the beginning and was reached to basal level at 15 minutes after intubation [11].

In the present study, raise in mean heart rate, mean systolic blood pressure and diastolic blood pressure was effectively reduced by Dexmedetomidine than Esmolol after laryngoscopy and endotracheal intubation. After induction, all raised baseline parameters were normalized after 10 minutes in group 1 and after 15 minutes in group 2. Study by Sharma et al., stated that 100mg Esmolol is effective in attenuating haemodynamic response to laryngoscopy and endotracheal intubation in treated hypertensive cases [12]. Study by Hale Yarkan Uysal et al., found that Esmolol was not effective in attenuating the BP to tracheal intubation, but it is effective in attenuating heart rate to tracheal intubation in hypertensive cases [13]. Study by Kindler et al., stated that 1-2mg/kg Esmolol is effective in attenuating HR response to trachea intubation [14].

Conclusion
The study results concludes that, Dexmedetomidine is efficient in attenuating the rise in mean heart rate, mean systolic blood pressure and mean diastolic blood pressure. Whereas Esmolol took longer duration in attenuation of mean heart rate, mean arterial pressure, mean systolic blood pressure and mean diastolic blood pressure after laryngoscopy and endotracheal intubation.

References
1. Zhao Li, Li Xu, Jinwei Zheng, Qingxiu Wang. Comparison of Intravenous Dexmedetomidine versus Esmolol for Attenuation of Hemodynamic Response to Tracheal Intubation after Rapid Sequence Induction: A Systematic Review and Meta-Analysis. BioMed Research International. 2019; 1-9.
2. AL Kovac, “Controlling the hemodynamic response to laryngoscopy and endotracheal intubation,” Journal of Clinical Anesthesia. 1996; 8(1):63-79.
3. Gurulingappa, Aleem MA, Awati MN, Adarsh S. Attenuation of cardiovascular responses to direct laryngoscopy and intubation-a comparative study between IV bolus fentanyl, lignocaine and placebo (NS). J Clin Diagn Res. 2012; 6:1749-52.
4. Ko BJ, Oh JN, Lee JH, Choi SR, Lee SC, Chung CJ et al. Comparison of effects of fentanyl and remifentanil on hemodynamic response to endotracheal intubation and myoclonus in elderly patients with etomidate induction. Korean J Anesthesiol. 2013; 64:12-8.
5. Sanders RD, Maze M, Alpha 2-adrenoceptor agonists, Current Opinion in Investigational Drugs. 2007; 8(1):25-33.
6. Grewal A. Dexmedetomidine: new avenues. J Anaesthesiol Clin Pharmacol. 2011; 27:297-302.
7. Srivastava VK, Nagle V, Agrawal S, Kumar D, Verma A, Kedia S et al. “Comparative evaluation of dexmedetomidine and esmolol on hemodynamic responses during laparoscopic cholecystectomy,” Journal of Clinical and Diagnostic Research. 2015; 9(3):01-05.
8. Ebert TJ, Bernstein JS, Stowe DF, Roerig D, Kampine JP. Attenuation of hemodynamic responses to rapid sequence induction and intubation in healthy patients with single bolus of esmolol. J Clin Anesth. 1990; 2:243-52.
9. Krishna Chaitanya, Jagadish Vaddineni, Narasimha Reddy, Sangamitra Gandra, Chaitanya Kumar, Venkateswar Rao et al. A Comparative Study between I.V 50% Magnesium Sulphate and Dexmedetomidine for Attenuation of Cardiovascular Stress Response during Laryngoscopy and Endotracheal Intubation. Journal of Evolution of Medical and Dental Sciences. 2014; 3(32):04:8741-8749.
10. Shree SR, Badrinarayan V. Evaluation of three regimens of esmolol for attenuation of cardiovascular responses to endotracheal intubation-A comparison with intravenous lignocaine. J Anaesth Clin Pharmacol 2003; 19(1):45-52.
11. Amutharani R, Sukumaran M, Vijayanand G. Comparative evaluation of dexmedetomidine and esmolol for attenuation of intubation stress response in well controlled hypertensive patients – a double-blind randomized control study. International Journal of Contemporary Medical Research. 2019; 6(2):B9-B12.
12. Sharma S, Mitra S, Grover VK, Kalra R. Esmolol blunts the haemodynamic responses to tracheal intubation in treated hypertensive patients. Can J Anaesth. 1996; 43:778-82.
13. Yarkan Uysal H, Tezer E, Türkoglu M, Aslanargun P, Başar H. Effect of dexmedetomidine on hemodynamic response to laryngoscopy and tracheal intubation in hypertensive patients: a comparison with esmolol and sufentanil. European Journal of Anaesthesiology. 2012; 29:237.
14. Kindler CH, Schumacher PG, Schneider MC, Urwiler A. Effects of intravenous lidocaine and/or esmolol on hemodynamic responses to laryngoscopy and intubation: a double-blind, contro led clinical trial. J Clin Anesth. 1996; 8:491-6.