An Observational Study of Intravenous Dexmedetomidine and Clonidine for Attenuating Haemodynamic Response to Laryngoscopy and Intubation in Patients Undergoing General Anaesthesia

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Abstract

Background: Laryngoscopy and endotracheal intubation alters cardiovascular physiology causing hypertension and tachycardia. Dexmedetomidine, an alpha 2 adrenergic receptor produces analgesia by direct activation of descending inhibitory pain pathway and inhibiting the release of substance P. Clonidine a centrally acting alpha 2 adrenergic agonist decreases central sympathetic nervous system in all hyperadrenergic situations. Hence we compare haemodynamic effects between dexmedetomidine 0.5 mcg/kg and clonidine 1mcg/kg during after laryngoscopy and tracheal intubation for patients undergoing general anaesthesia.

Method: Patients were allocated randomly into 2 groups of 30 each. Group D received dexmedetomidine 0.5mcg/kg diluted in 10ml NS and group C- clonidine 1 mcg/kg diluted in 10ml NS intravenously and hemodynamic parameters were observed. Dexmedetomidine/ Clonidine according to groups is given intravenously with premedication. After 5 minutes patients were induced with 2.5% thiopentone 5-7 mg/kg and succinyl choline 2mg/kg and intubated with appropriate sized cuffed ETT. Anaesthesia was maintained with O_2, N_2O, isoflurane and vecuronium bromide 0.08mg/kg.

Results: Haemodynamic changes after laryngoscopy and intubation were recorded at baseline, premedication, induction, intubation, 1, 3, 5,10 and 15 minutes. The initial fall in HR is more in Group C compared to Group D but the difference was insignificant, but since intubation till 10min post intubation HR was significantly ($p<0.05$) supressed more in Group D. Similarly fall in SBP and DBP is significantly ($p<0.05$) more in Group D compared to Group C.

Conclusion: Dexmedetomedine 0.5 mcg/kg intravenously 15 minutes prior to laryngoscopy and intubation attenuates the sympathetic response better as compared to clonidine without major side effects.

Keywords- *Dexmedetomidine, Clonidine, haemodynamic response, laryngoscopy, intubation, general anaesthesia*

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Introduction

General anaesthesia is a reversible condition which is drug induced and composed of four behavioural and physiologic states.[1] The critical phase of general anaesthesia is the induction phase.[2] Anaesthesia induction is commonly initiated by intravenous administration of hypnotics for abruptly bringing conscious patients into unresponsiveness to strong adrenergic stimuli including

endotracheal intubation and surgical procedures.[3]

Laryngoscopy and endotracheal intubation are undesired stimuli that provoke a transient but marked sympathetic response, resulting as tachycardia and hypertension. These responses are transitory, variable and are much more pronounced in hypertensive than in normotensive individuals.[3]

Manipulation of the airway, particularly laryngoscopy and endotracheal intubation changes the cardiovascular physiology both via reflex responses and the physical presence of an endotracheal tube.[4]

α-2 adrenoceptor agonists diminish the sympathoadrenal response by preventing noradrenaline release and thereby curbing the overall haemodynamic variability. They have sedative and analgesic properties and also decreases the need for anaesthetics and therefore can be used as an adjunct to general anaesthesia.

Dexmedetomidine is a unique anesthetic agent which activates the α-2 adrenergic receptor resulting in decrease in noradrenergic neurotransmitter release and suppression of adrenergic pathways and decreases the plasma catecholamine levels and catecholamine release which results in attenuation of haemodynamic response.[5]

Clonidine, is also a centrally acting α-2 adrenergic agonist and it suppresses central sympathetic nervous system in all hyperadrenergic situations.

Hence we compared dexmedetomidine and clonidine for attenuation of haemodynamic response to laryngoscopy and intubation.

Aims and Objectives

Aim

· The study is designed to compare haemodynamic effects between dexmedetomidine 0.5 μg kg^{-1} and clonidine 1 μg kg^{-1} during and after laryngoscopy and tracheal intubation for patients undergoing general anaesthesia.

Objectives

1. To compare haemodynamic changes after laryngoscopy and intubation.

2. To compare side effects and safety of dexmedetomidine and clonidine.

Materials and Methods

After obtaining permission from ethical committee the study was conducted at Dhiraj general hospital, S.B.K.S M.I & R.C in department of anesthesiology. The study was conducted for 60 patients of American society of anaesthesiologist's (ASA) grade I & II posted for surgery under general anaesthesia after taking informed written consent from July 2019 to June-2020.

They were allocated into two equal groups according to the study drugs. All the basal parameters were noted. The study was observational in nature.

Total 60 participants were allocated in following two equal groups:

Group D (Dexmedetomidine) :(n=30) received 0.5mcg/kg body weight of dexmedetomidine intravenously.

Group C (Clonidine) :(n=30) received 1mcg/kg body weight of clonidine intravenously.

Inclusion Criteria

· Adult patients aged between 18-60 years posted for elective surgeries under general anaesthesia.

· Patients belonging to ASA class I and II.

· No known history of allergy and hypersensitivity to study drug.

· Patient willing to sign informed consent.

Exclusion criteria

· Age < 18 years and > 60 years.

· Patients belonging to ASA class III and above.

· Patients with hypertension, cardiac, renal, hepatic and cerebral diseases.

· Patients with difficult airway and obese patients.

· Patients with endocrinal diseases like hyperthyroidism, hypothyroidism and diabetes mellitus.

- Patients coming for emergency surgeries.
- Pregnant females.
- Known allergy to the study drugs.
- Patient on beta blockers.

Pre-operative Examination

Preoperative assessment was done for each patient and necessary laboratory investigations was carried out. The patient was kept fasting for 8 hours before surgery and informed and written consent was taken.

On arrival in operation theatre after taking intravenous line, crystalloid was started at 4ml kg^{-1} hr^{-1}. Baseline parameters - heart rate(HR), mean arterial pressure(MAP), systolic blood pressure(SBP), diastolic blood pressure(DBP), electrocardiogram(ECG) and pulse oximetry(SpO2) were recorded. Then premedication was given with injection glycopyrrolate 0.2 mg, injection ondansetron 4mg intravenously, injection ranitidine 50 mg intravenously. All patients were pre-oxygenated via face mask. Group D patients were given intravenous dexmedetomidine 0.5 µg kg-1 body weight diluted in 10 ml normal saline using syringe infusion pump. Group C patients were given intravenous clonidine 1 µg kg^{-1} body weight diluted in 10 ml normal saline using syringe infusion pump.

After 5min of giving study drug patient was induced with injection 2.5% thiopentone 5-7 mg/kg and injection Succinylcholine 2 mg/kg intravenously. When the fasciculations disappeared, patients were intubated with appropriate sized cuffed endotracheal tubes within 15 seconds.. Anaesthesia was maintained with oxygen and nitrous oxide (50%-50%), 1 MAC isoflurane and injection vecuronium bromide 0.08 mg kg^{-1} as loading dose and 0.01 mg kg^{-1} maintenance dose as and when required intravenously. After completion of the surgery, neuromuscular blockade was reversed with injection neostigmine 0.05 mg kg^{-1} and injection glycopyrrolate 0.008 mg kg^{-1} intravenously.

Hypotension was treated primarily by increasing the i.v. infusion rate and then with 10 mg bolus dose of ephedrine iv and bradycardia with 0.6 mg of atropine iv.

After extubation, patients were observed for complications like nausea, vomiting, sedation, respiratory depression, bradycardia and hypotension.

Statistical Analysis

Data was collected and numerical variables were presented as mean & standard deviation (SD) while categorical variables were presented as frequency and percent. For numerical variables; unpaired student t-test was used whenever appropriate, for between group's comparisons, while for categorical variables; chi-square test was used. A difference with significant level<0.05 was considered statistically significant.

Observation and Result

No statistically significant difference observed in respect to age, gender and American society of anaesthesiologists (ASA) grading between the two groups. ($p>0.05$)

The preinduction values of mean heart(HR) rate were comparable between two groups with no significant difference. But during laryngoscopy rise in mean HR was significantly high in group C in the first 3 mins after intubation compared to Group D ($p<0.05$) as shown in Fig-1

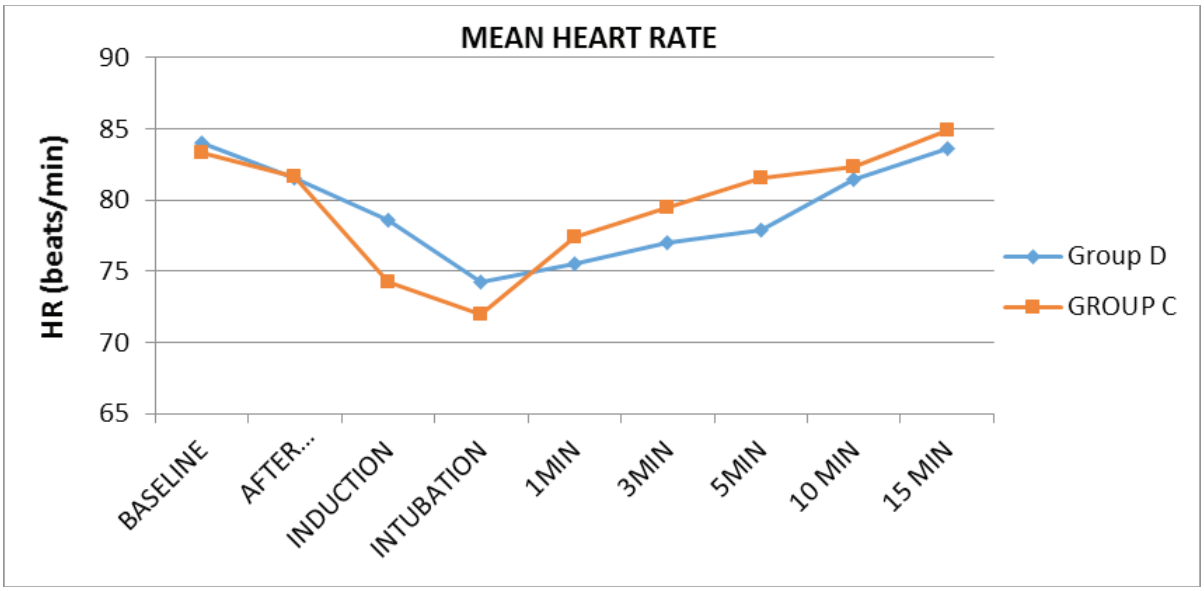

Fig-1 MEAN HEART RATE

The difference in the mean systolic blood pressure(SBP) in between the groups were statistically not significant during basal readings. After instillation of the study drug there was drop in the blood pressure in both the groups as shown in Fig 2 but during intubation rise seen in SBP in Group C was more as compared to Group D and the difference was significant ($p<0.001$).

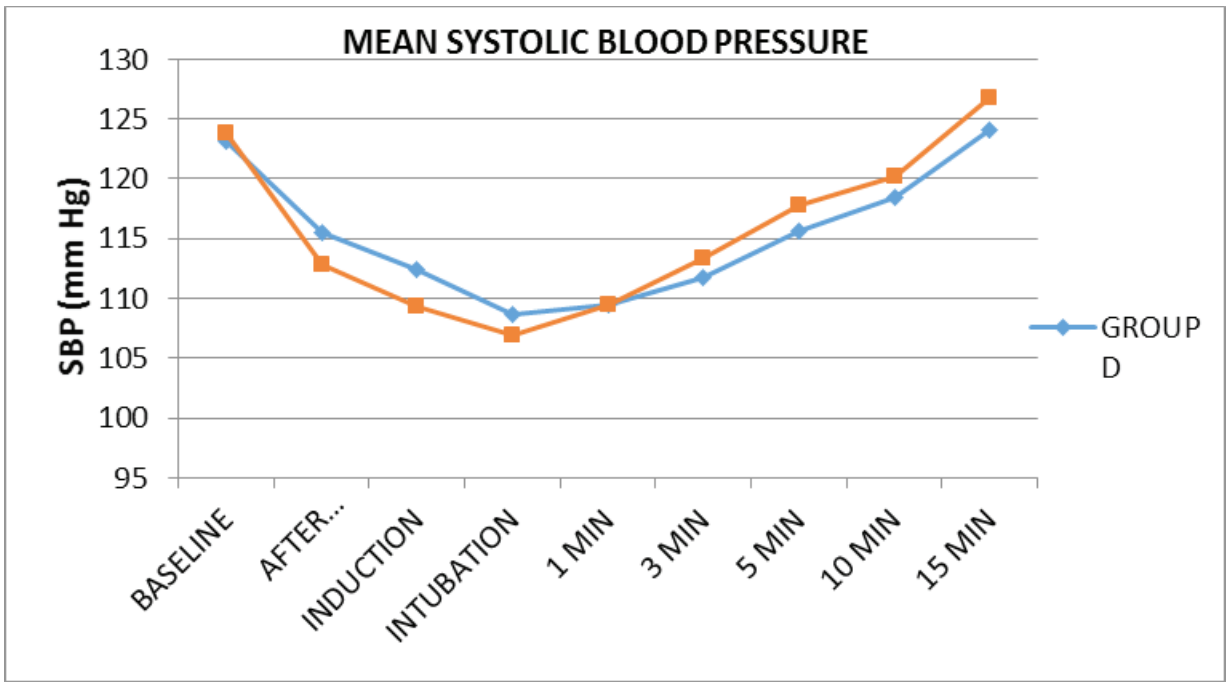

Fig-2 MEAN SYSTOLIC BLOOD PRESSURE

The difference in mean diastolic blood pressure(DBP) between the groups were statistically not significant during basal and after infusion of study drug. But during intubation as shown in Fig 3 the DBP in Group D remains significantly($p<0.05$)low as compared to Group C and remains on the lower side till 05 min.

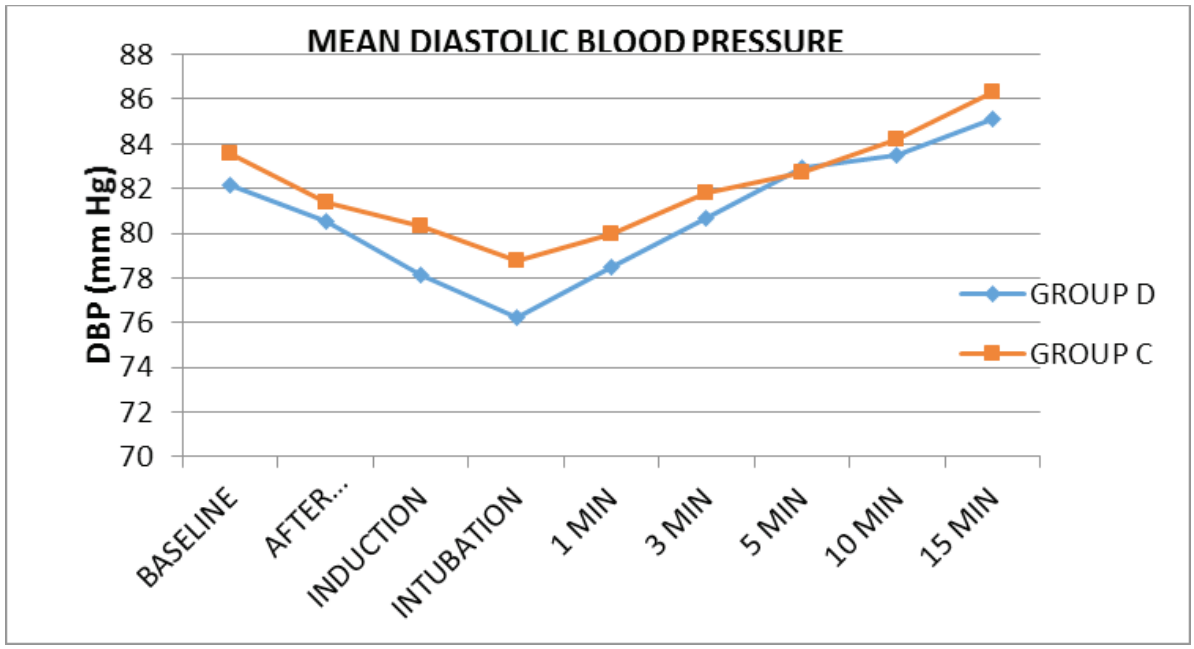

Fig-3 MEAN DIASTOLIC BLOOD PRESSURE

The difference in mean arterial pressure (MAP) between the two groups was statistically not significant during basal and after infusion of study drug. After that, from induction to intubation increase was noted in MAP in both the groups but the rise was significantly high in Group C($p<0.05$) than Group D. However, The MAP continued to be at lower levels compared to the basal value even after 10 minutes of intubation in Group D (Fig-4)

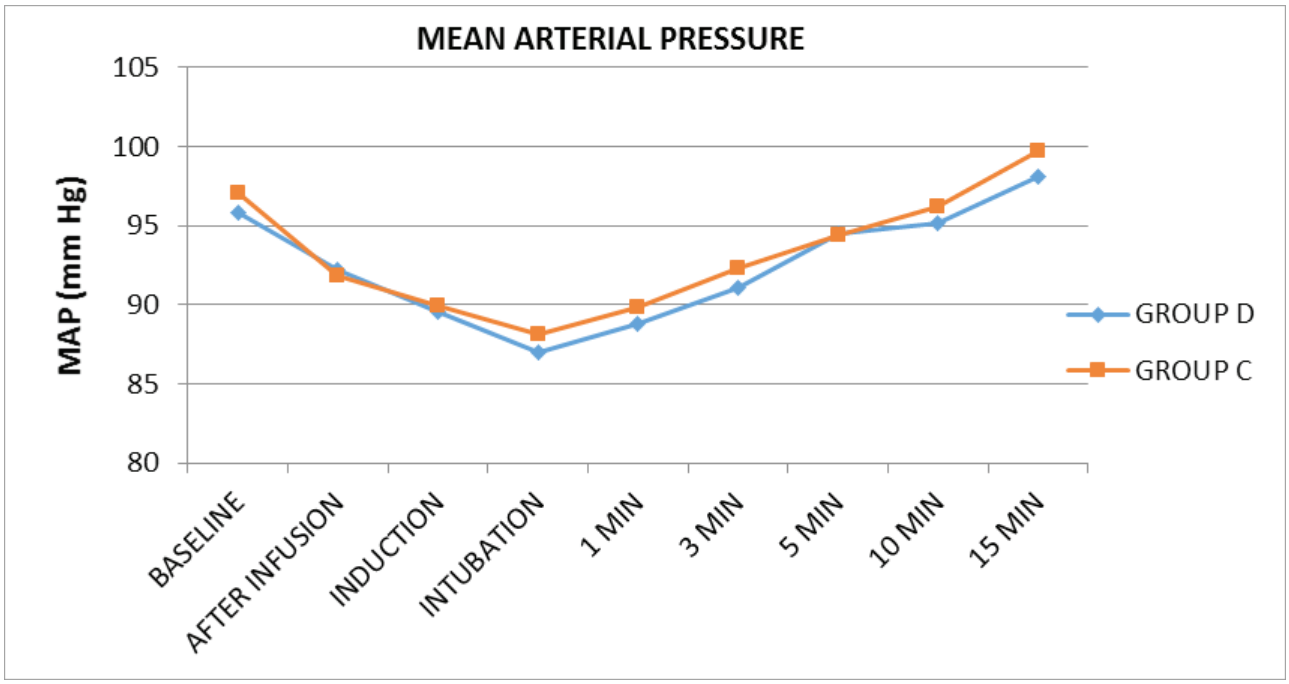

Fig-4 MEAN ARTERIAL PRESSURE

The difference in the mean SpO_2 between the groups were statistically not significant from basal to even after 15 minutes of intubation. ($p>0.05$)

Discussion

The hemodynamic responses to laryngoscopy and intubation, comprising of elevation in heart rate and rise in systolic and diastolic blood pressure, are well known. The potential for life threatening complications associated with these responses is also well documented.

The drugs for controlling these hemodynamic responses aim to stabilize heart rate and blood pressure during laryngoscopy and intubation in order to prevent any rise in myocardial work load and oxygen demand as well as to preserve the perfusion of vital organs. At the same time, safety of such drugs is also a prime concern. It is desirable to use a drug with least numerous, rapidly recognizable and easily treatable adverse effects.

The hemodynamic responses to laryngoscopy and tracheal intubation from reflex sympathetic discharge result from epipharyngeal stimulation. It is logical to select an agent which would prevent or minimize the laryngopharyngeal stimulation by the intubation process or an agent which would block the sympathetic activity associated with it.

Recently α-2 agonists like dexmedetomidine and clonidine have been tried for suppressing the response to intubation. There are two mechanisms by which dexmedetomidine produces analgesia which involves activation of presynaptic α-2 receptors in the spinal cord. One is by direct activation of the descending inhibitory pain pathway, the other is by inhibiting the release of substance P. They are without the side effects like respiratory depression or increased incidence of PONV.

The present study was undertaken to study the efficacy of dexmedetomidine and clonidine in blunting the haemodynamic response to laryngoscopy and intubation.

Our study was in correlation with the study conducted by **Sarkar A et al[6], Mondal S et al[7]** and **K Selvaraju et al[8]** which showed that SBP was more increased in patients of clonidine group as compared to dexmedetomidine group.

There was a contrast study in which **CM Suryavanshi et al[9]** had found that dexmedetomidine and clonidine were equally efficacious in attenuating haemodynamic response to laryngoscopy and intubation.

Our findings also correlate with the studies conducted by **Sarkar A et al[6]**, **Sharma A et al[10]**, **Suhasinirajashekar et al[11]** and **Ahmed ALM et al[12]** that dexmedetomidine is better in attenuating blood pressure response to laryngoscopy.

There were no incidence of hypotension, bradycardia, nausea, vomiting and bronchospasm in our study.

Conclusion

From the basis of our study, it was concluded that IV infusion dose of dexmedetomidine 0.5 mcg/kg could attenuate the sympathetic response to laryngoscopy and intubation better in comparison to IV infusion dose of clonidine 1 mcg/kg, administered prior to laryngoscopy and intubation without any major side effects of the drug in otherwise healthy patients undergoing elective surgeries under general anaesthesia.

Funding- Self

Conflict of Intrest- None

Bibliography

1. Miller RD. Monitoring brain state during general anaesthesia and sedation. Miller's anesthesia. 8th edn. Elsevier 2015;1:1524-25.
2. Kaur S, Kataria AP, Kaur G, et al. Comparison of induction characteristics of propofol-lipuro and etomidate-lipuro in cardiac patients in non-cardiac surgery. Int J Sci Study 2014;2(6):66-72.
3. Yang HS, Kim TY, Bang S, et al. Comparison of the impact of the anaesthesia induction using thiopental and propofol on cardiac function for non-cardiac surgery. J Cardiovasc Ultrasound 2014;22(2):58-64.
4. Rose DK, Cohen MM. The airway: problems and predictions in 18,500 patients. Can J Anaesth 1991;41(5 Pt 1):372-83.
5. Kahl M, Eberhart LH, Behnke H, Sänger S, Schwarz U, Vogt S, Moosdorf R, Wulf H, Geldner G. Stress response to tracheal intubation in patients undergoing coronary artery surgery: direct laryngoscopy versus an intubating laryngeal mask airway. Journal of cardiothoracic and vascular

anesthesia. 2004 Jun 1;18(3):275-80.

6. Prys RC, Foex P, Biro GP, et al. Studies of anaesthesia in relation to hypertension versus adrenergic ß receptor blockade. Br J Anaesth 1973;45(7):671-81.
7. Mondal S, Ghosh S, Bhattacharya S, Choudhury B, Mallick S, Prasad A. Comparison between dexmedetomidine and fentanyl on intubation conditions during awake fiberoptic bronchoscopy:A randomized double blind prospective study. Journal of Anaesthesiology Clinical Pharmacology 2015 Apr-Jun;31(2):212-16.
8. Selvarju K, Prasad KN, Reddy AK. Study between clonidine and dexmedetomidine in attenuation of pressor response during endotracheal intubation. IAIM, 2018; 5(8): 100-106.
9. Suryawanshi CM, Kumar R, Wadhwa R. A prospective study comparing the efficacy of intravenous clonidine with intravenous dexmedetomidine in attenuating the haemodynamic stress response during laryngoscopy and endotracheal intubation. Indian Journal of Clinical Anaesthesia. 2018 Jul;5(3):327-33.
10. Anish Sharma NG, Shankaranarayana PP. Pre-medication with IV dexmedetomidine vs. IV clonidine in attenuating the pressor response during laryngoscopy and endotracheal intubation. Int J Biomed Res. 2014;5:465-7.
11. Suhasinirajashekar, Mathews S, N Satyanarayana. Attenuation of Haemodynamic responses to laryngoscopy and intubation-A comparative study between intravenous dexmedetomidine and intravenous clonidine. IOSR Journal of Dental and Medical Sciences 2016; 15(6): Ver VII.
12. Ahmed ALM, Bora J. A clinical study of intravenous dexmedetomidine and intravenous Clonidine for attenuation of haemodynamic responses to laryngoscopy & intubation. J. Evid. Based Med. Healthc. 2016; 3(33), 1558-1564.