(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 5, Issue 2, Page No: 994-1002
March-April 2022

IJMSCR

Comparison Between Two Intravenous Doses Of Dexmedetomidine In Attenuation Of Hemodynamic Responses To Laryngoscopy And Endotracheal Intubation

[1]Dr. Sampriti Sadhukhan, [2]Dr. Manabendra Sarkar, [3]Dr. Mousumi Khanra
[1]Senior Resident, [2]Professor, [3]RMO,
Department of Anaesthesiology, NilRatan Sircar Medical College & Hospital, Kolkata – 700014

***Corresponding Author:**
Dr. Sampriti Sadhukhan
Senior Resident, Department of Anaesthesiology, NilRatan Sircar Medical College & Hospital, Kolkata – 700014

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Keywords: NIL

Introduction

A direct laryngoscopy allows visualization of the larynx.[1] By visualizing the larynx, endotracheal intubation is facilitated through the mouth down into the trachea. Laryngoscopy and intubation cause a breach to a person's protective airway reflexes[2,3] and this leads to different physiological changes[4] in the body involving various systems, among which cardiovascular system is mostly affected.[5,6] The reflex changes in cardiovascular system are manifested as hypertension,[7] tachycardia, arrhythmia, ectopic.[8] This is due to increased sympathetic discharge.[9] This manifestation to laryngoscopy and intubation may be harmful to some patients[10,11] and could cause complications such as myocardial ischemia, cardiac arrhythmia, pulmonary edema, ventricular failure, intracranial haemorrhage and cerebrovascular accident. Therefore, recommendations for attenuating the reflex hypertension and tachycardia manifested by upper airway irritation during laryngoscopy and intubation are required.[12,13]

Reid and Brace[14] in 1940 first described the hemodynamic responses to laryngoscopy and intubation. Since then studies have been conducted on attenuation of haemodynamic responses to intubation in different group of patients, both with and without cardiac illness by various pharmacological methods.

A variety of drugs[15,16] have been used to control these hemodynamic responses, such as vasodilators, beta blockers, calcium channel blockers, alpha-2 agonists[17,18,19] and opioids. However, no modality was devoid of drawbacks and limitations.

Dexmedetomidine is a highly selective alpha 2 adrenergic agonist. It provides sedation analgesia and produces stable hemodynamic by modulating stress responses with minimal respiratory depression. Pre-treatment with intravenous dexmedetomidine, attenuates hemodynamic response to tracheal intubation. Few authors have used dexmedetomidine in a dose of 0.5, 0.75, 1, 2 microgram/kg with or without opioids in comparison to lignocaine or beta blockers or normal saline and found dexmedetomidine to be effective in attenuation of stress response.[20]

Hence, in this study two different doses of dexmedetomidine (0.5mcg/kg and 1mcg/kg) are being compared to find out the most effective dose in reducing the stress response caused by laryngoscopy and endotracheal intubation.

Methodology

After getting clearance from Institutional Ethics Committee and with appropriate informed consent in the local language from the participants, this observational, experimental, double blinded,

randomised prospective study was conducted in general surgery OT complex of a tertiary care teaching institute over a period of 18 months.

Breast surgeries like modified radical mastectomy, and open cholecystectomy, hernioplasty, hemi-thyroidectomy was included in our study.

The sample size was estimated using the maximum mean HR difference of 5 at 5 min in two groups from previous study.[21] At 95% confidence limit and 80% power, a sample size of 23 was obtained in each group by taking largest mean difference of 5 and expected background standard deviation (SD) of 6. With 10% drop-out, sample size became 23 + 2.3≈ 26. However, 30 participants were included in the study in each group for ease of calculation.

The primary objective of the study was to arrive at an optimal dose of IV dexmedetomidine by comparing different doses of the drug in terms of attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation.

Sixty patients belonging to American Society of Anaesthesiologists (ASA) Physical Status I and II in the age group of 18 –55 years of either sex with Body mass index (BMI)<30, posted for elective surgeries under general anaesthesia, were enrolled for the study. Patients who were unwilling to participate, on sedative medications/opioids/anti-depressants, patients with morbid obesity, with a history of bronchial asthma, drug or alcohol abuse, known study drug allergy, cerebrovascular, neurologic, respiratory or ischemic heart disease (history of angina, previous myocardial infarction) and renal and hepatic dysfunction and seizure disorders and uncontrolled medical diseases like diabetes mellitus and hypertension were excluded from the study. Patients in whom laryngoscopy time exceeded 15 s were excluded.

At pre anaesthetic check-up patients were evaluated for any systemic diseases, laboratory investigations were checked and recorded. The patients were kept fasting overnight after 10:00 pm and received tablet Pantoprazole 40 mg orally and tablet alprazolam 0.5 mg orally as premedication at night before surgery. All patients were given clear fluid up to 2hours before surgery.

Patients were randomly divided into two groups of thirty each. Randomization was done by sealed envelope technique. In our study double-blinding procedure was followed. The primary investigator and the patients both were unaware as to which group the patient belonged to and were unaware about the drug administered. One of the resident anaesthesiologists administered the drug infusion and primary investigator recorded the parameters throughout the study. The results of the study were analysed by the statistician at the end of the study and then the decoding procedure was done by him.

On the day of the surgery, all patients were monitored with electrocardiography, pulse oximetry and non- invasive blood pressure. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) and oxygen saturation (SpO2) were noted.

An IV line was secured with18G peripheral venous canula, and IV fluid Ringer's lactate was administered. IV glycopyrrolate 0.2 mg and IV ondansetron 50 µg/kg IV were given half an hour before induction. Group A received IV dexmedetomidine 0.5 µg/kg diluted to 20 ml with normal saline as infusion over 10 min. Group B received IV dexmedetomidine 1µg/kg diluted to 20 ml with normal saline as infusion over 10 min. After completion of drug infusion, sedation was assessed at 2, 5 min using Ramsay sedation score.

Any incidence of bradycardia (HR <50 beats) was treated with IV atropine 0.6 mg and any hypotensive episodes were treated with incremental dose of IV phenylephrine, starting with 50microgram.

General anesthesia technique was standardized in both groups. All the patients were pre-oxygenated for 3 min. Then, patients were induced with IV propofol 2 mg/kg, IV fentanyl 1 µg/kg of body weight. Patients were intubated with cuffed endotracheal tube under direct laryngoscopic vision with IV succinylcholine 2 mg/kg of body weight.

Following laryngoscopy and endotracheal intubation, the parameters recorded were HR, SBP, DBP and MAP at 1, 3, 5 and 10 min after intubation. Anaesthesia was maintained with 67% nitrous oxide and 33% oxygen. Isoflurane 1 MAC was given to maintain the depth of anaesthesia throughout the surgery. Muscle relaxation was maintained with IV vecuronium 0.1 mg/kg with top ups of 0.04 mg/kg. After surgery, reversal was achieved with IV

Volume 5, Issue 2; March-April 2022; Page No 994-1002

neostigmine 0.05 mg/kg and IV glycopyrrolate 0.01 mg/kg. After adequate recovery, patients were shifted to post-anaesthesia care unit and monitored for 12 h and later shifted to ward.

Results

Statistical analyses were carried out in the present study by statistical package for social sciences (SPSS) version 20 SPSS Inc, Chicago, USA. Results on continuous variables are presented as mean ± SD and compared across the groups using student's unpaired t test. Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test. An alpha level of 5% was taken, so if any p value is less than 0.05, it has been considered as significant.

The patients in this study were mostly middle aged of ASA physical status I and II and gender selection was random and was found to be statistically insignificant. Height, weight, BMI were also statistically insignificant when both groups were compared. (Table 1)

No statistically significant difference of baseline vital parameters was found between two groups.

The group A had statistically higher values of HR, SBP, DBP and MAP at all time intervals post-intubation as compared to Group B. Hence, it can be inferred that the haemodynamic response was better attenuated in Group B. This indicates that dexmedetomidine in a dose of 1 microgram/kg was superior to dexmedetomidine in a dose of 0.5 microgram/kg in attenuating the intubation response. (TABLE 2-5)

No cases of anaphylactoid reaction, bradycardia nor hypo/hypertension were observed in any of the patients. Ramsay Sedation Scores at 2 min following dexmedetomidine infusion was statistically insignificant but at 5 min score was more in Group B. In our study, none of the patient suffered from fall of saturation and needed any oxygen supplementation.

Table 1- Demographic Data

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
AGE (years)	36.13±9.58	37.4±8.57	0.59
SEX (M: F)	16:14	14:16	0.60
BMI (kg/m^2)	22.97±1.93	22.44±1.93	0.30
ASA (I: II)	14:16	16:14	0.60

TABLE 1 shows comparison of AGE, HEIGHT, WEIGHT, BMI between the two groups using unpaired *t* test. There was no significant difference in demographic parameters between the two groups. SEX and ASA status were also comparable in two groups. (Compared by chi square test)

TABLE 2- COMPARISON OF HEART RATE BETWEEN TWO GROUPS AT VARIOUS TIME POINTS OF ENDOTRACHEAL INTUBATION.

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
HR 0 (BASELINE)	74.13±5.02	73.57±4.64	0.65

Volume 5, Issue 2; March-April 2022; Page No 994-1002

HR 1(1 min after intubation)	77.67±4.29	72.03±4.64	<0.00001
HR 3(3 min after intubation)	76.47±5.61	70.2±7.07	0.0003
HR 5(5 min after intubation)	79.03±4.74	69.03±8.04	<0.00001
HR 10(10 min after intubation)	80.2±6.19	70.13±6.67	<0.00001

TABLE 2 shows Baseline HR was not statistically significant in both groups.1,3,5 and 10 mins post intubation HR were significantly different in both groups when compared.

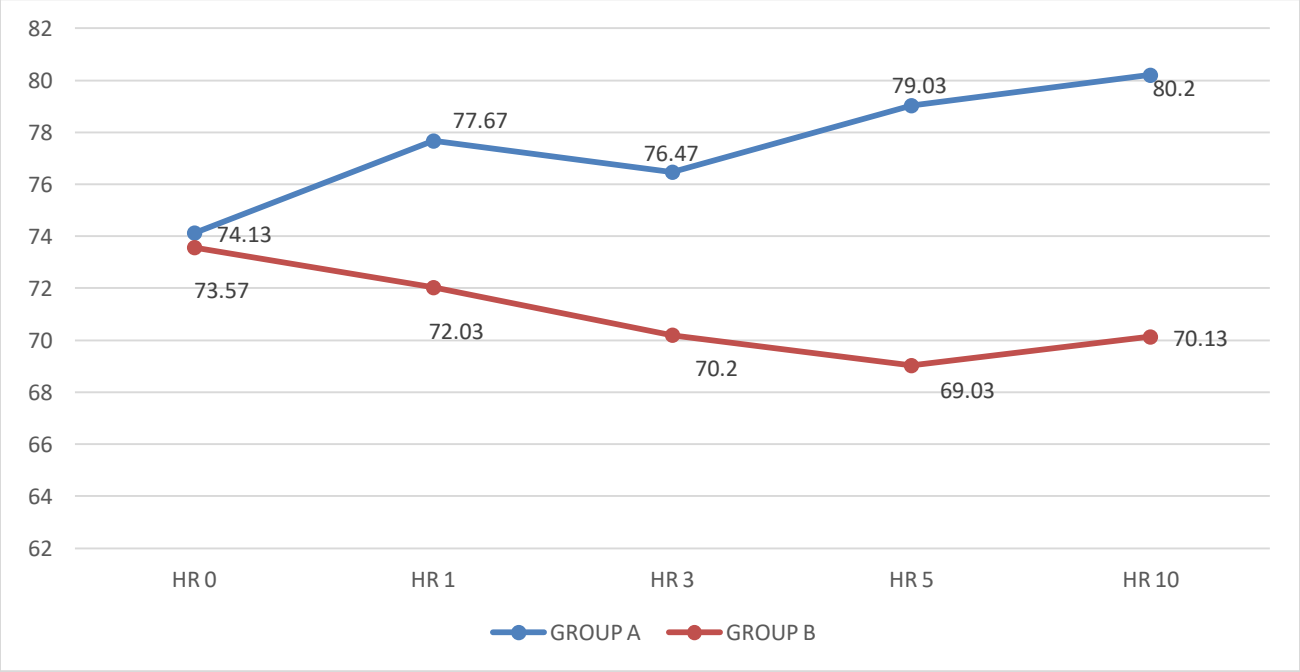

FIG 1 shows Baseline HR was not statistically significant in both groups.1,3,5 and 10 mins post intubation HR were significantly different in both groups when compared.

TABLE 3-COMPARISON OF SYSTOLIC BLOOD PRESSURE BETWEEN TWO GROUPS AT VARIOUS TIME POINTS OF ENDOTRACHEAL INTUBATION.

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
SBP 0 (BASELINE)	122.5±4.96	124.8±6.53	0.13
SBP 1(1 min after intubation)	119.7±6.71	115.37±6.16	0.01

Volume 5, Issue 2; March-April 2022; Page No 994-1002

SBP 3(3 min after intubation)	117.13±4.66	113.8±6.60	0.03
SBP 5(5 min after intubation)	113.03±5.11	108.83±6.59	0.007
SBP 10(10 min after intubation)	110.83±5.37	102.17±7.05	<0.00001

TABLE 3 shows baseline SBP was not statistically significant in both groups.1,3,5 and 10 mins post intubation SBP were significantly different in both groups when compared.

TABLE 4- COMPARISON OF DIASTOLIC BLOOD PRESSURE BETWEEN TWO GROUPS AT VARIOUS TIME POINTS OF ENDOTRACHEAL INTUBATION.

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
DBP 0 (BASELINE)	80.07±5.43	81.87±5.43	0.20
DBP 1(1 min after intubation)	81.07±5.18	77.47±5.60	0.01
DBP 3(3 min after intubation)	82±4.51	77.53±6.23	0.002
DBP 5(5 min after intubation)	78.26±3.83	68.26±5.81`	<0.00001
DBP 10(10 min after intubation)	76.67±4.05	62.6±6.04	<0.00001

TABLE 4 shows baseline DBP was not statistically significant in both groups.1,3,5 and 10 mins post intubation DBP were significantly different in both groups when compared.

TABLE 5-COMPARISON OF MEAN ARTERIAL BLOOD PRESSURE BETWEEN TWO GROUPS AT VARIOUS TIME POINTS OF ENDOTRACHEAL INTUBATION.

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
MAP 0 (BASELINE)	94.43±4	96.13±4.93	0.15
MAP 1(1 min after intubation)	93.97±4.83	90.83±4.39	0.01
MAP 3(3 min after intubation)	93.67±4.45	89.63±4.90	0.0007
MAP 5(5 min after intubation)	90.03±3.39	`81.73±5.09	<0.00001
MAP 10(10 min after intubation)	88.1±3.62	75.8±5.56	<0.00001

Volume 5, Issue 2; March-April 2022; Page No 994-1002

TABLE 5 shows baseline MAP was not statistically significant in both groups.1,3,5 and 10 mins post intubation MAP were significantly different in both groups when compared.

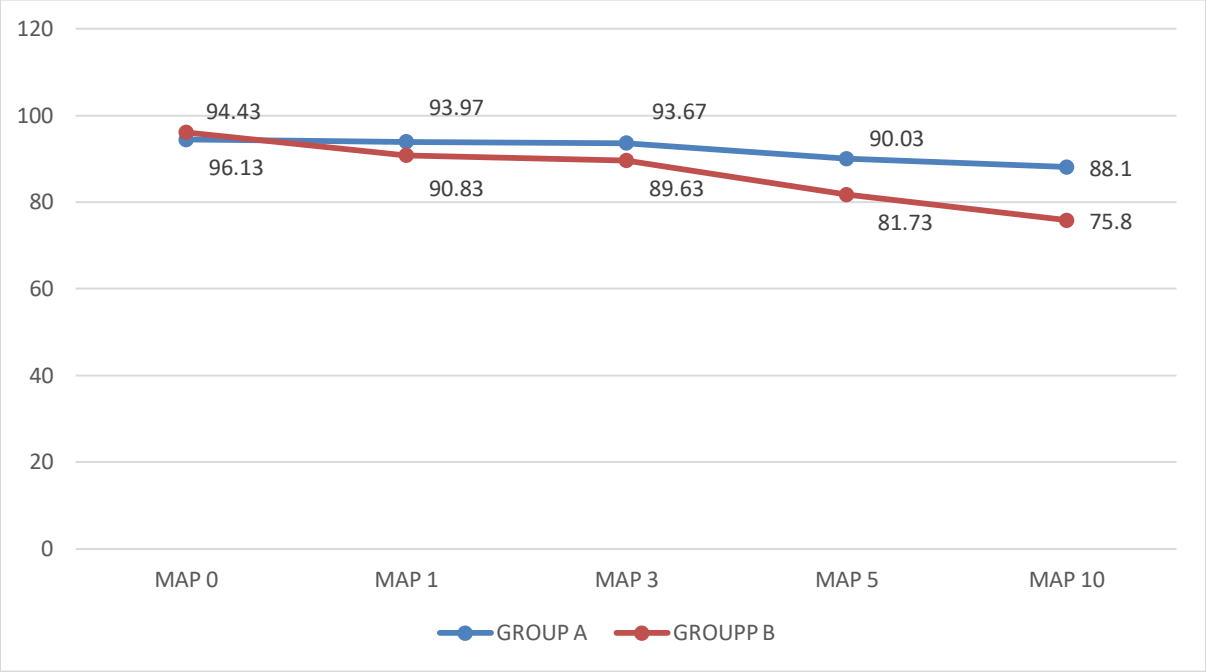

FIG 2: Show Baseline MAP was not statistically significant in both groups.1,3,5 and 10 mins post intubation MAP were significantly different in both groups when compared.

TABLE 6-COMPARISON OF RAMSAY SEDATION SCORES BETWEEN TWO GROUPS AT 2 min and 5 min AFTER DEXMEDETOMIDINE INFUSION

VARIABLES	GROUP A (n=30) MEAN±SD	GROUP B (n=30) MEAN±SD	*P* value
RSS 2 min	2.43±0.50	2.43±0.50	1
RSS 5 min	2.87±0.78	3.83±0.38	<0.00001

TABLE 6 shows comparison of RAMSAY SEDATION SCORES at 2 and 5min, which was statistically insignificant at 2min and significant at 5 min when both groups were compared.

Discussion

Laryngoscopy and endotracheal intubation are the usual procedure to maintain the airway in the patients under general anaesthesia. During and after laryngoscopy and intubation, a huge spectrum of reflex changes in the cardiovascular system occur which manifest as tachycardia, hypertension, arrythmias, and ectopic. The response is started within 5 seconds of laryngoscopy and peaks in 1-2 minutes and the normal level is reached within 10 minutes. These reflex changes are generally of short duration and well tolerated by patients without comorbidities and systemic diseases but these may be hazardous in certain group of patients with pre-existing cardiac and cerebral diseases. Therefore, it is necessary to attenuate the reflex hypertension and tachycardia manifested by upper airway manipulation during laryngoscopy and intubation. Various drugs have been used to attenuate these responses to laryngoscopy and intubation from the time of its

Volume 5, Issue 2; March-April 2022; Page No 994-1002

recognition i.e., use of alpha2 agonist [22,23](clonidine and dexmedetomidine), fentanyl, lignocaine, short acting beta-blockers (esmolol), vasodilators like injection nitro glycerine.

Dexmedetomidine, the dextro isomer and pharmacologically active component of medetomidine, is a highly selective and potent alpha2 adrenergic agonist. It is shorter acting than clonidine and much more selective for alpha2 vs. alpha1 receptors (dexmedetomidine 1620:1; clonidine 220:1). It provides excellent sedation, reduces blood pressure, heart rate, profoundly decreases plasma catecholamines and decreases perioperative requirements for inhaled anaesthetics and opioids.[24,25] It has an antidote named atipamezole. This also makes Dexmedetomidine a superior drug than clonidine.

To decrease the stress response to laryngoscopy and endotracheal intubation it is required to keep the laryngoscopy time as less as possible to limit the duration of exposure to noxious stimuli. So, the patients in whom the time of laryngoscopy exceeded 15 seconds were excluded from our study.

A study was conducted by Bon Sebastian et.al[21] in 2017 where they have given 0.5mcg/kg and 0.75mcg/kg or normal saline and vecuronium used for muscle relaxation. The study found that 0.75mcg/kg dexmedetomidine attenuate the hemodynamic stress responses to laryngoscopy and endo-tracheal intubation effectively compared to 0.5mcg/kg dexmedetomidine. Both the doses of dexmedetomidine were devoid of any adverse effects. In our study both doses of dexmedetomidine were found to attenuate the stress responses to laryngoscopy and endotracheal intubation. Also, no significant adverse events were noticed with two doses of dexmedetomidine.

In 2015, a study was conducted by Gulabani et al[26] on Two different doses of dexmedetomidine 1 and 0.5 µg/kg were compared with lignocaine 1.5 mg/kg to maintain hemodynamic stability associated with intubation. Dexmedetomidine 1 µg/kg was found to be more effective than dexmedetomidine 0.5 µg/kg and lignocaine. In our study we have also found that dexmedetomidine 1mcg/kg was more effective in attenuating the hemodynamic responses to tracheal intubation.

In 2014 Smitha et.al[27] compared the effect of 0.5 and 1mcg/kg of dexmedetomidine with normal saline in attenuating stress responses. They found that dexmedetomidine 1mcg/kg was more effective in controlling hemodynamic responses to tracheal intubation. In our study both doses of dexmedetomidine were found to attenuate the stress responses to laryngoscopy and endotracheal intubation but dexmedetomidine 1mcg/kg was more effective in attenuating the hemodynamic responses to tracheal intubation

A comparative study on efficacy of different doses of dexmedetomidine (0.5 mcg/kg,1mcg/kg,1.5mcg/kg,2mcg/kg) on hemodynamic response was conducted by Byron Bloor et.al[28] in 1992.The increase sedation in 2mcg/kg dose group was associated with reduction of heart rate. In our study both doses of dexmedetomidine were found to attenuate the stress responses to laryngoscopy and endotracheal intubation but dexmedetomidine 1mcg/kg was more effective in attenuating the hemodynamic responses to tracheal intubation

Limitations

However, this clinical study has some limitations like Norepinephrine and cortisol levels were not measured due to limited facility and cost constraint. More such studies are required in future for the proper estimation of results by keeping this limitation in mind.

Conclusion

The study was to compare the effects of two doses of dexmedetomidine in attenuating the hemodynamic responses associated with laryngoscopy and intubation. Here we have found that dexmedetomidine 1mcg/kg was more effective in attenuating the stress responses to laryngoscopy and endotracheal intubation. Also, both doses of dexmedetomidine were devoid of any adverse effects.

Acknowledgement

I want to acknowledge all my faculty members and seniors of my department for their constant help and immense support. I am also grateful to my juniors and all the OT technicians; without their help and valuable inputs my study would not have been completed.

Volume 5, Issue 2; March-April 2022; Page No 994-1002

References

1. Rose DK, Cohen MM. The airway: Problems and predictions in 18500 patients. Can J Anaesth 1991; 41: 372-83.
2. G. B. Drummond. Upper Airway Reflexes. British Journal Of Anaesthesia 1993;70(2):121-3.
3. John Widdicombe and Lu-Yuan Lee. Airway Reflexes, Autonomic Function, and Cardiovascular Responses. Environmental Health Perspectives.2001;109(4);579-84.
4. King BD, Harris LC, Griefenstein FE, Elder JD, Dripps RD. Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anaesthesia.Anaesthesiology1951;12(5):556-66.
5. Bucx MJL, Van Geel RTM, Scheck PAE and Stijnen T. Cardiovascular effects of forces applied during laryngoscopy. Anaesthesia 1995; 50: 17-22.
6. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth 1987;59:295- 9.
7. Forbes AM, Dally FG. Acute Hypertension During Induction Of Anaesthesia And Endotracheal Intubation In Normotensive Man.British Journal Of Anaesthesia.1970;42(7): 618–24.
8. Noble, M.J., Derrick, W.S. Changes in the electrocardiogram during induction of anaesthesia and endotracheal intubation.Can Anaesth Soc J.1959;6(3)267-70.
9. Russel WJ, Morris RJ, Frewin DB and Drew SE. Changes in plasma catecholamine concentrations during endotracheal intubation. Br J Anaesth 1981; 53: 837.
10. Prys-Roberts C, Greene LT, Meloche R, Foëx P. Studies of anaesthesia in relation to hypertension. II. Haemodynamic consequences of induction and endotracheal intubation. Br J Anaesth 1971;43:531-47.
11. Ismail S, Azam SI, Khan FA. Effect of age on haemodynamic response to tracheal intubation. A Comparison of young middle aged and elderly patients. Anaesth Intensive care 2002; 30 (5): 608-14.
12. AL Kovac. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth 1996;8(1):63–79.
13. Henderson J. Airway management in the adult. In: Miller RD, editor. Miller's Anaesthesia. 7th ed. Philadelphia: Churchill Livingstone; 2010. p. 1573-610 (2),121-23.
14. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex upon the heart.Surg Gynecol Obstet 1940;70:157-62.
15. Black TE, Kay B and Healy TEJ. Reducing the hemodynamic responses to laryngoscopy and intubation. Anaesthesia 1984; 39: 883-7.
16. Textbook of pharmacology & physiology in anesthetic practice- Robert K Stoelting-4 th ed: 340-5.
17. Maze M, Tranquilli W. Alpha-2 adrenoceptor agonists: Defining the role in clinical anesthesia. Anesthesiology. 1991;74:581-605.
18. Flacke JW. Alpha 2-adrenergic agonists in cardiovascular anesthesia. J Cardiothorac Vasc Anesth. 1992;6:344-59.
19. Tonner PH, Scholz J. Pre-anaesthetic administration of alpha2-adrenoceptor agonists. Baillieres Best Pract Clin Anaesthesiol. 2000;14:305-20.
20. Laha A, Ghosh S, Sarkar S. Attenuation of sympathoadrenal responses and anesthetic requirement by dexmedetomidine. Anesth Essays Res 2013;7:65-70.
21. Sebastian B, Talikoti AT, Krishnamurthy D. Attenuation of haemodynamic responses to laryngoscopy andendotracheal intubation with intravenous dexmedetomidine: A comparison between two doses. Indian J Anaesth. 2017;61:48–54.
22. Strosberg AD. Structure, function, and regulation of adrenergic receptors. Protein Sci.1993;2(8):1198-209.
23. Perez, Dianne M. (2006). The adrenergic receptors in the 21st century. Totowa, New Jersey: Humana Press; 2005.
24. Paranjpe JS. Dexmedetomidine: Expanding role in anesthesia. Med J DY Patil Univ 2013;6:5-13.
25. Yazbek-Karam VG, Aouad MM. Perioperative uses of dexmedetomidine. Middle East J Anaesthesiol 2006;18:1043-58.

Volume 5, Issue 2; March-April 2022; Page No 994-1002

26. Gulabani M, Gurha P, Dass P, Kulshreshtha N. Comparative analysis of efficacy of lignocaine 1.5 mg/kg and two different doses of dexmedetomidine (0.5 µg/kg and 1 µg/kg) in attenuating the hemodynamic pressure response to laryngoscopy and intubation. Anesth Essays Res 2015;9:5-14.
27. Smitha KS, Shukla D, Sathesha M, Rao R, Nethra S, K Sudhhesh, et al. Comparison of two different doses of dexmedetomidine in attenuating hemodynamic changes during laryngoscopy. J Evol Med Dent Sci 2014;3:13501- 8.
28. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Hemodynamic changes. Anesthesiology. 1992;77(6):1134-42.

Volume 5, Issue 2; March-April 2022; Page No 994-1002