Open Access

Original Article

Comparison of Intravenous Lignocaine and Intravenous Dexmedetomidine for Attenuation of Hemodynamic Stress Response to Laryngoscopy and Endotracheal Intubation

Sana Tariq, Khan Muhmmad Yaqoob, Arooj Shahid*, Komail Abid, Muhammad Mazhar Ul Haq****

Department of Anesthesiology, Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan
*Department of Pharmacology, Army Medical College/National University of Medical Sciences (NUMS) Rawalpindi Pakistan
**Department of Anesthesiology, Combined Military Hospital Quetta/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To compare the efficacy of Lignocaine and Dexmedetomidine in minimizing the hemodynamic stress response associated with laryngoscopy and endotracheal intubation.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Anesthesiology, Combined Military Hospital Rawalpindi, Pakistan, from Jul 2020 to Feb 2021.
Methodology: A total of 60 patients, aged 18-55 years were included in this study. They were randomly allocated to one of two groups. Group-L received intravenous Lignocaine, 1.5 mg/kg. Group-D received Dexmedetomidine 1 µg/kg as intravenous infusion 10 minutes before induction. Heart rate and mean arterial pressure were monitored at basal, pre-induction, induction, laryngoscopy and intubation and 1, 3, 5 and 10 minutes afterwards.
Results: Significantly reduced stress response was seen in Group-D as compared to Group-L. A lesser increase in heart rate was observed during intubation as compared to basal level in Group-D (14.14%) while it was 37.66% in Group-L. MAP was also seen to be less increased in Group-D (1.07 %) as compared to Group-L (22.6%).
Conclusion: Dexmedetomidine, when infused at a dose of 1 mcg/kg over 10 min prior to intubation, attenuates the hemodynamic stress response more efficiently, in comparison to 1.5 mg/kg of Lignocaine infusion.

Keywords: Dexmedetomidine, Intubation, Laryngoscopy, Lignocaine.

How to Cite This Article: *Tariq S, Yaqoob KM, Shahid A, Abid K, Haq MMU. Comparison of Intravenous Lignocaine and Intravenous Dexmedetomidine for Attenuation of Hemodynamic Stress Response To Laryngoscopy and Endotracheal Intubation. Pak Armed Forces Med J 2024; 74(4): 1138-1142. DOI: https://doi.org/10.51253/pafmj.v74i4.7000*

INTRODUCTION

One of the most important aspects of ensuring a safe anesthetic procedure in any patients is to secure their airway, for which endotracheal intubation and laryngoscopy remains a gold standard. However, instrumentation and tube placement, often evoke an exaggerated stress response in the form of hypertension, tachycardia and, rarely, arrhythmias.[1] This is due to an increase in sympathetic discharge caused by epipharyngeal and parapharyngeal stimulations, secondary to airway instrumentation, leading to a rise in serum catecholamine levels.[2] Though these effects are short-lived in normotensive and healthy individuals, they may produce fatal adverse effects, such as, myocardial infarction, left ventricular failure, arrhythmias, increase in intracranial pressure and rupture of aneurysm, in susceptible patients, such as those with essential hypertension, cerebrovascular disease, aneurysms and coronary artery disease.[3]

Hence, in order to diminish these vascular pressure responses and prevent any serious complications in susceptible patients undergoing general anesthesia, different pharmacological agents gave been used, including narcotic analgesics, calcium channel blockers, beta adrenergic blocking agents, clonidine and local anesthetic agents.[4,5] However, none of these techniques have proven to be entirely effective due to which the search for an ideal drug, that produces early and rapidly recognizable results, with simplicity to its use in routine practice, has been carried out over the years. Dexmedetomidine, an alpha-2 adrenergic agonist, is a relatively newer drug which is eight times more effective compared to clonidine, and also belongs to the same class of drugs. It produces analgesic, hypnotic, anxiolytic and sympatholytic effects with minimal side effects.[6,7] On the other hand, Lignocaine, an aminoethylamide, is one of the oldest and most widely used local anesthetics, which has been effectively used to blunt the hemodynamic response to intubation.[8] with

Correspondence: Dr Sana Tariq, Department of Anesthesiology, Combined Military Hospital Rawalpindi Pakistan
Received: 01 Jul 2021; revision received: 11 Oct 2021; accepted: 22 Dec 2021

1.5mg/kg I/V administration, 3 minutes preceding intubation, showing excellent results in literature.[9]

After the introduction of Dexmedetomidine, it became particularly essential to compare its efficacy with that of Lignocaine and evaluate whether Dexmedetomidine can replace it in long-term clinical practice. As a consequence, this study aimed to compare the effectiveness of these two drugs in diminishing the pressure response in patients, following laryngoscopy and endotracheal intubation.

METHODOLOGY

The quasi-experimental study was carried out at Combined Military Hospital, Rawalpindi, Pakistan, from July 2020 to February 2021, after obtaining approval by Ethics Review Committee (Letter number 174/6/21). Sample size was calculated by WHO sample size calculator, taking mean decrease in heart rate following intravenous administration of Dexmedetomidine vs control Group at fifth minute after intubation as being 66.37±9.8 vs 76.93±8.210.

Inclusion Criteria: Patient of ASA class 1 and 2 , with normal hemodynamics, of either gender, aged 18-55 years, who were to be operated electively under general anesthesia, were included.

Exclusion Criteria: Hypertensive patients as well as other high-risk patients with cardiovascular, renal, hepatic or cerebral diseases, obesity, pregnant and nursing women, were all excluded from the study. Moreover, individuals with anticipated difficult airway or a history of sensitivity to drugs were also not included.

Sample size was calculate to be 24 but was increased by the researchers to 60, dividing it into two equal groups of 30 patients, to keep statistical significance. Patients were randomly allocated to one of two groups with the help of computer-generated coded envelopes, Group-L (Lignocaine Group) and Group-D (Dexmedetomidine Group), with 30 patients in each group (Figure). They were kept nil per mouth from 10 pm onwards on the night prior to surgery. On arrival of the patient in the operating room, baseline parameters such as heart rate (HR), mean arterial pressure (MAP), respiratory rate (RR), and oxygen saturation (SpO2) were recorded. All patients were pre-hydrated with 500 ml of Ringer's lactate solution.

Group-L received 100 ml of normal saline 20 min preoperatively over a period of 10 min, and the infusion was completed 10 min before induction and 1.5 mg/kg of Lignocaine was administered IV 3 min before intubation. Group-D received Dexmedetomidine 1 mcg/kg diluted in 100 ml of normal saline IV over a period of 10 min, and the infusion was completed 10 min before induction.

Hemodynamic parameters were recorded during the basal period, pre-induction, after induction, during laryngoscopy and intubation, 1 min, 3 min, 5 min, and 10 min after intubation.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables with normal distribution were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Paired sample t-test was applied.

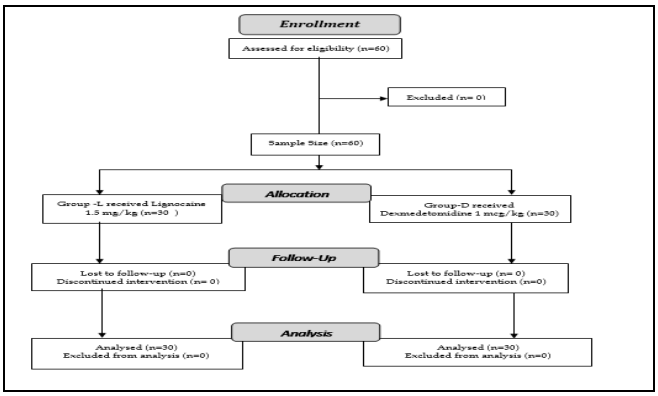

Figure: Patient Flow Diagram (n=60)

RESULTS

We analyzed our findings for Group-D and Group-L in terms of the mean arterial pressure and heart rate at basal level measured before induction of anaesthesia at patient holding area, pre-induction MAP and HR measured in operation theatre before induction of anesthesia, and the MAP and HR measured during induction of anesthesia, at intubation and at 1-, 3-, 5- and 10-minutes intervals. The two groups under study were comparable in demographic characteristics. Mean age was 36.57± 9.598 and 37.02±10.693 years respectively in Groups L and D. The average weight was 69.1±6.67 and 56.4±6.56 respectively in Groups L and D. Majority of patients in Group-L were Females (54%), whereas Group-D was equally divided into equal number of males and females (Table I).

In Group-L, the pre-induction changes in MAP and HR were negligible. All patients belonging to Group-D showed good tolerance against Dexmedetomidine. When MAP and HR were compared with

baseline, 8.87mmHg (14%) fall in MAP and a 4 beats /min (9.5%) fall in HR, was observed 10 minutes after the infusion. When compared with Group-L, Group-D showed much more notable fall in HR and MAP (p=0.04). Each of the groups exhibited an increase in HR and MAP following laryngoscopy and intubation. HR and MAP were seen to be maximal straight away after laryngoscopy and intubation. Group L showed a maximum of 29 beats/min (37%) increase in HR but Group D showed a maximum of 12 beats/min (14.27%) increase in HR in comparison to baseline readings. This difference between the two groups was highly significant.

Table-I: Demographic Data (n=60)

Variables	Group-L (n=30)	Group-D (n=30)
Age (years)	36.57± 9.598	37.02± 10.693
Weight (kg)	69.1± 6.67	56.4± 6.56
Gender		
Male	14(46%)	15(50%)
Female	16(54%)	15(50%)
ASA* Physical Status I/II	13/17	14/16

**ASA American Society of Anesthesia*

infusion, it causes peripheral vasodilation, direct cardiac depression and increased depth of anesthesia.[10] For these reasons, among all the previously used drugs for attenuating pressure responses, Lignocaine has been the cheapest and most extensively used. On the contrary, Dexmedetomidine is a relatively new drug, which is an alpha-2 agonist with an affinity for alpha-2 adrenoceptors that is eight times more effective than Clonidine11, and works by causing deep sedation, analgesia, sympatholysis and cardiovascular stability. It has remarkable opioid and anesthetic agent sparing properties and has been known to decrease the requirement of intra-operative anesthesia as well as avoid respiratory depression.[12] This study was, thus, conducted to evaluate and contrast the efficacy of these two agents in minimizing the hemodynamic stress response of endotracheal intubation, with least possible side effects.

One study suggested the use of Lignocaine as an I/V infusion with a dosage of 1.5mg/kg administered 3 min prior to intubation for optimal results.[13] which was carried out in our study. A dosage of 1 mcg/kg of Dexmedetomidine, diluted in 100 ml of normal saline,

Table-II: Comparison of Mean Heart Rate (Beats/Min) in Both Groups at Various Intervals (n=60)

Variables	Group-L (n=30)	Group-D (n=30)	p-value
Basal HR (beats/min)	77.00±6.873	84.27±5.723	0.41
Pre-induction HR (beats/min)	77.00±6.873	78.27±5.723	0.441
HR at Induction (beats/min)	74.30±7.939	76.27±5.723	0.040
HR at Laryngoscopy and Intubation (beats/min)	106.13±8.29	96.27±7.000	0.005
HR at 1 min (beats/min)	103.37±8.68	95.27±6.05	0.006
HR at 3 min (beats/min)	100.60±8.25	91.27±5.401	0.039
HR at 5 min (beats/min)	89.33±6.94	85.27±5.53	0.040
HR at 10 min (beats/min)	87.93±6.99	80.27±6.02	0.045

HR = Heart rate

Conversely, maximum increase in MAP during laryngoscopy and intubation in Group-L was observed to be 22% whereas that of Group-D was 1% when compared to baseline. This difference between groups was also highly significant (p=0.001).

Table-III: Comparison of Mean Arterial Pressure (mmhg) in Both Groups at Various Intervals (n=60)

Variables	Group-L (n=30)	Group-D (n=30)	p-value
Basal MAP (mmHg)	93.47±77.05	92.70±5.279	0.503
Pre-induction MAP (mmHg)	92.47±7.815	83.70±5.279	0.042
MAP at Induction (mmHg)	90.00±7.493	79.70±5.279	0.036
MAP at Laryngoscopy and Intubation (mmHg)	114.60±7.079	93.70±5.279	0.001
MAP at 1 min (mmHg)	107.20±6.488	92.70±5.279	0.006
MAP at 3 min (mmHg)	98.13±6.021	87.70±5.279	0.012
MAP at 5 min (mmHg)	93.60±5.805	83.77±5.348	0.015
MAP at 10 min (mmHg)	93.47±7.705	83.83±5.106	0.035

MAP = Mean arterial pressure

DISCUSSION

Lignocaine is an antiarrhythmic drug that acts on synaptic transmission and has a short duration of action, thus, when it is used as an intravenous

was used as an infusion over 10 minutes in our study, similar to other studies, which used 0.5 mcg/kg as well as 1 mcg/kg of Dexmedetomidine, to compare its effects with that of Lignocaine.[14,15] and concluded that Dexmedetomidine 1 mcg/kg showed better results. In

our study, patients infused with Dexmedetomidine showed reduction in their HR up to maximum of 9.5% while MAP was seen to be reduced up to 14%. This is similar to another other study.[16] which also observed a marked diminution in HR with Dexmedetomidine infusion, whereas a negligible reduction in MAP was seen in one study.[17]

A fall in SpO2 or respiratory depression was not seen in any of the patients in Group-D, which is in line with one study observation that Dexmedetomidine infusion does not interfere with respiration and causes sedation which imitates normal sleep, thereby allowing patients to respond to verbal commands.[18] For these purposes, Dexmedetomidine is considered a better option for sedation in intensive care units, magnetic resonance imaging, awake craniotomy, post-anesthesia care unit and awake fiber optic intubation. Lignocaine, on the other hand produced ineffective attenuation of stress response following intubation. Few authors.[17,18] have even reported Lignocaine to have very minimal effect in reducing the hemo-dynamic stress response which is again consistent with our study.

LIMITATION OF STUDY

Since the study was conducted on normotensive, healthy individuals, the results cannot be applied on patients with hypertensive disease or any other co-morbidities. This in turn provides us with incomplete knowledge when it comes to intubating high-risk patients especially those with essential hypertension and cardiovascular disorders. Hence, it would be more beneficial to conduct these studies in high-risk patients. Moreover, post intubation effects of Dexmedetomidine that can last longer and can have some important clinical implications were also not studied. Serum catecholamine, an objective means of measuring hemodynamic stress response, was not measured either.

CONCLUSION

Based on the results of our study, we concluded that 1 mcg/kg I/V administration of Dexmedetomidine, as a 10 min infusion, has proven to be more effective in maintaining hemodynamic stability associated with laryngoscopy and intubation when compared with a 1.5 mg/kg I/V infusion of Lignocaine, with no consequent adverse effects.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

ST & KMY: Data acquisition, data analysis, data inter-pretation, critical review, approval of the final version to be published.

AS & KA: Study design, drafting the manuscript, critical review, approval of the final version to be published.

MUG: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Barak M, Ziser A, Greenberg A, Lischinsky S, Rosenberg B. Hemodynamic and catecholamine response to tracheal intubation: direct laryngoscopy compared with fiberoptic intubation. J Clin Anesth 2003; 15(2): 132-136. doi: https://doi.org/10.1016/s0952-8180(02)00514-7
2. Figueredo E, Garcia-Fuentes EM. Assessment of the efficacy of esmolol on the haemodynamic changes induced by laryngoscopy and tracheal intubation: a meta-analysis. Acta Anaesthesiol Scand 2001; 45(8): 1011-1022. https://doi.org/10.1034/j.1399-6576.2001.450815.x
3. Srivastava VK, Agrawal S, Gautam SK, Ahmed M, Sharma S, Kumar R. Comparative evaluation of esmolol and Dexmedetomidine for attenuation of sympathomimetic response to laryngoscopy and intubation in neurosurgical patients. J Anaesthesiol Clin Pharmacol 2015; 31(2): 186-190. https://doi.org/10.4103/0970-9185.155146
4. Barak M, Yoav L, Abu el-Naaj I. Hypotensive anesthesia versus normotensive anesthesia during major maxillofacial surgery: a review of the literature. Sci World J 2015; 2015: 480728. https://doi.org/10.1155/2015/480728
5. Giovannitti JA Jr, Thoms SM, Crawford JJ. Alpha-2 adrenergic receptor agonists: a review of current clinical applications. Anesth Prog 2015; 62(1): 31-39. https://doi.org/10.2344/0003-3006-62.1.31
6. Miller CD, Warren SJ. IV Lignocaine fails to attenuate the cardiovascular response to laryngoscopy and tracheal intubation. Br J Anaesth 1990; 65(2): 216-219. https://doi.org/10.1093/bja/65.2.216
7. Wilson IG, Meiklejohn BH, Smith G. Intravenous Lignocaine and sympathoadrenal responses to laryngoscopy and intubation. The effect of varying time of injection. Anaesthesia 1991; 46(3): 177-180. https://doi.org/10.1111/j.1365-2044.1991.tb09403.x
8. Menda F, Köner O, Sayin M, Türe H, Imer P, Aykaç B. Dexmedetomidine as an adjunct to anesthetic induction to attenuate hemodynamic response to endotracheal intubation in patients undergoing fast-track CABG. Ann Card Anaesth 2010; 13(1): 16-21. https://doi.org/10.4103/0971-9784.58829
9. Keniya VM, Ladi S, Naphade R. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anaesthetic requirement. Indian J Anaesth 2011; 55(4): 352-357. https://doi.org/10.4103/0019-5049.84846
10. Sulaiman S, Karthekeyan RB, Vakamudi M, Sundar AS, Ravullapalli H, Gandham R. The effects of Dexmedetomidine on attenuation of stress response to endotracheal intubation in patients undergoing elective off-pump coronary artery bypass grafting. Ann Card Anaesth 2012; 15(1): 39-43. https://doi.org/10.4103/0971-9784.91480
11. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenal responses to tracheal intubation and reduces the need for thiopentone and

peroperative fentanyl. Br J Anaesth 1992; 68(2): 126-131. https://doi.org/10.1093/bja/68.2.126
12. Bajwa SJ, Kaur J, Singh A, Parmar S, Singh G, Kulshrestha A, et al. Attenuation of pressor response and dose sparing of opioids and anaesthetics with pre-operative Dexmedetomidine. Indian J Anaesth 2012; 56(2): 123-128. https://doi.org/10.4103/0019-5049.96303
13. Weinberg L, Jang J, Rachbuch C, Tan C, Hu R, McNicol L. The effects of intravenous Lignocaine on depth of anaesthesia and intraoperative haemodynamics during open radical prostatectomy. BMC Res Notes 2017; 10(1): 248. https://doi.org/10.1186/s13104-017-2570-4
14. 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(1): 5-14. https://doi.org/10.4103/0259-1162.150167
15. Talke P, Li J, Jain U, Leung J, Drasner K, Hollenberg M, et al. Effects of perioperative Dexmedetomidine infusion in patients undergoing vascular surgery. The Study of Perioperative Ischemia Research Group. Anesthesiology 1995; 82(3): 620-633. https://doi.org/10.1097/00000542-199503000-00003
16. Keating GM. Dexmedetomidine: A Review of Its Use for Sedation in the Intensive Care Setting. Drugs 2015; 75(10): 1119-1130. https://doi.org/10.1007/s40265-015-0419-5
17. Singh G, Kaur H, Aggarwal S, Sharda G, Jha A, Aggarwal H. Intravenous Dexmedetomidine vs. Lignocaine in attenuating the hemodynamic responses during laryngoscopy and endotracheal intubation: a randomized double-blind study. Anaesth Pain Intensive Care 2019; 19: 181-186.
18. Kim KH. Safe Sedation and Hypnosis using Dexmedetomidine for Minimally Invasive Spine Surgery in a Prone Position. Korean J Pain 2014; 27(4): 313-320. https://doi.org/10.3344/kjp.2014.27.4.313