Original Research

Comparison Of IV Dexmedetomidine And IV Clonidine To Attenuate Stress Response To Laryngoscopy And Endotracheal Intubation

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Received: 30 April, 2024 Accepted: 8 May, 2024

Abstract

Background: Endotracheal intubation is an essential skill to secure a patient's airway as well as provide oxygenation and ventilation. Dexmedetomidine is suitable for sedation and analgesia during the whole perioperative period. Clonidine is an imidazoline compound that has been extensively studied. Hence; the present study was undertaken for comparing the efficacy of ivdexmedetomidine and iv clonidine to attenuate stress response to laryngoscopy and endotracheal intubation.

Materials & methods: A total of 150 subjects of ASA Grade I/II were enrolled. All the subjects were randomized into three study groups as follows: dexmedetomidine group (Received IV dexmedetomidine 1 µg/kg in 100 ml NS over 10 min), Clonidine group (Received IV clonidine 2 µg/kg in 100 mL NS over 10 min) and control group (Received 100 mL of NS over 10 min). Pre-anesthetic evaluation of all the patients was done one day before the surgery. Complete demographic and clinical details of all the subjects was recorded. Intra-operative hemodynamic variables were recorded at 1 min, 3 min, 5 min, and 10 min after laryngoscopy and intubation. Surgery was commenced 10 min after laryngoscopy and intubation.

Results: Mean age of the patients of dexmedetomidine group, Clonidine group and Control group was 33.8 years, 31.9 years and 30.6 years respectively. Mean SBP, DBP and MAP among the patients the patients of dexmedetomidine group were significantly lower in comparison to the patients of the clonidine group and control group at different time intervals.

Conclusion: Both dexmedetomidine and clonidine were effective in attenuation of the hemodynamic response to intubation. However; among clonidine and dexmedetomidine, dexmedetomidine is more effective.

Key words: Clonidine, Dexmedetomidine, Intubation

Introduction

Endotracheal intubation is an essential skill to secure a patient's airway as well as provide oxygenation and ventilation. Endotracheal intubation is the process by which a tube is inserted into the trachea. This may be accomplished through the larynx or through the skin of the neck. Cricothyroidotomy and tracheostomy are the terms for the latter approach. Intubation is a procedure that is performed daily in many locations around the world—electively in the operating room and urgently in emergency rooms, in clinics, and in the field. Proficiency at intubation is a requirement for practitioners whose practices put them in an environment in which advanced cardiac life support, pediatric/neonatal advanced life support, and advanced trauma life support skills are used on a regular basis and in which advanced backup (an anaesthesia care provider) is not rapidly accessible. There are multiple

techniques available, including the visualization of the vocal cords with a laryngoscope or video laryngoscope, direct placement of the endotracheal tube into the trachea via cricothyrotomy, and fiberoptic visualization of the vocal cords via the nasal or oral route.[1-3] In most cases, endotracheal intubation is a semi-urgent procedure. A good bag-mask technique can be used to effectively oxygenate and ventilate the patient while appropriate staff and equipment are assembled. Suction, oxygen, and airway equipment, medications, and monitors are gathered and checked, and intravenous (IV) access assured. A brief "pre-assessment" of the patient including potential airway problems, aspiration risk, and co-morbid conditions should precede attempted intubation.[4,] [5]The first α2-adrenoceptor agonist was synthesized in the early 1960s to be used as a nasal decongestant. Dexmedetomidine was approved by the Food and Drug Administration at the end of 1999 for use in humans as a short-term medication (<24 hours) for analgesia and sedation in the intensive care unit (ICU). Its unique properties render it suitable for sedation and analgesia during the whole perioperative period. Its applications as a premedication, as an anesthetic adjunct for general and regional anaesthesia, and as a postoperative sedative and analgesic are similar to those of the benzodiazepines, but a closer look reveals that the α2-adrenoceptor agonist has more beneficial side effects.[6]

Clonidine is an imidazoline compound with the molecular formula $C_9H_9Cl_2N_3$. It is the prototype of alpha-2 adrenoceptor agonists that has been extensively studied with an alpha-2: alpha-1 ratio of 200:11. The drug is licensed for the treatment of hypertension, migraine and menopausal flushing. It is also an analgesic, sedative and anxiolytic. These properties along with its ability to maintain peri-operative haemodynamic stability make clonidine a useful agent in anaesthesia.[7,] [8]Hence; under the light of above-mentioned data, the present study was undertaken for comparing the efficacy of iv Dexmedetomidine and iv clonidine to attenuate stress response to laryngoscopy and endotracheal intubation.

Materials & methods

The present study was undertaken for comparing the efficacy of ivdexmedetomidine and iv clonidine to attenuate stress response to laryngoscopy and endotracheal intubation. A total of 150 subjects of ASA Grade I/II were enrolled. All the subjects were randomized into three study groups as follows: dexmedetomidine group (Received IV dexmedetomidine 1 µg/kg in 100 ml NS over 10 min), Clonidine group (Received IV clonidine 2 µg/kg in 100 mL NS over 10 min) and control group (Received 100 mL of NS over 10 min). Pre-anesthetic evaluation of all the patients was done one day before the surgery.Complete demographic and clinical details of all the subjects was recorded. Blood samples were obtained and hematological profile was evaluated. Assessment of airway was done by Mallampati grading to anticipate the possibility of difficult intubation. Intra-operative hemodynamic variables were recorded at 1 min, 3 min, 5 min, and 10 min after laryngoscopy and intubation. Surgery was commenced 10 min after laryngoscopy and intubation. All the results were recorded in Microsoft excel sheet and was subjected to statistical analysis using SPSS software. Student t test, chi-square test and ANOVA test was used for evaluation of level of significance.

Results

Mean age of the patients of dexmedetomidine group, Clonidine group and Control group was 33.8 years, 31.9 years and 30.6 years respectively. Majority proportion of patients of all the three study groups were males. Mean BMI of the patients of dexmedetomidine group, Clonidine group and Control group was 23.9 Kg/m^2, 22.8 Kg/m^2 and 23.1 Kg/m^2 respectively. Among the patients of thedexmedetomidine group, mean SBP at Baseline, 10 mins after drug administration, 1 min after intubation, 3 mins after intubation, 5 mins after intubation and 10 mins after intubation 118.3 mm of Hg, 108.3 mm of Hg, 110.9 mm of Hg, 108.9 mm of Hg, 105.7 mm of Hg and 101.8 mm of Hg respectively. Among the patients of the clonidine group, mean SBP at Baseline, 10 mins after drug administration, 1 min after intubation, 3 mins after intubation, 5 mins after intubation and 10 mins after intubation 119.2 mm of Hg, 107.3 mm of Hg, 118.8 mm of Hg, 113.1 mm of Hg, 112.5 mm of Hg and 111.1 mm of Hg respectively. Among the patients of the control group, mean SBP at Baseline, 10 mins after drug administration, 1 min after intubation, 3 mins after intubation, 5 mins after intubation and 10 mins after intubation 118.7 mm of Hg, 120.9 mm of Hg, 128.3 mm of Hg, 127.8 mm of Hg, 125.1 mm of Hg and 126.7 mm of Hg respectively. Mean SBP, DBP and MAP among the patients the patients of dexmedetomidine group were significantly lower in comparison to the patients of the clonidine group and control group at different time intervals.

Table 1: SBP at different time intervals

SBP (mm of Hg)	Dexmedetomidine group	Clonidine group	Control group
Baseline	118.3	119.2	118.7
10 mins after drug administration	108.3	107.3	120.9
1 min after intubation	110.9	118.8	128.3
3 mins after intubation	108.9	113.1	127.8
5 mins after intubation	105.7	112.5	125.1
10 mins after intubation	101.8	111.1	126.7

Table 2: Comparison of SBP at different time intervals

SBP (mm of Hg)	Dexmedetomidine group Vs Clonidine group	Clonidine group Vs Control group	Dexmedetomidine group Vs Control group
Baseline	0.12	0.36	0.96
10 mins after drug administration	0.95	0.00*	0.00*
1 min after intubation	0.00*	0.00*	0.00*
3 mins after intubation	0.01*	0.00*	0.00*
5 mins after intubation	0.00*	0.00*	0.04*
10 mins after intubation	0.00*	0.03*	0.00*

*: Significant

Table 3: DBP at different time intervals

SBP (mm of Hg)	Dexmedetomidine group	Clonidine group	Control group
Baseline	78.3	79.1	81.2
10 mins after drug administration	75.1	77.3	83.2
1 min after intubation	70.8	79.2	84.9
3 mins after intubation	68.2	76.2	86.8
5 mins after intubation	67.3	75.1	87.3
10 mins after intubation	65.9	73.2	85.4

Table 4: Comparison of DBP at different time intervals

DBP (mm of Hg)	Dexmedetomidine group Vs Clonidine group	Clonidine group Vs Control group	Dexmedetomidine group Vs Control group
Baseline	0.38	0.39	0.82
10 mins after drug administration	0.72	0.00*	0.01*
1 min after intubation	0.01*	0.01*	0.02*
3 mins after intubation	0.00*	0.01*	0.00*
5 mins after intubation	0.00*	0.00*	0.00*
10 mins after intubation	0.01*	0.00*	0.00*

*: Significant

Table 5: MAP at different time intervals

MAP	Dexmedetomidine group	Clonidine group	Control group
Baseline	90.8	91.2	90.3
10 mins after drug administration	80.9	78.6	91.2
1 min after intubation	81.3	87.3	98.4

3 mins after intubation	77.1	85.9	99.3
5 mins after intubation	74.9	84.2	95.7
10 mins after intubation	72.8	82.9	93.5

Table 6: Comparison of MAP at different time intervals

MAP	Dexmedetomidine group Vs Clonidine group	Clonidine group Vs Control group	Dexmedetomidine group Vs Control group
Baseline	0.11	0.91	0.76
10 mins after drug administration	0.39	0.00*	0.00*
1 min after intubation	0.00*	0.04*	0.00*
3 mins after intubation	0.00*	0.00*	0.03*
5 mins after intubation	0.00*	0.00*	0.00*
10 mins after intubation	0.00*	0.00*	0.00*

*: Significant

Table 7: Heart rate at different time intervals

Heart rate	Dexmedetomidine group	Clonidine group	Control group
Baseline	73.4	74.1	76.1
10 mins after drug administration	70.3	72.3	78.8
1 min after intubation	65.5	74.2	79.6
3 mins after intubation	63.3	71.3	81.4
5 mins after intubation	62.1	70.1	82.9
10 mins after intubation	60.2	68.3	80.1

Table 8: Comparison of HR at different time intervals

HR	Dexmedetomidine group Vs Clonidine group	Clonidine group Vs Control group	Dexmedetomidine group Vs Control group
Baseline	0.71	0.74	0.64
10 mins after drug administration	0.39	0.00*	0.00*
1 min after intubation	0.00*	0.00*	0.01*
3 mins after intubation	0.00*	0.00*	0.01*
5 mins after intubation	0.00*	0.00*	0.00*
10 mins after intubation	0.00*	0.00*	0.01*

*: Significant

Discussion

Mastering the skill of endotracheal intubation to secure an airway plays a critical role in many settings such as pre-hospital environments, emergency rooms, critical care units, and peri-operative medicine. In a rapidly deteriorating, critically ill patient, success rests on adequate preparation, experience, and anticipated difficulty associated with airway, clinical condition, and intubation. Rapid sequence intubation involves the simultaneous rapid administration of a paralytic drug and an induction agent to create optimal conditions to provide rapid control of the airway with the placement of an endotracheal tube.Indications for intubation to secure the airway include respiratory failure (hypoxic or hypercapnic), apnea, a reduced level of consciousness (sometimes stated as GCS less than or equal to 8), rapid change of mental status, airway injury or impending airway compromise, high risk for aspiration, or 'trauma to the box (larynx),' which includes all penetrating injuries to the neck, abdomen, or chest.[9-11]Dexmedetomidine is a new generation highly selective α2-adrenergic receptor (α2-AR) agonist that is associated with sedative and analgesic sparing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilizing effects, and preservation of respiratory function.Dexmedetomidine exhibits linear pharmacokinetics in the recommended dose range of 0.2 to 0.7 μg/ kg/ hr administered as intravenous infusion up to 24 hours. The distribution phase is rapid, with a half-life of distribution of approximately 6 minutes and elimination half life of 2 hours.Dexmedetomidine attenuates hemodynamic stress

response to intubation and extubation by sympatholysis.[12- 14]Clonidine is a commonly prescribed biochemical derivative of imidazoline with a variety of clinical uses. It was originally developed as a nasal decongestant, but its main use has been as an anti-hypertensive agent. It has been shown to be useful in treating several different drug withdrawal syndromes. Clonidine's effect on the body stems from its action on alpha-2 receptors, imidazoline receptors, and the functional overlap of alpha-2 receptors on mu receptors. Overdose results in a toxidrome not easily identified.Clonidine acts by stimulating the pre-synaptic alpha 2 adrenoceptors, thereby decreasing noradrenaline release from both central and peripheral sympathetic nerve terminals.3 The effects of clonidine occur due to its action both at spinal and supraspinal sites, including depression of thalamic transmission of impulses to the cerebral cortex as well as enhancement of descending inhibitory pathways to the dorsal horn.[15, 16]Hence; under the light of above-mentioned data, the present study was undertaken for comparing the efficacy of iv dexmedetomidine and iv clonidine to attenuate stress response to laryngoscopy and endotracheal intubation.In the present study, Mean age of the patients of dexmedetomidine group, Clonidine group and Control group was 33.8 years, 31.9 years and 30.6 years respectively. In the study conducted by Gupta SK et al, authors reported that mean age of the patients of control group, dexmedetomidine group and control group was 28.2 years, 32.1 years and 33.2 years respectively.[17]Nikam G et al, in another study reported the mean age of the patients of the dexmedetomidine group and Clonidine group was 36.23 years and 34.96 years respectively.[18]

In the present study, mean SBP, DBP and MAP among the patients the patients of dexmedetomidine group were significantly lower in comparison to the patients of the clonidine group and control group at different time intervals. In a previous study conducted by Suryawanshi CM et al, mean systolic blood pressure showed fall in clonidine group as well as in dexmedetomidine group, following infusion of study drug. There was a transient increase in the, mean systolic pressure following laryngoscopy and tracheal intubation in clonidine group from 112.83 to 118.8 and in dexmedetomidine group from 119 to 124.93. Also mean diastolic blood pressure mean systolic pressure following laryngoscopy and tracheal intubation in clonidine group from 73.93 to 76.53 and in dexmedetomidine group from 78.03 to 79.77.[19]Dexmedetomidine is more potent α-2 receptor agonist when compared to clonidine. So, dexmedetomidine is better drug of choice amongst α-2 receptor agonist to suppress deleterioushemodynamic response to laryngoscopy and endotracheal intubation. Though dexmedetomidine is costly compared to clonidine, it significantly reduces drug requirement of anaesthetic agent with better hemodynamic blunting response to laryngoscopy and intubation.[18, 19]Rawate et al, in a previous study, compared the effects of IV dexmedetomidine and clonidine in attenuating the pressor response to laryngoscopy and endotracheal intubation. 100 patients were selected and randomized into: Group C [Clonidine group], Group D [Dexmedetomidine group]. Mean SBP, DBP, MAP and HR in Group D was significantly lower as compared Group C. Mean HR, DBP and MAP at 10 minutes, after induction, at induction, at 1 minute after intubation between two groups, the difference was statistically significant. SBP and HR at after 3 minutes after intubation between two groups, the difference was statistically significant. They concluded that IV dexmedetomidine is superior and better drug compared to IV Clonidine to reduce hemodynamic response i.e. attenuation of pressure response to laryngoscopy and tracheal intubation with single premedication dose.[20]

Conclusion

Both dexmedetomidine and clonidine were effective in attenuation of the hemodynamic response to intubation. However; among clonidine and dexmedetomidine, dexmedetomidine is more effective.

References

1. Adewale L. Anatomy and assessment of the pediatric airway. PaediatrAnaesth. 2009 Jul;19Suppl 1:1-8.
2. Popat B, Jones AT. Invasive and non-invasive mechanical ventilation. Medicine (Abingdon). 2016 Jun;44(6):346-350.
3. Hagiwara Y, Watase H, Okamoto H, Goto T, Hasegawa K., Japanese Emergency Medicine Network Investigators. Prospective validation of the modified LEMON criteria to predict difficult intubation in the ED. Am J Emerg Med. 2015 Oct;33(10):1492-6.
4. Reynolds SF, Heffner J. Airway management of the critically ill patient: rapid-sequence intubation. Chest. 2005 Apr;127(4):1397-412.
5. Manthous CA. Avoiding circulatory complications during endotracheal intubation and initiation of positive pressure ventilation. J Emerg Med. 2010 Jun;38(5):622-31.
6. Gertler R, Brown HC, Mitchell DH, Silvius EN. Dexmedetomidine: a novel sedative-analgesic agent. Proc (BaylUniv Med Cent). 2001;14(1):13-21.
7. Peden CJ, Prys-Roberts C. International Practice of Anaesthesia. 6th. Oxford (UK): PracticeofAnaesthesia; 1996. The alpha-2 adrenoceptors and anaesthesia. Cedric Prys-Roberts and Burnell R. Brown.
8. Joint Formulary Committee. London: British Medical Association and Royal Pharmaceutical Society of Great Britain. (57th ed) 2008 Sep; British National Formulary.
9. Okubo M, Gibo K, Hagiwara Y, Nakayama Y, Hasegawa K., Japanese Emergency Medicine Network Investigators. The effectiveness of rapid sequence intubation (RSI) versus non-RSI in emergency

department: an analysis of multicenter prospective observational study. Int J Emerg Med. 2017 Dec;10(1):1.
10. Pagel PS, Hettrick DA, Kersten JR, Warltier DC. Dexmedetomidine produces similar alterations in the determinants of left ventricular afterload in conscious dogs before and after the development of pacing-induced cardiomyopathy. Anesthesiology. 1998;89:741–748.
11. Heusch G, Schipke J, Thamer V. Clonidine prevents the sympathetic initiation and aggravation of poststenotic myocardial ischemia. J CardiovascPharmacol. 1985;7:1176–1182.
12. Roekaerts PM, Prinzen FW, De Lange S. Beneficial effects of dexmedetomidine on ischaemic myocardium of anaesthetized dogs. Br J Anaesth. 1996;77:427–429.
13. 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;68:126–31.
14. Aho M, Lehtinen AM, Erkola O, Kallio A, Korttila K. The effect of intravenously administered dexmedetomidine on perioperative hemodynamics and isoflurane requirements in patients undergoing abdominal hysterectomy. Anesthesiology. 1991;74:997–1002.
15. Yasaei R, Saadabadi A. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 17, 2023.
16. Jamadarkhana S, Gopal S. Clonidine in adults as a sedative agent in the intensive care unit. J AnaesthesiolClinPharmacol. 2010;26(4):439-445.
17. Gupta SK, Singhal S. A Comparative Study of Dexmedetomidine and Clonidine for Attenuation of Hemodynamic Response during Laryngoscopy and Intubation. Acad. Anesthesiol. Int. 2020;5(2):49-52.
18. Nikam G, Madhukrishna N. A comparative study between clonidine and dexmedetomidine in attenuation of pressor response during endotracheal intubation. Indian Journal of Clinical Anaesthesia, April-June, 2018;5(2):244-248
19. 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 J ClinAnaesth. 2018;5(3):327-333.
20. RajashreeBhagwanRawate, Deepak M Kokane, VinayakSirsat. Comparative study between intravenous clonidine versus intravenous dexmedetomidine for attenuation of pressor response during endotracheal intubation. MedPulse International Journal of Anesthesiology. November 2021; 20(2):71-75.