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STUDY ON THE EFFECTS OF PREOPERATIVE DEXMEDETOMIDINE ON THE HEMODYNAMIC RESPONSE TO DIRECT LARYNGOSCOPY AND TRACHEAL INTUBATION.

Anaesthesiology

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ABSTRACT

Goals: In the perioperative phase and critical care situation, dexmedetomidine, an α2 agonist, has been assessed for its hypnotic, analgesic, and anxiolytic characteristics. We looked tested the hemodynamic responses to tracheal intubation following a single intravenous dosage of dexmedetomidine at a dose of 0.5 mg/kg, as well as the dose needs for anaesthetics for induction and their side effects. **Methods:** The study comprised 100 adult patients who were scheduled for elective surgery under general anaesthesia and required tracheal intubation. Two groups were created out of the 100 patients. Patients in group 1 (DG) received dexmedetomidine, while those in group 2 (NDG) received no hypnotic, analgesic, or anxiolytic medication at all. Prior to induction, the study medication was given intravenously over a 10-minute interval. During the 15-minute induction and postintubation periods, hemodynamic parameters, the total propofol dose, and side effects were noted. **Results:** In the dexmedetomidine group, the greatest percentage rise in heart rate following intubation was 18 % lower than in the non-dexmedetomidine group. In the dexmedetomidine group compared to the non-dexmedetomidine group, the highest percentage increases in blood pressure parameters after intubation were considerably lower. The mean total dose of propofol needed for induction was significantly reduced, going from 2.1 mg/kg in the non-dexmedetomidine group to 1.03 mg/kg in the dexmedetomidine group. **Conclusion:** Up until five minutes after intubation, the rise in heart rate and blood pressure, was significantly attenuated by the preinduction low dose dexmedetomidine. It considerably decreased the amount of propofol needed for induction.

KEYWORDS

Intubation, Systolic Blood Pressure, Laryngoscopy, Dexmedetomidine, General Anaesthesia, Pre Induction, Haemodynamic.

INTRODUCTION

In patients with underlying coronary artery disease, hypertension, or intracranial neuropathology, laryngoscopy and tracheal intubation(TI) may set off reflex responses that profoundly alter cardiovascular physiology and result in significant consequences. [1] A number of medications have been tried to lessen these reactions, but none have been completely effective.[2,3] A2-adrenoceptor agonist dexmedetomidine is the pharmacologically active d-isomer of medetomidine. It is the perfect medicine for intravenous (IV) titration due to its short half-life.[4] In the perioperative phase and critical care situation, its hypnotic, analgesic, and anxiolytic characteristics have been assessed in a number of investigations.[5-8] Data on its impact on the attenuation of the pressor response to direct laryngoscopy and Tracheal Intubation, however, are limited. Few research has examined the role of lower doses of dexmedetomidine (0.5–0.6 mg/kg) in attenuating pressor responses; the majority of investigations have utilised higher doses of dexmedetomidine, 1-2 mg/kg [9–23] The aim of this study was to assess the hemodynamic response to a single preinduction IV dosage of 0.5 mg/kg dexmedetomidine on adult patients having general anaesthesia, as well as the dose needs of propofol during induction and its side effects.

MATERIALS AND METHODS

Research instrument: It is a retrospective observational study of Pre Anaesthesia charts and Operation theatre notes.

Sample design: 100 Pre anaesthetic and Anaesthesia charts were studied from December 2020 to November 2022

Data collection: Data was collected from medical records of the patients who underwent General anaesthesia. All the vital signs of the patient were analysed.

Inclusion Criteria:

1. Patients who underwent General anaesthesia.
2. Patients who ever was given Injection dexmedetomidine.
3. Patients who are not given any hypnotic, analgesic, and anxiolytic before intubation.

Exclusion criteria:

1. Patients who underwent anaesthesia other than general anaesthesia.
2. Patients who ever are given any hypnotic, analgesic, and anxiolytic before intubation.

Statistical analysis:

The data was analysed by Percentage analysis and statistical test like Chi Square test. The chi square test was performed by comparing the effects in the patient with and without the test drug. The hypothesis was tested significant at P value < 0.05.

Baseline measurements of the heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP), and arterial oxygen saturation (SpO2) were taken and depicted in table 1. Before the study drug was infused (T0: baseline), after the infusion was finished (T1), at 5 minutes (T2), after induction (T3), right before intubation (T4), and after intubation at 1-minute (T5), 3-minute (T6), 5-minute (T7), 10-minute (T8), and 15-minute (T9) intervals, it was noted that the following physiological parameters were monitored: HR, SBP, DBP, MBP, SpO2, and EtCO2.

Table 1: Depicting the vital signs at different intervals

	HR		SBP		DBP		MAP	
	DG	NDG	DG	NDG	DG	NDG	DG	NDG
T0	80	82	130	130	80	80	123.33	123.33
T1	78	82	120	125	78	79	118	120.67
T2	77	83	110	115	75	77	111.67	115.33
T3	76	83	105	110	72	74	107	110.67
T4	79	88	95	100	65	67	96.67	100.33
T5	78	95	105	105	60	63	95	98
T6	77	90	110	115	62	64	98.67	102.33
T7	76	88	115	118	67	70	105.33	109.33
T8	75	85	115	120	75	77	113.33	117
T9	75	84	120	120	80	82	120	122

The mean, median, and measures of dispersion (standard deviation and standard error) were used to estimate all quantitative variables. Kolmogorov-Smirnov tests and measures of skewness were used to determine whether the data were normal.

Both the Student t test and the Chi-square test were used to analyse demographic data. Changes throughout time were examined using analysis of variance. Once statistical significance was established, a post hoc multiple comparison test with Bonferroni's correction was used to see how two sets of data differed for each variable. The t test was used to compare hemodynamic parameters between groups.

The demographic characteristics of the patients were comparable across the dexmedetomidine and non-dexmedetomidine groups, as shown in the table 2. The two groups' baseline hemodynamic parameters were equivalent.

We found a substantial drop in HR and blood pressure in the dexmedetomidine group compared to the non-dexmedetomidine

group five minutes after infusion (p 0.001).

Table 2: Demographic characteristics of patients receiving dexmedetomidine or Non-Dexmedetomidine prior to induction of general anaesthesia.

	DG	NDG
AGE	48.3	47.8
MALE:FEMALE	27 : 23	30 : 20

The HR in the non-dexmedetomidine group increased by a significant percentage from the baseline value (28.8% and16.4%, respectively) at 1 and 3 minutes after intubation before stabilising at 10 minutes. On the other hand, we observed 10.8% and 11.9% reductions in the HR from the baseline value in the dexmedetomidine group at 1 minute and 3 minutes after intubation, respectively. After that, the HR in the non-dexmedetomidine group returned to nearly baseline, whereas it stayed consistently lower in the dexmedetomidine group (p 0.001). A substantial difference in the HR between the two groups was seen during an intergroup comparison at all time periods and remained up until 15 minutes after intubation.

In the dexmedetomidine group, there was a statistically significant drop in blood pressure postintubation compared to baseline, which persisted for 5 minutes (p 0.001). However, there was a slight increase in SBP, DBP, and MBP after intubation when compared to pre intubation values. However, in the non-dexmedetomidine group, there was a considerable rise in SBP, DBP, and MBP following intubation relative to both baseline and pre intubation values, which was typically observed at 1 minute after Tracheal intubation and then reverted to levels similar to baseline. after one minute, three minutes, and five minutes after TI (p 0.001), there was a significant difference in blood pressure between the two groups; however, after ten and fifteen minutes after TI, the difference was no longer significant.

At all-time intervals, there was no statistically significant difference between the two groups' mean values of EtCO2 and SpO2 ($p > 0.05$). Throughout the whole study period, the SpO2 in neither group was ever lower than 95%.

The average total doses of propofol needed for induction in the dexmedetomidine and non-dexmedetomidine groups were respectively 60.57 ± 12.43 mg and 117.80 ± 15.86 mg, or 1.03 mg/kg and 2.1 mg/kg. Propofol mean dose differences between the two groups were statistically different (p 0.001). Except for two patients in the dexmedetomidine group who experienced hypotension and responded to ephedrine 6 mg IV, none of the patients in either group experienced any serious adverse effects, such as bradycardia, respiratory depression, or hypotension.

DISCUSSION

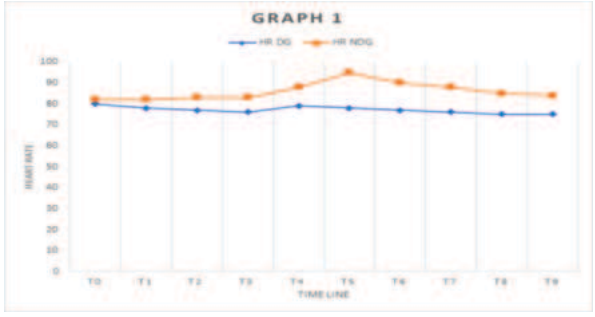
Our study has some restrictions. In high-risk cardiac patients, dexmedetomidine may be helpful; however, the current study only included patients with ASA physical status I and II. Additionally, the present study did not take into account more objective methods of assessing hemodynamic responsiveness, such as measuring the QT interval and plasma catecholamine levels. [22,41] We chose the propofol dose for induction based on our subjective evaluations.

Due to the increased hemodynamic stability brought on by dexmedetomidine infusion, it is challenging to determine the level of anaesthesia from alterations mediated by the autonomic nervous system. Measurement of effect site concentration and intraoperative bi spectral index monitoring would have been much more objective ways to determine the depth of anaesthesia and propofol dosage needed for induction, respectively.

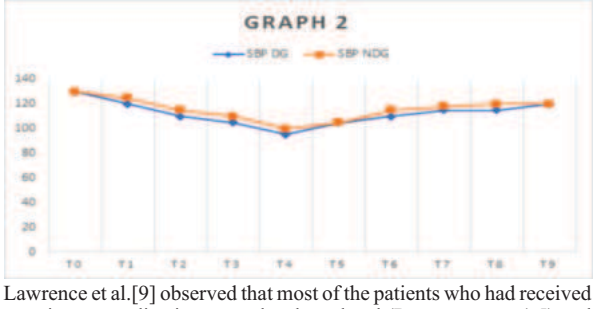
As opposed to the non-dexmedetomidine group, the HR in the current study dexmedetomidine group was considerably lower than the baseline values at all study time points (pre- and postinduction, as well as up to 15 minutes postintubation). Surprisingly, compared to the non-dexmedetomidine group, the maximum percentage increases in the HR from the pre intubation values at 1 and 3 minutes were, respectively, 19.6% and 8.14% less in the dexmedetomidine group (12.96% and 11.23% in the dexmedetomidine group vs. 32.57% and 19.37% in the non-dexmedetomidine group). Up until 3 minutes after intubation, there was a considerable decrease of the HR rise in response to TI; beyond that, the results were equivalent when comparing within and across groups, as depicted in Graph 1.

At all study time points (pre- and postinduction, and up to 15 minutes postintubation), SBP, DBP, and MBP were significantly lower in the dexmedetomidine group than the baseline values, whereas there was a significant increase in SBP, MBP, and DBP 1minute postintubation in the non-dexmedetomidine group. Dexmedetomidine considerably decreased the pressor response that was seen until 5 minutes postintubation, as seen by the highest percentage increases in SBP, DBP, and MBP at 1minute postintubation being much lower in the dexmedetomidine group than in the non-dexmedetomidine group, as depicted in Graph 2,3 and 4.

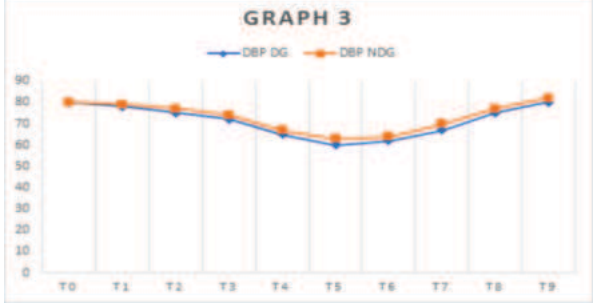
In numerous investigations, larger dexmedetomidine doses (1–2 mg/kg) were used, and the pressor response to TI was significantly attenuated. [9-19,32] Numerous of the aforementioned studies consistently described a biphasic response with initial transient hypertension (drug's vasoconstrictive effect) and later severe hypotension and bradycardia (effects of the drug's central sympatholysis) [28,29]and/or respiratory depression (action on postsynaptic a2-adrenoceptors in the locus coeruleus).[9,10,14,22,33] Dexmedetomidine was given by Kunisawa et al.[11] in two doses: a single dosage of 1.0 mg/kg for 10 minutes, followed by a continuous infusion of 0.7 mg/kg/h for 15 minutes before induction.

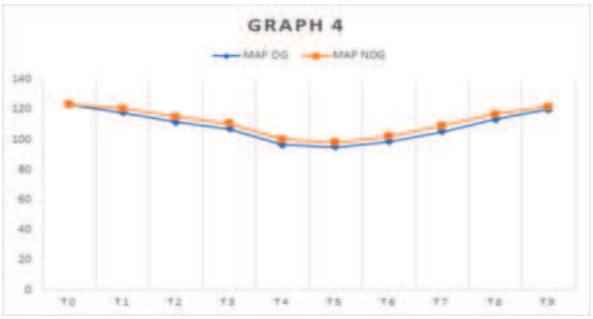


Surprisingly, they found no evidence of significant bradycardia, hypotension, or differences in the frequency of pharmacological interventions in any of the three study groups. This finding may be related to the strict criteria for administering a vasoactive agent (SBP 70 mmHg) or the absence of any premedication medications.[11] Following the completion of the dexmedetomidine infusion (1 mg/kg in 20 minutes), Bajwa et al.'s14 research showed that the oxygen saturation in the dexmedetomidine group decreased by up to 94e95%. Yildiz et al.'s observations of considerable drowsiness (with brief periods of apnoea in 3 patients) and a drop in SpO2 values immediately following medication infusion (1 mg/kg in 5 minutes) were noted, despite the fact that SpO2 values remained above 95% throughout.



Lawrence et al.[9] observed that most of the patients who had received atropine premedication were deeply sedated (Ramsay score 4-5) and had a greater incidence of hypotension and bradycardia after administering a single preinduction IV dose of dexmedetomidine at a dose of 2 mg/kg (given over 5 minutes).





Fewer researchers have examined the impact of lower dexme detomidine dosages (0.5–0.6 mg/kg IV) on sympathoadrenal responses to TI.[20-23] the findings of the current investigation are consistent with those of prior trials, which found that smaller doses of dexmedetomidine considerably reduced the maximal rises in SBP, DBP, and HR following TI.[20,21,23] Furthermore, compared to the non-dexmedetomidine group, Jaakola et al.[21] also showed a substantial decrease in plasma noradrenaline levels.

When assessing the effects of a single low dosage of dexmedetomidine (0.5 mg/kg, slow IV infusion for 10 minutes, 15 minutes before to TI) in patients with coronary artery disease undergoing off-pump coronary artery bypass grafting, Sulaiman et al[23] also noted comparable outcomes.

Dexmedetomidine was well tolerated in the current research at lower doses, and no negative reactions or severe side effects were seen. Only one patient in the dexmedetomidine group had hypotension, which need pharmacological treatment.

The ventilatory parameters (SpO2 and EtCO2) were likewise comparable across the two groups, and neither group's SpO2 ever dropped below 95%, demonstrating the safety profile of low-dose dexmedetomidine's continuous infusion.

Our results are in accordance with previous studies using similar low-dose infusions of dexmedetomidine.[20-23]

Dexmedetomidine has the unusual ability to sedate patients by interfering with the activation of postsynaptic a2 subtype adrenoceptors in the locus coeruleus.[29]

The drug's sedative and anaesthetic sparing properties have been thoroughly investigated and used in anaesthesia practise.[5,34-39]

The results of the current study shown that administering a single dose of dexmedetomidine (0.5 mg/kg IV) significantly decreased the doses of propofol needed for induction, with the dexmedetomidine group requiring just 1.04 mg/kg compared to 2.01 mg/kg in the non-dexmedetomidine group.

Similar dosages of dexmedetomidine have been used in prior studies to demonstrate considerable decreases in the amount of thiopentone needed for induction and the amount of intraoperative opioid needed.[10,20-22] Even though very few studies have looked at the impact of dexmedetomidine on the dosage of propofol needed to induce anaesthesia, they found similar outcomes.[15,16] According to a recent study by Liu et al[40], a single dose of dexmedetomidine at 0.5 mg/kg IV can dramatically lower the mean propofol effect site concentration (as measured by the Narcotrend index) without causing any unfavourable hemodynamic changes.

Our study has some restrictions. In high-risk cardiac patients, dexmedetomidine may be helpful; however, the current study only included patients with ASA physical status I and II. Additionally, the present study did not take into account more objective methods of assessing hemodynamic responsiveness, such as measuring the QT interval and plasma catecholamine levels. [22,41] We chose the propofol dose for induction based on our subjective evaluations.

Due to the increased hemodynamic stability brought on by dexmedetomidine infusion, it is challenging to determine the level of anaesthesia from alterations mediated by the autonomic nervous system. Measurement of effect site concentration and intraoperative bispectral index monitoring would have been much more objective ways to determine the depth of anaesthesia and propofol dosage needed for induction, respectively.

The hemodynamic reactions associated with laryngoscopy and intubation were significantly attenuated by a single dose of 0.5 mg/kg dexmedetomidine given over a period of 10 minutes prior to the induction of anaesthesia, and this dose was just as effective as the 1 mg/kg dose reported in the literature. Additionally, it decreased the amount of propofol needed for induction and had no discernible side effects. Our opinion is that extensive research into the cardiac protective effects of dexmedetomidine during induction and intubation may be necessary in various patient populations.

CONCLUSION:

The findings from our study underscore the potential benefits of dexmedetomidine administration in attenuating cardiovascular responses during intubation. Specifically, we observed a noteworthy reduction in the percentage rise of heart rate following intubation compared to the non-dexmedetomidine group, with the greatest decrease reaching 18%. Moreover, dexmedetomidine administration was associated with markedly lower percentage increases in blood pressure parameters post-intubation.

Furthermore, our results reveal a significant reduction in the mean total dose of propofol required for induction in the dexmedetomidine group compared to the non-dexmedetomidine group, indicating a potential synergistic effect between dexmedetomidine and propofol.

These findings highlight the promising role of dexmedetomidine in mitigating the hemodynamic response to intubation and optimizing induction protocols. Future research should delve deeper into the mechanisms underlying these observed effects and explore the clinical implications of dexmedetomidine use in various patient populations undergoing intubation procedures. Such investigations may ultimately contribute to refining perioperative management strategies and improving patient outcomes.

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Conflicts of interest: There are no conflicts of interest

REFERENCES:

1. Vaidya A, Phadke P. Role of Dexmedetomidine as Premedicant to Attenuate Pressor Response to Laryngoscopy and Intubation.
2. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. Journal of clinical anesthesia. 1996 Feb 1;8(1):63-79.
3. Bruder N, Ortega D, Granthil C. Consequences and prevention methods of hemodynamic changes during laryngoscopy and intratracheal intubation. InAnnales francaises d'anesthesie et de reanimation 1992 Jan 1 (Vol. 11, No. 1, pp. 57-71).
4. Carollo DS, Nossaman BD, Ramadhyani U. Dexmedetomidine: a review of clinical applications. Current Opinion in Anesthesiology. 2008 Aug 1;21(4):457-61.
5. Hall JE, Uhrich TD, Barney JA, Arain SR, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. Anesthesia & Analgesia. 2000 Mar 1;90(3):699-705.
6. Gautam S, Prakash V, Mishra N, Prakash R, Kumar S, Jafa S. Effect of Two Different Doses of Dexmedetomidine on the Hemodynamics of "Hypertensive Patients" Undergoing Laparoscopic Cholecystectomy. Anesth Essays Res. 2020 Jul-Sep;14(3):401-405. doi: 10.4103/aer.AER_14_21. Epub 2021 Mar 22.
7. Aho MS, Erkola OA, Scheinin H, Lehtinen AM, Korttila KT. Effect of intravenously administered dexmedetomidine on pain after laparoscopic tubal ligation. Anesthesia & Analgesia. 1991 Aug 1;73(2):112-8.
8. Venn RM, Bradshaw CJ, Spencer R, Brealey D, Caudwell E, Naughton C, Vedio A, Singer M, Feneck R, Treacher D, Willatts SM. Preliminary UK experience of dexmedetomidine, a novel agent for postoperative sedation in the intensive care unit. Anaesthesia. 1999 Dec;54(12):1136-42.
9. Lawrence CJ, De Lange S. Effects of a single pre.operative dexmedetomidine dose on isoflurane requirements and peri.operative haemodynamic stability. Anaesthesia. 1997 Jul;52(8):736-45.
10. Yildiz M, Tavlan A, Tuncer S, Reisli R, Yosunkaya A, Otelcioglu S. Effect of dexmedetomidine on haemodynamic responses to laryngoscopy and intubation: perioperative haemodynamics and anaesthetic requirements. Drugs in R & D. 2006 Jan;7:43-52.
11. Kunisawa T, Nagata O, Nagashima M, Mitamura S, Ueno M, Suzuki A, Takahata O, Iwasaki H. Dexmedetomidine suppresses the decrease in blood pressure during anesthetic induction and blunts the cardiovascular response to tracheal intubation. Journal of clinical anesthesia. 2009 May 1;21(3):194-9.
12. Menda F, Köner Ö, Sayin M, Türe H, Imer P, Aykac B. Dexmedetomidine as an adjunct to anesthetic induction to attenuate hemodynamic response to endotracheal intubation in patients undergoing fast-track CABG. Annals of Cardiac Anaesthesia. 2010 Jan 1;13(1):16-21.
13. Keniya VM, Ladi S, Naphade R. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anaesthetic requirement. Indian journal of anaesthesia. 2011 Jul;55(4):352.
14. Bajwa SJ, Kaur J, Singh A, Parmar SS, Singh G, Kulshrestha A, Gupta S, Sharma V, Panda A. Attenuation of pressor response and dose sparing of opioids and anaesthetics with pre-operative dexmedetomidine. Indian journal of anaesthesia. 2012 Mar;56(2):123.
15. Laha A, Ghosh S, Sarkar S. Attenuation of sympathoadrenal responses and anesthetic requirement by dexmedetomidine. Anesthesia, Essays and Researches. 2013 Jan;7(1):65.

16. Mondal S, Mondal H, Sarkar R, Rahaman M. Comparison of dexmedetomidine and clonidine for attenuation of sympathoadrenal responses and anesthetic requirements to laryngoscopy and endotracheal intubation. Int J Basic Clin Pharmacol. 2014 May;3(3):501-6.
17. Reddy SV, Balaji D, Ahmed SN. Dexmedetomidine versus esmolol to attenuate the hemodynamic response to laryngoscopy and tracheal intubation: A randomized double-blind clinical study. International Journal of Applied and Basic Medical Research. 2014 Jul;4(2):95.
18. Gogus N, Akan B, Serger N, Baydar M. The comparison of the effects of dexmedetomidine, fentanyl and esmolol on prevention of hemodynamic response to intubation. Revista Brasileira de Anestesiologia. 2014 Sep;64:314-9.
19. Unlugenc H, Gunduz M, Guler T, Yagmur O, Isik G. The effect of pre-anaesthetic administration of intravenous dexmedetomidine on postoperative pain in patients receiving patient-controlled morphine. European journal of anaesthesiology. 2005 May;22(5):386-91.
20. Basar H, Akpinar S, Doganci N, Buyukkocak U, Kaymak Ç, Sert O, Apan A. The effects of preanesthetic, single-dose dexmedetomidine on induction, hemodynamic, and cardiovascular parameters. Journal of clinical anesthesia. 2008 Sep 1;20(6):431-6.
21. Jaakola ML, Ali-Melkkilä T, Kanto J, Kallio A, Scheinin H, Scheinin M. Dexmedetomidine reduces intraocular pressure, intubation reponses and anaesthetic requirements in patients undergoing ophthalmic surgery. British journal of anaesthesia. 1992 Jun 1;68(6):570-5.
22. 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. British journal of anaesthesia. 1992 Feb 1;68(2):126-31.
23. 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. Annals of Cardiac Anaesthesia. 2012 Jan 1;15(1):39-43.
24. Roberts FL, Dixon J, Lewis GT, Tackley RM, Prys.Roberts C. Induction and maintenance of propofol anaesthesia: a manual infusion scheme. Anaesthesia. 1988 Mar;43:14-7.
25. Russell D. Intravenous anaesthesia: manual infusion schemes versus TCI systems. Anaesthesia. 1998 Apr;53:42-5.
26. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984 Nov;39(11):1105-11.
27. Krage R, Van Rijn C, Van Groeningen D, Loer SA, Schwarte LA, Schober P. Cormack–Lehane classification revisited. British journal of anaesthesia. 2010 Aug 1;105(2):220-7.
28. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Hemodynamic changes. Anesthesiology. 1992 Dec 1;77(6):1134-42.
29. Khan ZP, Ferguson CN, Jones RM. Alpha.2 and imidazoline receptor agonistsTheir pharmacology and therapeutic role. Anaesthesia. 1999 Feb;54(2):146-65.
30. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. British journal of anaesthesia. 1987 Mar 1;59(3):295-9.
31. Derbyshire DR, Chmielewski A, Fell D, Vater M, Achola K, Smith G. Plasma catecholamine responses to tracheal intubation. BJA: British Journal of Anaesthesia. 1983 Sep 1;55(9):855-60.
32. Esra A, Celik M, Orhon Z, Yiizer S, Sen B. Different doses of dexmedetomidine on controlling haemodynamic responses to tracheal intubation. Anesthesiology. 2010;27(2):12.
33. Correa-Sales C, Rabin BC, Maze M. A hypnotic response to dexmedetomidine, an alpha 2 agonist, is mediated in the locus coeruleus in rats. Anesthesiology. 1992 Jun 1;76(6):948-52.
34. Khan ZP, Munday IT, Jones RM, Thornton C, Mant TG, Amin D. Effects of dexmedetomidine on isoflurane requirements in healthy volunteers. 1: Pharmacodynamic and pharmacokinetic interactions. British Journal of Anaesthesia. 1999 Sep 1;83(3):372-80.
35. Tanskanen PE, Kyttä JV, Randell TT, Aantaa RE. Dexmedetomidine as an anaesthetic adjuvant in patients undergoing intracranial tumour surgery: a double-blind, randomized and placebo-controlled study. BJA: British Journal of Anaesthesia. 2006 Nov 1;97(5):658-65.
36. E. Ramsay MA, Luterman DL. Dexmedetomidine as a total intravenous anesthetic agent. The Journal of the American Society of Anesthesiologists. 2004 Sep 1;101(3):787-90.
37. Jalowiecki P, Rudner R, Gonciarz M, Kawecki P, Petelenz M, Dziurdzik P. Sole use of dexmedetomidine has limited utility for conscious sedation during outpatient colonoscopy. The Journal of the American Society of Anesthesiologists. 2005 Aug 1;103(2):269-73.
38. Chrysostomou C, Schmitt CG. Dexmedetomidine: sedation, analgesia and beyond. Expert opinion on drug metabolism & toxicology. 2008 May 1;4(5):619-27.
39. Liu C, Zhang Y, She S, Xu L, Ruan X. A randomised controlled trial of dexmedetomidine for suspension laryngoscopy. Anaesthesia. 2013 Jan;68(1):60-6.
40. Lindgren L. Rautiainen P, Klemola UM, Saarnivaara L. Haemodynamic responses and prolongation of QT interval of ECG after suxamethonium-facilitated intubation during anaesthetic induction in children: a dose-related attenuation by alfentanil. Acta Anaesthesiol Scand. 1991;35:355-8.
41. Palanca BJ, Mashour GA, Avidan MS. Processed electroencephalogram in depth of anesthesia monitoring. Current Opinion in Anesthesiology. 2009 Oct 1;22(5):553-9.