Efficacy of dexmedetomidine versus remifentanil to blunt the hemodynamic response to laryngoscopy and orotracheal intubation: a randomized clinical trial

Hesameddin Modir1, Bijan Yazdi1, Esmail Moshiri1, Abolfazl Mohammadbeigi2, Samira Afshari3
1 Department of Anesthesiology and Critical Care, Arak University of Medical Sciences, Arak, Iran
2 Neurology and Neuroscience Research Center, Qom University of Medical Sciences, Qom, Iran
3 Arak University of Medical Sciences, Arak, Iran

Abstract

The study aims to compare the efficacy of dexmedetomidine (DEX) vs. remifentanil (REM) to blunt the hemodynamic response to laryngoscopy and orotracheal intubation. Enrolled in a double-blind clinical trial, 124 patients undergoing elective surgery under general anesthesia at Amirkabir Hospital (Arak, Iran), were assigned into four groups equally (31 patients in each group), DEX, REM, DEX-REM, and normal saline (NS), who received intravenous DEX (1 µg/kg), REM (1 µg/kg), their equal mixture (each 0.5 µg/kg, 1 minute before tracheal intubation), and NS, respectively. Then, blood pressure (BP), heart rate (HR), and arterial oxygen saturation (SaO₂) were measured on arrival to the operating room, 1 minute before laryngoscopy and tracheal intubation, immediately after intubation, and afterwards every 5 to 15 minutes, and finally the data were analyzed using SPSS 18.0. The groups were same regarding to age, sex and baseline hemodynamic variables including mean of BP (P = 0.157), HR (P = 0.105) and SaO₂ (P = 0.366). Tukey post-hoc test showed that there DEX, REM, and a DEX + REM groups was same regarding to MBP and HR, but these hemodynamic responses were higher in NS group than other groups at all time after laryngoscopy and intubation (P < 0.05). Moreover, repeated measure test showed a decreasing trend in MBP and HR in three intervention groups at all time after intubation (P > 0.05). A DEX/REM mixture had the lowest BP and three intervention groups had lower HR than the NS group. A mixture of the drugs used seems to lead to not only a prevented increase in HR and BP during laryngoscopy but also a decreased BP and HR. This study was registered in Iranian Registry Clinical Center with the registration No. IRCT2016092722254N1.

Key words: dexmedetomidine; intratracheal, intubation; laryngoscopy, remifentanil; tracheal intubation

doi: 10.4103/2045-9912.241065
How to cite this article: Modir H, Yazdi B, Moshiri E, Mohammadbeigi A, Afshari S. Efficacy of dexmedetomidine versus remifentanil to blunt the hemodynamic response to laryngoscopy and orotracheal intubation: a randomized clinical trial. Med Gas Res. 2018;8(3):85-90.

Funding: The study was supported by a grant from Arak University of Medical Sciences, Arak, Iran.
Exclusion criteria are as follows: ASA greater than II, Mallampati class III–IV (patients with severe intubation difficulty), more than two intubation attempts, poor BP control, history of cardiovascular diseases, history of endocrine diseases (such as diabetes, hyperthyroidism or hypothyroidism), pregnancy, and addiction to opioids. Patients were assigned into four groups, including those who received normal saline (NS) (n = 31), DEX (n = 31), REM (n = 31), and DEX-REM combination (n = 31), and all patients were admitted one day before surgery while fasting for 8 hours. They were received electrocardiogram (EKG), pulse oximetry, and non-invasive blood pressure monitoring, on arrival to the operating room.

After initial assessment of vital signs, patients without any knowledge of which group they belong to received: intravenous DEX (1 mg/kg) (precedex, manufactured by Hospira, Inc., Lake Forest, IL, USA) diluted with 50 mL of NS for the DEX group over 10 minutes, 50 mL of NS injected to the those in the NS and REM groups at the same time at 10 minutes before the induction, then all were pre-oxygenated with oxygen 100% and anesthesia induction was performed with propofol (2 mg/kg, over 30 seconds), followed by atracurium (0.4 mg/kg) and intravenous midazolam (0.01 mg/kg). One minute before intubation, REM (GlaxoSmithKline Manufacturing S.P.A, Parma, Italy) 1 mg/kg was injected with 3 mL of NS in the REM group, which the volume (3 mL) was also used to match four groups at the same time in the NS and DEX groups. In the DEX-REM group, REM 0.5 μg/kg was injected with 3 mL of NS, 1 minute before TI and they received intravenous DEX (0.5 μg/kg) diluted with 50 mL of NS over 10 minutes. TI was applied via mouth by only one “anesthetist”, while anesthesia was maintained with 1% isoflurane and (50/50) mixture of nitrous oxide/oxygen. Besides recording the data on arrival to the operating room, we measured systolic and diastolic blood pressure, mean blood pressure, as well as HR, and arterial oxygen saturation (SaO2) 1 minute before laryngoscopy and TI, immediately after intubation and then every 5 to 15 minutes, and data were then recorded.

It should be noted that all the patients’ records were obtained through the SAADAT monitoring system (SAADAT Co., Tehran, Iran). Moreover, the information recorder was not aware of the classifications of patients and the type of ongoing intervention.

Finally, the data obtained were analyzed by SPSS 18.0 software (SPSS, Chicago, IL, USA) at a 0.05 level. Descriptive statistics were used to explore the patient’s characteristics. One-way analysis of variance (ANOVA) was used to compare age and hemodynamic responses among four groups. The Tukey post hoc test used for one to one comparison between groups. The trend analysis of BP and HR in each group was performed with repeated measures ANOVA.

**RESULTS**

**Characteristics of the patients intravenously receiving DEX and/or REM and undergoing elective surgery under general anesthesia**

This trial enrolled 124 patients assigned into four groups receiving: NS, DEX, REM, and a DEX/REM mixture. The mean age of participated patients was 35.66 ± 10.96 years old and ranged between 18 to 65 years old. From all 124 studied patients, 54% (67 patients) were male and 46% (57 patients) were female.

**Baseline measurements of the patients intravenously receiving DEX and/or REM and undergoing elective surgery under general anesthesia**

Table 1 shows that the groups was same regarding to age (P = 0.069), sex (P = 0.768) and baseline hemodynamic variables including mean of BP (P = 0.157), HR (P = 0.105) and SaO2 (P = 0.366). Therefore, the randomization adequacy was approved and no statistically significant difference was found in baseline among four groups (P > 0.05).

**Hemodynamic comparison of the patients intravenously receiving DEX and/or REM and undergoing elective surgery under general anesthesia**

Based on results in Table 2, no significant difference was found in MBP before laryngoscopy and intubation in all groups (P = 0.124). However, a significant difference was observed among four groups in MBP at all time after laryngoscopy and intubation including immediately, 1, 5, 10, and 15 minutes after laryngoscopy and intubation (P < 0.001). The Tukey post hoc test showed that there was no significant difference among DEX, REM, and a DEX-REM groups, but the MBP in NS group was statistically higher other intervention groups at all time after laryngoscopy and intubation (P < 0.05). The repeated measure ANOVA showed that there was an increasing trend in MBP of NS group (P = 0.034), while it was decreasing in all three intervention groups (P < 0.05; Figure 2).

As shown in Table 3, there was a significant difference in the mean of HR at all time of study since before laryngoscopy and intubation to 15 minutes after laryngoscopy and intubation (P < 0.05). The all three intervention groups including DEX,
### Table 1: Comparison the sex distribution, mean of age and baseline hemodynamic measurements of the patients intravenous received DEX and/or REM undergoing elective surgery under general anesthesia

| Item                        | DEX-REM | DEX       | REM       | NS          | P-value |
|-----------------------------|---------|-----------|-----------|-------------|---------|
| Age (year)                  | 33.65±7.218 | 37.23±12.953 | 32.68±7.296 | 39.10±13.816 | 0.069   |
| Mean of blood pressure (mmHg) | 93.52±5.111 | 93.26±4.131 | 92.26±4.726 | 91.16±5.367 | 0.157   |
| Heart rate (n/min)          | 81.71±6.246 | 84.00±8.914 | 86.42±7.451 | 83.58±6.966 | 0.105   |
| Arterial oxygen saturation (%) | 95.39±0.558 | 95.71±0.902 | 95.52±1.288 | 95.81±1.167 | 0.366   |
| Male gender (m(%))          | 15(48.4) | 16(51.6) | 17(54.8) | 19(61.3) | 0.768   |

Note: Data were expressed as the mean ± SD, except male gender, and analyzed by one-way analysis of variance in age and hemodynamic responses, and repeated measures analysis of variance in blood pressure and heart rate. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil.

### Table 2: Effect of dexmedetomidine vs. remifentanil on the mean blood pressure (mmHg) of patients undergoing elective surgery under general anesthesia before and after laryngoscopy and intubation at all time of surgery

| Time                        | DEX-REM | DEX       | REM       | NS          | P-value |
|-----------------------------|---------|-----------|-----------|-------------|---------|
| Before laryngoscopy and intubation | 90.42±3.45 | 91.87±4.12 | 90.16±4.44 | 92.39±5.14 | 0.124   |
| Immediately after laryngoscopy and intubation | 88.74±3.91 | 89.42±3.65 | 87.29±6.58 | 98.03±3.09 | <0.001  |
| 1 min after laryngoscopy and intubation | 84.58±5.43 | 87.48±4.23 | 86.71±6.33 | 98.48±4.23 | <0.001  |
| 5 min after laryngoscopy and intubation | 83.26±5.51 | 86.84±4.95 | 86.84±6.11 | 97.45±3.86 | <0.001  |
| 10 min after laryngoscopy and intubation | 83.87±5.07 | 85.90±3.56 | 88.29±6.01 | 95.39±4.04 | <0.001  |
| 15 min after laryngoscopy and intubation | 84.68±4.53 | 87.45±2.94 | 89.26±5.88 | 95.55±3.97 | <0.001  |

Note: Data were expressed as the mean ± SD, and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).

### Table 3: Effect of dexmedetomidine vs. remifentanil on the mean of heart rate (n/min) of patients undergoing elective surgery under general anesthesia before and after laryngoscopy and intubation at all time of surgery

| Time                        | DEX-REM | DEX       | REM       | NS          | P-value |
|-----------------------------|---------|-----------|-----------|-------------|---------|
| Before laryngoscopy and intubation | 79.42±6.12 | 81.26±8.47 | 85.10±7.39 | 83.10±7.90 | 0.024   |
| Immediately after laryngoscopy and intubation | 77.58±5.07 | 75.74±9.50 | 76.84±7.92 | 98.94±9.18 | <0.001  |
| 1 min after laryngoscopy and intubation | 77.45±4.96 | 72.81±8.80 | 73.10±7.86 | 105.32±10.08 | <0.001  |
| 5 min after laryngoscopy and intubation | 76.77±4.99 | 71.06±8.43 | 69.97±8.65 | 109.29±10.71 | <0.001  |
| 10 min after laryngoscopy and intubation | 78.23±4.44 | 75.26±7.69 | 73.26±7.45 | 100.39±9.45 | <0.001  |
| 15 min after laryngoscopy and intubation | 77.13±4.20 | 74.16±7.28 | 72.55±6.09 | 94.58±7.07 | <0.001  |

Note: Data were expressed as the mean ± SD, and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).

---

**Figure 2:** The trend of mean blood pressure at the time of arrival, immediately before and after laryngoscopy, 1, 5, 10 and 15 min after laryngoscopy and intubation of patients undergoing elective surgery under general anesthesia.

Note: Data are expressed as mean and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).
REM, and a DEX/REM mixture caused a decrease in HR. The lowest HR was observed in the DEX group immediately, 1 and 5 minutes and those in the REM group at 10 and 15 minutes after laryngoscopy and intubation. However, no significant difference was found among three intervention groups (P > 0.05). The repeated measure of analysis of variance showed that there was an increasing trend in mean of HR in NS group (P = 0.034), while all three intervention groups caused decreases in HR.

Figure 3: The trend of mean heart rate at the time of arrival, immediately before and after laryngoscopy, 1, 5, 10 and 15 min after laryngoscopy and intubation of patients undergoing elective surgery under general anesthesia. Note: Data are expressed as mean and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).

Figure 4: The trend of mean arterial oxygen saturation at the time of arrival, immediately before and after laryngoscopy, 1, 5, 10 and 15 min after laryngoscopy and intubation of patients undergoing elective surgery under general anesthesia. Note: Data are expressed as mean and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).

Table 4: Effect of dexmedetomidine vs. remifentanil on mean arterial oxygen saturation (%) of patients undergoing elective surgery under general anesthesia

|                          | DEX-REM       | DEX       | REM       | NS         | P-value |
|--------------------------|---------------|-----------|-----------|------------|---------|
| Before laryngoscopy and intubation | 96.58±0.886  | 96.52±0.72  | 96.90±0.54  | 96.61±0.80  | 0.188   |
| Immediately after laryngoscopy and intubation | 97.00±0.68  | 96.90±0.83  | 96.77±0.92  | 97.06±0.77  | 0.518   |
| 1 min after laryngoscopy and intubation | 96.97±1.17  | 97.65±0.79  | 97.19±0.95  | 97.32±0.75  | 0.134   |
| 10 min after laryngoscopy and intubation | 97.81±0.83  | 97.42±2.26  | 96.90±3.65  | 97.61±0.76  | 0.419   |
| 15 min after laryngoscopy and intubation | 97.32±0.79  | 97.39±1.05  | 97.84±0.69  | 97.44±1.40  | 0.326   |
| 25 min after laryngoscopy and intubation | 97.00±2.37  | 97.61±0.84  | 97.29±1.24  | 96.90±3.61  | 0.612   |

Note: Data were expressed as the mean ± SD, and analyzed by one-way analysis of variance followed by Tukey post hoc test. NS: Normal saline; DEX: dexmedetomidine; REM: remifentanil; min: minute(s).
ing trend in HR ($P < 0.05$; Figure 3).

Given the results, no significant differences were seen in SaO$_2$ among different groups in measured minutes ($P > 0.05$; Table 4). In addition, the overall trend of SaO$_2$ in all study groups was increasing and significant ($P < 0.05$; Figure 4).

**DISCUSSION**

The present study aims to compare the efficacy of DEX and REM on the hemodynamic response to laryngoscopy and intubation. Among four groups of NS, DEX and REM and DEX/REM mixture in the study, no significant difference was found in mean arterial pressure, mean heart rate and SaO$_2$ on arrival to the operating room, before and after laryngoscopy and intubation ($P > 0.05$). Immediately, 1, 5, 10, and 15 minutes after laryngoscopy and intubation ($P = 0.001$), this difference was found statistically in the groups. BP: The highest in the NS group vs. the lowest in the DEX-REM group; significant differences were also found in HR among the groups ($P = 0.001$); the highest in the NS group, while the lowest BP was observed in DEX group immediately, 1 and 5 minutes after laryngoscopy and intubation, vs. that in REM group at 10 and 15 minutes. Given the results, no significant difference was found in SaO$_2$ among all groups at the measured times ($P > 0.05$). Our results showed the lowest BP in the DEX-REM group and the lowest HR in the DEX group, respectively, immediately, 1, and 5 minutes after laryngoscopy and intubation, and same HR in the REM group at 10 and 15 minutes. In all intervention groups, the drugs, though, reduced HR, as compared with the NS group, no significant difference was found among them.

Aimed at comparing the effects of fentanyl and REM on hemodynamic response to endotracheal intubation and myocardial ischemia in elderly patients (> 65 years, 65 cases) with etomidate induction, a study was finally concluded that the REM group (vs. the control and fentanyl groups) showed a significant increase in all hemodynamic variables, after intubation, possibly due to the anesthetics used and the elderly were targeted in their study. However, our REM group patients had lower HR and BP, as compared with the NS group. Lee et al.7 aimed to compare the efficacy of DEX and REM to blunt hemodynamic response to laryngoscopy and TI, orotracheal intubation conducted a study on hemodynamic responses after orotracheal intubation in three groups of 30 patients, including normal saline-treated as control group, DEX, and REM groups. Another study by Moshiri et al.17 showed that the reduction of heart rate in dexmedetomidine group was lower than Propofol. Moreover, hemodynamic responses were same in electroconvulsive therapy in another study.16

Finally, the systolic and diastolic BPs were clearly less in patients in two recent groups than those in the NS group, while HR was higher in the DEX and REM groups than that in the NS group.7 In the present study, BP was lower in the intervention groups than in the NS group, while the least in the DEX-REM group. Three intervention groups showed lower HR than the NS group, which is not consistent with the by Lee et al.’s study.7 A study by Mireskandari et al.22 aimed to compare the effects of fentanyl, sufentanil, alfentanil, and REM on cardiovascular reactions to TI in children (1–6 years, 80 cases) undergoing elective surgery under general anesthesia, showed no significant difference in mean arterial pressure, systolic and diastolic BPs, and HR among the groups,22 whose results are not consistent with ours, which the intervention groups had lower BP than the NS group, while the least in the DEX-REM group and had lower HR than the NS group. The different results can be attributed to different target groups: children in their trial vs. adults in ours.

Moreover, Yarkan et al.11 aimed to evaluate the effects of DEX on hemodynamic response to TI in hypertensive patients (19–70 years, 60 cases in three groups) by comparing esmolol vs. sufentanil, eventually concluded that the administration of DEX before anesthesia induction can blunt the response in hypertensive patients. Unlike the NS group, DEX in our study reduced HR and BP. The Menda et al.’s double-blind trial12 on 30 patients in two groups receiving placebo and DEX showed that DEX can be useful to attenuate the response in CABG patients receiving beta-blockade, whose results were consistent with ours in which DEX was associated with a decrease in BP and HR, as compared with the NS group. Another study13 assessed the DEX effect on hemodynamic response during tracheal intubation in 50 patients undergoing elective surgery and showed that the need for thiopental and sevoflurane was decreased by 39% and 92%, respectively, during intubation and surgery in DEX group compared to placebo.13 The results of this study about the efficacy of hemodynamic parameters were consistent with ours.

Our results showed the lowest BP in the group receiving DEX/REM mixture, and the lowest HR was observed in the DEX group immediately, 1 and 5 minutes, and in the REM group at 10 and 15 minutes after laryngoscopy and intubation, while the administered drugs lowered HR in the three groups than in the NS group. Given our results, the administration of DEX and fentanyl and their mixture based on our dose regimen may well not only prevent HBP resulting from stimulation during laryngoscopy and TI but can also relatively reduce it. It was found that this goal could be better achieved using a mixture of REM and DEX, thereby, the mixture is recommended to prevent HBP, if been considered. Given our results, the intervention drugs, whether used individually or in combination, are recommended to control HR during laryngoscopy and TI, and the choice of appropriate drugs depends on the patient's condition and the anesthesiologist's preference.

Acknowledgment

We would like to thank all the people who participated in this study, the Research and Technology of Arak University of Medical Sciences, and the Clinical Research Development Center of Valiasr Hospital, Arak.

Author contributions

HM performed the conception or designed the interpretation of data for the work; and revised the final approval of the article. BY performed the conception or designed the work and revised the final approval of the article. EM performed the acquisition and analyzed the data for the work and drafted the article. AM performed the conception or designed the work analysis, or interpreted the data for the work; and revised the final approval of the article. SA collected the data, analyzed the data for the work and drafted the article. All authors approved the final version of the manuscript for publication.

Conflicts of interest

There is no conflict of interest.

Financial support

The study was supported by a grant from Arak University of Medical Sciences.
Sciences, Arak, Iran.

Institutional review board statement
The work is part of a thesis in General Medicine, with the Code of Ethics: IR.ARAKMU.REC.1394.274 and the clinical trial code number: IREC2016092722254N1 in Iranian Registry Clinical Center.

Declaration of patient consent
The authors certify that they have obtained patient consent forms. In the form, patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Reporting statement
This study follows the Consolidated Standards of Reporting Trials (CONSORT) guidelines.

Biostatistics statement
The statistical methods of this study were reviewed by the biostatistician of the Arak University of Medical Sciences, Arak, Iran.

Copyright license agreement
The Copyright License Agreement has been signed by all authors before publication.

Data sharing statement
Datasets analyzed during the current study are available from the corresponding author on reasonable request.

Plagiarism check
Checked twice by iThenticate.

Peer review
Externally peer reviewed. Open access statement
This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

REFERENCES
1. Jarineshin H, Kashani S, Vatankhah M, Abdolzadeh A. Better hemodynamic profile of laryngeal mask airway insertion compared to laryngoscopy and tracheal intubation. Iran Red Crescent Med J. 2015;17:28615.
2. Mensure Y, Taşdöğenb A, Olgunerb C, Korkmazb H, Ögünb E. The effect of different doses of esmolol on hemodynamic, bispectral index and movement response during orotracheal intubation: prospective, randomized, double-blind study. Rev Bras Anestesiol. 2014;64:425-432.
3. Figueredo E, Garcia-Fuentes E. Assessment of the efficacy of esmolol on the haemodynamic changes induced by laryngoscopy and tracheal intubation: a meta-analysis. Acta Anaesthesiol Scand. 2001;45:1011-1022.
4. Yu SK, Tait G, Karkoti K, Wijesundera D, McCluskey S, Beatie WS. The safety of perioperative esmolol: a systematic review and meta-analysis of randomized controlled trials. Anesth Analg. 2011;112:267-281.
5. Kobelt P, Burke K, Renker P. Evaluation of a standardized sedation assessment for opioid administration in the post anesthesia care unit. Pain Manag Nurs. 2014;15:672-681.
6. Costi D, Cyna AM, Ahmed S, et al. Effects of sevoflurane versus other general anaesthesia on emergence agitation in children. Cochrane Database Syst Rev. 2014:CD007084.
7. Lee J, Kim H, Kim M, Cho K. Comparison of dexmedetomidine and remifentanil for attenuation of hemodynamic responses to laryngoscopy and tracheal intubationhemodynamic responses to laryngoscopy and tracheal intubation. Anesth Analg Korean J. 2012;63:124-129.
8. Munro H, Tirotta C, Felix D. Initial experience with dexmedetomidine for diagnostic and interventional cardiac catheterization in children. Paediatr Anaeus. 2007;17:109-112.
9. Nichols D, Berkenbosch J, Tobias J. Rescue sedation with dexmedetomidine for diagnostic imaging: a preliminary report. Paediatr Anaeus. 2005;15:199-203.
10. Mäleč J, F M, Hess L, Kurzová A, Ocadlík M, Votava M. A combination of dexmedetomidine with ketamine and opioids results in significant inhibition of hemodynamic changes associated with laparoscopic cholecystectomy and in prolongation of postoperative recovery. Rozhl Chir. 2010;99:106-110.
11. Uysal HY, Tezer E, Türköğlu M, Aspanargun P, Başar H. The effects of dexmedetomidine on hemodynamic responses to tracheal intubation in hypertensive patients: A comparison with esmolol and sufentanyl. J Res Med Sci. 2012;17:22-31.
12. Menda F, Köner O, Sayın M, Tür H,IMER P, Aykaç B. Dexmedetomidine as an adjunct to anesthetic induction for esmolol on the hemodynamic response to endotracheal intubation in patients undergoing fast-track CABG. Ann Card Anaesth. 2010;13:16-21.
13. Tavlan A, Tuncer S, Reisi R, Yousunkaya A, Otelcioglu S. Effect of dexmedetomidine on haemodynamic responses to laryngoscopy and intubation: perioperative haemodynamics and anaesthetic requirements. Drugs R D. 2006;7:43-52.
14. Kunisawa T, Nagata O, Nagashima M, et al. Dexmedetomidine suppresses the decrease in blood pressure during anesthetic induction and blunts the cardiovascular response to tracheal intubation. J Clini Anesth. 2009;21:194-199.
15. Wei L, Deng X, Sui J, Wang L, Liu J. Dexmedetomidine improves intubating conditions without muscle relaxants in children after induction with propofol and remifentanil. Anesth Analg. 2015;121:785-790.
16. Moshibi E, Modir H, Bagheri N, Mohammadbeigi A, Jamilian H, Eshrat B. Premedication effect of dexmedetomidine and alfentanil on seizure time, recovery duration, and hemodynamic responses in electroconvulsive therapy. Ann Card Anaesth. 2016;19:263-268.
17. Moshibi E, Modir H, Yazdi B, Susanabadi A, Salehjafari N. Comparison of the effects of propofol and dexmedetomidine on controlled hypotension and bleeding during endoscopic sinus surgery. Ann TropMed Public Health. 2017;10:721.
18. Modir H, Yazdi B, Talebi H, Erargh MG, Behrouzi A, Modir A. Analgesic effects of ketorolac/lidocaine compared to dexmedetomidine/lidocaine in intravenous regional anesthesia. Ann TropMed Public Health. 2017;10:715.
19. Mupparapu M, Singer SR. The American Society of Anesthesiologists (ASA) physical status classification system and its utilization for dental patient evaluation. Quintessence Int. 2018;49:255-256.
20. Piepho T, Cavus E, Noppens R, et al. SI guidelines on airway management. Anesthesiol. 2018;144:27-40.
21. Ko B, Oh J, Lee J, Choi S, Lee S, Chung C. Comparison of effects of fentanyl and remifentanil on hemodynamic response to endo- tracheal intubation and myoclonus in elderly patients with etomidate induction. Korean J Anesthesiol. 2013;64:8-12.
22. Mireskandari S, Abulahrar N, Darabi M, Rahimi I, Haji-Mohamadi F, Movafegh A. Comparison of the effect of fentanyl, sufentanil, alfentanil and remifentanil on cardiovascular response to tracheal intubation in children. Iran J Pediatr. 2011;2:173-180.

Received: 2018-05-30
Accepted: 2018-08-03

C-Editor: Yang LJ, Zhao M; S-Editor: Yu J; L-Editor: Wang L; T-Editor: Jia Y