Dıfferent Doses Of Dexmedetomidine On Controllıng Haemodynamıc Responses To Tracheal Intubatıon

A Sa??ro?lu, M Celik, Z Orhon, S Yüzer, B Sen

Citation

A Sa??ro?lu, M Celik, Z Orhon, S Yüzer, B Sen. *Dıfferent Doses Of Dexmedetomidine On Controllıng Haemodynamıc Responses To Tracheal Intubatıon*. The Internet Journal of Anesthesiology. 2009 Volume 27 Number 2.

Abstract

Study ObjectiveTo compare the clinical effects of two different doses of dexmedetomidine on haemodynamic responses to tracheal intubation and quality of intubation.DesignDouble-blinded, randomized study.SettingOperating room.Patients60 ASA physical status I and II patients scheduled for elective gynecologic surgery.InterventionsGroup I patients received 1.0 μg.kg^{-1} in 10 min and group II patients received 0.5 μg.kg^{-1} dexmedetomidine in 5 min respectively. 90 sec after infusion, thiopental sodium 5 μg.kg^{-1} and vecuronium bromide 0.1 μg.kg^{-1} were administered for induction. Intubation was performed after 90 sec.MeasurementsMeasurements of systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) and O_2 saturation (SpO2) were performed at baseline (t) 60 sec after dexmedetomidine infusion (t_1), 60 sec after induction (t_2), 60 sec after intubation (t_3), 5 min after intubation (t_4). Quality of intubation was assessed according to Modified McNeil Scoring System.Main ResultsSBP, DBP, MAP values were significantly lower at t_3 period in group I than group II ($p<0.05$, $p<0.01$). HR values were comparable in the two groups ($p>0.05$). SpO_2 values were significantly lower at t_1 period in group I than in group II ($p<0.05$). There was no difference between the groups with respect to the quality scores of tracheal intubation, position of the vocal cords, jaw relaxation and movement of the limbs.SBP, DBP, MAP values were significantly lower at t_3 period in group I than group II ($p<0.05$, $p<0.01$). HR values were comparable in the two groups ($p>0.05$). SpO_2 values were significantly lower at t_1 period in group I than in group II ($p<0.05$). There was no difference between the groups with respect to the quality scores of tracheal intubation, position of the vocal cords, jaw relaxation and movement of the limbs.ConclusionDexmedetomidine 1 μg.kg^{-1} was found more effective than dexmedetomidine 0.5 μg.kg^{-1} in controlling haemodynamic responses to tracheal intubation.

INTRODUCTION

The pressor response to tracheal intubation resulting in tachycardia and hypertension, is well described as plasma concentrations of catecholamine are increased and may be associated with myocardial ischaemia [1,2,3]. Haemodynamic responses may be attenuated by several methods, including administration of iv opioids, vasodilators, β blockers or by deepening anesthesia.

Benzodiazepines, opiates, barbiturates, histamine and α adrenoceptor antagonists as well as anticholinergic agents, have traditionally been used as preoperative medication to eliminate or to suppress the stress reaction to anesthesia and surgery. It has become evident that, α_2 adrenoceptor agonists may also be a useful class of drugs in conjunction with anesthesia [2]. They simultaneously potentiate the effects of general anesthetic agents, reduce their dose requirements and attenuate sympathoadrenal responses to noxious stimuli encountered during anesthesia and surgery, thus providing improved haemodynamic, metabolic and hormonal stability [3].

Dexmedetomidine is a highly selective and potent α_2 adrenoceptor agonist. It is a pure α_2 adrenoceptor agonist in some pharmacological models in which clonidine has shown only partial agonistic activity.

The aim of the present study was to investigate the effects of two different doses of dexmedetomidine infusion on controlling haemodynamic response to tracheal intubation and the quality of intubation.

MATERIALS AND METHODS

After obtaining approval from the Ethics Committee and written informed consent, we studied 60 ASA I or II patients aged 18-60 years undergoing elective gynecologic surgery. Patients whose physical characteristics suggested difficulties in intubation and those who had a previously documented failed intubation and the patients who had hypertension or

cardiovascular disease and taking any medication were excluded. The patients were allocated randomly (balanced randomisation using a computer program, block size 10) to receive either dexmedetomidine infusion 1 μg.kg^{-1} (n:30) in group I in ten minutes or 0,5 μg.kg^{-1} (n:30) in group II in five minutes before induction of anesthesia (Lifecare 5000, Abbott, North Chicago, USA). The study was conducted in a double-blind fashion. Baseline measurements of arterial blood pressure, heart rate and O_2 saturation were performed in the operating room.

After arrival of the patients to the operating room, ECG and heart rate (Petaş KMA 100 monitor) were monitored continuously and non- invasive recordings of systolic, diastolic and mean arterial pressure at 5 min intervals were started with an automated oscillometric device. A vein in the dorsum of the left hand was cannulated for iv infusion (10 ml.kg^{-1} 0,9% NaCl) and administration of drugs.

During the infusion of dexmedetomidine, patients were preoxygenated with 100% oxygen via a face mask (oxygen flow 6 lt.min^{-1}). 90 secondes after the infusion, thiopentane 5 mg.kg^{-1} was given. Vecuronium 0,1 mg.kg^{-1} was administered to produce neuromuscular block. Then the patient's lungs were ventilated manually with 100% oxygen. 90 sec after vecuronium, laryngoscopy was attempted by the anesthetist. The anesthetist performing intubation assessed each patient for four variables: face mask ventilation, jaw relaxation, poısition of the vocal cords, reflex movement to tracheal intubation. The criteria used for ranking these variables were evaluated with the scoring system described by McNeil [(4)].

Anaesthesia was maintained with Sevoflurane 1% and N_2O-O_2 (66-34%). Measurements of SBP, DBP, MAP, HR and SpO_2 were performed 60 sec after dexmedetomidine infusion (t_1), 60 sec after induction (t_2), 60 sec after intubation (t_3) and 5 min after intubation (t_4). Hypotension (reduction in arterial pressure of 30% or more from the baseline) was treated primarily by increasing the i.v. infusion rate , and then reducing sevoflurane concentration or with 10 mg bolus dose of efedrine. Bradycardia (definied as heart rate less than 45 beat.min^{-1}) was treated with 0.5 mg bolus dose of atropine.

Statictical evaluation was performed using GraphPad Prisma v.3 packed programme. Data were analysed with Newman Keuls test, chi-square test, student's t test as appropriate. $p<0,05$ was considered statistically significant. The results were presented as means and SD.

RESULTS

The two groups were comparable in patient characteristics (Table 1). SAP, DAP, MAP were significantly lower in group I at t_3 ($p<0,05$, $p<0,01$) (Table 2). The two groups were comparable in heart rates ($p>0,05$), SpO_2 levels in group I at t_1 were significantly lower than group II ($p<0,05$) (Table 3). The two groups were also comparable in reflex movement to intubation, jaw relaxation, position of the vocal cords and the total quality scores of tracheal intubation ($p>0,05$).

In group I, SBP, DBP, MAP levels at t were significantly higher than t_2 and t_4, and significantly lower than t_3 period (Table 2). HR levels at t were significantly higher than all the other periods, SpO_2 levels at t were significantly lower than t_1, t_2, t_3, t_4 ($p<0,05$, $p<0,01$, $p<0,001$) (Table 3).

In group II, SBP, DBP, MAP levels at t were significantly higher than t_2 and t_4 and significantly lower than t_3 (Table 2). HR levels at t were significantly higher than t_1, t_2, t_3 and t_4, SpO_2 levels at t were significantly lower than t_1, t_2, t_3 and t_4 ($p<0,005$, $p<0,01$, $p<0,001$) (Table 3).

No patient required efedrine or atropine. Any side effect wasn't seen due to the infusion of dexmedetomidine.

Figure 1

Table 1: Patient characteristics

		Groups I (n=30)	Groups II (n=30)
Age (year)		40.53±9.12	41.1±9.22
Weight (kg)		68.67±13.72	69±9.87
ASA	I	30 (%100.0)	30 (%100.0)
	II	0 (%0.0)	0 (%0.0)
Mallampati	I	22 (%73.3)	21 (%70.0)
	II	8 (%26.7)	9 (%30.0)

*p<0.05

Figure 2

Table 2: SBP, DBP and MAP levels of the patients

	SBP (mmHg)		DBP (mmHg)		MAP (mmHg)	
	Group I	Group II	Group I	GroupII	Group I	Group II
t_0	137.2±15.95	138.27±13.37	75.97±9.59	78,77±6,69	99.8±9.69	101.13±9.36
t_1	129.3±15.87	133.37±14.16	74.13±9.25	76,4±6,35	94.6±9.69	98.13±8.16
t_2	122.23±16.93++	122.27±15.47++	75.77±11.11	74.53±10.63	92.9±12.46+	92.57±11.29++
t_3	148.7±20.74*++	160.1±16.85+++	90,4±12,36*+++	97.03±11.17+++	111.97±14.27*+++	120.8±10.86+++
t_4	118.57±16.75+++	124.63±15.17+++	73,2±11,24	78.4±11.42	91.83±11.95++	96.6±11.04+

*p<0.05; between groups

**p<0,01; between groups

+p<0,05; compared to t_0

++p<0.01; compared to t_0

+++ p<0.001; compared to t_0

Figure 3

Table 3: HR and SpO levels of the patients

	HR		SpO_2 (%)	
	Grup I	Grup II	Grup I	Grup II
t_0	95.23±12.28	91±10.9	98.03±1.07	97.93±0.91
t_1	72.7±13.77+++	73.43±13.33+++	98.9±1.06*+++	99.37±0.61+++
t_2	73.63±7.45+++	72.2±8.95+++	99.77±0.43+++	99.73±0.45+++
t_3	86.27±9.71++	85.53±9.86++	99.77±0.43+++	99.67±0.48+++
t_4	77.83±9.13+++	75.23±10.39+++	99.37±0.56+++	99.4±0.56+++

*p<0,05; between groups

++p<0.01; compared to t_0

+++ p<0.001; compared to t_0

DISCUSSION

The β_2 receptors are involved in regulating the autonomic and cardiovascular systems. β_2 receptors are located on blood vessels, where they mediate vasoconstriction, and on sympathetic terminals where they inhibit norepinephrine release. β_2 receptors are also located within the central nervous system and their activation leads to sedation, a reduction of tonic levels of sympathetic outflow and an augmentation of cardiac-vagal activity. This can result in a decrease in heart rate and cardiac output. The use of β_2 agonists in the perioperative period has been associated with reduced anesthetic requirements and attenuated heart rate and blood pressure responses to stressfull events. In addition, β_2 receptors within the spinal cord modulate pain pathways, thereby providing some degree of analgesia [5,6,7].

It was observed that dexmedetomidine used in premedication supresses the sympathetic activation which is due to the endotracheal intubation [8]. Güler et al. found that the increase in blood pressure and heart rate during the extubation is decreased and the quality of extubation is increased by dexmedetomidine [9].

It was found in the study by Jaakola et al. that , during the intubation blood pressure and heart rate is significantly reduced by 0.6 $\mu g.kg^{-1}$ dexmedetomidine [10]. In Scheinin's study these parameters were also reduced by equal doses of dexmedetomidine [11]. In the other study which was done by Tezer et al. it is concluded that sympathetic responses during laryngoscopy and intubation were effectively reduced by dexmedetomidine 1 $\mu g.kg^{-1}h^{-1}$ and esmolol 250 $\mu g.kg^{-1}min^{-1}$ [12]. Khan et al. demonstrated that heart rate, sistolic and diastolic blood pressure were reduced by dexmedetomidine [13]. In another study on the patients undergoing vascular surgery , it was observed that in the recovery period dexmedetomidine infusion led to supression on heart rate and plazma cathecholamine levels [14].

In this study dexmedetomidine 1 $\mu g.kg^{-1}$ and 0.5 $\mu g.kg^{-1}$ SAP, DAP, MAP and HR levels were significantly lower at 60 sec after induction and 5 min after intubation than baseline levels. But these levels were significantly higher 60 sec after tracheal intubation. It was found that dexmedetomidine 1 $\mu g.kg^{-1}$ is effective to suppress haemodynamic responses to tracheal intubation but dexmedetomidine 0.5 $\mu g.kg^{-1}$ hasn't the same effect.

In some studies it is observed that mean arterial pressure was decreased by low doses of dexmedetomidine (0.25-1 $\mu g.kg^{-1}$) and mean arterial pressure was increased transiently and heart rate was decreased significantly by high doses of (1-4 $\mu g.kg^{-1}$) dexmedetomidine [6,7]. Scheinin et al reported that the use of β_2 agonist leads to bradycardia [11]. Belleville et al found that dexmedetomidine which is given in two minutes the doses of 1-2 $\mu g.kg^{-1}$ causes irregular ventilation and apnea episodes [15]. Ebert et al. didn't observe any apnea, airway obstruction and hypoxemia with bolus doses of dexmedetomidine in their study and they reported that depression of respiration may be seen due to deep sedation, for the reason that β_2 adrenergic agonists don't have active role on the respiration center [7].

In another study in which the infusion of opioid and β_2 adrenergic agonists were compared, it was concluded that dexmedetomidine doesn't cause significant respiratuar depression and it decreases the risk of apnea [16]. Hofer et al reported that dexmedetomidine seems to be a good choice in

the critical patients in whom ventilation can be depressed with narcotics [17].

In the study which was done by Bekker et al patients in the dexmedetomidine group received an initial loading dose of 1 μg.kg^{-1} of dexmedetomidine over ten min, followed by a continuous infusion of 0.5 μg.kg^{-}1.h^{-1}. They determined that intraoperative dexmedetomidine infusion was effective for blunting the increases in SBP perioperatively and it did not increase the incidence of hypotension or bradycardia [18].

In this study any hypotension or bradycardia, were seen and any medical intervention, was required. Also significant respiratory depression, apnea, muscle rigidity or decrease in SpO_2 were seen in any patient.

In assessing the quality of intubation, there was no difference between the groups in means of jaw relaxation, position of the vocal cords, reflex movement to intubation and total score of intubation quality.

In summary, these results suggest that to controll haemodynamic responses to tracheal intubation, dexmedetomidine 1 μg.kg^{-1} is more effective than dexmedetomidine 0.5 μg.kg^{-1} without any side effect.

References

1. Shibman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth 1987; 59(3):295-299.
2. Longnecker DE. Alpine anesthesia: can pretreatment with clonidine decrease the peks and valleys? Anesthesiology 1987: 67(1):1-2.
3. Bloor BC. Clonidine and other alpha2-adrenergic agonists: an important new drug class for the perioperative period. Semin Anesth 1988; 68:170-7.
4. McNeil IA, Culbert B, Russell I. Comparison of intubating conditions following propofol and succinylcoline with propofol and remifentanil 2 micrograms kg-1 or 4 micrograms kg-1. Br J Anaesth 2000; 85:623-625.
5. Aantaa RE, Kanto JH, Scheinin M, Kallio AMI, Scheinin H. Dexmedetomidine premedication for minor gynecological surgery. Anesth Analg 1990; 70:407-13.
6. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous Dexmedetomidine in humans. II. Hemodynamic changes. Anesthesiology 1992; 77:1134-42.
7. Ebert T, Hall JE, Barney JA, Uhrich TD, Colinco MD. The effects of increasing plasma concentrations of dexmedetomidine in humans. Anesthesiology 2000; 93:382--394.
8. Erkola O, Korttila K, Aho M. Comparison of intramuscular dexmedetomidine and midazolam premedication for elective abdominal hysterectomy. Anesth Analg 1994; 79:646-53.
9. Güler G, Akın A, Tosun Z, Eskitaşoğlu E, et al. During the extubation the effects of dexmedetomidine on cardiovascular changes and quality of extubation in the old patients undergoing cataract surgery. Turkish Journal of Anaesthesia 2005; 33:18-23
10. Jaakola ML, Ali-Melkkila T, Kanto J, Kallio A, Scheinin H, Scheinin M. Dexmedetomidine reduces intraocular pressure, intubation responses and anaesthetic requirements in patients undergoing ophthalmic surgery. Br J Anaesth 1992; 68:570-575.
11. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenel responses to tracheal intubation and reduces the need for thiopentone and peroperative fentanyl. Br J Anaesth 1992; 68:126-131.
12. Tezer E, Sarıcaoğlu F, Çelebi N, Aypar Ü. Comparison of esmolol and dexmedetomidine in induction of anesthesia about hemodynamic and anaesthetic requirements. Turkish Journal of Anesthesia 2005; 13(4):247-252.
13. 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. Br J Anaesth 1999; 83: 372-80.
14. Talke P, Chen R, Thomas B, et al. The hemodynamic and adrenergic effects of perioperative dexmedetomidine infusion after vascular surgery. Anesth Analg. 2000; 90(4): 834-9.
15. Belleville JP, Ward DS, Bloor BC, Maze M. Effects of intravenous Dexmedetomidine in humans. Anesthesiology 1992; 77:1125-33.
16. Cortinez LI, Hsu YW, Sum-Ping ST, et al. Dexmedetomidine pharmacodynamics: Part I: Crossover comparison of the respiratory effects of dexmedetomidine and remifentanil in healthy volunteers. Anesthesiology 2004; 101(5):1066-76.
17. Hofer RE, Sprung J, Sarr MG, Wedel DJ. Anesthesia for a patient with morbid obesity using dexmedetomidine without narcotics. Can J Anaesth 2005; 52(2):176-80.
18. Bekker A, Sturaitis M, Bloom M, et al. The effect of dexmedetomidine on perioperative hemodynamics in patients undergoing craniotomy. Anesth Analg. 2008; 107 (4): 1340-1347.

Author Information

A.Esra Sa??ro?lu, MD
Anesthesiology and Reanimation Department, Göztepe Training Hospital

Melek Celik, MD
Associate Prof, Anesthesiology and Reanimation Department, Göztepe Training Hospital

Zeynep Orhon, MD
Anesthesiology and Reanimation Department, Göztepe Training Hospital

Serdar Yüzer, MD
Anesthesiology and Reanimation Department, Göztepe Training Hospital

Betul Sen, MD
Anesthesiology and Reanimation Department, Göztepe Training Hospital