ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at: www.ijmacr.com

Volume – 5, Issue – 6, November – December - 2022, Page No. : 92 - 99

A comparative study of intravenous dexmedetomidine HCL and fentanyl citrate for attenuating the hemodynamic response to laryngoscopy and double-lumen endobronchial intubation

[1]Dr. Vidhi Solanki, MD Anaesthesia, Senior Resident, Department of Anaesthesia, GCRI, B.J. Medical College, Ahmedabad-380016

[2]Dr. Nita D. Gosai, MD Anaesthesia, Associate Professor, Department of Anaesthesia, GCRI, B.J. Medical College, Ahmedabad-380016

[3]Dr. Jayshree M. Thakkar, MD Anaesthesia, Professor and HOD, Department of Anaesthesia, GCRI, B.J. Medical College, Ahmedabad-380016

Corresponding Author: Dr. Vidhi Solanki, MD Anaesthesia, Senior Resident, Department of Anaesthesia, GCRI, B.J. Medical College, Ahmedabad-380016

How to citation this article: Dr. Vidhi Solanki, Dr. Nita D. Gosai, Dr. Jayshree M. Thakkar, "A comparative study of intravenous dexmedetomidine HCL and fentanyl citrate for attenuating the hemodynamic response to laryngoscopy and double-lumen endobronchial intubation", IJMACR- November – December - 2022, Vol – 5, Issue - 6, P. No. 92 – 99.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Introduction: In laryngoscopy during endotracheal or endobronchial intubation, sympathetic nerve system is stimulated to increase plasma catecholamines and induce complication such as tachycardia, hypertension, arrhythmias, which causes myocardial ischemia, left ventricle failure, cerebral edema, pulmonary edema, increase intracranial pressure, increase intraocular pressure. DLT (double lumen endobronchial tube) effectively provide lung separation and Some difference in response could exist between endobronchial and endotracheal intubation due to different length and thickness, DLT are more thicker and rigid than SLT, so it makes more difficult to insert. An assumption is supported by finding that differ in their magnitude at different site with airways, force applied during scopy and related circulatory response. Among Various systemic as well as topical agents have been used to reduce this untoward hemodynamic response during laryngoscopy, In our study, we compare the effects of intravenous dexmedetomidine HCL and intravenous fentanyl citrate on hemodynamic response during laryngoscopy and double lumen endobronchial intubation.

Material and methodology

50 patients aged between 18-60 years belonging to ASA grade I and II were randomly divided 2 group, Group F: 25 Patients, Group D: 25 Patients.

Results

Dexmedetomidine used as I.V. in dose of 1mcg/kg provides beneficial effect in attenuation of hemodynamic

response during laryngoscopy and endobronchial intubation as compare to I.V. Fentanyl in dose of 2mcg/ kg. No Side effects seen in both groups

Conclusion: It is concluded that injectable dexmedetomidine 1mcg/ kg provides better attenuation of hemodynamic response during laryngoscopy and endobronchial double lumen tube intubation as compare injectable Fentanyl in dose 2mcg/kg.

Keywords: Double Lumen Tube, Hemodynamic Response, Endobronchial Intubation, One Lung Ventilation.

Introduction

Direct Laryngoscopy and endotracheal intubation is intrinsic component of general anesthesia technique. In laryngoscopy during endotracheal or endobronchial intubation, sympathetic nerve system is stimulated to increase plasma catecholamines and induce complication such as tachycardia, hypertension, arrhythmias, which leads to myocardial ischemia, left ventricle failure, cerebral edema, pulmonary edema, increase intracranial pressure, increase intraocular pressure.[1,2,3,4] Among Lung isolation methods DLT (double lumen endo bronchial tube) effectively provide lung separation and facilitate changing from two to one lung ventilation. Some difference in response could exist between endobronchial and endotracheal intubation due to different length and thickness, DLT are thicker and rigid than SLT, so it makes more difficult to insert. An assumption is supported by finding that differs in their magnitude at different site with airways, force applied during scopy and related circulatory response. [5,6,7] Various systemic as well as topical agents have been used to reduce this untoward hemodynamic response during laryngoscopy. The commonest strategies adopted are narcotics, vasodilators, β blockers, calcium channel blockers, lignocaine, clonidine, esmolol and placebo in supporting stress response to laryngoscopy and intubation. In this study design to compare the effects of intravenous dexmedetomidine HCL and intravenous fentanyl citrate on hemodynamic response during Laryn go scopy and double lumen endobronchial intubation.

Material & method

After approval by the institutional Ethical Committee and written informed consent taken from all patients, Study was conducted on 50 Adults undergoing surgery under general anesthesia requiring double lumen endobronchial tube insertion were randomly selected and allocated into two groups. Inclusion criteria were ASA grade I and II patients, Age of 18-60 years of both sexes, Patients with modified Mallam Pati grade class I and II, Patients who required elective surgery under general anesthesia with lung isolation devices like double lumen endobronchial tube. Exclusion criteria were emergency surgery, Difficult airway or upper airway abnormality, patients with hypertension, IHD or pregnancy, renal dysfunction, H/O CVD, contraindication to study design, intubation time >30secs.

Group D Dexmedetomidine (n=25)

Group F Fentanyl (n=25)

Pre-operative evaluation

All the patients were examined preoperatively and the procedures explained and written informed consent was taken. Routine investigation was done. They kept NBM as per guidelines.

Premedication

All patients were given T. lorazepam HCL 1mg at bed time on the previous night of surgery.

Monitoring

All routine monitors were applied before induction. Heart rate, systolic & diastolic blood pressure were

noted. IV line was secured, Inj. glyco 0.004mg/kg, Inj. Ondansetron0.08mg/kg, Inj. RAntidine 1mg/kg

Induction

All patients were pre- oxygenated with 100% oxygen for 3minutes. Induction was done with Inj. Thiopentone sodium 5mg/kg IV and Inj. Succinylcholine chloride 2mg/kg IV. At 3min after induction, using laryngoscope intubation of appropriate size double lumen endobronchial tube (39Fr or 41 Fr for male & 35Fr or 37Fr for female) within 60second in all patients. HR, SBP, DBP, MAP and SPO2 were recorded. Confirmation of correct positioning of the DLT can be done by auscultation or with fiberoptic bronchoscopy. After confirms placement in the trachea after both cuffs are inflated to seal leaks. On clamping the endobronchial lumen limb connector, breath sounds should be absent from the corresponding side of the lung if the endobronchial lumen is in the correct bronchus. On clamping the endotracheal limb connector and ventilating through the endobronchial lumen, breath sounds should be absent from the opposite side of the chest.

Maintenance

50:50 oxygen and nitrogen oxide mixture, (0.8-1%) sevoflurane and Inj. Vecuronium bolus dose 0.08mg/kg followed by maintenance dose 0.01mg/kg.

Reversal was done with Inj. Neostigmine 0.05mg/kg +glycopyrolate 0.4mg.

Observation

HR, SBP, DBP, MAP and SPO2 were recorded at 1min, 3min, 5min, 7min and 10min after laryngoscopy and intubation. Incidence of bradycardia and hypotension were noted.

Statistic

Statistical analysis was carried out using the GraphPad prism 8 statistical software. Continuous data are represented as Mean±SD. Analysis between the groups was done using unpaired t-test was used. Probability was considered to be significant if less than 0.05 and highly significant if less than 0.0001.

Observation & Results

Table 1: demographic profile of both groups.

	Group F (Mean±SD)	Group D (Mean±SD)	P value
Age(yrs)	50.28±12.99	50.4±10.99	0.9713
Weight(kgs)	55.56±6.678	55.96±5.303	0.8156
Sex (male: female)	(19:6)	(13:11)	
ASA I: II	(17:8)	(20:5)	

p>0.05-not significant, p<0.05- significant, p<0.0001-highly significant

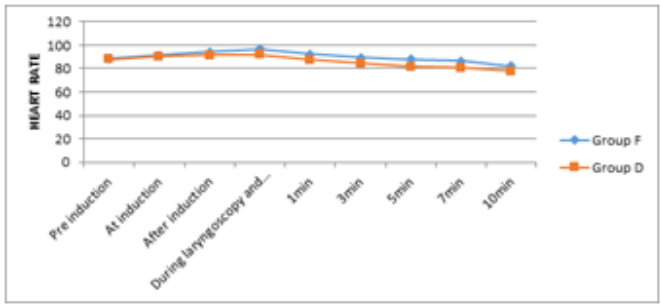
Age and weight of the all patients in both groups are comparable to each other and there is no statistical difference between them(p value >0.05)

Table 2: comparison of mean heart rate at different time interval between both groups

HR (bpm)	Group F	Group D	P value
Pre-induction	88.28±8.758	88.04±8.121	0.9204
At induction	91.73±9.018	90.32±8.275	0.5629
After induction	94.2±8.784	91.44±8.337	0.2602
During laryngoscopy and intubation	96.72±7.971	92.08±7.729	0.042
1min	92.12±7.276	87.24±6.936	0.019
3min	89.6±6.988	84.48±6.469	0.0099
5min	88.04±7.038	81.8±6.344	0.0019
7min	86.44±7.054	80.64±6.277	0.0035
10min	81.88±6.616	77.6±6.164	0.0221

p>0.05-not significant, p<0.05- significant, p<0.0001-highly significant

Graph 1: Change in mean heart rate



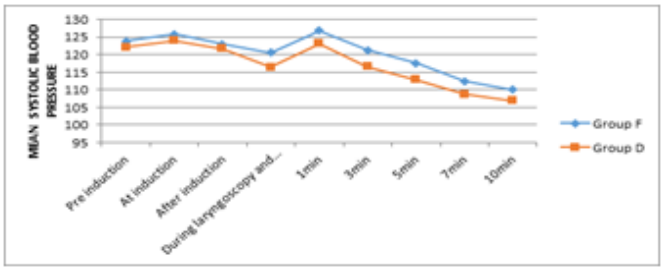
- The Heart rate was measured at pre-induction, at induction, after induction, during laryngoscopy and intubation, 1min, 3min, 5min, 7min, 10min after intubation(table-3).
- Heart rate response attenuation in all two group at the time of during laryngoscopy and intubation, 1min, 3min, 5min, 7min, 10min, but more significant in Group D as compare to Group F

Table 3: comparison of systolic blood pressure at different time interval between both groups.

SBP (mm hg)	Group F	Group D	P value
Pre-induction	123.9±6.861	122.2±6.193	0.368
At induction	125.9±7.02	124±6.649	0.3461
After induction	123±6.598	121.8±6.414	0.5457
During laryngoscopy and intubation	120.6±6.178	116.4±5.657	0.0166
1min	126.9±6.815	123.1±6.557	0.0502
3min	121.3±5.75	116.6±5.219	0.0041
5min	117.6±4.726	112.9±4.281	0.0006
7min	112.4±3.731	108.8±3.916	0.0017
10min	110±3.195	106.9±3.887	0.0029

p>0.05-not significant, p<0.05- significant, p<0.0001-highly significant

Graph 2: change in mean systolic blood pressure



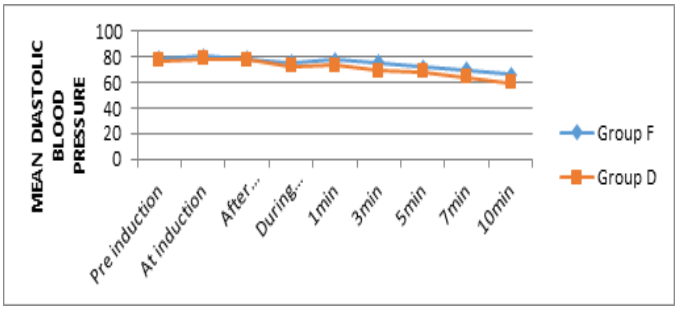
- The mean systolic blood pressure was measured at pre-induction, at induction, after induction, during laryngoscopy and intubation, 1min, 3min, 5min, 7min, 10min after intubation (table-4).
- SBP during pre-induction, at induction and after induction were comparable. There is no statistically significant difference. (p>0.05).
- In group D, SBP were less than group F at the time of laryngoscopy and intubation,1min,3 min, 5 min, 7 min and 10 min and is statistically significant (p <0.05)

Table 4: Comparison of dystolic blood pressure at different time interval between both groups.

DBP (mm hg)	Group F	Group D	P value
Pre-induction	78.48±6.239	77±4.796	0.3521
At induction	80.76±6.333	78.28±5.224	0.1377
After induction	78.64±5.353	77.48±5.133	0.438
During laryngoscopy and intubation	75.68±5.305	72.84±5.429	0.0675
1min	78±5.008	73.08±5.4	0.001
3min	75.44±5.15	69.28±5.842	0.0003
5min	72.16±6.169	68.56±5.067	0.0289
7min	69.48±5.716	63.56±5.163	0.0004
10min	65.96±6.295	60±5.017	0.0006

p>0.05-not significant, p<0.05- significant, p<0.0001-highly significant

Graph 3: change in mean diastolic blood pressure.



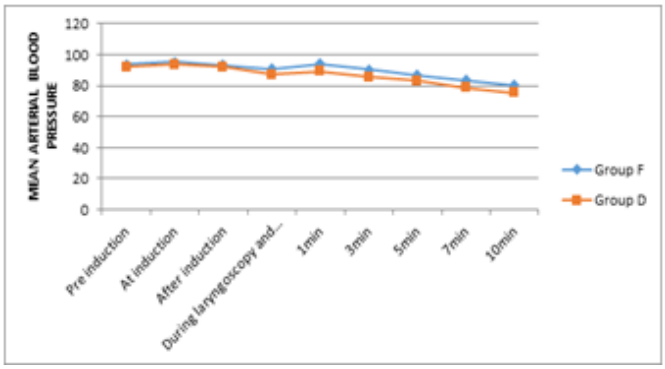
- The mean diastolic blood pressure was measured at pre-induction, at induction, after induction, during laryngoscopy and intubation, 1min, 3min, 5min, 7min, 10min after intubation(table-5).
- DBP during pre-induction, At induction and after induction were comparable. There is no statistically significant difference. (p>0.05).
- In group D, DBP were less than group F at 1min ,3 min, 5 min, 7 min and 10 min and is statistically significant (p <0.05)

Table 5: Comparison of mean arterial blood pressure at different time interval between both groups.

MAP (mm hg)	Group F	Group D	P value
Pre-induction	93.84±5.9	92.08±4.83	0.3336
At induction	95.48±5.269	93.48±5.051	0.177
After induction	93.24±5.198	92.08±5.098	0.4296
During laryngoscopy and intubation	90.8±5	87.24±4.884	0.014
1min	94.12±4.755	89.04±5.095	0.0007
3min	90.56±4.691	85.48±4.874	0.0005
5min	86.96±4.704	83.12±4.024	0.0033
7min	83.64±4.499	78.44±3.917	<0.0001
10min	80.16±4.432	75.44±4.083	0.0003

p>0.05-not significant, p<0.05- significant, p<0.0001-highly significant

Graph 4: change in mean arterial blood pressure.



- The mean arterial blood pressure was measured at pre-induction, at induction, after induction, during laryngoscopy and intubation, 1min, 3min, 5min, 7min, 10min after intubation(table-6).
- MAP during pre-induction, At induction and after induction were comparable. There is no statistically significant difference. (p>0.05)
- In group D, MAP were less than group F at 1min ,3 min, 5 min, 7 min ,10 min and is statistically significant (p <0.05).

Table 6: intra group comparison between group f and group d.

	Group d	Group f
Hypotension	NIL	NIL
Bradycardia	NIL	NIL
Arrythmia	NIL	NIL
Respiratory depression	NIL	NIL

- No incidence of complications in postoperative period in both Group D and Group F.

Time interval	Group F				Group D			
	HR	SBP	DBP	MAP	HR	SBP	DBP	MAP
At induction	<0.0001	<0.0001	<0.0001	0.0267	<0.0001	<0.0001	0.0079	0.0005
After induction	<0.0001	0.0131	0.8729	0.4039	<0.0001	0.1059	0.3374	>0.99
During laryngoscopy anyhd intubation	<0.0001	<0.0001	0.0063	0.0003	<0.0001	<0.0001	<0.0001	<0.0001
1min	<0.0001	<0.0001	0.6682	0.7095	0.1549	0.0479	<0.0001	<0.0001
3min	0.0483	<0.0001	0.0139	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
5min	0.7114	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
7min	0.0095	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
10min	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table 7: Types of complication.

Discussion

Laryngoscopy and Endobronchial intubation with DLT elicited a significant hemodynamic response & increase the plasma concentration of catecholamine following sympathoadrenal discharged caused by epipharyngeal and parapharyngeal stimulation that eventually results in increase in heart rate (20%), blood pressure (45-50%), myocardial oxygen demand, and ysarrhythmias. The magnitude of which may be greater when compared with standard endotracheal intubation. [10,11,12]. The main portion of the DLT is placed in the lower trachea approximately 1 to 2 cm above the carina, with the bronchial extension inserted far enough into one of the main bronchi. Because of the length and thickness of the tube and the associated carinal stimulation on placement, some differences in the responses could exist between endobronchial and endotracheal intubation. The assumption is supported by the findings that the cardiovascular responses to airway stimulation differ in their magnitude at different sites within the airways in human and that duration and forces applied during laryngoscopy are related to circulatory responses.[8]. In endotracheal intubation using a laryngoscope, the sympathetic nervous system is stimulated to increase the plasma catecholamine concentration and induce complications such as tachycardia, hypertension, and arrhythmia. These symptoms sometimes cause myocardial ischemia, left ventricular failure, or cerebral hemorrhage, increase intraocular pressure, coronary artery disease in high-risk patient. Cardiovascular instability may contribute to perioperative myocardial ischemia and cardiac morbidity in these patients. Thompson et al. [13] who studied 20 adult patients scheduled to undergo elective surgery requiring the routine use of a DLT, found that the increases in HR and SAP after endobronchial intubation were of similar magnitude and duration to the well-described responses to laryngoscopy and tracheal intubation, i.e., mean increases of 15−20 bpm and 30−40 mmHg, respectively, for approximately 5−6 min. To blunt this pressor response, various methods have been tried including, Deeper plane of anesthesia with intravenous or inhalation agent, Use of propofol, Curtailing the duration of laryngoscopy , Sympathetic blockage,

Lidocaine spray or gargles 3 minutes prior to intubation, Use of intravenous lidocaine to blunt the pressor response, Use of ACE inhibitors 45 minutes before intubation, Use of magnesium sulphate, Various antihypertensives and vasodilators e.g. IV hydralazine, ca^{+} channel blocker like nifedipine , beta blockers like Esmolol, Use of opioids prior to induction e.g. fentanyl, morphine , sufentanyl, alfentanil, Use of nitroglycerine, intravenous, sublingual spray ,intranasal , Use of gabapentin, Alpha 2 agonist like clonidine and dexmedetomidine. Dr Ramesh Kumar Khar war et al [14](2014) concluded the effect of dexmedetomidine and fentanyl for attenuation of haemodynamic responses during laryngoscopy and tracheal intubation and increase in pulse rate and mean arterial blood pressure was more in fentanyl group than in dexmedetomidine group.

Dr. Sagar Gandhi et al [9] (2014) compared the effectiveness of dexmedetomidine with fentanyl in attenuating the pressor response associated with laryngoscopy and endotracheal intubation in groups belonging to normotensive. ASA Grade I and II risk surgical patients. The study was carried out on 100 patients belonging to ASA Grade I and II, aged 15 to 65 years; including either gender, scheduled for elective surgical procedures under general anaesthesia. This study proved that dexmedetomidine when used as IV premedicant in dose of 0.6 mcg/kg provides beneficial effect in attenuation of pressor response to laryngoscopy and endotracheal intubation as compared to fentanyl in dose of 2 mcg/ kg. Nidhi D Patel et al[15](2015) observed that the increase in systolic blood pressure was highly significant in group-F who received fentanyl 2 mcg/ kg as compared to group-D who received dexmedetomidine during laryngoscopy and intubation at 1, 3, 5 and 10 mins. period after intubation (P <0.0001).

Studies suggest that perioperative use of dexmedetomidine may result in a decreased risk of adverse cardiac events, including myocardial ischemia.[16] α adrenoreceptors stimulation can beneficially modulate coronary blood flow during myocardial ischemia by preventing transmural redistribution of blood flow away from the ischemic endocardium by specific epicardial by specific epicardial vasoconstrictive effects leading to improvement in endocardial perfusion (the reverse steal effect) and by decreasing heart rate. This property along with haemodynamic stability and attenuation of intubation response makes dexmedetomidine an ideal an aesthetic adjuvant, particularly for patients undergoing coronary bypass grafting.[17]

Conclusion

Our study concluded that injectable dexmedetomidine 1mcg/kg provides better attenuation of hemodynamic response during laryngoscopy and endobronchial double lumen tube intubation as compare injectable Fentanyl in dose 2mcg/kg.

References

1. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987; 59 (3): 295 –9. [Pub Med: 3828177].

2. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. JC linAnesth. 1996; 8 (1): 63–79. [Pub Med: 8695083].

3. Edwards ND, Alford AM, Dobson PM, Peacock JE, Reilly CS. Myocardial ischemia during tracheal intubation and extubation. Br J Anaesth. 1994; 73 (4): 537 –9. [Pub Med: 7999498].

4. Fox EJ, Sklar GS, Hill CH, Villanueva R, King BD. Complications related to the pressor response to

endotracheal intubation. Anesthesiology. 1977; 47 (6): 524 –5. [Pub Med: 337858].

5. Hamaya Y, Dohi S: Differences in cardiovascular response to airway stimulation at different sites and blockade of the responses by lidocaine. Anesthesiology 2000; 93: 95-103.

6. Stoelting RK: Circulatory changes during direct laryngoscopy and tracheal intubation: Influence of duration of Laryn go scopy with or without prior lidocaine. Anesthesiology 1977; 47: 381-4.

7. Bucx MJ, van Geel RT, Scheck PA, Stijnen T: Cardiovascular effects of forces applied during laryngoscopy. The importance of tracheal intubation. Anaesthesia 1992; 47: 1029-33.

8. Kyung Yeon Yoo, Su Hyeon Park et al: Effects of Remifentanil and Alfentanil on Cardiovascular Responses to Laryn go scopy and Double-lumen Endo bronchial Intubation. Korean J Anesthesiol Vol. 52, No. 6, June, 2007; 52: S 14～20.

9. Sagar Gandhi et al. Comparison of dexme detomidine with fentanyl in attenuation of pressor response during laryngoscopy and intubation. Journal of pharmacy, vol 4, issue 2(Feb 2014)28-38.

10. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. Journal of clinical anaesthesiaology.1996 feb;8(1):63-79.

11. Kayhan Z et al. which is responsible for the haemodynamic response due to laryngoscopy and endotracheal intubation? Catecholamines, vasopressin or angiotensin? Eur J anaesthesia 2005 oct;22(10):780-5

12. Bruder N et al. Consequences and prevention methods of hemodynamic changes during laryngoscopy and intratracheal intubation. 1992;11(1):57-71

13. Thompson JP, West KJ, Hill AJ: The cardiovascular responses to double lumen endobronchial intubation and the effect of esmolol. Anaesthesia 1997; 52: 790-4.

14. Khar war RK, Kumar M, Tiwary PK, et al. A comparison of intravenous dexmedetomidine vs. inj. fentanyl for attenuation of hemodynamic responses during laryngoscopy and intubation after propofol induction. NJIRM 2014;5(3):71-75.

15. Patel ND, Patel JJ, Patel DD, et al. A study on comparison of intravenous dexmedetomidine with intravenous fentanyl for suppression of hemodynamic responses to laryngoscopy and endotracheal intubation during general anaesthesia. Nat J Med Res 2015;5(2):127-131.

16. Jaa kola ML, Ali-Melk Kila T, Kanto J, et al. Dexmedetomidine reduces intraocular pressure, intubation responses and an aesthetic requirement in patients undergoing ophthalmic surgery. Br J Anaesthesia 1992; 68 (6):570-575.

17. Talke P, Li J, Jain U, et al. Effects of perioperative dexmedetomidine infusion in patients undergoing vascular surgery. The Study of Perioperative Ischemia Research Group. Anesthesiology 1995;82(3):620-633.