 DOI: 10.18231/2394-4994.2017.0048

Efficacy of dexmedetomidine versus nitroglycerin for maintenance of hemodynamic variables during dental surgeries

Roopal Rambhai Garaniya[1,*], Vaishali Gautam[2]

[1]Resident Doctor, [2]Assistant Professor, BJ Medical College, Ahmedabad, Gujarat

***Corresponding Author:**
Email: roopalrgaraniya@gmail.com

Abstract

Aim: Is to find the effectiveness of dexmedetomidine versus nitroglycerin to provide hemodynamic stability during dental surgeries

Methods: Forty ASA I and II patients undergoing dental surgeries were randomly allocated into two groups of 20 each: Nitroglycerine (Group NTG) and Dexmedetomidine (Group DEX). Group NTG received infusion of nitroglycerine at a rate of 1-10 µg/kg/min & group DEX received infusion of dexmedetomidine at a rate of 0.2- 0.7 µg/kg/hr after a bolus dose of 1 µg/kg.

Results: There was better control of hemodynamic variables during intraoperative period in dexmedetomidine group in comparison to nitroglycerine group. There was significant difference in mean changes of heart rate and blood pressure from baseline value at all points of study between both the groups except just before the intubation when both the groups were comparable.

Conclusion: Dexmedetomidine was superior to nitroglycerin for maintenance of hemodynamic variables during dental surgeries.

Keywords: Dental surgeries, Dexmedetomidine, Hypotension, Hemodynamic changes, Nitroglycerin

Date of Acceptance: 19th December, 2016 **Date of Manuscript Receive:** 22nd August, 2016

Introduction

Control hemodynamics by reducing blood pressure in a graded manner is very useful during dental surgeries to improve visibility of surgical field. However, this measures carries high risk of complications, including cerebral damage, hypoxia and permanent neurological deficit. These responses may produce myocardial ischemia, infarct or arrhythmias in patients. The various interventions use to control blood pressure include volatile anesthetics, propofol, vasodilator drugs like nitroglycerine and sodium nitroprusside, calcium channel blockers, α blockers, β blockers like esmolol, alpha-2 agonists like dexmedetomidine and clonidine, lignocaine, magnesium sulfate, prostaglandins etc. Nitroglycerin is a vasodilator act by dilatation of blood vessels resulting in reduction in venous return.(1) Dexmedetomidine is effective in maintaining hemodynamic stability during intubation, during intraoperative period and during extubation without prolonging recovery which is due to its sympatholytic action.(2,3) Main objective of our study was to find out the efficacy of dexmedetomidine and nitroglycerine for maintenance of hemodynamic changes during dental surgeries.

Materials and Methods

After obtaining ethical committee clearance 40 patients were divided equally into two groups, group DEX and group NTG. Patients with systemic disease like cerebrovascular diseases, uncontrolled hypertension were excluded from the study. Informed written consent were taken from each patient. Baseline parameters were recorded. In test drug over 10 minutes Dexmedetomidine1µg/kg was given to group DEX in 100 ml of normal saline whereas group NTG receive plain 100 ml of normal saline. In Group- DEX, infusion was prepared by mixing 100 µg of dexmedetomidine to 49 ml of normal saline and infusion was started at 0.2-0.7 µg/kg/hr. In group NTG, infusion was prepared by mixing 25 mg of nitroglycerine to normal saline and maintenance infusion was started at 0.5-10 mcg/kg/min. Aim is to maintain all the hemodynamic variables within 20% of baseline value by titrating both the infusion rate. Premedication was done with Glycopyrrolate, Midazolam and Fentanyl (2 mcg/kg). After end of infusion induction was done with Propofol 2 mg/kg followed by Succinylcholine 1.5 mg/kg given before intubation. Hemodynamic measurements were recorded just after intubation and after that at 5 min, 10 min, 20 min, 30 min, 45 min, 60 min, 75 min and 90 min during intraoperative period. O_2, N_2O and Sevoflurane was used for maintenance of anaesthesia with muscle relaxation provided by subsequent doses of inj. vecuronium (0.01 mg/kg) after loading dose. Reversal was done with Glycopyrrolate and Neostigmine and hemodynamic parameters were recorded just after extubation and 5 min after extubation. Infusion was stopped 5 minutes after the patient was extubated. Bradycardia was taken as, heart rate below 50 beats/min; hypotension as fall in mean blood pressure below 20% of baseline values. Any incidence of bronchospasm, laryngospasm, postoperative vomiting or respiratory depression (Spo_2<

90%) were noted and managed according to standard protocols.

Statistical Analysis: All the data were entered on Excel sheet and analyzed statistically by using SPSS software. The difference between mean values of both the groups were analyzed by Student 't' test and all the qualitative values were presented in proportions. Chi square test was use to find the differences between the proportions. Significance level was taken as 95% and α – error was kept at 5% for all statistical analyses. P values <0.05 was considered as significant.

Results

Forty patients were included in our study and divided in to two groups of 20 each. Mean duration of surgery in group dexmedetomidine was 119 min with a standard deviation of 34 and in group nitroglycerine was 114 min with a standard deviation of 10 with p value of 0.54 which was not significant.

Table 1: Demographic variables

Criteria	Group DEX	Group NTG	P value
Mean age(years)	32.4	32.6	0.967
Mean weight(kg)	51.6	51	0.77
Sex ratio(M:F)	15:5	13:7	0.78

DEX –Dexmedetomidine NTG-Nitroglycerine

Table 2: Comparison of Mean change in Heart Rate ± S.D

HR	DEX		NTG		
	Mean	± SD	Mean	± SD	P value
Basal	85.35	14.2	92.6	9.3	0.0571
5Mins	80.1	13.8	92.7	8.6	0.001
10Mins	77.6	13.0	92.4	8.2	0.0001
At Induction	73.8	11.7	90.4	8.5	0.0001
At Intubation	73.9	10.3	90.4	9.6	0.0001
5Min	85.2	8.4	128.3	4.9	0.0001
10Min	82.5	8.9	125.1	6.6	0.0001
20Mins	80.8	8.3	116.8	8.2	0.0001
30Mins	76.4	9.1	110.7	8.0	0.0001
45Mins	75.4	8.4	99.7	8.5	0.0001
60Mins	72.0	7.5	98.9	6.6	0.0001
75Mins	72.6	7.0	99.1	7.1	0.0001
90Mins	72.4	5.4	100.7	6.2	0.0001
At Extubation	75.3	7.1	120.4	7.0	0.0001
5Mins After Extubation	74.7	6.4	106.4	5.1	0.0001

HR-Heart Rate, SD-Standard Deviation, DEX-Dexmedetomidine NTG-Nitroglycerine

Table 3: Comparison of Mean ± S.D. of Mean Blood Pressure

MBP	DEX		NTG		P value
	Mean	± SD	Mean	± SD	
Basal	92.05	3.517	88.65	4.815	0.4983
5Mins	92.20	3.915	88.95	5.010	0.5915
10Mins	87.95	4.084	89.00	5.331	0.4846
At Induction	81.55	5.652	91.10	4.962	0.0001
At Intubation	83.70	4.769	90.10	5.590	0.0001
5Min	92.15	5.224	100.45	5.155	0.0003
10Min	90.05	6.186	99.65	7.680	0.0001
20Mins	81.40	6.739	96.40	7.863	0.0001
30Mins	79.55	4.872	92.90	6.423	0.0001
45Mins	81.05	7.783	91.20	5.970	0.0001
60Mins	80.45	5.286	90.85	5.224	0.0001
75Mins	78.65	6.467	90.25	5.210	0.0001
90Mins	79.00	7.420	90.45	4.979	0.0001

At Extubation	86.55	5.753	93.35	5.274	0.0003
5Mins After Extubation	85.30	4.281	88.65	5.706	0.0406

MBP-Mean Blood Pressure, SD- Standard Deviation, DEX –Dexmedetomidine NTG-Nitroglycerine

Above tables shows the comparison of two groups with respect to mean change in heart rate and blood pressure from baseline value at various time intervals. P value between the two groups showed that there was significant difference in mean changes of heart rate and blood pressure from baseline value at all points of study except just before intubation when the groups were comparable.

Table 4: Incidence of adverse effect in both the group

Observation	DEX Group		NTG Group	
	Intra-operative	Post-operative	Intra-operative	Post – operative
Nausea	-	2(10%)	-	2(10%)
Vomiting	-	1(5%)	-	2(10%)
Hypotension	2(10%)	2(10%)	2(10%)	2(10%)
Bradycardia	1(5%)	1(5%)	0(0%)	0(0%)
Respiratory Depression	0(0%)	0(0%)	0(0%)	0(0%)
Laryngospasm	-	0(0%)	-	1(5%)
Bronchospasm	0(0%)	0(0%)	0(0%)	0(0%)

Above table shows that there was minimal incidence of nausea, vomiting, bradycardia, hypotension between both the groups. But results were not statistically significant.

Discussion

Lots of studies has been done till date to find out the most suitable drug which can be use to maintain stable hemodynamics during intraoperative period in various surgeries. Among them most popular drug now a days is alpha 2 agonist dexmedetomidine. In our study we conclude that dexmedetomidine was a better choice for hemodynamic control during dental surgeries in comparison to NTG. Durmus and Richa both demonstrate the efficacy of dexmedetomidine for hemodynamic control during faciomaxillary and ENT surgeries respectively.[4,5]

Demographic data, method of drug delivery were similar between both the groups in our study but there were noticeable changes in hemodynamic variables. Dexmedetomidine was found to be much more superior than nitroglycerine in inducing hypotension and maintaining hemodynamics during our study. Guven et al found that dexmedetomidine is a very good agent for maintaining hemodynamic stability and can be safely use as replacement of other drugs during intraoperative period.[6] Shams found that for surgeries which require controlled hypotension during intraoperative period dexmedetomidine is best choice as hypotensive agent.[7] M Guggiari used nitroglycerine to reduce blood pressure during brain surgeries and demonstrate its efficacy.[8]

The changes in mean pulse rates in both groups were significant ($p< 0.05$) which may be due to the fact that Dexmedetomidine is a alpha 2 receptor agonist and can causes bradycardia. Before induction mean arterial pressure in group DEX was 89.55+2.78 whereas in group NTG it was 88.65+4.815 mmHg ($p>0.05$). After 5 minute of intubation the mean MAP in group DEX was 92.15+5.09 and in group NTG was 100.45+5.15 mmHg which comes out to be significant ($P<0.05$) and remain significant throughout the surgery.

The incidence of hypotension, nausea, vomiting, respiratory depression and bronchospasm were not much different between the two groups. Suparto et al observed that there was no difference in incidence of hypotension in two groups when dexmedetomidine was compared with fentanyl.[9] Ferdi Menda et al bring out the similar conclusions in their study.[10] These finding were similar to findings of our study. In dexmedetomidine group one patient had one episode of bradycardia during intra-operative period and another one had one episode of bradycardia during postoperative period which was readily corrected with inj. atropine 0.6 mg IV in both the cases. No such cases were noted in nitroglycerin group. Similar to our study Suparto et al noted higher incidence of bradycardia in dexmedetomidine group in comparison to fentanyl.[9] Erkola et al had demonstrate that in dexmedetomidine group, number of patients suffering from bradycardia was significantly more than those pre-medicated with midazolam[11,12] while Jalonen et al in their study found that bradycardia was minimal with dexmedetomidine than in the control group.[13] So these studies has conflicting results. In our study additive effects of fentanyl and propofol may have contributed to bradycardia but since it occurred in one cases intra-operatively and one cases post-operatively, it may be an

incidental finding only. Tanskanen PE et al also reported increase in perioperative hemodynamic stability in patients receiving dexmedetomidine.[14] We had also observed that post-operative laryngospasm occur in a patient from nitroglycerine group but not in any patient in dexmedetomidine group as Turan G et al reported that dexmedetomidine was effective in attenuating airway reflex responses not only during intubation but also during tracheal extubation.[15] All these above mentioned facts suggest that dexmedetomidine was more effective than nitroglycerine in stabilizing the hemodynamics of patients during and after laryngoscopy and intubation in dental surgeries. Also dexmedetomidine provided intra-operative stability of hemodynamics without significant increase in incidence of side effects.

Conclusions

Use of dexmedetomidine in patients undergoing dental surgeries results in superior hemodynamics control as compared to nitroglycerine without increasing the incidence of adverse effects.

References

1. Rogers MC, Hamburger C, Owen K, *et al* (1979) Intracranial pressure in the cat during nitroglycerin-induced hypotension. Anesthesiology 51:227–229. [PubMed]
2. Dyck JB, Maze M, Haack C, Vuorilehto L, Shafer SL. The pharmacokinetics and hemodynamic effects of intravenous and intramuscular dexmedetomidine hydrochloride in adult human volunteers. Anesthesiology. 1993;78:813–20. [PubMed]
3. Adjuncts to anesthesia, In John F. Butterworth IV, David C. Mackey, John D. Wasnick, editors. Morgan And Mikhail's clinical anesthesiology, 5th ed, McGraw Hill (India) p 277-293
4. Durmus M, But AK, Dogan Z, Yucel A, Miman MC, Ersoy MO. Effect of Dexmedetomidine on bleeding during tympanoplasty or septorhinoplasty. Eur J Anaesthesiol. 2007;24:447–53. [PubMed]
5. Richa F, Yazigi A, Hage C. Dexmedetomidine an agent for controlled hypotension in maxilla fascial surgery. Eur J Anaesthesiol. 2004;21:A–242.
6. Guven DG, Demiraran Y, Sezen G, Kepek O, Iskender A. Evaluation of outcomes in patients given dexmedetomidine in functional endoscopic sinus surgery. Ann Otol Rhinol Laryngol. 2011;120:586–92.[PubMed]
7. Shams T, El Bahnasawe NS, Abu-Samra M, El-Masry R. Induced hypotension for functional endoscopic sinus surgery: A comparative study of dexmedetomidine versus esmolol. Saudi J Anaesth 2013;7:175-80. [PUBMED]
8. Guggiari M, Dagreou F, Lienhart A, Gallais S, Mottet P, Philippon J, et al. Use of nitroglycerin to produce controlled decreases in mean arterial pressure to less than 50 mm Hg. Br J Anaesth. 1985;57:142–7. [PubMed]
9. Suparto Suparto, Olivia C Flores, Clarissa Angela A Layusa: A Randomized Controlled Trial on the Effectiveness of Dexmedetomidine versus Fentanyl in Attenuating the Sympathetic Response to Direct Laryngoscopy and Endotracheal Intubation. Indonesia. digital journals, Volume: 60, Number:3,2010.
10. Menda F, Koner O, Sayin M, Ture 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. Ann Card Anaesth 2010;13:16-21. [PUBMED]
11. Aho M, Lehtinen AM, Erkola O, Kallio A, Korttila K. The effect of intravenously administered dexmedetomidine on perioperative hemodynamics and isoflurane requirements in patients undergoing abdominal hysterectomy. Anesthesiology. 1991;74:997–1002. [PubMed]
12. Aho M, Erkola O, Kallio A, Scheinin H, Korttila K. Dexmedetomidine infusion for maintenance of anesthesia in patients undergoing abdominal hysterectomy. Anesth Analg. 1992;75:940–6. [PubMed]
13. Jalonen J, Halkola L, Kuttila K, Perttilä J, Rajalin A, Savunen T, Scheinin M, Valtonen M. Effects of dexmedetomidine on coronary hemodynamics and myocardial oxygen balance. J Cardiothorac Vasc Anesth.1995;9:519–524. [PubMed]
14. 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. Br J Anaesth. 2006;97:658–65. [PubMed]
15. Turan G, Ozgultekin A, Turan C, Dincer E, Yuksel G. Advantageous effects of dexmedetomidine on haemodynamic and recovery responses during extubation for intracranial surgery. Eur J Anaesthesiol.2008;25:816–20. [PubMed]