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Original Research Article

Induced hypotension for functional endoscopic sinus surgery: comparison between dexmedetomidine and nitro-glycerine

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ABSTRACT

Background: Functional endoscopic sinus surgery (FESS) is a minimally invasive technique used to restore sinus ventilation and normal function by opening sinus air cells and ostia. FESS requires bloodless field, several techniques and drugs have been used in the past for achieving controlled hypotension such as nitroglycerine, esmolol, remifentanil, dexmedetomidine, isoflurane, propofol. Therefore, this study was conducted to compare between dexmedetomidine and nitroglycerine for controlled hypotension for FESS. Primary aim to compare quality of surgical field using average category scale and surgeon satisfaction and secondary aim to compare arterial pressure and heart rate changes between dexmedetomidine and nitroglycerine when used to induce hypotension.
Methods: This study was conducted in 40 consenting adult patients posted for FESS and were randomly divided into two groups, group D received dexmedetomidine 1 mcg/kg and group N received nitroglycerine 0.5 mcg/kg/min, both infusions started 10 min after induction. Parameters such as quality of surgical field by average category scale, heart rate and mean arterial pressure (MAP) recorded every 10 minutes.
Results: Dexmedetomidine and nitroglycerine both had comparable quality of surgical field. ACS grading of 1 or 2 were found among both the groups. Dexmedetomidine group had better mean arterial pressure at 10th, 20th, 30th, 40th, 50th, 60th and 70th min and heart rate at 10th, 20th, 30th, 40th, 50th, 60th and 70th min when compared to nitroglycerine group.
Conclusions: Dexmedetomidine and nitroglycerine both were found to be safe to use for controlled hypotension in functional endoscopic sinus surgeries.

Keywords: FESS, Controlled hypotension, Dexmedetomidine, Nitroglycerine

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is a minimally invasive technique used to restore sinus ventilation and normal function by opening sinus air cells and ostia in addition to nasal or paranasal polyp removal under direct visualization. Humans possess 4 paired paranasal sinuses such as maxillary, frontal, ethmoidal and sphenoidal sinuses. These are air filled spaces surrounding the nasal cavity and are joined by ostia. The paranasal sinuses are maintained in a healthy state by ventilation through the individual ostia and by a mucociliary transport mechanism that keeps a continuous protective layer of mucous flowing out of the sinuses. Most cases of sinusitis are caused by rhinitis. During any episodes of rhinosinusitis, the cilia function less efficiently leading to mucous stasis. The nasal mucosa becomes engorged, often resulting in occlusion of ostia.

This results in poor ventilation of sinus leading to hypoxia and mucous stasis which provide ideal condition for bacterial infection. The most suitable candidates for FESS are recurrent acute/ chronic infective sinusitis in whom medical therapy has failed. Other extended uses of FESS endoscopic dacryocystorhinostomy and endoscopic orbital compression. Advantages of FESS over conventional surgery permitting a better view of surgical field, a more precise and thorough clearance of inflammatory change, fewer complications, and lower recurrence rates.[1] FESS requires bloodless field for proper visualization. This can be achieved by controlled hypotension which reduces bleeding and creates better quality of surgical field for optimal operating condition.[2-4]

Controlled hypotension involves reducing arterial blood pressures up to 30% below its normal range or reducing MAP to 65 mmHg reversibly and maintaining this blood pressure throughout the surgery.[5] Most frequently used medications to induce hypotension are peripheral vasodilators such as sodium nitroprusside, nitroglycerine and hydralazine; inhaled anaesthetics like isoflurane and sevoflurane; intravenous anaesthetics like propofol; beta adrenergic antagonists like esmolol; adenosine and alpha-2 adrenergic agonists like clonidine and dexmedetomidine.[6,7] The reported disadvantages with the use of some of these agents include resistance to vasodilators, tachyphylaxis and reflex tachycardia partially offsetting the beneficial effect of hypotension with nitroglycerine, cyanide toxicity with the use of nitroprusside and delayed recovery from anaesthesia with the use of high doses of inhaled anaesthetics.[8,9] Dexmedetomidine is highly selective and potent alpha-2 adrenergic agonist causes reduction in blood pressure, slowing of heart rate, sedation, analgesia, and anaesthetic sparing effects. Controlled hypotension with dexmedetomidine has been reported in reducing surgical blood loss and improving surgical conditions in patients undergoing FESS.[10,11] The fall in blood pressure is mainly due to inhibition of central sympathetic outflow and due to stimulation of presynaptic alpha-2 adrenoceptors decreasing norepinephrine release. Dexmedetomidine has minimal respiratory depressant effect with potent sedative and analgesic effects compared with opioids and other sedatives. It is also shown that dexmedetomidine decreases the bleeding in surgeries within the framework of haemodynamic stability. The present study is undertaken to compare dexmedetomidine and nitroglycerine in achieving good surgical field during functional endoscopic sinus procedure.

METHOD

Source of data

Patients admitted in Yenepoya Medical College and Hospital, Mangalore, from the period of January’2019 to October’2019 posted electively for FESS.

Study design

The study design was quasi experimental study

Sample size

Calculated as per hospital records (no of patients undergone FESS past 3 years), Minimum sample size is 40.

$N=4PQ/d^2$

Where, P=Prevalence (from previous studies), d=allowable error (5-20% of P), Q=100-P 40. Patients undergoing FESS were randomly divided into two groups using closed envelope method.

Method of randomization was of double blind.

Inclusion criteria

Patients aged from 18-60 years who are scheduled for FESS under General anaesthesia and belongs to ASA I and II were included in the study.

Exclusion criteria

Patients with cardiac, respiratory, hepatic, renal, neurological, psychiatric illness, hypersensitivity or contraindication to dexmedetomidine or nitroglycerine and pregnant lady or lactating mothers were excluded from our study.

After approval from the ethical committee, patients who satisfied the inclusion and exclusion criteria were selected for the study. Written informed consent from all the patients are taken and documented. They were randomly divided into two groups using closed envelope method. Group D received dexmedetomidine and group N received nitroglycerine.

Infusions-Dexmedetomidine 1 µg/kg was diluted in 60 ml of NS and taken in a 60 ml syringe. Nitroglycerine 30 µg/kg (0.5 µg/kg/Min for one hour) was diluted in 60 ml of saline and was taken in 60 ml syringe.

Infusion was started after 10 Min of induction of general anaesthesia, one infusion was provided to the anaesthetist who is blind about the drug inside, infused at the rate of 1ml/hr. Haemodynamic parameters such as patients’ heart rate, systolic/diastolic/mean arterial blood pressure and 6-point scale was used to assess the amount of bleeding in the operative field: 0=no bleeding, a virtually bloodless field; 1=bleeding that was so mild that it was not a surgical nuisance; 2=moderate bleeding that was a nuisance but did not interfere with accurate dissection; 3=moderate bleeding that moderately compromised surgical dissection; 4=bleeding that was heavy but controllable and that significantly interfered with surgical dissection; and 5=massive bleeding that was uncontrollable and made dissection impossible. Scores ≤2 were considered to be optimal surgical conditions were recorded in each case. Heart rate was monitored continuously and blood pressure monitored every 2nd inute. Blood pressure and heart rate recorded every 10th minute interval. If MAP falls less than 60 mm Hg, Infusion is stopped for two minutes (till next blood pressure recording). If the MAP goes above 75 mm of Hg, propofol bolus 0.4 mg/kg given while stoppage time of infusion and amount of the propofol used is documented.

Ethical clearance certificate

Protocol no: 2017/273, YEC-1 approval date: 14-10-2017.

Statistical analysis

Data will be expressed in terms of mean and standard deviation. Independent t test is used to compare systolic/ diastolic/ mean arterial blood pressure/heart rate between the groups. Student t test is used to compare systolic, diastolic, mean arterial blood pressure and heart rate within group. P<0.05 is considered significant. Data will be analysed using SPSS version 22.

RESULTS

The present study shows that there is no significant difference in the SBP between the two groups also there is no significant difference in the DBP between the two groups (Table 2 and 3). Also, it is seen that group D has better MAP and heart rate when compared to group N (Table 4 and 5).

Figure 6 shows the ACS distribution of dexmedetomidine where it is shows grade 2 in all 20 subjects in 20 mins after induction, while at 30mins it shows grade 1 in 9 subjects and grade 2 in 11 subjects, while at 40, 50, 60 and 70 mins it is grade 1 majorly.

Figure 7 shows the ACS distribution of NTG, where it is shows grade 1 in 9 subjects and grade 2 in 11 subjects in 20 mins after induction, while at 30 mins it shows grade 1 in 12 subjects and grade 2 in 8 subjects, while at 40, 50, 60 and 70 mins it shows grade 1 in majority of the subjects.

Table 1: Patients in different age groups.

Age (Years)	Number	Percentage (%)
21-25	6	15
26-30	11	27.5
31-35	14	35
36-40	9	22.5
Total	40	100

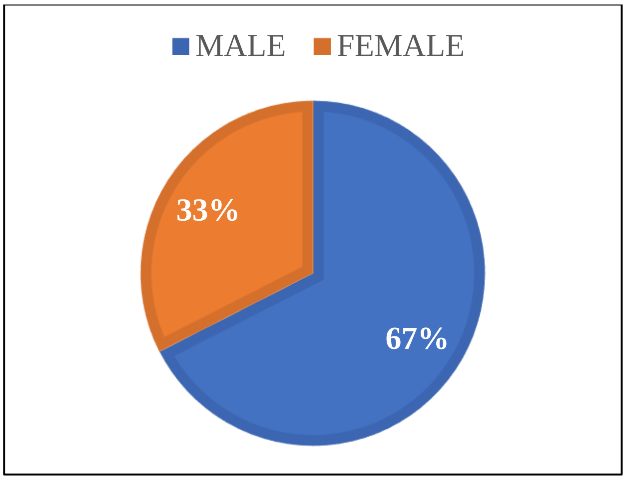

Figure 1: graphical presentation of demographic data.

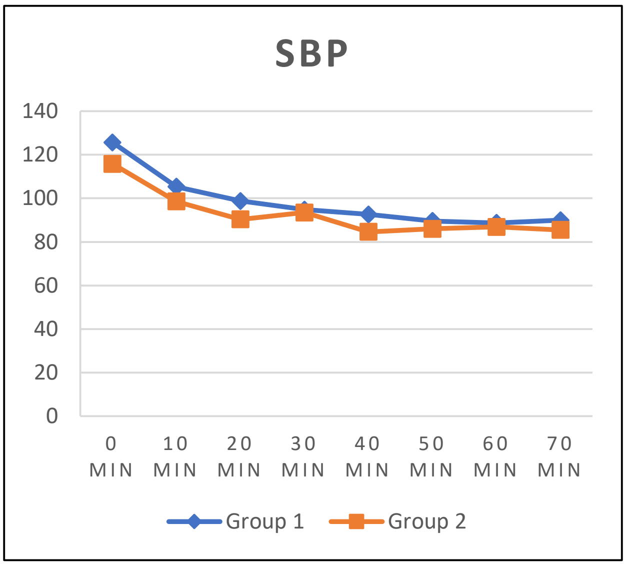

Figure 2: Comparison of systolic blood pressure between dexmedetomidine and nitro-glycerine from baseline to every 10th minute.

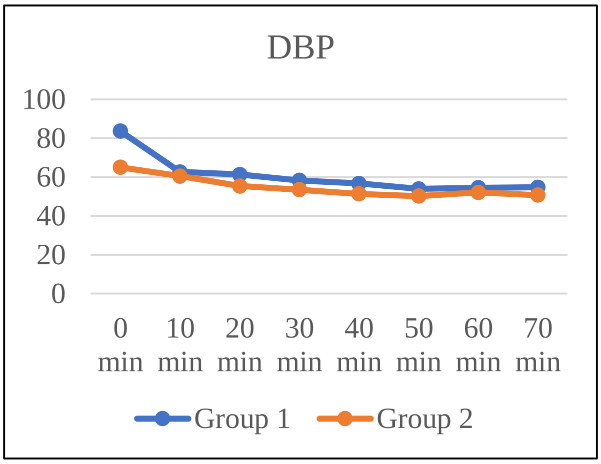

Figure 3: Comparison of diastolic blood pressure between dexmedetomidine and nitro-glycerine from baseline to every 10th minute.

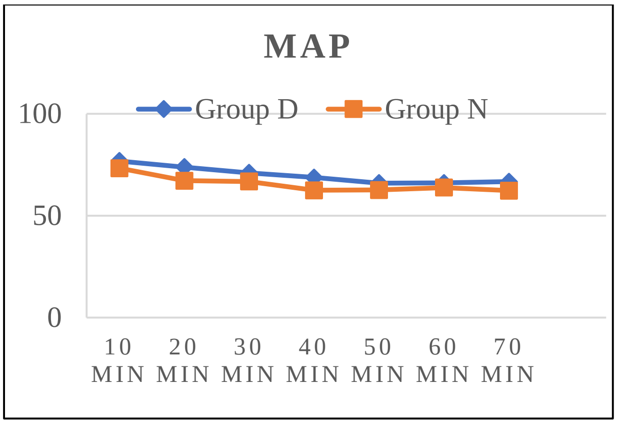

Figure 4: Comparison of MAP between dexmedetomidine and nitro-glycerine from baseline to every 10th minute.

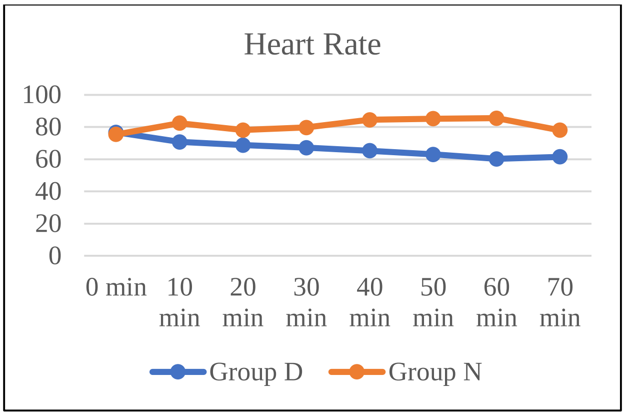

Figure 5: Comparison of heart rate between dexmedetomidine and nitro-glycerine from baseline to every 10th minute.

Table 2: Comparison between group D and group N of systolic blood pressure from baseline to every 10th minute.

SBP		Baseline	10	20	30	40	50	60	70
	Mean	**125.65**	**105.3**	**98.75**	**94.85**	**92.6**	**89.6**	**88.75**	**89.95**
Group D	% change from baseline		16.2	21.4	24.55	26.3	28.69	29.36	28.45
	SD from baseline		4.06	4.01	4.97	7.11	3.76	5.28	3.62
Group N	mean	115.8	98.6	90.3	93.5	84.6	86	86.9	85.5
	% change from baseline		14.85	22.02	19.25	27.2	25.73	24.95	26.16
	SD from baseline		2.9	3.45	5.61	4.4	2.59	2.19	2.32
P value			0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 3: Comparison between group D and group N of diastolic blood pressure from baseline to every 10th minute.

DBP		Baseline	10	20	30	40	50	60	70
	Mean	**83.6**	**62.6**	**61.35**	**58.3**	**56.7**	**53.9**	**54.5**	**54.7**
Group D	% change from baseline		25.11	26.61	30.26	32.17	35.52	34.8	34.56
	SD from baseline		4.5	4.01	5.76	4.01	3.46	2.23	2.84
Group N	mean	65	60.5	55.4	53.5	51.4	50.2	52.1	50.7
	% change from baseline		6.92	14.76	17.69	20.92	22.76	19.84	22
	SD from baseline		3.72	3.45	4.49	2.9	4.15	3.46	2.27
P value			0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 4: Comparison between group D and group N of mean arterial pressure from baseline to every 10th minute.

MAP		Baseline	10	20	30	40	50	60	70
	Mean	**96.9**	**76.8**	**73.8**	**70.95**	**68.7**	**65.95**	**66**	**66.65**
Group D	% change from baseline		20.74	23.83	26.78	29.12	31.94	31.88	31.32
	SD from baseline		2.84	2.93	3.76	2.59	1.63	2.4	1.87
Group N	mean	81.55	73.25	67.1	66.75	62.45	62.55	63.75	62.26
	% change from baseline		10.17	17.71	18.14	23.42	23.29	21.82	23.48
	SD from baseline		3.12	3.22	4.55	2.92	3.18	2.22	1.821
P value			0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 5: Comparison between group D and group N of heart rate from baseline to every 10th minute.

Heart rate		Baseline	10	20	30	40	50	60	70
	Mean	**76.7**	**70.7**	**68.8**	**67.15**	**65.25**	**63**	**60.2**	**61.5**
Group D	% change from baseline		7.8	10.29	12.45	14.92	18.44	21.51	19.81
	SD from baseline		4.84	3.39	4.25	2.63	2.29	2.01	2.66
Group N	mean	75.4	82.4	78.1	79.7	84.5	85.2	85.45	78.05
	% change from baseline		+9.28	+3.58	+5.7	+12.06	+12.99	+13.32	+3.51
	SD from baseline		7.11	3.17	3.54	3.92	3.87	4.83	16.92
P value			0.001	0.001	0.001	0.001	0.001	0.001	0.001

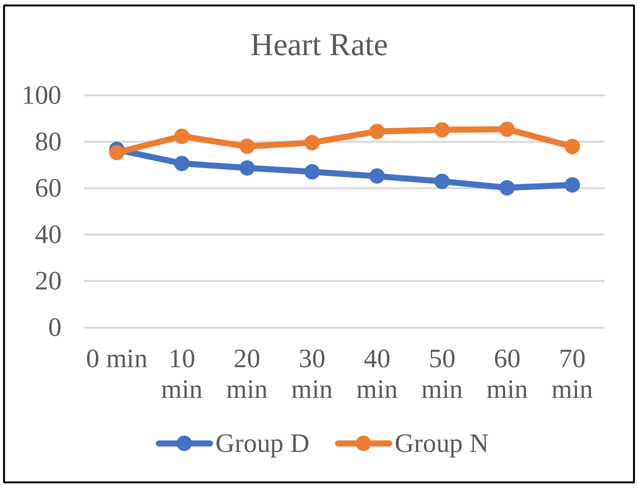

Figure 5: Comparison of heart rate between dexmedetomidine and nitro-glycerine from baseline to every 10th minute.

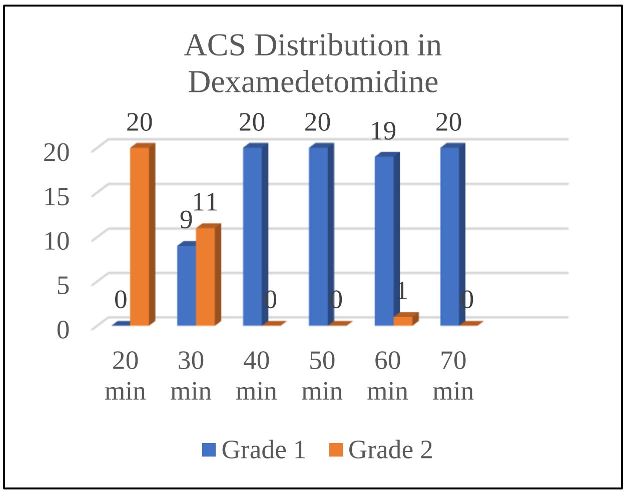

Figure 6: Comparison of average category score in dexmedetomidine every 10th minute after 20 minutes of induction.

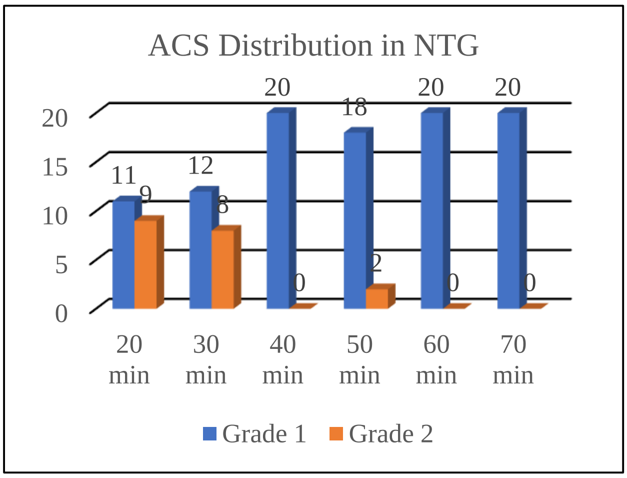

Figure 7: Comparison of average category scale in NTG every 10th minute after 20 minutes of induction.

DISCUSSION

Induced hypotension is controlled reduction in blood pressure so that bleeding at surgical field is minimal meanwhile perfusion to the vital organs is well maintained.[13] During endoscopic surgeries small amount of blood in the surgical field can make the surgeries difficult due to poor visibility. Induced hypotension decreases the bleeding at surgical site, improves the quality of surgical field, shortens the duration of surgery, decreases the number of manipulations and reduces the incidence of complications.[12,19]

In this present study, we chose to maintain target MAP of 60-75 mm of Hg during FESS to reduce bleeding and provide better quality of surgical field without causing decreased perfusion to vital organs.

Boezaart and his colleagues demonstrated induced hypotension by sodium nitroprusside or nitroglycerine in mandibular surgery to attain target MAP of 60-70 mm of Hg and found to be safe.[20] Surgical bleeding is influenced by arterial and venous pressure as well as regional capillary circulation. During FESS, capillary bleeding influences the operative field visibility most and it can be reduced by providing hypotension and using local vasoconstrictors. NTG induces hypotension by reducing the venous return due to dilatation of venous capacitance vessels which reduces the cardiac output. Dexmedetomidine is selective alpha-2 adrenergic receptor agonist. It decreases blood pressure and heart rate by decreasing central sympathetic outflow by stimulating presynaptic alpha-2 adrenoceptor.[14]

Both dexmedetomidine and NTG produced hypotension as required for FESS and MAP remained in similar range in both the groups during the period of controlled hypotension. But optimal surgical field as indicated by average category scale of 1-2 was achieved with both dexmedetomidine group and NTG group. But significantly increase in heart rate was seen with NTG group with the reduction in MAP.

Our study agrees with the study done by Vineela and colleagues, who concluded that both dexmedetomidine and nitroglycerine can be safely for FESS surgery to produce controlled hypotension.[17] But in their study average blood loss was less with dexmedetomidine when compared to nitroglycerine.

A Das and colleagues observed that surgeon's satisfaction score was significantly better in dexmedetomidine treated group than esmolol group. A nasal bleeding score was significantly higher in group esmolol than group dexmedetomidine.[2]

In contrast over study findings Srivastava and colleagues stated that average category score for group ESM was better than that of nitroglycerine group at all levels of MAP showing that esmolol provided better surgical field than nitroglycerine.[16] They opined that when NTG is used to induce hypotension, this results in vasodilatation with consequent more oozing at surgical site. Reflex tachycardia may be a contributing factor.

Our study is in agreement with the study of Shams and colleagues who observed that the average category scale for quality of surgical field was comparable in both groups in the range of MAP (55-65 mmHg).[11] Scores for a bloodless field were low in both groups and there was no significant difference.

In the present study, both groups of dexmedetomidine and nitroglycerine attained controlled hypotension between 60-75 mm of Hg. Group D showed MAP of 76.8±2.84, 73.8±2.93, 70.95±3.762, 68.7±2.59, 65.95±1.63, 66±2.40, 66.85±1.87 when compared to group N MAP of 73.25±3.12, 67.1±3.22, 66.75±4.55, 62.45±2.92, 62.55±3.18, 63.75±2.22, 62.26±1.821 at 10th, 20th, 30th, 40th, 50th, 60th and 70th minute respectively.

Our study was in agreement with previous studies, Vineela et al observed intraoperative blood loss blood loss of 152±23.78 ml in nitroglycerine group compared to 137±23.91 ml in dexmedetomidine group during FESS which was statistically significant.[17] The target mean arterial pressure (65-75 mmHg) was achieved in both the groups.

Rahman et al showed dexmedetomidine regimen as pre-induction bolus dose 1 µg/kg IV followed by post induction continuous IV infusion 0.8 µg/kg/hour significantly decreased the mean arterial pressure to the target level without the need of an additional hypotensive agent nitroglycerine, and it provides the excellent surgical field quality.[4]

Bajwa et al observed MAP was significantly reduced in dexmedetomidine group compared to other groups especially during intubation suggesting that dexmedetomidine is effective in blunting haemodynamic responses of stress during laryngoscopy however MAP was equally lowered in all three groups suggesting equal efficacy of all the three drugs.[3]

Chiruvella et al observed that MAP of 55.9±5.3 mm Hg while placebo group had 86.2±11.4 mm Hg, dexmedetomidine group had duration of surgery was reduced (78.34±16.7 Mins) when compared to placebo group (103.2±13.1 Mins). Dexmedetomidine caused decreased heart rate due to its central sympathetic outflow blockade while NTG infusion caused increased heart rate due to reflex tachycardia. In our study, the heart rate found to be in group D were 70.7±4.846, 68.8±3.39, 67.15±4.258, 65.25±2.63, 63±2.99, 60.2±2.01, 61.5±2.66 when compared to group N of 82.4±7.11, 78.1±3.17, 79.7±3.54, 84.5±3.92, 85.2±3.87, 85.45±4.83, 78.05±16.92 respectively at 10th, 20th, 30th, 40th, 50th, 60th and 70th minutes respectively.[5] Above results from my study was in agreement with previously conducted study.

Guney et al found that nitroglycerine had SBP, DBP, MAP had 30%, 33% and 34% reduction when compared to esmolol had SBP, DBP, MAP of 24%, 33%, 27% respectively.[15]

Bajwa et al observed mean heart rate was significantly lower in dexmedetomidine group compared to NTG or Esmolol.[3]

Srivastava et al observed intraoperative heart rate remained lower in group esmolol compared group nitroglycerine (83.87±7.58 vs 90.88±8.54) which was statistically significant.[16]

Enas et al observed that intraoperative heart rates remained lower in group esmolol compared to group nitroglycerine (83.87±7.58 vs 90.88±8.54) respectively and it was statistically significant.[20]

Limitations

Patient refusal, lack of understanding of concept of induced hypotension, Inadequate monitoring and patient factors were ischaemic heart disease, diabetes mellitus, anemia, polycythaemia, haemoglobinopathies, hepatic disease, ischaemic cerebrovascular disease, renal disease, respiratory insufficiency, uncontrolled hypertension, intolerance to agents used for controlled hypotension.

CONCLUSION

Dexmedetomidine and nitroglycerine both were found to be safe to use for controlled hypotension in functional endoscopic sinus surgeries. Dexmedetomidine provided better haemodynamic stability when compared to nitroglycerine. NTG produced significant increase in heart rate. When surgeon satisfaction was measured by average category score, both dexmedetomidine and NTG provided good surgical field and surgeon satisfaction.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Dalziel K, Stein K, Round A, Garside R, Royle P. Systematic review of endoscopic sinus surgery for nasal polyps. In NIHR Health Technology Assessment programme: Executive Summaries. NIHR J Library. 2003.
2. Das A, Chhaule S, Bhattacharya S, Basunia SR, Mitra T, Halder PS, Chattopadhyay S, Mandal SK. Controlled hypotension in day care functional endoscopic sinus surgery: A comparison between esmolol and dexmedetomidine: A prospective, double-blind, and randomized study. Saudi J Anaesthesia. 2016;10(3):276-82.

3. Bajwa SJ, Kaur J, Kulshrestha A, Haldar R, Sethi R, Singh A. Nitroglycerine, esmolol and dexmedetomidine for induced hypotension during functional endoscopic sinus surgery: A comparative evaluation. J Anaesthesiol Clin Pharmacol. 2016;32(2):192-7.
4. Rahman NI, Fouad EA, Ahmed A, Youness AR, Wahib M. Efficacy of different dexmedetomidine regimens in producing controlled hypotensive anaesthesia during functional endoscopic sinus surgery. Egypt J Anaesthesia. 2014;30(4):339-45.
5. Chiruvella S, Balaji Donthu VS, Babu D. Controlled hypotensive anaesthesia with dexmedetomidine for functional endoscopic sinus surgery: a prospective randomized double blind study. J Evol Med Dental Sci. 2014;3(37):9556-63.
6. Jacobi KE, Böhm BE, Rickauer AJ, Jacobi C. Moderate controlled hypotension with sodium nitroprusside does not improve surgical conditions or decrease blood BIBLIOGRAPHY Page 67 loss in endoscopic sinus surgery. J Clin Anaesthesia. 2000;12(3):202-7.
7. Mishra A, Singh RB, Choubey S, Tripathi RK, Sarkar A. A comparison between nitroprusside and nitroglycerine for hypotensive anaesthesia in ear, nose, and throat surgeries: A double-blind randomized study. Med J Dr. DY Patil University. 2015;8(2):182-88.
8. Dal D, Çelıker V, Özer E, Başgül E, Salman MA, Aypar Ü. Induced hypotension for tympanoplasty: a comparison of desflurane, isoflurane and sevoflurane. Euro J Anaesthesiol. 2004;21(11):902-6.
9. Puthenveettil N, Rajan S, Kumar L, Nair SG. A comparison of effects of oral premedication with clonidine and metoprolol on intraoperative haemodynamics and surgical conditions during functional endoscopic sinus surgery. Anaesthesia Essays Res. 2013;7(3):371-5.
10. Guven DG, Demiraran Y, Sezen G, Kepek O, Iskender A. Evaluation of outcomes in patients given dexmedetomidine in functional endoscopic sinus surgery. Anna Otol Rhinol Laryngol. 2011;120(9):586-92.
11. 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 Anaesthesia. 2013;7(2):175-80.
12. Degoute CS. Controlled hypotension drugs. 2007;67(7):1053-76.
13. Rodrigo C. Induced hypotension during anaesthesia with special reference to orthognathic surgery. Anaesthesia Progress. 1995;42(2):41.
14. Naaz S, Ozair E. Dexmedetomidine in current anaesthesia practice-a review. J Clin Diagnostic Res. 2014;8(10):GE01.
15. Guney A, Kaya FN, Yavascaoglu B, Gurbet A, Selmi NH, Kaya S et al. Comparison of esmolol to nitroglycerine in controlling hypotension during nasal surgery. Eur J Med. 2012;44(2):99-105.
16. Srivastava U, Dupargude AB, Kumar D, Joshi K, Gupta A. Controlled hypotension for functional endoscopic sinus surgery: Comparison of esmolol and nitroglycerine. Ind J Otolaryngol Head Neck Surg. 2013;65(2):440-4.
17. Vineela CH, Ganapathi P, Shankara Narayana P. Effect of controlled hypotension with dexmedetomidine versus nitroglycerine on intraoperative blood loss during FESS. J Dent Med Sci. 2015;14(4):42-5.
18. Al-Saidie EF, Ismail HM. Controlled hypotension for functional endoscopic sinus surgery: Comparison of esmolol and nitroglycerine. World J Pharmacy Pharmaceu Sci. 2016;12(5):286-93.
19. Baker AR, Baker AB. Anaesthesia for endoscopic sinus surgery. Acta Anaesthesiologica Scandinavica. 2010;54(7):795-803.
20. Boezaart AP, Van der Merwe J, Coetzee A. Comparison of sodium nitroprusside, and esmolol-induced controlled hypotension for functional endoscopic sinus surgery. Can J Anaesthesia. 1995;42(5):373-6.

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