Original Research Article

Controlled hypotension for ENT surgery: An observational comparative prospective study between esmolol and sodium nitroprusside

Dharmeshkumar H Gohil[1], Sunaina Patel[2*]

[1]Senior Resident, [2]Associate Professor, Department of Anaesthesia, Government Medical College, Surat, Gujarat, India.
Email: dharmeshgohil2804@gmail.com

Abstract

Background: Intraoperative bleeding may be reduced most effectively by induced systemic hypotension. When ENT surgery done with the intentional hypotensive anaesthetic technique resulted in reduction in blood loss, reduction in blood transfusion rate, improvement in the surgical field and reduction of the duration of surgery. **Objective:** To compare the efficacy of Esmolol and Sodium Nitroprusside in Controlled Hypotension for ENT Surgery **Materials and Methods:** This prospective study was conducted among 40 patients, 20 in each group [group-ESM (Esmolol) = 20, group-SNP (Sodium Nitroprusside) = 20], for the duration of 3 hour ENT surgery in department of Anesthesiology. The efficacy of the drugs was tested by comparing the length of time with the targeted pulse rate, mean arterial pressure, average category scale (ACS) and side effects. **Results:** Mean pulse rate and mean arterial pressure was lower in ESM group than the SNP group participants. There was statistically highly significant difference in average category scale of surgical field and blood loss between both group. Study observed that observed that none of patients had severe hypotension, hypertension, tachycardia or bradycardia during perioperative periods. Study observed that there was 3(15%) patients have episode of nausea and vomiting in group-SNP and none of the patients have nausea and vomiting in group-ESM. **Conclusion:** Achieving controlled hypotension resulted in improve surgical field, reduction in blood loss and duration of surgery in patients undergoing ENT surgeries. Esmolol and Sodium Nitroprusside provide stable haemodynamic profile. Although the surgical field as assessed by surgeons using ACS was statistically better in group Esmolol.

Key Words: Average Category Scale, Esmolol, ENT surgery, Controlled hypertension, Sodium Nitroprusside

***Address for Correspondence:**
Dr Sunaina Patel, Associate Professor, Department of Anaesthesia, Government Medical College, Surat, Gujarat, India.
Email: dharmeshgohil2804@gmail.com

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INTRODUCTION

When conservative management has failed in ENT pathologies, surgical management of acute and chronic sinus pathologies is indicated[1] and it raise the illumination and visualization of surgical dissection. Excessive bleeding has been observed in ENT surgery under general anesthesia (GA) when visibility impared[2]. Intraoperative bleeding is reduced most effectively by induced systemic hypotension. When ENT surgery done with the intentional hypotensive anaesthetic technique resulted in reduction in blood loss, reduction in blood transfusion rate, improvement in the surgical field, and reduction of the duration of surgery and the patient's baseline mean arterial pressure (MAP) reduced by 25% or MAP was kept at 60-70 mm Hg[3-6]. Esmolol is a ultrashort acting selective B1 adrenergic antagonist that decrease heart rate and blood pressure. It has rapid onset of action of bolus intravenous injection and infusion. Upon termination of infusion gradual recovery of arterial blood pressure to the pre infusion level, done without advancement of rebound hypertension[7-8]. A directly acting vasodilator, Sodium Nitroprusside used to achieve induced hypotension as it has rapid onset, rapid offset, and titrability. However, SNP use in surgery resulted in reflex tachycardia as well as

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venous congestion in the surgical site thus causing more blood loss[9-10]. So, the present study conducted with the primary objective to compare the efficacy of Esmolol And Sodium Nitroprusside in Controlled Hypotension for ENT Surgery and secondary objective to study the socio-clinical parameters and Average Category Scale (ACS) of Surgical Field among study participants.

MATERIALS AND METHODS

Study setting and duration

This study conducted in department of Anaesthesiology Government Medical College, Surat, Gujarat from July 2017 to August 2018.

Study design and study population

This prospective study enrolled 40 patients, divided by purposive sampling in 20 in each group [group-ESM (Esmolol) = 20, group-SNP (Sodium Nitroprusside) = 20], for the duration of 3 hour surgery like septoplasty, functional endoscopic sinus surgery (FESS), tympanoplasty and superficial parotidectomy. Inclusion criteria was ASA class 1, 2 and 3 scheduled for ENT surgeries, age between 18 to 60 year, no history of alcohol or drug abuse and patient giving informed written consent. Exclusion criteria was patient's refusal, age <18 year or >60 year, patient has significant dysarrythmia, inadequately controlled hypertension, pre-existing coagulation defect, patient taking anti-coagulant drug, cardio vascular drug like anti-arrythmic drug, allergy to beta-blocker, pregnant, lactating mother and morbidly obese and clinically significant neurologic, cardiac, renal, hepatic, gastro intestinal, endocrinal disease.

Anaesthesia technique: induction, maintenance and recovery

Pre anesthetic checkup has been performed the day before and on the day of surgery. Basic routine investigations like hemoglobin, renal function tests, serum electrolytes, random blood sugar and chest X-ray PA view has been done and recorded. All Patients were premedicated with Inj. glycopyrolate 0.2 mg IV 30 min before surgery and received Inj. midazolam 0.05 mg/kg IV just before shifting to the operation theatre. On arrival to the operation theatre monitor (ECG, pulse oximetry, NIBP) would be attached to the all patients and baseline parameters noted. Patients were induced with Inj. fentanyl 1 µg/kg IV, Inj. propofol 2 mg/kg IV, Inj. scoline 2 mg/kg IV. Patients have been maintained on O2 + N2O + Inj. vecuronium IV and isoflurane inhalation (1% to 2%). The hypotensive agent decided by the consultant anesthetist of the patient. Once steady state of anaesthesia has been attained (defined as a state of anaesthesia when no changes in hemodynamic variables took place for at least 10 min) the patients administered hypotensive medication.

Group-ESM (Esmolol) received a bolus dose of 1 mg/kg IV of Inj. Esmolol over 10 minutes followed by continuous infusion of 0.4 to 0.8 mg/kg/hr IV would be titrated to maintain MABP (60 to 70 mmHg).

Group-SNP (Sodium Nitroprusside) received a continuous infusion of 0.25 to 4.0 µg/kg/minute of Inj. Sodium Nitroprusside would be titrated to maintain MABP (60 to 70 mmHg).

Heamodynamic values have been recorded at a specific time interval from baseline (pre-operatively), 10 minute after post-induction (at start hypotensive agent), 5 minute after start of hypotensive agent, subsequently at 10 minute interval up to maximum 3 hour duration OR up to patient were shifted to post-operative recovery room. Infusion of study drug has been discontinued 5 minutes before the anticipated end of surgery. Residual neuromuscular block has been reversed with adequate dose of Inj. neostigmine and Inj. glycopyrolate and tracheal extubation performed. Monitoring of patient in post-operative room for adverse effects or side effects during post-operative period till baseline haemodynamics value achieved.

Average Category Scale (ACS) for intra-operative surgical field and blood loss adapted from fromme GA, *et al.* (1986).

Score	Surgical field
0	No bleeding
1	Slight bleeding – No suctioning of blood required
2	Slight bleeding – Occasional suctioning required. Surgical field not threatened.
3	Slight bleeding – Frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed.
4	Moderate bleeding - Frequent suctioning required. Bleeding threatens surgical field directly after suction is removed.
5	Severe bleeding - Constant suctioning required. Bleeding appears faster than can be removed by suction. Surgical field severely threatened and surgery not possible.

Data analysis

Qualitative data expressed as percentages and proportions. Quantitative data were expressed as mean and standard deviation. The differences between two groups with respect to continuous variables have been analyzed using unpaired t-test while categorical variables have been analyzed using chi-square test. All the statistical tests performed in Epi Info 3.5.1

software by CDC, USA. P value <0.05was considered as statistically significant while P value<0.01 was considered as statistically highly significant.

Ethical consent

Before proceeding with study, appropriate ethical clearance has been obtained from Hospital Ethics Committee. Each patient has been included in the study only after informed consent.

RESULTS

Table 1: Socio-demographic characteristics of study participants [n=40]

Parameter	Group-ESM (Mean±Sd)	Group-SNP (Mean±Sd)	P Value
Age (Year)	30.65±9.3317	26.75±8.1748	0.1679
Sex (M:F)	9(45%):11(55%)	11(55%):9(45%)	0.5271
Weight (Kg)	56.25±5.7754	57.25±5.3397	0.5730
ASA Class	2.25±0.4442	2.15±0.4893	0.5027
Duration of Surgery (Minute)	95.5±26.8475	105.25±35.7430	0.3355

Table 1 shows that the mean age in Group-ESM was 30.65 ± 9.3 year and in Group-SNP was a 26.75±8.1748 year. The difference was statistically not significant (P>0.05).Study also found difference between gender, weight, ASA class and duration of surgery but it was statistically not significant [p>0.05]. Figure 1 shows that at 5 minute after start of hypotensive agent Mean Pulse Rate in group-ESM was 73.7±10.7021 per minute and in group-SNP was 84.7±13.4668 per minute (p<0.001).At 50 minute after start of hypotensive agent Mean Pulse Rate in group-ESM was 71.4±7.8638 per minute and in group-SNP was 78.5±12.2966 per minute in group SNP (p<0.05). At 2 hour after start hypotensive agent Mean Pulse Rate in group-ESM was 62±1.4142 per minute and in group-SNP 75±13.0493 per minute (p<0.05).

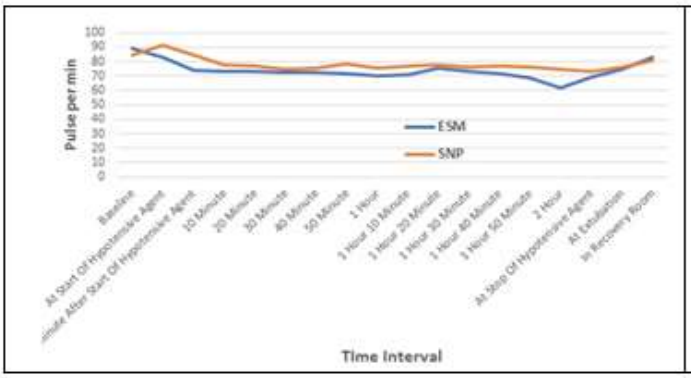

Figure 1: Pulse rate

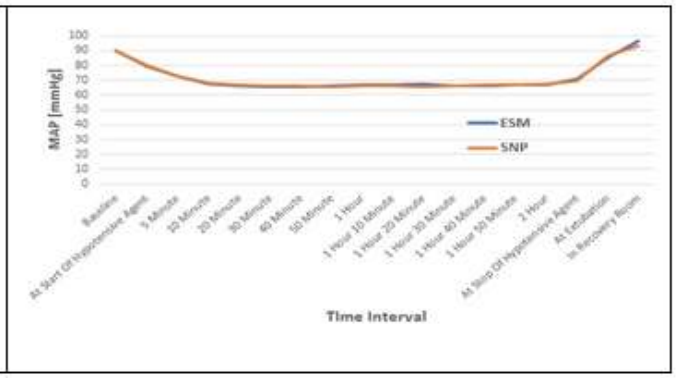

Figure 2: Mean Arterial pressure

Figure 2 shows that There was gradual fall in Mean Arterial Blood Pressure in both groups to reach target of 60 to 70 mmHg and time to achieved MABP (60-70 mmHg) was 10 minute after start of hypotensive agent in both groups (p>0.05) except at 1 hour 20 minute after starting hypotensive agent between both the groups (p<0.05). At 1hour 20 minute after start of hypotensive agent Mean Arterial Blood Pressure in group-ESM was 67.7±1.3707 mmHg and in group-SNP was 65.8±2.8516 mmHg (p<0.05).

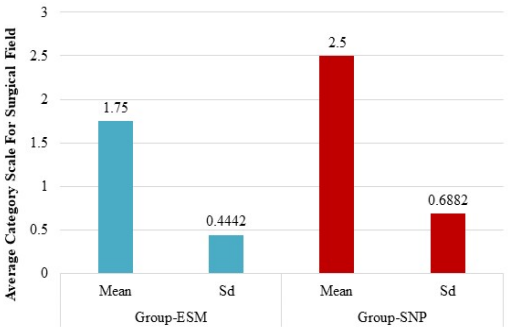

Figure 3:

We observed that there was statistically highly significant difference in average category scale of surgical field and blood loss between both group (p<0.001). It was 1.75±0.4442 in group-ESM and 2.5±0.6882 in group-SNP.

Table 2: Average category scale [ACS]

Average Category Scale (ACS) of Sugical Field	Number of patients in group-ESM	Number of patients in group-SNP	P Value
0	0	0	-
1	5(25%)	0	**0.0168**
2	15(75%)	12(60%)	0.3132
3	0	6(30%)	**0.007888**
4	0	2(10%)	0.1469
5	0	0	-
Mean ACS [mean ± SD]	1.75±0.44	2.5±0.68	0.0002

Table 2 shows that there was statistically highly significant difference in average category scale of surgical field and blood loss between both group (p<0.001). It was 1.75±0.4442 in group-ESM and 2.5±0.6882 in group-SNP. Almsot 5 (25%) patients in group-ESM and no patient in group-SNP have ACS score 1 (p<0.05); no patient in group-ESM and 6 (30%) patients in group-SNP have ACS score 3 (p<0.05). Around 15 (75%) patients in group-ESM and 12 (60%) patients in group-SNP have ACS score 2 (p>0.05); no patient in group-ESM and 2 (10%) patients in group-SNP have ACS score 4 (p>0.05). Almost 9(45%) patient in group-ESM and 10(50%) patient in group-SNP required inj. tramadol 100 mg IV as rescue analgesia in both groups (p>0.05). Study observed that observed that none of patients hadsevere hypotension, hypertension, tachycardia or bradycardia during perioperative periods. Study observed that there was 3(15%) patients have episode of nausea and vomiting in group-SNP and none of the patients have nausea and vomiting in group-ESM at post-operative period in ward for that patients was treated with Inj. ondansetrone 4 mg IV while none of the patients have any adverse effect in post-operative period in group-ESM.

DISCUSSION

In FESS like ENT surgery, many attempts have been done to improve the surgical conditions for FESS. Induced hypotension has been widely advocated to control bleeding during FESS to improve the quality of surgical field.[11,12] The two groups were similar demographically. The mean duration of surgery was slightly less in ESM group. The surgical duration has been shown to be shorter when controlled hypotension technique is used probably because of better visibility of surgical field and less time spent in repeated suctioning[13]. This finding is correlate with the study done by Dittrich S *et al.*[14], Srivastava U *et al.*[6], Cincikas D *et al.*[15] and Alkan A *et al.*[16].Study observed that mean pulse rate per minute was statistically significantly lower at 5 Minute, 50 Minute and 2 Hour after Start of hypotensive Agent. Study observed that mean 1arterial pressure [mmHg] was statistically significantly higher at 1hour and 20 Minute after Start of hypotensive Agent. Easy to administer, safe, have a rapid onset of action, short half-life, easily predictable and observable side effects are the characteristics ideal hypotensive agent.[17,18] Rather M *et al.*[19] conducted study in which the changes in HR between the two groups were statistically insignificant at preoperative and after recovery, but were significantly lower in the Esmolol group than the Sodium Nitroprusside group at post induction, 15, 30, 45, 60 min intraoperative. On intergroup comparison, changes in MABP between the two groups were statistically insignificant at preoperative, 15 min, 30min, 45min and 60 min intraoperative and after recovery. Similar observation also observed by Munshi F *et al.*[20] and Mageed HMA *et al.*[21]. Srivastava U *et al.*[6] observed that Both the drugs produced desired hypotension and improved surgical condition by reducing operative field bleeding but ideal operative conditions were achieved at mild hypotension (MABP 75–70) in ESM group while same conditions were achieved at MABP of 69–65 mm of Hg in NTG group. Mean heart rate was significantly higher in NTG group as compared to ESM group. Present study observed that mean ACS score was statistically significantly higher in SNP group than ESM group. This finding is similar with the study done by Rather M *et al.*[19], Munshi F *et al.*[20], Mageed HMA *et al.*[21], Srivastava U *et al.*[6], Boezaart AP *et al.*[22] and Shams T *et al.*[23].

CONCLUSION

Achieving controlled hypotension resulted in improve surgical field, reduction in blood loss and duration of surgery in patients undergoing ENT surgeries. Esmolol and Sodium Nitroprusside when used for controlled hypotension in ENT surgeries provide stable haemodynamic profile although the surgical field as assessed by surgeons using Average Category Scale was statistically better in group Esmolol as compared to Sodium Nitroprusside.

REFERENCES

1. Fokkens W, Lund V, Mullol J. European position paper on rhinosinusitis and nasal polyps 2012. Rhinol Suppl. 2012;23:1–298.
2. Sieskiewicz A, Reszec J, Piszczatowski B, Olszewska E, Klimiuk PA, Chyczewski L, *et al.*. Intraoperative bleeding during endoscopic sinus surgery and microvascular

density of the nasal mucosa. Adv Med Sci. 2014;59:132–5.
3. Chan W, Smith DE, Ware WH. Effects of hypotensive anesthesia in anterior maxillary osteotomy. J Oral Surg. 1980;38:504–8.
4. Rodrigo C. Induced hypotension during anesthesia with special reference to orthognathic surgery. Anesth Prog. 1995;42:41–58.
5. Das A, Mukherje A, Chhaule S, Halder PS, Mandal SK. Induced hypotension in ambulatory functional endoscopic sinus surgery: A comparison between dexmedetomidine and clonidine as premedication. A prospective, double-blind, and randomized study. Saudi J Anaesth. 2016 Jan-Mar; 10(1): 74–80.
6. Srivastava U, Dupargude AB, Kumar D, Joshi K, Gupta A. Controlled Hypotension for Functional Endoscopic Sinus Surgery: Comparison of Esmolol and Nitroglycerine. Indian Journal of Otolaryngology and Head and Neck Surgery 2013;65:440–444.
7. Ornstein E, Young WL, Ostapkovich N, Matteo RS, Diaz J. Deliberate hypotension in patients with intracranial arteriovenus malformations: Esmolol compared with isoflrane and sodium nitroprusside. Anesth Analg 1991;72:639-44.
8. Blowey DL. Anihypertensive agents: Mechanism of action, safety profies, and current uses in children. Curr Ther Res Clin Exp 2001;62:298-313.
9. Rodrigo C. Induced hypotension during anesthesia with specialreference to orthognathic surgery. Anesth Prog 1995; 42:41 –58.
10. Shoukry RA, Mahmoud A. Controlled hypotension for functional endoscopic sinus surgery: a Comparative study between magnesium sulfate and nitroglycerin. Ain-Shams Journal of Anaesthesiology 2017;10:91–96.
11. Eberhart LH, Folz BJ, Wulf H, Geldner G. Intravenous anesthesia provides optimal surgical conditions during microscopic and endoscopic sinus surgery. Laryngoscope 2003;113:1369-73.
12. Cincikas D, Ivaskevicius S. Application of controlled arterial hypotension in endoscopic rhino-surgery. Medicina (Kaunas) 2003;39:852-9.
13. Cincikas D, Ivaskevicius J (2003) Application of controlled arterial hypotension in endoscopic rhinosurgery. Medicina 9:852–859.
14. Dittrich S, Germanakis J, Dittrich H, Ewert P, Vogel M, Lange PE *et al.*. Comparison of sodium nitroprusside versus esmolol for the treatment of hypertension following repair of coarctation of the aorta. Interactive Cardiovascular and Thoracic Surgery 2003;2:111–115.
15. Cincikas D, Ivaskevicius J (2003) Application of controlled arterial hypotension in endoscopic rhinosurgery. Medicina 9:852–859.
16. Alkan A, Honca M, Alkan A, Gülec¸ H, Horasanlı E. The efficacy of esmolol, remifentanil and nitroglycerin in controlled hypotension for functional endoscopic sinus surgery. Braz J Otorhinolaryngol. 2019.https://doi.org/10.1016/j.bjorl.2019.08.008.
17. Simpson P. Perioperative blood loss and its reduction: the role of the anesthetist. Br J Anaesth. 1992;69:498-507.
18. Cincikas D, Ivaskevicius J, Martinkenas JL, Balseris S. A role of the anesthesiologist in reducing surgical bleeding in endoscopic sinus surgery. Medicina. 2010;46:730-4.
19. Rather M, Bashir F, Ahad S. Comparison of Dexmedetomidine, Esmolol and Sodium Nitroprusside for Hypotensive Anaesthesia in Functional Endoscopic Sinus Surgery. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) October 2015;14(10):126-131.
20. Munshi F, Bashir F, Ahad S, Rather M. Role of Esmolol and Sodium Nitroprusside as Hypotensive Agents in Functional Endoscopic Sinus Surgeries. Journal of Evolution of Medical and Dental Sciences 2015;4(96):16171-16174.
21. Mageed hma, saleh zt, el-sawy ahm, gabr aaa.Controlled hypotension in endoscopic sinus surgery: comparative study between the efficacy of esmolol, sodium nitroprusside and magnesium sulphate.Zagazig medical journal 2011;17(4):1-15.
22. Boezaart AP, van der Merwe J, Coetzee A. Comparison of sodium nitroprusside- and esmolol induced- controlled hypotension for functional endoscopic sinus surgery. Can J Anesth 1995;42:373–376.
23. 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.

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