Original Research Article

Comparison between intravenous dexmedetomidine and esmolol for induced hypotension during functional endoscopic sinus surgery and modified radical mastoidectomy

Kumar Ajay[1], Garg Ankur[2*], Agrawal Malti[3]

[1]Post Graduate Resident, [2]Assistant Professor, [3]Professor Department of Anaesthesiology, Rohilkhand Medical College and Hospital, Bareilly, U.P., Pin Code-243006, INDIA.
Email: ankurgarg.gsvm@gmail.com

Abstract

Aim: Bleeding is one of the major problems during surgery which reduces operative field visibility and recognition of anatomical landmarks becomes quite difficult. We aim to compare Dexmedetomidine and esmolol for controlled hypotension during functional endoscopic sinus surgery (FESS) and Modified Radical Mastoidectomy (MRM) as both the procedure use endoscope/microscope and a small amount of blood can obscure the field of surgery. **Material and Methods:** Sixty patients of American Society of Anesthesiologist physical status I and II undergoing general anesthesia for FESS and MRM were randomly allocated in two group of 30 patient each. Group D received Dexmedetomidine in a loading dose of 1 mcg/kg over 10 min followed by an infusion of Dexmedetomidine 0.5 mcg/kg and Group E received Esmolol 1 mg/kg as loading dose followed by Esmolol 0.5mg as maintenance in infusion. Both the group were compared for intraoperative hemodynamic parameters, postoperative effects. The post operative sedation was assessed with Ramsay Sedation Score. **Results:** Both Dexmedetomidine and Esmolol drugs produce desired hypotension and improved surgical field but ideal condition were achieved by Dexmedetomidine. Intraoperative mean Heart rate/min in Group D was 70.69±2.84 vs.74.39±2.66 in group E, which is statically significant.(p =0.000). The mean blood pressure (MAP) in group D was 70.63±077 and 73.09±0.81 in group E, which is also statically significant (p<0.001) and shows that dexmedetomidine is better for intraoperative control of MAP. Postoperative incidences nausea (group E 20% vs.13.33% in group D), vomiting (group E 6.7% vs. 3.3% in group D). The mean Ramsay Sedation Score in group D was 3.0±0.98 whereas it was 2.3±0.85 in group E. **Conclusion:** Both Dexmedetomidine and Esmolol can be used as a hypotensive agent in FESS and MRM surgery, however Dexmedetomedine is more effective than Esmolol in providing intraoperative hypotension. Also Dexmedetomidine have less complication or side effects. Sedation score in postoperative period is more in patients receiving Dexmedetomidine. However, the patients were awake and responded to commands.

Key Words: Dexmedetomidine, Esmolol, Functional Endoscopic Sinus Surgery, Hyotensive Anesthesia.

***Address for Correspondence:**
Dr. Ankur Garg, Assistant Professor, Department of Anaesthesiology, Rohilkhand Medical College and Hospital, Bareilly, U.P., Pin Code-243006, INDIA.
Email: ankurgarg.gsvm@gmail.com
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INTRODUCTION

Bleeding is one of the major problems during surgery which reduces operative field visibility and recognition of anatomical landmarks becomes quite difficult.[1,2] As an anesthetist, we have to reduce bleeding and keep the view of the endoscope/microscope dry by induced hypotension, by keeping the patient's baseline mean arterial pressure (MAP) is reduced by 30% or kept at 60-70 mmHg.[3] Controlled hypotension is a technique used to limit intraoperative blood loss to provide best possible field for

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surgery in Functional Endoscopic Sinus Surgery (FESS) and Modified Radical Mastoidectomy (MRM).[4] Several intravenous agents have been used for hypotension but only few studies have been performed to compare the efficacy of Dexmedetomidine and Esmolol in functional endoscopic sinus surgery and ear surgery. Dexmedetomidine is highly selective, specific and potent α_2 adrenergic agonist.[5] It is a centrally acting selectiveα_2 adrenergic agonist that acts as an antihypertensive drug by virtue of its ability to decrease sympathetic nervous system output from the central nervous system. It is a very promising drug in functional endoscopic sinus and ear surgery.[6] It reduces bleeding, keep the B.P. and H.R. on lower side, blunts the laryngoscopic intubation response, reduces the requirement of anesthetic agent,[7,8] decreases post operative nausea vomiting, has anxiolytic, analgesic effect and decreases plasma catecholamines concentrations. Esmolol is an ultra short-acting, highly cardioselective β2-adrenergic receptor antagonist involved in the control of heart rate (HR), contractility and artrioventricular conduction.[9] Its rapid elimination is due to conversion to inactivated free acid metabolite esterase. Esmolol produces desirable hypotension without tachycardia and improves surgical condition by reducing operative field bleeding.[10,11] The primary aim of this study was to compare the efficacy of Dexmedetomidine and Esmolol as an hypotensive agent in elective ear and functional endoscopic sinus surgery and determine anycomplication or side effects, post operative shivering, nausea, vomiting and to assess sedation in post operative period.

MATERIALS AND METHODS

After getting approval from the Institutional ethical Committee a prospective randomized double blind controlled study was conducted on sixty patients who underwent FESS and MRM under general anaesthesia. 60 patients of ASA physical status I and II of either sex, aged 18-50 years were recruited for this study. Patients with bleeding disorders, major hepatic, renal or cardiovascular dysfunction, pregnancy and taking any anticoagulation therapy were excluded from the study. Patients were divided in two randomly selected groups each comprising 30 patients. In D Group, (n=30) Dexmedetomidine and in E Group(n=30) Esmolol was used to provide controlled hypotension. A thorough pre-anaesthetic evaluation was performed and an informed written consent was taken from all the patients by the investigator a day prior to surgery. All patients were kept nil per oral night before surgery and received oral Alprazolam 0.25mg and oral Ranitidine 150mg in night before surgery. On the day of surgery after shifting the patient to operating room, standard monitors were connected, baseline (average of three) vital parameters of patients including Heart Rate (HR), systolic arterial pressure(SAP), diastolic arterial pressure(DAP), mean arterial pressure (MAP) and oxygen saturation were recorded. IV line was secured with 18-G venous cannula and Ringer's lactate infusion was started. The patients were randomly divided into two groups i.e. "D" and "E" group. Group D received 1 microgram/kg of Dexmedetomidine in 50 ml normal saline in 10 min and 10 ml normal saline over 1 min before induction of anaesthesia followed by 0.5mcg/kg/hr by infusion pump and group E received 50 ml normal saline in 10 min followed by Esmolol 1mg/kg over 1 min in 10 ml normal saline followed by 0.5mg/kg/hr infusion during maintenance in 50 ml of normal saline. Drugs and infusion will be prepared by some other anesthetist who was not involved in the current study. Patients were premedicated with Inj. Glycopyrrolate 0.2mg/ kg, Inj. Butorphanol 1mg. After pre-oxygination with 100% oxygen for 3 minutes. Induction was done with propofol 2.5mg/kg and succinylcholine 1.5mg/kg. The patients lungs were ventilated manually with 100% oxygen and oral endotracheal intubation was done with appropriate size cuffed disposable endotracheal tube (ET) 7.5 or 8.0mm I.D using Macintosh blade. Intubation was limited to over less than 30 seconds in all patients, failure to intubate within this period was excluded from the study. After confirming the position and fixing the ET tube patient was connected to ventilator andventilator setting of Tidal Volume and Respiratory Rate was adjusted to keep the $EtCO_2$ 30-35mmHg. Respiratory rate was kept between 12 to 14/min. Heart rate, systolic and diastolic B.P., SpO_2 were recorded to see the intubation response. Maintenance was done with O_2 and N_2O in the ratio 40:60 and isoflurane (0.6%) was started. Bolus dose of vecuronium(0.1mg/kg) was given. 1mg of vecuronium was given as top up during surgery. At the end of the surgery reversal was done with neostigmine 0.05mg/kg and glycopyrolate 0.008mg/kg. Throat pack was removed, pharyngo-tracheal suction done and then patient extubated after adequate reversal was achieved. Reading of B.P. and heart rate was taken at this time. Total fluid given and sedation score was assessed. After the patient were able to keep their eyes open, elevate head and breathe normally, they were shifted to ward. B.P. Heart Rate, sedation score using Ramsay Sedation Score, any side effects like shivering, nausea and vomiting were assessed 4 hr post operatively in PACU.

Statistical Analysis: Statistical analysis was done using statistical package for social sciences version 22. The result of variables was expressed in mean and standard deviations. Independent t-test was performed for comparing mean of the two groups, paired t-test was

performed for comparing mean percentage of improvement in the groups, *p* value < 0.05 was taken as statistically significant.

OBSERVATIONS AND RESULTS

Table 1: Comparison of sex and age (years) in groups

Variable	Group D	Group E	p-value
SEX	n (%)	n (%)	
MALE	12(40%)	15(50%)	
FEMALE	18(60%)	15(50%)	0.436#
MEAN AGE in Yrs (MEAN ± S.D)	33.2 ± 8.66	31.52 ± 6.80	0.379#

#statistically not significant

As shown in above table Male are 40% and female are 60% in group D, whereas in group E males are 50% and females are 50% respectively. The results are statistically not significant in between males and females in both the group E and group D (p=0.436). Also there was no statistically significant difference (p=0.379) observed between the two groups with regards to mean age. The mean age in group D was 33.2 ± 8.66 years, while in group E it was 31.52 ± 6.80 years.

Table 2: Comparison of mean Heart rate at different intervals (bpm)

Time of measurement	Group D (n=30)	Group E (n=30)	p-value
Baseline	90.73±10.45	92.07±8.87	0.596#
After drug administration	70.93±6.41	73.97±3.74	0.0287*
Induction	67.87±4.55	72.67±4.37	0.000*
Intubation	75.53±3.95	81.07±5.19	0.000*
Average intraoperatively	70.69±2.84	74.39±2.66	0.000*
Extubation	81.27±5.67	91.00±5.06	0.000*
5 min after extubation	75.00±3.72	77.73±3.99	0.023*
Average postoperativly	80.11±4.96	86.78±4.46	0.001*

#statistically not significant,*statistically significant

Above table and graph shows that in the baseline readings there was no statistically significant difference between the two groups (p=0.596), but during, induction, intubation and up to 30 minutes the difference in the pulse rate was statistically very significant in the two groups but the pulse was always below the baseline reading (p≤0.00). It was very significant at time of extubation and onwards till postoperative period (p≤0.001). Dexmedetomidine (Group D) reduces the pulse more as compared to Esmolol (Group E).

Table 3: Comparison of Mean blood pressure at different intervals in mmHg (values as mean ± S.D)

Time of measurement	Group D (n=30)	Group E (n=30)	p-value
Baseline	94.47±6.28	92.27±6.94	0.203#
After drug administration	78.63±4.70	81.53±6.24	0.047*
Induction	74.60±3.86	76.97±3.88	0.0210*
Intubation	86.07±5.85	89.48±6.92	0.0438*
Average intraoperatively	70.63±0.77	73.09±0.81	<0.001*
Extubation	94.03±5.17	96.93±5.12	0.0331*
5 min after extubation	82.07±5.09	89.57±4.21	0.000*
Average postoperativly	84.66±2.30	92.90±1.89	<0.001*

#statistically not significant,*statistically significant

The above table shows intergroup comparison of Mean Blood Pressure (MAP). Comparison in the two group revealed no statistical significant difference between the baseline MAP (p≥ 0.05). However, there was statically significant difference in the mean blood pressure at induction, intubation, throughout the surgery and on extubation (p≤ 0.05). Later after 5 minutes of extubation and in post operative period there was highly significant difference in MAP between the two study groups (p≤.001). Signifying that Dexmedetomidine reduces mean blood pressure more than Esmolol.

Table 4: Post-Operative Incidence of Nausea and Vomiting Comparison between the Two groups in %

	Group D		Group E		p-value
	n	%	n	%	
Nausea	4	13.3	6	20.0	> 0.05
Vomiting	1	3.3	2	6.7	> 0.05
Shivering	0	0	0	0	-

The above table shows comparison of incidence of nausea, vomiting and shivering in two groups. Postoperative nausea incidence were higher in Esmolol group (Group E) i.e.20% whereas it is 13.33% in group D, but is statistically insignificant (p≥0.05). Also postoperative vomiting incidence were also higher in Esmolol group (Group E) i.e. 6.7%, whereas it was 3.3% in group D, but it is also statistically insignificant (p≥0.05). There was no incidence of shivering.

Table 4: Comparison of sedation between the two groups using Ramsay Sedation Score

	Group D		Group E		p-value
	n=30	%	n=30	%	
SEDATION					
1	2	6.7	5	16.7	0.421#
2	6	20	16	53.3	0.007*
3	14	46.7	6	20.0	0.007*
4	6	20.0	3	10.0	0.469#
5	2	6.7	0	0	0.472#
6	0	0	0	0	-
Mean sedation score	3.0 ± 0.98		2.3 ± 0.85		0.002*

*statistically significant, #statistically not significant

Above table shows that 6.7% (Group D) and 16.7% (Group E) of patients have Ramsay Sedation Score 1, while 20% (Group D) and 53.3% (Group E) of patient have score 2. 46.6% of patient in group D and 20% of patient in group E have score 3, also 20% of patient in group D and 10% of patients have score 4. Rest 6.7% of patients in group D have score 5, and no patient have score 6. The mean sedation score of group D 3.0 ± 0.98 and in group E 2.3 ± 0.85 Shows statistically significant between the two groups (p=0.002). Showing that Dexmedetomidine causes more sedation as compared to Esmolol, in both the groups sedation may be due to General anaesthesia given to them and all patient were rousable.

DISCUSSION

This study compared the efficacy of Dexmedetomidine and Esmolol as an hypotensive agent in elective ear and functional endoscopic sinus surgery. Nowadays, it is utmost important to provide bleeding control by hypotensive anesthesia during functional endoscopic sinus surgery and ear surgery in terms of reducing intraoperative blood loss as well as providing satisfactory surgical field for operating as both the surgeries are microscopic surgeries. Dexmedetomidine is a potent highly selective alpha-2 adrenergic receptor agonist. It is selective, analgesic and anaesthetic sparing effects, and sympatholytic properties.[12] The fall in blood pressure is mainly due to inhibition of central sympathetic outflow and also due to stimulation of presynaptic α_2 adrenoceptors decreasing norepinephrine release.[13] An important advantage is its minimal respiratory depressant effect with the potent sedative and analgesic effects compared with opioids and other sedative. Many studies have shown that dexmedetomidine decreases the bleeding in surgeries due to hemodynamic stability.[14,15,16,17] Esmolol lowers arterial blood pressure through a decrease in cardiac output secondary to negative chronotropic and ionotropic effects of β- adrenergic antagonism. It provide stable course of controlled hypotension and produce beneficial effects in the surgical field and in blood conservation.[1,18] Esmolol was also used to provide controlled hypotension intraoperatively in many studies too.[14,19] In our study baseline mean HR were comparable between the groups (p=0.596). At all time intervals following intubation, the mean HR was suppressed maximum at 15 min interval with HR of 70.71±6.13 in group D where as the mean HR was suppressed but to a lesser extent in group E nearing baseline values at 15 minutes interval at 74.25± 4.56. The heart rate between the groups was significant (p≤0.05) at the following intervals, i.e. induction, intubation, 15 minutes intraoperativly and extubation. 5 minutes after extubation and 4 hour post operative monitoring at an interval of 30 minutes (p≤0.001) showing superior effect of Dexmedetomedine in prevention of tachycardia following extubation. Similar observations were noted byGogusNetal,[20] BajwaSS *et al*,[21] Gupta A.[22] Upon overall comparison between the two groups, the heart rate was better controlled with Dexmedetomidine than Esmolol at times. The baseline MAP was94.47±6.28 in group D. It was observed to have a decreasing trend following Dexmedetomidineinfusion (Induction). The value just before intubation was 21.03% below the baseline 74.60±3.86. The increasein MAP 86.07±5.85 noted following intubation, followed by an average MAP of 70.91±3.18 in intra-operative period. MAP was 0.47% less from the baseline, immediately on extubation with an average MAP increase to 94.03± 5.17 on extubation. However this increase in MAP is settled over the next 5 minutes with an average MAP 82.07±5.09 after extubation. In group E, the baseline MAP was 92.27±6.94. fall in MAP observed to 16.58% fall from the baseline with MAP 76.97±3.88followingEsmolol infusion (Induction). Immediately following intubation there was a sharp rise of MAP. It reached 89.48±6.92 but still 3.02% less than baseline and there after followed by an average MAP of 72.66±4.27 in intra-operative period. There is rise in MAP 5.05% more than baseline immediately on extubation with an average MAP increase to 96.93±5.12 on extubation. However this increase in MAP is settled over the next 5 minutes with an average MAP 89.57±4.21 on extubation. The result of response of drugs on MAP in our study are also like the result observed by Srivastava VK *et.al*.[23] who concluded that there was no significant increase in MAP comparative to baseline at any time intervals of intubation in group D, while it was significantly increased in group esmolol group. Like other studies conducted by Reddy SV[24]andSelvaraj[25] the current study also shows attenuation of MAP values post intubation, intra-operatively and extubationnearing baseline values. Postoperative incidence of nausea, vomiting was higher in Esmolol group (Group E) i.e.20% whereas it is 13.33% in group D, but is statistically insignificant (p≥0.05). Also postoperative incidence of vomiting was also higher in Esmolol group (Group E) i.e. 6.7%, whereas it was 3.3% in group D, but it is also statistically insignificant (p≥0.05). There was no incidence of shivering. The Ramsay sedation scores were significantly higher in group D compared with group E. Mean sedation score in group D is 3.0±0.98 and in group E 2.3±0.85 which is statistically significant (p=0.002).In concordance of Shams T *et al*[14] in their study on induced hypotension for functional endoscopic sinus surgery also concluded that sedation score were significantly lower in

E group at 15 and 30 minutes postoperatively. It is in concordance with our study.

CONCLUSION

Both Dexmedetomidine and Esmolol can be used as a hypotensive agent in elective ear and functional endoscopic sinus surgery, however Dexmedetomedine is more effective than Esmolol in providing intraoperative hypotension. Also Dexmedetomidine have lesscomplication or side effects, post operative shivering and nausea vomiting. Sedation score in postoperative period is more in patients receiving Dexmedetomidine. However, the patients were awake and responded to commands.

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