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Original Research Article

Comparison of Dexmedetomidine and Esmolol Induced Hypotension in Functional Endoscopic Sinus Surgery

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Abstract

Introduction: Functional endoscopic sinus surgery (FESS) is currently a broadly performed minimal invasive procedure and to reduce blood loss during operation, a new technique is employed called as the controlled hypotension. Different drugs are used to attain controlled hypotension with dexmedetomidine (DEX) and esmolol being two important ones among them. So, current research was aimed to compare the effectiveness of DEX and esmolol in FESS.

Material and methods: Present study was a single blinded, randomized and prospective comparative study done on the patients visiting Adarsh Hospital and Superspeciality ENT Research Centre, Jamudi, Azamgarh, UP. 66 patients fulfilling inclusion criteria were included into the study and were divided randomly into 2 groups i.e. based on the drug administered. Demographic data and variables to assess efficacy of the drug were noted and analyzed. A "P-value <0.05 was considered as statistically significant".

Result: The "average category scale" for operative field quality in present study was similar in both the groups. Our study observed no any significant variation in the blood volume lost and mean duration of surgery among both the groups. DEX group in current study had significantly higher "emergence time", sedation scores, time of total upturn from anesthesia and time of first analgesics demand than esmolol group.

Conclusion: This current study proved both DEX and esmolol as effective and safe drugs for having bloodless operative field during FESS. Our study documented DEX to have more efficacy than esmolol as hypotensive agents for controlled hypotension during FESS.

Keywords: Hypotension, FESS, DEX, Esmolol etc.

Introduction

Functional endoscopic sinus surgery(FESS) is nowadays an extensively performed minimal invasive procedure to access paranasal sinuses to provide drainage to the sinus cavities.[1] Further association of improved illumination & visualization with the newer techniques has noticeably enhanced surgical dissection but excessive bleeding during FESS under general anesthesia can result into impaired visibility leading to many complications. So the main concern of an ENT surgeon is to have visibly clear, bloodless operative field to demarcate the complex anatomy and can be attained by hypotensive anesthesia.

Controlled hypotension or Hypotensive anesthesia or Induced hypotension or Deliberate hypotension is a new technique employed these days to reduce blood loss during operation to have better quality of surgical field for enhanced success rate of the surgery.[2] In this method, blood pressure(BP) of patients undergoing surgery is safely dropped by around 20 % by reducing capillary leak, while preserving organ perfusion.[3] Many drugs are used to attain controlled hypotension such as high doses of inhalational anesthetics, calcium (Ca) channel blockers, nitroglycerine, α-adrenergic agonists, magnesium sulfate[4], β-blockers[5] and vasodilators (sodium nitroprusside) etc.

Esmolol, is an ultra-short acting selective (cardio selective) beta 1 (β1) or adrenergic receptor antagonist, which quickly starts its action when given as an infusion or as a bolus. It drops BP and the heart rate (HR) [6,7], efficiently blunting the adrenergic responses to perioperative stimuli and on stoppage of infusion, continuous recovery of BP to the initial value occurs in the absence of noticing any rebound hypertension. Dexmedetomidine (DEX) is an alpha 2 (α2) receptor agonist which is

highly selective and used during surgery as an adjuvant to general anesthesia to prevent tachycardia and hypertension. It has sympatholytic properties, analgesic, anti-anxiety, sedative and anesthetic sparing effects.[8] Sympatholytic action, both peripheral & central of DEX is arbitrated by α2 receptor (adrenergic) and evidenced by dose dependent decline in the cardiac output, BP, HR and release of norepinephrine. Considering the above reflection, the present research aimed to compare the effectiveness of DEX and Esmolol as hypotensive agents to attain controlled hypotension in FESS along with noticing the surgical field quality, blood loss, recovery profile etc.

Material and Method

The present study was a single blinded, randomized and prospective comparative study done on the patients visiting Adarsh Hospital and Superspeciality ENT Research Centre, Jamudi, Azamgarh, UP from July 2022 to June 2023. Total of 66 patients planned for elective FESS with 'ASA (American Society of Anaesthesiologists) grade I and grade II' having age from 20-65years were selected for the study. Patients with DM (diabetes mellitus), HT (hypertension), hypovolemia, cardiovascular, cerebrovascular, hepatic, renal or coagulation insufficiency were excluded from the study. The research was started after obtaining ethical clearance from Institutional Ethical Committee and consent was taken from all the recruited cases. The participants were allocated randomly to any of the 2 study groups, based on the drug given for controlled hypotension i.e. Group A having 33 patients administered with Dexmedetomidine (DEX) and Group B having 33 participants administered with Esmolol. During pre-operative assessment, clinical history was taken, vital signs were seen and physical & systemic evaluation was done for all the participants.

The airway and difficulty in intubation examination was done based on Mallampati classification & patients having grade above II were not considered for the study.[9] Cardiorespiratory reserve was evaluated based on Sabrasez test and patients holding breath for >30seconds were considered fit for general anaesthesia (GA).[10] Before administration of anaesthesia and during surgery baseline parameters like heart rate (HR), SpO_2 levels and mean arterial pressure (MAP) were noted and electrocardiogram (ECG) leads were placed for monitoring. Preparation of the patient was done and GA was given as per the standard protocol of the hospital. Group A patients were given 1μg/kg of DEX in 10ml of 0.9% normal saline over 10minutes before GA administration trailed by incessant drip of 0.4 - 0.8μg/kg/hour. Patients of group B were given 1mg/kg of esmolol over 1minute trailed by incessant drip of 0.4 - 0.8mg/kg/hour. To maintain mean MAP from 55-65 mmHg in both the groups, infusion was titrated. Before the start of surgery, in both the groups SBP (systolic blood pressure) was dropped to <100mmHg and was maintained between 80-100mmHg by adjustment of the dose of DEX and esmolol during the surgery. During surgery, visibility of the operative field was assessed based on "average category scale" used by previous studies.[2] Infusion of hypotensive drugs were stopped 10minutes prior to the cessation of surgery. The SBP was again maintained to the normal levels or close to it to ensure for haemostasis. The time of surgery was noted from the beginning of incision of skin to the ending of closure of skin. Patients were reversed with suitable drug doses at the end of surgery.

The vital functions were continuously monitored and recorded from premedication till the recovery. Initially, every 5minutes till 30minutes and at the start of hypotensive drug, every 10minutes till 90minutes. Emergence time (time between cessation of anesthetics and opening of eye if commanded verbally) and time to first analgesic requirement in post-anesthetic care unit (PACU) was recorded. Post-operative recovery was assessed based on "modified Aldrete score"[11,12] and time required to attain score of ≥9 was recorded. Sedation score was evaluated after tracheal extubation based on "Ramsay sedation scale" at 15, 30 & 60minutes.[13] Efficacy of the hypotensive drug was analysed, assessing the surgeon's score (about surgical field dryness), sedation score, emergence time, time to modified Aldrete score >9, first analgesic request, blood loss (mean) and number of cases needing blood transfusion during operation. Data were noted and analyzed using SPSS version 20. "P-value <0.05 was considered as statistically significant".

Result

The current research was comprised of 66 subjects which were further divided into 2 groups i.e. group A and group B based on the hypotensive drug used for induced hypotension in FESS. Table 1 depicts the demographic variables of the study subjects. The study included patients from age 20-65years. Group A had 12 (36.66%), 17 (51.51%) and 5 (15.15%) patients in age group 20-35years, 36-50years and 51-65years respectively. Group B included 13 (39.39%), 16 (48.48%) and 4 (12.12%) patients in above age groups consecutively. There was no association found between age and the type of drug used in FESS for induced hypotension. Study included patients with ASA grade I and ASA grade II only. Group A had 19 (57.57%) and 14 (42.42%) subjects & group B had 12 (36.36%) and 11 (33.33%) subjects with ASA grade I and ASA grade II respectively. The number of males in both the groups were more than females with group A

having 27 (81.81%) males & 6 (18.18%) females and group B having 26 (78.78%) males & 7 (21.21%) females.

The association of gender and ASA grade with the hypotensive drug used in FESS was observed as non-significant. The "average category scale" for operative field quality was comparable in both groups with scores ≤2 during the hypotensive period and median range of scores in both groups to be 2(1-3). We found no any significant variation in the blood volume lost during surgery among both the groups with 131.6±25.9ml mean blood loss in group A and 133.4±21.9ml in group B.

Mean duration of surgery was non-significantly higher in group B (90.2±13.1mins) than group A (87.1±13.2mins).

Table 1: Demographic variables of both the groups

Parameter		Group A	Group B	p-value
Age (years)	20-35	12 (36.66%)	13 (39.39%)	0.919
	36-50	17 (51.51%)	16 (48.48%)	
	51-65	5 (15.15%)	4 (12.12%)	
ASA Grade	Grade I	19 (57.57%)	12 (36.36%)	0.689
	Grade II	14 (42.42%)	11 (33.33%)	
Sex	Male	27 (81.81%)	26 (78.78%)	0.756
	Female	6 (18.18%)	7 (21.21%)	
Average category scale (Median –Range)	15mins	2(2-3)	2(1-3)	
	30mins	2(1-3)	2(1-2)	
	45mins	2(1-2)	2(2-3)	
	60mins	2(2-3)	2(1-3)	
Blood loss (ml)		131.6±25.9	133.4±21.9	0.761
Duration of surgery (mins)		87.1±13.2	90.2±13.1	0.341

Table 2 shows the variables effective in comparing efficacy of hypotensive agents being used in both the groups. Emergence time was significantly higher in group A i.e. 8.26 ± 0.64mins than group B i.e. 4.89 ± 0.56mins. Time to "modified Aldrete score" >9 was also significantly raised in group A i.e. 9.84 ± 0.91mins compared to group B i.e. 6.82 ± 1.05mins. Sedation score after surgery was assessed at 15mins, 30mins and 60mins. At 15mins and 30 mins sedation score was significantly high in group A i.e. 3.79 ± 0.28 & 3.39 ± 0.22 than group B with 2.38 ± 0.18 & 2.37 ± 0.18. At 60mins sedation score between both the groups was comparable and the difference was non-significant with 2.00 ± 0.28 in group A and 2.00 ± 0.29 in group B. Time of first analgesic request in group A was significantly more i.e. 57.49 ± 3.89mins as compared to group B i.e. 30.17 ± 2.84mins.

Table 2: Variables comparing efficacy of hypotensive agents used in both the groups

Parameter		Group A	Group B	p-value
Emergence time (mins)		8.26 ± 0.64	4.89 ± 0.56	**<0.0001**
Time to "modified Aldrete score" >9 (mins)		9.84 ± 0.91	6.82 ± 1.05	**<0.0001**
"Sedation score" (in mins after surgery)	15mins	3.79 ± 0.28	2.38 ± 0.18	**<0.0001**
	30mins	3.39 ± 0.22	2.37 ± 0.18	**<0.0001**
	60mins	2.00 ± 0.28	2.00 ± 0.29	1.00
Time to first analgesic request (mins)		57.49 ± 3.89	30.17 ± 2.84	**<0.0001**

Discussion

The study was conducted on the patients visiting Adarsh Hospital and Superspeciality ENT Research Centre, Jamudi, Azamgarh, UP and a total of 66 study subjects were enrolled in the current research. To manage bleeding during FESS and to get better quality of operative field different drugs are extensively used to attain controlled hypotension. The current research was done to analyse the effectiveness of such two drugs i.e DEX and esmolol as hypotensive agents. In our study, maximum patients in both the groups were from age 36-50years followed by 20-35years and 51-65years age group. Our study showed no association found between age with the type of hypotensive drug used in FESS. This finding of current research is in accordance to the study by Damarla R et.al.[14] and Sahu B P et.al.[15] The association of gender and ASA grade with the type of hypotensive agent was also observed as non-significant in our study which is supported by the study of Sahu B P et.al.[15] and Shams T et.al.[16] respectively. Study by Bajwa et al.[17] also observed no significant association between the demographic variables and study groups.

The "average category scale" for operative field quality was similar in both the groups which is in harmony with the findings by Shams T et.al.[16] Current study observed no significant variation in the blood volume lost and mean duration of surgery

among both the groups. This finding is strongly supported by Damarla R et.al.[14] and Shams T et.al.[16] Study by Usha B et.al.[18] also documented similar findings stating that DEX offers improved hemodynamic stability & surgical field visibility during FESS. Another study by Liu et.al.[19] analysed no significant association of age and surgery duration with the study groups.

To see efficacy of the hypotensive drugs being administered to the patients, recovery parameters, sedation scores and time of first analgesic demand were assessed. DEX group in current study had significant higher "emergence time" and time to total upturn from anesthesia than esmolol group. This finding of current research is in harmony with study by Sahu B P et.al.[15] and Shams T et.al.[16] Study by shah SM et.al.[20] also assessed higher emergence time in DEX patients.

In current research DEX group had significantly raised sedation score and time of first analgesics demand than esmolol group. Study by Usha B et.al.[18] reported similar findings and this outcome is also strongly supported by Sahu B P et.al.[15] and Shams T et.al.[16] Sharaf MIA et.al.[21] observed significantly longer sedation score at 15 and 30mins in DEX group supporting present study. Another study by Valecha et.al.[22] also documented enhanced analgesic and sedative property along with low dose of inducing agent compared to esmolol group. Gurbet et.al.[23] also found low demand of analgesic requirements in DEX group.

The possible reason behind this outcome could be that the DEX has analgesic sparing & sedative effects through central actions in the dorsal horn of the spinal cord and in the locus ceruleus. The result of our study proved DEX to be more efficient hypotensive agent than esmolol during FESS. Our result is in disagreement with the study by Kakati et.al.[24] as they found esmolol to be more effective than DEX during FESS. The current study is in accordance with the study by Ajay et.al.[25] and Mahajan et.al.[26]

Conclusion

This current study proved both DEX and esmolol as effective and safe drugs for having bloodless operative field during FESS. Our study documented DEX to have more efficacy than esmolol as hypotensive agents for controlled hypotension during FESS. Compared with esmolol, DEX had benefit of sedative and inherent analgesic property along with anesthetic sparing effect and early recovery time.

The extra advantage seen in the case of DEX was remarkably less need for blood transfusion in DEX group patients. This research can help surgeons in decision making while choosing drug of interest for controlled hypotension during FESS and will help patients by reducing complications and side effects.

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Authors' contribution: Both the authors have made considerable contribution in designing, data collection, analysis and interpretation

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