International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2021; 4(2): 197-201
Received: 28-02-2021
Accepted: 30-03-2021

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Dexmedetomidine and esmolol for induced hypotension for functional endoscopic sinus surgery: A comparative study

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DOI: https://doi.org/10.33545/26643766.2021.v4.i2c.255

Abstract
Background: Functional endoscopic sinus surgery (FESS) is a minimally invasive surgical procedure performed under controlled hypotensive anaesthesia. This technique has advantage of minimal blood loss and visualize surgical field distinctly. The present study was designed to compare the efficacy of Dexmedetomidine and Esmolol for the induction of controlled hypotension in functional endoscopic sinus surgeries.
Materials and Methods: A total of 80 cases with paranasal sinus pathologies posted for functional endoscopic sinus surgeries between 21-60 years were recruited. Study participants were randomly divided into two study groups i.e. group 1 administered with dexmedetomidine and group 2 administered with Esmolol. Parameters like hemodynamics, total intraoperative fentanyl consumption, duration of surgery and total blood loss were noted.
Results: The mean difference of systolic blood pressure, diastolic blood pressure and mean arterial pressure was not statistically significant (P>0.05). The mean difference of heart rate between two study groups was statistically significant (p<0.05). The mean duration surgery in group 1 was 87.9 min and in group 2 was 89.5 min. The estimated blood loss was 132.2 ml in group 1 and 134.2ml in group 2. No desaturation was observed in the study participants during recovery and postoperative period.
Conclusion: Both dexmedetomidine and esmolol infusion are efficacious and are safe drugs for maintaining controlled hypotension and improve the quality of surgical field. Dexmedetomidine was associated with good postoperative sedation while esmolol associated with early recovery time. Surgeon satisfaction score was similar was similar in both.

Keywords: functional endoscopic sinus surgery (FESS), Dexmedetomidine, esmolol, controlled hypotension

Introduction
Functional endoscopic sinus surgery (FESS) is a minimally invasive approach to the sinus cavities. There are major complications reported for FESS under general anaesthesia resulting from impaired visibility due to excessive intraoperative blood loss [1]. Controlled hypotension is a novel method used to minimize the intraoperative blood loss to Visualize surgical field distinctly and improves surgical success rate [2-4]. To achieve controlled hypotension, some anaesthetic drugs such as inhalational anesthetics, calcium channel blockers, α-adrenergic agonists, β-blockers and vasodilators are used in the surgery.
Dexmedetomidine, a highly selective alpha 2 adrenoceptor agonist is used as an adjuvant to general anaesthesia during surgery. It has sedative, analgesic and anaesthetic sparing effect and sympatholytic properties. Central sympatholytic action of dexmedetomidine mediated by alpha 2 adrenergic receptors manifest as dose dependent decrease in arterial blood pressure, HR, cardiac output and nor epinephrine release [5-7]. Esmolol, an ultrashort acting, cardio selective beta 1 receptors antagonist reduces HR and blood pressure hence it is effectively used in blunting adrenergic responses to perioperative stimuli like laryngoscopy, tracheal intubation and extubation. It has rapid onset of action when given as a bolus and as an infusion [8, 9]. Hence, the present study was designed to compare the efficacy of Dexmedetomidine and Esmolol for the induction of controlled hypotension in functional endoscopic sinus surgeries.

Materials and Methods
The present prospective randomized study was carried out in the Department of

Anaesthesiology, Dr. Patnam Mahender Reddy Institute of Medical Sciences, Rangareddy and SVS Medical College, Mahaboobnagar from April 2019 to March 2021. A total of 80 cases with paranasal sinus pathologies posted for functional endoscopic sinus surgeries were recruited. The cases of ASA grade I and ASA grade II, cases age group between 21- 60 years and willing to participate in the study were included. Cases with diabetes mellitus, uncontrolled hypertension, cardiovascular complications, COPD, cerebrovascular diseases and renal complications were excluded. Informed consent was obtained from all the study cases and study protocol was approved by institutional ethics committee.

The study participants were randomly divided in to two study groups based on the drug administered i.e. group 1 administered with dexmedetomidine and group 2 administered with Esmolol. Prior to the surgery, complete clinical history, physical examination, vital signs and airway assessments was done for all the participants. All the Participants were premedicated with Inj.glycopyrrolate 0.2mg intramuscularly and Inj.ondansetron 4mg ib, 30 min prior to induction. Before induction of anaesthesia, baseline measurements of heart rate, mean arterial pressure and levels of oxygen saturation levels were noted. Patients were then preoxygenated for 3 minutes, and anaesthesia was induced with thiopentone 5 mg/kg and fentanyl lµg/kg intravenously. Succinyl choline 1-1.5mg/kg iv was given to facilitate endotracheal intubation with appropriate size cuffed oral endotracheal tubes and lidocaine iv 1-1.5mg/kg was given to suppress hemodynamic response to laryngoscopy and tracheal intubation. Anesthesia was maintained with oxygen (40%), nitrous oxide (60%), seroflurane (1.5-2%), vecuronium on controlled ventilation with closed circuit. Group 1 participants were administered with dexmedetomidine loading dose of 1µg/kg within 10 min followed by 0.4-0.8µg/kg/h infusion during maintenance. Group 2 participants were administered with Esmolol with loading dose 1 mg/kg being infused over one min followed by 0.5 mg/kg/h infusion during maintenance. All infusions were titrated to maintain a mean arterial pressure between 70-75mm of Hg. Parameters like heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), oxygen saturation levels were measure and noted for every 2 minutes up to first 10min, thereafter for every 5 min up to 30 min and later for every 15 min up to 60 min.. The total intraoperative fentanyl consumption, duration of surgery and total anaesthesia time and time for first analgesic request after surgery was noted. The post-operative sedation score was assessed with Ramsy sedation score (at 15 min, 30 min and 60 min) after tracheal Extubation and post-operative side effects were recorded.

The SPSS version 23 was used to carry out statistical analysis relevant to the study. The frequency and percentages (%) were calculated. The chi-square test was used to test the significance of qualitative data. P-value of <0.05 was considered as statistically significant.

Results

Table 1: Demographic data of two study groups.

Demographic parameters		Group1 Mean ± SD	Group 2 Mean ± SD	p-value
Age (In years)		29.24 ± 1.38	29.45 ± 2.51	0.286
BMI		23.04 ± 1.13	22.89 ± 1.88	0.674
Height		168.2 ± 3.37	167.5 ± 3.56	0.662
Weight		64.04 ± 8.78	63.98 ± 6.53	0.264
ASA grade	I	24	22	-
	II	16	18	
Duration of surgery		87.9 ± 10.36	89.5 ± 12.43	0.561
Blood loss		132.2 ± 6.27	134.2 ± 5.96	0.274

Table 2: Comparison of systolic blood pressure and diastolic blood pressure among two study groups

Duration	Systolic blood pressure		p- value	Diastolic blood pressure		p-value
	Group 1 Mean ± SD	Group 2 Mean ± SD		Group 1 Mean ± SD	Group 2 Mean ± SD	
At beginning	114.2±2.82	114.7±2.56	0.541	68.66±1.18	68.88±1.61	0.568
2 min	112.7±3.20	113.1±2.23	0.238	67.45±1.59	67.23±1.22	0.451
4 min	108.5±2.27	109.2±3.54	0.141	65.63±1.66	66.29±1.50	0.237
8 min	104.5±4.23	105.2±3.87	0.530	64.89±1.98	65.21±1.64	0.366
10 min	101.2±2.98	101.8±3.63	0.872	61.33±1.68	63.86±1.25	0.891
15 min	98.56±5.45	99.66±3.28	0.212	60.84± 1.45	61.28±1.37	0.567
20 min	98.20±5.06	98.89±5.34	0.386	59.79±2.01	61.08±1.21	0.436
25 min	98.01±4.12	98.24±4.03	0.158	59.62±1.28	60.32±1.89	0.279
30 min	97.69±3.65	97.88±2.35	0.275	59.56±1.89	59.88±1.53	0578
45 min	97.48±2.68	97.64±2.86	0.247	59.34± 1.75	59.51±1.23	0.489
60 min	97.37±2.08	97.99±3.55	0.359	59.45±1.44	60.28±1.65	0565

Table 3: Comparison of mean arterial pressure and mean heart rate among two study groups

Duration	Mean arterial pressure		p- value	Mean heart rate		p-value
	Group 1 Mean ± SD	Group 2 Mean ± SD		Group 1 Mean ± SD	Group 2 Mean ± SD	
At beginning	81.23±2.45	83.42±2.69	0.278	80.23±4.63	82.33±6.10	0.002
2 min	80.98±2.20	81.73±1.56	0.182	79.60±5.63	81.06±5.87	0.048
4 min	77.65±2.58	78.94±1.78	0.537	78.29±4.87	80.25±6.46	0.162
8 min	75.47±1.56	75.89±2.31	0.246	76.58±5.66	80.12±4.58	0.024
10 min	73.11±2.85	73.5±2.04	0.380	75.29±5.81	78.89±5.74	0.031
15 min	72.45±2.30	72.56±1.81	0.458	73.26±4.28	79.56±4.67	0.044
20 min	72.57±1.53	72.66±1.79	0.621	69.56±3.39	78.35±4.98	0.024

25 min	72.89±1.86	72.80±1.54	0.936	66.23±3.40	77.88±5.08	0.022
30 min	72.28±2.13	72.59±1.67	0.412	64.82±3.92	77.67±4.95	0.018
45 min	72.43±1.68	72.77±1.89	0.687	62.58±4.81	77.54±4.38	0.031
60 min	72.31±1.56	72.43±2.78	0.258	62.34±4.54	77.36±5.08	0.024

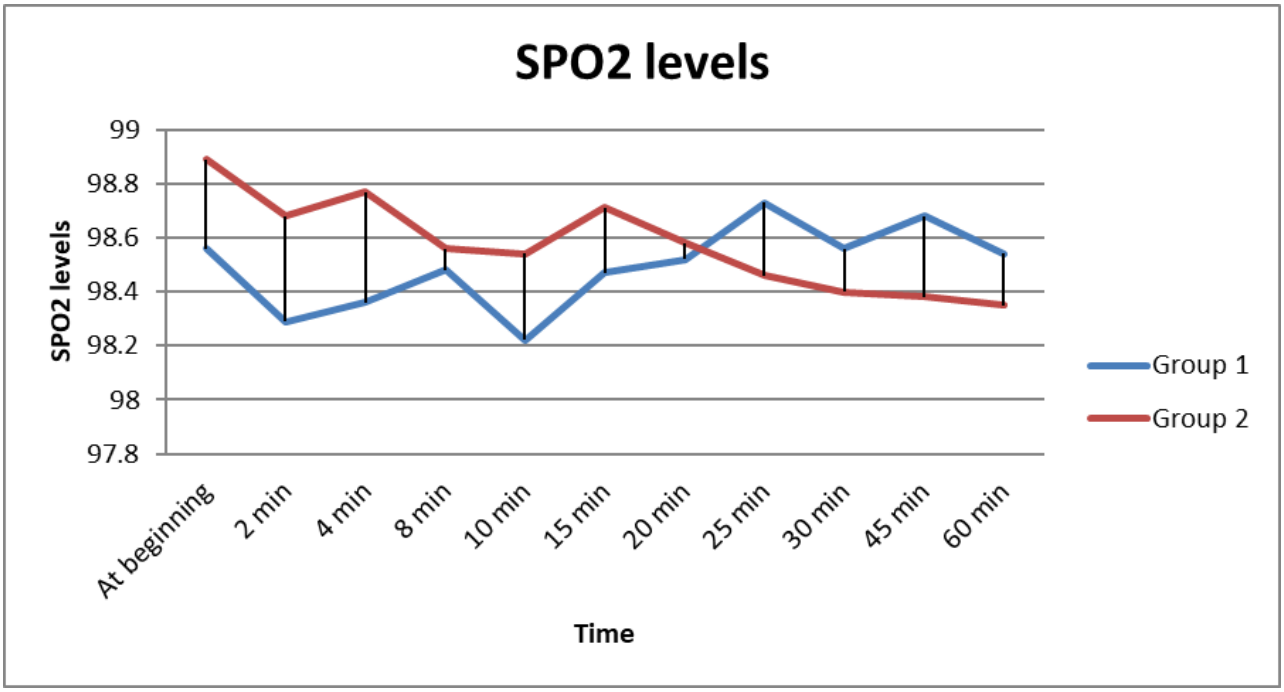

Fig 1: Comparison of SpO2 levels between two study groups after induction.

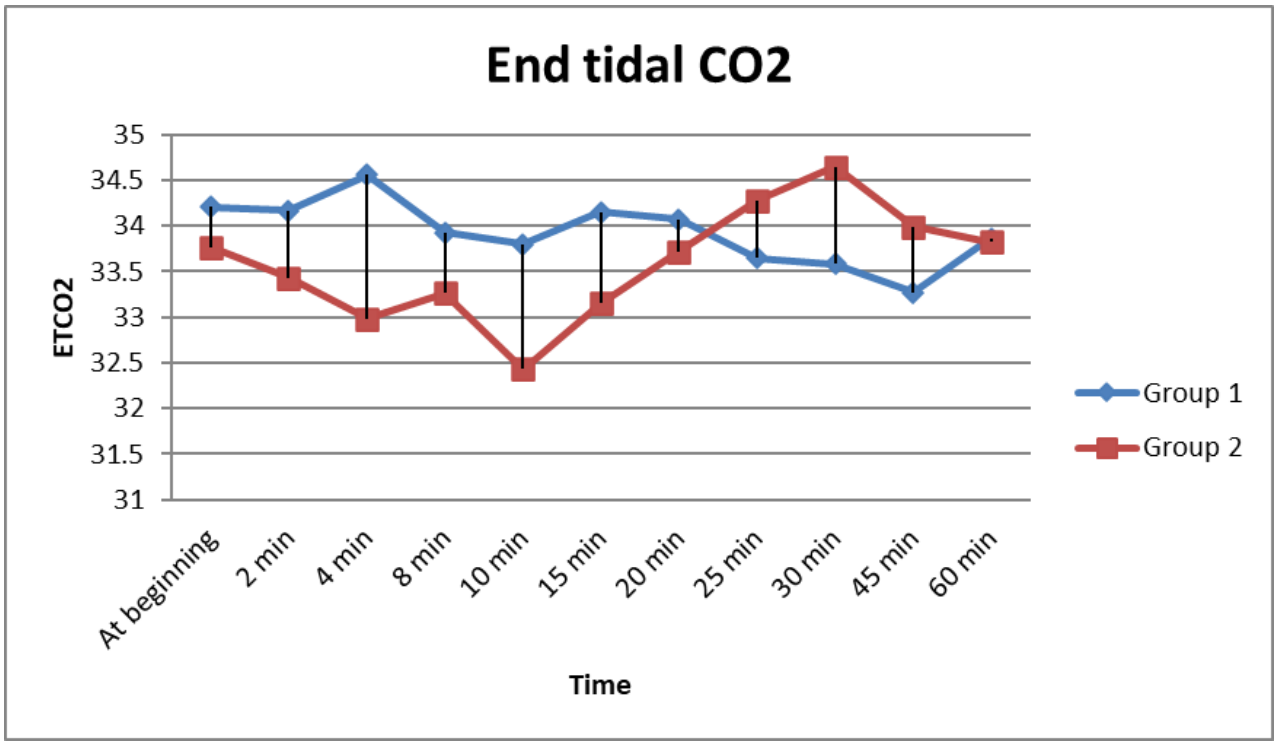

Fig 2: Comparison of end tidal CO2 levels between two study groups after induction

Table 4: The sedation score among the study groups assessed by RSS scores.

Duration	Sedation sore	Group 1 (n=40)	Group 2 (n=40)	P-value
15 min	1	02	03	0.981
	2	38	37	
30 min	1	06	02	0.552
	2	34	38	
60 min	1	07	01	0.145
	2	33	39	

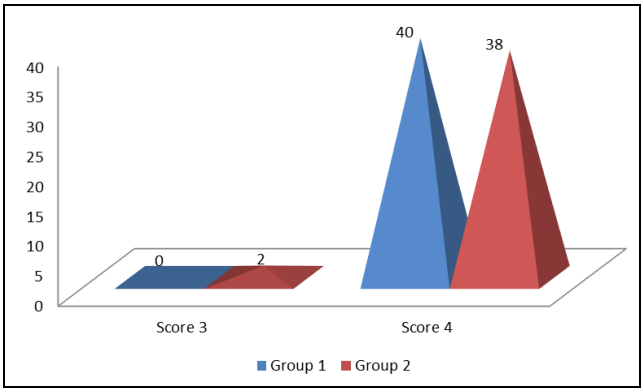

Fig 3: The surgeon satisfaction score among the subjects of two study groups.

Discussion

Functional endoscopic sinus surgery (FESS) is commonly operated under induced or controlled hypotensive anaesthesia in which arterial blood pressure is decreased in a predictable manner [10, 11]. The present study was designed to compare the efficacy of Dexmedetomidine and Esmolol for the induction of controlled hypotension in functional endoscopic sinus surgeries. A total of 80 cases with paranasal sinus pathologies posted for functional endoscopic sinus surgeries were recruited. The study participants were randomly divided in to two study groups based on the drug administered i.e. group 1 administered with dexmedetomidine and group 2 administered with Esmolol. The mean age in group 1 cases was 29.24 and in group 2 were 29.45. The mean difference of age between the groups was statistically not significant (p=0.286). The mean BMI in group 1 was 23.04 and in group 2 22.89. The mean difference of BMI (p=0.674), height (p=0.662) and weight (p=0.264) between the two study groups was not statistically significant. In this study, the mean duration surgery in group 1 was 87.9 min and in group 2 was 89.5 min. The estimated blood loss was 132.2 ml in group 1 and 134.2ml in group 2 (Table 1). In a study by Sukhminder Jit Singh Bajwa *et al*. noticed that there was no statistically significant difference between the study groups with regards to demographic variables [12]. A study by Shams T *et al*. found mean age in group DEX was 34.8 years and in group Esmolol was 36.1 years. The mean duration of surgery was 88.1 min in group DEX, 90 min in group Esmolol. The estimated blood loss was 130.6 ml in group 1 and 131.4ml in group 2 [4]. A study by Juan Liu *et al*. found no significant difference between age, weight, and surgery duration [13].

In this study, the mean systolic blood pressure, diastolic blood pressure and mean arterial pressure of participants during administration of drugs and at regular intervals in the both study groups were comparable. The mean difference of SBP, DBP and MAP was not statistically significant (P>0.05). There was no requirement of antihypertensive drugs and there was no incidence of hypotension (Table 2 &3). The mean arterial pressure was significantly lower in dexmedetomidine group than Esmolol group after infusion of study drugs. None of the cases experienced bradycardia, resistant hypotension or hypertension during the study period [12]. A study by Shams T *et al*. noticed baseline values of MAP were comparable between both study groups. In both the study group, there was a significant reduction in MAP compared to baseline value intraoperatively [4].

The mean heart rate was comparable in both the study groups. The mean difference between two study groups was statistically significant (p<0.05). The mean HR was gradually decreased at all the intervals in group 1, whereas in group 2, the mean HR was increased at 15 minutes and thereafter it was decreased (Table 3). In a study by Sukhminder Jit Singh Bajwa *et al*. noticed that the mean heart rate was significantly lower in dexmedetomidine group than Esmolol group [12]. A study by Shams T *et al*. noticed that there were no intergroup significant differences in HR after induction or during the hypotensive period. HR showed significant increase in E group 5, 10 min after stoppage of hypotensive agent, at end of surgery and after recovery compared to DEX group [4].

In the present study, the mean oxygen saturation levels were constant between two study groups. No desaturation was observed in the study participants during recovery time and postoperative period. The mean difference of end tidal CO2 levels in study subjects between two study groups was statistically not significant. In this study, the surgeon satisfaction score among the subjects of two study groups showed that group 1 and group 2 had high satisfaction scores i.e. 40 cases of group1 had score 4, whereas 38 cases of group 2 had score 4 and 2 cases had score 3. The sedation scores were assessed at 15, 30, 60 minutes of postoperative period by RSS score. At 15 min, more number of group 2 subjects had higher sedation rates, whereas at 30min and 60min group I cases had higher rates of sedation scores (Table 4). A study by Sukhminder Jit Singh Bajwa *et al*. observed that 72% of patients given dexmedetomidine had sedation scores 3 and above while only 20% of patients given esmolol had such higher sedation score [12].The sedation scores were significantly lower in E group compared with DEX group at 15 min and 30 min postoperatively. Time to first analgesic request was significantly longer in DEX group [4]. No side effects were observed to the study drugs during the entire study period. A study by Sukhminder Jit Singh Bajwa *et al*., Das A *et al* and Ibraheim *et al* noted minimal side effects related to the study drugs [12, 17, 18].

A study by Valecha DS *et al*. concluded that dexmedetomidine has better analgesic property, better sedative and reduced dose of inducing agent than esmolol [11]. A study by Sukhminder Jit Singh Bajwa *et al*. concluded that Dexmedetomidine and Esmolol provided better hemodynamic stability while performing FESS. Dexmedetomidine provides an additional benefit of reducing the analgesic requirements and providing postoperative sedation [12]. A study by Shams T *et al*. concluded that both dexmedetomidine and Esmolol are effective drugs for controlled hypotension and effective in providing ideal surgical field during FESS. Dexmedetomidine has more sedative and analgesic effect than Esmolol [4]. A study by Juan Liu *et al*. concluded that dexmedetomidine with Esmolol has advantages in less pain, better quality and less adverse postoperative complications [13]. A study by Kakati R *et al*. concluded that Esmolol was effective for controlled hypotension in FESS than DEX. Esmolol is effective in providing quality of surgical field and minimal adverse postoperative complications [14]. A study by Mahajan L *et al*. concluded that dexmedetomidine was effective in proving better surgical field along with low blood loss and better hemodynamics than metoprolol [15]. A study by Kumar Ajay *et al*. concluded that

Dexmedetomidine is effective in providing intraoperative hypotension with minimal postoperative adverse effects than Esmolol [16].

Conclusion

The results of this study concluded that both dexmedetomidine and esmolol infusion are efficacious and safe drugs for maintaining controlled hypotension and improve the quality of surgical field. Both the study drugs can provide haemodynamic stability and minimal blood loss during the FESS. However, dexmedetomidine was associated with good postoperative sedation while esmolol was associated with early recovery time. Surgeon satisfaction score was similar in both drug groups.

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