Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/9a457x74

# COMPARATIVE EVALUATION OF THE EFFICACY OF DEXMEDETOMIDINE VERSUS ESMOLOL FOR CONTROLLED HYPOTENSION IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY

**Dr. Tanweer Ahmad[1], Dr. Anjum Shamim Khan[2], Dr. Asif Hussain[3*]**

[1*]DNB, Department of Anaesthesiology and Critical Care, Government Medical College, Anantnag, India.
[2]HOD, Associate Professor, Department of Anaesthesiology and Critical Care, Government Medical College, Anantnag, India.
[3]Senior Resident, Department of Anaesthesiology and Critical Care, Government Medical College, Anantnag, India.

***Corresponding Author:** Dr. Asif Hussain
*Senior Resident, Department of Anaesthesiology and Critical Care, Government Medical College, Anantnag, India. Mail ID: drasifhussain2020@gmail.com

## Abstract

**Background:** Functional endoscopic sinus surgery (FESS) is a minimally invasive surgical procedure designed to restore normal drainage and function of the paranasal sinuses. However, FESS performed under general anesthesia has been reported to be associated with major complications, primarily resulting from impaired visibility due to excessive bleeding.

**Aim:** To compare the efficacy of dexmedetomidine and esmolol as hypotensive agent for controlled hypotensive anesthesia in functional endoscopic sinus surgery with regards to inducing dry surgical field, duration of post-operative analgesia and sedation, and adverse effects.

**Methods:** This longitudinal prospective comparative study included patients aged 25-55 years undergoing elective FESS under general anesthesia. Participants were randomly assigned to two groups: Group D received dexmedetomidine, and Group E received esmolol. Data were collected on intraoperative parameters such as heart rate, blood pressure, oxygen saturation, and surgical field quality. Postoperative parameters included the duration of analgesia and sedation, and the incidence of adverse effects. Statistical analysis was performed using SPSS software.

**Results:** The dexmedetomidine group had significantly lower intraoperative fentanyl consumption and a longer time to the first analgesic request postoperatively compared to the esmolol group. The quality of the surgical field, assessed by the absence of an obscured field, was significantly better in the esmolol group, with only 10% of cases reporting an obscured field compared to 40% in the dexmedetomidine group. Intraoperative blood loss was significantly higher in the dexmedetomidine group. However, the dexmedetomidine group exhibited better postoperative sedation scores, though they experienced higher incidences of bradycardia and hypertension. The esmolol group had faster recovery times and lower postoperative sedation scores. Both drugs were effective for controlled hypotension during FESS, but esmolol provided a clearer surgical field and quicker recovery, while dexmedetomidine offered better postoperative analgesia and sedation.

**Conclusion:** This study concluded that both dexmedetomidine and esmolol are effective for controlled hypotension during FESS. Dexmedetomidine provided better postoperative analgesia and

sedation but was associated with higher intraoperative blood loss and more frequent adverse effects such as bradycardia and hypertension. Esmolol offered a clearer surgical field and faster recovery with fewer adverse effects, making it a preferable choice for patients where rapid recovery and minimal postoperative complications are prioritized.

**Keywords:** FESS, Dexmedetomidine, Esmolol, blood loss, analgesia, sedation, hemodynamic.

## Introduction:

Functional endoscopic sinus surgery (FESS) is a minimally invasive surgical procedure designed to restore normal drainage and function of the paranasal sinuses.1 This approach contrasts with traditional sinus surgery, which often involves extensive removal of sinus tissue and bone. FESS, on the other hand, aims to preserve as much of the normal anatomy as possible, reducing the risk of complications and promoting faster recovery.2

However, FESS performed under general anesthesia has been reported to be associated with major complications, primarily resulting from impaired visibility due to excessive bleeding.3 These complications range from orbital hematoma, injury to the optic nerve, cerebrospinal fluid fistula, to intracranial injuries. Due to the location of Endoscopic sinus surgery even a small amount of bleeding can leave a negative effect on the vision of the surgeon, which in turn leads to several problems in establishing a proper surgical field.4

To properly perform the controlled hypotension procedure, several drugs have been explored. These include vasodilators such as sodium nitroprusside and nitroglycerine, beta-blockers, high doses of inhaled anesthetic agents, or a combination of these.5 However, a consensus regarding an ideal agent for this purpose is yet to be reached.6

Dexmedetomidine, a highly selective alpha-2 adrenoceptor agonist, is extensively used as an adjuvant to general anesthesia during surgical procedures. This medication is recognized for its sedative, analgesic, and anesthetic-sparing properties, making it a valuable component in anesthetic regimens. This comprehensive profile of dexmedetomidine underscores its importance in modern anesthetic practice, particularly in settings requiring precise control of hemodynamic parameters and effective pain management. Consequently, dexmedetomidine continues to be a preferred choice for anesthesiologists seeking to optimize surgical outcomes and improve overall patient care. 7

Esmolol, an ultrashort-acting, cardio-selective beta 1 receptor antagonist reduces HR and blood pressure hence it is effectively used in blunting adrenergic responses to perioperative stimuli such as laryngoscopy, tracheal intubation, and extubation. It has a rapid onset of action when given as a bolus and as an infusion.9 The perioperative use of this drug as an anesthetic adjunct has been only recently explored by various studies, although its use for hemodynamic stability and cardiac protection is well accepted.8, 9 In this context, the present study was planned to compare the efficacy and safety of dexmedetomidine and Esmolol as a hypotensive agent in FESS with regards to quality of the surgical field, duration of analgesia and sedation, and recovery profile of the patients.

## Material and methods:

This longitudinal prospective comparative study was conducted at the Department of Anesthesiology and Critical Care of the Government Medical College Anantnag, Jammu and Kashmir, from August 2022 to May 2024.

***Study population****:*

The study was conducted among patients of either sex, aged 25-55 years undergoing elective functional endoscopic sinus surgery under general anesthesia in the study institution during the period of the study.

***Grouping method****:* The study utilized two groups of patients:

**Group D:** Patients in this group received loading dose of dexmedetomidine 1µ per Kg Bw I/V diluted in 10ml of 0.9% of saline within 10 minutes followed by 0.4 to 0.8 µ per Kg Bw per hour infusion during maintenance.
**Group E:** Patients in group E received esmolol loading dose of 1mg/kg BW infused over 1 min diluted in 10ml of 0.9% of saline, followed by 0.5 mg /kg Bw/hr. infusion during maintenance.

***Data collection procedure:***
All patients meeting the inclusion and exclusion criteria were evaluated, investigated, and assessed for complete clinical history, physical examination, and airway assessment. Those providing written informed consent were assigned numbers from 001 to 060.
On arrival at the operation theater, standard, anesthetic monitoring was instituted with ECG, NIBP, pulse oximeter, and ETCo2. Intravenous access was secured by inserting 2 cannulas, of 20 G, one forinfusion of dexmedetomidine or esmolol and other cannula for fluids, and other drugs. All patients were premedicated with injection Glycopyrrolate 0.2 mg intramuscular and injection ondansetron 4mg intravenous 30 minutes prior to induction. Before induction of anesthesia baseline measurements of heart rate, MAP, and SPO2 levels were recorded. After pre- oxygenation, 03 minutes patients were induced with injection propofol 2 mg/kg BW, injection fentanyl 1µ per Kg Bw I/V. Injection succinylcholine 1 to 1.5 mg per Kg Bw I/V was given to facilitate endotracheal intubation with an appropriate-sized oral cuffed endotracheal tube. Injection lidocaine 1 to 1.5 mg/kg BW was given before intubation to suppress hemodynamic response to laryngoscopy and endotracheal intubation. A 22 G radial artery catheter was inserted for continuous measurement of arterial blood pressure. Anesthesia was maintained with O2 (40) + N2O (60%) + sevoflurane (1.5 to 2%) and injection atracurium for controlled ventilation, the same standard technique was performed in all the patients. Controlled ventilation was maintained by adjusting respiratory rate and tidal volume according to body weight to maintain normocapnea (ETCO2 of less than 35 mmHg).
The infusion was titrated to maintain MAP between 55 to 65 mmHg. Intraoperative parameters like heart rate, SBP, DBP, MAP, and SPO2 were measured and noted at baseline and 5 mins, 10 min,15 mins, 30 mins, 60 mins, and 90 mins.
After extubation and full recovery, patient were shifted to post anaesthetic ward to be observed, while the time to first analgesic request was recorded. Ramsay sedation scale at 15, 30, and 60 min after tracheal extubation was noted. Postoperative vitals like heart rate, SBP, DBP, MAP, and SpO2 were measured at 30 mins, 1 hour, 2 hours, 4 hours, 8 hours, 12 hours, 16 hours, 20 hours and 24 hours respectively.

***Data management and statistical analysis****:*
Collected data was entered into the Microsoft Excel sheet and the statistical software SPSS version 25 was used to analyze the data. The data were presented in percentages and proportions using tables and charts. Using suitable statistical tests, associations were calculated, and a p-value of $<0.05$ was considered statistically significant.

**Results:**
The study included 60 patients, with 30 in each group. The mean age was 31.6 years in the dexmedetomidine group and 30.1 years in the esmolol group, with no significant difference in age, weight, or ASA classification between the groups [Table 1].

**Table 1: Demographic profile among the study population**

| Variables | Group D | Group E | P Value |
|---|---|---|---|
| Age (years) | 31.6±4.1 | 30.1±5.2 | 0.219 |
| Sex M/F | 21/9 | 16/14 | 0.184 |
| Weight (kgs) | 55.7±3.8 | 54.6±3.9 | 0.273 |
| ASA I/II | 12/18 | 14/16 | 0.602 |

The mean intra-operative heart rates were similar between the Dexmedetomidine and Esmolol groups across various time points (baseline, 5 min, 10 min, 15 min, 30 min, 60 min, and 90 min), with no significant differences observed. The p-values ranged from 0.184 to 0.487 [Table 2].

**Table 2: Comparison of mean intra-operative heart rates between the Dexmedetomidine and Esmolol groups over time**

| **Heart rate** | **Group D** | **Group E** | **P Value** |
|---|---|---|---|
| **Baseline** | **72.5± 5.0** | **71.5±5.1** | **0.487** |
| **5 min** | **72.7± 5.0** | **74.0±5.2** | **0.328** |
| **10 min** | **71.8± 4.7** | **73.5±4.8** | **0.184** |
| **15 min** | **71.5±4.6** | **73.0±4.5** | **0.197** |
| **30 min** | **71.3± 4.5** | **72.8±4.6** | **0.195** |
| **60 min** | **71.2±4.8** | **72.5±4.7** | **0.233** |
| **90 min** | **71.0± 4.7** | **72.2±4.6** | **0.231** |

The mean intra-operative MAP showed no significant differences between the groups at baseline and various time points (5 min, 10 min, 15 min, 30 min, 60 min, and 90 min). The p- values ranged from 0.058 to 0.147 [Table 2].

**Table 2: Comparison of mean intra-operative MAP between the Dexmedetomidine and Esmolol groups over time**

| **MAP** | **Group D** | **Group E** | **P Value** |
|---|---|---|---|
| **Baseline** | **120.5±8.0** | **117.5±8.1** | **0.147** |
| **5 min** | **117.8±7.6** | **117.4±5.0** | **0.081** |
| **10 min** | **117.5±7.9** | **116.5±4.7** | **0.061** |
| **15 min** | **117.3±7.8** | **116.2±4.6** | **0.065** |
| **30 min** | **116.8±8.0** | **114.9±4.5** | **0.067** |
| **60 min** | **116.5±8.1** | **116.2±4.8** | **0.067** |
| **90 min** | **116.2±7.7** | **117.3±4.7** | **0.058** |

In the Dexmedetomidine group, 12 participants (40%) experienced an obscured surgical field, compared to 3 participants (10%) in the Esmolol group. The chi-square value was 2.391, and the p-value was 0.017, indicating a significant difference, with Esmolol providing a clearer surgical field [Table 3].

**Table 3: Comparison between Dexmedetomidine and Esmolol groups based on intraoperative obscured surgical field**

| Obscured surgical field | Group D | Group E | Total | Chi-Square | p value |
|---|---|---|---|---|---|
| Yes | 12 (40) | 3 (10) | 15 (25) | 2.391 | 0.017* |
| No | 18 (60) | 27 (90) | 45 (75) | | |
| Total | 30 | 30 | 60 | | |

The mean intraoperative blood loss in the patients was statistically significantly higher in the dexmedetomidine group as compared to esmolol group [Fig 1].

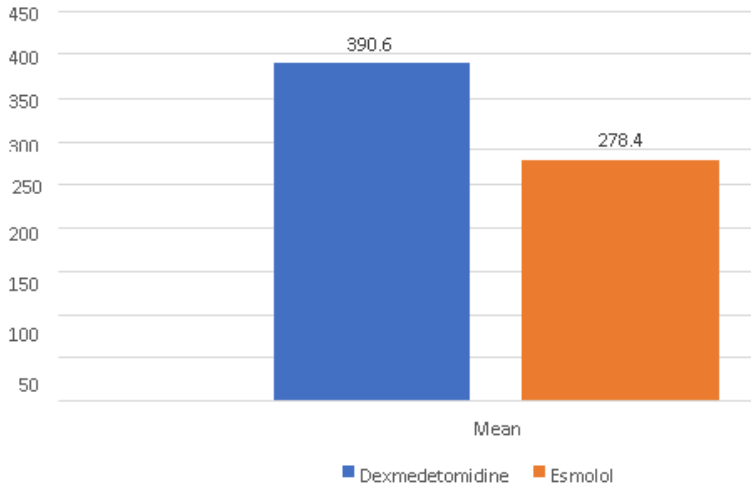


**Fig 1.**

The mean time to sedation was 5.76 minutes (SD=1.64) in the Dexmedetomidine group and 2.19 minutes (SD=1.45) in the Esmolol group. The t-test value was 8.932, and the p-value was <0.001, indicating a significantly longer time to sedation in the Dexmedetomidine group [Fig 2].

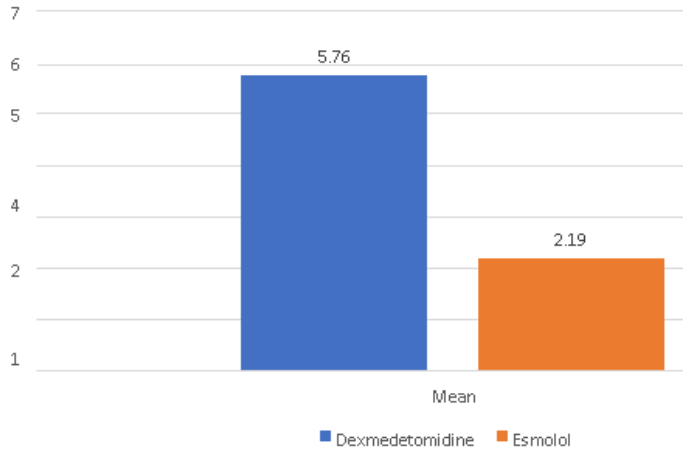


**Fig 2.**

Postoperative adverse effects included hypertension (20% in the Dexmedetomidine group), bradycardia (40% in the Dexmedetomidine group vs. 6.7% in the Esmolol group), and hypotension (6.7% in the Esmolol group). The chi-square value was 22.186, and the p-value was<0.001, indicating significant difference in overall adverse effects between the groups [Fig3].

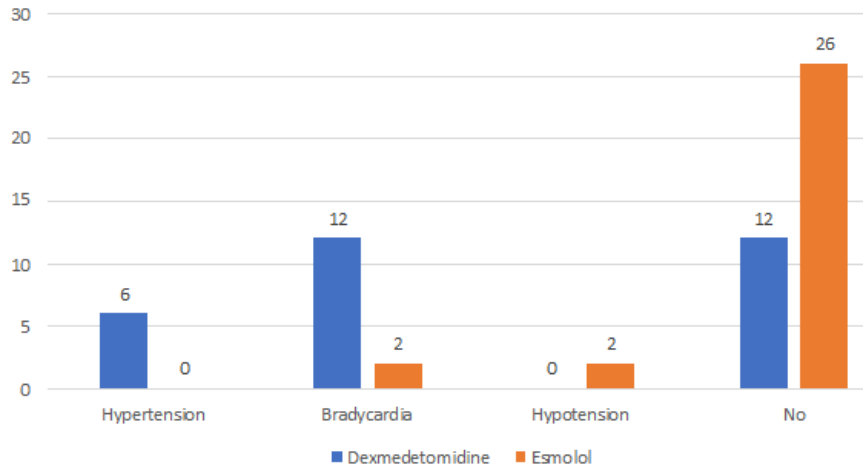


**Fig 3.**

**Discussion:**

The distribution of diagnoses revealed that chronic rhinosinusitis with polyposis was the most common condition in both groups. In the Dexmedetomidine group, chronic rhinosinusitis with polyposis accounted for 26.7% of cases, while in the Esmolol group, it was 36.7%. Chronic rhinosinusitis was more prevalent in the Esmolol group (23.3%) compared to the Dexmedetomidine group, which had no cases. These findings align with previous studies that highlighted chronic rhinosinusitis as a common indication for FESS (Tarek et al.; Lee et al.; Shamset al.).10,11,6 Additionally, conditions such as antrochoanal polyp and mucocele were also observed, with the former being more common in the Dexmedetomidine group (13.3%) and the latter exclusively seen in this group. This distribution supports the variability of sinus pathologies encountered in FESS and underscores the importance of tailored anesthetic approaches to managedifferent conditions effectively (Snidvongs et al.; Bajwa et al.). The predominance of chronic rhinosinusitis with polyposis is consistent with the extensive literature on FESS, which emphasizesits role in managing complex sinus diseases (Das et al.; Ravikumar et al.). 12,13,7,14

During the intraoperative period, mean heart rates were similar between the groups at various time points, showing no significant differences (p-values ranging from 0.184 to 0.487) . This stability is crucial for maintaining hemodynamic control and minimizing cardiac stress during surgery. Studies by Damaria et al. and Gupta et al. have similarly shown that both dexmedetomidine and esmolol effectively manage heart rates intraoperatively, contributing to safer surgical conditions.15,16 Intraoperative SBP and DBP also showed no significant differences between the groups across multiple time points, with p-values for SBP ranging from 0.058 to 0.147and for DBP from 0.184 to 0.328. These results indicate that both drugs were effective in maintaining stable blood pressure levels during surgery. Research by Sahu et al. and Sujay et al. supports these findings, demonstrating that both dexmedetomidine and esmolol provide effective blood pressure control, which is essential for reducing blood loss and improving the surgical field. 17,18 However, SpO2 levels showed significant differences at 10 and 15 minutes intraoperatively, with the Dexmedetomidine group displaying lower values (p=0.048 and p=0.045, respectively). This finding suggests that while both agents are effective, dexmedetomidine may require more careful monitoring of oxygenation. Studies by Bafna et al. and Damaria et al. have highlighted the importance of monitoring SpO2 when using dexmedetomidine, particularly in prolonged surgeries.19, 15

The clarity of the surgical field, assessed by the presence of an obscured field, was significantly better in the Esmolol group (p=0.017), with only 10% of cases reporting an obscured field compared to 40% in the Dexmedetomidine group. This aligns with the findings of Gupta et al., who reported that esmolol provides a clearer surgical field, thereby enhancing the surgeon's ability to perform precise maneuvers.16 Intraoperative blood loss was significantly lower in the Esmolol group, with

a mean of 278.4 ml compared to 390.6 ml in the Dexmedetomidine group ($p<0.001$). This supports the findings of Sahu et al. and Sujay et al., who observed that esmolol is more effective in reducing intraoperative blood loss, thereby reducing the need for transfusions and improving surgical outcomes.17,18 Finally, the Ramsay Sedation Scores indicated that the time to achieve sedation was significantly longer in the Dexmedetomidine group ($p<0.001$), which corroborates the findings of Bafna et al. that dexmedetomidine provides prolonged sedation.19

The study revealed that a significantly higher percentage of participants in the Dexmedetomidine group experienced an obscured surgical field (40%) compared to those in the Esmolol group (10%), with a chi-square value of 2.391 and a p-value of 0.017. This indicates that Esmolol provided a clearer surgical field, which is critical for the precision required in Functional Endoscopic Sinus Surgery (FESS). Similar findings were reported by Parvizi et al., who observed that Esmolol effectively minimized intraoperative bleeding, thereby enhancing surgical visibility.20 This is supported by studies from Lobna et al. and Bharathwaj et al., which noted that Esmolol's ability to reduce heart rate and maintain hemodynamic stability contributes to less blood obscuring the surgical field.21,22 Furthermore, Das et al. found that Esmolol, compared to Dexmedetomidine, allowed for better visualization during surgery due to its rapid onset and effective blood pressure control.7 Ahmed et al. also highlighted that superior surgical field clarity with Esmolol can facilitate more precise surgical maneuvers and potentially reduce operative time.21 The findings from this study align with the broader literature, reinforcing that Esmolol is preferable for maintaining a clear surgical field during FESS.

The mean intraoperative blood loss was significantly higher in the Dexmedetomidine group (390.6ml) compared to the Esmolol group (278.4 ml), with a t-test value of 15.002 and a p-value of <0.001. This substantial difference underscores the effectiveness of Esmolol in minimizing blood loss during FESS. Parvizi et al. reported similar results, demonstrating that Esmolol significantly reduces intraoperative bleeding, thereby enhancing surgical outcomes.20 This is consistent with thefindings of Lobna et al. and Bharathwaj et al., which showed that Esmolol's hemodynamic control capabilitiescontribute to lower blood loss.21,22 Studies by Das et al. and Ahmed et al. also support these findings, highlighting that Esmolol's rapid action and efficient maintenance of lower mean arterial pressure (MAP) are key factors in reducing blood loss during surgery.7, 23

The study found that the mean time to achieve sedation was significantly longer in the Dexmedetomidine group (5.76 minutes) compared to the Esmolol group (2.19 minutes), with a t-test value of 8.932 and a p-value of <0.001. This indicates that Dexmedetomidine provides a moreprolonged sedative effect. Research by Damaria et al. supports these findings, showing that Dexmedetomidine's sedative properties contribute to longer sedation times, which can be beneficial for extended surgical procedures requiring sustained anesthesia.15 Similarly, Gupta et al. observed that Dexmedetomidine offers enhanced sedation and analgesia, making it suitable for surgeries where prolonged sedation is needed.16 Studies by Sahu et al. and Sujay et al. further confirm that Dexmedetomidine leads to higher sedation scores, thereby providing a calm and stable intraoperative environment.17

Postoperative adverse effects differed significantly between the Dexmedetomidine and Esmolol groups. Hypertension was observed in 20% of the Dexmedetomidine group, whereas no cases were reported in the Esmolol group. Bradycardia occurred in 40% of the Dexmedetomidine group compared to 6.7% in the Esmolol group, while hypotension was noted in 6.7% of the Esmolol group only. The chi-square value was 22.186, and the p-value was <0.001, indicating significant differences in adverse effects between the groups. Damaria et al. found similar trends, with Dexmedetomidine associated with higher rates of bradycardia and hypertension due to its sympatholytic properties.15 Gupta et al. also reported that Dexmedetomidine can lead to significant bradycardia, necessitating vigilant monitoring and management.16

**Conflict of interest:** Nil

**Funding:** Nil

**References:**

1. Krings JG, Kallogjeri D, Wineland A, Nepple KG, Piccirillo JF, Getz AE. Complications of primary and revision functional endoscopic sinus surgery for chronic rhinosinusitis. The laryngoscope. 2014 Apr;124(4):838-45.
2. Green R, Banigo A, Hathorn I. Postoperative nasal debridement following functional endoscopic sinus surgery, a systematic review of the literature. Clinical Otolaryngology. 2015Feb;40(1):2-8.
3. Suzuki S, Yasunaga H, Matsui H, Fushimi K, Kondo K, Yamasoba T. Complication rates after functional endoscopic sinus surgery: analysis of 50,734 Japanese patients. The laryngoscope. 2015 Aug;125(8):1785-91.
4. Chaaban MR, Rana N, Baillargeon J, Baillargeon G, Resto V, Kuo YF. Outcomes and complications of balloon and conventional functional endoscopic sinus surgery. American journal of rhinology & allergy. 2018 Sep;32(5):388-96.
5. Boonmak P, Boonmak S, Laopaiboon M. Deliberate hypotension with propofol under anaesthesia for functional endoscopic sinus surgery (FESS). Cochrane Database of Systematic Reviews. 2016(10).
6. Shams T, El Bahnasawe NS, Abu-Samra M, El-Masry R. Induced hypotension for functional endoscopic sinus surgery: A comparative study of dexmedetomidine versusesmolol. Saudi journal of anaesthesia. 2013 Apr 1;7(2):175-80.
7. Das A, Chhaule S, Bhattacharya S, Basunia SR, Mitra T, Halder PS, et al. Controlled hypotension in day care functional endoscopic sinus surgery: A comparison between esmolol and dexmedetomidine: A prospective, double-blind, and randomized study. Saudi journal ofanaesthesia. 2016 Jul 1;10(3):276-82.
8. Srivastava U, Dupargude AB, Kumar D, Joshi K, Gupta A. Controlled hypotension for functional endoscopic sinus surgery: comparison of esmolol and nitroglycerine. IndianJournal of Otolaryngology and Head & Neck Surgery. 2013 Aug;65:440-4.
9. Zhang L, Yu Y, Xue J, Lei W, Huang Y, Li Y, et al. Effect of deliberate hypotension on regional cerebral oxygen saturation during functional endoscopic sinus surgery: a randomizedcontrolled trial. Frontiers in Surgery. 2021 Sep 8;8:681471.
10. Tarek S, Nahla S EB, Mohamed AS, Ragaa EM. Induced hypotension for functional endoscopic sinus surgery: a comparative study of dexmedetomidine versus esmolol.
11. Lee J, Kim Y, Park C, Jeon Y, Kim D, Joo J, et al. Comparison between dexmedetomidine and remifentanil for controlled hypotension and recovery in endoscopic sinus surgery. Annals of Otology, Rhinology & Laryngology. 2013 Jul;122(7):421-6.
12. Snidvongs K, Tingthanathikul W, Aeumjaturapat S, Chusakul S. Dexmedetomidine improves the quality of the operative field for functional endoscopic sinus surgery: systematic review. The Journal of Laryngology & Otology. 2015 Jul;129(S3):S8-13.
13. 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. Journal of Anaesthesiology Clinical Pharmacology. 2016 Apr 1;32(2):192-7.
14. Ravikumar M, Shanmugasundaram P. Comprehensive study on effectiveness and advantages of dexmedetomidine and esmolol in controlled hypotension for functional endoscopic sinus surgery. Journal of Evolution of Medical and Dental Sciences. 2017 Apr 27;6(34):2789-94.
15. Damarla R, Mamidi M. Dexmedetomidine and esmolol for induced hypotension for functional endoscopic sinus surgery-a comparative study. National Journal of Physiology, Pharmacy and Pharmacology. 2022;12(3):317-21.

16. Gupta KK, Kumari V, Kaur S, Singh A. Comparative evaluation of propofol versus dexmedetomidine infusion for hypotensive anesthesia during functional endoscopic sinus surgery: a prospective randomized trial. Anesthesia and Pain Medicine. 2022 Jun 14;17(3):271-9.
17. Sahu BP, Nayak LK, Mohapatra PS, Mishra K. Induced hypotension in functional endoscopic sinus surgery: a comparative study of dexmedetomidine and esmolol. Cureus. 2021 May;13(5).
18. Sujay JN, Kumar S, Vijay T. To compare the efficacy of dexmedetomidine versus labetalolin providing controlled hypotension in functional endoscopic sinus surgery. Anesthesiology and Pain Medicine. 2021 Feb;11(1).
19. Bafna U, Sharma P, Singhal RK, Gurjar SS, Bhargava SK. Comparison of hypotensive properties of dexmedetomidine versus clonidine for induced hypotension during functional endoscopic sinus surgery: A randomised, double-blind interventional study. Indian Journal of Anaesthesia. 2021 Aug 1;65(8):579-85.
20. Parvizi A, Haddadi S, Habibi AF, Nemati S, Akhtar N, et al. Dexmedetomidine efficacy in quality of surgical field during endoscopic sinus surgery. Iranian Journal of Otorhinolaryngology. 2019 Sep;31(106):281.
21. Lobna M, Mostafa Is, Rabab Mm, Sabry M. Comparison between dexmedetomidine and esmolol for hypotensive anaesthesia during functional endoscopic sinus surgery in children. The Medical Journal of Cairo University. 2018 Sep 1;86(September):2781-90.
22. Bharathwaj DK, Kamath SS. Comparison of dexmedetomidine versus propofol-based anaesthesia for controlled hypotension in functional endoscopic sinus surgery. Southern African Journal of Anaesthesia and Analgesia. 2018 Sep 20.
23. Ahmed ME, Elsayed MM, Sarhan NA, Fathallah MA. Surgical Field Visibility during Functional Endoscopic Sinus Surgery: esmolol-induced hypotensive anesthesia versus hypotensive total intravenous anesthesia. International Journal of Medical Arts. 2019 Oct 1;1(2):110-8.